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EXPERIENCE OF SOVIET MEDICINE IN A GREAT PATRIOTIC WAR 1941-194--ETC(U)

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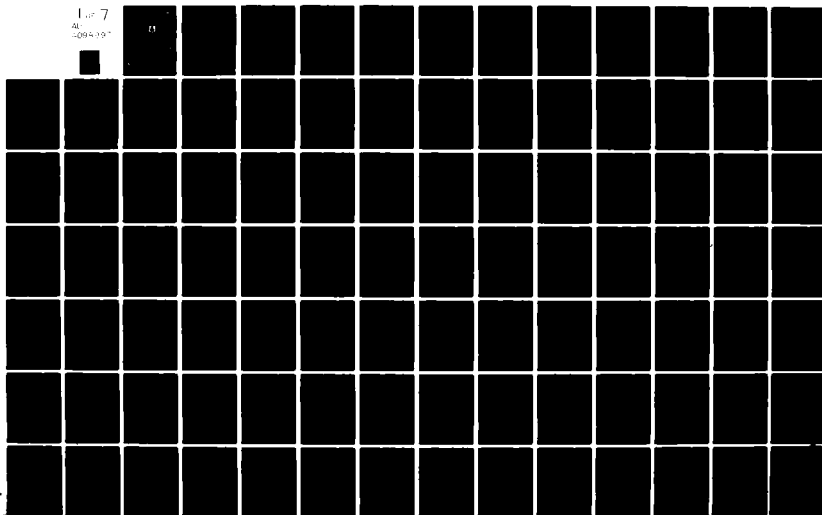
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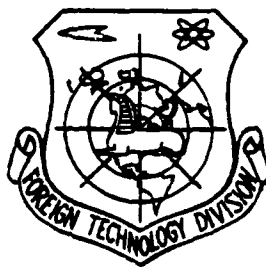


EXPERIENCE OF SOVIET MEDICINE IN A GREAT PATRIOTIC WAR
1941-1945

by

Ye. I. Smirnov, Editor

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EXPERIENCE OF SOVIET MEDICINE IN A GREAT
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WP.AFB, OHIO.

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U. S. BOARD ON GEOGRAPHIC NAMES transliteration SYSTEM

Block	Italic	Transliteration	Block	Italic	Transliteration
А а	<i>А а</i>	A, a	Р р	<i>Р р</i>	R, r
Б б	<i>Б б</i>	B, b	С с	<i>С с</i>	S, s
В в	<i>В в</i>	V, v	Т т	<i>Т т</i>	T, t
Г г	<i>Г г</i>	G, g	У у	<i>У у</i>	U, u
Д д	<i>Д д</i>	D, d	Ф ф	<i>Ф ф</i>	F, f
Е е	<i>Е е</i>	Ye, ye; E, e*	Х х	<i>Х х</i>	Kh, kh
Ж ж	<i>Ж ж</i>	Zh, zh	Ц ц	<i>Ц ц</i>	Ts, ts
З з	<i>З з</i>	Z, z	Ч ч	<i>Ч ч</i>	Ch, ch
И и	<i>И и</i>	I, i	Ш ш	<i>Ш ш</i>	Sh, sh
Й й	<i>Й й</i>	Y, y	Щ щ	<i>Щ щ</i>	Shch, shch
К к	<i>К к</i>	K, k	Ъ ъ	<i>Ъ ъ</i>	"
Л л	<i>Л л</i>	L, l	Ы ы	<i>Ы ы</i>	Y, y
М м	<i>М м</i>	M, m	Ь ь	<i>Ь ь</i>	'
Н н	<i>Н н</i>	N, n	Э э	<i>Э э</i>	E, e
О о	<i>О о</i>	O, o	Ю ю	<i>Ю ю</i>	Yu, yu
П п	<i>П п</i>	P, p	Я я	<i>Я я</i>	Ya, ya

*ye initially, after vowels, and after ъ, ы; e elsewhere.
When written as ё in Russian, transliterate as yě or ě.

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

Russian	English	Russian	English	Russian	English
sin	sin	sh	sinh	arc sh	sinh ⁻¹
cos	cos	ch	cosh	arc ch	cosh ⁻¹
tg	tan	th	tanh	arc th	tanh ⁻¹
ctg	cot	cth	coth	arc cth	coth ⁻¹
sec	sec	sch	sech	arc sch	sech ⁻¹
cosec	csc	csch	csch	arc csch	csch ⁻¹

Russian English

rot curl
lg log

Page 1.

[Translator's note: Please change Поперечный from Cross to Transverse; вколоченный from Packed in to Impacted; Носой from Impacted to Oblique; краевой from Edge/Boundary to Marginal.]

Experience of Soviet medicine in a Great Patriotic War 1941-1945.

Page 2.

Part I.

SURGERY.

Page 3.

Section the eleventh.

BULLET WOUNDS DAMAGES OF EXTREMITIES.

Pages 4-14 no typing.

Page 15.

General/common/total unit.

Chapter I.

SHORT SURVEY, ~~COVERAGE~~ OF THE DEVELOPMENT OF THE METHODS OF THE TREATMENT OF THE BULLET BREAKS OF THE BONES OF EXTREMITIES.

Honored Scientist professor is the lieutenant general of medical service N. N. Yelanskiy.

The history of the treatment of the breaks of bones raises to deep ancient times. The in detail presented and ordered system of the treatment of breaks we find in Hippocrates, who distinguished the simple and compound breaks. During the treatment of breaks it used the traction/extension of extremity and one-time setting of bone broken ends with the aid of the different apparatuses, bandaging extremity and immobilization by splints/pulp publications.

The apparatuses, which put to use Hippocrates for setting of breaks and traction/extension of extremity, were constructed according to the principle of lever, winch or wedge and they made it possible to use large force.

Hippocrates gave very valuable instructions relative to the

periods of setting of the complicated breaks, recommending to produce one-time setting of the break by means of the lever and traction/extension either during the first day or after a lapse of seven and more than days when calm down inflammatory phenomena.

Hippocrates very well understood both the value of the correct position of the broken ends of bone with the healing of fracture and value of the bond of these broken ends with the periosteum and the soft tissues. Uncovered and exposing into the wound bone he advised to saw off for warning/preventing the unavoidable process of sequestration, recommending, however, to leave the partially uncovered sectors of bone, which give flaky cortical sequestrations.

Immobilization during the first days after the break of the bones of extremities was achieved by rest position on the cushions/pads, and only after 7-9 or 11 days when disappeared inflammatory phenomena, extremity was stacked in the splint/pulp publications.

To avoid formation of bedsores Hippocrates cautioned from the imposition of splints/pulp publications directly on the body, in particular in the region of bone prominences.

During the treatment of breaks Hippocrates used also the method

of constant traction/extension "in the relation to those patients who cannot be treated under the bandages by one of the before presented methods".

Being the greatest master of medical art, Hippocrates not only for his time, but also for the number of the subsequent centuries determined the general/common/total principle of the treatment of breaks. They expressed thought about the need to fix/record hand in the functionally advantageous position/situation.

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Based on the example of hand Hippocrates showed that natural it is necessary to consider not only the position/situation of hand the arrow/pointer when it carries shoulder forward for the firing from the onion, that "natural position/situation in the different cases different, and even in one and the same work". "Dressing" has nothing in common with the art of firing/shooting the onion.

FOOTNOTE 1. In this case "dressing" it is understood in the sense "bandage", superimposed in the specific fixed/recorded position/situation. N. P. ENDFUNCTNTE.

In fact, who will want the bandaged hand so to keep, to cause other

pains, far greater than wound".

After the subjugation of Greece by Rome Greek culture, and with it and medicine they arrived into the decline. From Hippocrates's times to the Middle Ages it was not maintained the sources which would indicate any significant changes or progress in the treatment of the breaks of the bones of extremities.

In connection with the common decline of culture, science and art, conjugated with suppressing effect of church and supremacy of inquisition, arrived into the decline and the medicine which changed into the hands of clergy. In the VII epoch dad prohibited to the physicians of spiritual rank to perform operations/processes, and because of this surgical interventions became the property of the ignorant barbers and charlatans.

As a result the medicine completely was separated from the surgery, which was brought down to the degree of low craft, he occupied by which, it was considered prejudicial for the educated doctor.

Only in 1416 in France to Bradcbreyam was opened the access into the medical schools for the doctors of the internal diseases/illnesses, and in 1579 the the Pope removed/took prohibition

to clergy to perform operations/processes, but these measures he did not soon yield positive results, and in many countries of Europe surgery still numerous years remained during the position/situation of the craft, far distant behind the medical science.

Appearance of firearms played significant role in the development of the exercise about the breaks. After 1567, when appeared siliceous guns, cnick yielded the place for musket. And nevertheless muskets an even for a long time were used only in the beginning of battle, and its outcome solved halberds, peaks and bayonets.

The appearance of bullet wounds coincided with the period of the maximum decline of medicine as the sciences when the correct scientific estimate of wounds was impossible, since by their treatment knew barbers, who did not possess medical knowledge. Therefore to the publication of the first descriptions of bullet wounds from the time of their appearance it passed 150-200 years.

Nonconformity between the sizes/dimensions of damages and the severity of further course with the bullet wounds destroyed ignorant observers/spotters. Severe festerings with the high fever, flows of pus, hemorrhage and frequently attacked/advanced numbness of entire extremity were explained by the fact that all bullet wounds are gas

casualty, and this it forced to resort to the removal/distance of the jammed bullets. Since the removal/distance of bullets did not facilitate course, for the purpose of the annihilation of the penetrated in the wounds poison tried to cauterize by their hardened iron or to pour by boiling oil and resin.

It is logical that in the majority of the cases this did not help. After the removal/distance of bullets, cauterization of wounds by hardened iron and flooding by their boiling oil of wound they were strongly inflamed, course and outcome of wounds became still worse. This frightened doctors and casualties: in the struggle with complications, which were assigned to the poison of bullet shells, were helpless all known at that time substances.

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During the treatment of the bullet breaks of the bones of extremities were used the same methods, as during the treatment of wounds, i.e., cauterization by hardened iron or flooding by boiling oil. Outcomes were, of course, so/such sad. At that time to make amputation they avoided, since they did not know how to stop hemorrhage, for its stop most frequently resorted all to the same cauterization by hardened iron. The dressing of vessels, which was being used already by Celsus and by Galenus, did not receive wide

acceptance due to the absence of information on the anatomy of vascular system and physiology of blood circulation.

Opened in the XVII century by Harvey the laws of blood circulation (1649), contributed to the wider application of amputations with the bullet breaks.

Large role in the dissemination of amputations with the bullet breaks played also invention by Morel (1674) of the tourniquet whose use/application decreased the danger of hemorrhages.

At the end of the XVII epoch German surgeon Gottfried Purman derived, that the complications of bullet wounds are caused not by their poisoning, and mainly presence in wound of foreign bodies and contused tissues. He recommended the removing of bone fragments and foreign bodies by expanding the wound by the pressed sponge or through the section/cut of wound. The bullet breaks Purman also treated conservatively, using bandages, splint and compresses.

In the XVIII epoch begins the new incline of medical science. In France operational and military field surgery they are developed with a comparatively very widely main mode due to the expansion of readings/indications to the amputation. The number of amputations within this period so increased that Ludovik XIV once said: "Hostile

weaponry is less dangerous for the members of my soldiers, than surgeons' knives". A. A. Eobrova has the instruction that, "... on contemporaries' admonition, the wish to become famous by the large number of made amputations was not alien to many and contributed to passion amputata". The same in turn, impelled some doctors high fee/pay/board for the production of amputation. Thus, in England for each produced amputation revealed 5 pounds it was sterling.

In the XVIII epoch it was proposed with the bullet breaks of bone to produce for the preventive target splitting up of bullet wounds (Ledran, Bil'ger).

During XVIII and first half the XIX epochs with the bullet breaks of the bones of extremities extensively used amputations, expansion, probing and splitting up the wounds mainly for the purpose of the removal/distance of foreign bodies. All these methods gave equally high lethality. At the same time were observed the individual cases of the bullet breaks with which the casualties rejected operational intervention and survived, after maintaining extremity.

In the Crimean War 1854-1856 both the Russian troops/forces and the hostile troops they were found under conditions, extremely unfavorable for the development of surgical activity. The besieged and attacking troops/forces greatly suffered from the typhus,

dysentery, cholera and other infectious diseases.

N. I. Pirogov, who marked the beginning of military field surgery as science, created new direction in the treatment of bullet breaks.

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In the beginning of his work in Crimea N. I. Pirogov frequently resorted to the primary operational expansion they were equal, to the removal/distance of bone fragments and foreign bodies, but then it it was convinced not only of the aimlessness, but also the damage of such an intervention and even it prohibited to investigate wounds by finger/pin or probe, since this made the course worse of wound. Then N. I. Pirogov began to widely produce the primary amputations of extremities with the bullet breaks of bones. However, these operations/processes gave very poor result, and N. I. Pirogov, taking into account high lethality after the amputations of thigh, arrived at the conclusion that "the early amputation belongs to the most killing operations/processes". "The large part of the early amputations of thigh, made during November and December of 1854, ended by death".

This impelled N. I. Pirogov in the second period of the Crimean

War to sharply narrow readings/indications to the primary amputations and to advance the principle of so-called "saving treatment" of the bullet breaks of the bones of extremities. "However that may be, I assume that is time to agree to all military surgeons and to try the saving method in the bullet breaks of thigh in the large sizes/dimensions. Having before eyes 90o/o and 95o/o mortality, given by the early amputation of thigh both and in Frenchmen in Crimea (see the report of Legue and Shenyu), it seems to me that we not only right, but even they are obligated to be decided to this". "From the amputations, made in a small trochanter and interacetabular line, I can give only 3 reliable cases of recovery ... ". "From that entire seen by me in me remained the general/common/total persuasion, that the expectant method is nevertheless less killing ... than early amputation".

Large role in the decision/solution of a question of surgical tactics with the bullet breaks, mainly lower extremity, played the gypsum bandage, for the first time applied by N. I. Pirogov in war. To N. I. Pirogov belongs priority in the use/application of gypsum bandages, about which it itself several times mentions at its "beginnings of general/common/total field surgery".

Thus, in the preface to this book he writes: "Finally, on a feeling of very natural pride I will remind my readers that I the

first tested anesthetizing in the field of battle during the siege of Saltov in Caucasus, where I was sent by the highest command in 1847; I the first also adapted my gypsum bandage to the dressing of casualties on the dressing stations and to the distant transports (author's italics, N. E.) and the first demonstrated that my osteoplastic operation/process above the foot of foot can be included also in a number of field surgical operations/processes".

This method was published by N. I. Pirogov seven years earlier than Dutch surgeon Mathiessen (1852); N. I. Pirogov wrote: "I ascertained that this bandage can find vast use/application in the military field practice and therefore published the description of my method in the special pamphlet, published in the Russian language ¹, and in the 2nd unit of my "Chirurgie Hospital-klinik" (1851-52)".

FOOTNOTE ¹. "Stick-on alabaster bandage in the treatment of simple and compound fractures and for the transport of casualties in the field of battle", SPB, 1845. ENDFOOTNOTE.

Gypsum bandage must be laid "in two different periods of the compound bullet fracture": in fresh cases - in order to prevent "stress and acute edema by the immobility of the ends of the break and by the uniform, surrounded moderate pressure; ... to make possible and convenient transport of casualty", and in the period of

festering - "for the purpose of holding down/retaining the ends of the break in the known, but unconstrained (not forcible) position/situation". N. I. Pirogov gives the very detailed description of procedure and readings/indications to the use/application of a gypsum bandage.

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At the "Beginnings of general/common/total military field surgery" he adds: " I would not repeat, however, what has already long ago he described, but there are gentlemen who have forgotten this (author's. italics - N. E.) and, after beginning to use my bandage since 1858, they speak about it, seemingly about its".

In the estimate of the outcomes of the treatment of the bullet breaks N. I. Pirogov rejects general/common/total statistics, considering this "affair useless and impracticable". "Who does not know, for example, the differences between the removal of thigh in the upper and the removal in lower third ... that better do not be accepted for the statistics - such to nothing it will not serve".

In the Crimean War, according to N. I. Pirogov, the amputations during the damages of the diaphysis of shoulder in middle third were produced 10 times less frequently than the amputation of lower

extramities. "More frequently was encountered removal in the surgical neck/journal and immediately lower than head. For the usual bullet breaks of middle and lower third of diaphysis I eliminated entirely early amputation of shoulder from the list of field operations/processes". With these break of shoulder N. I. Pirogov advised not to investigate wound by finger/pin, but to lay on entire extremity provisory bandage with the windows. Through 2 weeks, if there are no complications, it is necessary temporary bandage to change to the "constant and window". But if developed acute suppurative edema, then bandage it should have been to remove/take, after leaving only gypsum groove, and treated by sections/cuts, and also by application of ice and washes.

During the "saving treatment" of the breaks of the diaphysis of shoulder, according to N. I. Pirogov, the lethality oscillated from 20.0 to 25.00/o whereas with the breaks of the upper pineal system of shoulder - from 55.0 to 68.00/o.

Amputations with the breaks of shoulder at all levels it gave from 21.0 (in Englishmen in Crimea) to 50.00/o (in Frenchmen) of lethality, the late amputations of shoulder - from 30.0 to 50.00/o.

N. I. Pirogov retorted to the resections of the diaphysis of shoulder with its breaks, since with 45.0-50.00/o of lethality in the

remaining cases after this operation/process was obtained unsuitable and functional relation extremity.

With the bullet breaks of forearm, according to N. I. Pirogov, expectant and "saving treatment" it is possible to conduct still more frequently than during the damages of shoulder. Lethality during the "saving treatment" of breaks of both bones of forearm did not exceed 20.0-25.0o/o, but with the breaks of one bone -11.0-13.0o/o. Upon the early amputation of forearm (according to N. I. Pirogov) it was observed from 6.0 to 50.0o/o and were lethal outcomes.

High value in the "saving treatment" of the bullet breaks of thigh N. I. Pirogov added gypsum bandage. Comparing all forms/species of immobilization, which were being used with the transport of casualties with the bullet break of thigh (starch and dextrine bandages, and also the "wire pants", proposed by Bonnet), N. I. Pirogov wrote: "I was convinced of the superiority of my gypsum bandage before all these methods".

On the outcomes of amputations with the bullet breaks of the bones of shin N. I. Pirogov according to the experiment/experience of three latter/last wars in which participated Russian army, could note 50.0-54.0o/o of lethality, whereas in Frenchmen it reached to 84.0o/o.

For the treatment of the bullet breaks of the bones of shin N. I. Pirogov in the period of transport laid gypsum bandage. On the arrival of casualty into the hospital with the first signs of edema the bandage was cut. During the festering after the collapse of edema was laid gypsum bandage with the window.

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Estimating N. I. Pirogov's role in the decision/solution of a question about the treatment of bullet breaks, it is necessary to note first of all, that it marked the beginning of new direction in the treatment, the beginning of "saving treatment", as it called itself N. I. Pirogov. In this "saving" direction, it is doubtless, large role played N. I. Pirogov's gypsum bandage. This direction in the treatment of bullet breaks remained dominating in all wars, up to the present time.

The ideas of Ledran and Bil'ger with them actually the correct propositions of primary active interventions with the bullet breaks proved to be unpractical due to ignorance of the role of infection and absence during wars of the XVIII and XIX epoch of the necessary organizational forms, which ensure rendering aid by casualty.

With an increase in the scales of war and quantity of the losses by unpractical ones proved to be French military field surgeons' basic ideas (Persi and Larrey) about the wide application of the primary amputations which gave some positive results in the wars of low scale. From the moment/torque the introductions of the "saving treatment" of N. I. Pirogov to the primary amputations did not return.

In N. I. Pirogov's epoch and even to it (A. Pare, Persi, Larrey, etc.) purely empirically they began to use some antiseptic substances - liquid of iodine, potassium iodide, lead water, solution of sodium chloride, spirit of camphor, quinine, etc., but these substances at that time did not play significant role in the treatment of bullet breaks, since they were used unsystematically, without the accounting to the essence of their useful effect.

In 1876, 1877 and 1878 some military field surgeons began to use Lyster method. K. K. Reyer, who worked at the Caucasian Front used this method systematically. In spite of the use/application of an antiseptic method, in K. K. Reyer it was not noted a significant improvement in the results of the treatment of bullet breaks. The bullet breaks of thigh, with which primarily or was for a second time

applied the antiseptic method of treatment, it gave 64.30/o of lethality. K. K. Reyer attached much importance to that, was used Lyster method primarily or for a second time, i.e., after a lapse of certain time after the wound when wound already underwent any manipulations without the observance of the rules/handspikes of antiseptis. Thus, with the bullet breaks of the bones of the extremities (shoulder, forearm, thigh and shin), treated primarily according to Lister's method, 4 died of 22 people (18.10/o), and of 62 casualties, treated according to Lister's method for a second time, died 25 (40.30/o). Hence arose thought about the prevailing value of secondary infection. The first aid and the first bandage, superimposed with the observance of antiseptic conditions, had to determine the lot of extremity and further condition of casualty.

The special feature/peculiarity of K. K. Reyer's procedure consisted in the fact that it did not recognize gypsum bandages and used the exclusively U-shaped Fol'kman splints which with the transport of casualty, of course, could not ensure proper rest. In this respect it is necessary to note the positive experience of Bergmann, who used simultaneously with Lyster method a Pirogov gypsum bandage and obtained the best results.

In the Russo-Turkish war 1877-1878 the preliminary surgical expansion of wound apertures in no way it practiced. "The vast majority of the doctors, who performed on the dressing stations, believed in the constant force of gypsum bandage and therefore their first concern consisted of how to put gypsum bandages, as far as possible, on all breaks of extremity" (A. A. Bobrov). According to N. I. Pirogov's data, in this war in Bulgaria "... in all 16 battles of right flank are made in 32953 wounded 292 (i.e. 0.880/o) large operations/processes (amputations, resections, the dressings of arteries) and are superimposed 1245 gypsum bandages, i.e., came to 112 wounded one operation/process and on 28 - one gypsum bandage".

In the hospitals was allowed/assumed the research of wound only during the development of festering. For the dressings of wounds were used the gauze, carbolyzed gauze, absorbent cotton, carbolyzed or salicylic cotton. Lint and rags were removed from use. During festering of wounds were produced sections/cuts, contra-apertures, removed free fragments, extensively were used drainage rubber tubes. For the retention of the broken upper extremity and shin in the correct position were used different U-shaped splints. With the breaks the thighs put to use constant traction/extension with the aid of the mat/patch or the gypsum boct, laid on foot and half of shin.

For the traction/extension was suspended the cargo from 8 to 25

pounds. Contra-extension was created either by stop/emphasis to the healthy/sound foot, or elevation of the foot end of the bed. With the transport of casualties was laid deaf gypsum bandage.

Thus, in the Russo-Turkish war 1877-1878 dominated the exclusively saving method of the treatment of the breaks of the bones of extremities and nevertheless, in spite of the mass of the unfavorable conditions under which "it was necessary to be casualty, lethality was comparatively small" (A. A. Bobrov).

N. I. Pirogov explained good outcomes of bullet breaks, which were being observed in the Russo-Turkish war by 1877-1878, which follow: "1) by the special feature/peculiarity of the properties of the traumatic damages which depended on the nearness of the distance of those fighting and from the properties of hostile weaponry, 2) by the almost continuous dispersion of casualties by transport even 3) by a good content, by the treatment of casualties, by the abundance of surgical dressing substances and immobile bandages". In this case N. I. Pirogov arrived at the conclusion that "with best device and greater efficiency the administrations the same very conditions of the distance not only of this, but also most brilliant result".

In Russo-Japanese war (1904-1905) predominated conservative methods of the treatment of the bullet breaks of extremities. In the

foremost stages they tried by the application of primary dressing to prevent the introduction of secondary infection. With the bullet breaks used for the immobilization of the extremities of splint and gypsum bandages. In the leadership/manual on the military field surgery, comprised on the basis of the experiment/experience of Russo-Japanese war (R. R. Vreden and O. Ettingen), in chapter about the treatment of breaks is described only the procedure of the application of transport and gypsum dressings. On surgical interventions apropos of bullet breaks mentions only V. I. Dobrotvorskiy (at the VI congress/descent of Russian surgeons). These operations/proccesses were produced in the deep rear (in Harbin) and consisted in splitting up of wounds apropos of the flows of pus and introduction of the foreign bodies, which support festering.

Despite the fact that in the peaceful surgical practice at this time already they began to use x-ray examination, X-ray diagnostics with the bullet breaks at the front in the Russo-Japanese war was not used.

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O. Ettingen in regard to this wrote: "The unconditional requirement for the X-ray machine, it seems me, there does not exist. I remember not one case wherever the absence of the latter was the fault of the

fact that the casualty could not be shown/rendered urgent surgical allowance".

For warning/preventing the secondary infection was used individual dressing packet, and also collargol, xeroform, Vioform and dermatol. Probing and research of wounds by finger/pin for the purpose of the primary removal/distance of foreign bodies no longer were used. Sharply was shortened the number of primary amputations which were produced on the foremost stages only with the disengagements, crushings of extremities with the damage of bones, joints, vessels and nerves.

Frequently was used the gauze, impregnated with antiseptic solution, namely colloid silver, silver, biophorm and dry-form gauze. The sterilization of surgical dressing and linen was used rarely. O. Ettingen in regard to this wrote: "Aseptic surgical dressing must be sterilized on the native land" ... "on the dressing stations cannot be sterilized by greater unit. Entire/all asepsis does depend on that, is it possible to deliver in large quantities to the foremost line the virtually convenient types of surgical dressing in the finished sterilized form/species". Here he recommended as a good simplest method of sterilization the "smoothing of linen", and for the surgical dressing - its "boiling during 10 minutes in that boiling by key/wrench to water". "However here presents large

difficulties the drying out of surgical dressing; therefore its evaporation on the sieve, set above the boiling water, will be still more practically".

The given citation from G. Ettinger's statements as cannot more clearly draws the picture of the "asepsis", which was being used in the Russo-Japanese war.

In the Russo-Japanese war in the Russian army, headed by commercial tsarist Generals, a question about the most effective treatment of casualties, including casualties with the break of bones, actually not at all attracted attention, since in the presentations/concepts of the ruling circles of tsarist Russia, as in all capitalist countries, soldier played only the role of "gun meat". After soldier's wound it was estimated as the excess ballast which impeded the combat operations of the troops/forces, joining them and disturbing operational efficiency. Hence and arose evacuation system and "evacuation into that that not it stopped".

The absence of single medical leadership/manual made this position/situation worse even more. Entire leadership/manual by medical service was located in combat command element's hands which was interested, first of all, in the release of army in the field from the troubled her activities large quantities of casualties.

As a result of the absence of proper leadership/manual of medical service and supremacy of the principle of the evacuation of casualties into the rear therapeutic and, in particular, surgical aid on the stages of evacuation was reduced to the minimum. By the same is explained the fact that the newest achievements of the surgery of that time - X-ray diagnostics, gypsum bandage, asepsis and antisepsis - in the Russo-Japanese war did not play a noticeable role.

The first world war introduced little new into a question about the treatment at the front of bullet breaks. The absence of single leadership/manual of medical service, supremacy of the principle of evacuation in that that not stopped also in this war they played their negative role in the treatment of breaks.

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Struggle with the infection in the first world war, just as in Russo-Japanese war, was reduced to warning/prevention of the development of secondary infection. As the decisive motive to this they served the assertion of Bergmann about the "sterility of bullets" and about the so-called "humane bullet wounds".

Questions of asepsis and antisepsis were permitted also in this war a little better than in the Russo-Japanese war. "The absence of aseptic material and apparatuses for the sterilization and its storage created in the foremost therapeutic installations, which conduct principle pure/clean of asepsis, this unfavorable situation for the defense of wounds from the infection, that even the completely prepared and competent surgeon often proved to be here completely powerless" (V. M. Svyatukhin).

Rubber gloves it was not, and therefore in the first world war and a question about the aseptic work could not obtain practical permission/resolution. Standard still, besides the wire splints of Cramer and bast splints, in the first world war on the supply of medical installations it was not. However, for the application of gypsum dressings with the bullet breaks under conditions of forward area it was neither time nor devices/appliances nor specialists, who master gypsum coating technique.

With the increased flows of casualties all doctors, nurses and doctor's assistants dealt only with the imposition of bandages and with bandaging. Despite the fact that were given out the individual voices of the progressive-minded surgeons (V. A. Oppel', M. I. Rostovtsev, A. A. Nemilov, V. N. Pavlov-Sil'va et al.) about the need for drawing nearer surgical aid the line of combat and spreading its

volume, nevertheless in the relation to the breaks of the bones of extremities nothing it was made. Other surgeons (A. V. Martynov, V. M. Svyatukhin) the idea of expansion of volume and approximation/approach to front of surgical aid with the bullet breaks considered "utopian".

V. A. Oppel' characterized surgical aid in the first world war as the system of dressings and evacuation. "The individual surgical dressing detachments of divisions, individual infirmaries of divisions, mobile hospitals worked surgical, but majority was inactive, being limited by dressings and by the application of immobile dressings, moreover under the bandages of the heifer of sea of pus. Reasons for this relation was much: first straight/direct ban perform operations/processes, then the impossibility to make them after the absence of surgeon or after the absence of the corresponding instrumentation, then conscious conviction in the use of precisely evacuation system, the wish to transmit casualty for the operation/process under more favorable conditions. In the surgical dressing detachments of division it was not possible to perform those operations/processes which should have been made, due to the absence of surgical inventory".

The given citations characterize the organization of surgical aid in the first world war in the foremost stages from the very

unattractive side.

Envelopment by the operational surgical aid of casualties with the bullet break of the bones of extremities in the first world war increased/grew gradually towards the rear. Being completely negligible in the army and army installations, the surgical treatment of the bullet breaks of the bones of lower extremities in the rear hospitals achieved 43.20/o (according to V. A. Oppel').

An increase in the percentage of operability with the bullet breaks of the bones of lower extremities in the rear hospitals attests to the fact that the operations/processes were reduced to the struggle with the infectious complications of wounds (removal of sequestrations, fragments, the autopsy of flows and amputation).

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For the transport immobilization in the regiments (at the Western Front, according to A. A. Opakin) were used the wooden and plywood splints: the external splint for the thigh (125 cm of length and 7 cm of width), internal (90 cm of length, and 7 cm of width) and additional (100 cm of length and 7 cm of width). For the upper extremity were used carton- busbar/tire bandages, splints of Cramer, carton splints of Pal'tin, Rauer, wire splints of Kukoverov.

For the treatment of the bullet breaks of thigh traction/extension by Russian physicians (A. A. Kholin, I. I. Adamovskiy, S. K. Solovyev, I. A. Tikhomirov, B. M. Molokanov, M. P. Lavrova, V. N. Tomashevskiy et al.) designed the very convenient splints, being a combination of two planes with the device/appliance for the traction/extension in the physiological position/situation, or the machine tools, which support extremity in the halfbent position/situation.

For the foremost therapeutic installations were designed the very convenient splints, which make it possible produce the immobilization of thigh in the halfbent position/situation. To their number it is necessary to relate V. N. Pavlova-Sil^{ovskiy}~~ov~~'s splint which is fortified from the side the body and the lower extremity; its stub end is established/installed in the armpit, thigh is stacked on the average/mean frame of splint; to it can be adapted skeletal/skeleton traction/extension.

Sokolovsky's splint is the bent dual inclined plane with the device/appliance for the traction/extension of thigh and shin. This splint can be applied as transport and as therapeutic.

Yu. Yu. Kramarenko proposed splint for the treatment of the breaks of thigh by traction in the physiological position/situation. Splint this extension and can be adapted for any position/situation of thigh, leaving opened for the drainage and the dressings wound aperture.

For the treatment of the bullet breaks of shoulder by traction/extension in the position/situation of removal/diversion by I. A. Tikhomirov, Sh. D. Khakhutov designed wooden splints.

For the immobilization of breaks was extensively used already from stage infirmaries gypsum bandage. During the treatment in the hospitals of the rear they also put to use gypsum bandages. However, since 1915 they already began to extensively use gummy-plaster (K. P. Vegner) and skeletal/skeleton traction/extension with nail.

The idea of the treatment of the breaks by the traction/extension of extremity in the halfbent physiological position/situation was developed in the first world war by K. P. Vegner, A. V. Smirnov, K. M. Belyayev, B. M. Molokanov and I. A. Tikhomirov.

At the end of the war were organized special traumatological institutes in Moscow, Petrograd, Kharkov, Astrakhan, Saratov and

Tiflis.

In the hospitals of the deep rear for the treatment of breaks were used the gypsum bandages, very frequently bridge-like or fenestrated, and also gummy-plaster or skeletal/skeleton traction/extension with the aid of the nail of Shteynman. In the beginning the wars extensively used massive gypsum bandages, they were laid on the abundant wadded littering. In these bandages the casualties arrived into the hospitals of the deep rear and were situated in them to the formation of strong/durable corn or sequestral capsule. Only after this was used operational intervention for the removal/distance of sequestrations. Treatment in the gypsum bandages through windows of which ensued/escaped/flowed out daily a large quantity of pus, it was continued long months. But if attacked/advanced the consolidation of break, then extremity proved to be functionally barely suitable. A. A. Khclin so describes the outcomes of the treatment of breaks by the gypsum bandages: "At the end of treatment by gypsum bandage is obtained the rectified, alien to organism, thick, edematic or becme emaciated atrophied extremity".

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As a result of prolonged immobilization was developed the contracture

and the ankylosis of joints, which forced surgeons to search for other methods of treatment. Already since 1915 into the practice the treatments of the breaks became to introduce gummy-plaster traction/extension according to K. F. Vegner and skeletal/skeleton traction/extension the nail of Shteynman. The method of skeletal/skeleton traction/extension used N. N. Petrov, A. V. Smirnov, I. A. Tikhomirov, A. A. Kholin, A. V. Martynov, Ts. S. Kagar, A. Ya. Tsitronblaya, A. A. Oshman, M. P. Lavrov, K. F. Vegner, V. M. Tomashevskiy and many others. All these authors obtained as a result of applying the skeletal/skeleton traction/extension such best results, than after the use/application of the gypsum bandage: the shortenings of extremities were observed considerably less frequent, the function of joints remained normal or insignificantly restricted.

Thus, Russian surgeons during the treatment of the bullet breaks in the first world war applied the saving method of N. I. Pirogov, asepsis and antisepsis for warning/preventing the secondary infection and developed the procedure of skeletal/skeleton traction/extension.

For the evaluation of the results of the treatment of the bullet breaks in the first world war there are no integrated results. There are only statistical data of the individual authors, according to which it is possible to compose general idea about the outcomes of bullet breaks.

Thus, according to V. A. Oppel', the lethality of casualties with the bullet break of extremities was such (Table 1).

From Table 1 it is evident that the lethality with the wounds of lower extremities with the break of bones in the stage and rear hospitals was more than in the mobile/motile infirmaries, and into mobile/motile infirmaries, as correctly noted V. A. Oppel', were delivered sometimes wounded exsanguinated, in the condition of shock, which was clearly inadmissible. The high numerals of lethality in the rear hospitals with the bullet breaks of the bones of extremities both in that operated and in those not operated show that wounded extremities were situated in that launched condition. "Who it saw in the hospitals, infirmaries, in the hospital trains, on the first evacuation points and other installations the flows of pus, which escape/ersued from the entrance and outlets of bullet canals, writes V. A. Oppel', that without any statistics will immediately say that many casualties perished because with them was not supplied the timely operational aid".

According to the data of V. A. Oppel, amputation of shoulder gave 5.70/o of lethal outcomes, amputation of forearm - 6.40/o, the amputations of thigh - 22.90/o, the amputations of shin - 8.50/o.

Table 1. Lethality of the operated and unoperated wounded with the bullet break of bones extremities in the different therapeutic installations in the first world war according to V. A. Oppel' (in the percentages).

(1) Место перелома	(2) Оперированные			(3) Неоперированные		
	(4) Подвижные лазареты	(5) Этапные лазареты	(6) Госпитали	(4) Подвижные лазареты	(5) Этапные лазареты	(6) Госпитали
(7) Правая верхняя конечность	5,8	8,4	3,3	1,6	1,3	1,5
(8) Левая верхняя конечность	4,2	8,3	2,9	1,5	1,9	0,9
(9) Нижние конечности . . .	9,7	17,4	12,7	3,9	7,6	6,6

Key: (1). Place of break. (2). Operated. (3). Not operated. (4). mobile/motile infirmaries. (5). stage infirmaries. (6). hospitals. (7). Right upper extremity. (8). Left upper extremity. (9). Lower extremities.

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Thus, in spite of the very unattractive organization of the treatment of the bullet breaks of the bones of extremities in the first world war, because of the asepsis and antisepsis for the purpose of warning/prevention of the secondary infection of the breaks of extremities and development of the method of the treatment of the breaks by traction/extension in the physiological position/situation, Russian surgeons achieved a significant improvement in the results in comparison with the outcomes of the un

breaks of thigh in the preceding wars. However, these results it was not possible to consider satisfactory, since were used not all possibilities of timely rendering aid by casualty in war, this aid proved to be late.

It is possible to say that in the first world war for the treatment of the bullet breaks of the bones of extremities it was not created the conditions, which ensure taking all measures, shown the condition in which were situated the casualties on different stages of evacuation, in particular forward area. "The basic reasons of the unsatisfactory results of the medical and sanitary provision of the troops/forces, writes Ye. I. Smirnov, must be searched for in the poor organization of army medical affair in the tsarist army during the war, in the incorrect understanding of the problems of military medicine in the circles of supreme command, especially in the General Staff of tsarist army, and in the absence of sharp, single leadership/manual of the setting of therapeutic affair both in the field medical service and in the rear hospitals from the side of main army medical administration" (Medical service of Russian army in the war 1914-1917, pg. 14, Kuybyshev, 1942).

Because of the disdainful relation to the wounded soldiers, the absence of single expert in therapeutic questions leadership/manual of medical service into the tsarist armies the ideas, which were

being voiced by the best specialist-surgeons (N. A. Vel'yaminov, V. A. Oppel', V. N. Pavlov-Sil'^{Vansky} et al.), did not meet sympathy in command element and was not obtained realization.

N. A. Vel'yaminov at the XIV congress/descent of Russian surgeons in 1916 said: "Unfortunately, we see that in the present war almost in all departments and the organizations the doctors are pressed back from the administrative and organizational activity, and to us, for doctors, it is necessary less to struggle with death than with those obstacles, which to us place administrators - not doctors - in our special affair. Especially suffer from this setting of affair we, surgeons, and suffer hundreds of thousands of our patients".

In the Soviet period radically it changed both entire appearance of the army and relation to the wounded soldiers and entire organization of medical service; changed the principles of the treatment of bullet breaks. During the treatment of bullet breaks were used all most modern methods, which gave good results in the peaceful practice, and were created conditions for the realization in war of all diagnostic and therapeutic substances.

Was first of all achieved the single understanding of the essence of pathological processes with the bullet wounds generally

and with the bullet breaks in particular. The bullet breaks of steel to be examined from the point of view of the completeness of organism; hence arose the tendency to prevent the phenomena of shock and anemia, to increase the resistivity of organism by the blood transfusion, by the designation/purpose of vitamins and by feeding easily available diets, by the effect on the nervous system of the casualty via therapeutic exercise, physiotherapy, and also by all other measures, which raise the general/common/total resistivity of organism. Were finally rejected the old presentations/concepts of Bergmann about the sterility of bullets and fragments which sharpened entire attention in the secondary infection, allowing the course of reparative processes in the wound and struggle with the primary infection to organism itself. Were studied the reasons, which facilitate the development of infection in the wound.

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Hence arose and found systematic use/application the primary processing of wounds with splitting up of wound canal and carving of nonvital soft tissues and removal/distance of bone fragments. Was taken into consideration the effect of the early and most modern immobilization of breaks, is studied the value of the factor of time of rendering of first aid of first medical, first medical, qualified surgical and specialized aid and antishock measures in all foremost

stages of the evacuation of casualties with the break of the bones of extremity.

The primary surgical processing of wounds and rendering to the specialized aid with the bullet breaks into shortest possible periods after wound became necessary.

All these measures were conducted with the utilization of most complete provision by asepsis with the use/application of antiseptic substances and antibiotics.

Thus, in the Soviet period it was developed and in the wide scales applied in practice the single system of the treatment of bullet breaks.

In the period of military engagements in Khasan, Khalkhin-Gol and in combat with the White Finns there were tested and were refined the principles of the treatment of bullet breaks. It was explained that the primary surgical processing of bullet wounds, the understood by some authors as sterilization by knife, in the spirit of Friedrich's theory, are virtually unattainable. The carving of the edges of wound and the removal/distance of the fragments of bones during the primary processing of bullet wounds began to conduct not for the sterilization of wound, but for the removal/distance of

nonviable contused tissues. Suturing and tamponade of wounds after the primary processing of bullet breaks lead to the outbreak of heavy and sometimes anaerobic infection.

In the Soviet period only became possible the observance of the rules/handspikes of asepsis and antiseptics in all stages of the evacuation of casualty, beginning with PMP. This was in accordance with introduced in the ordinary practice of therapeutic aid the aseptic operation of the greater unit of the casualties within the shortest periods after wound and rear of the line of combat, which pursued the target of warning/prevention of the development of infection; it was at the same time realized the organization of the specialized aid with the bullet breaks.

If in the first world war the now achievements of medical science did not find use for the treatment of wounded due to the absence corresponding conditions on the front, then in the Soviet period these conditions were created, in spite of the considerably complicated operational situation and an increase in the contingents of casualties.

The fact that in the time of the first world war A. V. Martynov considered utopia (pg. 23), with the Soviet regime was realized, it became that universally recognized, indisputable and known to any

doctor. In the Great Patriotic War despite the fact that a number of those fighting was colossal and with respect to this was great a number of wounds, the supply status of casualties with operational surgical aid exceeded the most daring waitings.

If in the first world war the operability of casualties with the break of extremities was increased in the rear hospitals in comparison with mobile/motile and stage infirmaries, then in the Great Patriotic War was observed opposite phenomenon - a great quantity of operations/processes with the breaks was produced in the army and army therapeutic installations, being decreased in front and rear hospitals.

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The earlier and the more modern was produced the primary surgical processing in the army or army area, the less it was readings/indications to secondary interventions in the front line and rear hospitals.

In the preceded the Great Patriotic War period was manufactured the procedure of the treatment of the bullet breaks of the bones of extremities in the rear hospitals chiefly by skeletal/skeleton traction/extension or by skeletal/skeleton traction/extension in the

combination with the deaf gypsum bandages. In view of the fact that during the war with the White Finns the victims during the first 2-3 days after wound could be evacuated under the conditions of peaceful clinical circumstances, by them within the next few days after operation/process they relieved transport immobilization to the therapeutic by skeletal/skeleton traction/extension. This tactics in the relation to bullet breaks gave the best results.

The medical service of Soviet army entered the Great Patriotic War that of ideologically armed by the Stalin exercise about the concern and the attention to the man as to most valuable capital, ready to the execution of great Stalin precepts in the attitude of the sick and wounded soldiers of the Soviet army. Having the known experiment/experience of the effective provision of casualties, the medical service, surrounded by the concerns of party/batch and government, and during the Great Patriotic War attained in the affair of the treatment of the bullet breaks of the bones of the extremities of great successes.

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Chapter II.

CLASSIFICATION CHARACTERISTIC OF ANATOMICAL CHANGES WITH THE BULLET BREAKS OF THE BONES OF EXTREMITIES.

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Anatomical changes in the tissues with bullet fractures of the long tubular bones of extremities are very multifaceted. Differences depend not only on the character/nature of wound, form/species of the wounding shell, its kinetic energy, form/species of break, level of damage and direction of the wounding shell, but also on the period, which passed from the moment/torque of wound. In present chapter are given general/common/total data, which concern building/structure of wound canal, depending on the mentioned above factors, moreover special attention is turned to the statistical data. From the given digital indicators in the sufficient measure it is clear, with what

forms/species of bullet breaks and, therefore, with what means of anatomical changes it is more frequently, in all it was necessary to be encountered in the combat situation.

On the basis of the deepened development of the histories of disease/illness is possible the following classification of the bullet wounds of extremities with the break of bones.

The classification of the bullet wounds of extremities with the break of bones.

По виду ранящего снаряда	(2) Пулевые	(3) Осколочные	
По характеру ранения	(5) Сквозные	(6) Слепые	(7) Касательные
(8) По виду перелома	(9) Переломы неполные	(10) Переломы полные	
	(11) дырчатые, краевые	(12) поперечные, продольные, косые	вколоченные, (13) крупнооскольчатые, мелкооскольчатые, раздробленные
(14) По локализации ранения кости	(15) Верхняя треть	(16) Средняя треть	(17) Нижняя треть
	плечо, предплечье, бедро, голень (18)	плечо, предплечье, бедро, голень (19)	плечо, предплечье, бедро, голень (20)
(23) По сопутствующим повреждениям	(24) Мягкие ткани	(25) Крупные сосуды	(26) Нервы
	(24) обширные повреждения	(25) незначительное повреждение	(26) с повреждением
	(25) без повреждения	(26) с повреждением	(27) без повреждения
	(26) с повреждением	(27) без повреждения	(28) с повреждением
	(27) без повреждения	(28) с повреждением	(29) без повреждения

Key: (1). According to the form/species of the wounding shell. (2). Bullet. (3). Fragmentation. (4). According to character/nature of wound. (5). Through. (6). Blind. (7). Tangents. (8). According to form/species of break. (9). Breaks (incomplete. (10). Breaks (full/total/complete. (11). perforated, edge/boundary. (12). cross, longitudinal, oblique. (13). packed in, large-splintered, small-splintered, crushed. (14). On localization of wound of bone. (15). Upper third. (16). Middle third. (17). Lower third. (18). shoulder forearm, thigh, shin. (19). Soft tissues. (20). Large vessels. (21). Nerves. (22). Joints. (23). On associated damages. (24). extensive damage. (25). insignificant damage. (26). with

damage. (27). without damage.

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According to the form/species of the wounding shell all wounds are divided into two basic groups: a) bullet and b) fragmentation.

To examine wounds depending on the form/species of the wounding bullets or genus of fragments is extremely difficult, since neither casualty himself nor doctor in the process of rendering aid to casualty can in each individual case accurately determine, the fragment of what shell plctted/applied this wound; equally it is difficult, especially with the perforating wounds, to determine the character/nature of the wounding shell generally.

During the separation of all wounds into the bullet ones and the fragmentation ones in some percentage of the cases it was not nevertheless the possible to accurately determine the nature of the wounding shell, are so similar were similar the destruction, caused by bullets and fragments of shells.

Bullet and fragmentation wounds in turn, are separated into the blind ones, the through ones and the tangents.

Each of the means of wounds indicated encompasses two groups: 1) the wound of soft tissues even 2) the wound of soft tissues and bones.

The wounds of extremities with the damage of bones in turn, are distributed according to the character/nature of breaks to the incomplete breaks - edge/boundary and perforated and to the full/total/complete breaks - large-splintered, small-splintered, crushed, oblique, cross, longitudinal and packed in.

By the crushed breaks are understood the heaviest damages to bone. Here are involved "disengagements" and "crushings" of extremities. With the crushed breaks bone broken ends do not touch with each other, but they are located on certain, sometimes significant, distance from the place of break and from each other. Under the large/coarse and small-splintered breaks are understood such breaks, with which the fragments in the significant part touch between themselves.

All wounds of the extremities: blind, through and tangents with the break of bones in turn, are subdivided into: a) wound with the damage of large vessels, b) wound with the damage of large/coarse nerves, c) wound with damage of large/coarse nerves and vessels simultaneously, d) wound without the damage of large vessels and

nerves.

Finally, into the special group are secreted the wounds with the break of the bones of shin, thigh, shoulder and the forearms, which penetrate and which do not penetrate into the joint.

From the given scheme of the classification of the damages of extremities with the break of bones evidently entire diversity of these wounds and, therefore, a difference in the picture of wound canal.

The special features/peculiarities of building/structure of wound canal depend on the following factors:

- a) the form/species of the wounding shell,
- b) the anatomical and physiological properties of the damaged tissues,
- c) the character/nature of wound (blind, through, tangent),
- d) the form/species of break,
- e) the violation of the integrity of the adjacent joints,

- f) the degree of the damage of nerves and vessels,
- g) the topography of wound canal (level of break),
- h) the position/situation of extremity at the moment of wound.

All this one way or another unavoidably affects the special features/peculiarities of the structure of the walls of wound canal and its extent.

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General/common/total statistical evidence about the different types of bullet fractures of the bones of extremities.

If we take the total quantity of bullet breaks of long tubular bones as one hundred, then the bullet breaks of individual bones are distributed as follows (according to the data of the deepened development):

Shoulder bone..... 20.3

radiation/radial bone..... 14.4

the ulna..... 13.7

both bones..... 7.2

it is unknown..... 2.5

bones of forearm as a whole..... 36.7

femoral bone..... 13.0

the tibia..... 13.1

fibular bone..... 7.4

both bones..... 8.7

it is unknown..... 1.4

bones of shin as a whole..... 19.2.

The bullet wounds of extremities with the damage of bones, as a rule, were observed more frequently than fragmentation (Table 2).

The bullet wounds of thigh with the damage to bone were observed somewhat more frequently than fragmentation; approximately/exemplarily the same relationships/ratios were observed with the bullet breaks of shoulder. The bullet breaks of fibular bone were encountered almost equally frequently both with the fragmentation ones and with the bullet wounds, whereas with the wounds of radiation/radial and ulna bullet wounds were encountered much more frequent than fragmentation ones. Thus, the bullet breaks of radiation/radial bone as a result of bullet wounds were observed into 72.60/o of cases. Approximately/exemplarily at the same level stood the frequency of the bullet wounds of the ulna.

Thus, with rendering aid more frequently it was necessary to deal concerning the bullet wounds. Although the wound canals with the bullet and fragmentation wounds are in principle different, nevertheless in a significant number of cases the structure of wound canals was very similar. The reason for this was the fact that the wound canals with the bullet wounds were different, depending on the bearing/angle at which the bullet penetrated in the tissue of extremity, from the strain of bullet at the moment of the strike/shock about the bone, from the rebounding in the tissues. Passing through the tissues of clothing, bullets and fragments of

shell carried off depthward the wounds of the unit of the clothing/uniform. Finally, bullets could penetrate the tissue by those by already deformed as a result of the rebounding, which was observed under conditions for urban combat, and also in the mountain localities and in the fortified areas.

Wound canals with the fragmentation wounds were distinguished by nature, depending on form and size/dimension of fragments.

The special features/peculiarities of wound canals both with the bullet ones and with the fragmentation wounds depended also on kinetic energy of the wounding shell.

Table 2. Distribution of the breaks of the bones of extremities according to the form/species of the wounding shell (in the percentages).

(1) Наименование кости (2) Вид ранящего снаряда		(3)	(4)	(5)	(6)	(7)	(8)
		Плечевая	Лучевая	Локтевая	Бедренная	Большеберцовая	Малоберцовая
Пуля (9)		56,7	72,6	71,1	53,9	51,6	49,5
Осколок (10)		43,3	27,4	28,9	44,1	48,4	50,5

Key: (1). Designation of bone. (2). Form/species of wounding shell.
 (3). Shoulder. (4). Radiation/radial. (5). Cubital. (6). Femoral.
 (7). Tibial. (8). Fibular. (9). Bullet. (10). Fragment.

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Finally, it is necessary to note that wound canal, its value and building/structure hardly ever reflect the actual sizes of wound. The zone of damage was not usually limited only to the place of the passage of shell; therefore the appearance of wound and wound canal yet are not determined the sizes/dimensions of the damage of the segment of extremities as a whole.

N. I. Pirogov wrote in his time: "Which particularly differs in my eyes the activity of bullet shell on the tissue, this is the precisely molecular jolt which it by them communicates; its boundary

and degree we never not in the condition to determine accurately". At present it is customary to assume that the degree of the decomposition of tissue depends on the mass of shell, multiplied by its rate.

In the principle this rule/handspike remains valid however, it is necessary to have in mind that a sharp increase in the manpower of shell can produce the significant decomposition of tissues, proportional to the square of its rate. If the wounding shell possesses high rate, then, penetrating in the tissue, it acquires the capability to exert explosive/bursting activity. At the moment of introducing the wounding shell in the region of wound and for certain elongation/extent from it (which is furthermore defined by the rate of its flight) in the tissues of extremity is observed as if phenomenon of the burst: soft tissues are exfoliated, vessels and nerves are damaged at the significant distance from the place of the direct damage of the integrity of tissues by the mass of the wounding shell.

By the latter fact to a certain extent it is explained, why with the examination/inspection of wound not always it is possible to determine the form/species of the wounding shell to which it is plotted/applied.

Concerning bullet wounds, N. I. Pirogov wrote: "... with word, you are convinced, that it is not possible to give the general/common/total characteristic of bullet apertures, which would befit for all cases".

This spoke with respect to the wound apertures of skin, but in the equal measure it can be referred also to those deeper lying to tissues.

The role of kinetic energy of the wounding shell in the frequency of the bullet breaks of the bones of extremities can be explained from the analysis of the relationship/ratio of blind-end, perforating and tangential wounds (Table 3).

Thus, among the bullet breaks of shoulder more frequently were encountered perforating wounds (73.90/o) and very rarely tangents (1.80/o). Then concerns other tubular bones.

Table 3. the distribution of the bullet breaks of the bones of extremities according to the character/nature of wound (in the percentages).

(1) (2) Локализация перелома Характер ранений	(3)	(4)	(5)	(6)
	Плечо	Пред- плечье	Бедро	Голень
(7) Сквозные	73,9	84,4	63,6	64,1
(8) Слепые	19,0	10,6	33,3	24,0
(9) Касательные	1,8	2,3	2,2	3,6
(10) Прочие	5,3	2,7	0,9	8,3

Key: (1). Localization of break. (2). Character/nature of wounds.
 (3). Shoulder. (4). Forearm. (5). Thigh. (6). Shin. (7). Through.
 (8). Blind. (9). Tangents. (10). Other.

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From the comparison of numerical data it is possible to see that the greater the volume of extremity, the more strongly is developed the musculature, the more rarely occur the perforating wounds, which are escorted/tracked by the break of bones. Thus, the perforating wounds of forearm, which are escorted/tracked by the break of bones, were observed into 84.4c/o of cases of all bullet breaks of the bones of forearm, and thighs - into 63.6c/o of cases.

Given data tell about the fact that the perforating wounds which

were observed considerably more frequent than blind ones and tangents, as a rule, were brought in by the shells, which possessed high kinetic energy.

The data, which concern the relationship/ratio of the character/nature of the wounds of the individual segments of extremities, which are escorted/tracked by the break of bones, with the form/species of the wounding shell, are represented in Table 4.

Among the bullet wounds of shoulder, forearm, thigh and shin most frequently were encountered through. The percentage of such wounds is extremely high; for the shoulder it composes 90.3, for the forearm - 96.0, for the thigh - 80.3 and for the shin - 89.2. Thus, in the overwhelming majority of the cases the bullet breaks of the bones of extremities were the result of perforating bullet wounds. Among the bullet wounds, which were being escorted/tracked by the break of bones, blind were encountered comparatively rarely. Thus, the bullet breaks of shoulder with the bullet blind-end wounds were observed only in 7.50/o of cases, forearm - in 2.50/o, thighs - in 18.60/o and shins - in 7.20/o.

On the basis of the comparison of the frequency of bullet perforating and bullet blind-end wounds it is possible to indicate that in the process of rendering aid the surgeon considerably more

frequently met with perforating bullet wounds. In addition to this, the relative rarity of blind-end bullet wounds to a certain extent tells about the fact that the contemporary bullets possess extremely high penetrating power - high kinetic energy.

The perforating fragmentation wounds of extremities, which were being escorted/tracked by breaks, were observed more rarely than bullet. The perforating fragmentation wounds of shoulder, which were being escorted/tracked by the break of bones, were observed in 52.60/o of cases of all bullet fragmentation breaks of shoulder, forearm - in 59.50/o, thighs - in 42.40/o, shins - in 43.00/o.

The decrease of the percentage of perforating fragmentation wounds entails an increase in the frequency of blind ones; therefore the blind-end wounds of extremities, which were being escorted/tracked by the break of bones, were more frequently fragmentation than bullet. Thus, for instance, blind-end bullet wounds of shoulder, which were being escorted/tracked by the break of bones, composed 7.50/o, and blind fragmentation - 34.00/o, the blind-end bullet wounds of thigh - 18.60/o, and fragmentation - 51.90/o, etc.

Table 4. Distribution of the bullet breaks of the bones of extremities according to form/species and character/nature of wound (in the percentages).

(1) Локализация перелома	(2) Вид ранения	(3) Характер ранения			(4) Всего
		(5) сквозное	(6) слепое	(7) прочие	
(8) Плечо	(9) Пулевое	90,3	7,5	2,2	100,0
	(10) Осколочное	52,6	34,0	13,4	100,0
(11) Предплечье	(9) Пулевое	96,0	2,5	1,5	100,0
	(10) Осколочное	59,5	23,9	16,6	100,0
(12) Бедро	(9) Пулевое	80,3	18,6	1,1	100,0
	(10) Осколочное	42,4	51,9	5,7	100,0
(13) Голень	(9) Пулевое	89,2	7,2	3,6	100,0
	(10) Осколочное	43,0	38,1	18,9	100,0

Key: (1). Localization of break. (2). Means of wound. (3). Character/nature of wound. (4). In all. (5). through. (6). blind. (7). other. (8). Shoulder. (9). Bullet. (10). Fragmentation. (11). Forearm. (12). Thigh. (13). Shin.

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As can be seen from the given numerals, in the overwhelming majority of the cases the blind-end wounds of extremities with the damage of bones were fragmentation, but not bullet. In addition to this, the significant percentage of blind-end fragmentation wounds tells also about the fact that kinetic energy of the flying fragments is considerably less than the energy of the flying bullet. The form of fragments and their sizes/dimensions are different and as a result

of that different also both the character/nature of wound canals and the degree of the damage of soft tissues.

With the fragmentation blind-end wounds considerably more frequently than with the bullet ones, were observed multiple wounds.

The tangential wounds of extremities, which were being escorted/tracked by the break of bones, were encountered considerably thinner/less frequent than blind or through, regardless of the fact they were bullet or fragmentation. Despite the fact that the tangential wounds are equally frequently both the bullet and fragmentation, the surgical anatomy of wound canals was different and depended on the special features/peculiarities of the anatomical building/structure of this segment of extremity, on the size/dimension of fragments and on the degree of the violation of the integrity of bone.

With the fragmentation tangential wounds soft tissues frequently literally escaped for the elongation/extent, which corresponds to the value of the wounding shell, what almost never it was observed with the bullet tangential wounds.

With the fragmentation wounds more frequently were observed the disengagements and crushings of extremities, while with the bullet

wounds this was observed extremely rarely. In exactly the same manner with the tangential bullet wounds in comparison with the fragmentation tangential wounds the breaks of bones were observed as an exception, besides it is more frequent on the shin where as a result of the surface disposition of the tibia even bullet tangential wound led to the break.

The distribution of casualties with the break of the bones of extremities during the combat operations/processes of the Great Patriotic War according to the form/species of the wounding shell is represented in Table 5.

Table 5. Distribution of casualties with the bullet break of the bones of extremities according to the form/species of the wounding shell for the time of two combat operations (in the percentages)

(1) Боевые операции: М — бой по разгрому немцев под Москвой (октябрь 1941 г. — февраль 1942 г.) В — бой за Берлин (апрель — май 1945 г.)	(2) Локализация перелома	(3) Вид ранящего снаряда										(4) Итого
		(5) пуля					(6) осколком					
		(7) ручей- ная	(8) разрыв- ная	(9) автомат- ная	(10) артилле- рийная	(11) мина	(12) противо- пехотная мина	(13) граната	(14) авиабом- ба	(15) неизвест- ного сна- ряда		
М	(16) Плечо	55,0	5,7	0,7	7,1	19,3	—	—	3,6	8,6	100,0	
В		34,8	1,6	—	9,7	8,1	—	—	1,6	24,2	100,0	
М	(17) Предпле- чье	67,4	4,0	—	4,3	17,3	—	—	1,2	5,8	100,0	
В		56,7	—	—	16,4	16,4	—	—	1,5	9,0	100,0	
М	(18) Бедро	57,3	1,4	0,7	5,6	25,2	—	—	2,1	7,7	100,0	
В		44,0	4,0	1,3	13,3	17,4	—	1,3	1,3	17,4	100,0	
М	(19) Голень	55,0	2,0	—	5,9	27,7	—	—	2,5	6,9	100,0	
В		40,6	1,0	2,0	9,9	24,7	1,0	1,0	2,0	17,8	100,0	

Key: (1). Combat operation/process: М — combat on the rout of the Germans in the environs of Moscow (October 1941 - February 1942). В — combat for Berlin (April - May 1945). (2). Localization of break. (3). Form/species of wounding shell. (4). Altogether. (5). bullet. (6). fragment. (7). gun. (8). explosive/bursting. (9). automatic. (10). artillery shell. (11). mine. (12). antipersonnel mine. (13). garnets. (14). aircraft bomb. (15). unknown shell. (16). Shoulder. (17). Forearm. (18). Thigh. (19). Shin.

Thus, with the bullet breaks of the bones of lower extremities

toward the end of the Great Patriotic War (in combat for Berlin) in comparison with the combat operations/processes in the environs of Moscow considerably decreased a quantity of bullet ones and increased a quantity of fragmentation wounds.

Among the fragmentation wounds in combat for Berlin increased the specific gravity/weight of wounds by the fragments of artillery shells and decreased the specific gravity/weight of wounds by fragments from the aircraft bombs. This is explained by an increase in the power of artillery fire and by the decrease of the activity of hostile aviation toward the end of the war.

Forms/species of the breaks of bones with the bullet wounds of extremities.

Given above data, which concern the form/species of the wounding shells and their special features/peculiarities, were reflected in the distribution of different forms/species of the bullet breaks of the bones of extremities (Table 6).

From the preceding information it is evident that approximately/exemplarily into 50.00% of all cases of the bullet wounds of shoulder, forearm, thigh and shin with the violation of the integrity of bones were observed the large-splintered breaks and it

is very rare - longitudinal breaks.

With the fragmentation wounds of extremities large-splintered breaks were encountered more rarely than with the bullet wounds, then the crushed breaks were encountered considerably more frequent. The crushed breaks with the bullet wounds of shoulder were observed in 15.60/o, with the fragmentation ones - in 25.90/o, with the bullet wounds of thigh - in 12.80/o, and with the fragmentation ones - in 17.30/o, etc.

Consequently, the heaviest group of bullet breaks - the crushed breaks - they were more frequently the result of fragmentation wounds. The latter fact is very important in that sense, that it serves as the indirect exponent of the decomposition of soft tissues and, therefore, complexity of wound canals.

Table 6. Distribution of the bullet and fragmentation wounds of extremities according to the form/species of break (in the percentages) .

(2) Вид перелома	(1) Локализация перелома и вид ранения	(3) Плечо		(4) Предплечье		(5) Бедро		(6) Голень	
		(7) пуле- вое	(8) оско- лоч- ное	(9) пуле- вое	(10) оско- лоч- ное	(11) пуле- вое	(12) оско- лоч- ное	(13) пуле- вое	(14) оско- лоч- ное
(15) Крупнооскольчатый		50,3	36,6	46,0	38,4	44,7	31,5	41,3	28,0
(16) Краевой		7,7	10,0	11,4	9,9	10,8	17,3	14,5	15,6
(17) Косой		13,7	11,8	10,2	9,6	16,8	15,7	9,4	7,8
(18) Дырчатый		1,6	3,4	3,3	2,5	4,9	7,7	7,4	7,7
(19) Раздробленный		15,6	25,9	9,9	24,4	12,8	17,4	14,2	29,9
(20) Поперечный		3,2	5,6	3,2	2,8	4,6	5,7	2,1	2,4
(21) Малооскольчатый		6,5	5,5	15,1	11,5	3,4	3,1	10,0	7,5
(22) Продольный		0,6	0,7	0,8	0,6	0,8	1,0	0,9	0,9
(23) Вколоченный		0,8	0,5	0,1	0,3	1,2	0,6	0,2	0,2
(24) Итого		100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0

(2) Form of break.

Key: (1). Localization of break and the means of wound. (3).

Shoulder. (4). Forearm. (5). Thigh. (6). Shin. (7). bullet. (8).

fragmentation. (9). Large-splintered. (10). Edge/boundary. (11). By

sand bar. (12). Perforated. (13). Crashings. (14). Cross. (15).

Small-splintered. (16). Longitudinal. (17). Packed in. (18).

Altogether.

If we consider that with the fragmentation wounds building/structure of wound canal, as a rule, is characterized by special complexity, irregular form and considerable range in the

proximal and extremital direction, then with the crushed breaks it is possible to expect the significant decomposition of soft tissues, the degree of decomposition can be the directly proportional degree of the decomposition of bones.

With the bullet wounds, which were being escorted/tracked by the crushing of the bones of extremities, also suffered soft tissues; however, to the considerably smaller degree, than with the fragmentation ones.

Perforating wounds. If one considers that the breaks of the long tubular bones of extremities more frequently were observed with the perforating wounds, then from a practical point of view is of interest the distribution of the individual forms/species of the breaks of bones with these wounds (Table 7).

As is evident on table 7, with the perforating wounds most frequently were observed large-splintered breaks. Thus, with the through ones of thigh large-splintered breaks were encountered into 44.20/o and most rarely longitudinal - 0.70/o. Then was observed also with the perforating wounds of shoulder and forearm. Comparing the numerical data of Table 7 with the data about the frequency of bullet wounds with the perforating wounds (pg. 33), it is possible to draw the conclusion that with the perforating bullet wounds of shoulder,

forearm, thigh and shin most frequently were observed large-splintered fractures.

Blind-end wounds. With the blind-end wounds large-splintered breaks were encountered somewhat more thinly/less frequently than with the through ones (Table 8).

Table 7. Distribution of the individual forms/species of the breaks of the long tubular bones of extremities with the perforating bullet wounds (in the percentages).

(12) Локализация перелома	(1) Вид перелома	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
		Крупно-оскольчатый	Краевой	Косой	Дырчатый	Раздробленный	Поперечный	Мелкооскольчатый	Продольный	Вколоченный	Итого
(13) Плечо		49,7	7,3	12,8	1,6	16,4	4,2	6,7	0,5	0,8	100,0
(14) Предплечье		45,6	10,4	10,0	2,8	12,5	3,2	14,7	0,7	0,1	100,0
(15) Бедро		44,2	11,1	16,8	4,2	13,0	5,4	3,5	0,7	1,1	100,0
(16) Голень		34,1	15,1	8,6	7,5	22,7	2,3	8,6	0,9	0,2	100,0

Key: (1). Form/species of break. (2). Large-splintered. (3). Edge/boundary. (4). By sand bar. (5). Perforated. (6). Crushed. (7). Cross. (8). Small-splintered. (9). Longitudinal. (10). Packed in. (11). Altogether. (12). localization of break. (13). Shoulder. (14). Forearm. (15). Thigh. (16). Shin.

Table 8. Distribution of the individual forms/species of the break of long tubular bones with the blind-end wounds (in the percentages).

(12) Локализация перелома	(1) Вид перелома	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
		Крупно-оскольчатый	Краевой	Косой	Дырчатый	Раздробленный	Поперечный	Мелкооскольчатый	Продольный	Вколоченный	Итого
(13) Плечо		40,0	13,5	16,5	6,2	11,7	4,3	5,9	1,4	0,5	100,0
(14) Предплечье		41,3	15,7	11,7	6,4	9,5	2,6	11,4	1,1	0,3	100,0
(15) Бедро		32,5	18,8	16,7	10,3	12,1	4,7	3,1	1,3	0,5	100,0
(16) Голень		31,0	22,4	9,3	15,9	9,7	2,4	7,9	1,3	0,1	100,0

Key: (1). Form/species of break. (2). Large-splintered. (3). Edge/boundary. (4). By sand bar. (5). Perforated. (6). Crushed. (7).

Transverse. (8). Small-splintered. (9). Longitudinal. (10). Packed in. (11). Altogether. (12). Localization of break. (13). Shoulder. (14). Forearm. (15). Thigh. (16). Shin.

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Given data show that the character/nature of the distribution of the individual forms/species of the break of the bones of extremities with the blind-end wounds on the whole is similar to the distribution with the perforating wounds, but nevertheless there are some special features/peculiarities. thus, if with the perforating wounds the large-splintered breaks of thigh were observed into 44.20/o of cases, then with the blind-end wounds - into 32.50/o, whereas moreover similar relationships/ratios are encountered also with the blind-end wounds of shoulder, forearm and shin.

Tangential wounds. Special interest are of tangential wounds, first of all because in a number of cases the breaks of bones were, apparently by the result of the lateral activity of shell. It is difficult to say, as the frequently appearing with the tangential wounds breaks they were the result of the lateral activity of the wounding shell, because not always the examination/inspection of wound makes it possible to strictly differ tangential wounds from the through ones. Therefore given in Table 3 numerical data completely to

not reflect actual state of affairs. It would seem that with the tangential wounds the large-splintered breaks must be encountered rarely; nevertheless from the preceding information it is evident that with the tangential wounds the large-splintered breaks of the bones of shoulder, forearm, thigh and shin were encountered considerably more frequently than this it would be possible to assume (Table 9). The remaining forms/species of the breaks of the bones of extremities were encountered considerably thinner/less frequent than large-splintered, and almost so frequently as with the blind-end, perforating and tangential wounds.

Special position occupied the edge/boundary breaks which were observed considerably more frequent with the tangential wounds than with the blind ones and the through ones.

Oblique breaks, as a rule, were encountered equally frequently in all forms of the wounds of shoulder, forearm, thigh and shin. Perforated breaks were encountered rarely.

Dependence of the form/species of break on building/structure of bone.

The special features/peculiarities of building/structure of tubular bones to a certain extent affected the frequency of different

forms/species of break. The diaphysis of bones, which consist of the compact substance, exert the wounding shell greater resistance than the pineal systems, in which the layer of compact substance is very insignificant, and bulk consists of spongy substance. The latter, apparently possesses special physical properties, in consequence of which and the relationship/ratio of the frequency of the individual forms/species of the bullet breaks with one and the same form/species of the wounding shell another, than within the limits of diaphysis.

Table 9. Distribution of the individual forms/species of the breaks of the long tubular bones of extremities with tangential bullet wounds (in the percentages).

(1) Вид перелома (12) Локализа- ция перелома	(2) Кру- пно- осколь- чатый	(3) Крае- вой	(4) Ко- сов	(5) Дыр- чатый	(6) Рав- дроб- лен- ный	(7) Попе- реч- ный	(8) Мелко- осколь- чатый	(9) Про- доль- ный	(10) Вко- лочен- ный	(11) Итого
(13) Плечо	19,4	38,9	16,7	—	9,7	13,9	1,4	—	—	100,0
(14) Предплечье	32,4	18,6	12,4	1,4	17,9	2,1	15,2	—	—	100,0
(15) Бедро	23,7	29,0	18,4	2,6	15,8	7,9	2,6	—	—	100,0
(16) Голень	34,3	31,9	7,6	3,3	12,9	3,3	6,2	0,5	—	100,0

Key: (1). Form/species of break. (2). Large-splintered. (3). Edge/boundary. (4). By sand bar. (5). Perforated. (6). Crushed. (7). Cross. (8). Small-splintered. (9). Longitudinal. (10). Packed in. (11). Altogether. (12). Localization of break. (13). Shoulder. (14). Forearm. (15). Thigh. (16). Shir.

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Thus, the perforated breaks of thigh in middle third were encountered only into 2.4c/o of cases, greater percentage they were in upper (6.4) and lower third of thigh (10.3), i.e., in the limits of pineal systems and metaphyses of femoral bone. Large-splintered fractures most frequently were observed in middle third (46.5o/o), it is thinner/less frequent in upper third (36.5o/o) and it is still thinner/less frequent in lower third (33.3o/o and to a number of

breaks each third).

The packed in breaks, as a rule, were observed in the limits of pineal systems and metaphyses and only into 0.50/o of cases in the region of diaphysis.

The crushed breaks of thigh were observed equally frequently as in the upper, so in middle and lower third. The crushed breaks were most frequently the result of fragmentation wounds; hence it is possible to draw the conclusion that with the fragmentation wounds the form/species of the break to a lesser degree depends on building/structure of the damaged bone, than with the bullet ones.

With the bullet wounds of shoulder, which were being escorted/tracked by the break of bone, was observed approximately/exemplarily the same regularity, as with the breaks of thigh. The large-splintered breaks of shoulder were observed in the limits of diaphysis into 48.40/o of cases, whereas in upper third - in 39.50/o, and in the lower third in 44.60/o, perforated - mainly in upper and lower third. Thus, the perforated breaks of the upper pineal system of shoulder bone were observed in 4.30/o of cases, those of lower pineal system - only in 1.80/o and in middle third - in 1.60/o. Approximately/exemplarily the same relationships/ratios were observed also with the packed in breaks of shoulder bone.

The relationship/ratio of the individual forms/species of the breaks of the bones of forearm and shin reflects the same regularity which was observed also with the bullet breaks of shoulder and thigh. However, the perforated breaks in middle third of shin were observed still thinner/less frequent than with the bullet breaks of femoral and shoulder bone, and composed only 0.40/o, and in lower third - 1.20/o.

During the comparison of the individual forms/species of the bullet breaks of the bones of shoulder, forearm, shin and thigh attention is drawn to the fact that with the breaks of upper third of bones of shin it is more frequently than with the breaks of upper third of shoulder, forearm and thigh, were encountered the large-splintered, crushed and small-splintered breaks. The latter fact is the result of the fact that the tibia lies/rests very superficially and it differs in form from other tubular bones. It actually on is tubular, and it must be related to trihedral bones.

With the bullet breaks of the tibia longitudinal breaks were observed more frequently than with the bullet breaks of shoulder, forearm and thigh. So, the longitudinal breaks of the bones of shin both in lower third and on the average composed 0.70/o. With the

wounds of thigh and shoulder longitudinal breaks are encountered equally frequently in the limits both of upper, middle and lower third.

Given data confirm position/situation that the physical qualities of the spongy and compact substance of bones are different. Consequently, the character/nature of wound canals is also various and depends on damage level to bone.

Furthermore, a comparatively high frequency of the large-splintered, small-splintered and crushed breaks, and also the presence of longitudinal breaks they speak, that in a number of cases during the bullet damages of bones the extent cracks unavoidably must be different. Cracks, being propagated in the proximal and extremital direction, can penetrate the joint and not only increase the zone of damage to extremity, but also determine further development of pathological process.

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This of the point of view great interest are of the data, which concern the frequency of arthrites, which were being observed with the bullet breaks of the tubular bones of extremities.

The analysis of data of the deepened development of the histories of disease/illness shows that most frequently suppurative arthrites were observed with the longitudinal breaks of thigh, shin and forearm. In the second place will cost the small-splintered, large-splintered and crushed breaks, which is completely logical, if we consider the described above mechanism of wounds and the form/species of the wounding shell.

If we compare the frequency of suppurative arthrites during the damages of shoulder, forearm, thigh and shin, then it appears that most frequently suppurative arthrites were observed in all forms of the break of thigh. The latter is explained by the fact that on the thigh most frequently it is possible to see cracks, which are propagated to the side both of hip and knee joint. Most rarely suppurative arthrites were observed in all forms of the bullet breaks of shoulder.

Thus, if we compare the frequency of suppurative arthrites in all forms of the break of the long tubular bones of extremities, then it appears that in the first place in the frequency will cost the thigh, on the second - shin, on the third - forearm and on the fourth - shoulder.

Logical to assume that with the bullet breaks of the long

tubular bones of extremities the frequency of suppurative arthrites and crack propagation into the adjacent joints must to a certain extent depend on the level of break (table 10).

Of given above data follows the practically important conclusion that most frequently the bullet breaks of upper and lower third of thigh were penetrating into the joint, since with the wounds of the mentioned levels in these places cracks are formed most frequently. In the second place in the frequency of the penetrating into the joint bullet breaks of tubular bones will cost the shin. The third place occupies forearm and at the latter/last place will cost the shoulder. Thus, the surgical anatomy of the bullet wounds of thigh and shin is considerably more complex than the surgical anatomy of the wounds of shoulder and forearm.

The frequency of suppurative arthrites during the damages of thigh and shin is determined, apparently not only by more frequent crack formation, but also by sizes/dimensions of joints.

Table 10. Frequency of suppurative arthritides with the bullet breaks of the bones of extremities on different levels (in the percentages to a number of breaks each third).

Наименование кости	Уровень перелома (по третям)		
	(3) верхняя треть	(4) средняя треть	(5) нижняя треть
(6) Плечевая	1,1	0,2	0,1
(7) Кости предплечья	1,1	0,05	0,6
(8) Бедренная	2,7	1,4	6,3
(9) Кости голени	4,8	0,7	1,1

Key: (1). Designation of bone. (2). Level of break (on third). (3). upper third. (4). middle third. (5). lower third. (6). Shoulder. (7). Bones of forearm. (8). Femoral. (9). Bones of shin.

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For the frequency of the cracks, which penetrate into the joint, with the wound of the lower pineal system of thigh and upper pineal system of shin paid attention already N. I. Pirogov. He wrote that "the cracks, which penetrate into the joint, belong generally to the usual phenomena of the bullet wound of pineal system, particularly lower end of the thigh and upper of the tibia". This position/situation of N. I. Pirogov, expressed by it 100 years ago, is confirmed by the analysis of data of the deepened development of the histories of disease/illness.

In contrast to the wounds, which penetrates into the joint and which are frequently escorted/tracked by severe complications, the not penetrating into the joint perforated and edge/boundary breaks flowed/occurred/lasted most they were favorably and finished shortly with recovery without the complications, giving the best anatomical and functional results.

Therefore, estimating clinical outcomes and methods of treatment, which were being used with the bullet breaks of extremities, it is first of all necessary to consider the severity of wound; then it will be possible to explain, why with the light breaks, which were not undergoing early primary surgical processing, and subsequently to the specialized treatment, were obtained better results, than in the cases of the heavy breaks, which were undergoing early surgical processing and specialized treatment.

Perforated and edge/boundary breaks for the most part required neither primary processing nor the specialized treatments and during the conservative treatment gave excellent results. The heaviest crushed and large-splintered breaks it gave satisfactory and good results only because of the early primary surgical processing and the specialized treatment.

To course and outcome of the bullet breaks in significant degree influenced the associated damages of vessels and nerves whose frequency was represented in Table 11.

The surgical anatomy of the wounds of extremities, which are escorted/tracked by the break of bones, is especially complex when simultaneously with the bone are damaged nerves and vessels.

From given above data it is possible to draw the conclusion that by the greatest severity and greatest complexity were characterized the large-splintered and crushed breaks of the tubular bones of extremities; with of this type breaks considerably suffered soft tissues.

Table 11. Frequency of the damages of vessels and nerves with the bullet breaks of the bones of extremities (in the percentages).

(1) Локализация перелома	(2) Сопутствующие повреждения	
	(3) крупных сосудов	(4) нервов
(5) Плечо	9,7	35,6
(6) Предплечье	7,4	30,5
(7) Бедро	8,0	10,6
(8) Голень	14,9	22,2

Key: (1). Localization of break. (2). Associated damages. (3). large vessels. (4). nerves. (5). Shoulder. (6). Forearm. (7). Thigh. (8). Shin.

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It is possible to expect that with the breaks of this form/species frequently must be observed and the violation of the integrity of nerves and vessels. The analysis of data of the deepened development of the histories of disease/illness from this point of view showed that the damages of nerves most frequently were observed with the crushed and edge/boundary breaks.

With the large-splintered bullet breaks of shoulder the damages of nerves were observed in 36.6c/c of cases. At the latter/last place will cost the packed in and longitudinal breaks, with which the

damages of nerves were observed only in 12.00/o of cases.

On the shin the damages of nerves were observed mainly with crushed breaks (39.50/o); in the second place stood large-splintered breaks (20.40/o), also, at the latter/last place - longitudinal.

A comparatively high frequency of damages of nerves with the bullet breaks of shoulder is explained by the special features/peculiarities of the topography of basic nerve trunks, by their disposition near one from another. By the same is explained different frequency of their damages depending on the level of wound. Thus, on the thigh into 11.50/o of cases of damaging the nerves they were observed with the wounds upper third; on the shoulder 44.50/o cases of all damages of nerves they came to middle third. On the shin they were observed almost equally frequently both with the wounds in middle (22.00/o) and with the wounds lower third (29.80/o); then was noted on the forearm both in middle third (31.60/o) and in lower (28.30/o) third of it.

From the analysis of given data it is possible to draw the conclusion that on those segments of the extremities where the muscles change into the tendons where a quantity of soft tissues is small, where the nerves adjoin close to the bones or are arranged/located very close to them, with the large-splintered and

crushed breaks always it is possible to expect the damage of the nerve trunks.

The experiment/experience of the Great Patriotic War showed, thus, that into 35.60/o of cases of the bullet breaks of shoulder and into 30.50/o of cases of the bullet breaks of forearm were damages of nerves, which to a considerable degree affected outcomes. The same relates also to the breaks of thigh and bones of the shin where multiple failure of major vessels and nerves when the break of bones is present, served as reading/indication to the amputation, and the damage of nerve burdened clinical outcomes.

From given above data evidently entire diversity of the conditions, which are determining building/structure of wound canal and its special features/peculiarities, which are the result mainly of the action of the wounding shell on the tissue.

Anatomical special features/peculiarities of the individual means of the damages of the tissues of extremities.

In order to more fully/totally/completely visualize the surgical anatomy of the wounds of extremities and their complications, it is necessary briefly to dwell on the anatomical special features/peculiarities of the individual tissues of extremities.

Wound of skin. Entrance and outlet in the skin hardly ever reflect the character/nature of actual violation the integrities of soft tissues on the course of wound canal. With the bullet wounds, the especially not escorted/tracked by break bones, entrance and outlet the skins, as a rule, are small; their form is close to the subglobose. Depending on the bearing/angle at which the shell penetrated in the tissue, value and form of inlet can be changed; form from the circular changes into the oval, and with the tangential wounds skin can be damaged only along passage line of the wounding shell.

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With fragment blind-end wounds the inlet of skin, depending on the value of fragment, can be very insignificant and as with the bullet wounds, in any way he does not determine the sizes/dimensions of the damage of the integrity of the tissues which are on the course of wound canal.

With the tangential fragmentation wounds, plotted/applied by large/coarse fragments, it is possible to observe the defects of skin and its scaling for the significant elongation/extent. Outlet with the perforating wounds both by the bullet and by fragment, can achieve large sizes/dimensions with the bullet breaks when the penetrating extremity shell carries off after itself the units of the broken ends of bone, and bullet, encountering bone, frequently is strained; in such cases it can leave the soft tissues, after changing its direction. Therefore with the perforating wounds, which are escorted/tracked by the break of the bones of extremities, the outlet of skin, as a rule, always is considerably more than entrance.

Subcutaneous cellulose, depending on the degree of its development, also differently reacts to the passing shell.

With the blind-end and perforating wounds in the region of inlet as a result of the contusion cellulose dies/becomes numb over the considerably greater area, than the area of the damage of skin. With the tangential wounds, bullet and fragmentation, cellulose can be stratified for the significant elongation/extent and, being necrotized, to involve and the necrosis of the corresponding sector of skin.

The fascias, which surround extremity, forming bone- fascial cases of the groups of muscles, exert in view of their elasticity great resistance to the wounding shell. As a rule, wound aperture in the fascia has slit-shaped form and does not correspond to the degree of the decomposition of muscular tissue, which is arranged/located under it. Fascias on the extremities, especially on the lower, differ in terms of special density and intractability to the stretching, in consequence of which bone-fascial sheaths unchange their volume.

Muscles undergo always considerably greater decomposition, than it is possible to assume on the basis one examination/inspection alone of skin wound or aperture in the fascia. In view of the elasticity of the edge of muscular wound they diverge, are formed the

pockets, the depressions, which more complex, the more complex the form of the wounding shell.

In addition to this, the position/situation of extremity and the condition of muscle at the moment of wound exert a substantial influence on the form of muscular wound; as a result of the contraction/abbreviation of muscular beds wound canal acquires particularly complex form.

In connection with the fact that the muscles are included in the unyieldable bone- fascial spaces, developing following the wound edema of tissues and, therefore, an increase in the volume of the damaged tissues is limited to dense fascial leaflets, in consequence of which sharply is raised intra-tissue pressure and attacks/advances the disorder of blood supply, which creates favorable conditions for the development of anaerobic infection.

Bones. The bullet damages of bones are characterized by also large diversity. With the large/coarse and small-splintered, and also crushed breaks the unit of the fragments remains connected with the periosteum, and if the latter is connected with soft tissues, then such fragments are viable, other fragments lose bond with the periosteum and, remaining in the wound, they are in a number of cases actually foreign bodies.

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At the moment of the passage of the wounding shell the pericosteum can scale from the bone sometimes for the significant elongation/extent. In such cases is disturbed the integrity of vessels its, is possible education of subperiosteal hematomas of small size/dimension. The cracks, which are propagated from the place of damage for bone in the proximal and extremital direction, also contribute to the education of hematomas which are arranged/located along the course of cracks.

At the moment of the wound of extremity, in view of the observing jolt, is noted hemorrhage into the spongy substance of pineal systems and into the marrow area. The units of the brain, deprived of nourishment, are very inclined to the numbness.

The damage of vessels and nerves can be different, depending on the character/nature of the wounding shell. Sometimes it is possible to see crushing for the significant elongation/extent and educating the defects in the wall of vessel.

The hemorrhages, which appear at the moment of wound, are

propagated on the loose connective tissue. Depending on the topography of loose connective tissue is possible the education of hematomas of different form/species.

Above were described subperiosteal hematomas. Sometimes the blood is propagated on the loose connective tissue, which surrounds bone, forming paraossal hematomas, and on intermuscular loose cellulose - intermuscular hematomas, etc.

The developing later festering in the region of wound is propagated on the loose connective tissue, and thus are developed suppurative flows and phlegmons.

The topography of suppurative flows is determined by the special features/peculiarities of building/structure of bone-fascial spaces of the individual segments of extremities, and also by the degree of the violation of their integrity at the moment of wound.

Thus, correct presentation/concept about the character/nature of wound canal and corresponding estimate of the surgical anatomy of wound are possible only under the condition of the thorough analysis of all noted above special features/peculiarities of the individual means of the damages of the tissues of extremities.

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Chapter III

Diseases damages, which associate the bullet breaks of the bones of extremities.

N. S. Molchanov.

Total changes in the organism and the disease of internal organs/controls with the bullet breaks of the bones of extremities.

N. I. Pirogov as early as 1866 wrote: "he very rarely occurs in the military field practice so that the bullet breaks and unconnected with the crushing bones would heal without the singular fits and the results. Still thinner/less frequent this occurs, if break is complicated by crack or split". Further N. I. Pirogov indicated that "the ...entire series/number of the most different successive or secondary phenomena was distinctive to all damage of the integrity of organic tissues. Here are involved: the local phenomena of stimulation/irritation, phenomena of general/common/total traumatic stimulation/irritation, constitutional diseases/illnesses, which are connected up trauma, some singular local fits, traumatic nerve phenomena of stimulation/irritation and finally traumatic and trauma-hospital infections/contaminations". Elsewhere N. I. Pirogov wrote:

"frequently they are noted after traumatic damages and local suffering of internal organs/controls, which are escorted/tracked by fever or without it. To quite ordinary ones of them belong blenorrhoea of intestinal canal and albuminorrhoea.

Generally trauma destroys whole organism much deeper than this they visualize".

N. I. Pirogov's these statements are in full/total/complete agreement with the ideas of S. P. Botkin and I. P. Pavlov about the completeness of organism, about the sameness of the external and internal medium of organism.

As is known, already S. P. Botkin repeatedly underscored the need for the understanding of human organism as unit as the samenesses of mental and physical. He attached exceptional value to mental components in the development of pathological processes and voiced thought, that the nerve centers are the middle link of that reflector mechanism which is the basis of the pathogenesis of some morbid processes.

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With the saturated clarity the completeness of organism was

shown by I. P. Pavlov. As is known, I. P. Pavlov understood under the completeness of organism, in the first place, the "degree of correlation of all its units and their functions in the sense functioning as unit, system, but besides system, constantly and by continuously interacting with the environment in the process of the mobile/motile, flowing, continuously oscillating, variable balancing of organism in the surrounding peace/world". In the second place, I. P. Pavlov understood organism as whole in the sense of that understood mainly through the nervous system of the functional unity of its external and internal vital activity, i.e., the activity, which joins with the conditions of environment, and the activity, which occurs in the internal medium of organism. Thirdly, I. P. Pavlov understood organism as whole in the sense of the sameness of mental and somatic. Speaking about the functional sameness of nervous system, I. P. Pavlov always underscored all dominating, regulating functions of organism the role of large hemispheres.

"To the large hemispheres, wrote I. P. Pavlov, continuously fall countless stimulations/irritations both of the external peace/world and from the internal medium of organism itself. We have, thus, before ourselves, first of all, the most complex construction/design, mosaic... but from each individual condition of cortical cells can be formed special conventional stimulus... All this is encountered, collides but must store/add up, be systematized. Before us,

therefore, in the second place, grandiose dynamic system".

I. P. Pavlov's exercise about the completeness of organism was developed by his numerous pupils.

K. M. Bykov showed that "the internal for the organism medium continuously sends signals into the central nervous system, into the cerebral cortex, creating the specialized information about the events, which are accomplished in the internal organs/controls". By K. M. Bykov and his coworkers proved that these signals reflector influence the functional condition of brain, reflecting in its activity entire diversity of the work of internal organs/controls. Important fact in this case should be considered the accurately established facts that the stimulations/irritations of internal organs/controls are capable of becoming the conditioned reflex, and by the nature these internal (interoreceptive) conditioned reflexes are in principle identical with those, which opened I. P. Pavlov in the relation to external for the organism irritants.

N. I. Pirogov's statements about deep changes in the organism under the effect of the trauma were confirmed by the numerous observations of the Soviet surgeons (V. A. Oppel', P. A. Cyprian, N. N. Yelanskiy, S. I. Banaytis, M. N. Akhutin, A. A. Vasil'yev) and the therapists, who indicated the significant changes in all

organs/controls with different wounds and first of all with the wounds of tubular bones. The mentioned authors showed that the wound of tubular bones were most frequently escorted/tracked by the shock in genesis of which, as is known, exceptional role belongs neurodeflector mechanisms, sepsis and other pathological processes. By the authors was shown change in the reactivity of entire organism during the damage of tubular bones and series of changes from the side of internal organs/controls.

Experience of the Soviet doctors, who worked at the fronts of the Great Patriotic War 1941-1945, to a considerable extent supplemented data obtained by the previous authors. Numerous observations in the period of the Great Patriotic War showed frequency and diversity of pathological processes from the side of internal organs/controls in casualties generally, also, during the damages of tubular bones in particular. This concerned changes in the cortex, and the violations of the function of circulatory apparatus and diseases of the lungs, etc.

For the illustration are given short extractions from the histories of disease/illness.

1. M. M. I. Raven 12/X 1944 11 hours. It entered on DMP 12/X 1944 13 hours. Diagnosis: the wound of right thigh in lower third

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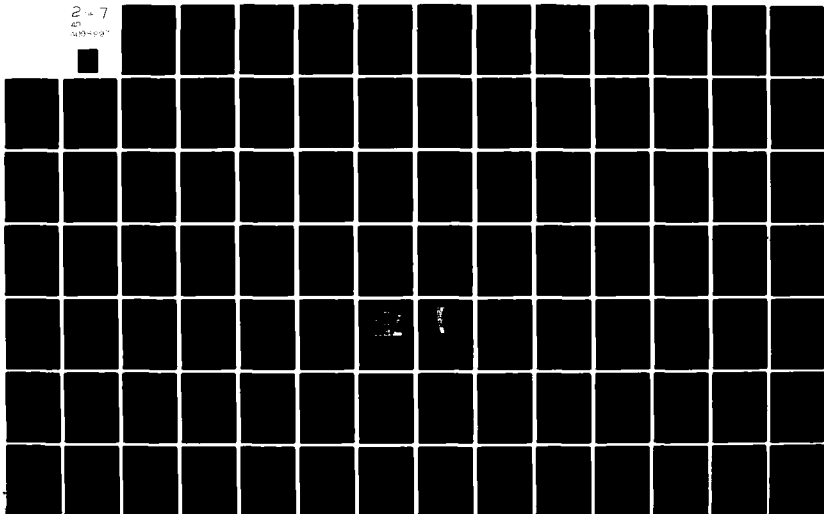
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EXPERIENCE OF SOVIET MEDICINE IN A GREAT PATRIOTIC WAR 1941-194--ETC(U)
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with the damage to bone. Blood loss. Complaints of the overall weakness, the sharp pains in the right leg, the noise in ears.

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Casualty in the consciousness, moans, are somewhat excited, it voices fears, is not wounded stomach. It is pale, skin integuments have the earthy hue: skin dry, eyes were thrown, there is a collapse of neck veins. In lower third of right thigh wound by the fragment of shell, is damaged the bone. Lymphatic apparatus without the changes.

Pulse of 104 strikes/shocks per minute, rhythmic, weak filling. Boundaries of heart in the norm. The tones of heart are muted. Arterial pressure 52/35 mm of the mercury column. Respiration 36 per minute. In light substantial changes there is not. Tongue moist, coated. The liver and spleen could not be felt. Temperature of 34°.

Quantity of circulating blood 3000 cm³.

	12/X	13/X	
	вечер (1)	утро (2)	вечер (1)
Артериальное давление (3)	65/45	70/48	76/48
Пульс (4)	104	96	88
Дыхание (5)	30	24	18

	Исследование крови (6)		
	12/X	13/X	14/X
Гемоглобин (в %) (7)	66	54	44
Эритроциты (8)	2 710 000	2 600 000	2 200 000
Лейкоциты (9)	53 500	62 800	26 200
Сегментоядерные (в %) (10)	57	69,5	78
Палочкоядерные (в %) (11)	19	23	12,5
Юные (в %) (12)	1,5	—	—
Моноциты (в %) (13)	1,5	1	3,5
Лимфоциты (в %) (14)	20,5	6,5	8
Эозинофилы (в %) (15)	0,5	—	—
Ретикулоциты (в %) (16)	0,3	0,6	1,2
Белок крови (в %) (17)	7,09	8,42	—
Сахар крови (в мг %) (18)	164	134	—

Key: (1). evening. (2). morning. (3). Arterial pressure. (4). Pulse.
 (5). Respiration. (6). Research of blood. (7). Hemoglobin (in o/o).
 (8). Erythrocytes. (9). Leukocytes. (10). Segmentonuclear (in o/o).
 (11). Stabnuclear (in o/o). (12). Young (in o/o). (13). Monocytes (in
 o/o). (14). Lymphocytes (in o/o). (15). Eosinophils (in o/o). (16).
 Reticulocytes (in o/o). (17). Protein of blood (in o/o). (18). Sugar
 of blood (in mg o/o).

Seedings/inoculations of the blood under the aerobic and
 anaerobic conditions for an increase not in the distance.

Operation/process. After the transfusion of blood (500 cm³, the
 first group) under chloroethyl anesthesia is produced circular

three-moment amputation (according to N. I. Pirogov) in middle third of right thigh. It is evacuated in a good condition 16/X 1944.

2. G. k. O., 33 years, 8/XI 1944 14 hours was wounded (it was undermined on mine). First aid is shown/rendered by aidman. On PMP are superimposed the bandage, the splint of Cramer. It entered on DMP 18/XI 1944 20 hours.

Diagnosis: the disengagement of left shin and right forearm.
Burn/scald of face.

Casualty in the consciousness, is passive. During the burst is burned the skin of face. Skin the bodies to touch dry; eye lackluster, were thrown. Nourishment is somewhat lowered/reduced.

Pulse of 136 strikes/shocks per minute, weak filling. The boundaries of heart in the limits of norm, tones are pure/clean. Arterial pressure 109/74 mm of the mercury column. Respiration 20 per minute. Percussively everywhere clear pulmonary sound, is auscultatory - individual dry wheezes. Tongue pure/clean, moist. The liver and the spleen do not palpate. Temperature of 36.3°. From the side of nervous system no substantial changes there are.

	Исследование крови	
	8/XI	9/XI
Гемоглобин (в %) (3)	69	73
Эритроциты (4)	3 980 000	4 270 000
Лейкоциты (5)	49 100	24 900
Сегментоядерные (в %) (6)	21	30
Палочкоядерные (в %) (7)	67,5	59,5
Юные (в %) (8)	3,5	2
Миелоциты (в %) (9)	2	0,5
Лимфоциты (в %) (10)	4,5	7,5
Моноциты (в %) (11)	1	0,5
Эозинофилы (в %) (12)	0,5	—
РОЭ (мм в час) (13)	15	21
Белок крови (в %) (14)	7,5	7,22
Сахар крови (в мг%) (15)	173	115
Аскорбиновая кислота в крови (в мг%) (16)	0,77	1,01

Key: (1). Research. (2). blood. (3). Hemoglobin (in o/o). (4). Erythrocytes. (5). Leukocytes. (6). Segmentonuclear (in o/o). (7). Stabnuclear (in o/o). (8). Young (in o/o). (9). myelocytes (in o/o). (10). Lymphocytes (in o/o). (11). Monocytes (in o/o). (12). Eosinophils (in o/o). (13). ROE (mm an hour). (14). Protein of blood (in o/o). (15). Sugar of blood (in mg o/o). (16). Ascorbic acid in blood (in mg o/o).

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A quantity of circulating blood is equal to 3500 cm³.
 Electrocardiogram without the substantial changes. In seedings/inoculations of the blood under the aerobic and anaerobic conditions of pathogenic microbes it is not discovered.

Operation/process. After the transfusion 500 cm³ of blood of the I (O) group is produced the amputation of left shin in middle third and the amputation of right forearm.

10/XI 1944 it is evacuated in the satisfactory condition.

The given examples illustrate the presence of different changes from the side of different systems and organs/controls of casualty (nervous system, circulatory apparatus, metabolic processes, the picture of the blood, etc.), which are observed already during the first hours and the days after wound. No bases for joining similar changes with the development infections; evidently, they are explained by reflector effect from the side of central nervous system. This is confirmed by the fact that all phenomena indicated do not carry stable character/nature and disappear in proportion to the output/yield of casualty from pre-shock, heavy condition.

Literary and statistical survey/coverage.

V. V. Svirchevskaya and L. A. Brodovich revealed/detected significant anemia in those wounded in the extremity, especially in the presence in them of the complication of anaerobic infection. The

average percentage of hemoglobin in this group of casualties was equal to 43, and a quantity of erythrocytes fell to 2760000 with the colored indicator into 0.76. T. S. Chernosvitcva and K. V. Arkhangel'skiy arrived at the conclusion that a quantity of reticulocytes in the puncture specimen of breast bone with the wounds with the damage of bones was on the average considerably higher than with the wounds only of soft tissues. They explained this by the stimulation/irritation of bone marrow as a result of mechanical trauma. Those not less expressed were changes in the white blood with the wounds of tubular bones. V. A. Beyer, who studied the morphological picture of the blood in the foremost stages of evacuation (DMP) with different bullet wounds, including with the bullet breaks of thigh, shin, feet, upper extremities, arrived at the conclusion that into the first they were frequent after wound, sometimes even for the first hour, almost in all casualties, independent of presence or absence of shock, appeared distinct leukocytosis of neutrophilic character/nature, up to the appearance of myelocytes. This leukocytosis during the subsequent days was decreased also after 7-8 days in the absence of postwound or post-operation complications a quantity of leukocytes came to the norm. The research of puncture specimen with the escorted/tracked by leukocytosis wounds of extremities showed the presence of the distinct stimulation/irritation of bone marrow; the author assumed that it was the result of reflector effects from the side of

vegetative centers.

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With the complication of wound of infection in the peripheral blood attacked/advanced ordinary changes in the leukocytes, shift/shear, acceleration of ROE.

R. M. Gutman it produced the research of bone marrow in casualties with the complication of a toxic-septic infection and in a number of cases found the hyperplasia of reticulo-endothelial system and erythroid tissue and their suppression. This different reaction of bone marrow, apparently depended on the relationship/ratio of infection and reactivity of organism. M. I. Arinkin and A. F. Aleksandrov, that studied bone marrow with the wounds, which were being escorted/tracked by sepsis, came to light/detected/exposed three types of the violation of the leukopoietic function: a) myelocytic reaction, b) the stimulation/irritation of a reticulo-endothelium, c) plasmocytic (appearance of plasma cells in the increased quantity in the peripheral blood and bone marrow) reaction. To the latter the authors assigned unfavorable prognostic value.

Of that presented it above follows that the wounds of tubular

bones both with the complications and without the same, produced change in the hemopoietic function.

During the damage/defeat of tubular bones greatly frequently were observed the changes from the side of circulatory apparatus. It is completely obvious that the character/nature of these changes to a considerable degree depended on the severity of wound and on its complicated factors.

A. Ya. Gubergrits, who studied the condition of cardiovascular system in casualties with the uncomplicated break of bones, did not observe the expressed changes, except the moderate lability of pulse; however, with bullet osteomyelitis, predominantly the bones of thigh and shin, in the significant percentage of the cases he noted the expansion of the boundaries of heart, muting and even decomposition of the first tone in heart, the presence of functional systolic noise, tendency toward the hypotonia. Capillaroscopy showed in this group of casualties the pathologically changed forms of capillaries (expansion of venous branch, winding) and an increase in the quantity of functioning loops.

G. V. Babakhanov, observing in the foremost stages of evacuation those wounded in the extremity damage of bone, it noted in the significant percentage the case (to 70.0) tachycardia, the expansion

of the boundaries of heart, the appearance of systolic noise in head, arrhythmia.

Even more expressed became changes from the side of heart with the complication of wound of infection. D. A. Aron indicated in these cases the frequent pulse, the "symptom of shears", a drop in the blood pressure. S. Z. Kostyukova studied the condition of cardiovascular system in casualties into the upper and lower extremities with the complication of anaerobic infection. The functional capability of heart she judged on the basis of electrocardiograms. In 94.50/o of casualties S. Z. Kostyukova revealed/detected significant changes in the muscles and only in 5.30/o - small damages/defects. In the significant percentage of cases (88.8) electrocardiographic changes indicated also the violation of coronary blood circulation. The carried out by S. Z. Kostyukovoy observations showed that into some cases the electrocardiographic changes carried the reversible character/nature, in others - stable, which, apparently depended on severity and character/nature of wound and on its complications.

Very interesting data were obtained during the study of the condition of vessels in those wounded in the extremity. N. Ya. Chervyakovskiy, B. N. Mogil'nitskiy they indicated the development of endarterites, endovasculites with the typical disorders of local

blood circulation. A. P. Avtsyn very frequently saw with the wounds of thigh, hip and knee joint ascending thrombophlebitides of the extensive departments of venous system.

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He considered the damages/defeats of veins, arteries and capillaries the primary sources of the sepsis which, using its sectional materials, was encountered with the wounds into the lower extremities into 84.70/o. Wound sepsis, according to I. G. Rufanov's data, most frequently was developed during the damage of thigh (18 times more frequent than during the damage of shoulder, and 12 times it is more frequently than with the wound of shoulder joint). I. S. Dergachev also indicated that during the anaerobic infection the thromboses of vessels were encountered into 25.00/o of cases.

Given data attest to the fact that with the wounds of tubular bones initially attacked/advanced the mildly expressed dystrophic changes in the myocardium. In proportion to the complication of infection these changes became more expressed and deep, acquiring the sometimes irreversible nature. Infection in the significant percentage of the cases was escorted/tracked by the damage/defeat of vessels.

Lung ailments. During the bullet damages of tubular bones frequently were observed the diseases of the lungs. O. N. Pedorov, studying in KhPPG of the second line of the disease of the lungs in those wounded in the extremity, it revealed/detected focus pneumonia into 22.5-51.90/o, depending on severity and character/nature of wound. Most frequently pneumonia were encountered during the damage of lower extremities. As the example of the pulmonary complication, developing after bullet break, can serve the following observation.

T. S. P. 34 years. It is wounded by the bullet 6/III 1942. Diagnosis: the perforating bullet wound of middle third of right shin with the damage to fibular bone. On PMP 2 hours after wound is established/installed the diagnosis of damage to bone. 18 Hours after wound on DMP is introduced antitetanus serum. Skin is greased by iodine, is superimposed bandage with Rivanol and splint of Cramer.

9/III in KhPPG is given following description of wound: entrance bullet aperture in lower third of right shin. Musculocutaneous wound 4x2 cm, with the cut all over edges. Wound fresh, there are no sharp/acute inflammatory phenomena around it. Outlet on the posterior surface of middle third of shin. The musculocutaneous wound 5x3 cm, with the cut all over edges, there are no sharp/acute inflammatory phenomena. Skin is greased by iodine, are superimposed aseptic bandage, splint.

10/III on 13/III the temperature within limits of 39.4-39.3°. General condition of average/mean severity. Is discovered left-side croupouse pneumonia. 16/III was established/installed normal temperature. Wound is pure/clean. Treatment - shift/relief of bandages. General/common/total treatment by sulfathiozole, the cardiac and expectorants. However, 17/III on 20/XIII temperature it keeps in limits of 37.8-38.2°.

28/III casualty is converted into the evacuation hospital. During three days after evacuation the temperature within limits of 37.6-39.5°, then was lowered to normal numerals. Was established/installed the designed chair/stool, earlier which was by liquid. Wounds granulated well, but with abundant suppurative discharge; available previously edema of shin drops. Appetite is good. Treatment: the shift/relief of bandage on the shin.

It is evacuated into another evacuation hospital, where it entered in the satisfactory condition, but under the left scapula were heard out moist wheezes - residual phenomena of transferred pneumonia.

In the process of treatment repeatedly was investigated the

mucus (30/IV, 4/V, 7/V, 6/VII), tubercular bacilli/rods on it is discovered.

15/V roentgenography: the break of middle third of fibular bone with its defect.

Temperature from April through July is normal. In the region of wound was formed the fistula, around which there were an infiltrate, an insignificant quantity of suppurative discharge. 6/V under the local anesthesia 0.25o/c solution of novocaine produced the section/cut through the fistula over the external surface of middle third of right shin, are extracted 6 bone sequestrations of different value. Is inserted tampon.

Analyses of the blood.

Дата	Гемо-глобин (в %)	Эритроциты	Лейкоциты	РСО (мм в час)	Палочко-ядерные	Сегментно-ядерные	Лимфоциты	Моноциты	Эозинофилы	Общая вывод
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
					в процентах					(12)
22/IV	57	—	11 900	46	3	51	42	1	3	Небольшой пойкилоцитоз (13)
6/VII	62	4 850 000	13 800	42	3	63	32	1	1	

Key: (1). Date. (2). Hemoglobin (in o/o). (3). Erythrocytes. (4). Leukocytes. (5). ROE (mm an hour). (6). Bacillus/rod nuclear. (7). Segmentally nuclear. (8). Lymphocytes. (9). Monocytes. (10). Eosinophils. (11). in percentages. (12). General/common/total conclusion/derivation. (13). Small poikilocytosis.

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Subsequently the temperature remained normal. Treatment of wound by bandages with Rivanol.

17/V is noted sagging of foot, a reduction in the painful sensitivity over the external surface of shin, the absence achilles of reflex.

3/VIII it is discharged from the healed by wound, defect fibular bone and overhanging right foot as a result of the damage of fibular nerve.

In the given observation occurred the bullet perforating wound of right shin with the damage to the fibular bone also of fibular nerve. Although by itself wound did not relate to the rank of heavy ones and flowed/occurred/lasted relatively smoothly, on the third day after wound developed croupouse pneumonia.

Thus, even with a comparatively light wound in this case were observed the following complications: croupouse pneumonia, osteomyelitis and paralysis of extensors of the foot as a result of the damage of fibular nerve.

Is hence clear the need of comprehensive research and treatment of casualty with the bullet break of extremity; this casualty needs the aid not only of surgeon and roentgenologist, but also therapist, and neuropathologist.

According to O. N. Fedorovcy's data, pneumonia in the majority of the cases (more than 60.00/o) was developed within the early periods (to 10 days) after wound.

P. D. Kozintzev studied under conditions GBA of the disease of the lungs (pneumonia) in those wounded the lower extremities and he arrived at the conclusion that they more frequently were observed in heavily wounded, especially in those wounded the hip or knee joint and into the thigh with the damage to bone. In these cases pneumonia sometimes was developed within the late periods, appearing, apparently, as a result of the forced position/situation of patients and due to a reduction in the immunobiological properties of organism. L. N. Jacques revealed toxic-septic pneumonia with the wounds, which were being escorted/tracked by sepsis. A. Z. Chernov revealed suppurative foci in the lungs in 50.00/o of dead casualties whose wound was complicated by sepsis.

Finally, N. S. Molchanov and A. V. Golyaev frequently indicated developing suppurative processes in the lungs with the wounds with the damage to bone.

Entire presented indicates the frequency of the damages/defeats of the lungs with the wounds of tubular bones.

Violation of the function of digestive apparatus. Is next established/installed with the wounds of tubular bones the violation of the function of digestive apparatus. A. Ya. Gubergrits, V. G. Vogralik et al. described the suppression of gastric secretion in

casualties with the suppurative processes after wound, especially with bullet osteomyelitis.

It is necessary to assume that and the so-called "traumatic diarrheas" to a certain extent depended on the violation of secretion. However, in these cases one cannot fail to take into consideration of the effect of infection, first of all dysentery.

By research is established/installed the suppression of the function of the liver with the wounds, which were being escorted/tracked by suppurative process, the violation of carbohydrate metabolism/exchange with osteomyelitis. Is established/installed the presence of different kidney damages/defects (nephritides, nephrosis) with the wound of bones, especially with protracted bullet osteomyelitis.

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Violation of metabolism/exchange. Great interest are of the data, which concern the violation of metabolism/exchange, first of all of salt metabolism/exchange, with the wound of tubular bones. Even into the first world during the damage of tubular bones (S. P. Fedorov, A. V. Smirnov, S. K. Solov'yev) frequently was observed kidney colic which, on authors' opinion was developed as a result of

the supersaturation of the blood with salts of calcium and phosphorus as a result of crushing of bone tissue. The experiment/experience of the Great Patriotic War showed that kidney colic was encountered still more frequently than thought the previous authors. It they especially frequently observed with the wounds of the tubular bones, complicated by infection, also, first of all by osteomyelitis (A. P. Tsulukidze, P. I. Krasil'shchik, A. T. Lidskiy). P. I. Krasil'shchik observed kidney colic into 7.5% of all wounds into the thigh. A. P. Tsulukidze stated/established that of 45 patients with nephrolithiasis in 9 was a wound of tubular bones. Of 184 killed wounded with the damage tubular bones kidney colic was discovered in 5 (2.80%). Calculi/stones were revealed on the average 2-4 months after wound.

All authors considered it possible to explain so frequent a formation of calculi/stones in the kidneys by a number of factors: by the violation of salt metabolism/exchange, by infection, by oil embolism. As a result of crushing bone, and also disorder of the functions of vegetative nervous system and violation of correlation in the organs/controls of internal secretion in the blood was raised the content of calcium and phosphorus.

In the presence of infection frequently occurred the focus damages/defects of kidneys in the form of pyelonephritis, infarction,

encysted focus (A. P. Tsulukidze). This suppurative focus served as that nucleus/kernel, on which settled the salts, which were being contained in the blood in the high concentration. Furthermore, it is necessary to keep in mind that infection itself disturbed colloidal equilibrium and thereby it contributed to the fallout of crystals.

In a number of cases, apparently known role played oil embolism (I. G. Rufanov). Upon crushing of bone marrow and appearance as a result of this of oil embolism could occur the infarctions of the kidneys which sometimes became the nucleus/kernel of future calculus/stone.

Besides these basic reasons, which conditioned the formation of calculi/stones, some authors (A. T. Lidskiy) indicated also the series/number of the predisposing factors. To them it was possible to relate the passive position/situation of patient, diet, significant disorders of vegetative nervous system, violation of correlation in the organs/controls of internal secretion, development of acidosis and prolonged reception/procedure of sulfanilamides. Latter/last factor should be attached special importance, since during the war repeatedly it was indicated the possibility of the formation of calculi/stones with the example of sulfanilamides, in the presence of infection in the urinary tracts (N. N. Yelanskiy, B. A. Shmukler et al.).

Clinical manifestation and course of different diseases of internal organs/controls in casualties, yes even wound itself to a considerable extent depended on the general condition of organism, fatness of casualty, condition of his nervous system, etc. In this respect great interest was of the course of wounds and diseases in those, who suffered alimentary exhaustion and avitaminosis. P. A. Cyprian indicated that in these cases considerably was repeated/quickenened the infection of wounds, the course of wound process was heavy and prolonged, frequently occurred anaerobic infection. The course of wounds and diseases was characterized by expressed unresponsiveness. Temperature remained normal or even was lowered/reduced of leukocytosis it was not observed, but sometimes occurred even leucopenia (N. S. Melchanov). The inflammatory process indicated only high ROF, left-shift of leukocyte formula, quickened labile pulse.

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The course of the damages of tubular bones was characterized by delay and inferiority of reparative processes.

P. A. Cyprian indicated frequency (10.50/o) in this case the

not-grown-together breaks, their delayed consolidation and disagreement of the already healed wounds. Among them the not-grown-together breaks composed 12.80/o, delayed consolidation - 33.10/o, and the disagreement of wounds - 54.10/o. It should also be noted that in casualties, who suffered alimentary dystrophia, even more frequently were observed the diseases of internal organs/organs, also, first of all of circulatory apparatus and lungs (N. S. Molchanov). It is completely obvious that the changes in the course of disease, complication of infection considerably made prognosis and outcome worse of wounds.

Entire presented attests to the fact that already during the Great Patriotic War there were indications of the significant frequency of the diseases of the internal organs/organs, which complicated the damages of tubular bones.

The study of data of the deepened development of the histories of disease/illness to a considerable degree it supplemented and refined the observations, carried out by authors indicated above during the Great Patriotic War, it established the high frequency of the diseases of internal organs/organs in casualties. In this respect the wounds of tubular bones especially were secreted among the wounds of other localizations.

It is necessary to note certain difference in the frequency of the diseases of internal organs/controls with the wounds of different localization. data of the deepened development for this question are represented in Table 12.

Table 12. Number of complications of internal organs/controls on 100 casualties with the bullet break of extremities.

Локализация перелома (1)	Осложнения (2)	Пневмо- ния (3)	Нефроли- тиаз (4)	Прочие за- болевания внутренних органов ¹ (5)	Сеп- сис ² (6)	Всего (7)
Плечо . . . (8)	(9)	0,5	0,1	11,1	1,0	12,7
Предплечье . . . (10)	(11)	0,4	0,1	10,8	0,2	11,5
Бедро . . . (12)	(13)	1,1	0,5	14,4	9,5	25,5
Голець . . . (14)	(15)	0,8	0,1	15,1	2,2	18,2
В среднем (16)		0,7	0,2	12,7	2,8	16,4

Key: (1). Localization of break. (2). Complications. (3). Pneumonia. (4). nephrolithiasis. (5). Other diseases of internal organs/controls¹.

FOOTNOTE¹. Into the group "other diseases of internal organs/controls" entered all diseases and complications, which accompanied wound, with exception of pneumonia, nephrolithiasis, and also the diseases, caused by sepsis. Significant percentage fell at the disease/illness of circulatory apparatus, disease of gastrointestinal tract, etc. ENDFCCTNOTE.

(6). Sepsis².

FOOTNOTE 2. In the group "sepsis" are included different diseases of internal organs/controls (most frequently the disease of heart, lungs, kidneys), caused by septic infection. In the majority of the cases with the sepsis was destroyed the number of systems and organs/controls, which impeded the classification of those sickened according to organoplastic signs. ENDFOOTNOTE.

(7). In all. (8). Shoulder. (9). Forearm. (10). Thigh. (11). Shin. (12). On the average.

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Already from the preceding information it is evident that the wounds of thigh were escorted/tracked by the greatest quantity of complications from the side of internal organs/controls. Somewhat more than in 25.50/o of all casualties with the break of femoral bone were these or other diseases. This concerned all groups of diseases, especially sepsis and pneumonia. A considerably smaller number of diseases was noted during the damage of shoulder and especially forearm, with which pneumonia were observed two times more thinly/less frequently than with the wound of thigh, and sepsis - 9-45 times thinner/less frequent.

According to the data of the deepened development, the frequency

of the diseases of internal organs/controls during the damage of tubular bones was changed in the dependence on the character/nature of break (Table 13, 14, 15 and 16).

As is evident, whereas among the wounds of different tubular bones were most frequently complicated by the diseases of internal organs/controls the wounds of thigh, wound of forearm they were escorted/tracked by diseases considerably thinner/less frequent.

Has the specific value and the character/nature of damage.

Table 13. Frequency of the diseases of internal organs/controls with the wounds of forearm with the break of bone with the different types of break. (on 100 casualties according to each form/species of break).

Вид перелома Заболевания	(3) Крутинос-кольчатый	(4) Краястый	(5) Косой	(6) Цирчатый	(7) Раздробленный	(8) Поперечный	(9) Мелкооскольчатый	(10) Продольный	(11) Вколоченный	(12) В среднем
Пневмония (13)	0,4	0,2	0,2	—	0,9	—	0,6	2,3	11,1	0,4
Нефролитиаз (14)	0,1	0,2	—	—	0,1	—	—	—	—	0,1
Прочие заболевания внутренних органов (15)	11,1	11,6	11,4	12,9	8,5	10,7	12,0	2,4	—	10,8
Сепсис (16)	0,01	—	0,2	—	0,9	—	0,3	—	—	0,2

Key: (1). Diseases. (2). Form/species of break. (3). kruinoos-ring-shaped. (4). Edge/boundary. (5). By sand bar. (6). perforated. (7). Crushed. (8). Cross. (9). small-splintered. (10). Longitudinal. (11). impacted. (12). On the average. (13). Pneumonia. (14). nephrolithiasis. (15). Other diseases of internal organs/controls. (16). Sepsis.

Table 14. Frequency of the diseases of internal organs/controls with the wounds of shoulder with the break of bone with the different types of break. (on 100 casualties according to each form/species of break).

Вид перелома (1)	(2) Круиноос-кольчатый	(4) Крестообразный	(5) Косой	(6) Диагональный	(7) Раздробленный	(8) Поперечный	(9) Мелкокольчатый	(10) Продольный	(11) Включенный	(12) В среднем
Пневмония (13)	0,8	0,3	—	—	0,6	—	1,7	—	—	0,5
Нефролитиаз (14)	0,1	—	—	—	0,4	—	—	—	—	0,1
Прочие заболевания внутренних органов (15)	11,9	11,0	10,9	10,9	12,3	9,8	11,1	16,0	16,0	11,1
Сепсис (16)	0,5	0,6	0,2	—	1,9	0,6	0,4	—	—	1,0

Key: (1). Diseases. (2). Form/species of break. (3). kruinoos-ring-shaped. (4). Edge/boundary. (5). By sand bar. (6). Perforated. (7). Crushed. (8). Cross. (9). small-splintered. (10). Longitudinal. (11). Packed in. (12). On the average. (13). Pneumonia. (14). nephrolithiasis. (15). Other ailments of internal organs/controls. (16). sepsis.

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As can be seen from Table 13-16, most frequently the diseases of internal organs/controls appeared with the crushed, small-splintered and large-fragment break. Sepsis most frequently was noted with the first two (crushed and small-splintered) breaks. Generally, besides three forms/species of breaks indicated, the diseases of internal organs/controls frequently were encountered with the longitudinal,

perforated, cross and packed in breaks.

Evidently, vital importance in the development of one or the other diseases of internal organs/controls played other factors - the damage of vessels, crushing of soft tissues and many others.

The most frequent diseases of internal organs/controls with the wounds were the disease/illness of the lungs (pneumonia, abscess), then the disease of heart (myocardial dystrophy), disease/illness of kidneys (nephritis, amyloidosis, nephrolithiasis), anemia, and also sepsis with the different damages/defects of internal organs/controls.

Diseases on the years of war. On the years of the Great Patriotic War were distributed the diseases dissimilarly (Table 17).

Table 15. Frequency of the diseases of internal organs/controls with the wounds of thigh with the break of bone with the different types of break (on 100 casualties according to each form/species of break).

Заболелания (1)	Вид перелома (2)	(3) Крупнооскольчатый	(4) Краявой	(5) Косой	(6) Дырчатый	(7) Газдроб- ланный	(8) Поперечный	(9) Мелкоос- кольчатый	(10) Продольный	(11) Вколоченный	(12) В среднем
Пневмония (13)		1,1	0,9	1,7	0,4	1,3	1,0	0,7	—	—	1,1
Нефролитиаз (14)		1,1	0,2	0,6	—	—	—	0,7	—	—	0,5
Прочие заболевания внутренних органов (15)		14,2	16,1	15,2	19,0	12,5	15,1	17,2	20,0	16,2	14,4
Сепсис (16)		9,9	2,7	7,0	2,4	18,3	9,7	16,4	5,7	2,7	9,5

Key: (1). Diseases. (2). Form/species of break. (3). large-splintered. (4). Edge/boundary. (5). By sand bar. (6). Perforated. (7). Crushed. (8). Cross. (9). small-splintered. (10). Longitudinal. (11). impacted. (12). On the average. (13). Pneumonia. (14). nephrolithiasis. (15). Other diseases of internal organs/controls. (16). Sepsis.

Table 16. Frequency of the diseases of internal organs/controls with the wounds of shin with the break of bone with the different types of break. (on 100 casualties according to each form/species of break).

Вид перелома Заболевания	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
		Крупнооскольчатый	Краевой	Косой	Дырчатый	Раздробленный	Поперечный	Мелкооскольчатый	Продольный	Вколоченный	В среднем
Пневмония (13)		0,4	0,5	1,1	0,2	1,6	1,6	0,8	2,1	—	0,8
Нефролитиаз (14)		0,1	0,1	0,2	—	0,2	—	—	—	—	0,1
Прочие заболевания внутренних органов (15)		15,5	14,0	14,8	17,1	14,6	12,0	16,8	10,7	9,1	15,1
Сепсис (16)		1,3	0,7	0,2	0,7	6,6	0,8	1,2	—	—	2,2

Ключ: (1). Diseases. (2). Form/species of break. (3).

large-splintered. (4). Edge/boundary. (5). By sand bar. (6).

Perforated. (7). Crushed. (8). Cross. (9). small-splintered. (10).

Longitudinal. (11). Packed in. (12). On the average. (13). Pneumonia.

(14). nephrolithiasis. (15). Other diseases of internal

organs/controls. (16). Sepsis.

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As is evident, with the wounds of tubular bones a great number of diseases of internal organs/controls fell to the third year of war (besides the diseases of kidneys); high percentage they were, also, on the second year; the smallest percentage was in the beginning of war (first year). This is explained by the fact that a great number of casualties with the break of the bones of extremities was observed on the third year of war.

Time of the appearance of diseases of internal organs/controls. The diseases of internal organs/controls during the damage of tubular bones most frequently appeared within the more distant after wound periods than they differed significantly from the internal diseases, which accompanied the wounds of other localizations (wound of chest, skull, etc.) (Table 18).

As can be seen from Table 18, a number of diseases of internal organs/controls to a considerable degree was increased within the late (it is more than 20 days) after wound periods.

Table 17. Distribution of the diseases of internal organs/controls with the wound of tubular bones according to the years of the Great Patriotic War (in the percentages).

(1) Засолевания	(2) Год войны	(3) Первая	(4) Вторая	(5) Третья	(6) Четвертая	(7) Итого
(8) Сепсис.		16.1	25.1	31.6	27.2	100.0
(9) Эндо- и перикардит		18.3	21.4	37.4	22.9	100.0
(10) Болезни мышц сердца		18.9	25.6	31.2	24.3	100.0
(11) Пневмония		15.5	26.8	33.9	23.8	100.0
(12) Абсцесс легкого		14.1	25.2	38.8	22.1	100.0
(13) Нефрит		25.6	29.6	28.6	16.2	100.0
(14) Прочие болезни почек		25.0	32.9	26.4	15.7	100.0
(15) Анемия		14.6	26.5	34.5	24.4	100.0
(16) В среднем		16.8	26.3	32.8	24.1	100.0

Key: (1). Diseases. (2). Year of war. (3). The first. (4). The second. (5). The third. (6). The fourth. (7). Altogether. (8). Sepsis. (9). Endo- and pericarditis. (10). Diseases/illnesses of muscle of heart. (11). Pneumonia. (12). Abscess of lung. (13). Nephritis. (14). Other diseases/illnesses of kidneys. (15). Anemia. (16). On the average.

Table 18. Time of the appearance of the first signs of diseases after wound with the bullet breaks of tubular bones (in the percentages).

(1) Заболелания	(2) Число дней после ранения	(3)				(4) 21 и свыше	(5) Итого
		До 3	4-5	6-10	11-20		
(6) Сепсис		10,3	13,8	20,4	21,3	34,4	100,0
(7) Эндо- и перикардит		10,4	4,7	8,5	24,5	51,9	100,0
(8) Болезни мышцы сердца		10,0	7,5	21,2	18,0	43,3	100,0
(9) Пневмония		7,0	6,4	13,9	21,7	51,0	100,0
(10) Абсцесс легкого		1,0	1,9	1,9	14,3	80,9	100,0
(11) Нephрит		1,4	5,5	5,1	13,9	75,0	100,0
(12) Прочие болезни почек		2,6	0,9	9,6	15,6	71,3	100,0
(13) Анемия		11,6	8,5	18,1	22,0	39,8	100,0
(14) В среднем . . .		9,2	8,8	16,8	20,4	44,8	100,0

Key: (1). Diseases. (2). Number of days sepsis. (7). Endo- and pericarditis. (8). Illments of muscle of heart. (9). Pneumonia. (10). Abscess of lung. (11). Nephritis. (12). Other diseases/illnesses of kidneys. (13). Anemia. (14). On the average.

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Some clinical forms as, for example, diseases/illnesses of kidneys, abscesses of the lungs, were encountered during the first days after wound extremely rarely (1.0-1.4-2.6c/o); but anemia, the disease/illness of heart, sepsis, pneumonia they were frequent diseases during the first after wound days, which is explained by the occurred blood loss and the rapid development of infection. Thus, on the first 10 days after wound it fell: 38.2o/o of cases of anemias, 27.3c/o of pneumonia, 38.7o/o of cases of the disease/illness of the muscle of heart.

Periods of rendering to surgical aid and disease of internal organs/controls. The early rapid development of infections and significant anaemisation could advance, also, as a result of late surgical intervention. For refining these periods of the development of diseases were compared with the periods of surgical intervention. These data, based on materials of author's development, are represented in Table 19.

As can be seen from given data, a number of diseases of internal organs/controls increased/grew with an increase in the periods from the wound to the primary surgical processing, especially by sepsis, by the disease of heart, kidneys.

Table 19. Distribution of casualties with the diseases of internal organs/controls with the wound of tubular bones in connection with the period of rendering to the surgical aid (in the percentages).

(1) Заболевания	(2) Сроки (в часах)						(4) Позже суток	(5) Итого
	(3) До 3	4-6	7-9	10-12	13-17	18-24		
(6) Сепсис	5.2	10.1	10.2	7.2	9.6	16.5	41.2	100.0
(7) Эндо- и перикардит	4.4	9.9	9.9	5.5	6.6	18.7	45.0	100.0
(8) Болезни мышцы сердца	4.2	9.2	9.2	9.2	12.8	13.7	41.7	100.0
(9) Пневмония	6.5	9.3	15.2	10.6	11.8	13.6	33.0	100.0
(10) Абсцесс легкого	2.3	10.1	10.8	4.8	10.8	24.0	37.2	100.0
(11) Нефрит	3.3	10.4	14.8	8.6	11.9	12.9	38.1	100.0
(12) Прочие болезни почек	5.6	7.0	14.1	2.8	7.1	12.7	50.7	100.0
(13) Анемия	6.0	10.1	12.2	7.2	12.6	17.3	34.6	100.0
(14) В среднем	5.3	9.9	11.8	7.7	11.3	16.2	37.8	100.0

Key: (1). Diseases. (2). Period (in hours). (3). To. (4). It is later than days. (5). Altogether. (6). Sepsis. (7). Endo- and pericarditis. (8). Diseases/illnesses of muscle of heart. (9). Pneumonia. (10). Abscess of lung. (11). Nephritis. (12). Other diseases/illnesses of kidneys. (13). Anemia. (14). On the average.

Special features/peculiarities of the course of the diseases of internal organs/controls.

Concerning the special features/peculiarities of the course of different diseases of internal organs/controls during the damages of tubular bones, it is necessary to note the following.

The diseases of the lungs, especially pneumonia, very frequently accompanied the damages of tubular bones. Hemorrhages into the lungs in contrast to other wounds (for example, chest, skull, etc.) they were encountered extremely rarely and, apparently they were connected with the contusion of chest.

According to the data of B. S. Nalimov, hemorrhages into the lungs with the wound of tubular bones there was not more than 1.00/o, while with the penetrating wounds of chest they exceeded 90.00/o.

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Bulk of the diseases of the lungs composed pneumonia which in essence (95.00/o) were focus, they were arranged/located paravertebrally, also, in the lower departments of the lungs. Most frequently pneumonia were developed within the late after wound periods. Thus, during the first 10 days after wound pneumonia were encountered in 27.30/o all sickened by pneumonia of those wounded tubular bones; within the more distant periods (after 10 days) of pneumonia they were developed into ^{74.7}~~74.7~~ 74.7/o, moreover into 51.00/o - it is later than 20 days after wound. In the late after wound periods pneumonia were most frequently encountered in casualties with the coritic bandage, which was conditioned, apparently by forced position/situation of casualties and by the conjugated with it

limitation of respiratory movements. The course of pneumonia in this case differed little from the ordinary. Pneumonia in casualties with the phenomena of sepsis were characterized by fine focal/acinous character/nature, duration course, and also by tendency toward the abscess formation, the development of meta- and parapneumonic abscesses of the lungs. The abscesses of the lungs composed 13.4 on 1000 casualties.

In the genesis of those developing in wounded pneumonia, apparently the significant role played both neuroreflector and toxic-infection processes. Infection, apparently was propagated hematogenically, via skidding into the vessels and tissue of the lung of microbes and emboli, which condition the development of pneumonia and abscesses, to what is a series/number of proofs. A. Z. Chernov established in the capillaries and the fine/small branches of pulmonary arteries the presence of the small groups of microbes, and also tissue emboli. Another proof of the hematogenic origin of focus pneumonia with the wounds, complicated by sepsis, is their fine focal/acinous character/nature, and also perivascular disposition of these fine/small infiltrative processes (A. Z. Chernov). The frequency of pneumonia was conditioned on a large quantity of predisposing factors number of which includes cooling, the anemia, the reduction in the immunobiologic properties of organism, damage of the function of circulatory apparatus and respiratory organs and many

others. However, the basic reason for pneumonia should be considered the presence of microorganisms (flora, which vegetates in the lungs and which enters from the stricker areas) and a change of the condition of macroorganism as a result of wound.

Diseases/illnesses of heart. During the damage of tubular bones by frequent complications also were the diseases/illnesses of the heart: endocarditides, pericarditides, and also the damage/defeat of the myocardium of inflammatory and dystrophic character/nature. It should be noted that the endocarditides into 85.00/o were developed against the background of the available sepsis in casualties as myocardites.

The diseases of heart with the wounds of tubular bones appeared both into the early ones and within the late after wound periods, moreover in the latter/last cases they were encountered much more frequently. Thus, if during the first 10 days after wound endocarditides were encountered into 23.60/o of cases, and the damage/defeat of myocardium into 38.70/o, then within the later periods the first were observed into 76.40/o, moreover 51.90/o it is later than 20 days, and the second - into 61.30/o.

By nature the endocarditides were warty and ulcerous. In the first period of disease most frequently were encountered vegetative

endocarditides. Their clinical symptomatology differed little from the ordinary, but it was shaded by the symptom complex, caused by basic disease or sepsis, which complicated wound (subjective sensations, temperature, changes in the blood, etc.). This to a considerable extent impeded the diagnosis of disease. The diseases of myocardium, which escorted/tracked wound tubular of bones, were developed in the form of dystrophic or inflammatory changes.

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Dystrophic changes usually appeared as a result of the nervous reflex impulses/momenta/pulses, on one hand, and the action of blood loss and toxic-infection - on the other hand. Frequently, as it was already indicated, they were developed within the earlier periods, apparently in essence due to the abundant blood losses, and subsequently and due to the complicated wound infection. Within the late periods, especially frequently with the sepsis, appeared myocardites. Clinically disease was developed by ordinary symptomatology. The electrocardiographic study, produced of S. Z. Kostyukovoy et al., showed that the frequently ventricular complex was changed: tooth T became small, sealed, two-phase, negative. Cut ST was above or lower than isoline, and sometimes accepted even coronary ones character/nature.

Speaking about the damages/defeats of circulatory apparatus with the wounds of tubular bones, it is necessary to emphasize the frequency of thrombophlebitides with this type of damages. A. Z. Chernov observed thrombophlebitides into 58.0c/o of cases of wounds, which ended lethally; frequently the thrombi carried the suppurative disseminated character/nature itself they sometimes served as the source of sepsis.

Diseases/illnesses of kidneys. Frequent complication with the wound of tubular bones were the diseases of kidneys. They also were distinguished within the later periods, which is evident from given data (Table 18).

The diseases of kidneys, as showed V. A. Beyer, in the period of the Great Patriotic War were encountered predominantly in the winter months (during February - 13.4c/o), it is thinner/less frequent - in the summer months (from 3.0 to 12.0c/o). As is evident, cooling is one of the predisposing to the disease factors. From the individual diseases of kidneys most frequently was encountered focus nephritis, then glomerulonephritis, amyloide-lipoide nephrosis or amyloidosis. Focus nephritis was observed frequently with the wounds, complicated by sepsis. In the latter/last cases frequently was developed pustular or infectious nephritis. The suppurative inflammation of kidneys was result either the penetration of infection into the kidney

hematogenically, or the direct march/passage of infection from the suppurative focus. The penetrated the kidney microorganisms jammed in glomeruli and vessels of cortical layer, in consequence of which attacked/advanced the swelling of endothelium, the accumulation of leukocytes in the capillaries and into area of Bowman capsule, edema of interstitial tissue and especially frequently the education of ulcers on the surface of kidney. Subsequently individual abscesses were resolved, forming fine/small hems, sometimes they they decanted and they formed large ulcer. Clinical manifestation and course of focus nephritides were ordinary. The clinical picture of suppurative nephritides was characterized by the general/common/total septic symptoms (chill, an increase in the temperature to 40°, headaches, etc.) and next local phenomena in the form of pain in the lumbar region, muscle tensions in the lumbar region and in the region of front/leading abdominal wall, sickliness during a deep palpation in the region of one or the other kidney. During the research of urine were revealed the protein, a large quantity of leukocytes in an insignificant quantity or even a full/total/complete absence of erythrocytes. However, sometimes a number of leukocytes in the urine was small.

In the series/number of patients within the relatively late after wound periods was developed diffusion glomerulonephritis with the specific to it symptom complex. In these cases it was possible to

think about its allergic nature. Evidently, the complicated wound infection was the sensitizing or resolving factor.

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In the clinic of diffusion glomerulonephritis should be noted some special features/peculiarities, namely: intensity and perseverance of edemas, frequent accumulation of fluid/liquid in the areas (into 24.00/o, according to V. A. Beyer's data), the rapidly advancing/attacking deficiency of circulatory apparatus, comparatively rare complications of uremia. Finally, in the cases of the wounds, complicated by osteomyelitis, was developed amyloid-lipoid nephrosis or amyloidosis of kidneys. V. A. Beyer, whereas studying similar materials, confirmed the noted already during the Great Patriotic War possibility of the development of early amyloidosis. Thus, they established/installed the development of amyloidosis in casualties in the course of the first-second month after the damage of tubular bones. It is completely obvious that in the bulk of diseases the development of amyloidosis was conditioned on the presence of subacute and chronic suppurative processes and, in particular, osteomyelitis.

It was already indicated (pg. 51), that in the literature is a sufficient number of communications/reports, which were concerning;

the onset of nephrolithiasis during the damage of tubular bones.

Table 13-16 shows the specific gravity/weight of nephrolithiasis of other complications.

During the research during the Great Patriotic War of urine in casualties with the damage of tubular bones V. A. Beyer in 22.50/o revealed/detected urinary/urine sediments in the form of oxylates, urate and phosphates. All this confirmed the possibility of the frequent complications of the wounds of bones of nephrolithiasis.

Sepsis was also one of the most frequent complications of the wound of tubular bones and it was encountered predominantly with the wounds of thigh. Clinically sepsis was developed by common for ones a pyo-septic disease by the symptoms: suppurative wound as the focus of infection, bacteremia, the intermittent or hectic fever, a chill, perspiration, delirium, the blackout of consciousness, the progressive anemia (Z. S. Chernov). Sepsis was always escorted/tracked by the significant and different damages/defeats of the internal organs/controls: either by the focus processes of infiltrative and pyoinflammatory character/nature or by diffusion parenchymatous changes. In this case to a certain degree were destroyed all organs/controls and systems. Very frequently took place anemia, diseases of heart, lungs, kidneys. Most frequently were observed the

damages/defeats of the lungs (pneumonia into 50.00/o, besides frequently abscessing).

With the wounds of tubular bones were very sharply expressed changes from the side of the blood. They were characterized, in the first place, by the expressed anemia, and in the second place, by changes in the white blood which in essence were conditioned on that complicated wound by infection.

Anemias were always hypochromic. M. L. Shcherba, studying anemias in casualties, noted that the greatest degree of anaemisation was observed during the damage of extremities. Thus, if the incidence/drop in hemoglobin to 40o/o was noted in 32.10/o of those wounded into the stomach, the chest and the head, then with the wounds of extremities it was established/installed in 38.80/o (with the wounds of lower extremity - in 40.20/o, with the wounds of upper extremity - in 37.40/o). During the first days after wound the development of anemia in essence was conditioned on blood loss. Weakening the immunobiologic properties of organism, blood loss favored the development of wound infection. The complicated wounds infection contributed to further development of anemia, as a result, on one hand, the hemolyzing activity of microbial agent, and on the other hand - the suppression of hemopoiesis. This was confirmed the works of M. I. Arinkin, A. F. Aleksandrov, A. V. Kukoverov et al.

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However, Thus, blood loss was only initial moment/torque, in essence the anemia developed the result of the effect on the central nervous system toxic-infection factor. Thus, in the majority of the cases was a combination of trauma (blood loss) and infection. The research of the peripheral blood indicated a reduction in hemoglobin, the decrease of a quantity of erythrocytes, low colored indicator, in the initial period to an increase in the reticulocytes. According to M. L. Shcherb's data, the character/nature of infection and prolonged fever were very sharply reflected in the hemopoietic function. The more prolonged there was the feverish period and the above there was the temperature, in other words the more heavily flowed/occurred/lasted the infection, the sharper was expressed the anemia. Are very characteristic changes in the blood with the complicated by osteomyelitis wounds of tubular bones. A. V. Kukoverov, who studied this question on the material of the Great Patriotic War, showed that the anemia during this period was characterized by the series/number of special features/peculiarities. From them should be noted the frequently observed "stability" both of the maintenance of hemoglobin and of quantity of erythrocytes, the progressive acceleration ROE, neutrophilia, left-shift of leukocyte

formula. However, in the first periods of disease anemia retained hyper-regenerative - hypochromic character/nature. Subsequently, depending on the degree of infection and functional condition of hemopoietic apparatus, was developed the more or less expressed suppression of hemogeny. In the cases of the heavy course of osteomyelitis in the peripheral blood appeared the plasma cells, which indicated the activity of focal infection. During the remission/abatement of osteomyelitic process and with its march/passage into the chronic stage hematologic indicators gradually were leveled.

The research of the puncture specimen of the breast bones, produced by A. V. Kukoverov, showed that the greatest changes appeared during the first 10-17 days after the wound when was noted the expressed reanimation of erythropoiesis and leucopoiesis due to the intensive reproduction/multiplication of normoblasts, moreover in half of the cases a quantity of reticulocytes in the peripheral blood grew. This reanimation of erythropoiesis was the result of blood loss. Subsequently, as has already been indicated, a basic effect on erythropoiesis had infection.

The anemia, which appeared during the first days after wound and which was being reinforced subsequently under the effect of the infection, conditioned by reflector route/path the damage of the

functional activity of different systems and organs/controls, first of all of circulatory apparatus (myocardial dystrophy).

It is completely obvious that developing as a result of blood loss and toxic infection the anemia could not but be reflected on the course of wound process and the outcomes of wound. M. L. Loberba showed that most frequently the lethal outcomes occurred in such cases of the wounds, during which under the effect of the toxicosis or infection attacked/advanced the sharply pronounced anaemisation.

Pathogenesis of the diseases of internal organs/controls.

That increasingly above-presented testifies about the significant frequency and the great variety of the diseases of internal organs/controls with the wound of ribbed bones. Evidently, pathogenesis of these different diseases was dissimilar. There is no doubt, that the leading pathogenetic factors in the majority of these diseases were neurohumeral effects, the blood loss and infection.

The role of neurogenic factors in the pathogenesis of many pathological processes with the wounds of tubular bones was confirmed by the series/number of facts.

First,, as has already been indicated, these wounds were frequently escorted/tracked by shock condition having at their basis neuroreflector effects. In the second place, the wounds of tubular bones, as showed the observations of V. A. Beyer, were frequently escorted/tracked by expressed by leukocytic (to 60000) of the peripheral blood into the first hours after trauma, that also it was possible to explain only by neurohumeral mechanism. A. V. Kukoverov showed that also in bone marrow during the first days after wound was observed the reanimation of erythropoiesis and leucopoiesis.

Finally, the same they indicated observed in some casualties during the first days after wound changes from the side of circulatory apparatus and respiratory organs. The work of the Soviet authors (T. S. Istamanova, B. I. Kuselevskiy, A. V. Tonkikh, N. S. Molchanov et al.) in the period of the Great Patriotic War proved the possibility of the development of the series/number of pathological processes in the lungs and the cardiovascular system as a result of neurohumeral effects.

There is no doubt, that during the damage/defeat of tubular bones in the region of the casualty sector appear many different impulses/moments/pulses, which influence the condition of central

nervous system. Excitation, fear, pain and other passions also cannot but be reflected in the activity of cerebral cortex. It is known that one pain alone, causing significant reaction from the side of the cerebral cortex and subcortex, conditioned the series/number of shifts/shears in the functional condition of systems and organs/controls, including hormonal system (adrenal glands, the hypophysis, etc.).

Numerous reactions from the side of central nervous system, and also from the side of the damaged tissues through the cerebral cortex to a considerable degree changed the reactivity of organism.

One cannot fail to consider also the changes in the reactivity of organism, which appear as a result of entry during the prolonged period of the fission products of protein from the place of damage. By the sensitization of organism partly it was possible to explain the onset of some pathological processes in genesis of which, together with the infection, occurred allergic factor (diffusion glomerulonephritis, endocarditis).

Entire presented attests to the fact that in the development of many diseases of internal organs/controls in casualties with the damage of tubular bores the dominant role they played: the condition of macroorganism, change from the side both central nervous system

(brain core) and reactivity of organism.

Vital importance in the pathogenesis of the diseases of internal organs/controls in casualties had infection. It is necessary to assume that the pathogenic elements/cells entered these or other organs/controls from the focus of wound hematogenically. True, in a number of cases the generalization of process depended also on thrombophlebitides. However, the hematogenic way of the development of such diseases is doubtless that it is confirmed by the histological research of A. Z. Chernov, carried out with the diseases of the lungs in the cases of the wound of tubular bones. A. Z. Chernov revealed/detected, in the first place, the fine focal/acinous character/nature of pneumonia, in the second place, the disposition of foci around the vessels, thirdly, the accumulation of bacteria by groups or by small groups in the capillaries and the fine/small branchings of pulmonary arteries, fourthly, they noted only the insignificant damage/defeat of bronchi, and sometimes also their full/total/complete intact nature. Pyemic foci by their origin, apparently are obligated to embolic processes.

It is not possible, however, to exclude other mechanisms in the development of the diseases of internal organs/controls in casualties. Has already been mentioned about the significant role in this respect of anemia and, apparently hypoxemia, on it by that

conditioned.

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Has already been indicated that anemia itself frequently determined the determination of the series/number of dystrophic processes (heart). Should be also considered violation with the wounds of the bones of metabolism, first of all of salt. Finally, it is necessary to mention about the infectious-allergic mechanisms which defined development of such diseases as endocarditis and diffuse glomerulonephritis.

The frequency of the diseases of internal organs/controls with the wound of tubular bones was conditioned on a large quantity of such predisposing moments/torques as cooling, reduction in the immunobiologic properties of organism, decrease of the vital capacity of the lungs as a result of weakening respiratory/breathing excursions under the effect of the wound (pain, gypsum coating, the forced position/situation, etc.). In view of the frequent diseases of light ores and kidneys it is necessary to pay special attention to the cooling, which is the basic predisposing factor. The attempt to establish the interrelation between the frequency of the diseases of internal organs/controls and the season is represented in Table 20 (according to the data of author's development).

As can be seen from given data, only in the groups into which enter pneumonia, abscess of the lungs, sepsis and nephritis, is noted a large number of disease in winter period, but in the remaining groups of a similar regularity it was not observed.

Table 20. Distribution of the diseases of internal organs/controls in casualties with the bullet damage of tubular bones according to the months of year (on each disease, accepted as 100).

(1) Название болезни	(2) Месяц года												(3) Всего
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
(4) Эндо- и перикардит	15,3	17,6	13,6	3,5	5,3	3,1	8,4	9,8	6,9	3,1	5,3	8,4	100,0
(5) Болезни мышц сердца	14,0	13,7	10,6	6,7	2,2	2,4	5,6	10,9	8,5	9,6	6,1	9,7	100,0
(6) Пневмония	19,3	13,6	11,7	6,5	2,8	2,6	7,4	7,7	7,2	4,8	7,1	9,3	100,0
(7) Абсцесс легкого	16,6	17,3	9,8	6,7	4,3	1,8	6,1	7,4	9,8	6,1	5,5	8,6	100,0
(8) Сепсис	17,2	10,5	12,3	8,5	3,1	2,9	7,7	8,6	6,7	6,2	6,3	10,0	100,0
(9) Нефрит	11,3	13,6	13,6	5,0	4,0	3,3	7,0	11,3	7,3	6,0	7,6	10,0	100,0
(10) Прочие болезни почек	14,3	14,3	10,7	10,7	2,9	4,3	8,6	7,8	9,3	6,4	5,0	5,7	100,0
(11) Анемия	11,9	13,6	12,5	5,0	2,2	2,4	9,3	11,3	9,5	7,4	6,8	8,1	100,0

Key: (1). Name of disease/illness. (2). Mesyats year. (3). In all.
 (4). Endo- and pericarditis. (5). Diseases/illnesses of muscle of heart. (6). Pneumonia. (7). Abscess of lung. (8). Sepsis. (9). Nephritis. (10). Other diseases/illnesses of kidneys. (11). Anemia.

Preventive and therapeutic measures.

As a result of the frequent diseases of internal organs/controls in casualties already during the Great Patriotic War came to light the need of conducting the series/number of preventive and therapeutic measures. One of the most essential preventive/warning measures was the early and thorough processing of the wound whose

value is evident from Table 19. Furthermore, during the war were already manufactured measures for prophylaxis of the diseases of light ones and kidneys. To them should be related warm drinking, banks, cardiovascular substances, vagosympathetic blockade, reception/procedure of the preventive doses of sulfidine (10.0 during the first three days), etc.

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Observations during the Great Patriotic War showed the effectiveness of the conducted measures. In the course of war a quantity of pneumonia, nephritides and other diseases in connection with the used substances regularly was decreased. One should also indicate the significant effectiveness of the timely and sufficient blood transfusions with the expressed blood losses, which contributed to warning/prevention of diseases. Active struggle with the developed infection (sulfanilamides, penicillin) was also the effective method of warning/preventing the diseases of internal organs/controls. With the onset of one or the other diseases of internal organs/controls were used ordinary dietetic treatment, pharmacotherapy, and in a number of cases and physiotherapy.

Estimating the results of the treatment of the diseases of the lungs, should be again emphasized the effectiveness of the

use/application of sulfarilamides and penicillin.

Thus, given literary data, and also the results of the deepened development of the histories of disease/illness and materials of personal observation show that the bullet breaks of tubular bones were frequently escorted/tracked by the different diseases of the internal organs/controls from number of which should be especially noted anemias, pneumonia, myocardial dystrophies, diseases/illnesses of kidneys and sepsis. The diseases of internal organs/controls in the majority of the cases were developed within the relatively late after wound periods (it is later than the 20th day). The basic place in the genesis of these diseases occupied blood loss and infection; vital importance had also the series/number of the predisposing factors.

Timely diagnosis, taking of preventive and therapeutic measures to a considerable extent contributed to both the decrease of a quantity and to reverse development of the diseases of internal organs/controls, which provided the favorable course of wound process and the outcome of wound.

Stone-education with the bullet breaks of extremities.

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Based on materials of the deepened development of the histories of disease/illness, the stone-education was observed with the bullet breaks of the bones of all four segments, on the average into 0.180/o of cases, moreover with the breaks of thigh this complication was encountered five times more frequently than with the breaks of each other segment individually (breaks of thigh 0.50/o, shin, shoulder and forearm on 0.10/o).

Stone-education was observed mainly with the breaks, which were being escorted/tracked by the large decomposition of the bone: with comminuted fractures into 0.30/o of cases, with the oblique ones - into 0.220/o, with those crushed - into 0.20/o, with the edge/boundary ones - into 0.120/o. With the perforated, cross and longitudinal breaks the stone-education in no way was encountered.

The dependence of stone-education on the heavy infection succeeds in coming to light/detecting/exposing not on each segment, for example, with the breaks of thigh, complicated by sepsis, the stone-education was observed 1.50/o, i.e., three times more frequently than with all breaks of thigh, and with the breaks of

shin, complicated by sepsis, it in no way occurred.

With bullet breaks of thigh, complicated by osteomyelitis, the percentage of the cases of stone-education (0.69) was more than with all breaks of thigh (0.5), while with the breaks of shin and shoulder, complicated by osteomyelitis, stone-education was encountered more rarely (0.06 and 0.050/o), than with all breaks of these segments (0.10/o).

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Thus, the materials of the deepened development show that in the stone-education the great value has extensive decomposition large/coarse of bones, that is escorted/tracked by lasting septic or other less virulent infection.

Although the complication indicated is described already more than 100 years ago however up to now still there is no unity of opinion to the reasons for its onset. The only general/common/total moment/torque to which refer almost all authors, this the prolonged immobilization of casualty. The onset of calculi/stones in similar cases is explained by the delayed drain of urine from the pelvises with the subsequent fallout of the crystals of urinary/urine salts from which subsequently are formed the calculi/stones. However, if

the conditions indicated actually/really occurred, then secondary nephrolithiasis, or as it still call, the "traumatic calculi/stones of kidneys", it would be observed one and all in all casualties with the prolonged and full/total/complete immobilization. Actually secondary stones of kidneys after the bullet break of thigh are relatively very low percentage. Prolonged immobilization - only one of the numerous factors, which facilitate stone formation in the kidneys.

As showed repeatedly produced intravenous pyelourethrography evacuation of urine from the kidney pelvises in casualties, who are found at least and very long time in the condition of full/total/complete immobility, but in the absence of any changes from the side of central nervous system or inflammatory infiltrative processes in pelvic or retroperitoneal cellulose, it in no way differs from the same in healthy/sound people. Thus, the assumption that the causal factor of secondary stone-education is the delay of the drain of urine, is confirmed in no way.

Much greater value can have the muscular inactivity, which has the specific effect on a mineral-the salt a metabolism/exchange in casualties. Besides muscular inactivity, there is another series/number of reasons for kidney and extra-kidney origin, which facilitate stone-education in the kidneys. However, the explanation

of these reasons presents significant difficulties. The study of the histories of the disease/illness of casualties does not always make it possible to explain the reason for the onset of calculus/stone in the kidney. Certain light/world to the etiology of stone-education can spill the study of structure and chemical composition of the removed or spontaneously detached calculi/stones of kidneys in those wounded the thigh.

All theories, by which they try to explain the onset of nephrolithiasis in civil/civilian population in peacetime, cannot be applied for the interpretation of stone-education in casualties. The latter, it is doubtless, is caused by the series/number of the neurohumeral effects, connected with character/nature and degree of damages to bone and surrounding soft tissues, with the character/nature of the subsequent complications of local ones, in the zone of wound, and common (metastatical infection), and also by the specific conditions of the hospital content, sometimes very lasting.

It is known that the first clinical manifestations of nephrolithiasis appear not earlier than through 1 $\frac{1}{2}$ -2, but in the majority of the cases through 4 even more than months after wound. From the histories of disease/illness it is evident that the calculi/stones are formed predominantly with the complication of

wound of extensive osteomyelitis of the broken ends of the crushed bone, by suppurative flows or by the subsequent education of dummy joint. However, as showed the observations of the author, in certain cases in the casualties of young age with the relatively favorable course of the wound of thigh suddenly appeared kidney colic.

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Fig. 1. Photograph of both of kidneys and ureters wounded R. In the photograph are visible the shadows of concretions in the region of pelvises of both of kidneys and right ureter.

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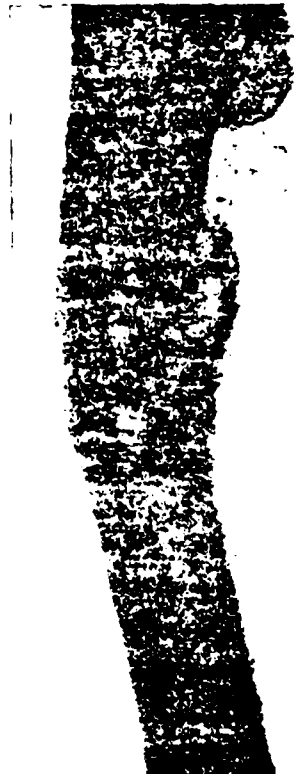


Fig. 2. Healed break of right femoral bone wounded R, after perforating fragmentation wound of thigh.

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Frequently it appeared after the long time already after the healing of the wound when casualty long before the appearance of pains or withdrawal of calculus/stone left hospital and he was found under ordinary household conditions.

The first communications/reports about the stone-education in

the kidneys with the bullet breaks of thigh in the period of the Great Patriotic War are given in the work of A. T. Lidskiy, N. I. Starov and A. I. Yakovlevy. Their observations the authors partially carry even to the war with the White Finns when for one of them (to A. T. Lidskiy) it was necessary to observe in casualties with the bullet break of bones, complicated by osteomyelitis, the typical picture of kidney stones. By the reason for stone-education in such casualties it was inclined was inclined to count, besides the destructive processes in the casualty bone, mainly the reception/procedure of the large doses of sulfanilamide preparations, which were being widely prescribed by these casualty.

From of this type by assertion it cannot be agreed. Kidney stones in casualties or with the closed bone breaks was described more than hundred years ago, when sulfanilamide preparations not at all there existed. Furthermore, with chemical investigation of the calculi/stones, which were secreted spontaneously or removed during the operation/process, in them never it was discovered the crystals of sulfanilamides. Observing in certain cases after the excessive use/application of this preparation or as a result of the individual characteristics of the individual patients the fallout of the crystals of sulfanilamides cannot serve as the analogy of stone-education in casualties with the bullet break of thigh, complicated by osteomyelitis.

By only general/common/total moment/torque upon the occlusion of ureter the precipitated crystals of sulfanilamides and the introduction of concretum from pelvis in ureter is kidney colic, but also it with sulfanilamide "calculi/stones" never achieves this intensity as with ordinary gravel.

For the occlusion of the upper urinary routes/paths by salts of sulfanilamides is more characteristic suddenly appearing anuria, caused by filling of lumen of both ureters, and sometimes also pelvises by putty-shaped mass from sulfanilamide salts.

The kidney calculi/stones, which are observed with the bullet wounds of thigh, can be divided into two basic groups: 1) acid, noninfected and 2), the alkaline, predominantly infected calculi/stones.

To the medium of the calculi/stones of the first group most frequently are encountered oxylates. This in the overwhelming majority the single calculi/stones of small sizes/dimensions, which are secreted spontaneously with the phenomena of sharp/acute kidney colics.

"Alkaline" calculi/stones achieve significant sizes/dimensions, frequently performing small scaphuli and kidney pelvis. In certain cases alkaline calculi/stones perform the lumen of kidney pelvis and ureter in the form of set first larger/coarser, then the finer/smaller individual calculi/stones, detected in the X-ray photograph in the form of the chain/network, repeating the anatomical outlines of kidney pelvis and ureter. In the latter case frequently simultaneously are observed the calculi/stones of the bladder.

Both forms/species of calculi/stones have different origin, in the majority of the cases different clinical picture, with them are used the completely different methods of treatment, also, in particular prophylaxis.

The basic reason for stone-education in casualties should be considered violations from the side of the central nervous system, which create the specific shifts/shears of phosphoric-calcium metabolism/exchange as a result of which are formed gravel.

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For the illustration of this position/situation it is possible to give one observation O. G. Plisan. In that wounded the region of neck, right scapula and right hand during the objective research were

discovered the increased right patellar reflex, the increased perspiration to the right on the neck, by armpit, in the parotic region and on the breast. Anisothermia. In the region of right scapula wound by the size/dimension: 6x3 cm with very flaccid epithelization. 8 Months after wound appeared the attacks/seizures/paroxysms of kidney colics with dysuric phenomena. During further research are discovered phosphate calculi/stones. Those produced already after the appearance of kidney colics biochemical research did not reveal/detect any significant changes in the content of calcium, phosphorus and sodium in the blood and the urine.

Unfortunately, the author not cite data of the microscopic examination of the sediment of urine, why remains unexplained presence or the absence of the pyrrhea which could somewhat explain the dysuric phenomena, which were being observed in casualty. More interesting data, which explain the onset of phosphate calculi/stones, it brings A. I. Yakovlev in the already mentioned work of A. T. Lidskiy, N. I. Starov and A. I. Yakovlevoy. During the histological research of the kidneys of the casualties, which was killed as a result of the heavy septic process after the bullet break of bones, are established/installed heavy secondary changes in the parenchyma of kidney. "In the ducts was noted parenchymatous regeneration, by places insignificantly expressed obesity of the

epithelium of convoluted tubules with the flattening of cells. In the lumen of ducts was a detritus either homogeneous dense cylinders, some with layering of epithelial cells, microbial flora or phosphoric-lime salts. In the lumen of Bowman's capsule of some glomeruli was observed serous or hemorrhagic exudation, exfoliation of epithelium in the individual sections of pelvis and presence of the homogeneous masses, impregnated with salts, in the form of rough crystals and fine sand".

Given data, although they relate to the heaviest forms of the bullet break of thigh, best anything illustrate etiology and dynamics of the onset of secondary ones or as them still are called, the "traumatic calculi/stones of kidney".

The prolonged septic course of the wound of thigh is doubtlessly escorted/tracked by bacteria and inflammatory-degenerate changes in the parenchyma of kidney. The latter, as showed the classical experimental research of M. N. Moskalev, predispose to the formation of slightly pustular damage/defeat of kidney and further development of so-called pyelonephritis.

In the process of coursing the suppurative wound of thigh it is extremely difficult to trap the moment/torque of the invasion of infection into the kidney and the onsets of pyelonephritis. The high

temperature in similar cases, which is not escorted/tracked by pains in the region of kidneys, always makes it necessary to assume that deterioration in the condition of casualty depends on local process in the wound of thigh. Urine at first contains only the moderately increased quantity of protein, transparent cylinders and a little the partially lixiviated erythrocytes, that also is estimated as the focus nephritis, which is considered one of the etiological factors of stone-education in casualties (A. P. Tsulukidze).

Only after a lapse of certain time (1-2 months) it is possible to reveal/detect the alkaline reaction of the urine in the sediment by which is contained the increased quantity of leukocytes and salts of phosphates. During seeding/inoculation of such urine always it is possible to reveal/detect *Staphylococcus aureus*, it is thinner/less frequent than the *Proteus vulgaris*, which cause alkaline fermentation of urine.

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Entirely in another way flows/occurs/lasts the onset of the acid uninfected calculi/stones in the kidneys in casualties with the bullet break of thigh.

The mass research of urine in those wounded into the thigh, that were being produced in one of the rear hospitals by V. D. Yankovskiy and G. A. Sventitsky, revealed/detected in 45.00/o of casualties significant oxaluria. In 14.00/o of them oxylates of calcium were encountered in the form of druses and conglomerates, in 7.00/o - in the form of sand. Further observation made it possible to establish that in 26.00/o of casualties microlithiasis was escorted/tracked by hepatic colic.

Microlithiasis was observed predominantly in casualties with the bullet break of thigh and partially shins (25.00/o); the second place in the frequency of the onset of microlithiasis occupy the wounds of spine (10.70/o). With the wounds of upper extremities with the damage to bone the liberation/excretion of microscopic calculi/stones was

observed into 8.2o/o.

The isolation of oxalates with the urine, naturally, preceded excess content of oxalic acid in the blood, which was observed predominantly in those casualties who according to the character/nature of wound (bullet break of thigh) forced were to undergo prolonged full/total/complete immobilization. The control research of wounded and healthy/sound people's blood (workers of food industry and service) showed that in casualties, who are found on the hospital mode/conditions under conditions of the full/total/complete inactivity of muscles, a quantity of oxalic acid on the average composed 16.7 mg o/o, whereas achieving in some 22.8 mg o/o, in healthy/sound people, which were being found under the same conditions of nourishment, an average quantity of oxalic acid was equal to 7.8 mg o/o.

It should be noted that hyperoxalemia was observed predominantly in the period of convalescence, being escorted/tracked simultaneously by hypercalcemia. In proportion to casualty it was freed/released from the pinning down his movements gypsum bandage and was renewed active muscular activity, hypercalcemia was relieved by the normal content of oxalic acid in the blood. But by this time has already been formed concrement, whose spontaneous isolation was escorted/tracked by typical hepatic colic.

For the illustration let us give the following observations.

1. K. R. F. , 45 years, is converted into hospital on 4 November, 1945, apropos of oliguria. On 6 April, 1944, at the front obtained the perforating fragmentation wound of middle third of right thigh with the break of femoral bone and since then it was located on the treatment in the hospitals.

In the course of the latter/last four months it began to note dull pains in the lumbar region, and in the latter/last two weeks the decrease of the diurnal isolation of urine.

Upon the inspection/examination in the region of middle third of right thigh - stronger scars after perforating fragmentation wound. From the side of the organs of respiration and blood circulation without the evasions from the nerves; the organs/controls of digestion - tongue it is lined, stomach soft and painless, departures of intestine normal urino-genital system - kidney do not palpate, symptom of Pasteur positive from both sides, are wet 2-3 times in a 24 hour period, total quantity of urine 100.0 in days; the analysis of urine; color - unclear; specific gravity/weight - 1026, reaction - alkaline, protein - 0.06‰, in the sediment leukocytes 8-10 into the

field of view, the erythrocytes, fresh unitary in the field of view; salts - phosphates in large quantities. Residual nitrogen of the blood 120 mg o/o. In the review X-ray photograph (Fig. 1) of upper urinary/urine ones it is travelling in the region of right pelvis which is somewhat expanded and deformed, and on the course of entire right ureter is a shadow of concretum and in the region of left pelvis is a shadow of analogous character/nature.

In the X-ray photograph (Fig. 2) the grown together break of femoral bone.

Three days after entry into the hospital in patient oliguria changed into anuria; from the operation/process of patient proposed categorically it refused, the general condition of patient gradually deteriorated, but the 8th day from the beginning of anuria in patient appeared delirious condition. To the outcome of the 9th day in the period of the clear consciousness of patient it consented to operation/process. Taking into account smaller roentgenological changes in the region of left kidney, it was decided to operate patient to the left.

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With exposure of left kidney the latter proved to be increased in the

sizes/dimensions; during the palpation of pelvis and upper third of ureter the latter proved to be the expanded and filled dense masses; left ureter at the output/yield from the pelvis was opened, from the section/cut began to be secreted in large quantities the salts; however, to free entire ureter from them through this section/cut was impossible, and therefore, at a distance down on 4-5 cm, on the ureter was produced the second section/cut from which they began to be allotted to salt of analogous character when was removed the unit of the salts through the upper section/cut and from the area of pelvis on the operating table, left kidney began to secrete a significant quantity of urine, to the places of the sections/cuts of ureter were conducted/supplied drainage and wound was in layers closed. In the postoperation period diuresis rapidly increased, the general condition of patient was improved on the 10th day after operation/process drainage were removed and wounds subsequently rapidly were closed. When to patient three weeks after the halls of the presence of shadows not only in the region of left kidney and ureter where was produced operation/process, but also in the region of right kidney and ureter. In the region of the bladder was only discovered the shadow of small concretment. From cystoscopy and removal/distance of the calculus/stone of the bladder of patient categorically it refused. The general condition of patient became completely satisfactory, residual nitrogen of the blood was lowered to the norm and 2 1/2 months after the produced operation/process of

patient it was discharged from hospital.

2. O., 20 years, is wounded 7/XII 1942. Diagnosis: the bullet break of left thigh with the damage to bone. After wound was soon superimposed the circular gypsum bandage which 9/II 1943 was taken/removed. 18/II 1943, i.e., 9 weeks after wound, appeared left-side hepatic colic. Colic preceded the increased content of protein in urine (0.33‰) and the appearance of a large quantity of fresh erythrocytes.

During the subsequent analyses of urine invariably/unchangedly it was noted oxaluria.

Is most demonstrative the following observation.

3. K., 21 year, is wounded 13/II 1943. Diagnosis: the multiple fragmentation wound of lower third of right thigh with the break of bone and the damage of knee joint.

Is soon after wound produced the surgical processing of wound and is superimposed the gypsum bandage, which 27/IV they removed/took. 30/IV, i.e., 2 1/2 months after wound, for the first time is noted sickliness in the left lumbar region. In the urine, undertaken 12/IV are determined acid reaction, specific

gravity/weight 1 007, protein, protein 0.03‰, fresh erythrocytes in large quantities and oxylates which were noted also during subsequent analyses of urine. 5/V cruel attack/seizure/paroxysm of pains in the left side. Patient rushes about from the pain. In the X-ray photograph, in the pelvic department of left ureter, in the place of crossing over with the vessels the shadow of calculus/stone by size/dimension 0.5x1 see 16/VI spontaneously it withdrew the calculus/stone of the yellow-brown color (oxylate).

To what extent is distinguished the etiology of the onset of aseptic "acid" calculus/stone and the infected "alkaline", so differs clinical picture with the aseptic and infected calculus/stone. General/common/total is hepatic colic, but also it flows/occurs/lasts differently.

As it was indicated, the appearance of the uninfected calculus/stone precedes the abundant isolation of salts, and then microlite. During this period of patient it complains about the sensation of burning in the urinating canal, the sharp pains during the urination. Sometimes these phenomena are are so/such insignificant, that the patient does not add to them special importance. Only the surprise full/total/complete occlusion of ureter by larger/coarser calculus/stone causes sharp pains in the lumbar region, which irradiate into the egg or into the head of flaccid sex

term. Simultaneously is raised temperature. Severe pains cause urges to the vomiting, swelling/distension of stomach, that simulate intraperitoneal catastrophe. In proportion to the advance of calculus/stone and reduction of the cross-country ability of ureter the pains and all secondary phenomena calm down or even cease, temperature is lowered, and the general condition of casualty is improved. Further advance of calculus/stone causes again the same phenomena. Only after the introduction of calculus/stone into the intramural department of ureter to the pains is added the quickened urination with a feeling of incomplete emptying bladder.

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After the withdrawal of calculus/stone is noted stopping pains, appears a feeling of full/total/complete alleviation, disappear all phenomena, connected with the paresis of intestine. Only at the latter/last moment of the advance of calculus/stone on the urinating canal of patient test/experience sharp pain during the urination, surprise fine delay of urine and difficulty during the urination, which is relieved after the withdrawal of calculus/stone by free urination with wide stream.

Entirely otherwise flows/occurs/lasts hepatic colic with the infected calculus/stone. Besides the pains in the obturated kidney,

colic is escorted/tracked by the staggering chill with the very high temperature. The general condition of casualty sharply deteriorates. Skin is done by dry, with the slightly icteric hue, sclera they are icteric; the tongue of dry. Wound becomes cyanotic; granulation flaccid, by places they are covered/coated with greyish raid. Instead of abundantly that secreting to this thick pus from the wound escape/ensues ichorous fluid/liquid. Stomach is inflated, gases will not withdraw. With the feeling sharp; sickness in edge-spinal bearing/angle in the side of obturation. The urine which was constantly turbid, is made by transparent/hyaline. The designation/purpose of pain relievers removes pains, but the general condition of casualty continues to remain heavy. By siphon enema to the brief period it is possible to free intestine from the gases and at this moment it is possible to palpate the considerably increased dense kidney.

Both in the first and in the second case, besides the characteristic picture of the sharp/acute occlusion of ureter by calculus/stone, diagnosis it is easy to establish/install by x-ray examination. Already in the ordinary X-ray photograph on the course of ureter is visible the shadow of concretment, especially distinct with the acid aseptic calculi/stones. Considerably less distinctly is revealed/detected the "alkaline" infected calculus/stone, which is frequently the lump of mucus and pus, inlaid by salts of phosphates.

This calculus/stone among the gases, which overfill intestine, sometimes succeeds in revealing/detecting only with great difficulty.

Similar cases great aid in the diagnosis can render the research of the blood for leukocytosis, undertaken of three points: from the finger/pin and both edge-spinal bearings/angles. As showed the research of A. Z. Medvedovskiy, the reinforced by data clinical research, increase in leukocytosis on one side can aid diagnosis.

The intensive treatment by the large doses of sulfanilamides, the intravenous pouring in of urotropin, cytotropin and so forth remained unsuccessful. Most active proved to be surgical intervention which involved the exposure of kidney, pyelotomy, decapsulation, removal/distance of calculus/stone from the ureter and drainage of pelvis.

By oblique section/cut or by slantwise-cross section/cut, according to S. P. Fedorev, they uncover kidney. Near-kidney cellulose is vitreously edematous, sometimes yellowish-greenish. On splitting up of oil capsule there is exposed the sharply increased kidney of cyanotic-purple color. Through the strained expanded capsule x-ray the separately arranged/located or confluent into the loculi/nests fine/small abscesses of yellowish gray color, surrounded with cherry-red annulus. The kidney pelvis, covered by edematous fat,

is expanded; its wall is thickened. On splitting up of peripelvic fat by longitudinal section pelvis they reveal; from it is secreted an abundant quantity of urine with mucus and pus or liquid pus. If calculus/stone is located in the pelvis, then it are extracted.

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Calculus/stone usually is included in the lump of mucus and pus. After the removal/distance of calculus/stone and washing of kidney pelvis with any antiseptic or warm physiological solution for washing of the remaining in it clsters/clcts mucuses and pus, inlaid by urinary/urine salts, into the area of pelvis introduce rubber drainage and fix/record to the wall of pelvis with nodular catgut suture. Following this is produced decapsulation; individual fine/small ulcers cut with cross-shaped sections/cuts, after which the kidney stacks in kidney bed. Under the posterior and to the front face of kidney are stacked the wide gauze tampons, which eject into the upper bearing/angle of lumbar wound. Pelvic drainage they eject into the lower bearing/angle of the wound where it they fix/record to the skin with nodular silk suture. Laminar suture of lumbar wound.

If calculus/stone is located in upper third of ureter or on the boundary of upper and middle third, for its extraction is produced longitudinal splitting up of the ureter above the calculus/stone.

After the extraction of calculus/stone on the wound of ureter are laid 1-2 nodular catgut sutures. But if calculus/stone is arranged/located in the lower departments of ureter, it is necessary to be restricted only to the drainage of kidney pelvis; subsequently the calculus/stone will withdraw spontaneously. With the significant sizes/dimensions of the calculus/stone when hopes for spontaneous withdrawal it is small, it must be removed operationally in the cold stage.

If calculus/stone is removed, drainage, drainage of the pelvis is extracted on the 12-16th day after operation/process; but if calculus/stone remains in the ureter, then drainage is extracted only after the removal/distance of calculus/stone. In always findings of catheter in the pelvis the latter wash in the dilute solution of lunar caustic or Rivanol. The condition, analogous described with the infected calculi/stones, can be observed, also, with the "acid" calculus/stone. In such cases during the obturation of ureter by calculus/stone appear the conditions of M. N. Moskalev's pure/clean experiment from injectives into the ear of the rabbit of the pure/clean culture of staphylococcus and by the simultaneous dressing of ureter. In patients is observed the invasion into the kidney of the infection, which prevails in the wound of thigh, with the subsequent development of pustulous nephritis. However, this course of kidney colics with the uninfected calculus/stone is encountered

rarely.

During the subsequent improvement in the general condition of patient can be observed the full/total/complete spontaneous release of kidney and ureter from concretions, following how the reaction of urine it is made by acid, and urine becomes transparent/hyaline with the negligible content of leukocytes.

The described picture is observed usually as far back as of the stay of casualty in the hospital. The large calculi/stones of kidneys or coralliform calculi/stones, which do not initially cause special sufferings, most frequently are observed through many years after wound. This in the overwhelming majority of the cases phosphate calculi/stones. Oxylates, and by the fact more urate are encountered as rare exclusion.

With coralliform calculi/stones surgical intervention is used only when besides calculus/stone, are phenomena of pyonephrosis with the total loss of the function of kidney. With coralliform calculi/stones, arranged/located only in one of the poles of kidney and partially in the kidney pelvis, as showed author's experience, successfully can be produced the partial resection of kidney.

S., 45 years, is wounded in 1943 into the right thigh with the

break of bone. Subsequently heavy course with extensive suppuration of wound, independent withdrawal of sequestra in the three-fold sequestrectomy. Subsequently it constantly notes turbid urine, periodically peaked sharp pains during the urination, at times colic pains in the left lumbar region. The urine of alkaline reaction contains a large quantity of leukocytes. In the X-ray photograph coralliform calculus/stone with the cuneate process, turned with point to the spine.

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On intravenous pyelogram - moderate expansion of the scuphuli of upper half of kidney, expressed pyeloectasis. Branching calculus/stone occupies the lower crescent of kidney. In seeding/inoculation of urine is discovered the growth of white staphylococcus.

Under ether/ester-oxygen anesthesia/narcosis is made the resection of the lower pole of kidney with the subsequent intensive treatment penicillin. After operation/process the reaction of urine was made acid with the unitary leukocytes in the sediment.

Four month old observation of the patient established/installed the normal function of kidney and the absence of the relapse of

calculus/stone.

In his classical work "surgery of kidneys and ureters" S. P. Fedorov indicated the inexpediency of the operational removal/distance of phosphate calculi/stones due to 100o/o of their recurrence; at present the use/application of antibiotics in the post-operation period frees patients from the relapse of phosphate calculus/stone, thereby introducing very important amendment into seemingly still so recently firm position/situation.

Logically arises the question about the possibility of prophylaxis of stone-education in casualties. As showed the research of V. D. Yankovskiy and G. A. Sventitskiy, the period of convalescence is most important in the relation to the detection of precalculous condition. The isolation of microliths with the urine serves as the first signal of the formation of calculus/stone in the kidney. Frequently producing through the known time intervals (10-15 days) of the research of the sediment of urine, it is possible to record this moment/torque in which doctor's attention must be concentrated almost to the same degree as on the course of wound.

O. G. Plisan recommends immediately on the appearance of intensive oxaluria and in particular microlithuria the using of lumbar blockade according to A. V. V^{sh}ny^Sovskiy. However, as notes G.

A. Sventitskiy from the same hospital, the favorable effect of loin novocaine blockade on the isolation of oxylates with the urine is extremely short-time, why it cannot be considered the substance of prophylaxis of stone-education in the casualties.

Much greater value can have a more rapid removal of casualty from the condition of muscular inactivity and a change in the diet. High value acquires the limitation of the carbohydrates, the oxaluric effect of which at present is completely established/installed. At the same time, the decrease of the content in the food of sodium chloride and at the same time an increase in the foodstuffs, which have the alkalizing effect on organism (potatoes), contributes to an increase in the removal of endogenic calcium through the intestine and to the decrease of its isolation through the kidneys (G. A. Sventitskiy).

Immeasurably great difficulties presents struggle with phosphaturia and the formation of phosphate calculi/stones in casualties. And in these cases "acid" of diet with the preferred content of meat and fish, increased by the content of fats is produced change of reacting the urine. However, this acidifying effect, reinforced by the simultaneous designation/purpose of mineral acids (salt/hydrochloric, phosphoric), is extremely nonpersistent, since it resists the constant alkalization of urine as a result of

the intensive activity of the microbes, which call alkaline fermentation of the urine (golden and white staphylococcus, less frequent the *Proteus vulgaris*).

As it is already indicated, fallen phosphates rapidly are cemented, forming concretions, capable of fulfilling entire lumen of kidney pelvis and ureter, being converted into the so-called coralliform calculi/stones. Therefore it is extremely important at the very beginning of phosphaturia to explain the reasons, which facilitate the fallout of phosphates, to produce seedings/inoculations of urine, to establish/install the presence in it of suppurative cells, blood and other pathological inclusions/connections.

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Appearance in the arsenal of the therapeutic substances of antibiotics - penicillin and streptomycin - increased the possibility of effective struggle with the infectious phosphaturia. If in the period of the Great Patriotic War a quantity of penicillin was very limited and penicillinotherapy during the suppurative processes it did not have wide acceptance, then recently by the introduction of the large doses of penicillin to the majority of the cases successfully to struggle with phosphaturia, called and supported

golden and white staphylococcus. The fact indicated has greater value, that, in contrast to the "acid" oxalate calculi/stones, which was only the clinical occurrence, which escorted/tracked the course of the bullet break of the thighs, phosphate and in particular the coralliform calculi/stones are observed during the long time and after abandonment by the casualty of hospital.

Thus, it is at present necessary not only to distinguish the possibility of stone-education in casualties with the bullet break of thigh, but in each individual case it is necessary to consider the character/nature of stone-education and the time of its onset.

Stone-formation precedes the easily determined period of precalculous condition.

Prolonged of the immobilization of casualties with the complicated bullet break of thigh, but without the septic phenomena, in the period of convalescence is frequently escorted/tracked by oxaluria, microlithuria and isolation of the calculi/stones of oxylates. At the same time metastatical inflammatory phenomena in one or both kidneys contribute to the onset of phosphaturia and to the formation of phosphate calculi/stones. Taking into account the facts indicated, it is possible to undertake in the earliest periods decisive measures to averting of the stone-education: in the first

case - by dietetic measures, by the early renewal of muscular activity; the second - by active struggle with the septic complications, the use/application of antibiotics and the operational measures on the kidney with the preceding and subsequent treatment by antibiotics.

Foreign bodies their effect on the course of the bullet breaks of the bones of extremities.

Lieutenant Colonel of medical service K. P. Ivan'kovich.

General/common/total statistical evidence.

On the frequency of wounds with the presence of foreign bodies up to now usually they judge by a number of blind-end wounds, although already long ago, long before the discovery/opening of X-rays, were observed the cases, when with the blind-end bullet wound did not find foreign bodies, but with perforating they were revealed (M. G. Nagumovich, 1822, I. F. Eusch, 1831). After introduction to the practice of the roentgenological method of research were considerably increased in frequency the cases of finding foreign bodies, where then they did not expect, and vice versa. Thus, on the basis of a number of blind-end wounds it cannot be accurately said, as frequently into one or the other category were observed wounds

with the foreign bodies.

The statistical evidence about the blind-end wounds are generally sufficiently scarce and undetermined, for example, Denne (Denne) in the Italian war 1859 established/installed the frequency of blind-end wounds from 2 to 22o/o [cited in Chauvel and Nimier (Chauvel, Nimier)], and in the Great Patriotic War the frequency of blind-end wounds achieves, according to some authors' data, 74.4o/o (I. A. Zvorykin's data; the blind-end and mixed wounds together).

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These oscillations/vibrations are completely natural, since in the different time there were different methods and the possibility of the diagnosis of foreign bodies, and combat operations/processes carried different character/nature. According to Ye. I. Smirnov, blind-end wounds in 1942 on the whole composed 34.8o/o.

Are even more skimpy the information about the blind-end wounds with the bullet break of the bones of extremities. Relative to previous wars such information it was possible to find only in K. Sokolov; they relate to the war of the Serbians and Montenegrins with Turks (1876-1877). According to his data to 100 bullet breaks of the bones or extremities there were 32 blind-end wounds.

In the Great Patriotic War, according to different authors' data, among the bullet breaks of the bones of extremities blind-end wounds were from 4.70/o (forearm) to 28.30/o (thigh), and based on materials of the deepened development of the histories of disease/illness in average/mean 20.40/o, that it by no means corresponds to the number of bullet breaks with the foreign bodies, which on the average is equal to 31.00/o (Table 21).

From Table 21 it is evident that a number of bullet breaks of the bones of extremities with the foreign bodies exceeded a number of blind-end wounds of extremities with the break of bone on the average to 10.60/o, the smallest difference was observed with the breaks of the bones of shin (7.80/c), greatest - with the breaks of shoulder (15.50/o).

Table 21. Frequency of the blind-end bullet wounds of extremities with the break of bone and bullet breaks with the foreign bodies (in the percentages).

(1) Локализация перелома	(2) Характер ранения	(3) Слепое	(4) Синхрон- ными те- лами	(5) Разница
(6) Плечо		19.0	34.5	15.5
(7) Предплечье		10.6	18.7	8.1
(8) Бедро		33.3	46.3	13.0
(9) Голень		24.0	31.8	7.8
(10) В среднем		20.4	31.0	10.6

Key: (1). Localization of break. (2). Character/nature of wound. (3). Blind. (4). With foreign bodies. (5). Difference. (6). Shoulder. (7). Forearm. (8). Thigh. (9). Shin. (10). On the average.

Table 22. Frequency of the detection of foreign bodies with the blind-end and perforating wounds of extremities with the break of bone (in the percentages).

(1) Локализация перелома	(2) Характер ранения	(3) Слепое	(4) Сквозное
(5) Плечо		85,2	20,0
(6) Предплечье		84,7	9,5
(7) Бедро		78,9	24,5
(8) Голень		83,2	13,5
(9) В среднем		82,2	15,2

Key: (1). Localization of break. (2). Character/nature of wound. (3). Blind. (4). Through. (5). Shoulder. (6). Forearm. (7). Thigh. (8). Shin. (9). On the average.

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These numbers are obtained as a result of the fact that into 15.20/o of through bullet breaks were discovered the foreign bodies, but in 17.80/o of blind-end wounds of extremities with the break of bone during the most thorough study of the histories of disease/illness could not find indications of the presence of foreign body.

The data about the frequency of the detection of foreign bodies in individual segments are given in Table 22.

Blind-end wounds without the foreign body most frequently were observed, when foreign body settled from the large turned wound into the first hours after wound ever before the surgical processing or unnoticeably it settled from the wound during the primary processing. The same group includes the wounds, with which the small rapidly healing outlet was arranged/located far from the entrance and therefore it was not noticed in the process of the treatment of casualty, and also when the tangential or ricocheting wound they accepted for the blind: finally, here should be related the cases of the unclear documentation when the fact of removal/distance or spontaneous rejection/separation of foreign body from the wound was not noted in the history of disease/illness or when they did not change initially inaccurate diagnosis.

Foreign bodies with the perforating wounds of extremities with the break of bones were observed, in the first place, with the wounds by explosive/bursting or blasting bullet, if one or several units of the bullet left the wound through one (exit) aperture, and other units remained in the wound canal; in the second place, when outlet was formed by that bounced piecewise of bone (with the blind-end wound); third, in the cases of introduction through one inlet of several wounding shells which only some left outside; and finally when two blind-end wounds erroneously accepted as one perforating.

Foreign bodies with perforating wounds with the break of bones more frequently were observed with the wounds by fragment (19.80/o), than with the wounds by bullet (12.00/o).

Thus, during the Great Patriotic War occurred the possibility not only to establish/install the frequency of the bullet breaks of the bones of extremities with foreign body (31.00/o), but also to refine the characteristic of blind-end and perforating wounds in the relation to foreign bodies, that importantly virtually, since the presence of foreign body in the wound canal is not always indifferent for the casualty with the break of bone.

Diagnosis of foreign bodies.

Foreign bodies with the bullet breaks of the bones of extremities were discovered during the primary surgical processing (without the x-ray examination) into 17.00/o of cases, with the aid of the x-ray examination - into 76.80/o, by other methods (probing, feeling, etc.) - into 6.20/o.

With the bullet breaks of the bones of extremities with the presence of foreign bodies only 8.10/o of casualties they did not undergo x-ray examination, whereas generally 25.50/o of all wounded with the break of bones extremities they did not undergo research by

this method. Hence it is apparent that the significant percentage of the breaks of tubular bones with the presence of foreign bodies was studied roentgenologically.

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The diagnosis of foreign bodies with the breaks rarely presented difficulties, which depended mainly on the technical difficulties, which were being encountered in the X-ray room, or on the violations of the basic rules/handspikes of x-ray examination. In the unitary cases of the error for diagnosis were the result of the insufficient contrast of some metals (aluminum) or the strong contrast of some medicinal substances, which contain hearth and imitated the foreign bodies. (Latter/last genus of error they entailed sometimes unnecessary operations/processes).

Sometimes appeared difficulties during the determination of localization of the foreign body: in the bone or outside it, since this required more complex research, which was not always possible in the army and front line therapeutic installations. An similar error illustrates the following observation.

M. N. obtained multiple fragmentation wounds, including break of left tibia bone. In the X-ray photograph of the right thigh (on the

paper) of changes in bone is not discovered. In 2 months after wound with the incidence/drop in the casualty occurred the break of right thigh. With the repeated survey of the first X-ray photograph is discovered in the center of the diaphysis of right thigh the shadow of foreign body in diameter approximately 0.5 cm. Around the foreign body developed the osteomyelitic process, which involved pathologic fracture.

The greatest difficulties appeared during the definition, is foreign body the unit of the bullet or another shell. In the overwhelming majority of the cases the roentgenologists carried to the "metallic fragments" everything that it did not have the configurations of bullet. Meanwhile in many instances on the X-ray image it is possible to distinguish the units of the bullet of other fragments (Fig. 160).

Noncontrast foreign bodies with the bullet breaks were revealed almost exclusively during operational intervention or during the dressings, as as fistulography it was used rarely (0.20/o).

During the Great Patriotic War into 25.20/o of cases the foreign bodies were discovered by Soviet surgeons without the special x-ray examination, which was the significant achievement of the Soviet surgery, in many respects obligated to the work of N. I. Pirogov on

the diagnosis of foreign bodies.

Forms/species of foreign bodies frequency of their detection.

In the Great Patriotic War in the wound canals with the bullet breaks were encountered all possible foreign bodies - from the whole, unfaulted 55-millimeter mines (are published 5 cases: Pigurnova, V. I. Repet'ko, M. B. Pekhmana et al.) to the smallest dust-figurative particles of the wounding shells.

Furthermore, in the wound frequently found secondary foreign bodies, particles clothing, foot-wear, personal objects/subjects of soldier, and also objects/subjects of equipment and armament; considerably more rarely were revealed other secondary shells (calculi/stones, glass, etc.) (Fig. 3).

Among the secondary foreign bodies should be noted the noncontrast foreign bodies, which in the combination metallic ones met into 1.60/o of cases. It is known that in actuality the noncontrast foreign bodies were encountered considerably more frequently than this is reflected in the documentation.

Noncontrast foreign bodies were very frequently organic origin and therefore is considerably bacterially contaminated. According to

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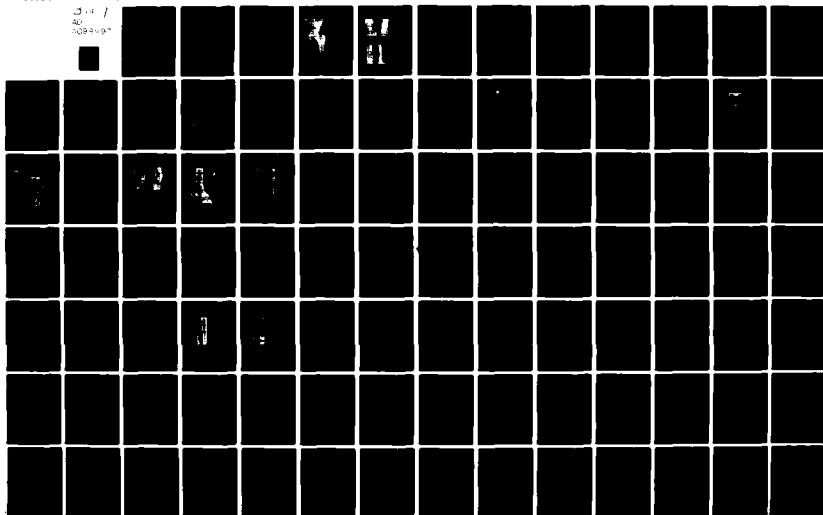
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the data of author's development, noncontrast foreign bodies into 90.00/o were the particles of clothing and foot-wear, which do not reveal tendency toward the growing.

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Very rarely (1.10/o) noncontrast foreign bodies were discovered in the bone together with the metallic ones. With the breaks, caused by the fragments of shells, min, etc., noncontrast foreign bodies were encountered almost 3 times more frequently than with the bullet breaks.

In the previous wars were also observed very different foreign bodies, including whole, unfaulted nuclei/kernels; one of such nuclei/kernels, weighing 6 pounds. N. I. Priogov removed during the Crimean campaign 1854-1856 in casualty with the bullet break of thigh.

Subsequently will be given the materials, which concern only the metallic foreign bodies, which in the overwhelming majority of the cases were the primary wounding shell.

The fragments of artillery shell, mine and aircraft bomb were encountered with the bullet breaks of extremities equally frequently,

while fragments Grants somewhat more frequently, which is explained by its ballistic properties (Table 23).

From Table 23 it is evident that the bullet foreign bodies were encountered more rarely than fragmentation ones almost 2 1/2 times. This fact has very vital importance, since with an increase in the number of fragmentation wounds sharply is increased a number of wounds with the foreign bodies, which requires the significant expansion of the volume of work during the primary surgical processing.

The frequency of bullet breaks with the foreign body gradually was increased each year of the war: in 1941 - 28.40/o, in 1942 - 30.00/o, in 1943 - 31.70/o, in 1944 - 32.70/o and in 1945 - 36.20/o. This corresponded to an increase in the frequency of bullet breaks, caused by fragments from 35.50/c in the first year of war to 44.70/o to last year.

A number of fragmentation wounds increased/grew each year of war with respect to an increase in the offensive combat operations, which is reflected, in particular, in the report materials along two successive fronts (Bryansk and 2nd Baltic).

Table 23. Frequency of bullet breaks with the foreign body with the wound by the different shells (in the percentages).

(2) артилле- рийна	(1) Основны					(8) Пуля и ее части	(9) В среднем по всем снарядам
	(3) мины	(4) авиа- бомбы	(5) гранаты	(6) неизвестного происхожде- ния	(7) в среднем		
48,0	47,8	47,5	59,3	45,4	47,6	19,4	31,0

Key: (1). Fragments. (2). Artillery shells. (3). mine. (4). aircraft bomb. (5). grenades. (6). unknown origin. (7). on the average. (8). Bullet and its unit. (9). On the average on all shells.

Table 24. Distribution of casualties with the bullet break of the bones of extremities according to form/species and value of foreign bodies (in the percentages).

(1) Размер, порожди- тель (в см)						(3) 3,1 и более	(4) Итого
	(2) Разрывной снаряд	0-0,1	0,2-0,5	0,6-1	1,1-2	2,1-3	
(5) Пуля		6,1	32,4	15,3	15,4	29,2	1,6
(6) Осколок		1,9	28,4	30,1	27,0	7,2	5,4
(7) В среднем		3,8	30,1	23,4	21,7	17,3	3,7
							100,0

Key: (1). Size/dimension of foreign body (in cm). (2). Wounding shell. (3). and more. (4). Altogether. (5). Bullet. (6). Fragment. (7). On the average.

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Fig. 3. Bullet break of large trochanter of left thigh. In the place of break a significant quantity of thin metallic semirings (unit of the chain/network of the hours), which were incorporated in the wound at the moment of wound.

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Fig. 4. Oblique break of lower third of left thigh. Wound is blind. Near the place of break the fragment of shell by the size/dimension 0.5x0.5 of cm.



Fig. 5. Perforated break of lower metaphysis of right tibia. Single blind-end wound. On the course of wound canal are arranged/located 6 metallic fragments by size/dimension from the point to 1x0.6 cm. Two largest/coarsest and two fine/small fragments are located in the tibia.

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With the treatments of casualties with the foreign bodies was necessary to consider as disposition, so a number and a size/dimension of foreign bodies.

Size/dimension of foreign bodies with the bullet breaks is important from the point of view not only of pathogenesis and treatment, but also ballistics (Table 24).

If we exclude from a number of bullet foreign bodies the unfaulted bullets, then particle distribution of the bullet according to the size/dimension will be in the percentages of such.

Taking into account that are here represented the foreign bodies according to the maximum sizes, should be drawn the general/common/total conclusion that with the bullet breaks were observed predominantly the fine/small foreign bodies by

size/dimension to 1 cm.

This is completely logical, since the large/coarse wounding shells usually produced the such extensive decomposition of bone and soft tissues, that the casualties frequently died on the field of battle.

There are experimental data (V. A. Thiele, 1894) and clinical observations (N. N. Yelanskiy, 1941), which indicate that the fine/small foreign bodies can produce in the large/coarse bones the large decomposition (Fig. 4).

By author's development it was possible to come to light/detect/expose, that with the blind single bullet breaks into 41.90/o bullet breaks they were produced by fine/small fragments not more than 1 cm (Table 26).

Consequently, on the basis of the experiment/experience of the Great Patriotic War it was explained that also the small fragments of the disrupting shells possessed large living force and brought in heavy decomposition bones.

In terms of a number of the foreign bodies, discovered with the bullet breaks, the wounds can be divided into four groups: 1) with

one by foreign body, 2) with two and three, 3) four- ten times, 4) with eleven and more.

This division into the groups, if are known the sizes/dimensions of foreign bodies, gives some bases for the judgment about the possibility of the removal/distance of all foreign bodies, located in the wound canal (Table 27).

From given in Table 27 data it is evident that the single foreign bodies were encountered more frequent than multiple with the wounds both by bullet, and by fragments. However, with the wounds by fragments single foreign bodies were encountered considerably more frequent; whereas multiple foreign bodies were encountered predominantly with the wounds by bullet, which occurs especially relief, if we exclude the unfaulted bullets: one unit fragmented bullet was encountered into 14.40/o, 2-3 units - into 26.40/o, 4-10 units - into 29.00/o, and 11 and more than units - into 30.20/o.

Table 25. Distribution of foreign bodies (particles of the bullet) according to their size/dimension (in the percentages).

(1) Размер инородного тела. (в см)				
0-0,1	0,2-0,5	0,6-1	(2) Больше 1	(3) Итого
8,4	44,4	20,9	26,3	100,0

Key: (1). Size/dimension of foreign body. (in cm). (2). It is more. (3). Altogether.

Table 26. Distribution of casualties with the bullet break of the bones of extremities according to the value of the wounding shell with the blind-end wound by fragment (in the percentages).

(1) Размер ранящего снаряда (в см)					(3) Итого
0-0,5	0,6-1	1,1-2	2,1-3	(2) Больше 3	
11,8	30,1	38,6	10,4	9,1	100,0

Key: (1). Size/dimension of the wounding shell (in cm). (2). it is more. (3). Altogether.

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On the whole with the breaks, caused by bullet, were discovered predominantly multiple foreign bodies, and with the breaks, caused by fragments, single foreign bodies.

If we consider that all through bullet breaks without the foreign bodies were plotted/applied by the unfaulted bullet, then,

according to the data of deepened development with the addition and, it would have been possible to establish that in the Great Patriotic War with the bullet bullet breaks the bullet was torn (it decomposed) into 14.30/o. This number should be considered minimum, since with the through bullet breaks are completely possible the cases, when bullet with the strike/shock about the bone decomposed into the individual large/coarse units which everyone took off from the body at the moment of wound, or when through break was brought in by the unit of the bullet, which was torn to the moment/torque of wound.

The presence of multiple foreign bodies with the wound by fragment can be explained only by the simultaneous incidence/impingement of several fragments, moreover in the majority of the cases the break was produced only by one fragment, and others only simultaneously struck into the extremity; most frequently these associated foreign bodies penetrated through the independent wound apertures. However, frequently were observed also the wounds when several fragments penetrated through one wound aperture, moreover in certain cases they all served as a reason for the break only in one place (Fig. 5).

Vital importance for the correct treatment has localization of foreign body and its relation to the bone (Table 28).

Table 27. Distribution of casualties with the bullet break of bones according to a form/species of the wounding shell and a number of foreign bodies (in percent).

(1) Число инородных тел (2) Ранящий снаряд	(3) Итого				(4) Итого
	1	2-3	4-10	11 и более	
(5) Пуля и ее части	37,2	19,3	21,4	22,1	100,0
(6) Осколки	62,2	20,0	11,3	6,5	100,0
(7) В среднем	52,3	19,7	15,2	12,8	100,0

Key: (1). Number of foreign bodies. (2). Wounding shell. (3). and more. (4). Altogether. (5). Bullet and its unit. (6). Fragments. (7). On the average.

Table 28. Localization of foreign body with the bullet breaks of the bones of extremities (in the percentages).

(1) Локализация инородного тела (2) Ранящий снаряд	(3) В кости или среди костных отломков	(4) В кости или среди костных отломков и в мягких тканях	(5) Только среди мягких тканей	(6) Всего
(7) Пуля и ее части	10,3	12,7	77,0	100,0
(8) Осколки	23,1	6,7	70,2	100,0

Key: (1). Localization of foreign body. (2). Wounding shell. (3). In bone or among bone broken ends. (4). In bone or among bone broken ends and in soft tissues. (5). Only among soft tissues. (6). In all. (7). Bullet and its unit. (8). Fragments.

Foreign bodies most frequently were arranged/located in the soft tissues, clear bone or bone fragments, moreover with the bullet wounds foreign bodies were arranged/located in the bone or among the bone fragments less frequent than with the fragmentation wounds.

The fragments of shells, min and bombs were encountered in the bone or among the bone fragments and were absent from the soft tissues more than 2 times of more frequent than bullets or their units. This has very vital importance, since with the fragmentation wounds bacterial contamination is greater than with the bullet ones.

The frequency of finding foreign bodies in the individual bones was the following (in the percentages to a number of breaks of each bone with foreign bodies):

(1) Большеберцовая кость	31,8	(4) Лучевая кость	14,5
(2) Бедренная	18,7	(5) Плечевая	10,2
(3) Локтевая	15,9	(6) Малоберцовая кость	8,5

Key: (1). The tibia. (2). Femoral bone. (3). Ulna. (4).

Radiation/radial bone. (5). Shoulder bone. (6). Fibular bone.

The spongy building/structure of epi-metaphysis favors introduction, and under the weakened manpower and to the jamming of the wounding shell (Table 29). Therefore foreign bodies most

frequently were encountered in the bones which had the more powerful/thicker epi-metaphysis units (tibial, thigh).

Bullet foreign bodies.

Wound by "explosive/bursting" bullet. In the Great Patriotic War personal firearms was characterized by great variety. Many authors noted that with the bullet wounds the fragments of rifle and automatic bullets were encountered more frequent than in the previous wars. To establish/install the frequency of the jamming of shrapnel bullets in this war is difficult, since extremely rarely were encountered typical lead shrapnel bullets, and the used for the filling of shell pieces of metal it was difficult to distinguish of the secondary metallic foreign bodies.

It should be noted that the breaks, caused by automatic bullets, were encountered rarely (0.80% all bullet wounds), and foreign bodies with these breaks (most frequently in the form of whole bullet) were discovered in three and the more of times more frequent (61.00%) than with the breaks, caused by other bullets (19.00%).

As it is already indicated (pg. 78), for each of 100 bullet breaks into 14.30% of cases they revealed in the wound canal of the unit of the torn bullet.

After for the armament were accepted threaded/cut rifles and tunicary bullets (end of the past century), fairly often became to be noted the decomposition/decay of shell bullets; it was assumed that the reason for the break of bullet is its poor finishing, negligent storage and so forth, etc. First XX century began to invent the special-purpose bullets, mainly for the adjustment fires, which had special blasting mechanism.

Table 29. Distribution of the bullet breaks of the bones of extremities according to the level of the segments of extremities and dependence on localization of foreign body (in the percentages).

(1) Уровень перелома по трети (2) Локализация инородного тела	(3) Верхняя	(4) Средняя	(5) Нижняя	(6) Всего
(7) В кости или среди костных осколков	42,6	23,8	33,6	100,0
(8) В других местах	31,6	40,8	27,6	100,0

Key: (1). Level of break on third. (2). Localization of foreign body. (3). Upper. (4). Middle. (5). Lower. (6). In all. (7). In bone or among bone fragments. (8). In other places.

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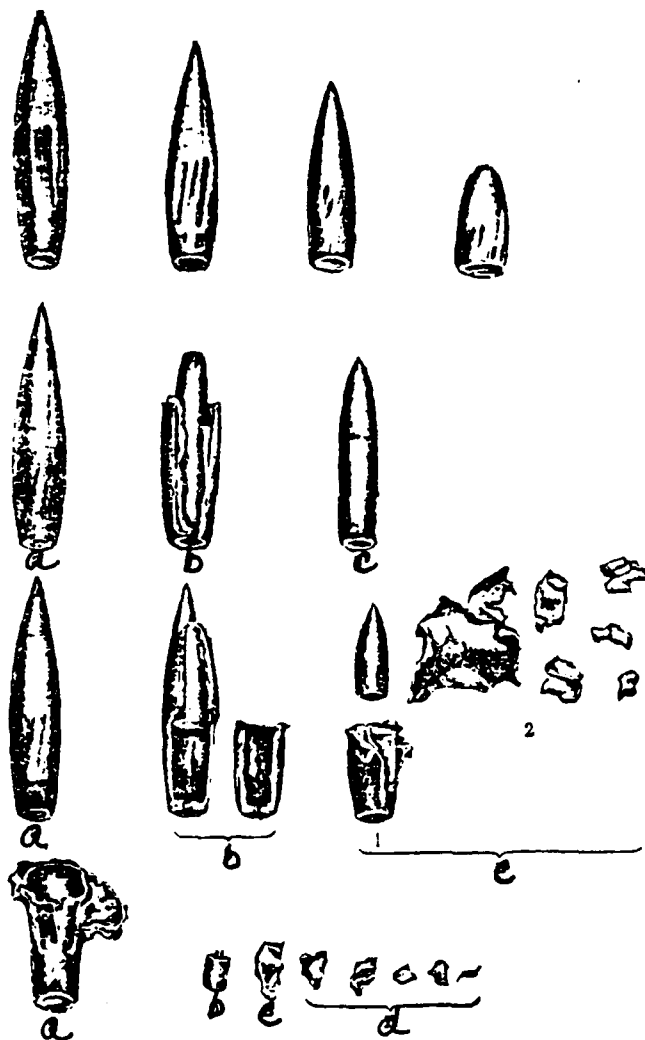


Fig. 6. Models of bullets, extracted by author on operations/processes during Great Patriotic War.

First series/number (on top): Rifle-machine-gun and automatic bullets of the different length and forms, which were being used by Germans and Finns (to the right).

The second series/number: a) the armor-piercing bullet whole; b) the same bullet with the detached head of steel core and shell; shell is sawn lengthwise, is visible the thin lead gasket between core and casing; c) the steel core, which fell from the shell and which applied independently wound.

The third series/number: a) incendiary bullet; b) the same bullet on the cut; the cylinder, which contained combustible mixture, is sawn in half; c) the same bullet, which was torn on the unit in the body of the casualty: 1 - basis of bullet, above it steel core; the shell of basis is sawn lengthwise, is inside visible the cylinder, which contained combustible mixture, 2 - pieces of the torn shell and lead gasket from the head of bullet; all these units are extracted during the primary processing.

The fourth series/number: the units of the blasting bullet, removed from the knee joint during the primary processing: a) the greatest unit of the bullet, copper shell and the lead gasket is sawn

lengthwise and crosswise and expanded/scanned; is inside visible cup, also the slightly notched, contained firing pin/striker and small coupling; b) shock worker; c) the unit of the deformed small coupling; d) the fine/small units of the shell and lead gasket. All this units lay/rested at the knee joint separately.

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During the first world war frequently were observed the wounds by such bullets, majority of authors considering that the enemy used them for the destruction of living target. In the Great Patriotic War, besides blasting bullets, were used those also tracing, incendiary ones and armor-piercing.

All these bullets did not have blasting mechanism, but they decomposed on the unit, apparently it is more frequently than ordinary bullets. Fig. 6 depicts the models of bullets; in Fig. 7 - the scheme of the longitudinal section of the blasting bullet whose units after burst are depicted in the lower series/number Fig. 6.

Recently the break of bullets was conditioned on use/application of special alloys during the preparation/manufacture of bullets, on reheat of trunk/stem with the lasting firing, in particular from the machine gun (G. A. Zedgenidze). However, the decomposition/decay of

bullets into pieces with the accidental wounds from the known weaponry attests to the fact that, apparently the most frequent reasons for decomposition/decay on the unit of the nonexplosive bullets were the technical defects of bullets, the obstacle, exerted by bone, and also rebounding of the surrounding objects/subjects. The strike/shock of bullet about the bone has very vital importance, which is confirmed by the result of the survey of 10000 X-ray photographs, in which were fixed predominantly the wounds into the soft tissues. The decomposition/decay of bullets with the integrity of bone was observed in this case very rarely (not more than 0.1-0.20/o bullet wounds of soft tissues).

As is known, the preparation/manufacture technique of blasting bullets is more complex than the preparation/manufacture technique of simple ones. Blasting bullets therefore are more expensive than simple. By these (if one takes into account the exhausted economy of the suffered wound enemy) perhaps is explained the fact that in the last two years of war the wounds in connection with the breaks of bullets were encountered more rarely.

On the basis of anamnestic data in the Great Patriotic War the breaks, caused by blasting bullet, were from 2.9 (forearm) to 5.60/o (thigh).

The specific units of the blasting bullet with the blind-end wound of knee joint are depicted in Fig. 6.

To recognize the specific units of the blasting bullets was difficultly not only on the X-ray photographs (with the photograph was required the specific projection), but also in the presence of removed on the operation/process or spontaneously detached foreign body, in view of the fact that the overwhelming majority of the surgeons was not familiar with the different types of bullets and their units.

According to data obtained as a result of the deepened development, the breaks, caused by blasting bullet, and the Great Patriotic War were encountered approximately into 6.00/o of cases.

In the Great Patriotic War were observed two types of the disposition of the units of the bullet (from the break or the burst): 1) on the course of wound canal, frequently even to the place of the break (it is characteristic for the break) (Fig. 9 and 10) and 2) it is dispersed in all directions from the place of the break (it is characteristic for the burst) (Fig. 11).

The large/coarse fragments of bullets, if they are not held up by bone, fly usually further than fine/small.

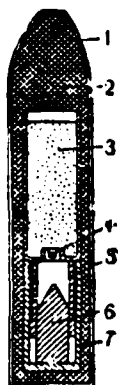


Fig. 7. Scheme of the section/cut of blasting bullet (according to A. A. Opokin). 1 - shell; 2 - lead core; 3 - explosive; 4 - primer; 5 - small coupling; 6 - shock worker; 7 - wall of cup.

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Fig. 9 and 10 depict the disposition of the units of the armor-piercing bullet after its break, which was begun even to the strike/shock into the bone; basic part of the shell was delayed on the spot of the strike/shock of bullet about the bone, and other, finer/smaller units of the shell were arranged on the course of wound canal; further all passed the steel core of bullet. It is possible that in this case the bullet ricocheted to the entry into the thigh.

Fig. 11 depicts the photo-X-ray photograph of the bullet break of lower third of shoulder bone. Bullet entered from behind and it

was torn in bone; parts of it were scattered radially toward the front; one large/coarse fragment flew out from the shoulder and stuck in the forearm.

In the position/situation of the unfaulted bullets with the bullet breaks, according to the data of author's development, are noted two regularities.

1. Located in soft tissues bullet almost always accepted longitudinal position/situation along axis of extremity, if it did not lean by end into bone. In the bone the bullet, as a rule, was arranged/located cross or slantwise (predominantly in epi-metaphyses). If bullet was located by rear sight in the marrow area, then it occupied longitudinal position/situation.

2. Approximately/exemplarily into 40.00/o of cases stuck bullet its head was disposed of towards inlet as a result of rotation around lateral axis. Although about such rotations of bullets known already from end of the XIX century,, until now, it is not yet established/installed, when more frequent they occur: during the flight or in tissues of casualty. On the basis of author's development it is possible to assume that the rotation of bullet more frequently occurred in the air and bullet entered into body by its basis.

This assumption is based on the frequent disposition with the basis forward of the bullet, wedged in into the bone, and also on the ejection of a significant quantity of fragments of bone into the soft tissues on the course of wound canal when bullet proved to be that turned on 180° (Fig. 12).

These special features/peculiarities in the disposition of whole bullet it is equal characters/natures both for the long ones and for the short bullets.

Microflora of foreign bodies and bone sequestrations.

According to the data of the deepened development, the bacteriological research of foreign bodies and sequestrations was produced rarely (0.10/o). The group of the authors (S. P. Vilesov et al.) from the Kazan' bacteriological institute reported the following results of the bacteriological research of the foreign bodies: sterile foreign bodies were encountered into 28.00/o of cases, and bacterially contaminated - into 72.00/o.

Most contaminated proved to be the foreign bodies, arranged/located in the bones and among the bone broken ends: here

sterile foreign bodies compose 13.30/o, and bacterially contaminated - 86.70/c.

With the accustoming of foreign bodies was noted the decrease of microbial flora; so, foreign bodies from the healed wound proved to be sterile into 44.00/o and from that not healed - into 16.00/o of cases.

The bacterial contamination of bone sequestrations is considerably higher than foreign bodies, which is evident from the data of the Tadzhik Institute of Epidemiology, Microbiology and Sanitation, the obtained during the research of foreign bodies and bone sequestrations, extracted from the prolongedly not healing wounds (Table 30).

Anaerobes, into those divided from the bone sequestrations, gave growth 2 1/2 times more frequently than the anaerobes, isolated during seeding/inoculation of foreign bodies.

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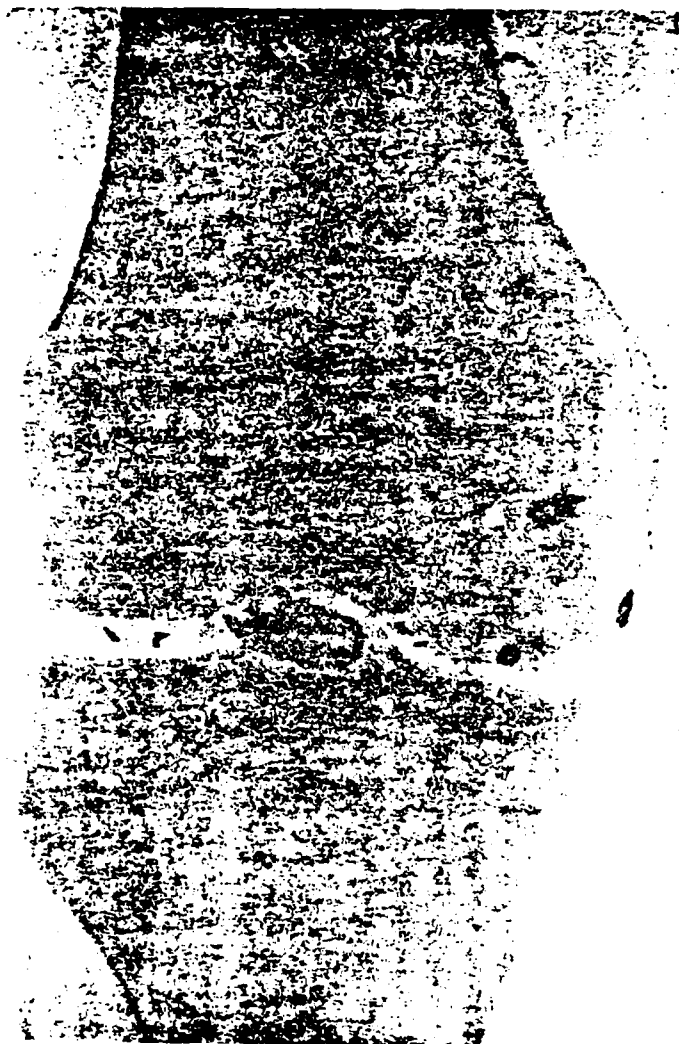


Fig. 8. Knee joint. front-posterior projection (X-ray photograph). In the bones there are no noticeable changes. Against the background of joint slit and lower pineal system of thigh to 10 shadows of metallic

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foreign bodies by value from the point ones to 2x1 cm; among them there is one, characteristic for the firing pin/striker of blasting bullet (having the form of cylinder with the spiculate summit).

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Fig. 9.



Fig. 10.

Fig. 9. Oblique bullet break of diaphysis of femoral bone. On the

course of wound canal a large quantity of metallic foreign bodies -
from the smallest to the whole core of the armor-piercing bullet.

Fig. 10. The same as in Fig. 9, but in another projection.

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Fig. 11. Bullet large/coarse and small-splintered break of lower third of right shoulder (profile/specialty and leg). In the region of break and toward the front from it a large quantity of metallic foreign bodies of most different form by size/dimension from smallest to 1.5x1 cm (part of bullet).

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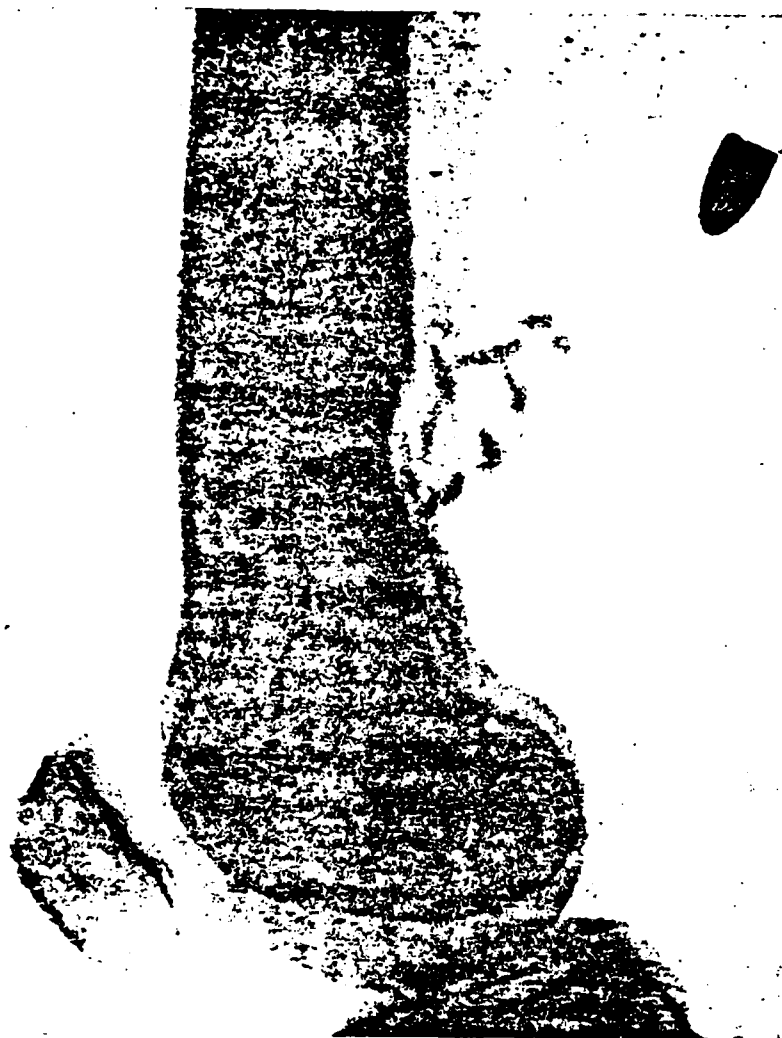


Fig. 12. Lower third of right thigh. Perforated break of metaphysis. In the soft tissues of tail end of the thigh the group of fine/small bone fragments for the elongation/extent 4 cm of bone itself. Further to the posterior surface of thigh is disposed of automatic bullet, head turned to the bone.

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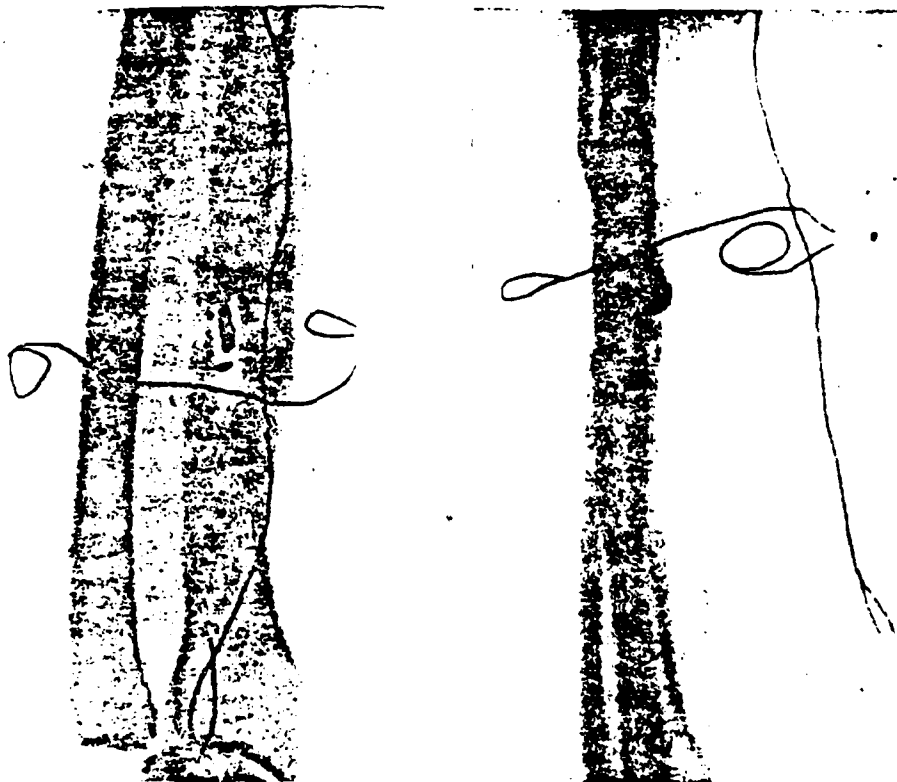


Fig. 13. Lower half of left forearm (front-posterior and side view). In the bone area of the diaphysis of radiation/radial bone two metallic foreign bodies: fine/small and 1x1 cm. Near them are arranged/located two thin wires in the form of cross (reference point on the skin).

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Spontaneous rejection/separation transfer of foreign bodies with the bullet breaks of the bones of extremities.

During the deepened development of the histories of disease/illness it was noticed that in the discharge of wounds the metallic foreign bodies were rare find, more frequently were encountered noncontrast foreign bodies, if they were not fixed/recorded by somewhere metallic foreign body.

According to the data of author's development, among all foreign bodies, available in casualties with the break, involuntary withdrawal was noted only into 4.10/o of cases.

Fine/small metallic foreign bodies penetrate deeply in the tissue and remain there in minimum by the volume, little infected area. Large/coarse and average/mean foreign bodies more frequently are located in the large areas which even more greatly are expanded during the active processing of wound.

It should also be noted that the operations/processes, which were being produced near the location of foreign body, or the presence of hereabout suppurative process did not completely

contribute to the independent rejection/separation of foreign body, if only it was not carried off into the overall wound area. Not without reason in the preantiseptic era for the alleviation the withdrawals of foreign body put to use numerous medicinal substances and physical substances.

According to the data of author's development, from every 100 cases of the rejections/separations of foreign body for the first month after wound it is 42.5 on second 25.6 and for the subsequent months - 31.9.

The long-term deaf gypsum bandage, superimposed to the uncovered wound as a result of operating the moist chamber/camera, formed by deaf gypsum bandage, apparently contributes to the rejection/separation of foreign bodies in connection with an increase in the autolytic and exudative processes in the wound.

The transfer of foreign bodies is the unfinished rejection/separation; in the majority of the cases it occurred as a result of the moderate festering around the foreign body and in connection with anatomical features of the region of its localization.

According to the data of author's development, the small

transfer of foreign body in the soft tissues was observed only into 0.250/o of all bullet breaks.

In the literature within the time of the Great Patriotic War were only unitary communications/reports about the transfer of foreign bodies in the bone (G. A. Zedgenidze). In view so rare spontaneous a withdrawal of foreign bodies from the wound special importance acquires a question about their removal/distance.

Table 30. Contamination of foreign bodies and bone sequesters by microbes (in the percentages) based on materials of the Tadzhik Institute of Epidemiology.

(1) Результат исследования (2) Материал исследования	(3) Стерильные инородные тела	(4) Аэробы	(5) Анаэробы	(6) Анаэробы и аэробы	(7) Всего
(8) Инородные тела	9,0	55,8	12,7	22,7	100,0
(9) Костные септестры	2,4	77,8	5,7	14,1	100,0

Key: (1). Result of research. (2). Material of research. (3). Sterile foreign bodies. (4). Aerobes. (5). Anaerobes. (6). Anaerobes and aerobes. (7). In all. (8). Foreign bodies. (9). Bone sequestrations.

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Removal/distance of foreign bodies with the bullet breaks of the bones of extremities and outcomes.

Surgeons already had long ago been attempted to remove foreign bodies. However, the failures and the complications, connected with this, and also the frequent growing of the foreign bodies, contaminated by microbes (according to different authors' data, from 31.8 to 68.20/o), forced surgeons' majority to recognize metallic foreign bodies only by the indicator of greater than usually, the microbial contamination of wound, moreover in the majority of the

cases foreign body was only mechanical stimulus that carries on itself microbes (to 86.7c/o).

In the beginning of the Great Patriotic War the surgeons adhered to the conventional installation - during the primary surgical processing to remove only the incidentally encountered foreign bodies, while subsequently - only harming.

If in the previous wars was noted excessive entrainment by searches/scannings and by the removal/distance of foreign bodies, then in the Great Patriotic War, especially in the beginning of it, was observed certain excessive conservatism, noted in the literature (Yu. Yu. Dzhanelidze), in the instructional instructions (N. N. Burdenko) and the been reflected in the materials author's of development (Table 31).

During the establishment of readings/indications to the removal/distance of foreign bodies with gun breaks principal difficulty presented suppurative processes in the region of bone fragments and in the basic bone broken ends. During the prolonged festering it is not always easy it was easy to determine, to what degree this depended on foreign body; therefore, according to the materials of the deepened development, rarely occurred the operations/processes, undertaken specially for the removal/distance

of foreign body. In the majority of the cases the removal/distance of foreign bodies was only one of the elements/cells of other operations/processes.

Thus, into 49.50/o foreign bodies they were removed incidentally with other operations/processes, including into 31.80/o during the primary surgical processing. In 43.10/o festering in the wound it served as occasion for the operation/process, during which were removed the foreign bodies. In 7.40/o alien ones it is thaved they are removed for preventive reasons and on other reasons among which very modest place engaged the pressure of foreign body on the vessel or on the nerve.

Therefore special x-ray examination for the purpose of the determination of accurate localization of foreign bodies with the bullet breaks engaged very modest place, especially as break by itself required in the majority of the cases of the reiterative x-ray examinations (latter were produced into 91.90/o of cases of all breaks with the foreign bodies).

Table 31. Frequency of the removal/distance of foreign bodies with the bullet breaks of the bones of extremities on the years of war) (in the percentages to a number of casualties with the foreign bodies).

(1) Год	1941	1942	1943	1944	1945
	33,2	40,1	49,0	52,8	53,6

Key: (1) . Year.

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According to the data of author's development, special research for determining the localization of foreign bodies was applied only into 6.10/o of cases of the removal/distance:

	(1) В процентах
(2) Простое зондирование	2,6
(3) Отметки и ориентиры на коже	1,8
(4) Введение в рану зонда под рентгеновским экраном	0,8
(5) Операции под рентгеновским экраном	0,5
(6) Фистулография	0,2
(7) Радиоскопия и магнит	0,2
(8) Метод иглы	0,1
(9) " парallaxa	0,1

Key: (1) . In the percentages. (2) . Simple probing. (3) . Marks and reference points on skin. (4) . Introduction to wound of probe under X-ray screen. (5) . Operations/processes under X-ray screen. (6) . Fistulography. (7) . Radioscopy and magnet. (8) . Method of needle. (9) . Method of parallax.

In such a manner as is shown experiment/experience, most frequently was used stoppage probing, in spite of the negative attitude toward it of many surgeons. Obviously, the correctly produced probing is the simple, rapid and safe method of determining the localization of foreign body and free bone fragment in the festered, fistulate wound; by training session it is possible to distinguish by probe metallic foreign body of the bone fragment (via rapping, but not friction).

If we reject/throw simple probing and radiosonde, then it will seem that the x-ray examination specially for determining the localization of foreign bodies was used only into 3.30/o.

The different instruments (balloscopes, fluoroscopes, radiosondes, etc.), and also other methods (parallax, needle, fistulography, etc.), which were being used in the Great Patriotic War, were comparatively little used for determining the localization of foreign bodies for the bullet breaks of the bones of extremities.

was undeservedly little used also fistulography, identical suitable both for the establishment of localization of foreign bodies and for the determination of bone sequestrations and suppurative foci in the bone.

For determining the localization of foreign bodies in the soft tissues and bone the author successfully put to use reference point on the skin of two thin long wires (Fig. 13), which stuck by collodion on the prepared for the operation/process skin with the aid of the large gauze towel. In the case of necessity by the same towel was glued up the wound. Above the towel was laid sterile bandage, after which was produced the X-ray photograph in two projections.

The towel, which fixes reference points, did not remove/take to the end of the operation/process. Section/cut was produced through it, and in the case of necessity wire during the operation/process was cut with shears.

Being guided by photographs and stuck on the skin reference points, it was possible to correctly put casualty for the operation/process, to outline rational access to the foreign body and finally to inspect/check during the operation/process the correctness of the chosen direction to the foreign body.

If foreign body was located in the soft tissues, then for its removal/distance it was not required any makeshifts, although frequently this presented great difficulties, since foreign bodies with the bullet breaks were usually arranged/located deeply; for this reason for the access to them most frequently were used wide

sections/cuts. According to the data of author's development, into 20.70/o for the approach to the foreign body was required individual section/cut. The use/application of an X-ray screen during the operation/process did not exceed 0.50/o and of radiosonde and magnet - not more than 0.20/o.

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The carving of capsule together with the foreign body usually was not used, since completely formed capsule was encountered rarely. The bed of foreign body they treated by antiseptics; wound in the overwhelming majority the cases they did not sew. As a rule, introduced antitetanus serum.

In order to remove foreign body from the bone, it was necessary to form a trepanation aperture of significant sizes/dimensions, since otherwise appeared difficulties with the extraction of foreign body from the bone.

Author's development showed that the attempts to remove foreign body were finished by failure during the removal/distance from the soft tissues into 2.30/o of cases, from the bones - into 3.50/o; on the average - into 2.50/o.

According to different authors' data in the period of the Great Patriotic War, with the different bullet wounds the frequency of the unsuccessful attempts to remove foreign body oscillated most frequently from 20 to 50%.

During the radiation/emission of the histories of disease/illness it was impossible to come to light/detect/expose the serious complications, which attacked/advanced as a result of the removal/distance of foreign bodies. The moderate temperature and local reaction was observed approximately/exemplarily into 80%. It is obvious, against the background of heavy fresh wound, and also during the prolongedly flowing wound processes it is difficult to distinguish the complications, which appear in connection with the removal/distance of foreign bodies, of the complications, which associate wound.

Severe complications and fatal results after the removal/distance of foreign bodies were observed mainly in peacetime after the removal/distance of the gotten accustomed to, "calm", foreign bodies (S. S. Girgolav).

Frequency of the removal/distance of foreign bodies (in the stages of evacuation, segments, form/species and sizes/dimensions of foreign body, single and multiple). According to the data of author's

development it is established/installed, that with the bullet breaks of the bones of extremities the foreign bodies were removed in half of all wounded with the foreign bodies (into 51.90/o). According to some authors' data, the operation/process of the removal/distance of foreign bodies during the Great Patriotic War was employed more frequent than other operations/processes, being from 15.0 (G. Ya. Iosset and A. N. Gorelova) to 70.00/o (P. F. Gorislavets) of all operations/processes.

Based on materials of the deepened development, the removal/distance of foreign bodies among the operations/processes, produced by casualty with the foreign body, engaged the second place (during the primary treatment - after splitting up, and with the subsequent operations/processes - after sequestrectomy). In individual stages of 100 produced operations/processes to the removal/distance of foreign bodies it was necessary: at the therapeutic installations of army area - 23.9, in GBA - 30.4, in GBF - 37.5 and in the rear hospitals - 35.9.

Thus, in all stages of evacuation to the removal/distance of foreign bodies it was given sufficiently attention.

The frequency of the removal/distance of foreign bodies with the breaks of different regions (in the percentages to a number of breaks

with the foreign bodies) was different: with the breaks of shoulder it composed 43.90/o, forearms - 49.40/o, thighs - 50.10/o and shins - 56.30/o.

It is widely-known that the complications more rarely are observed with the bullet foreign bodies, than with the fragmentation ones; therefore bullet foreign bodies removed more rarely (43.70/o) than fragmentation (56.00/o). Another reason for the more rare removal/distance of bullet foreign bodies consisted in the fact that among them is more frequent (38.50/o) than with fragmentation wounds (30.30/o), were encountered fine/small foreign bodies (to 0.5 cm).

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Thus, according to the data of author's development, it is established/installed, that the frequency of the removal/distance of foreign bodies was directly proportional to their sizes/dimensions: of 100 casualties upon the introduction of foreign body by size/dimension to 0.5 cm it was removed in 14.1; by the size/dimension of 0.6-1 cm - in 42.7; 1.1-2 cm - in 66.3, and with the size/dimension of 2.1 cm and more - in 84.3.

Important value had the timely removal/distance of foreign

bodies. During the Great Patriotic War from every 100 removed foreign bodies it was removed in the first twenty-four hours 30.0; to the 2-5th day - 9.9; to the 6-10th day - 5.5; to the 11-30th day - 10.0; to the 31-60th day - 16.5; to the 61-90th day - 11.4; to the 91st day it is later - 16.7.

Thus, almost third of foreign bodies it was removed in the first twenty-four hours. Large/coarse foreign bodies removed not only more frequently, but also are earlier than fine/small (Table 32).

From Table 32 it is evident that among the removed for a period of the first month foreign bodies invariably/unchangedly predominated the large/coarse foreign bodies - by size/dimension from 2 to 3 cm; for a period of the second month the first place in the frequency engaged equal with them also fine/small - by size/dimension from 0.5 to 1 cm, and in the subsequent months fine/small foreign bodies engaged the first place in the frequency. This sequence in the removal/distance of foreign bodies, apparently is explained by the fact that the large/coarse foreign bodies more greatly turn to themselves attention, easily they are revealed, and easily removed. As a rule, they produce significant decomposition, forming a large quantity of necrotic tissues. However, fine/small and average/mean foreign bodies more rarely attract attention of surgeon, are produced usually finer/smaller decomposition, and therefore they are more

rarely escorted/tracked by inflammatory phenomena and severe complications.

Furthermore, fine/small foreign bodies usually were arranged/located in the small areas where the suppurative processes with more difficulty were diagnosed, why their removal/distance retarded.

It is customary to assume that each alien body is the indicator of the greater contamination of wound and the carrier of the bacteria (not thinner/less frequent than 72.00/o); therefore is logical the tendency to remove as far as possible all foreign bodies. However, experiment/experience showed that very rarely all foreign bodies, which simultaneously stuck in the organism, caused equally frequently the complications of inflammatory character/nature. Known also that the more the foreign bodies was located in the wound, the thinner/less frequent them were removed.

Table 32. Distribution of casualties with the bullet break of the bones of extremities according to the sizes/dimensions of foreign bodies and time of their removal/distance (in the percentages).

(2) Размер иностран- ных тел (в см)	(1) Время удаления (в сутках)						(3) и больше
	1	2-5	6-10	11-30	31-60	61-90	
0-0,4	13,2	8,5	7,4	9,9	8,9	8,8	12,0
0,5-1,0	10,2	11,5	15,8	20,6	24,2	29,3	27,8
1,1-1,5	8,1	10,8	24,2	14,6	17,4	22,3	20,5
1,6-2,0	11,5	15,4	13,7	13,5	17,1	16,3	14,8
2,1-3,0	53,3	42,3	34,7	32,1	24,2	18,6	21,1
(4) Больше 3,0	4,7	11,5	4,2	9,3	8,2	4,7	3,8
(5) Всего	100,0	100,0	100,0	100,0	100,0	100,0	100,0

Key: (1). Time of removal/distance (a day). (2). Size/dimension of foreign bodies (in cm). (3). and it is more. (4). It is more. (5). In all.

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Based on materials of author's development, in casualties with the single foreign bodies their removal/distance was produced into 65.10/o, and in casualties with the multiple foreign bodies - into 38.80/o, including in 6.80/o of casualties were removed all foreign bodies, and in 2.50/o of casualties foreign bodies were removed repeatedly.

It at first glance seems paradoxical that the greater the foreign bodies, the thinner/less frequently they are removed. However, this is explained by preponderance among the single larger/coarser, and among the sets - finer/smaller foreign bodies (Table 33).

Multiple foreign bodies were more rarely removed also because sometimes it was difficultly establish, which of them serve as a reason for complications. The most reliable method of identification - fistulography, according to the data of author's development, was used altogether only into 0.180/o; however fistulography, apparently also cannot give in all cases of correct response/answer.

On the whole it is necessary to recognize that the single and multiple foreign bodies were removed approximately equally frequently, if we make a correction for the foreign bodies of small sizes/dimensions which rarely were subject to removal/distance.

Table 33. Sizes/dimensions of single and multiple foreign bodies with the bullet breaks of the bones of extremities (in the percentages).

(2) Группа раненых	(1) Размер инородных тел (в см)				(3) Еще 3	(4) Всего
	0-0,5	0,6-1,0	1,1-2,0	2,1-3,0		
(5) С одним инородным телом	19,0	22,6	25,6	28,0	4,8	100,0
(6) Со многими (взят размер самого большого)	46,9	24,1	18,4	7,8	2,8	100,0

Key: (1). Size/dimension of foreign bodies (in cm). (2). Group of casualties. (3). It is more. (4). In all. (5). With one foreign body. (6). With many (is undertaken the size/dimension of the largest).

Removal/distance of foreign bodies from the bone.

Should be particularly examined the bullet breaks with finding of foreign body only in the bone or among bone fragments; such the cases were encountered on the average into 18.00/o (among the bullet wounds - into 10.30/o, and among the fragmentation ones - into 23.10/o).

The frequency of the removal/distance of foreign bodies from the bone and the soft tissues with the bullet breaks approximately identical: from the bone - 54.30/o of the soft tissues - 51.40/o, but within the periods of removal/distance was an essential difference (Table 34).

Table 34. Time of the removal/distance of foreign bodies from the soft tissues and from the bone with the bullet breaks of the bones of extremities (in the percentages).

(1) ~~Время после ранения~~ (в сутках) (2) ~~Локализация~~ ~~инородного тела~~	1	(3) ~~От 2~~ (4) ~~до 30~~	(3) ~~От 31~~ (4) ~~до 60~~	(3) ~~От 61~~ (4) ~~до 90~~	(5) ~~91 и~~ ~~более~~	(6) ~~Всего~~
(7) В кости	5,7	21,4	24,6	17,1	31,3	100,0
(8) В мягких тканях	33,9	25,8	13,8	10,7	15,8	100,0

Key: (1). Time after wound (a day). (2). Localization of foreign body. (3). From. (4). to. (5). and more. (6). In all. (7). In bone. (8). In soft tissues.

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Foreign bodies were removed of the bone within the later periods than from soft tissues; of the bone in the course of the first month after wound it was removed foreign bodies 2 times less than from the soft tissues.

Although the delay with the removal/distance of foreign body from the bone is explained by the difficulties of diagnosis (necessary the X-ray photograph) and by the large complexity of operational intervention, than during the removal/distance of foreign body from the soft tissues, it is nevertheless here necessary to note certain conservatism in a question of readings/indications to the early removal of the stuck in the bone foreign body.

Festering around the foreign body in the bone serves as only absolute reading/indication to its removal/distance.

The negative activity of foreign bodies on the regeneration of bone tissue little proved and therefore it can be only relative

reading/indication to the removal/distance of foreign body.

For explaining the effect of the located in the bone foreign body to the course of the bullet break were subjected to author's development all cases of the presence of foreign body in the bone or directly among the bone fragments in the absence of foreign bodies in other places (Fig. 14).

From the represented scheme it is evident that after the removal/distance of foreign body of the bone osteomyelitis was eliminated 3 times more frequently.

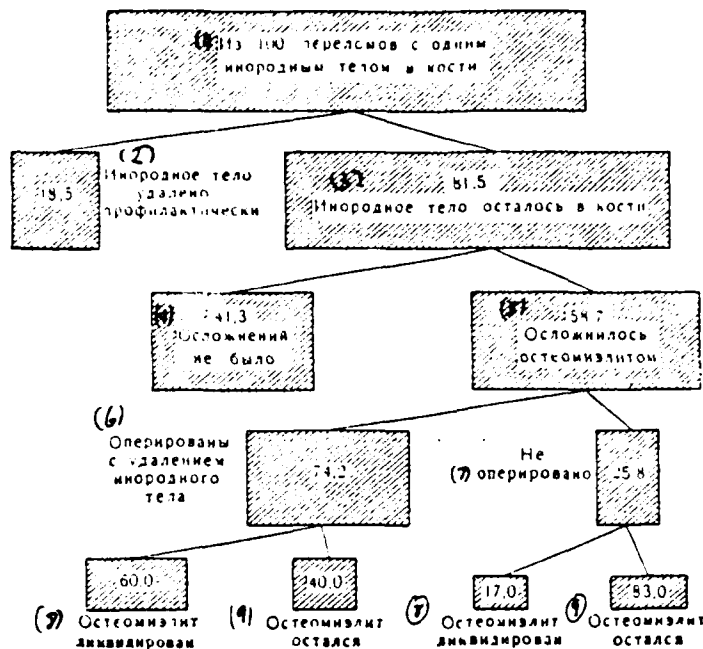


Fig. 14. Scheme of the distribution of casualties with the delay of foreign body in the bone.

Key: (1). Of 100 breaks with one foreign body in the bone. (2). Foreign body is removed preventive. (3). Foreign body remained in bone. (4). No complications. (5). Complicated by osteomyelitis. (6). They are operated with removal/distance of foreign body. (7). Is not operated. (8). Osteomyelitis is eliminated. (9). Osteomyelitis remained.

However, one removal/distance of foreign body, apparently it is insufficient, since into 40.00% of cases after the removal/distance of foreign body osteomyelitis nevertheless remained; it is most real sequestrectomy, which can eliminate osteomyelitis even when foreign body is not removed. Is very significant this example.

B. obtained 2/II 1944 wound by the fragment of mine into middle third of right crus; fragment by the size/dimension 1.0x0.4 of cm stuck in the tibia on the boundary with upper third (Fig. 15). Through 11 weeks to casualty it was produced sequestrectomy, during which remove the foreign body could not; changed only his position/situation in the bone (Fig. 16). Operation/process in history of disease/illness is written as follows: "is discovered the defect of the tibia, which leads from anteroexternal edge into the osteomyelitic cavity of large sizes/dimensions. By Levrets forceps is expanded the area from which by the sharp/acute Volkmann's spoon are extracted fine/small sequestrations and granulation. Streptocide into the wound ... ". Even in a month casualty was discharged to noncombatant duty. To the demand through 4 1/2 years the casualty answered, that there are no disorders on the side of the damaged extremity. The given case completely harmonizes with the results of the bacteriological research of foreign bodies and bone sequestrations (pg. 83).

It should be noted that the outcomes of osteomyelitis during finding of foreign body in the bone differed little from the outcomes of all osteomyelitis, which arose after the bullet break (table 35).

The favorable course of wound with the foreign body in the bone without its removal/distance was observed in 41.3%; all these wounded were discharged without a Fistula. Such treatment was observed in essence with the jamming of fine/small foreign bodies.

With the size/dimension of foreign body to 1 cm is not removed by 53.7o/o, it is removed by 46.3o/o, with the size/dimension from 1.1 to 2 cm it is not removed by 24.2o/o, whereas are removed by 75.8o/o with the size/dimension more than 2 cm not removed by 18.5o/o, whereas are removed by 81.5% and it is considerably more frequent with the jamming in epi-metaphysis (78.6o/o), than in diaphysis (21.4o/o).

Preventive foreign bodies are removed from the bone with the favorable result into 18.5o/o.

The author, who worked in the front line evacuation hospital, turned to all casualties, who were being found under its observation in by that discharged with the uneliminated/unremoved foreign body from the bone, with the request to report the distant results of treatment after extraction from the hospital.

Responses/answers it is obtained from 108 casualties with the following periods after wound; through 3 years - 11.80/o, through 4 years - 29.10/o after 5 years 31.80/o, through 6: years 18.20/o, after 7 years - 9.10/o.

During the development of findings are established/installed the following relationships/ratios (table 36).

The best distant results are obtained in casualties with the foreign body in the shoulder bone, worse - with the foreign body in the bones of the forearms, average/mean between them - with the foreign bodies in the femoral bone and in the bones of shin. In casualties, discharged without the fistulas, the aggravation of osteomyelitis with the formation of fistulas (32.40/o) advanced in the next 3 years after extraction; therefore favorable course in remaining cases (45.40/o) must be considered stable.

Table 35. Complication of osteomyelitis in the different groups of casualties (in the percentages).

(1) Группа раненых	(2) Осложнение остеомиелитом	(3) Выписан из госпи- тала с остеомиелитом (как основной исход)
(4) Все раненые с огнестрельным переломом	34,8	14,0
(5) Раненые с одним инородным те- лом в кости	58,7	24,3

Key: (1). Group of casualties. (2). Complication of osteomyelitis.

(3). It is discharged from hospital with osteomyelitis (as basic outcome). (4). All casualties with bullet break. (5). Casualties with one foreign body in bone.

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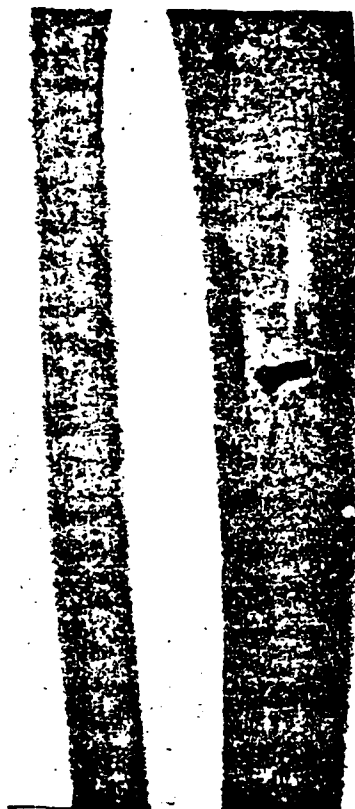


Fig. 15. Middle third of right shin. Perforated break of the tibia with the foreign body by the size/dimension 1x0.3 cf cm, cross located in medullar area.

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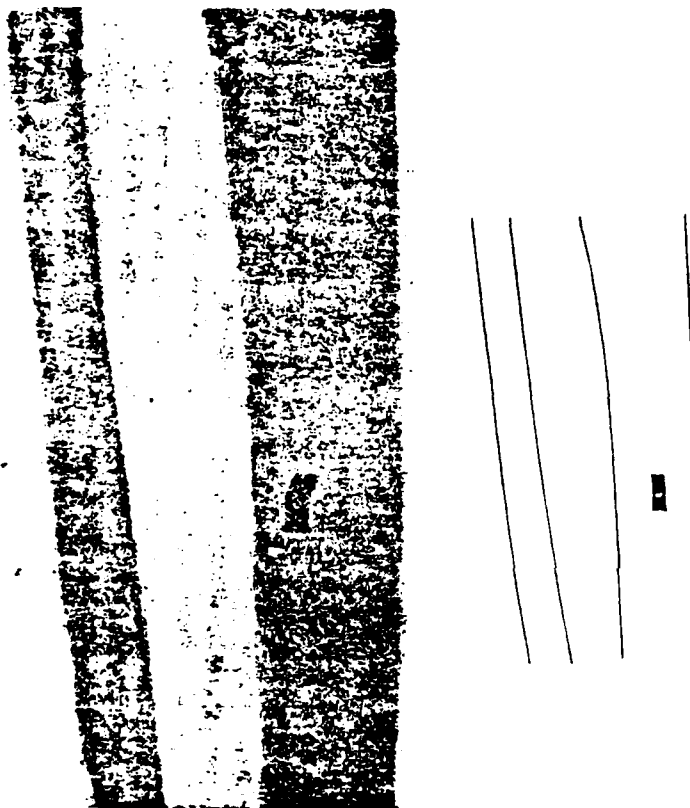


Fig. 16. The same as in Fig. 15, only foreign body after operation/process occupied longitudinal position/situation.

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Thus, wounds with the bullet break of long tubular bones with the foreign body in the bone or among the bone fragments directly gave the high percentage of the complications of osteomyelitis (58.7). Struggle with this complication was conducted mainly operationally (74.20/o), thanks to which of 3/5 casualties they were discharged from hospital without fistula with the eliminated osteomyelitic process. In 50.00/o of the wounded, discharged from hospital with the uneliminated/unremoved foreign body from the bone (with the fistula or without the fistula), was noted the favorable course of wound for a period of 7 years.

The general information about the effect of the removal/distance of foreign bodies, independent of their localization, to the clinical outcomes of the breaks of the bones of extremities they are represented in table 37.

Table 36. Characteristic of the course of wound after extraction from the hospital in casualties with the uneliminated/unremoved foreign body from the bone (in the percentages).

(1) Группа раненых (2) Течение ранения	(3) Выписанные без свищей	(4) Выписанные со свищом	(5) Всего
(6) Благоприятное	45,4	4,6	50,0
(7) Неблагоприятное	32,4	17,6	50,0
(8) Итого	77,8	22,2	100,0
(9) При неблагоприятном течении удалено инородное тело	9,2	6,5	15,7

Key: (1). Group of casualties. (2). Course of wound. (3). Discharged without fistulas. (4). Discharged with fistula. (5). In all. (6). Favorable. (7). Unfavorable. (8). Altogether. (9). During unfavorable course is removed foreign body.

Table 37. Clinical outcomes and the duration of hospital treatment in casualties with the removed and uneliminated/unremoved foreign bodies with the bullet breaks of the bones of extremities (in the percentages).

(1) Клинические исходы	(2) Инородные тела	
	(3) удалены	(4) не удалены
(5) Хороший результат анатомический и функциональный . . .	39,4	23,2
(6) Контрактура	26,4	27,7
(7) Ложный сустав	1,6	4,2
(8) Культи	4,1	3,3
(9) Остеомиелит	20,2	21,0
(10) Прочие	17,3	20,6
(11) Всего . . .	100,0	100,0
(12) Средняя продолжительность госпитального лечения (в месяцах)	5,0	4,5

Key. (1). Clinical outcomes. (2). Foreign bodies. (3). they are removed. (4). they are not removed. (5). Good result anatomical and functional. (6). Contracture. (7). Dummy joint. (8). Stump. (9). Osteomyelitis. (10). Other. (11). In all. (12). Average/mean of duration of hospital treatment (in months).

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In the Great Patriotic War the foreign bodies with the breaks of the bones of extremities removed only from strict readings/indications, mainly apropos of complications (60.00/o): the

best results removal/distance of foreign bodies gives with the complications of the vulgar non-virulent infection when inflammatory process is localized the place in wound itself and when, therefore, the removal/distance of the foreign body, which stimulates wound mechanically, could not but give favorable effect.

At the same time the removal/distance of foreign bodies did not play a large role in the struggle with the gaseous and septic infection, that is fully understandable, since during this infection inflammatory process greatly rapidly exceeds the limits of wound; therefore in these cases the removal/distance of foreign body could not noticeably influence a descent in the number of amputations and fatal results.

The periods of the removal/distance of foreign bodies from the wound, it is doubtless, have high value, especially when into previously is significant the quantity of the necrotized and anematized tissue and, therefore, is a threat of the development of malignant infection (table 38).

From table 38 it is evident that with lengthening of the period of the removal/distance of foreign body the clinical outcomes deteriorated. The previously removal/distance of foreign body is especially desirable with the breaks, because it can prevent not only

the direct infection of bone fragments and basic broken ends, but also the development of general/common/total infection. However, later removal of foreign body during the advanced infection of bone and in the presence of the very virulent infection, which left beyond the limits of wound, can prove to be futile.

There is special interest in the comparison of the clinical outcomes of bullet breaks with by foreign bodies, also, without them.

For the correct estimate of clinical outcomes in these groups of casualties it is necessary to consider, what forms/species of breaks were observed in each of these groups (table 39).

With the breaks of the bones of extremities with the foreign bodies in comparison with the breaks without the foreign bodies was observed more than incomplete and less than comminuted and crushed fractures together and it seemed that in the casualties with the foreign bodies had the lighter breaks than the casualties without the foreign bodies.

However, if one considers that the most severe breaks (crushed) was among the casualties with the foreign bodies 1 1/2 times more than among the casualties without the foreign bodies, then it is necessary to recognize that the severity of injuries in both groups was almost identical.

Table 38. Time of the removal/distance of foreign bodies and clinical outcomes with bullet breaks of the bones of extremities (in the percentages).

(1) Время удаления	(2) Клинические исходы				(7) Итого
	(3) хороший	(4) контрактура	(5) остеомиелит	(6) прочие	
(8) Первые сутки	33,8	22,8	17,2	26,2	100,0
2-3-и сутки	29,8	27,6	16,2	26,4	100,0
(9) В течение 2-го месяца	31,8	29,1	22,6	16,5	100,0
(10) В течение 3-го месяца	31,7	24,6	21,9	21,8	100,0
(11) Позже 3 месяцев	24,3	28,7	27,2	19,8	100,0

Key: (1). Time of removal/distance. (2). Clinical outcomes. (3). good. (4). contracture. (5). osteomyelitis. (6). other. (7). Altogether. (8). First day 2-3 days. (9). In the course of 2nd month. (10). In the course of 3rd month. (11). It is later than 3 months.

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It is widely-known that the bullet wounds gave the best outcomes, than fragmentation ones; by data of the deepened development this is confirmed with the bullet breaks (table 40).

But if bullet and fragmentation wounds are divided into two groups: with the foreign body and without the foreign bodies and then are compared clinical outcomes, then it will seem that in the groups without the foreign body the best clinical outcomes will be also with

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the bullet wounds. (Smaller number of contractures after fragmentation wounds, apparently it is explained by a large number of amputations and by higher lethality among those wounded by fragments).

Table 39. Form/species of break in casualties with the foreign body and without it (in the percentages).

(1) Виды переломов (2) Группа раненых	(3) Дырчатые и краевые	(4) Продольные, косые и по- перечные	(5) Раздроблен- ные (с дефе- том кости)	(6) Оскольчатые	(7) Всего
(8) С инородными телами	17,0	15,8	18,1	49,1	100,0
(9) Без инородных тел . .	14,3	17,5	12,2	56,0	100,0

Key: (1). Forms/species of breaks. (2). Group of those wounded. (3). Perforated and edge/boundary. (4). Longitudinal, oblique and cross. (5). Crushed (with defect of bone). (6). Fragment. (7). In all. (8). With foreign bodies. (9). Without foreign bodies.

Table 40. Distribution of casualties with the bullet break of the bones of extremities according to the clinical outcomes, the average duration of hospital treatment (in the months), according to the form/species of the wounding shell and according to presence or absence of foreign body (in the percentages).

(1) Вид и характер ранения (2) Клинические исходы	(3) Пулевые			(4) Осколочные		
	(5) с инородным телом	(6) без инородного тела	(7) в среднем	(5) с инородным телом	(6) без инородного тела	(7) в среднем
(8) Хороший	16,5	29,9	27,4	24,3	16,1	19,9
(9) Контрактура	39,6	34,6	35,5	32,7	32,5	32,6
(10) Анкилоз	5,2	3,5	3,8	5,8	5,0	5,4
(11) Ложный сустав	4,1	1,9	2,4	2,0	4,8	3,6
(12) Культи	3,3	1,8	2,1	4,8	8,2	6,6
(13) Остеомиелит	10,0	7,1	7,7	10,2	10,9	10,5
(14) Комбинация ¹	8,7	3,9	4,8	6,7	6,6	6,6
(15) Прочие	12,6	17,3	16,3	13,5	15,9	14,8
(16) Всего	100,0	100,0	100,0	100,0	100,0	100,0
(17) Средняя продолжительность госпитального лечения	5,5	4,0	—	5,5	5,2	—

Key: (1). Form/species and the character/nature of wound. (2). Clinical outcomes. (3). Bullet. (4). Fragmentation. (5). with foreign body. (6). without foreign body. (7). on the average. (8). Good. (9). Contracture. (10). Ankylosis. (11). Dummy joint. (12). Stump. (13). Osteomyelitis. (14). Combination¹.

FOOTNOTE¹. Into the combination could enter the outcomes. besides "good indicated", the "stump" and "other". ENDFOOTNOTE.

(15). Other 2.

FOOTNOTE 2. In the group "other" the outcome of the break was good.
ENDFOOTNOTE.

(16). In all. (17). Average/mean duration of hospital treatment.

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In the groups of those wounded with foreign bodies are revealed/detected other relationships/ratios: with the breaks, caused by fragments, on the majority of sources the indicators are better than with the bullet breaks; with respect to ankylosis, osteomyelitis and duration of treatment the indicators are identical or almost identical and only according to a number of those amputated and dead the fragmentation breaks were accompanied by the worse indicators, than bullet.

Here especially convincingly it is derived, that the fragmentation wounds are more frequent than bullet, they are escorted/tracked by heavy infection. In fact, when discussion deals with perforating wounds, i.e., about such wounds with which the wounding shell, having very large manpower, damages bone and goes out outside, then fragmentation wounds greatly strongly differ from

bullet ones in terms of poor clinical outcomes; in these cases the microbes find more the necrotized tissue, than in the presence of foreign body. When the topic is about the less severe wounds with the jamming of the wounding shell, then with the fragmentation wounds the indicators of outcomes are considerably better than with the bullet ones. This is completely explained by the fact that with the bullet wounds when in the wound remain the fragments of bullet, there was more heavy breaks, than among the blind-end fragmentation wounds with the foreign body (table 41). In the group of bullet wounds with the presence of foreign bodies in the wound entered all wounds by explosive and explosive bullets, including armor-piercing, whose steel core easily was disengaged shell.

Among the bullet wounds there was almost doubly more than the crushed breaks, it is considerably more than fragmented ones and two times of less than the lighter breaks.

However, the higher percentage of those amputated and dead persons there is constantly observed nevertheless with the breaks, caused by fragments. Both the amputations and lethal outcomes in these cases were mainly the result of the malignant infection, which complicated the course of wound and break.

Course outcomes of the bullet breaks of wounded with the foreign

bodies and in casualties without the foreign bodies.

For deciding/solving the question about the role of foreign bodies with the bullet breaks of extremities were compared two groups of the casualties: into one entered the casualties with the foreign bodies in the wound, into another - without the foreign bodies.

Table 41. Character/nature of breaks with the bullet and fragmentation wound with the foreign body (in the percentages).

(1) Вид ранения	(2) Переломы			(6) Всего
	(3) раздроб- ленный	(4) осколь- чатый	(5) прочие	
(7) Пулевое (43,2)	29,3	50,0	21,7	100,0
(7) Осколочное (56,8)	15,0	34,5	50,5	100,0

Key: (1). Means of wound. (2). Breaks. (3). crushed. (4). fragmented. (5). other. (6). In all. (7). Bullet. (8). Fragmentation.

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Above it was already indicated, that the severity of damages on the water of the break in both groups was almost identical; however, a number of different complications in casualties with the foreign bodies was considerably more (table 42), that is partly explained by a somewhat large number of fragmentation wounds in this group of casualties, whereas in essence this must be related due to the presence of foreign bodies.

Due to a greater quantity of complications the casualties with the foreign bodies more frequently underwent operations/processes after the primary surgical processing: in the group with the foreign bodies it is operated by 64.10/o, whereas in the group without the

foreign bodies - 57.70/o. Furthermore, each of that operated transferred a larger number of operations/processes (in the group with the foreign bodies to one casualty on the average it was necessary for 1.65 operations/processes, and in the group without the foreign bodies - 1.5 operations/processes).

However, in spite of operation/process and series/number of other therapeutic measures, clinical outcomes in casualties with the foreign bodies proved to be more badly.

Lethality among the casualties with the foreign bodies was also higher than in casualties without the foreign bodies.

Higher lethality in casualties with the bullet break with the foreign bodies is the result not only of more frequent complication by anaerobic infection and sepsis, but also higher frequency of the complications, which are finished with lethality in the presence of foreign bodies. Thus, in the presence of foreign bodies she died of anaerobic infection 23.50/o, from the sepsis - 29.20/o, and in the absence of foreign bodies from the anaerobic infection - 9.80/o and sepsis - 17.90/o.

Were different the average duration of the hospital treatment of casualties and a number of those passed them stages from the moment/torque of wound and up to the completion of treatment.

Table 42. Frequency of the complications of the bullet breaks of the bones of extremities with to the presence of foreign body and without it (in the percentages).

(2) Группа раненых	(1) Осложнения	(3) Анаэробная инфекция	(4) Сепсис	(5) Остеомиелит	(6) Гнойные затеки	(7) Без осложнений, сопутствующих заболеваний и ранения
(8) С инородными телами		5,5	3,8	49,3	38,3	5,8
(9) Без инородных тел		2,7	1,6	48,4	24,8	8,8

Key: (1). Complications. (2). Group of casualties. (3). Anaerobic infection. (4). Sepsis. (5). Osteomyelitis. (6). Suppurative flows. (7). Without complications accompanying diseases in wounds. (8). With foreign bodies. (9). Without foreign bodies.

Table 43. Clinical outcomes in casualties with bullet break in the presence of foreign body and without it (in the percentages).

(1) Клинические исходы		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(10) Группа раненых		Хороший	Контрактура	Анкилоз	Ломный сустав	Культи	Остеомиелит	Комбинация и прочие	Всего
(11) С инородными телами		21,2	35,2	5,5	2,9	4,5	10,1	20,6	100,0
(12) Без инородных тел		25,7	33,9	4,0	2,8	3,7	8,3	21,6	100,0

Note. Tables 40 and 43 osteomyelitis show as by the basis of outcome (with fistulas) in contrast to tables 37 and 38, where are given all cases of osteomyelitis, observed in casualties with the extraction.

Key: (1). Clinical outcomes. (2). Good. (3). Contracture. (4). Ankylosis. (5). Dummy joint. (6). Stump. (7). Osteomyelitis. (8). Combination and other. (9). In all. (10). Group of casualties. (11). With foreign bodies. (12). Without foreign bodies.

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According to data of the deepened development, for the casualties with the foreign bodies the average duration of their hospital treatment was equal to 5.5 months, and an average number of passed stages was equal to 5.3, and for the casualties without the foreign bodies respectively - 4.6 months and numbers of passed stages - 5.1.

The average period of the education of the callus in both groups was identical (2.6 months), which is completely explained by the almost identical severity of damage (table 39) and by the almost identical frequency of the complications of osteomyelitis (table 42) in these groups.

Thus, on the basis of the given materials of the deepened and author's development, literature and report data, and also personal observations it is possible to make following conclusions in the relation to the bullet breaks of long tubular bones with the foreign bodies. In this group in comparison with the group of casualties without the foreign bodies was observed almost identical severity of breaks. However, due to a large quantity of complications, especially pyogenic and anaerobic infection, that required of the use/application of operations/processes in a larger number of casualties and conducting of a significant quantity of repeated operations/processes, in the group of casualties with the bullet break of long tubular bones with the foreign bodies in comparison with the group of casualties without the foreign bodies obtained the worse results both on the clinical outcomes and the lethality and in the average duration of hospital treatment, and also according to an average number of passed stages.

Relatively good results after the removal/distance of foreign bodies were obtained when wound was complicated by the vulgar infection, which was not being extended beyond the limits of wound, in this case removal/distance of foreign bodies within the earlier periods gave the best results.

Taking into account the fact that the malignant infection (sepsis, anaerobic infection) in the presence of foreign bodies was encountered considerably more frequently, and also that the worse clinical outcomes in the group with the foreign bodies were obtained, in spite of the sufficiently frequent removal/distance of foreign bodies (51.90/o), should be recognized as worthwhile very the previously (in the first 2-3 hours) removal/distance of "accessible" metallic fragments for the purpose of warning/prevention of the development of malignant infection.

The materials of development established/installed, that the heavy infection complicated bullet breaks with the wound by fragments more frequently than with the wound by bullet, regardless of the fact, there were in the wound their metallic foreign bodies in it was not.

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Chapter IV.

DIAGNOSIS OF THE BULLET BREAKS OF THE BONES OF EXTREMITIES.

Honored Scientist professor is the lieutenant general of the medical of services M. N. Yelanskiy.

General/common/total principles of the diagnosis of the bullet breaks of the bones of extremities in war.

In the Great Patriotic War while conducting the principle of stage treatment with the evacuation according to the designation/purpose the diagnosis of bullet breaks moved slowly exceptional value. Any deliberate aid by casualty, who enter the stages of evacuation, is impossible without the classification of casualties, based on the thorough and accurately set diagnoses. Only with the correctly set diagnosis timely possible and correct rendering aid and in the majority of the cases only by the errors for diagnosis it was possible to explain the incorrect or untimely rendering to surgical aid in all stages.

In view of this setting of of correct diagnosis with the bullet breaks of extremities it was given considerable attention in all stages of evacuation, beginning from the army area.

Already in the foremost stages of evacuation diagnosis with the bullet break consisted not only in the instruction of accurate anatomical localization of the damaged bone, but also in the estimate of the general condition of casualty, or in the indication of the presence of other accompanying damages which can complicate wound and influence his course and outcome or with which is necessary urgent or urgent aid (for example, the combination of the damage of vessels and massive damage of soft tissues or joint). Into the general/common/total concept of diagnosis entered the damages of other regions of body (for example, head, breast, stomach, etc.). Here with the bullet breaks of the bones of extremities entered the determination of the character/nature of wound which could influence course and outcome of wound. Diagnosis without fail had to reveal the character/nature of the break of bone (full/total/complete or incomplete, perforated or crushed, edge/boundary break or disengagement and crushing, break one or two bones, which penetrate or not penetrating into the joint, etc.).

All these facts, which characterize break, had decisive importance not only when selecting of the method of rendering aid, but also during the determination of further course and prognosis of wound.

Diagnosis also included those developing in casualty with the break of the bones of the extremities of the complication both local and general character/nature (shock, suppuration, tetanus, anaerobic infection, sepsis, secondary hemorrhage, anemia, exhaustion,

pneumonia, the disease of kidneys, etc.).

All details of the diagnosis of the bullet breaks of the bones of extremities indicated can be conducted/supplied under one general/common/total concept of the "clinical diagnosis" of breaks.

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In the Great Patriotic War with all wounds, including with the bullet ones, was conducted comprehensive clinical research and proved to be in the maximum volume the aid, necessary for casualty on medical indices.

In the Great Patriotic War Soviet doctors during the treatment of casualties proceeded from I. P. Pavlov's exercise about the completeness of organism; therefore treatment consisted not only in the local action on the wound, but also the action on entire organism, i.e., was conducted the treatment not only of wound, but also casualty. This superimposed on the medical workers the very critical problems: to in proper time and fully investigate casualty, to establish/install the accurate diagnosis of wound, to give the accurate estimate of general condition and reactivity of entire organism. Timely taking of therapeutic measures was possibly only under the condition of the early and accurately established/installed

diagnosis and accounting of the general condition of casualty and developing in it complications.

On the basis of that outlined above, during the Great Patriotic War in the army was conducted the principle of rendering to the specialized aid and treatment. Into the concept of the specialized aid and treatment entered the so-called complex inspection/examination and the treatment. In the specialized hospitals the inspection/examination and the treatment of casualties with the break of the bones of extremities were usually produced, besides surgeons, also by therapists, neuropathologists, roentgenologists, dietitians and by the qualified by specialists laboratory assistants - bacteriologists and biochemists. The leading role and responsibility for timely comprehensive diagnosis and treatment were laid on the surgeon. The identification of the full/total/complete breaks of thigh, shoulder and breaks of both bones of shin and forearm was frequently very simple and accessible even to the quite wounded or giving to him aid comrade or to aidman.

The damages of large vessels, which were being escorted/tracked by strong hemorrhage, were established/installed immediately after wound. During such damages already on or of combat (in the company) was laid the tourniquet, which was observed into 1.20/o with respect to all casualties with the break of the bones of extremities.

On BMP and PMP more precisely formulated intensity the hemorrhages and in accordance with this were amended: tourniquet was removed/taken or, on the contrary, they laid (2.40/o of all wounded with the break of bones extremities).

The symptoms of shock established/installed already in PMP; in accordance with this were taken therapeutic measures it was accepted decision/solution about the evacuation, and also about the form/species of transport.

On DMP and in KhPFG already had the capability to refine the degree of shock and blood loss by determining of blood pressure and elementary clinical research of the blood.

In the foremost stages (BMP, PMP, DMP) the break of the bones of extremities most frequently was established/installed basically of the following symptoms:

1. Violations of the function of extremity (impossibility to raise, to bend, to lead or to lead extremity).

2. Abnormal mobility of extremity (involuntary overhang or

dumping of extremity with elevation of casualty and his transfer to stretchers, flexing of extremity at angle out of joint).

3. Bone crepitation or sound of friction of broken ends of bone.

4. Shortenings of extremity or its deformation in comparison with healthy/sound extremity (measurement by centimeter belt/ribbon, possible already under conditions of PMP, it made it possible to accurately determine degree of shortening).

5. Pains in place of break with load along the axis of extremity.

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This method helped to differentiate the break of bones from the wound only of soft tissues. By the same it would have been possible to be guided for the purpose of the tentative preliminary diagnosis of break before the removal/taking of bandage, which was especially important on PMP. In this case it was considered that with incomplete breaks of bone and with breaks of one of two bones of shin or forearm this reception/procedure and some others, it could give negative results.

6. With localization of wound in region of shin or forearm compression of both bones out of place of wound caused pains in region of break, what it could not be during damage only of soft tissues.

Local investigation (feeling, auscultation, measurement) gave the possibility to determine abnormal mobility, the crepitation of bone broken ends, an increase of the volume of extremity in the region of the break, the presence of pulsation or noise (in the more last stage) with pulsating hematomas, pains with the pressure by the broken bone in the region of break.

7. With examination/inspection of region of wound after removal of bandage disposition of wound apertures - entrance and exit - could aid diagnosis of break of one or the other bone. In certain cases, for example, with the multiple wounds by fragments or in the blind-end wound and the bias of wound canal, this however, it did not give correct instructions for the identification of break. In particular it was difficult to be guided during the diagnosis of the break by the presence of one wound aperture in the region of upper third of thigh or nates. Such cases are frequent they were the reason diagnostically for errors with the breaks upper third or the neck/journal of thigh.

8. In certain cases, except wound apertures, break indicated seen with eye fragments of bone in wound, which most frequently occurred on shin in view of surface disposition under skin of tibia. This method of the direct research of the place of break most frequently was used on DMF and KhFFG during the primary processing of wound. After the operational expansion of wound apertures it was possible via direct examination/inspection and feeling of wound canal to establish/install localization and character/nature of break.

9. Most modern method of diagnosis of breaks of bones of extremities, their character/nature and complications was in Great Patriotic War roentgenological method. It they most frequently put to use, beginning from the specialized hospitals of the first echelon of GBA.

By x-ray examination was usually completed the clinical diagnosis of the breaks of the bones of extremities, initiated in the foremost stages of army area. X-ray examination helped to accurately establish/install the character/nature of the break, a quantity, sizes/dimensions and localization of bone broken ends, presence and localization in the wound of foreign bodies, and also developing complications (anaerobic infection, osteomyelitis, etc.).

All mentioned symptoms and methods of diagnosis gave the

possibility to place the accurate diagnosis of the bullet break of the bones of extremities already in the foremost stages of army area.

However, incomplete breaks (perforated and edge/boundary), and also breaks only of one of two bones of shin or forearm always could not be accurately identified before roentgenological research. In accordance with this in some such cases the accurate diagnosis of the break it was placed only during the primary surgical processing on DMP or in KhPPG or after x-ray examination in the specialized hospital.

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The specific gravity/weight of the break of one bone of shin and forearm among the breaks of the bones of thigh, shin, shoulder and forearm was quite significant, namely: the breaks of one ulna composed by 13.60/o, one radiaticn/radial - 14.40/o, one tibia - 13.10/o and one fibular bone - 6.80/o. Perforated and edge/boundary breaks with the wounds of shoulder composed 11.10/o, with the wounds of forearm - 13.60/o, with the wounds of thigh - 19.70/o and with the wounds of shin - 22.60/o. In these cases the clinical diagnosis of the breaks in the army stages of evacuation could present some difficulties and entail both the diagnostic errors and belated imposition of transport immobilization.

During the treatment of the bullet breaks of the bones of extremities and their complications timely diagnosis, especially in the foremost stages of evacuation, had vast value, since delay with rendering aid could cost life to casualty. This, first of all, relates to the hemorrhages and the shock, the anaerobic infection and the sepsis.

Is given below the obvious case of timely diagnosis, and the timely systematically conducted measures for the struggle for the life of the wounded.

The soldier T. P. S., 35 years, is wounded 15/I 1945 5 hours. In the medical card of forward area is set the diagnosis: the perforating fragmentation wound of left thigh with the break of bone. At PMP is introduced antitetanus serum. 9 Hours of 50 minutes of the same for the casualty is delivered to DMP in the condition of the shock of the second degree. Arterial pressure 80/50 mm of mercury column. To wounded poured 500 cm³ of the blood, 500 cm² of fluid/liquid E. A. Asratyan, 500 cm³ of physiological solution, 50 cm³ 40o/o glucose, 40 cm³ 30° alcohol and calcium chloride 10 cm³ 10o/o solution. Infusion partially was produced during the operation/process. Operation/prccess under the local anesthesia.

Section/cut through the external wound in long in 25 cm and through the wound on the internal surface of thigh in long in 8 cm. Muscles are hemmed to the fascia. Hemostasis. Is superimposed the Diedrich's splint 17/I 1945 casualty was evacuated to KhPPG, where it entered in the condition of average/mean severity with the complaints on the pain in the region of wound.

18/I 1945 the condition of casualty deteriorated. Pulse of 110 strikes/shocks per minute; the dry, lined tongue. During the dressing it is discovered, that the wounds on the thigh are tightly tamped, thigh is edematic, the muscle of the color of boiled meat, they maze into the wound. Is diagnosed the mixed form of anaerobic infection.

Operation/process. Is produced the wide carving of soft tissues in the region of wound, are removed bone fragments, is superimposed bandage with the hypertonic solution and Diedrich's splint. It is introduced to 800 cm³ of fluid/liquid of I. R. Petrov, 300 cm³ of physiological solution, 5 doses of antigangrenous serum, is assigned camphor, streptocide and morphine.

In the following days the temperature to 38.5°; edema of thigh it did not progress; abundant discharge from the wound of serous character/nature. To casualty were daily introduced 5 doses of antigangrenous serum in the physiological solution intravenously,

fluid/liquid of I. R. Petrov, camphor, morphine gave inside 50 cm³ of vodka.

26/I casualty was carried on the spot into the evacuation hospital. Casualty in the heavy condition. The tongue of dry, rough, is lined, with the cracks. Pulse soft, rhythmic, frequent, satisfactory filling. The extensive wounds of left thigh are moderately festered flows and there is no infiltration. Signs not no anaerobic infection there is.

29/I is superimposed deaf gypsum bandage. In the first days of February the temperature was lowered to the norm and subsequently of complications it was not observed. In September of 1945 the casualty is discharged with the grown together break and the almost healed wound. Sharp limitation of movements in the left knee joint and the shortening of left lower extremity on 4 cm. In the X-ray photograph was determined strong/durable callus with the foci of softening and the presence of fine/small sequestrations (osteomyelitis).

In the given observation especially instructive is, first of all, the fact that the casualty after after 4 hours 50 minutes after wound was delivered on DMP, where in proper time they diagnosed the shock of the second degree and were accepted decisively all measures, possible under conditions of DMP, for the removal of

casualty from the condition of shock.

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In spite of shock, to casualty in proper time was produced the primary surgical processing of wound, which it, because of the taken measures, transferred well. On the second day after arrival at KhPPG and on the third day after wound in casualty was discovered anaerobic infection, was immediately carried out repeated surgical processing with the subsequent introduction of antigangrenous serum and the use/application of cardiac substances. During 10 days the patient thoroughly they observed and carried on the tireless struggle with the anaerobic infection, which was crowned by success. To casualty was not only rescued life, but also was saved the extremity.

In the cases of the late diagnosis of hemorrhages, development of anaerobic infection, erroneous evacuation of casualties with symptoms of the incipient anaerobic infection appeared the need for the amputation of extremity, sometimes attacked/advanced lethal outcome.

In the given above case is necessary to note the timely and early diagnosis of anaerobic infection and early operational intervention apropos of complication.

The timely diagnosis of the associating breaks wounds of vessels, nerves, joints, and also the timely identification of the complications of bullet breaks of anaerobic infection, by tetanus, by osteomyelitis, by sepsis, etc. - had very high value for organization of the correct treatment of breaks and they decisively affected the determination of their outcomes. In view of the high value and the vastness of this question the diagnosis of the associating breaks wounds and complications of bullet breaks is given in individual chapters.

X-ray diagnostics of the bullet breaks of long tubular bones and subsequent complications.

The corresponding member of the Academy of medical Sciences of the USSR professor is the Lieutenant Colonel of medical service D. G. Rozhlin.

X-ray examination with the bullet breaks of the long tubular bones.

With the suspicion to the break of the bone of any origin the X-ray diagnostics is most accurate of all methods of research, available of contemporary clinic. Indicating the reliable signs of full/total/complete and incomplete break, X-ray diagnostics most accurately establishes/install localization and extent of break, its characteristic features, a number of broken ends, their condition, the effectiveness of the therapeutic measures, directed toward overcoming of the displacement of broken ends, more precisely formulates the time of onset and the dynamics of the education of the callus and its special feature/peculiarity.

If in accordance with all authoritative surgeons' experience the breaks of peacetime, as they are clear clinically not they seemed,

nevertheless need roentgenological refinement, then is obvious the need for the dynamic x-ray examination of those in the majority of the cases of the more complex damages which are observed with the bullet wounds. With the estimate of the condition of casualty after the bullet break, with the extraction of casualty into the unit, into the battalion of convalescents, with the instruction of the degree of disablement and so forth roentgenological conclusion is one of the necessary and most important objective documents.

However, frequently clinical picture is such, that in the x-ray examination there is no need, for example, with the disengagements of hand, foot, whole extremity. In other cases, in view of military-tactical circumstances and other facts, x-ray examination is impossible.

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Procedure of x-ray examination with the bullet breaks of long tubular bones.

During the Great Patriotic War upon the inspection/examination of a large quantity of casualties the roentgenologists had neither time nor possibility to in sufficient detail interrogate casualty, and even more subject to his comprehensive clinical research. They could assign to casualty only the series/number of additional questions and inspect him in connection with the specific character of the roentgenologically determined special features/peculiarities.

However, in essence roentgenologists leaned on polyclinical data, indicated by surgeon, who directed casualty to the x-ray examination.

Both in peacetime and during the Great Patriotic War surgeons facilitated in this respect roentgenologist's work, indicating the damaged organ/control, the predicted diagnosis, the clinically

emergent doubts. Frequently surgeon, who leads casualty, came into the X-ray room during the research. This personal contact of surgeon and roentgenologist both in the X-ray room and in the medical dressing room provided worthwhile and directed discussion of all appeared questions.

To roentgenologist when selecting of projections for the photographs and during the centering it was necessary to distinctly visualize the region of damage, the location of entrance and exit wound aperture, fistula course, etc.

During the research of casualty in the bandage in it it had to be contained the ointment in which are included the substances with the high atomic weight.

With the execution of photographs (as any roentgenological procedures) it was necessary to stack casualty, without having traumatized him, adapting easily and well mobile/motile tube to the casualty, and casualty to the tube.

Photographs after the necessary processing (manifestation, fixing and washing) were inspected/checked for the purpose of the determination of their fitness for a medical-roentgenological analysis. The overdeveloped photographs did not befit, since they did

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not reveal/detect the symptoms of anaerobic infection.

No matter how they were peculiar and even pathognomonic some manifestations of bullet wound (about which it will be said below), nevertheless is a series/number of general/common/total methodic installations during the x-ray examination; with the traumata of any origin remain valid the basic X-ray symptoms, which characterize break and crack.

The peculiarity of the break both closed and bullet can be studied only on the basis of the analysis of the photographs, produced in two projections, as far as possible in the mutually perpendicular planes. The used with the bullet breaks large fixing bandages, in particular, gypsum, frequently impeded, but completely they did not eliminate the possibility of the x-ray examination of the damaged bones in two projections, if not in the mutually perpendicular planes, then at least in the projections, which supplement one another.

With the impossibility to make photographs in two mutually perpendicular directions sometimes during the Great Patriotic War they resorted to the stereo-X-ray photographs (V. I. Sobolyev et al.), in other words shifting tube, they made consecutively/serially two photographs which subsequently were examined, putting to use

stereoscope. Such stereoscopic x-ray examinations can be produced under calm conditions in the rear hospitals, with the light load of X-ray separation/section.

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The analysis of stereo-X-ray photographs can prove to be useful, but impressions in the relation to depth and so forth were very subjective and for their correct interpretation they required special experiment/experience.

The repeated photographs, which are aimed, could be fulfilled on the films of small sizes/dimensions. However, on the first photographs it was necessary not only to study the zone of the greatest damage, but also to establish/install or to exclude the presence of cracks, sometimes very large and which achieved, even with the breaks of the middle of diaphysis, one of the pineal systems and the joint. Frequently were observed dual breaks at the different levels.

In the case of blind-end wound in the absence of foreign body in the zone of the greatest damage it was necessary to subject to the x-ray examination (first of all fluoroscopic) other departments, until is discovered metallic foreign body.

If extremity was located in the gypsum bandage, the control x-ray examination (x-ray examination and photographs), used for inspecting/checking the standing of broken ends, made it possible to judge presence and to a certain extent about the position/situation of metallic foreign bodies, but it did not give convincing data in the relation to anaerobic infection and suppurative processes in the bone. For exclusion or confirmation of these complications and simultaneously for the more accurate inspection/check of the standing of broken ends and condition of the callus it was to be resorted to the control x-ray examination during the shift/relief of gypsum bandage. If there were moving alert/alarm subjective and objective symptoms, then gypsum bandage was removed/taken earlier than the period, and casualty after clinical inspection/examination in the case of necessity they appointed to the repeated x-ray examination.

With the skeletal/skeleton traction/extension control photographs or x-ray examination produced in the wards through the days or two-three days, putting to use portable X-ray machine.

Repeated x-ray examination after surgical intervention frequently showed that some foreign bodies and free bone broken ends, which it was proposed to remove, remained on the spot.

With the repeated photographs for comparison and studying the details they were produced as far as possible in the same projections as preceding. Thus, roentgenologist, if to him it was not set other problems, made repeated photographs, having before himself preceding, and it was oriented toward the appropriate arrangement of casualty, centering to the necessary for it region.

The bullet wounds of extremities were sometimes connected with so insignificant a damage to bone, that the corresponding changes were not revealed even in the photographs in two projections. The fact is that standard projections (for example, posterior and lateral or front/loading and lateral) in this case, especially with the fresh wounds, could prove to be unfavorable for the development/detection of primary zone damages. Small changes, if they are not for this projection edge/boundary or if they do not fit closely to the film and are closed over with the massive sector of healthy/sound bone, they can remain not discovered in the standard photographs. Subsequently even around the uninfected sector of damage appears the

sufficiently large field of aseptic inflammation with osteolysis and osteoporosis; therefore through one or another the period become roentgenologically easily distinguished the changes which badly/poorly or in no way were outlined in the photographs, produced sometimes a total of several days ago (hence the need for repeated control photographs).

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During the infection, but only after the specific periods, were created the even better conditions for the detection of zone of primary fault - broken ends and the condition for the detection of zone of primary fault - broken ends and the necrotic sectors - against the background of osteoporosis and osteolysis. The early phases of bullet osteomyelitis were distinguished on the basis of characteristic symptoms - progressive osteonecrosis and osteolysis, but not earlier than the 3-4th week after wound.

For the development/detection of the small zone of damage to bone immediately after the wound when yet there was not later than the appearing secondary aseptic inflammation, but that it is more the manifestations of infection, photographs should have been made under the most advantageous conditions in order to reveal/detect at least small changes. Made not only standard photographs, but also during

the arrangement of the damaged department one time to the entrance, but another time - to the outlet. The direction of the contral bundle of X-rays corresponded in to common wound course, i.e., the line, which unites entrance and outlet. In such photographs frequently even immediately after wound it was possible to reveal insignificant damages. However, in the additional photograph, made under such conditions, when central light beam is perpendicular to wound course, it was possible to reveal the bone broken ends, knocked out from the bone and arranged/located in the soft tissues from the course of wound canal. Thus was revealed/detected the path of motion of shell in the damaged organ/control. But in the photograph, where the wound canal coincides with the direction of the bundle of the frame of rays/beams, bone broken ends, which are located in the soft tissues, were laid on the bone and therefore they were not revealed/detected.

When, in the wound, the fine/small fragments of shell and metallic dust are present, the route/path of shell was especially distinctly noticeable.

However, the first x-ray examination was desirable to fulfill as early as possible, under appropriate conditions - during the first days after wound. However, as this is set to data of the deepened development of the histories of disease/illness, military-tactical circumstances during the Great Patriotic War rarely made it possible

to subject those wounded into the extremity to x-ray examination on DMP and in KhPPG of the first line and even in the army evacuation hospital. In the overwhelming majority of its cases they produced in front line or rear SEG and evacuation hospitals (Ye. I. Zakharov, A. A. Nikitin, I. Ya. Podoprigor, I. Ye. Rukhman). In the absence of special readings/indications repeated x-ray examination usually is made through 4-6 weeks, timing it to the shift/relief of gypsum bandage.

In the presence of fistula course in order to establish/install its bond with the specific sector of the damage/defeat of bone, with the sequestration, with the metallic or nonmetallic foreign body, and also that to study the special features/peculiarities of fistula course, its branchings, bag like expansions, etc., they resorted to fistulography. It and with the great benefit was used during the Great Patriotic War. This chapter of X-ray diagnostics is developed in the monograph of G. A. Zedgenidze, and also in the works of D. Ye. Goldstein and D. Ya. Bogatin.

The best contrast substance was iodolipol; however, completely satisfactory results were obtained also with use 30-40o/o of the water suspension of sulfate barium. The intended for fistulography water suspension of sulfate barium twice underwent boiling. Photographs made in two mutually perpendicular projections. The

selection of most convenient projections was provided by preliminary roentgenoscopy - fistuloscopy. The experiment/experience of the Great Patriotic War attests to the fact that frequently it was possible to be restricted to one fistuloscopy (without fistulography).

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However is great the value of single, even very scalene x-ray examination in several projections, nevertheless correct diagnosis and identification of the special features/peculiarities of the course of break best anything were provided by the comparison of clinical data with the the dynamic roentgenological research, in particular, with the thorough analysis of the series of photographs.

Peculiarity of X-ray picture with the bullet breaks of long tubular bones.

As a result of bullet wound can arise the following roentgenologically determined means of the damages of the bones whose unit is observed also with the closed breaks: 1) crack or crack, 2) incomplete break with the larger or smaller defect of bone substance, but without the discontinuity of the basic massif of bone for entire its elongation/extent, i.e., tangential (edge/boundary or trough) and perforated breaks, 3) the incomplete disengagement of the sector of

bone with the partial necrotization of broken end, 4)
full/total/complete break with the displacement of broken ends or
with their satisfactory standing or penetration of broken ends, 5)
the disengagement of extremity.

In contrast to the closed breaks, which are characterized by the frequency of the so-called typical localizations, bullet breaks, as is known, they appeared in any region, if only manpower of the wounding shell was sufficient in order to cause one or the other damage to bone.

The considerable range of damage to bone more frequently is observed with the bullet ones and only rarely with the closed breaks.

Some forms/species of the breaks of bones, namely oblique, cross, longitudinal, packed in, and also cracks and different combinations of these damages to bone are encountered both with that closed and with the bullet traumata. With the bullet wounds from the types of breaks indicated most frequently were observed oblique and slantwise-cross.

Both large-splintered and small-splintered breaks they were encountered more frequently with the bullet wounds and it is considerably less frequent with the closed traumata. The crushed

breaks are still more characteristic for the bullet wounds. Multifragment breaks considerably more frequent than other bullet breaks were complicated by osteomyelitis.

Some incomplete breaks, namely tangents and, in particular, edge/boundary, and perforated were also observed only with the bullet wounds and with the rarely encountered during the Great Patriotic War wounds by silent weaponry.

In the presence of blind-end wound the roentgenologically discovered metallic foreign body usually made it possible to judge the character/nature of the wounding shell.

Upon consideration of the special features/peculiarities of damage to bone and the standing of broken ends it is possible to establish/install the details of wound course. The route/path of the wounding shell in the damaged region especially distinctly comes forward in the presence of metallic dust, which, however, sufficiently rarely was observed with the wounds of extremities.

The rough damages of bones both closed, and bullet, are characterized by the presence of two or several broken ends which are frequently displaced one with respect to another. Type and degree of displacement were compulsorily indicated by roentgenologist.

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By the basic roentgenological symptom, which characterizes thin damages with the closed trauma, as with the bullet, is break in the bone structure in the form of the line of illumination, which presents the projection of the plane of the break or fracture.

With the packed in break is revealed step-shaped strain of outlines and reinforcing of the intensity of the shadow of the wedged in and partially necrotized sector of bone. With the bullet wounds the packed in breaks were observed rarely.

Incomplete and full/total/complete bullet breaks greatly frequently were escorted/tracked by cracks (Fig. 17, 18 and 19). But rarely cracks were observed also as the only bone damage with the bullet wounds of extremities.

To the incomplete bullet breaks with the defect of bone substance relate tangential and perforated breaks.

Tangential damage can be surface with the changes only in the periosteum and the skin of cortical substance. Tangential wound can

lead also to a deep U-shaped damage; however, the state of preservation of the basic massif of bone is not disturbed and, therefore, and such cases displacement is not determined (Fig. 17, 20 and 21).

Röntgenologist, describing tangential damage, it indicated not only length, but also depth of damage. In certain cases the trough had significant depth, for example, sometimes was observed the defect not only of cortical, but also spongy substance (Fig. 20 and 21). The exposure of spongy substance more frequently connected with the complication - with the restricted purulent-necrotic process or even with osteomyelitis, which are extended beyond the limits of the primary zone of damage.

During the deepened development of the histories of disease/illness, on N. N. Yelanskiy's proposition, edge/boundary were called the tangential incomplete breaks which were characterized by the retention/preservation/maintaining some unit of the diameter of bone, but in the absence of the röntgenologically determined cracks.

With the incomplete bullet breaks of long tubular bones, besides the tangents (including edge/boundary), were observed the perforated breaks, which were being usually escorted/tracked by radial cracks (Fig. 19). In such cases, as with all cracks of bullet origin, it was

necessary to establish/install, does not reach one or the other crack the joint. This crack was frequently entrance "portae", whence infection applied to joint.

The incomplete disengagement of the larger or smaller sector of bone is characterized by the partial necrotization of the broken end (its shadow becomes more intensive), moreover subsequently broken end can or to beget (then its structure it becomes normal), or undergo osteolysis.

Full/total/complete breaks are large-splintered (Fig. 18), and also small-splintered (Fig. 22, 23 and 24) and crushed (Fig. 25 and 26).

The variety/subspecies of large-splintered break is "butterfly" break with the presence of two large/coarse trigonal broken ends, by directed angles one toward another; usually simultaneously it is observed and several short cracks. With the bullet wounds "butterfly" breaks were encountered rarely; V. I. Sobolyev observed them into 1.50/o of cases of the bullet damages of thigh.

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Fenestrated A. V. Melnikov calls such bullet multifragment break

when as a result of the thrust of muscles scraps disperse, and in the center is formed the polygonal "window", bordered by the displaced to the side scraps. Breaks of this type (Fig. 18) were encountered, but it is rare. Still less frequent it was possible to reveal/detect multi-fenestrated bullet break.

Large-splintered is the dual break of one and the same bone, i.e., presence, besides the central (proximal) and peripheral (extremital) broken end, even and intermediate broken end, which is located between the central and the peripheral.

In the presence of two breaks at the different levels calculated the standing of intermediate broken end on the basis of the relation both to the proximal and to the extremital broken end. The dual break into some cases was escorted/tracked by sharp shortening and strain of extremity, in others - by less significant consequences. If the intermediate broken end of the significant magnitude was arranged/located perpendicular to the axis of bone, i.e., step-shaped, then shortening and strain were very significant. However, intermediate broken end was more frequently disposed of between the proximal and extremital broken end in such a way that was obtained the zigzag line. In the latter/last cases the degree of shortening and the strain of the damaged bone sharply varied, which depended, in particular, on the bearing/angle between the

intermediate broken end and both basic broken ends, and also from the parallel or not parallel disposition of the extremital broken end of relatively proximal.

Sometimes was observed full/total/complete break on the same level, and higher or below incomplete break. During the attempt to amend incorrect standing in the region of full/total/complete break was a danger "to break" and to displace bone in the region of incomplete break. Therefore roentgenologist noted not only presence and localization of full/total/complete break, but also presence at one or the other level of incomplete break.

The dual break was discussed only when there was a large/coarse intermediate broken end - in 4-5-6 it is more than centimeters. Smaller intermediate broken ends did not give the sharply pronounced step-shaped and zigzag strain.

With the dual breaks sometimes was observed the setting of intermediate broken end according to the relation both to the proximal and to the extremital broken end. In such cases was considered the amount of each displacement.

With the multifragment breaks was observed not only the large extent of damage to bone. Large/coarse, and finer bone broken ends

were simultaneously the secondary shells, which damage the surrounding bone muscles. The significant violation of the muscular bed, which adjoins the bone, conditioned deterioration in the nourishment of bone; consequently, with the multifragment bullet breaks were created the conditions, which favored the development of infection.

An even larger alertness was necessary with the bullet crushed breaks. On N. N. Yelanskiy's proposition, the crushed break was called large/coarse or small-splintered break with the defect of the bone when bone broken ends did not touch between themselves. As it will be indicated below, a great quantity of cases of the bullet sepsis and other complications was noted precisely in this case the type of breaks.

With each break was studied the standing of broken ends, presence and character/nature of displacement. Were distinguished the displacement: lateral, along the length (with the setting, with the disagreement, with the penetration), angular and peripheral. With the closed break the or other displacement was explained by the thrust of muscles which with some localizations of break could lead to the significant displacement.

Meanwhile with the bullet break simultaneously with the damage to bone appeared the damage of muscles, in consequence of which in the fresh cases, even with the large bone defect, the displacement was frequently little noticeable; however subsequently, when the parietic condition of muscles disappeared, with the bullet break frequently appeared significant displacement.

If we consider only primary changes, immediately appearing as a result of multifragment bullet break, then into some cases large/coarse and fine/small fragments tightly fit closely one to another, and also to the proximal and extremal unit of the broken in two bone, without disturbing significantly of its normal configuration. In other cases they were displaced, and sometimes they were located in the soft tissues at a great distance from the proximal and extremal unit, i.e., from the basic massif of bone.

Roentgenologist's special attention deserved the displaced large/coarse broken ends, arranged/located at the right angle to the basic massif of the damaged bone (Fig. 26). During this disposition of large/coarse broken end greatly frequently was retarded the healing; frequently subsequently attacked/advanced the education of excess callus; in this case was excluded the possibility of the

pressure of the broken ends of bone on the vessels and the nerves. Consequently, the bone broken ends, arranged/located perpendicular to the basic mass of bone, as far as possible it was to be removed.

Furthermore, with the bullet breaks frequently was observed the significant cracking of bone. Cracks frequently applied to large distance, in particular on length of bone. These cracks in the presence of infection contributed to the extensive spread of osteomyelitis which frequently was observed with the bullet breaks. If crack achieved joint, then suppurative damage/defeat frequently was propagated also to the joint (pg. 39).

With the multifragment bullet breaks the frequently significant part of the bone broken ends after the specific rearrangement of their structure participated in the education of the callus. The corresponding observations of some surgeons in the previous wars were confirmed during the Great Patriotic War by numerous serial roentgenological observations with the favorable clinical course and outcome.

In present chapter is given the sufficient number of observations, which illustrate the possibility of the favorable course (according to the type of the closed break) of the extensive multifragment breaks even thigh, and that of more other tubular

bones.

At the same time in the presence of infection, even when the bond of bone broken ends with the periosteum was maintained, frequently attacked/advanced trophonecrotic and vascular violations, which led to necrobiosis and of these broken ends, and also to the onset and the significant dissemination of suppurative process. Such broken ends in full or in part were torn away and were converted in the sequestrations which gradually were displaced and were pushed out. The individual stages of this process in the bone broken ends and in the remaining previously not changed sectors of bone were outlined well during the dynamic X-ray examination (on the series of photographs).

In each individual case the course of the bullet break could be accurately established/installed only as a result of the sufficiently extended clinical X-ray observation (see below).

The onset of the callus after bullet breaks frequently was retarded, but this yet did not exclude the possibility of development subsequently of worthy callus.

With the edge/boundary break, and during the significant depth of trough and the extensive damage of periosteum periosteal bone formation occurred predominantly on the contradictory/opposite surface of bone. In these cases it was possible to note one-sided callus, sometimes with the concavity on the side of damages. Such changes never were observed with the closed traumata; they were characteristic only for the open bullet breaks. If one-sided callus was insufficient thickness, then with too great and early a load was feasible break and even repeated breaks in this weak spot (G. A. Zedgenidze).

If foreign body was arranged/located in the bone, then with the x-ray examination with turning of the extremity being investigated around its axis foreign body, naturally, always penetrated the bone.

Photographs only in two projections did not always guarantee from the errors, especially when bone was globular, cylindrical or trihedral, which is characteristic for the individual sections of long tubular bones. In such cases the foreign body, which is located out of the bone, in the photographs in two projections can projection be laid on the image of bone. In this respect methodic multi-axial x-ray examination could prove to be more useful than photographs without the preceding x-ray examination. In the presence of foreign body within the bone around it in the photograph was observed the

rarefaction/evacuation in the form of bright rim, the "aureole", that appeared as a result of osteolysis.

During the extra-bone disposition of foreign body, according to the observations of G. A. Zedgenidze, on one of two photographs, made in the mutually perpendicular positions/situations, sometimes could be revealed/detected the picture, which simulates osteolysis (symptom of "Obreol"). But this illumination with respect to the projection of foreign body on the bone, apparently that is the result of secondary emission from the metallic body, repeated the form of the latter and it was observed only on one of two mutually perpendicular projections. Furthermore, in these cases in the photographs it was noted neither damages of bone plates nor reactive sclerous changes from the side of endosteum nor periosteal layerings.

In accordance with the numerous observations (G. A. Zedgenidze, V. S. Malkova-Stroganov, N. S. Kosinskaya et al.) the bullets after damage to bone could undergo not only significant strain, but also crushing to the fine/small small pieces.

Comparing the place of inlet with the established/installed special features/peculiarities of damage to bone, in the standing of broken ends and by the disposition of metallic foreign body, it was frequently possible with the blind-end wounds to accurately present

wound canal. Along the wound route/path, besides the bone fragments, were arranged/located fine/small fragments of shell or metallic dust. In the photograph was obtained the peculiar picture, which reminds the tail of comet.

This roentgenological picture considerably more frequently was encountered with the intra-cranial wounds (plumb - according to N. S. Kosinskoy), than with the wounds of the extremities and other regions with a large quantity of muscles.

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Basic roentgenological symptoms of complications with the bullet breaks of long tubular bones.

Dummy joint in the X-ray image is characterized by the presence of closing plates which cover spongy substance in the contiguous ends of the broken ends. If the not connected ends of the broken ends are not covered by closing plate and narrow spaces are bared and if the ordinary periods of the formation of the callus passed, then before us nevertheless the picture of the delayed consolidation, and not the dummy joint.

The late displacement of broken ends does not differ in the

X-ray image from early displacement. Consequently, basic difference is in the time of the onset of the displacement of broken ends.

Both with the late ones and during the early displacement roentgenologist in his conclusion not only indicated the presence of the displacement of broken ends, but also accurately were described form/species and degree of displacement.

Special attention with the bullet wounds deserve the roentgenological symptoms of the following complications: 1) anaerobic infection (presence not only of gas, but also edema), 2) different types of suppurative processes in the damaged bones, 3) the presence of trofo-neurotic changes, which attack in the extremital departments of the skeleton of extremities with the wounds of the proximal sectors of peripheral nerve trunks.

However, with the bullet wound on the first photograph could be recognized not only presence either absence of break, localization and the special feature/peculiarity of damage to bone, presence or the absence of alien metallic bodies, but simultaneously, after paying proper attention to the condition of soft tissues, to reveal the symptoms of the anaerobic infection (therefore photograph must not be overdeveloped).

The roentgenological picture of anaerobic infection is in detail described in the second volume of present "work".

During the study of the course of the bullet breaks of special attention deserves the identification of suppurative process in the damaged bone.

The suppurative processes, which complicate bullet break, were revealed clinical X-rayly not right after wound, but after 1-2-3, but rarely also 4 months after wound. In this respect most prolonged observations are necessary with the bullet breaks of the femoral bone (see below).

Suppurative processes in the damaged bones are dissimilar in the relation as the extents of zone, is observed complication, so course and outcome. These essential differences clinical X-rayly were outlined well.

It was necessary to consider that the bullet break can flow/occur/last without the complications, i.e., according to the type of the closed break either to be complicated in is general/common/total, by the easily overcome restricted pyonecrotic

process or to give more serious complication, namely bullet osteomyelitis.

In the extremely rare cases after bullet break appeared the peculiar form of osteomyelitis, total central necrosis and its suppurative fusion in the closed space. This terrible complication little known; its roentgenological symptoms are described on pg. 115 of present volume.

If bullet break flowed/occurred/lasted over the type of the closed break, then was observed the gradual disappearance of osteolysis and osteonecrosis, appeared a good callus with the assimilated periosteal layerings and with the "calm" bone structure, therefore, with the absence of areas and sequestrations (Fig. 27, 28, 29 and 30).

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The limited pyonecrotic process (the "wound of bone", according to S. S. Girgolav's terminology) could be surface and deeper penetrate not only into the cortical, but also into the spongy substance of bone (Fig. 20 and 21).

The surface pyonecrotic process, which was being observed during

the tangential damages, could be revealed in the the bullet osteoperiostitis. When into the zone of primary fault with the bullet edge/boundary breaks was involved for the specific elongation/extent cortical layer and those of the adjoining the department spongy of substances, then the restricted pycnecrotic process in the X-ray image was characterized by the presence of necrosis and osteolysis in the limits of the zone of damage; in further phases was observed enosteal, guessing by analogy with following and periosteal reaction. The restricted pyonecrotic process was sometimes overcome even by the conservative methods of treatment, but nevertheless after operation/process the elimination of process occurred more rapidly (if was removed all that was dead and not viable).

In the beginning of the Great Patriotic War it was established/installed, that bullet osteomyelitis in early phases is roentgenologically characterized by progressive osteonecrosis and osteolysis, in the larger or smaller measure extending beyond the limits of the primary zone of damage. In the region of diaphysis with bullet osteomyelitis it was observed, furthermore, scaling and the fringing of periosteum (Fig. 31 and 32).

The character/nature of the primary fault to bone significantly affected the special features/peculiarities of the appearing subsequently complication. Bullet osteomyelitis of diaphysis in the

X-ray image presents the complex picture usually of the slowly and badly/poorly healing break (having one or the other extent), frequently the multifragment and crushed break, with a large quantity of cracks, that is escorted/tracked by increasing osteonecrosis and osteolysis. For one or the other elongation/extent was observed the reaction from the side of periosteum - scaling and fringing.

In the X-ray photographs, made within the relatively early periods (to the offensive of the consolidation of break), osteonecrosis and osteolysis were observed most frequently in the region of the break in one or in two basic broken ends of diaphysis (so-called terminal osteomyelitis), less frequent - in one or in several nonbasic/minority broken ends of bone. Necrosis and osteolysis were extended beyond the limits of the zone of primary fault, usually for a comparatively small elongation/extent. However, cracks were frequently the routes/paths of the dissemination of infection, and in the X-ray image - necrosis and osteolysis for the significant elongation/extent.

With terminal osteomyelitis in the region of the basic broken ends of long tubular bones frequently was revealed sufficiently large/coarse rim/coronal necrosis, subsequently completely torn away and converted in rim/coronal sequestration.

These roentgenological signs of acute and subacute bullet osteomyelitis could be in proper time identified, which facilitated a good effect of surgical intervention.

In the chronic phases as a result of the significant periosteal layerings, which thickened and of the frequently sharply strained the bone and endosteal sclerous changes, and also the presences of areas (frequently set) with the sequestrations, to carry out effective surgical intervention, it is doubtless, was more difficultly than in the clinical X-ray identified sharp/acute and subacute phases of bullet osteomyelitis. On the whole in the chronic phase bullet osteomyelitis was characterized by the roentgenological special features/peculiarities, typical and for the chronic phases of hematogenic osteomyelitis.

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The significant strain of the diaphysis of long tubular bones, which was being frequently observed with chronic bullet osteomyelitis, is caused, in the first place, by the primary special features/peculiarities of the corresponding bullet breaks, predominantly multifragment and crushed, and also by the frequency of the secondary displacement of broken ends, revealing configuration of bone as a whole, and, in the second place, by massiveness and by

irregularity of periosteal layerings.

The frequently observed with chronic bullet (and hematogenic) osteomyelitis fistula courses best anything were outlined with the aid of fistulography, but sometimes they distinctly came forward in the ordinary photographs (without the introduction of contrast substance) in the form of "canals", clearly delimited ribbon-like illuminations, which interrupt cortical layer.

in the pineal systems and in other departments of skeleton with the analogous bone structure, with the sharply thinned out cortical layer even very surface tangential damage to bone was connected with the exposure of marrow spaces, which in the large measure contributed to the dissemination of infection. Meanwhile in the diaphysis where the thickness of cortical layer is significant, tangential wound could and not be escorted/tracked by the exposure of marrow space; in these cases the damage frequently remained local, i.e., in the presence of infection more frequently was observed local bone wound, and not osteomyelitis, which was being extended beyond the limits of the primary zone of damage.

The bullet breaks of pineal systems were frequently complicated not only by osteomyelitis, but also by arthritis with further march/passage of suppuration to the contiguous surface of the joined

bone. In the appropriate cases pathological changes in the contiguous pineal system first of all were revealed in the places of the fastening of joint capsule, in particular in the region of passing the synovial membrane into the joint cartilage in the so called circular or encircling zone of synovial membrane (A.E. Rubasheva).

Para-articular changes in the soft tissues and implication in the process of turns and bursas in a number of cases were also traced roentgenologically (V. S. Malkova-Stroganov, M. S. Kosinskaya). The individual anatomical education, which form part the soft tissues of the supporting-motor apparatus of extremities (tendon, muscle, turns, capsule) roentgenologically was distinguished in good photographs, since these education in the norm in the specific sectors was surrounded by oil cellulose. The latter, weakly holding up X-rays, in the photograph is more transparent/hyaline than adjacent muscles and tendon. The infiltration of oil cellulose annihilated the available in the photographs in the norm contrast between the soft tissues of extremities indicated.

With bullet osteomyelitis by the sufficiently prolonged period was held up the development of the callus, in particular in that sector where there was more than the necrotized bone where mainly appeared and went out sequestrations.

At the same time the presence of the callus yet did not exclude the possibility of the complication of osteomyelitis. The appearance of new periosteal layerings during already the previously assimilated periosteal layerings (laminated periosteum) testified about the presence of suppurative process. Laminated periosteal layerings are characteristic for the repeatedly peaked process.

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The torn fringed periosteum was observed in the presence of the cesspools, through which go cut sequestrations and pus, that stimulate by correspondingly periosteum. Thus far roentgenologically was revealed the torn fringed pericsteum, about the recovery of the complicated break it was not necessary to speak.

The roentgenological confirmation of clinical recovery after bullet break were the callus with the assimilated periosteal layerings, the absence of areas and sequestrations, the absence of the scaled, torn or fringed periosteum. With the areas one ought not to mix the osteoid fields, which appear after wound or surgical intervention on the spot of bone defect. With the sufficient massiveness of the remaining sectors of bone osteoid field did not weaken/attenuate its full value (Fig. 27).

Some roentgenological data, necessary for the identification of course, complications and the outcomes of bullet breaks, in particular - bullet osteomyelitis, are presented in the 16th volume of "Work". ⁴ In peacetime, frequently were observed the damage of peripheral nerve trunks. The corresponding consequences roentgenologically were outlined well, in particular if there was an incomplete break of the damaged nerve and phenomenon of stimulation/irritation. In these cases in the extremal department of extremity attacked/advanced the changes, which were being developed mainly in osteoporosis, rarely in osteolysis of closing plates of ungual tuberosities of extremity phalanges. However, in youths could advance accelerated synostosis in adult ones - the local early manifestations of aging the osteoarticular apparatus.

With the wounds of the nerves of upper extremity osteoporosis began in the skeleton of hand and extremal department of the bones of forearm, with the wounds of the nerve trunks of lower extremity - in the skeleton the feet and in the extremal department of the bones of shin.

Trophoneurotic during the damage of the nerve trunks, according to the data of G. I. Turner, S. M. Davidenkov, A. I. Kochergina and according to the personal observations of the author, in contrast to osteoporosis from the inactivity, appeared early.

During the damage of the peripheral nerves of extremity this osteoporosis was not limited to the innervational zone only of that nerve which was damaged, but it was propagated more or less evenly to entire hand or foot.

Thus, trophoneurotic osteoporosis always exceeded the limits of the sensitive innervational zone of one or the other damaged nerve. Only seldom against the background of general/common/total osteoporosis was revealed sharper osteoporosis in the zone of the innervation of the damaged nerve.

With the causalgia sharp trophoneurotic changes in the extremital department of the skeleton of extremities were sometimes revealed after only one or two days after wound.

Trophoneurotic osteoporosis could be revealed, also, on opposite side as a result of the irradiation of stimulation/irritation in the spinal cord, so-called segmental repercussion (i.e. repulsing or repercussion in the symmetric department of the skeleton of noninjured extremity). If osteoporsis was observed to the the contradictory/opposite to side, then it was expressed weaker, also, for the smaller elongation/extent in comparison with the side of

wound.

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Thus, the X-ray diagnostics of bullet breaks with the methodically correctly carried out photographs was reduced to the identification of the damage of bones, localization, extent, to the explanation of the peculiarity of break and standing of broken ends, to the establishment of the condition of their surrounding soft tissues, roentgenologically more precisely formulated, in particular, in the relation to the symptoms of anaerobic infection, and also to the determination of presence, number and position foreign metallic bodies.

Repeated photographs were timed to the time of the shift/relief of bandage or were fulfilled in connection with clinical data. Via comparison with the preceding photographs was studied the dynamics of process in the X-ray image, the healing of bone wound, the development of the callus, the presence of complications in the bone and in the soft tissues, post-operation course. Roentgenological picture was always analyzed in connection with clinical and laboratory data.

The bullet wounds of bones could flow/occur/last over the type

of the closed break; however, frequently they were complicated by the suppurative process in the zone of damage, in many instances which were being extended beyond its limits.

The bullet breaks of long tubular bones over the type of the closed break most frequently flowed/occurred/lasted: 1) with the perforating wounds; 2) with the blind-end wounds, if large/coarse foreign metallic bodies were located in the soft tissues, but not between the bone broken ends and not in the bones; 3) with the incomplete breaks; 4) with nonfragmentary (oblique, cross and slantwise-cross) breaks; 5) in the absence of the displacement of fragments, 6) during the rapidly assimilated periosteal layerings.

One ought not to have feared the complications of bullet osteomyelitis, to be very vigilant and to catch the initial symptoms of complication with the following roentgenologically determined or more precisely formulated primary and early special features/peculiarities of bullet break: 1) with the blind ones, and those more with the fragmentation wounds, if large/coarse alien metallic bodies were located between the bone broken ends, especially in the bone; 2) with the full/total/complete breaks, in particular with the multifragment ones (large/coarse and small-splintered) and even in the greater measure with those crushed; 3) during the displacement of broken ends; 4) in the prolonged absence of the

callus; 5) in the presence of breaks in the periosteal layerings.

Bullet osteomyelitis was characterized by the changes, which emerge beyond the limits of the primary zone of damage. The roentgenological symptoms of bullet osteomyelitis are progressive osteonecrosis and osteolysis, scaling and fringing of periosteum.

Bullet osteomyelitis was revealed roentgenologically in the long tubular bones not earlier than the 3-4th week after wound.

The duration of the latent period during which clinical X-rayly it was impossible in by confidence to establish/install or to exclude bullet osteomyelitis, for all long tubular bones did not exceed 2 months. Only with the bullet breaks of femoral bone this period frequently was lengthened to 3, and sometimes to 4 months.

It is later, in the absence of the clinical X-ray symptoms of osteomyelitis, this complication no longer appeared.

With chronic bullet osteomyelitis were observed the areas with the sequestrations, endosteal sclerosis, pericosteal, in essence the assimilated layerings. In the presence of fistulas it is extremely valuable they were valuable fistulographic data.

The significant strain of bones with chronic osteomyelitis was caused, in the first place, by the special features/peculiarities of the corresponding bullet breaks, predominantly multifragment and crushed, and also by the frequency of the displacement of the broken ends, which disturbed the configuration of bone as a whole, in the second place, by massiveness and by the nonuniformity of periosteal layerings.

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Exceptional attention was paid to the most severe and rare form of bullet osteomyelitis - total central necrosis. This the form of bullet osteomyelitis was distinguished only on the basis of the following roentgenological symptom: the decompositions of cortical substance into two layers - to the external, in which there were manifestations of osteopetrosis, and internal - dead, appearing in the X-ray photograph as metal. This heaviest form of acute and subacute bullet osteomyelitis (with the total central necrosis) was observed in the diaphysis only with the full/total/complete breaks mainly of femoral bone, and in the unitary cases - other long tubular bones. With timely operational intervention wounded recovered.

X-ray examination with the bullet breaks in the early stages of evacuation played the significant role upon the setting of any

prognosis. Individual additions and the correction of the general/common/total estimate which on the need was in the following stages, did not weaken/attenuate the justified by practice general/common/total devces, basic reference points, which made it possible sufficient to accurately predict course and outcomes for the overwhelming majority of casualties and, therefore, to ensure in the adequate/approaching circumstances most rational treatment.

Page 115a.



Fig. 17. Tangential U-shaped break of shoulder bone 10 days after

fragmentation wound. On the boundary of middle and proximal third of diaphysis of shoulder bone over the external surface for the elongation/extent 1 cm is absent cortical layer, is bared the spongy substance of bone. Multiple long cracks, of which one, which goes upward, interrupts/breaks cortical layer on the internal surface of shoulder bone. Several fine/small bone broken ends, penetrating to the bone (in the additional photograph in perpendicular projection they are arranged/located in the soft tissues). One fine/small cortical broken end, connected with periosteum with the basic massif of bone. Fine/small metallic fragments in soft tissues.

Page 115b.



Fig. 13. Many and large-splintered fenestrated break of shoulder bone in middle and lower third of diaphysis 3 weeks after fragmentation wound. Satisfactory standing of broken ends in the photographs in two projections. Cracks, which go in the extremital direction. Metallic fragment within medullar space. Periosteal callus is distinctly expressed on the internal surface, it is absent from the external surface where there are two small necrotized sectors of the cortical substance, which protrude in the photograph more sharply than normal cortical substance.

Page 115c.



Fig. 19. Bullet perforated break of extremital metaphysis of radiation/radial bone 10 days after perforating wound. There are

multiple cracks, radially arranged/located with respect to the perforated defect in the bone. On the course of wound canal in metaphysis fine/small bone fragments. The cracking of cortical layer over the external surface; in adjacent soft tissues several fine/small bone fragments. There is no periosteal reaction still.

Page 115d.

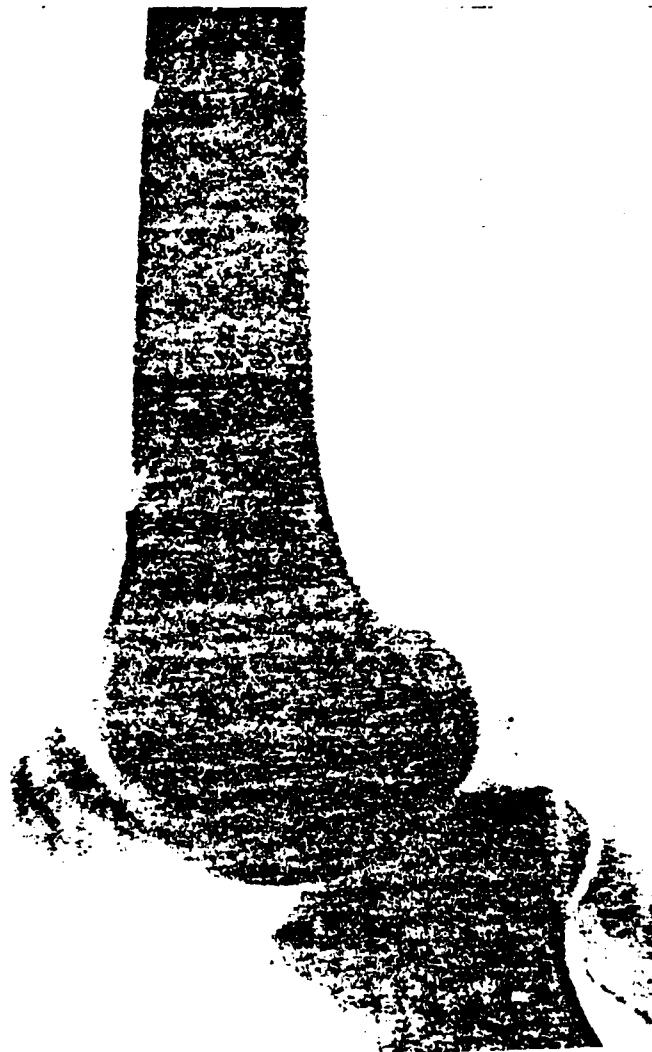


Fig. 20. Bullet U-shaped break of extremity of thigh on
boundary with metaphysis ¹⁸ days after perforating wound. Clinically

- sickness, the swelling of soft tissues, wound with suppurative discharge, the small oscillations of temperature, moderate leukocytosis. Absence of cortical layer over the front face on the elongation/extent 8 mm. Exposure of spongy substance. Hardly the expressed endosteal sclerosis only in the region of the bottom of bone defect. Multiple fine/small broken ends, partially - in soft tissues. Infiltration of upper turn. Picture of organic suppurative wound of bone.

Page 115e.

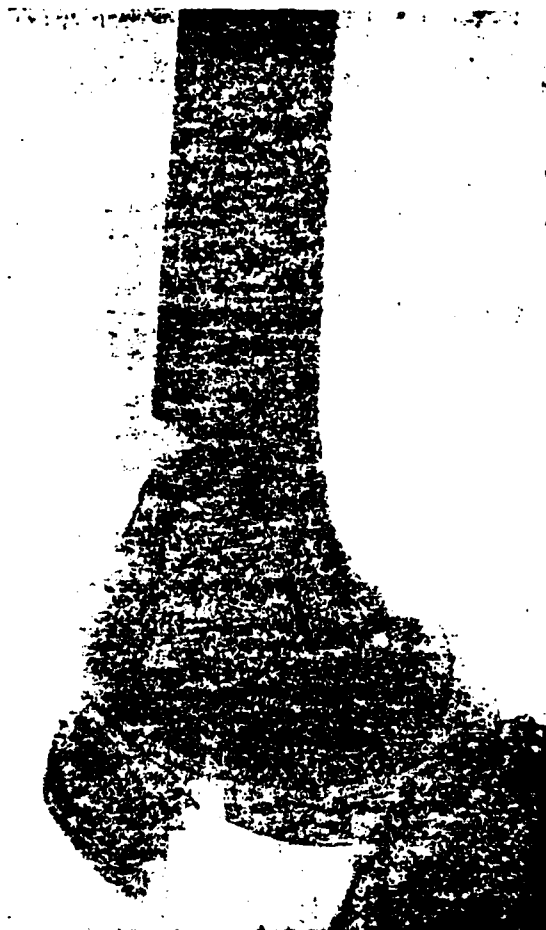


Fig. 21. Repeated photograph 2 months after two "scraping out" of sharp/acute spoon. Clinically picture on the whole the same as in Fig. 20. Nevertheless in the photograph are absent the previously observed fine/small bone broken ends in soft tissues, upper turn is not infiltrated. However, endosteal sclerotization and appearance no

closing plate there is. The spongy substance of bone remains uncovered almost for entire elongation/extent of bone defect. In the region of the bottom of bone wound - fine/small sequestrations. The restricted pyonecrotic process is not overcome (surgical intervention was insufficient radical, it was not realized in the limits of normal bone tissue).

Page 115f.



Fig. 22. Perforating bullet wound of middle third of shoulder bone. In the photograph after wound is determined small-splintered break with cracking and necrotization of the unit of the bone fragments. The periosteum in places is scaled, in places fringed. Gypsum bandage.

Page 115g.



Fig. 23.



Fig. 24.

Fig. 23. Photograph of shoulder bone of the same casualty after two

months after wound; gypsum bandage it is taken/removed. Clinically - fistula. In the photograph - progressive necrosis, sequestration, the scaled and fringed periosteum. Against the background of osteoporosis more distinctly come forward long cracks. Picture of bullet osteomyelitis. See Fig. 24 - after surgical intervention.

Fig. 24. 3 months after sequestrectomy. The recovery (areas and there are no sequestrations, periosteal layerings are assimilated).

Page 115b.



Fig. 25. Bullet multi-splintered break of thigh in extremital quarter of diaphysis. Individual broken ends insufficiently touch or in no way touch with each other. Displacement of basic extremital broken end towards the inside to third of diameter of diaphysis (but in the lateral photograph and at certain angle, point directed toward the rear). In the photograph through 6 weeks the callus hardly is planned. Clinically - wound with abundant suppurative discharge. Operation/process - resection.

Page 1151.



Fig. 26.

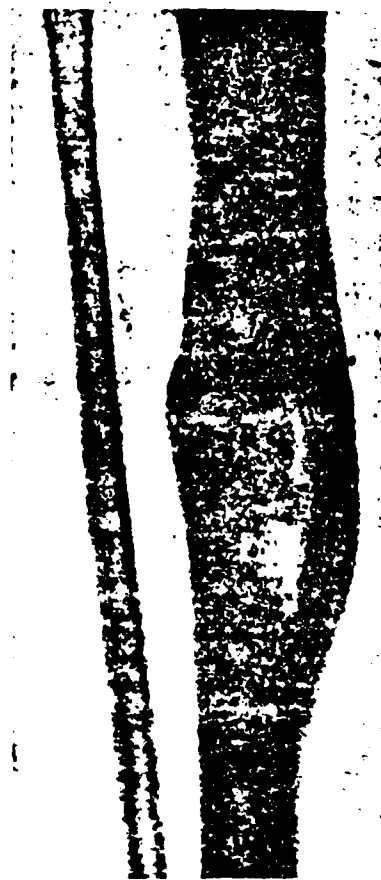


Fig. 27.

Fig. 26. Mixed many and large-splintered, and also small-splintered pieces of femoral bone on boundary of middle and extremity third of diaphysis 4 weeks after perforating bullet wound. Basic broken ends will be at certain angle, point those directed towards the outside;

insignificant displacement along the length (setting of basic broken ends on 1.5-2 cm). One of the large/coarse broken ends, that is located in soft tissues in the medial side, is arranged/located at the right angle to the axis of bone. Periosteal and parosseal development of the callus.

Fig. 27. Bullet break of tibia 2 months after sequestrectomy and removal/distance foreign bodies. It is clinically healthy/sound. In the photograph a good callus with the centrally arranged/located osteoid field.

Page 5.

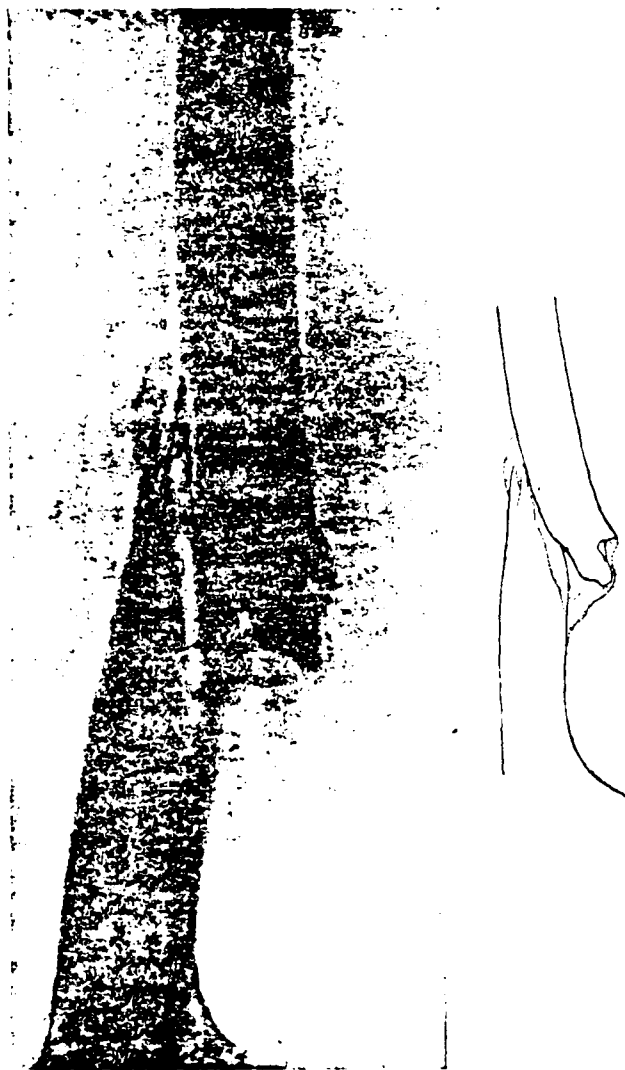


Fig. 24. Bullet oblique break of thigh on boundary of middle and extremital third of diaphysis after perforating wound by fragment of mine. the lateral photograph 50 days after wound. Extremital broken end is displaced toward the front for half the diameter of diaphysis.

displacement along the length with the setting on 2 cm, insignificant angular displacement. Necrotization of ends of the basic broken ends. Partial development of endosteal and periosteal callus.

Page 115k.

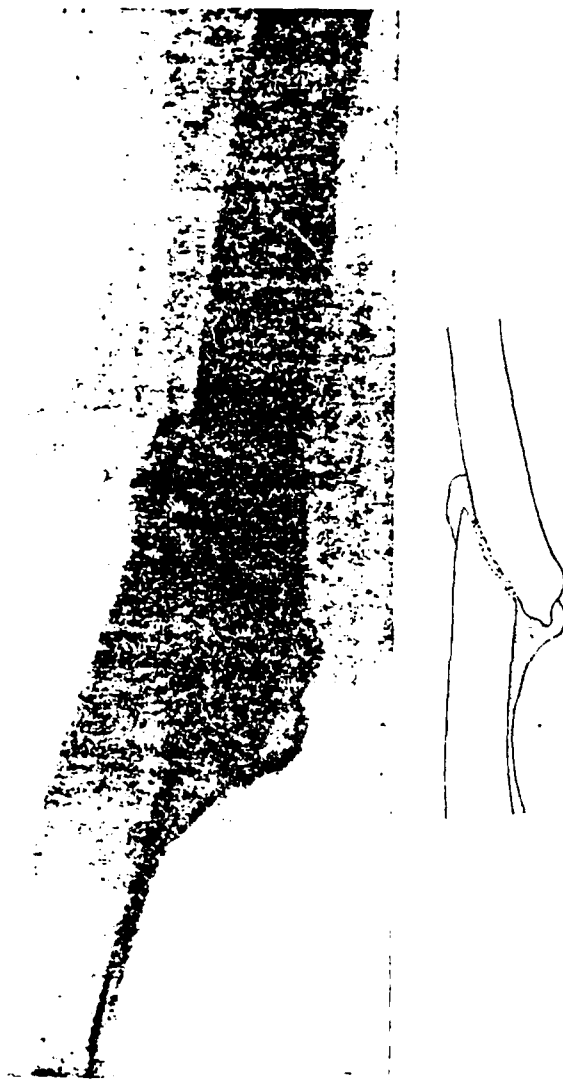


Fig. 29. Repeated lateral photograph after 47 more days.

Powerful/thick callus with the assimilated periosteal layerings.

Almost complete disappearance is earlier than the observed sectors of the necrosis of bone (the "regressing necrosis"). Outcome according to the type of the closed break.

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Fig. 30. Simultaneously made photograph of thigh of the same casualty, as in Fig. 29, in posterior projection.

Page 115m.

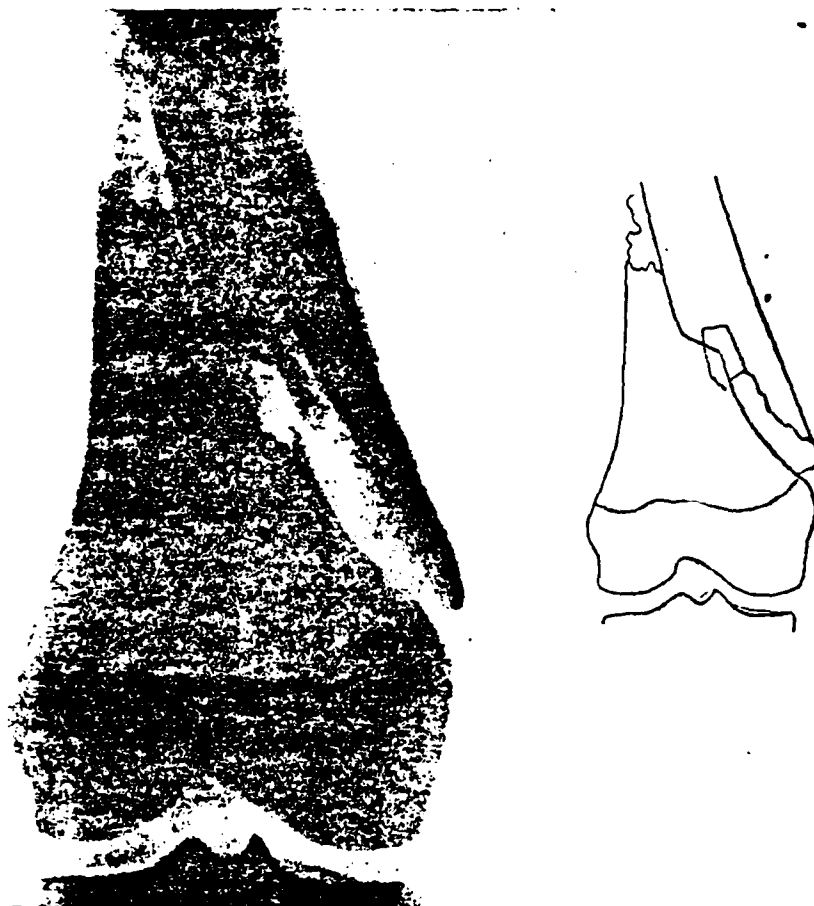


Fig 31. Bullet oblique break of thigh in lower quarter of diaphysis 3 weeks after perforating wound. Extremital broken end is displaced towards the outside to half the diameter of diaphysis. There are a displacement along the length (with the setting), an equal to 3 cm, and insignificant angular displacement. Between the basic broken ends of bone - small bone fragment. Is sufficiently expressed the periosteal and parosseal formation of the callus.

Page 115n.

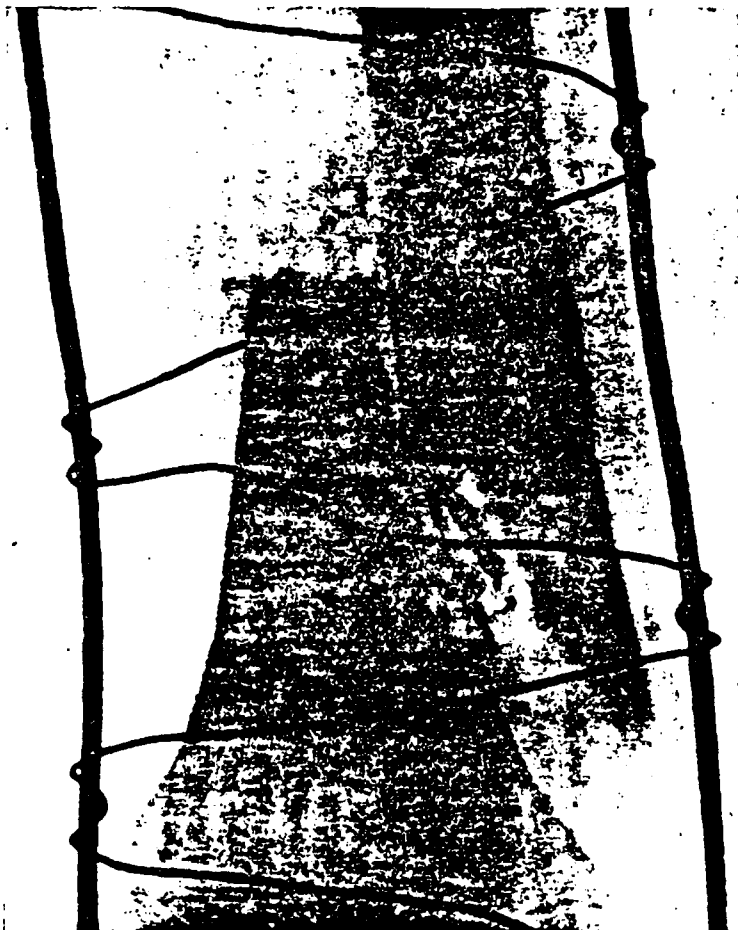


Fig. 32. Repeated photograph after 2 months. Significant necrotization of extremital broken end (progressive osteonecrosis). Fringed pericosteal layerings. Picture of bullet osteomyelitis.

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Chapter V.

TREATMENT OF THE BULLET BREAKS OF THE BONES OF EXTREMITIES.

General/common/total principles of the treatment of the bullet breaks of the bones of extremities.

Honored Scientist professor is the lieutenant general of medical service N. N. Yelanskiy.

During the combat operations in the area of Khasan lake, on Khalkhin-Gol river and in contact with the White Finns was the rating value of the early primary surgical processing of wounds, was manufactured the procedure of primary surgical processing, was established/installed the inadmissibility of the imposition of primary suture even after radical surgical processing, was tested transport immobilization by standard transport splints. As the therapeutic immobilization with the equal success were used both

known methods - skeletal/skeleton traction/extension and deaf gypsum bandage.

However, this experiment/experience could not be widely and completely used during the Great Patriotic War, since during combat operations/processes indicated above army therapeutic installations were based on the powerful/thick net/system of the therapeutic stationary installations of peacetime, equipped with all devices/appliances and conveniences and secured by the highly skilled specialists. Casualties often were situated in the military circumstances only of first 2-3 days, and then they struck into the peaceful circumstances of clinics and well-organized hospitals.

During the war with the White Finns the casualties frequently during the day of wound struck to Leningrad where they remained for the most part up to the recovery.

Thus were created maximally favorable conditions for the stage treatment: a small quantity of intermediate stages, an entry soon after wound into the stationary therapeutic installation, the short evacuation routes and the treatment in the special surgical installations, profiled on the narrow specializations.

Entirely others were conditions in the beginning of the Great

Patriotic War. In particular were heavy the conditions of the treatment of the bullet breaks of the bones of extremities in the course of the first months of the war when for the troops/forces it was necessary to conduct complex defensive actions.

In connection with the conditions of the combat situation of wounded in the extremity with the break bones could not be held up for the prolonged period for the treatment in the intermediate stages and after rendering to their vitally necessary aid immediately they evacuated into the front line hospitals; however there, as a result of the frequent raids of hostile aviation, circumstances for the casualties was not always favorable.

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If in the first world war casualties felt themselves in safety, being found in 5-10 km from the line of combat, then into the Great Patriotic War evacuation routes, the hospital trains, evacuation stations and hospitals of some front sectors for the elongation/extent of several hundred kilometers underwent bombings from the air. In view of this of casualties during the hostile raid it was necessary to transfer in the bomb-proof shelter.

The treatment of casualties was reduced to their removal from

the condition of shock, primary processing of wounds, imposition of the transport immobilizing splints, after which they were sent to the following stage.

In the front line hospitals of casualties they subjected to thorough classification and they distributed on the specialized evacuation hospitals.

In view of the conditions of combat situation the specialized hospitals for the treatment of casualties with the break of the long tubular bones in the first months of war could be expanded/scanned only in the second echelon of the hospital basis of front, where casualties arrived on the average through 2 weeks.

In spite of the clinical circumstances in the front line hospitals and the possibility of applying in them any methods of the treatment of the breaks, in the first months of war was conducted treatment mainly by deaf gypsum bandages. Skeletal/skeleton traction/extension did not find during this period of wide application, since to leave casualties with the break of thigh in the front line hospitals for the long period, necessary for the skeletal/skeleton traction/extension, it was impossible. Casualties were subject to treatment in the hospitals of the rear of the country, in the front line hospitals they were held up only for

shifting/relieving the transport immobilization by splints by the therapeutic immobilization by gypsum bandages, and also for production in surgical interventions for the purpose of the elimination of the complications of wounds of infection. Casualties with complications, that were needing surgical interventions, were treated in the transport splints up to the elimination of complications.

In the first period of the Great Patriotic War with a change in the transport immobilization to the therapeutic was not always possibly to accomplish timely righting of broken ends and roentgenological supervision after their correct position. Therefore into the rear evacuation hospitals casualties arrived sometimes with the shortening, by deformation and by the incorrect position/situation of broken ends.

Since the periods of the delivery/procurement of casualties into the rear hospitals varied from 30 to 60 days, in them have time to develop secondary complications - contracture of joints, strain and shortening of extremities. During the first year of war in the rear hospitals such complications rescued by skeletal/skeleton traction/extension only in cases when it was not septic phenomena, but if they were, then main attention was given to the struggle with them; as a result of strain, shortening and contracture acquired

stable nature and unfavorably affected clinical outcome the wounds.

During the first year of the Great Patriotic War the procedure of the treatment of the bullet breaks by deaf gypsum bandages yet was not finally manufactured and standardized. Gypsum bandage frequently was laid with the abundant wadded gasket. For the gypsum coating of extremities were used the improvised apparatuses for the traction/extension and orthopedic tables, since yet it was not manufactured standardized orthopedic tables with the mechanical traction, which facilitates setting of broken ends and their retention in the correct position with the application of gypsum dressing.

Within this period appeared many improvised constructions/designs of plaster tables, the more or less facilitated imposition gypsum bandages.

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Among them it is necessary to name/call extension operating orthopedic table of V. T. Razumovskiy; reposition X-ray- plaster cast apparatus of G. I. Weinstein, apparatus for the traction/extension of I. G. Turovets, table of Ya. N. Redin, S. M. Dukhovskiy, S. I. Margolin, Ya. G. Dubrov, K. M. Klimov, N. N. Nazarov et al.

From the beginning of 1942 in the independent armies they began to secrete the specialized hospitals for the treatment of the bullet breaks of the bones of extremities. In these hospitals the casualties struck sometimes during the first two days. At many fronts already from December 1941 in the specialized hospitals FEP for the treatment of the bullet breaks of extremities began to extensively use deaf gypsum bandages. During this period combat operations occurred under Moscow, and casualties frequently arrived without any processing in the transport splints into the hospitals FEP, located in Moscow, where they underwent primary processing with the subsequent application of deaf gypsum dressing, after which they evacuated depthward the countries.

In 1942 for the treatment of bullet breaks were used mainly the deaf gypsum bandages which were laid in the army hospitals and in the hospitals of front line evacuation points. With the application of gypsum dressings they attempted to produce setting of broken ends with the aid of different thrust and devices/appliances to the improvised orthopedic tables. Was widely disseminated Ye. K. Nikiforovoy's table with attachments for the traction/extension on the units/blocks or propeller thrust. During this period greatly frequently were laid the gypsum bandages with the wadded gasket, the

so-called transport gypsum bandages, which in the rear hospitals were replaced by therapeutic gypsum bandages.

In the rear from the first year of war were already organized the specialized hospitals for the treatment of the bullet breaks of long tubular bones. In view of the fact that in the beginning of war gypsum technology was not not completely not modern, transport gypsum bandages in the rear were replaced by therapeutic gypsum bandages and skeletal/skeleton traction/extension. The latter already from the first year of the war very widely was used in the rear hospitals during the displacement of broken ends and the shortenings. Skeletal/skeleton traction/extension was limited to the series/number of contraindications.

After the late entry of casualties into the rear hospitals in them sometimes already attached/advanced the intergrowth of bones in the faulty position/situation. To resort to refracture and subsequent skeletal traction/extension at first they were not solved due to the frequent complications of osteomyelitis and by septic condition.

Only since 1943 they began to expand readings/indications to surgical intervention both in the front line ones and in the rear hospitals. For dealing with the septic condition they began to extensively use the examination of wounds and the secondary surgical

processing of the wounds of soft tissues and bones. "The greater the period from the day of wound, the greater the readings/indications to surgical intervention" (S. S. Gircglav). If the casualty after the entry had high temperature, anemia, chills, poor appetite, shift/shear of leukocytic formula to the left, gypsum bandage was removed/taken, extremity they thoroughly inspected, made the X-ray photographs and in the presence of readings/indications performed the repeated radical processing of bone wound and wounds of soft tissues with the removal/distance of the free broken ends bones and foreign bodies, with the carving of necrotic soft tissues, with the reposition of broken ends and by the subsequent application of deaf gypsum dressing in the correct position. The phobia to sharpen infection wounds by repeated intervention and fear to destroy granulating shaft in the septic condition of casualty proved to be exaggerated. The surgical method of radical processing was here most effective.

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In these casualties usually found in the wound the foreign bodies, necrotic tissues, accumulation of pus, incorrect position/situation of the broken ends, which compress soft tissues and disturbing blood circulation and, etc. All these unfavorable factors were the sources of the prolonged and constant stimulation/irritation of central

nervous system and reflector route/path they decreased the resistivity of organism against the infection, and also retarded the processes of regeneration in the wound. In the rear hospitals during the significant strains and the shortenings of extremities were frequently they began to resort to refracture with the subsequent imposition of skeletal/skeleton traction/extension, which considerably improved the outcomes of the bullet breaks of long tubular bones. Thus, operability, according to data of one of the local evacuation points, with the bullet breaks of long tubular bones in 1941 was calculated into 9.6c/o, in 1942 - into 13.6o/c, in 1943 - into 31.3o/o.

Is inversely proportionally to an increase in the surgical activity decreased the lethality, which in some rear hospitals was lowered with 1941 to 1944 four times.

For 1944 and 1945 the characteristically great expansion of volume and the closest approach to a line of combat of the specialized aid with the bullet breaks of long tubular bones, and also an increase in the surgical activity both with the primary and during the secondary surgical processing.

On all GBA were isolated the hospitals for the casualties with the bullet break of thigh and the wound of joints. In some armies and

fronts were isolated the specialized hospitals for the casualties with the break of the bones of shin however on the majority of fronts casualties with the break of the bones of shin, shoulder and forearm they underwent the primary processing of wounds on DMP, and then with their transport immobilization they directed into the general-surgical hospitals GBA. On GBF were only isolated individual hospitals or special separations/sections of large hospitals for the treatment of those wounded in the shin separately from obtained other forms/species wounds, and also the separation/section for the treatment of casualties with the break of the tubular bones of upper extremity. If those wounded into the thigh and the large/coarse joints specialized aid was rendered already in the hospitals of the first echelon GBA, then the specialized aid by that wounded the shoulder and the shin began only in the hospitals GBF.

During the primary and secondary surgical processing of the bullet breaks of the bones of extremities in last year of war were conducted the principles of maximally radical intervention. If in the first period of war primary processing was reduced in the majority of the cases to splitting up of wounds and removal/distance of free bone broken ends, then into 1944 and 1945, besides splitting up, began to more frequently use the more radical methods of processing wounds - carving of the crushed tissues both the removal/distance of free broken ends and also the sawing of the uncovered from the periosteum

bone fragments. For the provision of a drain of wound secret/secretion to wound they tried to attach funnel-shaped form, made contra-apertures, they focused attention on the wider surgical processing of bone wound. Already on DMP in this case attempted to remove from the wound all nonvital tissues, including bone broken ends the devoid blood supplies, surgeons' majority under the broken ends, deprived of blood supply, understanding the bone broken ends, completely isolated from the soft tissues. However, some surgeons (V. S. Levit) considered that all free broken ends, even connected with the periosteum, and also standing sharp ends of the proximal and extremital end of the break were nonvital, and therefore they are subject to subperiosteal removal/distance. During the processing according to V. S. Levit was removed bone marrow for the elongation/extent 1-2 cm.

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Subsequently, as showed experiment/experience, this excessive radicalism did not justify itself, since direct, and distant results proved to be more badly than during the ordinary processing of bone wound.

After the primary surgical processing of bullet breaks the thighs by casualty laid transport splints, and in order to ensure the

large durability of fixation, on DMF they fortified by their gypsum annuli. In the specialized hospitals inspected the wounds and made the X-ray photographs of the region of the break in two projections. In the case of the absence of complications and in the presence of the being all-inclusive processing transport immobilization they replaced by therapeutic immobilization by means of the deaf gypsum bandage.

If with roentgenography in the region of break revealed foreign bodies or large quantity of bone broken ends, and the general condition of casualty and the condition of wound indicated the developing complication, then in the specialized hospital performed expanded reworking the wounds of cdes by the supervision of X-ray photographs in two projections.

Processing wounds, setting of broken ends and the application of deaf gypsum dressing with the bullet breaks of the bones of lower extremities in the specialized hospitals produced on the special orthopedic tables with the mechanical traction. On these tables it was possible to attach to casualty any position/situation, including lateral, to inspect and to feel the place of break and to determine the position/situation of broken ends, and also for the purpose of the detection of foreign bodies and hematomas after splitting up of wound canal and expansion of wound by small hooks by rule of thumb to

directly inspect all depressions of wound.

This early and modern surgical processing to a considerable extent prevented the complications of the bullet breaks of the tubular bones of extremities and facilitated their subsequent course. During this period considerably were shortened the periods of the treatment of the casualties by transport immobilization. Thus, with the breaks of thigh for the purpose of therapeutic immobilization deaf, unpadded gypsum bandage was laid already in army specialized KHPPG.

During this period they began to more frequently use the roentgenological supervision of the correct position of broken ends after the application of deaf gypsum dressing as in the army ones, so especially in the front line hospitals. With the incorrect standing of broken ends the initially superimposed gypsum bandage was removed/taken and was laid new, using one-time traction/extension on the orthopedic table or on the apparatus for the traction/extension.

In this final period the wars with the bullet breaks of long tubular bones began more widely (at some fronts - to 200/o of cases) it is nearer to the front to use the method of skeletal/skeleton traction/extension. Casualties arrived into the front line hospitals in the majority of the cases with the well superimposed on GFA deaf

therapeutic gypsum bandage. From a number of those arrived repeated surgical processing with the removal/taking of gypsum bandage underwent not all casualties, but only those in which they revealed the unsatisfactory standing of broken ends, incorrectly, unsuccessfully superimposed initially gypsum bandage or complication of infection. In the latter/last cases in the front line evacuation hospitals greatly frequently was used skeletal/skeleton traction/extension with the subsequent application of gypsum dressing after the elimination of complications. During this period of the relative security of rear and front line hospital bases in the presence of readings/indications it was possible to more widely put to use skeletal/skeleton traction/extension, using it not only in the rear ones, but also in the front line hospitals.

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At some fronts already since 1943 with the bullet breaks of thigh on the wide scale was used the following method. After processing of wounds on DMP of casualties as rapid as possible, sometimes with the aid of the aviation, evacuated in the Diedrich's transport splints directly into the specialized front hospitals where they underwent comprehensive research. If wound was well processed and flowed/occurred/lasted without the complications, immediately after setting of break on orthopedic table was laid dead gypsum

bandage. If, however, was revealed significant displacement or the complication of wound of infection, then was applied cleole [? kleolovyy] or skeletal/skeleton traction/extension. Adhesive plaster and skeletal/skeleton traction/extension used to the elimination the displacement of broken ends or before the elimination of the complication of infection, after which they changed for the therapeutic immobilization by deaf gypsum bandage. According to S. I. Banaytis, the use/application of this method into 1944 and 1945 was such (Table 44).

From the preceding information it is evident that in 1944 into 85.90/o of cases in the front line hospitals was carried out the skeletal/skeleton or adhesive plaster traction/extension; with this 76.40/o of casualties with the break the thighs in 1944 arrived into the front line hospitals in the transport splints of Diedrich to the discharge of 10 days from the moment/torque of wound.

In 1945 the casualties, who were delayed in the army area, entered front line hospitals in the deaf gypsum bandages, while in the transport splints they entered with the possibility of delivery/procurement during the first 2-3 days and it is earlier which allowed in this year 72.60/o of casualties in the entry to render specialized assistance with the application of deaf gypsum dressing "from the administrative readings/indications with the

subsequent evacuation into the rear" (S. I. Banaytis).

S. I. Banaytis's data confirm role and value of early skeletal/skeleton traction/extension with the bullet breaks of thigh.

If the specialized aid with the bullet breaks of thigh was rendered on GBA or GBF during the first 2-3 days, then readings/indications to the skeletal/skeleton traction/extension were encountered comparatively rarely (3.0-5.0%).

Table 44. Character/nature and the periods of immobilization to the application of blind gypsum dressing with the bullet breaks of thigh in the front line hospitals in 1944-1945 (in the percentages).

(1) Наложение глухой гипсовой повязки	1944 г.	1945 г.
(2) Сразу после поступления	14,1	72,6
(3) После предварительного липкопла- стырного вытяжения:		
(4) в течение 3-7 дней	25,2	19,6
(5) " " 8-10 "	8,1	3,0
(5) После предварительного скелетного вытяжения:		
(6) в течение 5-7 дней	7,1	1,3
(7) " " 8-15 и более дней . .	45,5	3,5
(8) Итого . . .	100,0	100,0

Key: (1). Application of deaf gypsum dressing. (2). Right after entry. (3). After preliminary adhesive plaster traction/extension. (4). during days. (5). After preliminary skeletal/skeleton traction/extension. (6). during 5-7 days. (7). during 8-15 and more than days. (8). Altogether.

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But if it was held up to 10 and more than days, then usually were developed the complications, which served as reading/indication to the treatment in an open manner with the use/application of immobilization skeletal/skeleton traction/extension. As is shown the experiment/experience of some fronts, afterward early shown/rendered

(during the first 2-3 days) specialized aid in the majority of the cases it was possible to apply therapeutic immobilization by deaf gypsum bandage. Rendering to the specialized aid in GBA after wound usually soon prevented the complications of infection and made excessive the shift/relief of bandage in the front line ones and even in the rear hospitals.

On the reports of local and rear evacuation points (MEP and REP), in last year of war the casualties arrived into the hospitals in the well superimposed deaf gypsum bandages with the correct or satisfactory position/situation of broken ends, with the normal temperature in the absence of complaints.

But if, in spite of the early produced primary processing and the early shown/rendered in army KhFPG specialized aid, nevertheless was developed one or the other complication, in the front line hospital was removed/taken gypsum bandage, wound they subjected to repeated surgical processing and on the extremity again laid deaf gypsum bandage or they changed to the skeletal/ . leton traction/extension. This measure in last year of war in the specialized hospitals was used into 12.0-15.0c/o of all cases of the break of thigh. With the bullet breaks of the bones of upper extremity and shin skeletal/skeleton traction/extension was used only in the tenths of percentage.

Thus, the methods of the treatment of the bullet breaks of extremities during the Great Patriotic War gradually were developed and were improved.

Although the volume of surgical aid was closely related to the operational situation, the theater operations, the medical armament and to the provision with specialists' cadres, nevertheless for entire duration of war as red thread is passed the basic principle of the approximation/approach of the qualified surgical and specialized aid to a line of combat and manifestation of maximum surgical activity for the purpose of both prophylaxis and struggle with the complications.

As the basis of the treatment of the bullet breaks of long tubular bones were assured the following principles:

- 1) earliest possible rendering of first aid and the early carrying out/removal of casualties from the field of combat;
- 2) earliest possible imposition of standard splints for the transport immobilization;

3) prophylaxis of shock and struggle with it, and also struggle with hemorrhage, with the phenomena of exsanguination and taking the general/common/total measures, which raise the resistivity of organism;

4) the utilization of sulfanilamides, specific sera and antibiotics for warning/preventing the infection and for dealing with the developing complications;

5) earliest possible rendering to the first surgical qualified aid and the broad coverage of the casualties by the specialized treatment.

During the Great Patriotic War the first aid by casualty and their carrying out/removal from the field of combat usually continued uninterruptedly under the fire/light of enemy. This had special importance for the heaviest casualties with the break of the bones of lower extremity and with the damage of large vessels, since the timely rendering by them of first aid and most rapid carrying out/removal with such wounds were a question of life or death.

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Casualties with the break of the bones of upper extremities in

the majority of the cases themselves went out from under the fire/light, and sometimes they reached also BMP.

Carrying out/removal from the field of combat of casualties with the break of bones shins or thigh into the cover and the rendering of first aid were realized by aidmen, porters or comrades.

For the carrying out/removal of casualties with the break of the bones of extremities were used different substances and devices/appliances - overcoat, cape-tent, stretchers, boat-drag harrow or the improvised devices/appliances from the veneer.

It is especially convenient they were convenient for the carrying out/removal of casualties with the break of the bones of lower extremities boat-drag harrow and the sledge or the trolley/cart with the canine harness, which most frequently were used in the winter time in the sector of activity BMP.

First aid by casualty with the break of the bones of extremities consisted in the application of dressing on the wound, for which put to use first aid kit, and in the presence the hemorrhages - in the imposition of the styptic tourniquet. Sometimes one swallow of vodka with the morphine considerably tranquilized pains during the transport of casualty to BMP.

In the majority of the cases transport splints were laid by casualty on BMP, It is thinner/less frequent in the companies or on the spot of wound, moreover they were prepared from the improvised means.

For the immobilization of upper extremity most frequently used the splint of Cramer, covered of decked boats cotton, for the immobilization of the lower extremity of the splint of Diedrich or Vinogradov. In the company, on BMP and PMP transport splints were laid above the dress. On BMP after surgical processing the wounds of splint laid on the body. The splint of Diedrich fixed/recorded on BMP with gypsum annuli in the region breasts, elbow and talocrural joint.

With the bullet breaks of the bones of shin was most frequently used the immobilization by wire splints. However, experiment/experience showed that one posterior splint for the immobilization of the break of shin it is insufficient; therefore from the sides in the region of knee joint were added the two additional plywood or shorter wire splints of Cramer.

Prophylaxis of shock, struggle with the shock and blood loss. General/common/total measures, which raise the resistivity of the

organism of casualties with the bullet break of the bones of extremities. The bullet breaks of the bones of extremities greatly frequently were escorted/tracked by the overall heavy phenomena, connected initially with the shock and the blood loss, and subsequently - with the subsequent complications.

For the purpose of prophylaxis of shock with the bullet breaks of the bones of extremities they observed the cautious carrying out/removal of casualties from the field of combat with the subsequent use/application of narcotic drugs, transport immobilization, wrapping and heating of casualties.

Especially effective antishock method with the bullet breaks of the bones of extremities was the novocaine blockade of the place of break, which began to be used already from first half of 1943. During this period, according to S. I. Banaytis's data, novocaine blockade in the foremost stages was carried out into 49.00/o, whereas subsequently - into 65.00/o of all breaks of the bones of extremities. Novocaine blockade more frequently was used with the breaks of the bones of lower extremities (into 85.00/o according to S. I. Banaytis).

The effectiveness of novocaine blockade was greatest in the absence of the expressed symptoms of the developing shock; therefore

used it was to be within the earliest possible periods after wound.

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PMP is the first stage, in which had the capability to produce the novocaine blockade of the place of break during appropriate for this readings/indications. According to the data of the army surgeons Bogdanov and Voronkov, on PMP in different periods of offensive combat operations novocaine blockade was produced in 1.2-8.3c/o of all casualties, moreover most frequently it was used with the bullet breaks of femoral bone (from 69.0 to 94.5o/o).

After the novocaine blockade of the place of break were turned off/disconnected extero- and interreceptive impulses/momenta/pulses, which go to the cerebral cortex, considerably was improved cardiac and respiratory/breathing activity. In the subsequent stages of evacuation novocaine blockade with the breaks was used rarely, since after surgical processing and good immobilization of extremities the necessity for it disappeared.

For dealing with the shock and with the blood loss with the bullet breaks of the bones of extremities on PMP and the subsequent stages extensively used transfusion the blood and different antishock solutions.

Almost with all bullet breaks of the bones of extremities were noted changes in the cardiovascular and respiratory/breathing activity, increase in the temperature, change in the picture of the blood, shifts/shears of the acid-base equilibrium and other biochemical changes in the blood.

These changes in the general condition of casualties with the bullet break of the bones of extremities depended on deep shifts/shears in the organism, which occurred under the effect of the nervous reflex impulses/moments/pulses which could be explained, only on the basis of I. P. Pavlov's exercise about the completeness of organism, about the interconnection of the occurring in it changes and about the regulating effect of cerebral cortex on all physiological and pathological processes in the organism.

Upon the setting of the diagnosis of bullet break was estimated not only the condition of wound place of break and extremity, but also the condition of wounded - health, temperature, blood pressure, pulse, respiration, picture of the blood, neurologic status.

During the treatment of the bullet breaks of the bones of extremities considerable attention was paid to the general condition

of casualties, therefore, already beginning from the foremost stages, was conducted the treatment not only of wound and break, but also casualty, on the basis of the presentation/concept "about the completeness" of organism.

The laid soon after wound transport immobilization had as a goal to prevent the arrival of nervous reflex painful pulses from the place of break. The same target pursued the novocaine blockade of the place of break and the introduction of pain relievers during the transport of casualties with the break of bones. The blood transfusion also was used for the action on the general/common/total resistivity of organism, lowered/reduced by blood loss and excessive stimulations/irritations of nervous system.

After primary surgical processing the casualties with the bullet break underwent the specialized treatment, primary task of which was multilateral action on the organism of casualty for an improvement in the reparative processes. Are here involved, first of all, the repeated blood transfusions the intensive nourishment, the vitamin therapy (mainly the use/application of vitamins C and D) and the medicinal/medicamentous therapy, which improves cardiac and respiratory/breathing activity. Casualties with the bullet break were found under the systematic observation of the traumatological surgeons, and in their treatment they took part therapist and

dietician.

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In the food of casualties with the bullet break predominated milk-vegetable and protein products, since during the prolonged suppurative process in connection with the infection of bone wound and the rejection/separation of necrotic tissues of organism daily lost with pus a significant quantity of tissue protein, in the organism was disturbed calcium balance, was developed hypoproteinemia and occurred the impoverishing of bone system by calcium salts. For replenishing the significant expenditure/consumption of protein they diminished calcium salts it was required the food, rich in worthy animal proteins, by calcium salts and by vitamins C and D, which regulate calcium metabolism/exchange in the organism.

However, from the first days of treatment the casualties with the bullet break for improvement of the activity of cardiovascular and respiratory/breathing system were occupied by respiratorily/breathing, it is therapeutic and general hygienic gymnastics. Extensively was used the functional treatment, which was consisting in the early movements of extremity, to the load of individual muscular groups and entire extremity.

High value in an increase in the general/common/total resistivity of organism had the extensively used in casualties with the bullet break physiotherapy which decreased the pains, improved blood circulation, it contributed to the resorption of inflammatory edema and infiltrate.

Very large is merging/coalescence by the course of wound process and the general/common/total resistivity of organism with the bullet breaks of the bones of extremities just as with other heavy wounds, is exerted the high morale and political awareness of casualties.

All casualties obtained the daily being all-inclusive political information and situation reports; the regular conversations with the casualties, which elucidated position/situation in the country and at the fronts, invariably/unchangedly contributed to maintenance in the casualties of the cheerfulness of spirit and tendency faster to recover in order to be returned to the front.

First surgical qualified aid with the bullet breaks. First surgical aid by casualty with the bullet break of the bones of extremities was rendered on CMP; it was called the primary surgical processing of wounds in contrast to the late surgical processing, produced within the late periods during the infection of the not processed previously wound.

The target of the primary surgical processing of wound was warning/prevention of the development of infection in the wound and creation of the conditions, favorable for its healing.

The primary surgical processing of bullet breaks was at the same time and the beginning of the specialized aid, since the significant part of the casualties with the bullet break, that were subjected to primary processing, no longer needed surgical interventions.

With the bullet breaks of the bones of extremities the primary surgical processing of bone wound had its special features/peculiarities as a result of the observed with them pathological changes in bone and its surrounding soft tissues.

Soviet anatomical pathologists (I. V. Davydovskiy, A. V. Smol'yannikov, A. P. Avtsyn, S. M. Derizhanov) in detail studied the finest structure of bone with the bullet breaks. The significant sectors of bone are primarily necrotized as a result of the direct trauma, the hemorrhages and the jolt of bone. Furthermore, the individual sections of bone are necrotized secondarily as a result of the damage of the soft tissues, which surround bone, the thrombosis of arteries and veins of bone and compression of the feeding bone

vessels by inflammatory edema.

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The presence of the necrotic sectors of bone and soft tissues retards and impedes the regeneration of bone and the coalescence of break and contributes to the development of infection in the necrotic tissues. In order to accelerate and to lighten the process of the regeneration of bone tissue and surrounding bone soft tissues and to prevent the development of infection, it is necessary as early as possible to remove entire nonvital from the wound (bone and soft tissues), leaving in the wound only viable bone and undamaged/uninjured soft tissues, capable of the regeneration, to create the favorable conditions of drain from the wound of the infected wound secret/secretion.

Hence becomes clear the attention which gave the Soviet surgeons to processing "bone wound" with the bullet breaks of the long tubular bones, and the requirement of maximum radicalism some Soviet surgeons' on the part during the primary processing of bone wound.

As readings/indications to the the primary surgical processing bullet breaks served large wounds with the turned entrance and outlet, swellings or hematomas in the soft tissues, and also the

presence of foreign bodies and bone fragments in the surrounding tissues.

In some of the milder cases of the bullet breaks of the long tubular bones, in particular with the perforating bullet wounds with the point entrance and outlet, and also with the breaks one bone alone on the shin and forearm in the absence of swelling, and also hemorrhage and hemorrhage from the wound, in the presence of perforated or edge/boundary breaks - primary surgical processing was not performed. On the data of the deepened development, the primary surgical processing for the different reasons it did not undergo by 33.10/o of all casualties with the bullet break, 24.50/o - with the bullet break of thigh, 24.40/o - with the bullet break of the bones of shin, 30.30/o - with the bullet break of shoulder bone and 44.50/o - with the break of the bones of forearm. From the preceding information it is evident that the greatest percentage of primary processings was observed with the breaks of thigh and shin and that the contraindications to the primary processing were encountered the more frequently, the easier there were the wounds and the less there was the size/dimension of the damaged bone.

Procedure of primary surgical processing with the bullet breaks of long tubular bones. Processing wounds with the breaks not shoulder, the forearm and the shin more frequently was performed

under the local anesthesia, but with the breaks of thigh under narcosis. The very rarely radical processing of a deep wound of thigh or shin it was possible to perform painless under the local anesthesia. Cerebrospinal anesthesia although sometimes and was used during processing of the bullet breaks of thigh and bones of shin, it had the essential deficiencies, which limit its use/application. Its most essential defect was a significant decrease in arterial pressure, which was that especially contraindicatedly wounded into the thigh and the shin, that were being located able of shock or by recently brought out from it. The comparative technical complexity of this form/species of anesthetization also did not contribute to its wide use/application.

The work experience of the specialized hospitals showed that processing wounds with the breaks of the bones of lower extremity it is best to produce on the orthopedic table with the traction/extension for both extremities, since it is possible to create convenient access to the wound, arranged/located on the posterior or lateral side of extremity with the utilization of a lateral inclination/slope of table.

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In the absence of this table it was necessary to put to use one-two

aidmen's aid who during the operation/process held extremity in the elevated position/situation, and during processing of wound, arranged/located from behind or on the side, turned casualty.

Processing wounds with the bullet breaks required a good knowledge of topographic anatomy, technical ability, good assistance, sufficient quantity of instrumentation and good illumination in the depth of wound. As the most rough error was considered processing wound with the bullet breaks without assistant's aid, since without it could not be spread and inspected wound, could not be found and bandaged in the depth of wound the bleeding vessel.

A sufficient quantity of instruments was required so that in the course of operation/process it would be possible to replace the contaminated clamps, scalpels, forceps and shears by pure/clean ones. The basic goal of the primary surgical processing of wounds were removal/distance from the wound of the crushed nonvital tissues, fragments of bones, of foreign bodies, saved blood, stop of hemorrhage and creation of favorable conditions to the drain of wound secret/secretion.

From the surgeon during the primary processing of the wound of soft tissues and bullet break of bone was required the ability rapidly to examine the topography of wound area and to differ

healthy/sound tissues from the tissues of those damaged and nonvital. First of all one ought not to have cut all over all contaminated tissues which came into contact with foreign body, clothing and hair, carried into the wound by fragments or bullet.

Skin they cut all over only in the cases of its significant damage and contamination and then is very economical - on 0.5-1 cm from the edge of wound. With deep wounds for the creation of the best access it was necessary to expand wound aperture sections/cuts along the axis of extremity upward and downward. Contaminated subcutaneous cellular tissue they cut all over all over periphery of wound aperture. Fascia cut all over in the form of long oval for the provision of a hiatus of wound and creation of favorable conditions to the drain of wound secret/secretion (Fig. 33, 34 and 35).

Especially thoroughly cut all over the contused and nonvital muscles, which usually took the form of the tarnished torn muscular fibers, bleeding, and which are not reduced with the gripping by their toothed forceps. Carving was best entirely produce with sharp/acute Cooper ones shears or by sharp/acute scalpel in the limits of viable tissues. The boundaries of carving were determined depending on the special features/peculiarities of each wound, its form/species, depth and interrelations with the vessels and the nerves.

With a deep wound of the thick layer of muscles the section/cut is made longer, the skins of muscles cut all over for the greater elongation/extent than internal. However, compulsorily was considered the disposition of large vessels and nerves which under no conditions was not to be either crossed/intersected, or uncovered. To examination/inspection and to the carving of nonvital tissues in the depth of wound contributed breeding/culture/dilution of the edges of wound by small hooks. Experiment/experience showed that all manipulations in the wound on the carving of muscles, the removal/distance of the fragments of bone and the stop of hemorrhage had to be produced under the control of view (Fig. 36 and 37).

With the operation/process compulsorily revealed and unloaded hematomas, and damaged vessels lardaged.

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The detection of the damaged vessels helped operation without the tourniquet, since hemorrhage caused damage of vessel. However, during the processing tourniquet it relied to keep by that superimposed on extremity, but that not tightened so that with the suddenly opened/discovered abundant hemorrhage it would be possible

to immediately tighten tourniquet and to stop blood flow.

It was sometimes greatly difficultly reveal/detect in the wound the shortened ends of the torn vessel which nevertheless could give subsequently large hemorrhage. In such cases where on the basis of localization of wound was assumed the damage of vessel, one should have with dull small hooks expanded wound, with the aid of gauze tips moved apart muscles in that place where is located the neurovascular bundle, and to bandage the shortened ends of the damaged vessel.

In spite of stopping of hemorrhage, during the surgical processing it was assumed/set to find and to bandage in the wound all damaged vessels to avoid secondary hemorrhages, since the dressing of the vessel higher than wound for the elongation/extent for the most part did not guarantee from the secondary hemorrhages which with the bullet breaks were especially risky.

Special attention was given to processing bone wound. All free fragments of bone from the wound area, and also from muscle mass, where they were introduced at the moment of wound, completely they removed. Were subject to removal/distance the fragments, connected with the scraps of periosteum and torn muscles. However, surgeons' majority retained those connected with the periosteum and with the undamaged/uninjured muscular tissues the larger/coarser fragments of

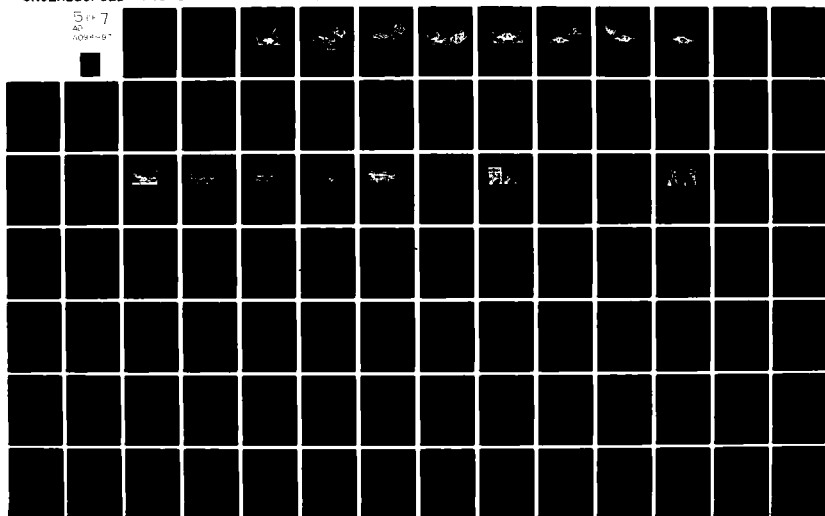
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FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OH F/G 6/5
EXPERIENCE OF SOVIET MEDICINE IN A GREAT PATRIOTIC WAR 1941-1945--ETC(U)
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bone, since they presented that by plastic material, which necessary to organism for educating the callus on the spot of break (Fig. 38).

The sharp/acute standing in the wound broken ends of bone, bared from periosteum, leveled by the Gigli saw or they bit sharp/acute by cutting pliers (Fig. 39). Bone marrow was removed only in such cases if there was a visible by rule of thumb compression of bone trabeculae or a depression in it of bone fragments. undamaged/uninjured bone marrow they usually retained.

With the perforating wounds with the break of the bones of extremities thus was treated the outlet in order to convert wound canal into two cone-shaped areas, which converge by its summits in the region of the break of bone.

With the blind-end wounds with the break of the bones of extremity, if after processing of wound remained a deep area, which does not have output/yield for the wound secret/secretion down, it was necessary to artificially create contra-aperture.

The disposition of the wound area it was necessary to estimate, on the basis of the horizontal position of casualty on the spin. The delay of the drain of the wound infected secret/secretion is connected with the abundant reproduction/multiplication of microflora

in wound contents in maximally favorable for reproduction/multiplication microbes the conditions of natural "thermostat" and "nutrient medium".

The delay of drain from the wound leads to the education of a significant quantity of microbial toxins, their absorption, decomposition of wound barrier and dissemination of infection beyond the limits of wound area, and also to a change of the conditions of osmotic pressure in the wound and an increase in the absorption of wound contents.

As showed the experiment/experience of the Great Patriotic War, with the bullet breaks of the bones of extremities to the wounds, which have the form of bowl, it was necessary to shape in the form of infundibulum with the wide aperture and a good drain down. It was necessary to attend to so that the output/yield from the infundibulum would not be constrained by the shortened muscles, which was achieved either by the carving of special canal in the muscles, or by the stitching of the aponeurosis in the depth of muscles, or by the abandonment of drainage, which communicates the lowest department of wound with the posterior (lower) surface of extremity.

Page 128a.

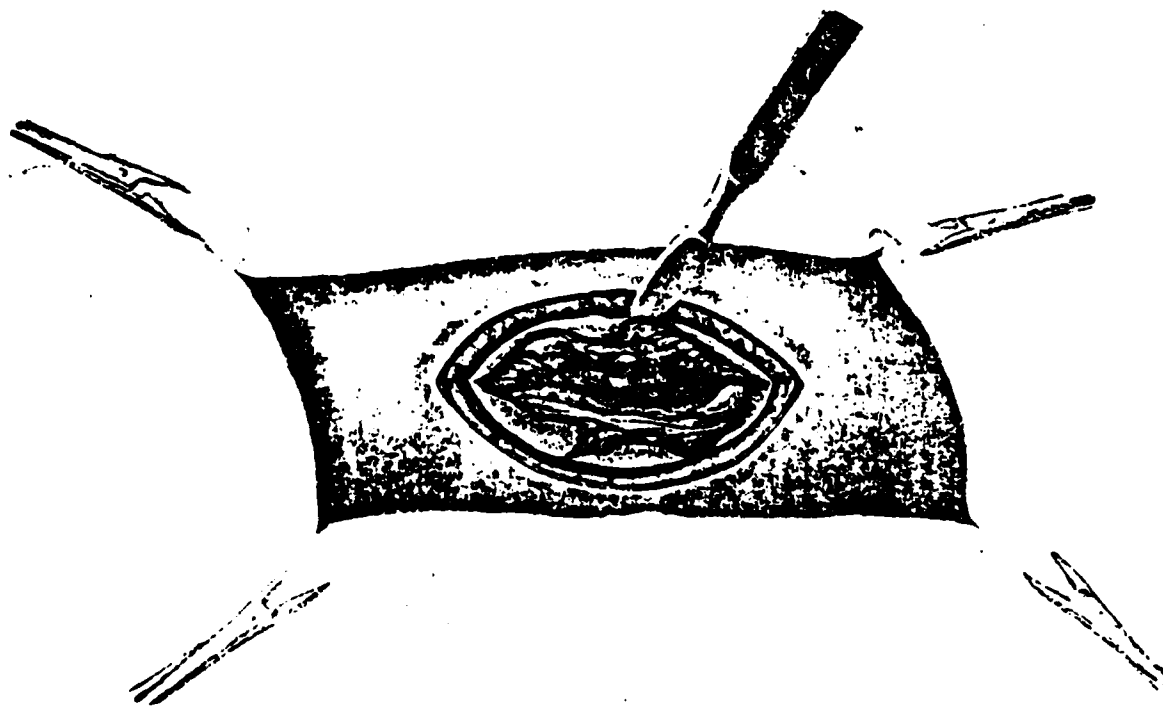


Fig. 33. Primary surgical processing of bullet break of thigh (figure from nature). First moment/torque an operation-carving of the crushed skin. (Artist Ya. V. Blagoveshchenskaya).

Page 128b.

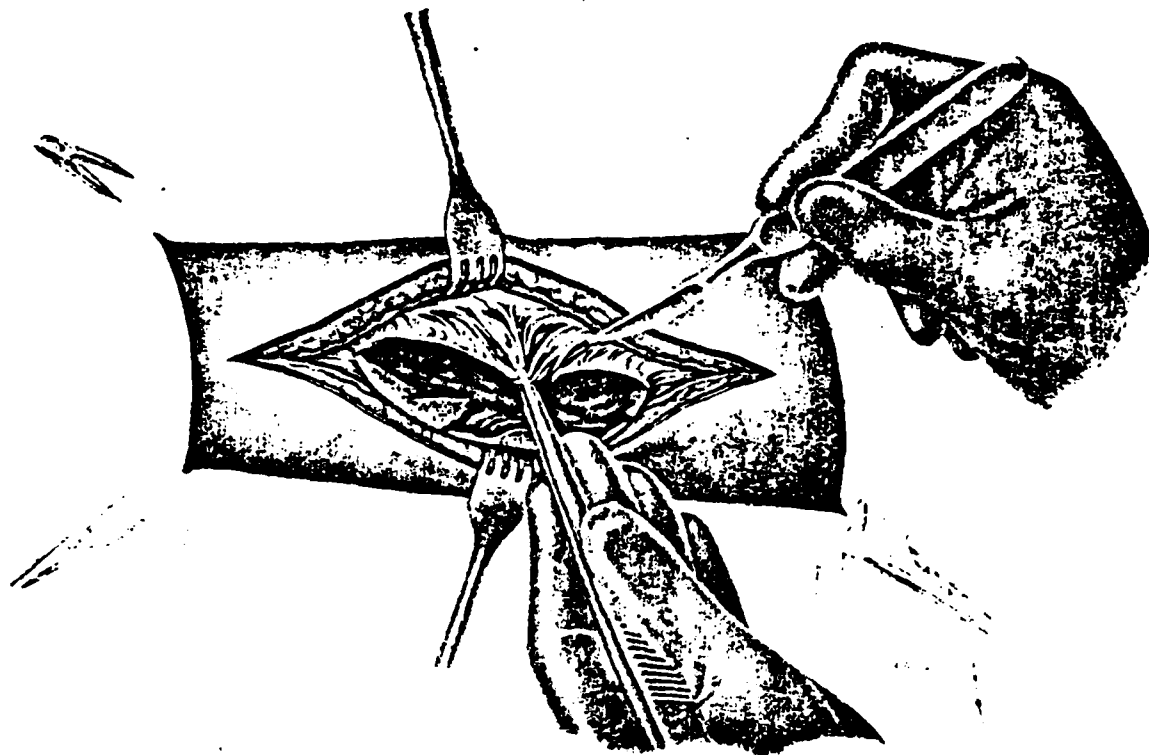


Fig. 34. Primary surgical processing of bullet break of thigh. Second moment/torque of operation/process - carving of subcutaneous cellular tissue together with the skin. (Artist Ye. V. Blagoveshchenskaya).

Page 128c.

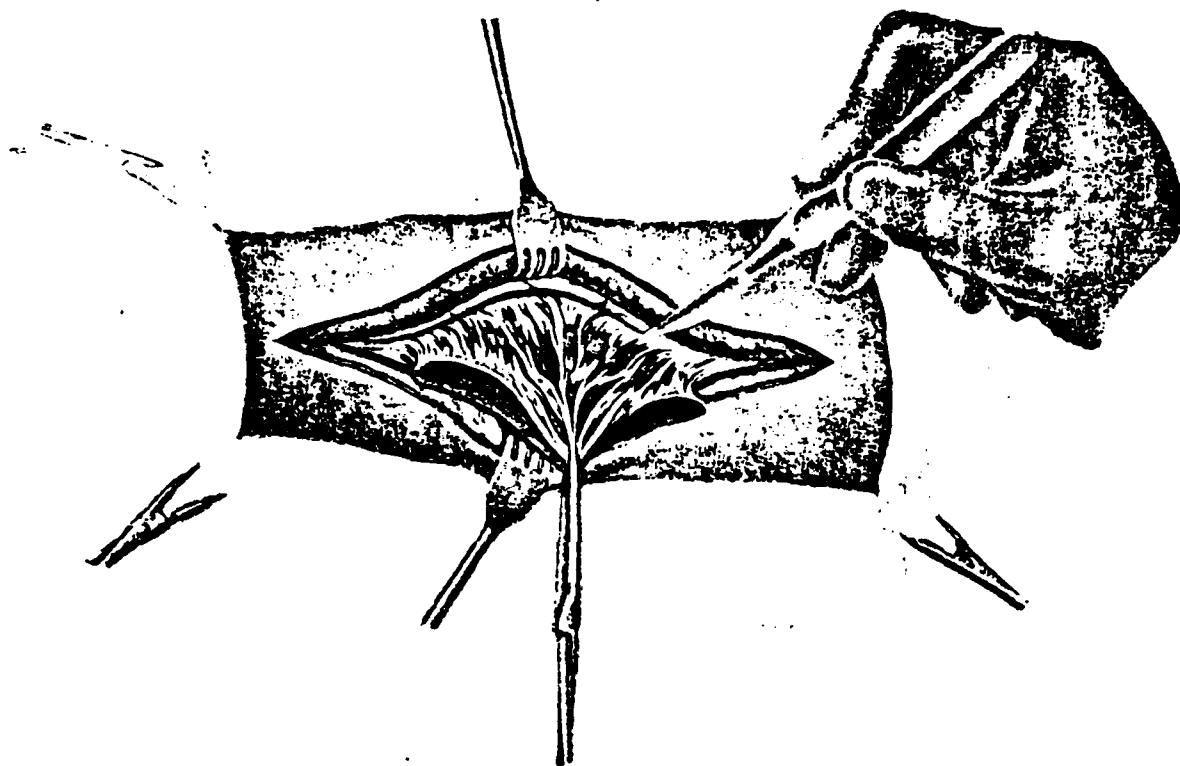


Fig. 35. Primary surgical processing of bullet break of thigh. Third moment/torque of operation/process - splitting up of fascia. (Artist Ya. V. Blagoveshchanskaya).

Page 128d.

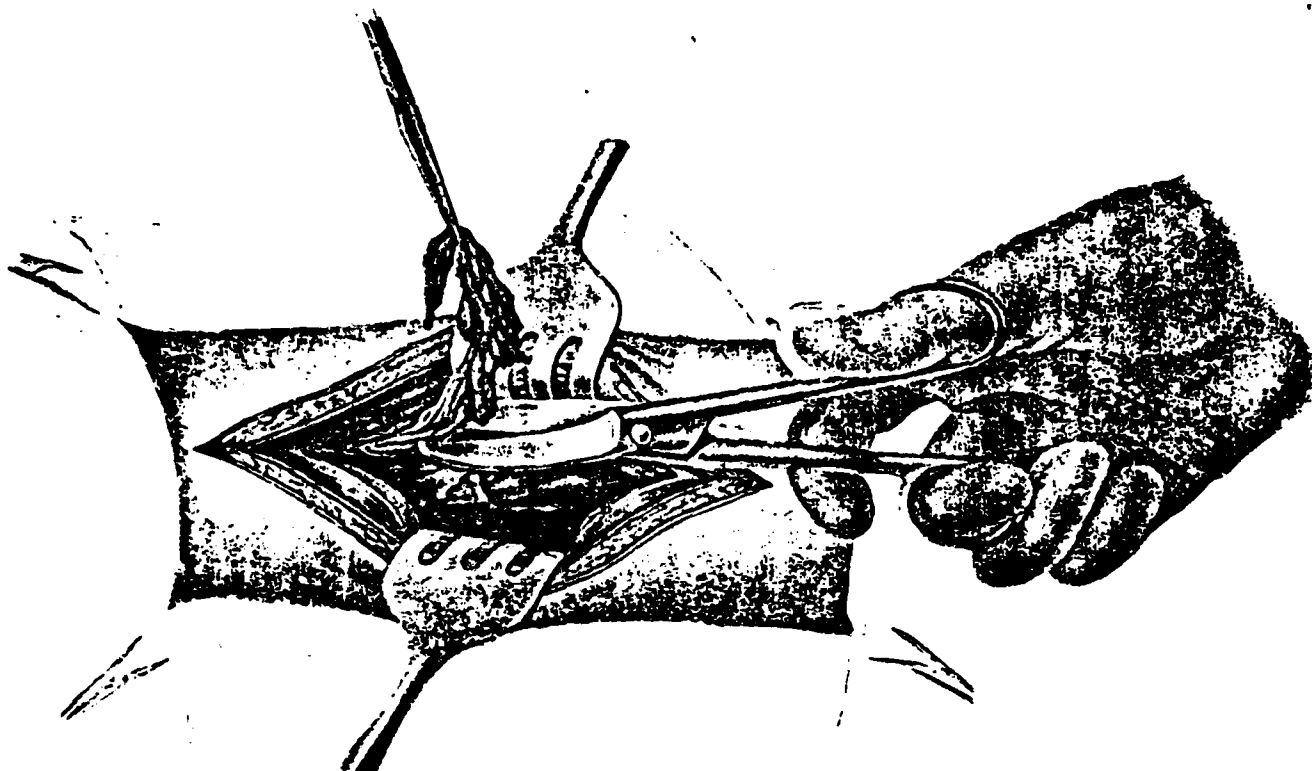


Fig. 36. Primary surgical processing of bullet break of thigh. Fourth moment/torque of operation/process - carving of the crushed muscle.
(Artist Ye. V. Blagoveshchenskaya).

Page 128e.

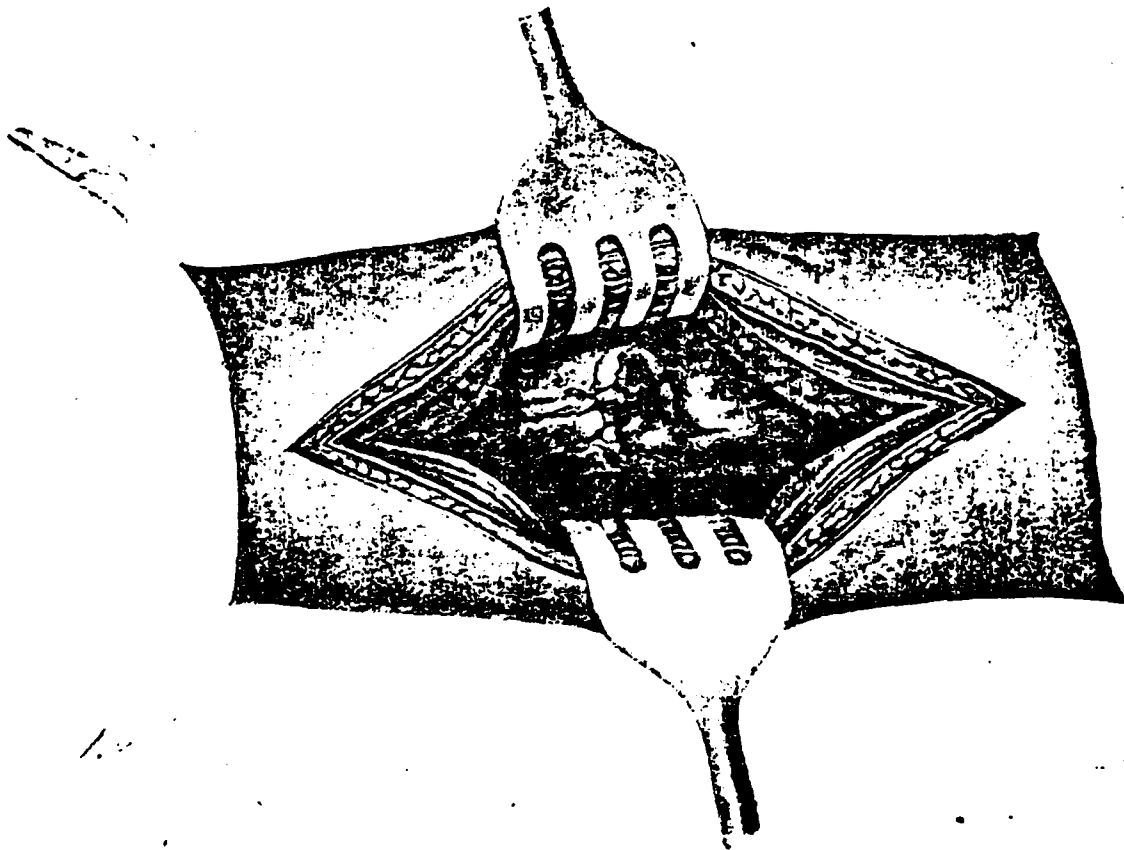


Fig. 37. Primary surgical processing of bullet break of thigh. Fifth moment/torque of operation/process. Form/species of the wound before processing of the crushed bone after the carving of the crushed soft tissues. (Artist Ye. V. Blagoveshchenskaya).

Page 128f.

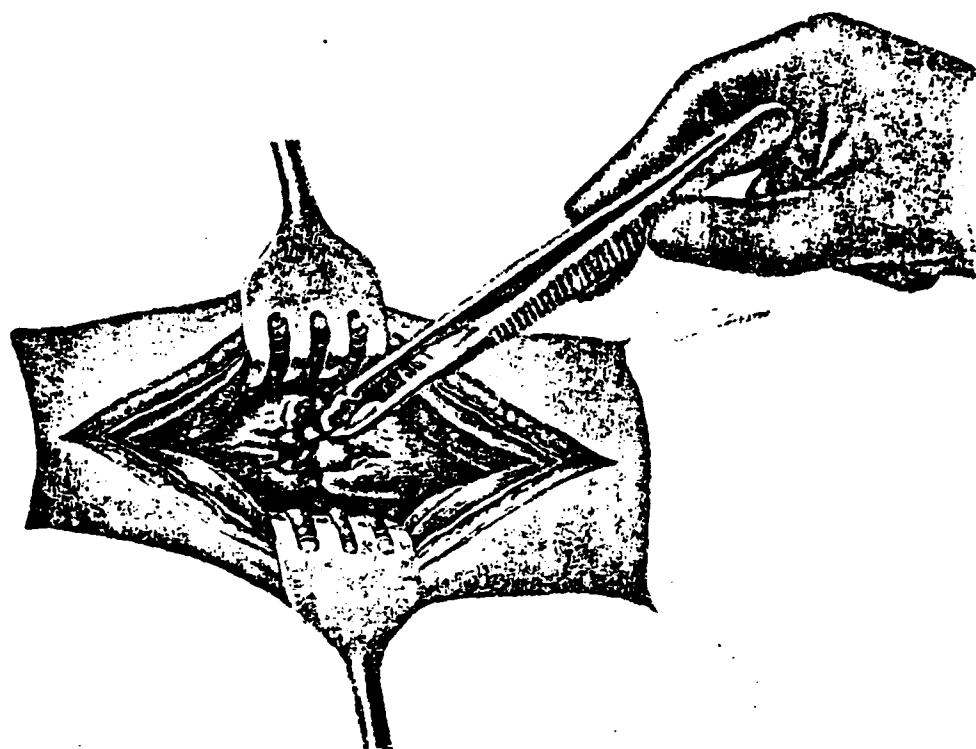


Fig. 38. Primary surgical processing of bullet break of thigh. Sixth moment/torque of operation/process - removal/distance of the free bone broken ends, which were revealed/detected after the traction/extension of extremity. (Artist Ye. V. Blagoveshchenskaya).

Page 128g.

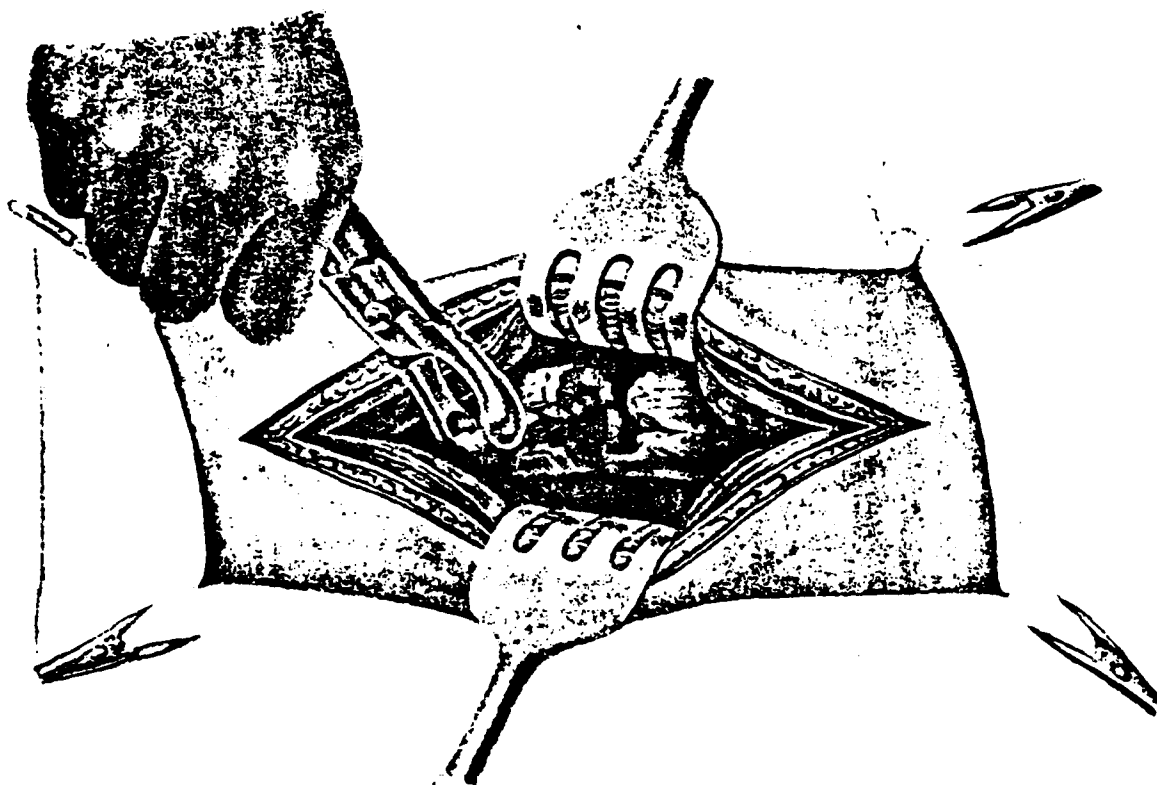


Fig. 39. Primary surgical processing of bullet break of thigh.
Seventh moment/torque of operation/process - removal/biting off of
the sharp edges of the connected with the periosteum broken ends.
(Artist Ye. V. Blagoveshchenskaya).

Page 128h.

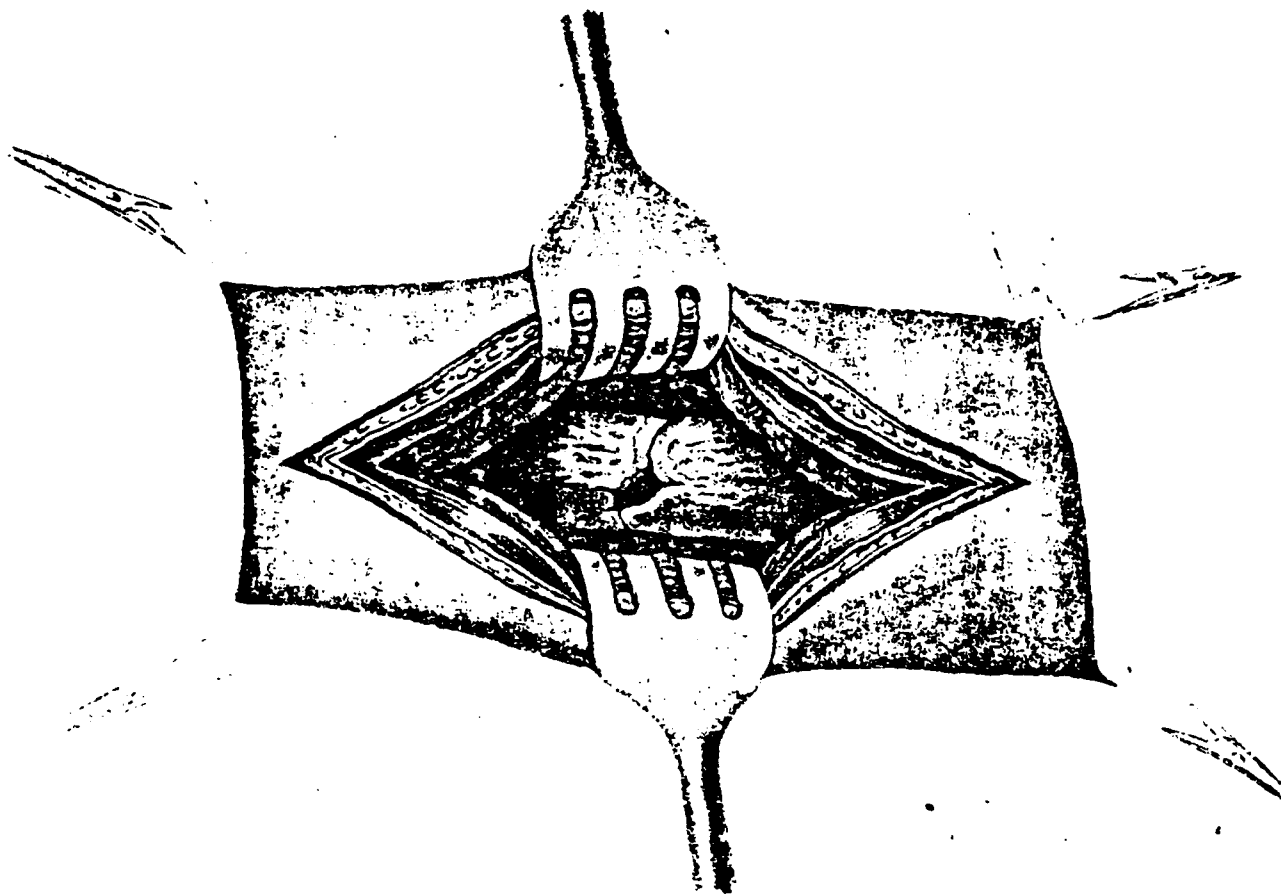


Fig. 40. Primary surgical processing of bullet break of thigh. Eighth moment/torque of operation/process. Form/species of wound after the removal/distance of nonvital tissues and reposition of broken ends. (Artist Ye. V. Blagoveshchenskaya).

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The primary surgical processing of wound was finished with introduction to the wound of antiseptic substances or antibiotics. The best effect was obtained from atomization into earlier than sulfanilamides and penicillin (5000 units of penicillin to 1.0 powder-like streptocides or sulfathiazole), from the irrigation of wound by the solution of penicillin (500-1000 units in 1 cm³), and also by the solution of chloramine or hypertonic solution of common salt.

After the primary surgical processing of wound to the scraps of bone added correct position and extremity was fixed/recorded with standard transport splint or deaf gypsum bandage.

Late primary processing. The primary surgical processing of the bullet breaks of the bones of extremities usually is performed on ^{DMP} in the first twenty-four hours and first hours after wound. However, according to the conditions of the combat and medical situation in certain cases it were produced also within the later periods.

During the Great Patriotic War they forewent the proving to be erroneous position/situation, that the primary surgical processing,

produced late, can destroy granulating shaft and cause septic phenomena. Late primary processing was, of course, less advantageous than the primary processing, produced into the first hours after wound, but also with the late primary the processing, produced into the first hours after wound, but also during the late primary processing were obtained the best results, than in the case of the failure of it within one or another the period. On this basis for entire duration of the Great Patriotic War in the majority of casualties with the break the primary processing of wounds was conducted independent of the periods of the delivery/procurement of casualties.

During the late primary surgical processing of the bullet breaks of the bones of extremities it passed to consider the presence of infection not only into earlier, but also beyond its limits. Especially dangerously and stormily flowed/occurred/lasted the early developing in the wound anaerobic infection. This complication radically changed entire character/nature of the primary surgical processing of the bullet breaks of the bones of extremities.

Anaerobic infection could develop in the wound in the first twenty-four hours and hours after wound. If in such cases primary processing was performed to the second day, then infection could be disseminated already far beyond the limits of wound canal; then only

output/yield was the amputation of the extremity higher than place of the dissemination of anaerobic infection. In this, first of all, and was expressed the negative side of late primary surgical treatment. With early arrival surgical processing still could prevent the development of anaerobic infection and save extremity, whereas after the late entry of casualty with the signs of anaerobic infection very frequently only the amputation of extremity rescued the life of casualty.

But if the signs of anaerobic infection after the bullet break of extremity it was not, then late primary processing was performed on the same rules, as processing fresh wounds. Readings/indications to the carving of necrotic or nonvital tissues remained valid and during the late processing of wounds, the creation of the completely drain of wound secret/secretion in the period of festering wound acquiring exceptional value.

During the primary surgical processing of the bullet breaks both in the period of festering and in the fresh cases some surgeons used the method of the washing of wound with the digested (boiled) water with the liquid potassic green soap by wads on the long forceps.

With this method fine/small foreign bodies, fragments of bone and blood clots were removed by mechanically strong water jet from of the arranged/located highly above the level wound the Esmarch vessels. However, this method did not find wide acceptance in the army and army therapeutic installations.

Was used also the reception/procedure of the stitching of skin to deep fascial intermuscular interlayers, in order to ensure the hiatus of wound and to prevent the joining of the edges of muscles and the occlusion of wound canal by the stuck out and edematic muscles. However, soon and from this method surgeons' majority refused, since in by mash weld beveled edges was frequently developed infection.

Secondary surgical treatment of wounds with the bullet breaks of the bones of extremities. If the primary surgical processing of bullet break was produced incompletely or, in spite of is sufficiently the radically produced primary processing of break. During the Great Patriotic War the bullet breaks of the bones of extremities frequently (pg. 132) underwent primary processing on DMP, and to reworking in the specialized hospitals (Table 72, pg. 162). Thus, was obtained the two-moment processing of bullet breaks. However, frequently these two moment/torque were divided by small time interval, in terms of the greater unit interval from one to

several days. Arose question, does have sense to perform the surgical processing of wounds with the bullet breaks of the bones of extremities at two moments/torques and not better to concentrate this processing on one stage and to produce it completely one time. Conditions, necessary for the full/total/complete being all-inclusive processing of bullet breaks of the bones of extremities, could be created only in specialized hospitals. Therefore, code according to the conditions of the combat and medical situation of these casualties it was possible to deliver during the first day after wound in specialized army or front line ^{Kh}PPG, there could be realized one-time surgical processing with the utilization of x-ray examination, qualified surgical aid and special equipment for setting of broken ends and application of therapeutic immobilization.

However, in extremely variable combat and medical situation of the Great Patriotic War it was not possible to guarantee the delivery/procurement of all wounded with the break of bones extremities into specialized army (or front line) hospitals in the first twenty-four hours after wound. However, to leave casualties without the aid in the waiting of their delivery/procurement into specialized hospitals was inadmissible as a result of the danger in anaerobic infection, which most frequently was developed during the late surgical processing.

Therefore when the delivery/procurement of casualties with the break of the bones of extremities into the specialized hospitals was held up on day and more, is performed the two-moment surgical processing: the first moment/torque - to DMP for the purpose of prophylaxis of complications, and the second moment/torque in specialized KhPPG, if the clinical course of wound and x-ray examination revealed the defects of processing on DMP.

Very frequently the surgical processing, produced on DMP, was so high quality that in specialized KhPPG was produced only the testing x-ray examination, after which without the additional processing was laid therapeutic gypsum bandage.

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In other cases even the most radical and completely produced on DMP or in specialized KhPPG processing of wound with the utilization of the modern orthopedic equipment and x-ray examinations did not prevent subsequently of complications and did not eliminate the need for repeated surgical processing.

This is explained by the fact that both with the primary and during the repeated surgical processing of the bullet break of bone it is very difficult, and sometimes even could not be accurately

recognized and completely removed nonvital soft tissues or bone broken ends. The fact is that the so-called signs of the lack of vitality of these tissues are so little characteristic which to the operating surgeon greatly frequently was difficult to accurately establish/install the boundaries of the dissemination of the primary traumatic necrosis of the soft tissues and bone.

Furthermore, it was necessary to be counted also the possibility of "successive necrosis" both the soft tissues and bone, in spite of the radically produced primary surgical processing.

This is confirmed by the fact that bullet osteomyelitis most frequently was encountered (see that 16) with the multifragment and crushed breaks, in spite of the most radical methods of processing with the removal/distance of bone fragments and even with the cross resection of the fragments of bone.

To the force of the led consideration it was not possible to carry all cases of repeated surgical processings with the bullet breaks to the defects of primary surgical processing. In certain cases the repeated surgical processings, which were being produced in the subsequent stages of evacuation, was conditioned on the development of the "successive necrosis" of bone or soft tissues.

As reading/indication to the secondary surgical processing served pain in the wound, high temperature, swelling of the extremities, which fixed edematous of the edge of wound aperture, the presence in wound of foreign bodies and free broken ends of bone, detected in the X-ray photograph, and the continuous hemorrhage from the wound.

Reworking of the bullet breaks of the bones of extremities consisted in the addition of section/cut with respect to found in the X-ray photographs changes, in the carving of the remaining uneliminated/unremoved necrotic soft tissues, in the removal/distance of foreign bodies and not connected with the periosteum fragments of bone with the addition in certain cases of contra-apertures for an improvement in the conditions of the drainage of wound area. After processing were used antiseptic preparations, antibiotics, produced setting of broken ends on the plaster table and was created therapeutic immobilization with the aid of the deaf gypsum bandage or the skeletal/skeleton traction/extension.

Specialized treatment with the bullet breaks of the bones of extremities. In view of the significant severity of the clinical course of the bullet breaks of bones the extremities and the frequently observed with them severe complications already from the very beginning of the war of the casualties, who obtained heaviest

wounds with the bullet the break of thigh, concentrated in the special hospitals which began to be called specialized. Initially these hospitals were created in the deep rear, then in the front line and army rear. The same hospitals and separations/sections were created in a deep and front rear for the treatment of the bullet breaks of the bones of shin, shoulder and forearm.

The specialized aid with the bullet breaks of the bones of extremities began from the primary surgical processing which was produced most frequently on DMP and in KhPPG of the first line or, which occurred more rarely, in specialized army KhPPG of the second line.

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third of casualties (33.10/o) with the bullet break of the bones of extremities did not undergo on different reasons primary surgical processing. In 77.20/o of casualties with the bullet break of the bones of extremities was produced primary surgical processing on DMP, while in 16.90/o in KhPPG of the first or second line (in specialized KhPPG).

In the significant part of the cases (49.90/o of breaks of shoulder, 58.30/o of bones of forearm, 35.40/o of breaks of thigh,

27.30/o of breaks of the bones of shin) this primary surgical processing achieved its target: she prevented the development of infection and subsequently it contributed to the smooth course of break. In these cases further specialized aid consisted in the roentgenological supervision of the position/situation of bone broken ends, the imposition of therapeutic immobilization and in the complex functional treatment.

In another, sufficiently significant part of the cases, in spite of the produced primary surgical processing (on DMP or in KhPPG of the first line), breaks were nevertheless complicated by infection.

With the bullet breaks of the bones of the extremities, which were complicated by infection, in the specialized hospitals performed comprehensive clinical and X-ray examination, secondary surgical processing and used therapeutic immobilization into 13.10/o of bullet breaks the thighs by skeletal/skeleton traction/extension, and in the remaining cases by deaf gypsum bandage or by splints.

The therapeutic exercise and the physiotherapy comprised also here the essential unit of the complex functional treatment.

Into the concept of the specialized treatment with the bullet breaks they entered: 1) the refinement of the diagnosis of break and

associated complications with the utilization of all clinical ones and of the roentgenological method of the research: 2) the surgical processing of wound (primary and during the appropriate readings/indications secondary); 3) struggle with the complications; 4) setting of broken ends on the orthopedic table or with the aid of the skeletal/skeleton traction/extension; 5) the application of therapeutic deaf gypsum dressing; 6) roentgenological supervision for the position/situation of broken ends; 7) functional complex treatment (with the utilization of physiotherapy and therapeutic gymnastics).

Thus, and the primary surgical processing of fresh wounds, and the late, and secondary surgical processing of the infected wounds with the bullet breaks were the individual elements of the general/common/total single system of the specialized treatment of the bullet breaks of the bones of extremities, which was being conducted during the Great Patriotic War.

Organization of work in the specialized surgical field mobile hospital for the treatment of the bullet breaks of thigh and large/coarse joints - hip and knee. The surgical processing of wounds with the bullet breaks of thigh and application of therapeutic immobilization by deaf gypsum bandage or by skeletal/skeleton traction/extension were the very work consuming processes, which

required the special preparation of the doctors and trained average/mean and auxiliary medical personnel, and also special equipment. Significant difficulties presented the process of the medical processing of those wounded the thigh, since the removal/taking the immobilizing splint and the washing of extremity were conjugated with the additional trauma, to the accomplishment of that not admitted in casualties with fracture of thigh, that were in heavy state.

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Therefore at some fronts in the specialized hospitals was manufactured for rendering aid by casualty with the break of thigh the special system, which reduced to the minimum the traumatization of casualties with the transference, transfer and to medical processing, and also during the X-ray examination. The observance of basic rule/handspike - as far as possible to less shift casualty during all manipulations - was achieved by the fact that the casualty remained on the same stretchers, on which he was delivered with the transport immobilization, up to the moment/torque of his transfer to the orthopedic table.

On the removal/taking from the motor vehicle the casualty on the stretchers entered sorting, where to him was measured the temperature

then in the X-ray room where to it on the same stretchers made X-ray photographs in two projections, and hence into the preoperation. Here to casualty were introduced by intravenously 1-1.5 cm³ 10/o solution of morphine, after which they undressed, was removed/taken from the thigh splint and carefully they shifted by completely bared to the orthopedic table, fixing/recording with special attachments lower extremities in the elongated position/situation.

On the orthopedic table thoroughly, without causing pain, shaved off hair and washed entire body, putting to use bast wisp, by soap and by warm water from the jug. After the removal/taking of bandage region the wounds to the period of washing covered/coated with sterile towel. After the end of the washing of casualty they wiped by towels, covered/coated with pure/clean sheet and on the orthopedic table, placed on rollers, brought into the operating room, where yielded the X-ray photographs. Surgeon began the questions, the examination/inspection and the thorough research of casualty, and then the examination/inspection of wound and X-ray photograph.

If the primary processing of wound was not performed or there were readings/indications to reworking, surgeon produced on the same table under narcosis or under the local anesthetization surgical intervention and under the control of eye, via feeling and with the aid of the thrust in the orthopedic table were established/installed

bone broken ends in the correct position.

After operation/process and setting of broken ends table with the casualty in operated surgeon's accompaniment they transported into the plaster room where the special plaster brigade in the composition of nurse and two trained aidman-cast appliers laid under the observation of surgeon deaf gypsum bandage.

If primary surgical processing was produced on DMP and no readings/indications to reworking there was, in the operating room was produced only setting of break, after which casualty they transported on orthopedic table into the plaster room for the application of deaf gypsum dressing.

At the plaster room the casualty lay/rested on the orthopedic table to the moment/torque of indurating the gypsum - 20-30 minutes, after which it they shifted to the special meshed shield on which they transferred in the special hotly heated and well ventilation ward where the casualty remained 8-12 hours - to the full/total/complete drying out of gypsum. Of this ward he several days. In this case they controlled by photograph the position/situation of broken ends, they explained further course of wound and possibility of further evacuation.

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If revealed anaerobic infection, casualty of the preoperation on the same table and with the same splint, and sometimes directly from the sorting or the X-ray room they directed into the separation/section for the casualties with the anaerobic infection where was performed medical processing and surgical intervention.

In certain cases with the examination/inspection in the operating room or after surgical intervention the surgeon made the decision to subject casualty to treatment by skeletal/skeleton traction/extension to the application of deaf gypsum dressing and in the operating room he here introduced spoke into the bone and fortified clip. Such casualties they directed in the ward where was conducted treatment by skeletal/skeleton traction/extension.

Procedure of the impsition of the deaf gypsum bandages, which were being used in the specialized breaks of the bones of extremity. From a large quantity of proposed within the time of the Great Patriotic War orthopedic tables most convenient and most widely used proved to be the table of the institute of the name of N. V. Sklifosovskiy (Fig. 41). This table is made from the tree/wood, it has metallic propeller thrust for the traction/extension of two lower extremities, metallic rod - stop/emphasis for the perineum with the

support/socket for the pelvis, support/socket for the breast, omitted board- support/socket for the pelvis and worm worm gear - for the lateral inclinations/slopes of entire table. Table easily is dismantled and occupies little place with the transportation. Table can be placed on the small wheels which makes it possible to transport on it patient of one room into another, without disturbing traction/extension.

With the lowering of a board-delivery to patient it leans mainly on the thoracic and pelvic board- supports/sockets, which makes it possible to freely wash entire body of patient, and during the operation/process provides free access to the posterior and lateral surfaces of body and both lower extremities. With the application of gypsum dressing this table gave the possibility to solidly hold extremities and the broken ends of bones in the correct position, leaving free for the cover/roof/pavement with gypsum body, pelvis and both extremities.

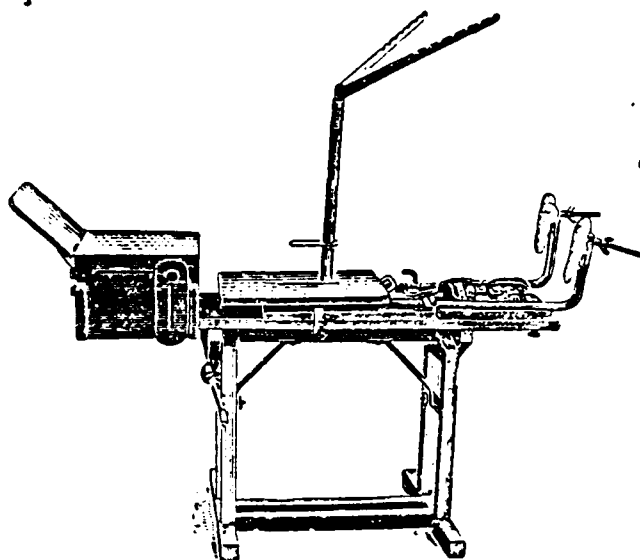


Fig. 41. Orthopedic and extension table of the institute im. N. V. Sklifosovskiy.

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Fig. 42 depicts preparator/training for the imposition as the hypo-owl of bandage in casualty with the break of right thigh. Both lower extremities after setting of broken ends are fixed/recorded by thrust. Pelvis and breast rest upon the support/socket. Knee joints for preventing the sag are hung on the gauze strips. To the bone prominences (rump, iliac bones and inguinal bend) are superimposed the cotton-gauze cushions, while to the breast - oil cloth bag in by inserted in it two sheets in order to create under the bandage free space in the region of front/leading thoracic wall.

Fig. 43 depicts the application of the deaf gypsum dressing: on the body are superimposed two wide gypsum casts, while to the extremity - front/leading and posterior cast. These casts are fixed/recorded in three places by the circular courses of gypsum bandage. Further (Fig. 44) are superimposed two the so-called locking casts to the region of groin and hip joint.

Fig. 45 shows further strengthening cast by the circular courses of bandage and release steps from the lady's mantle. Fig. 46 shows bandage in the completed form/species and extraction from under the bandage first of sheet from the oil cloth bag, and then bag itself. Wooden support/socket is raised under the pelvis and gypsum bandage leans on it by wide surface, which safeguards from its break. Metallic supporting/reference rod is extracted, and casualty can be moved to the shield for the drying of gypsum bandage.

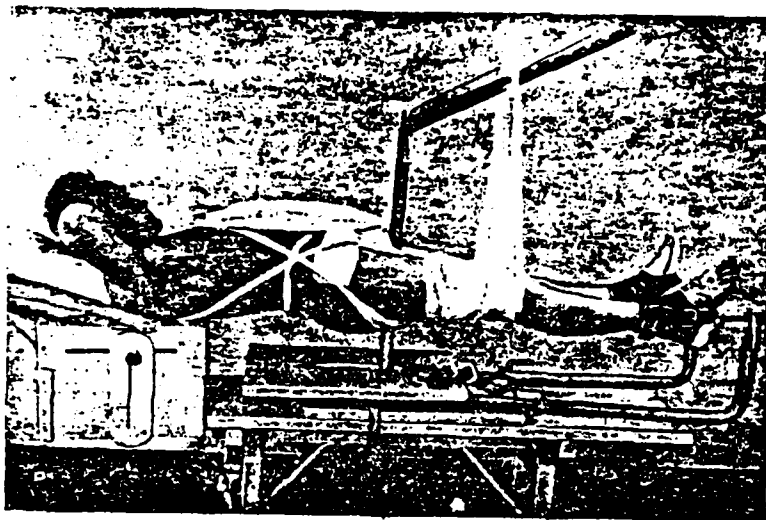


Fig. 42. Application of hip plaster dressing with bullet break of right thigh on the orthopedic table of the institute of name N. V. Sklifosovskiy. First moment/torque - casualty is packed on the table and is prepared to the application of hip gypsum dressing.

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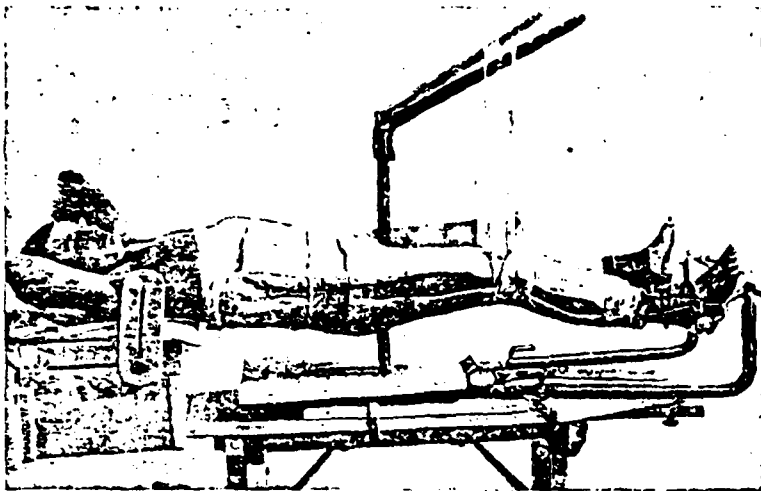


Fig. 43. Application of hip gypsum dressing with bullet break of right thigh on orthopedic table of institute im. N. V. Sklifosovskiy. The second moment/torque - to casualty are superimposed cast on the body, front/leading and posterior cast to The right lower extremity.

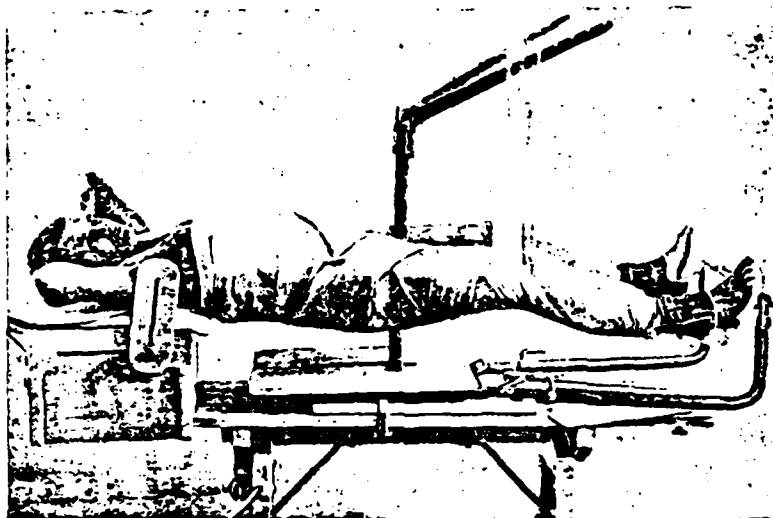


Fig. 44. Application of hip gypsum dressing with the bullet break of right thigh on the orthopedic table of the institute im. N. V. Sklifosovskiy. The third moment/torque - to casualty after consolidation the gypsum bandages of the preceding casts superimposed two casts, the so-called locking, in the region of groin and hip joint.

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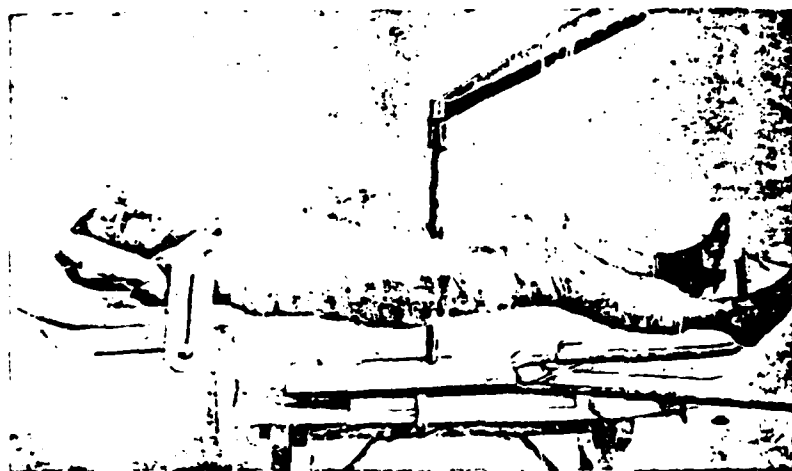


Fig. 45. Imposition by hip hypc-cwl of bandage with bullet break of right thigh on orthopedic table of institute im. N. V. Sklifosovskiy. The fourth moment/torque - casts are attached by gypsum bandages.

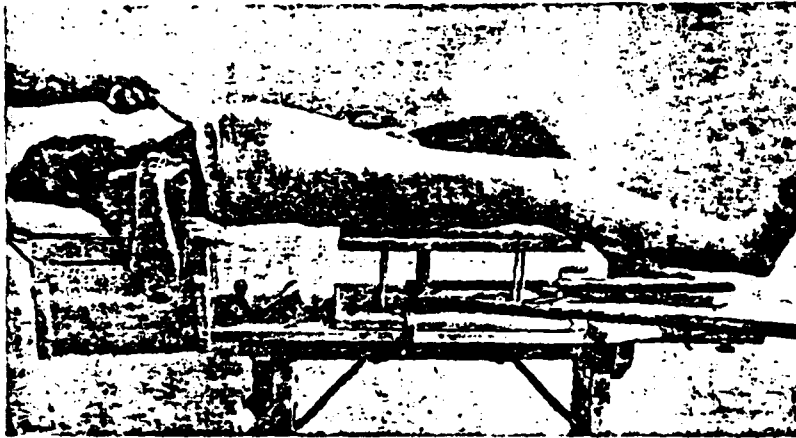


Fig. 46. Application of hip gypsum dressing with the bullet break of thigh on the orthopedic table of the institute im. N. V.

Sklifosovskiy. The fifth moment/torque - after consolidation stops by gypsum cast and with gypsum bandages is finished the process of the application of dressing by the removal/distance of oil cloth cushion/pad from chest.

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Fig. 47 depicts preparation/training for the application of deaf thoracobrachial plaster dressing. Hand is suspended/hung from the gauze strips in the position/situation of flexing in the elbow under straight/direct angle and is diverted. To the breast is put on gauze shirt.

Fig. 48 and 49 depict the imposition of the corset on the body even of two casts on the shoulder, one long cast goes from the scapula of healthy/sound side over the posterior surface of shoulder and on the cubital edge of forearm and hand to the basis of fingers/pins, and another is placed into the bearing/angle between the chest and the shoulder from crest of iliac bone to the elbow joint. Assistant produces the traction/extension of shoulder for the forearm, and surgeon sets break and are fixed/recorded casts with the circular courses of gypsum bandage.

Fig. 50 depicts the thoracobrahcial bandage in the completed form/species. Casualties with the bullet break of shoulder, bones forearms and shin specialized aid rendered in the majority of the cases in the specialized separations/sections of front line evacuation hospitals.

Therapeutic gypsum bandages in the majority of the cases were laid directly on the body and on the wound without the wadded gasket in order to use hygroscopic properties of gypsum.

As delivery to the shift/relief of gypsum bandages they served: the presence of infecticus complications, hemorrhage, incorrect position/situation of broken ends, defects of gypsum bandage - fractures, short gypsum bandages, the excessive soaking of bandage by pus.



Fig. 47.



Fig. 48.

Fig. 47. Application of thoracotrachial gypsum dressing with bullet break of right shoulder with utilization of orthopedic table of institute im. N. V. Sklifosovskiy. The first moment/torque - to casualty after the suspension/mounting of upper extremity to the levers of the table of the institute im. N. V. Sklifosovskiy is put on gauze shirt.

Fig. 48. Application of thoracotrachial gypsum dressing with bullet break of right shoulder with utilization of orthopedic table of institute im. N. V. Sklifosovskiy. The second moment/torque - to casualty are superimposed two gypsum casts on the body.

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Basic principles of the treatment of the complications of the bullet breaks of the bones of extremities in the front line and rear hospitals. Surgical tactics in the relation to different complications with the bullet breaks during entire war was expressed in a gradual increase in the surgical activity in all stages. The significant part of the casualties with the bullet break of the bones of extremities underwent the repeated operations/processes (Table 45) .

From Table 45 it is evident that that with the breaks of the bones of lower extremity the operations/processes were produced more frequently than with the breaks of the bones of upper extremity. A great quantity of operations/processes is produced with breaks of both bones of shin (71.00/o) and thigh (61.00/o). This is understandable, since the wounds of the lower extremities of distance a greater quantity of complications were escorted/tracked by the heavier decomposition of tissues, than the wound of upper extremities.

It is necessary to emphasize that the surgical activity in the front line and rear hospitals for a period of 4 years of war continuously increased/grew. Thus, according to the data of the deepened development, a number of operated in the army, front line and rear hospitals casualties with the bullet break of thigh composed in 1941 49.9% in 1942 - 53.8c/c, in 1943 - 60.9o/o, in 1944 - 63.3o/o and in 1945 68.2c/o.

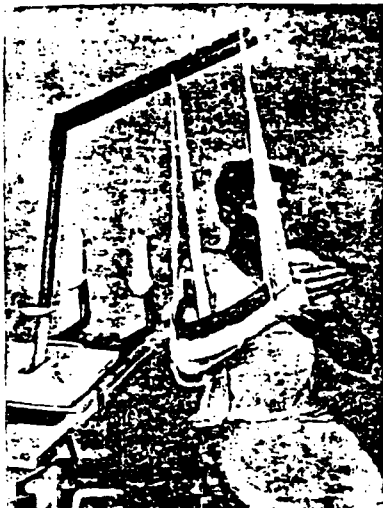


Fig. 49.



Fig. 50.

Fig. 49. Application of thoracotrachial gypsum dressing with bullet break of right shoulder with utilization of orthopedic table of institute im. N. V. Sklifosovskiy. The third moment/torque - after strengthening by the gypsum bandages of the preceding casts are superimposed the casts: 1) to the back of upper extremity; 2) to inside of shoulder with the stop/emphasis on the body.

Fig. 50. Application of thoracotrachial gypsum dressing with bullet break of right shoulder with utilization of orthopedic table of institute im. N. V. Sklifosovskiy. Fourth moment/torque - .

thoracobrachial bandage in the completed form/species after the consolidation of the preceding casts by gypsum bandages.

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This surgical activity was justified by an improvement in the functional results, by a descent in the percentage of complications and lethality. The systematic use/application of therapeutic physical exercise, the utilization of mechanic-therapeutic equipment and physiotherapy contributed to the acceleration of recovery and to improvement in the functional results with the bullet breaks of the bones of extremities.

Table 45. Distribution of casualties with the break of the bones of extremities according to a quantity of produced operations/processes, besides the primary processing (in the percentages).

(1) Количество операций	(2) Огнестрельный перелом							
	(3) плечевой кости	(4) лучевой кости	(5) локтевой кости	(6) обеих ко- стей пред- плечья	(7) бедрен- ной кости	(8) больше- берцовой кости	(9) малобер- цовой кости	(10) обеих ко- стей го- леней
(11)								
1 операция	68,5	75,5	74,5	72,5	53,2	62,2	65,6	58,8
2 операции @	22,3	19,8	19,7	22,6	28,2	26,3	23,5	28,4
3 "	7,4	3,7	4,4	3,5	11,7	8,4	7,2	9,2
4 " @	1,3	0,7	1,1	1,4	4,5	2,3	2,8	2,5
5 операций	0,4	0,2	0,2	—	1,7	0,5	0,8	0,7
6 "	0,1	—	—	—	0,4	0,2	0,1	0,3
7 "	—	—	0,1	—	0,2	0,1	—	—
8 "	—	0,1	—	—	0,1	—	—	0,1
(12) Итого	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
(13) Всего подвергалось опе- рациям	46,6	26,4	30,4	39,9	61,0	60,7	47,6	71,0

Key: (1). Quantity of operations/processes. (2). Bullet break. (3). shoulder bone. (4). radiation/radial bone. (5). ulna. (6). both bones of forearm. (7). thigh bone. (8). tibia. (9). fibular bone. (10). both bones of shin. (11). operation/process. (12). Altogether. (13). In all it underwent operations/processes.

Periods of rendering aid by casualty with the bullet break of the bones of extremities.

Honored Scientist professor is the lieutenant general of medical service N. N. Yelanskiy.

Keeping in mind to avoid the development of complications, to periods rendering aid by casualty in the Great Patriotic War paid considerable attention.

Table 46.

(1) Локализация перелома	(2) Стадия медицинской эвакуации	(3) Поле боя		БМП (фельд- шер) (6)	ПМП (врач) (7)	(8) Итого
		(4) само- и взаимно- помощь	(5) санитар			
(9)						
Плечо		35,5	53,3	2,4	8,8	100,0
(10) Предплечье		37,0	51,6	2,9	8,5	100,0
(11) Бедро		28,8	55,9	3,8	11,5	100,0
(12) Голень		30,8	54,6	3,7	10,9	100,0
(13) В среднем		32,7	53,9	3,3	10,1	

Key: (1). Localization of break. (2). Stage of medical evacuation.
 (3). Field of combat. (4). self-mutual aid. (5). aidman. (6).
 feldsher. (7). doctor. (8). Altogether. (9). Shoulder. (10). Forearm.
 (11). Thigh. (12). Shin. (13). On the average.

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First aid by casualty with the bullet break of the bones of extremities, as a rule, exerted into the first hours after wound on the field of battle aidman, casualties themselves (self-help) or comrades (mutual assistance). Frequently aid rendered on BMP or PMP paramedics or doctors, moreover in such cases it was simultaneously and first aid. This occurred when that obtained wound was located at the moment of wound near BMP or PMP. As frequently proved to be first aid in the different stages, evidently from Table 46.

Thus, from the materials of the deepened development it is evident that the first aid in the company sector was shown/rendered on the average into 86.6c/c (among other things by aidman into 53.9o/o). First aid coincided with first aid on the average into 13.4o/o. Self-help and mutual assistance were used with the wounds of upper extremity more frequently than by lower, and the coincidence of first aid with first aid with the breaks of the bones of lower extremities was noted more frequently than with the breaks of the bones of upper extremities. This is explained by the fact that original dressing and an immobilization of upper extremity it was more easily carry out, the lower, where frequently it was necessary to free/release extremity from the foot-wear.

A great number of casualties obtained first aid into the first hours after wound, whereas moreover on the years of war was noted steady increase in the quantity of the casualties, who obtained aid in the first hour after wound (Table 47).

Table 47. Distribution of casualties with the bullet break of the bones of extremities with respect to the time of rendering of first aid according to the years of war (in the percentages).

(1) Срок оказания помощи в часах	(3) плечо			
	(7) первая	(8) вторая	(9) третья	(10) четвертая
1-й	61,5	69,4	73,2	79,7
2-3-й	15,4	12,2	9,8	8,8
4-5-й	8,1	5,1	3,6	3,1
6-й и позже (11)	15,0	13,3	13,4	8,4
(12) Всего. .	100,0	100,0	100,0	100,0

(2) Локализация перелома и год войны											
(4) предплечье				(5) бедро				(6) голень			
(7) первая	(8) вторая	(9) третья	(10) четвертая	(7) первая	(8) вторая	(9) третья	(10) четвертая	(7) первая	(8) вторая	(9) третья	(10) четвертая
72,2	77,6	80,2	84,6	53,3	61,8	66,8	72,3	61,4	69,2	72,0	78,5
11,9	8,9	7,3	6,2	14,7	11,2	7,7	8,5	17,3	12,0	9,9	8,4
8,6	2,3	2,7	1,6	7,0	5,1	4,6	4,1	6,0	4,0	3,1	3,0
9,3	11,2	9,8	7,6	25,0	21,9	20,9	15,1	15,3	14,8	15,0	10,1
100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0

Key: (1). Period of rendering aid in the hours. (2). localization of break and year of war. (3). shoulder. (4). forearm. (5). thigh. (6). shin. (7). the first. (8). the second. (9). the third. (10). the fourth. (11). and it is later. (12). In all.

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Thus, the periods of rendering of first aid each year of war were shortened, in particular with the breaks of shoulder, shin and thigh, which was caused by the more rapid carrying out/removal of casualties as a result of the successful offensive of the troops/forces of the Red Army during the latter/last three years of war.

However, it is noted that the casualties with the break of the bones of upper extremities obtained aid into the first hours in the greater percentage of the cases, than casualties ones with the break of the bones of lower extremities. This is explained by the fact that the casualties with the break of the bones of upper extremities were more active than casualties with the break of the bones of lower extremities, why they obtained earlier first aid.

For the comparative evaluation of the periods of rendering of first aid according to the combat operations/processes cite data of the deepened development, which concern two combat operations/processes (Table 48).

From the preceding information it is evident that with the bullet breaks of shoulder and bones of shin the periods of rendering

of first aid of later 6 hours were shortened more than three times, and with the breaks of thigh almost one and a half times.

All this tells about the progressed improvement in the organization of first aid by casualty with the break of the bones of extremities during the Great Patriotic War.

The conditions for combat and the character/nature of area relief strongly affected the periods of rendering of first aid. Thus, V. N. Pomosov gave the following information about the rendering of first aid by casualty during combat in Carpathians: 83.00/o of casualties first aid obtained for the first hour, 13.30/o - for 2 hours, 3.10/o - for 4 hours and 0.60/o - not later than 6 hours. V. N. Pomosov noted that in the company sector in the mountain-forest locality the medical support to realize considerably better and is simpler. Natural terrain forest integument make it possible comparatively to safely to crawl and select casualty. This makes it possible to also draw nearer BMF the chain of the advancing/attacking subunits. The difficulties of the search of casualties in the mountain-forest locality were facilitated by the : approximation/approach of medical links to a chain of the advancing/attacking subunits for the provisor with them coupling constant.

Table 48. Distribution of casualties with the bullet break of the bones of extremities according to the time of rendering of first aid during the combat operations/processes on the rout of the Fascist-German troops/forces in the environs of Moscow - M and in the environs of Berlin - B (in the percentages).

(1) Боевая операция	(2) Локализация перелома	(3) Час после ранения				(5) Всего
		1-2	2-3-2	4-5-2	6-2 и позже (4)	
М	(6) Плечо	56,0	20,6	7,8	15,6	100,0
Б		91,4	4,3	—	4,3	100,0
М	(7) Предплечье	71,6	16,7	3,5	8,2	100,0
Б		89,8	3,4	—	8,8	100,0
М	(8) Бедро	50,8	16,1	10,5	22,6	100,0
Б		66,6	11,1	6,4	15,9	100,0
М	(9) Голень	52,9	24,1	6,5	16,5	100,0
Б		84,4	7,8	2,6	5,2	100,0

Key: (1). Combat operation/process. (2). Localization of break. (3). Hour after wound. (4). and it is later. (5). In all. (6). Shoulder. (7). Forearm. (8). Thigh. (9). Shin.

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With the rendering to first medical aid were amended the shortages, allowed with the rendering of first aid, and was laid transport immobilization. If the periods of the delivery/procurement of casualties on BMP and PMP had important value, then even greater

value had the periods of primary surgical processing.

The periods of production in the primary surgical processing of casualties with the bullet break of the bones of extremities depended on many reasons: from the periods of the delivery/procurement of casualties, from the stage, in which was performed the primary perfecting of a break, quantity of the casualties entering, presence of the qualified surgeons, organization of surgical work on the stage and many others.

Despite the fact that the periods of production in the primary surgical processing determined many factors, was noted with each year of war a steady increase in the number of cases of the primary processing of wounds and the contraction/abbreviation of the periods of its production with the bullet breaks (Table 49).

With the breaks of shoulder during the first year of war primary surgical processing was not produced into 53.10/o of cases, but during the fourth year only into 13.20/o of cases.

With the breaks of the bones of forearm a quantity of those not treated with 67.00/o during the first year was shortened to 23.60/o to the fourth year. With the breaks of thigh a quantity of the untreated casualties during the first year of war was 44.80/o, and

during the fourth only 12.0o/o. Finally, with the bullet breaks of the bones of shin a quantity of the untreated casualties with 42.6o/o during the first year of war was shortened to 12.6o/o to the fourth year. But if we consider the fact that in the fourth year of war the conditions for processing of wounds were most favorable, then it is obvious that on the fourth year of war the bullet breaks of the bones of extremities remained without the processing only in such a case, when they were not subject to primary processing from the medical readings/indications.

For the breaks of shoulder, thigh and bones of shin this will compose 12.0-13.2o/o, also, for the breaks of the bones of forearm - 23.6o/o.

Simultaneously was noted an increase in the number of casualties, who obtained processing into the first hours after wound. Thus, with the breaks of shoulder during the first year of war primary surgical processing was produced in the first 12 hours after wound into 32.4o/o of cases, whereas during the fourth year of war into their the same hours it was treated by 56.9o/o.

With the bullet breaks of thigh the primary processing of wounds was performed in the first 12 hours after wound during the first year of war into 23.9o/o, and during the fourth year of war - into

46.40/o.

It is necessary, however, to note that with the bullet breaks of thigh the primary processing was produced into the second day and it is later into 46.80/o of cases during the first year of war and into 26.00/o of cases during the fourth year. The significant percentage of those processed into the second day is explained by the fact that casualties with the break the thighs in recent years of war fairly often directed without the processing directly into the specialized hospital where with it simultaneously is performed primary surgical processing and they rendered specialized aid.

Because of this tactics primary processing somewhat retarded, but it was replaced by the more advanced early used specialized aid.

With the bullet breaks of the bones of shin during the first year of war in the first 12 hours after wound to primary surgical processing it underwent by 28.1c/c of wounded, and during the fourth year - 48.60/o.

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Table 49. Distribution of casualties with the bullet break of the bones of extremities according to the years of war and the periods of production in the primary surgical processing (in the percentages).

(1) Локализация перелома	(2) Сроки пер- вичной хирур- гической обработки	(3) Первые сутки после травмы							
		(4) Год войны							
		1941	1942	1943	1944	1945	1946	1947	Всего
(14) Плечо	(11) Первый	0,5	3,3	11,4	9,3	7,9	6,6	5,1	20,3
	(12) Второй	0,9	4,6	8,7	12,1	8,7	7,1	5,6	21,5
	(13) Третий	0,6	3,5	12,5	13,3	7,9	11,0	7,2	16,7
	(14) Четвертый	1,7	7,3	20,6	17,8	9,5	10,9	5,9	24,8
(16) Пред- плечье	(11) Первый	1,5	3,2	12,5	7,5	6,2	7,3	8,3	2,7
	(12) Второй	0,5	3,8	9,6	8,1	6,9	8,3	9,6	17,6
	(13) Третий	0,9	4,5	14,1	13,6	6,2	9,6	8,2	12,8
	(14) Четвертый	0,9	7,6	22,6	14,4	8,2	9,2	6,5	19,4
(17) Бедро	(11) Первый	0,8	2,3	7,4	7,1	6,3	6,3	6,5	16,5
	(12) Второй	1,3	1,9	8,9	6,6	6,7	7,9	7,4	14,1
	(13) Третий	0,9	3,0	8,7	10,1	7,6	10,2	10,3	12,5
	(14) Четвертый	0,8	6,0	14,7	14,7	10,2	10,9	8,2	8,5
(18) Голень	(11) Первый	1,1	3,6	7,5	9,6	6,3	9,1	6,4	16,2
	(12) Второй	1,2	3,4	7,8	8,2	7,5	9,6	8,4	14,5
	(13) Третий	1,1	3,7	10,9	9,8	8,3	11,9	9,4	11,9
	(14) Четвертый	1,5	7,8	16,7	14,6	8,0	11,4	7,9	9,0

(4) Про- ше сутки и позже	(5) Итого	(6) Про- ше сутки и позже	(7) Итого	(8) Про- ше сутки и позже	(9) Итого
31,9	100,0	9,2	100,0	53,1	100,0
28,3	100,0	8,9	100,0	36,1	100,0
25,8	100,0	10,2	100,0	23,5	100,0
17,1	100,0	8,0	100,0	13,2	100,0
33,0	100,0	11,6	100,0	67,0	100,0
35,3	100,0	10,6	100,0	51,4	100,0
27,1	100,0	12,0	100,0	34,4	100,0
19,9	100,0	8,1	100,0	23,6	100,0
46,8	100,0	6,4	100,0	44,5	100,0
45,7	100,0	10,2	100,0	29,0	100,0
36,8	100,0	8,7	100,0	19,6	100,0
26,0	100,0	6,3	100,0	12,0	100,0
40,2	100,0	10,5	100,0	42,6	100,0
39,4	100,0	9,1	100,0	29,9	100,0
34,0	100,0	8,1	100,0	20,3	100,0
23,1	100,0	7,3	100,0	12,6	100,0

Key: (1). Localization of break. (2). Periods of primary surgical processing. (3). First day (on hours). (4). Second day are later. (5). Altogether. (6). Time is not established/installed. (7). It was not processing. (8). In all. (9). Year of war. (10). It is unknown. (11). The first. (12). The second. (13). The third. (14). Shoulder. (15). The fourth. (16). Forearm. (17). Thigh. (18). Shin.

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Table 50. Distribution of casualties with the bullet break of the bones of extremities according to the periods of production in the primary surgical processing in the periods of combat operations/processes on the rout of the Fascist-German troops/forces in the environs of Moscow (M) and in the environs of Berlin (B) (in percent).

(1) Боевые операции	(2) Локализация перелома	(3) Первые сутки (по часам)						
		1-а	2-3-а	4-6-а	7-9-а	10-12-а	13-18-а	19-24-а
М Б	(10) Плечо	— 1,9	7,5 9,8	5,7 25,5	9,4 15,7	5,7 5,9	5,6 13,7	5,6 4,0
М Б	(11) Предплечье	1,0 —	7,2 5,9	14,4 30,3	6,2 9,8	6,2 5,9	5,2 9,8	6,2 3,9
М Б	(12) Бедро	— 1,8	— 5,2	5,4 12,3	5,4 24,6	2,7 12,3	5,4 8,8	6,8 3,5
М Б	(13) Голень	— 4,3	8,0 7,1	8,0 25,7	12,5 20,0	4,5 5,7	10,2 4,3	1,1 10,0

(4) час не устано- вен	(5) Вто- рые сутки и позже	(6) Итого	(7) Неиз- вестно	(8) Всего	(9) Не было
20.8 17.6	39.7 5.9	100.0 100.0	8.6 5.6	100.0 100.0	58.6 12.9
14.4 7.9	39.2 21.5	100.0 100.0	11.0 5.6	100.0 100.0	66.8 19.4
17.6 3.5	56.7 28.0	100.0 100.0	5.1 9.7	100.0 100.0	45.8 17.3
12.5 10.0	43.2 12.9	100.0 100.0	12.0 8.0	100.0 100.0	50.7 21.6

Key: (1). Combat operations/processes. (2). Localization of break.
 (3). First day (on hours). (4). Hour is not established/installed.
 (5). Second day are later. (6). Altogether. (7). It is unknown. (8).
 In all. (9). It was not. (10). Shoulder. (11). Forearm. (12). Thigh.
 (13). Shin.

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Is especially noticeable the difference within the periods of

primary surgical processing with the bullet breaks of extremities in the individual combat operations/processes (Table 50).

In combat in the environs of Moscow in 1941 with the wounds of shoulder remained untreated 58.6c/o of casualties, while in combat in the environs of Berlin in 1945 - only 12.9o/o. With the bullet breaks of the bones of forearm in combat in the environs of Moscow were not produced primary surgical processing by 66.8o/o of casualties, but in combat in the environs of Berlin - only 19.4o/o of casualties.

With the breaks of thigh during the combat operation/process on the rout of the Fascist-German troops/forces in the environs of Moscow primary surgical processing was not used in 45.8c/o of casualties, in combat in the environs of Berlin - in 17.3o/o of casualties.

With the breaks of the bones of shin in combat in the environs of Moscow did not have primary surgical processing 50.7o/o of casualties, in combat in the environs of Berlin - in 21.6c/o of casualties.

From given data it appears, to what extent was spread the volume of surgical aid in the combat operation/process in the environs of Berlin in comparison with the combat operations/processes in the

environs of Moscow in 1941. The absence of the surgical processing of the casualties, who obtained wound in combat in the environs of Berlin, in the percentage of the cases indicated was explained exclusively by the absence of readings/indications to it.

Noticeably increased a quantity of casualties with the break, processed surgical for the first 12 hours, which also testifies about a significant improvement in the surgical aid. Thus, in combat in the environs of Moscow and the first 12 hours underwent primary surgical processing by 28.30/o of casualties with the break of shoulder, whereas in combat in the environs of Berlin within the same period were processed 58.80/o of breaks of shoulder.

Processing with the bullet breaks of the bones of forearm increased in the first 12 hours after wound from 35.0 to 57.90/o, with the bullet breaks of thigh - from 13.5 to 56.20/o and with the bullet breaks of the bones of shin - from 33.0 to 62.80/o.

Is late produced the primary processing (i.e. to the second day it is later) with the breaks of shoulder in combat in the environs of Moscow into 39.70/o, and in the environs of Berlin - into 5.90/o of cases. With the bullet breaks of the bones of forearm primary surgical processing was produced to the second day and it is later with the rout of the Germans in the environs of Moscow into 39.20/o

of cases, and in combat in the environs of Berlin - into 21.50/o.

Late (i.e. to the second day it is later) was produced primary surgical processing with the bullet breaks of thigh in combat in the environs of Moscow into 56.7c/c, in combat in the environs of Berlin - into 28.00/o of cases. With the bullet breaks of thigh it is necessary to consider the strategic formation of primary surgical processing with the specialized aid which usually was produced to the second day in army KhPPG.

With the bullet breaks of the bones of shin primary surgical processing into 48.20/o of cases is produced to the second day and it is later with the rout of the Germans in the environs of Moscow, whereas in combat in the environs of Berlin - into 12.90/o of cases.

Thus, with all bullet breaks of the bones of extremities a number of primary processings, produced to the second day is later, in last year of war sharply it was lowered.

High value has a question about how affected area relief the delivery/procurement of casualties with the breaks of the bones of extremities on DMP and for the periods of production in the primary surgical processing.

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The periods of the entry of casualties on DMP during the combat operations in Carpathians are represented in Table 51, comprised according to the data V. N. Pomcsova.

In the first 6 hours from the field of combat it is carried out by 99.00/o, on PMP entered 91.4c/c, also, on DMP - 42.00/o. In the first 12 hours on DMP entered 68.8c/o of all casualties (V. N. Pomcsov).

These data reflect the velocity of the entry of all casualties (including with the break) in DMP during combat under conditions of the mountain-forest locality. In spite of difficulties in the delivery/procurement of casualties with PMP to DMP, periods deliveries/procurements under these conditions proved to be shorter in the mountains, than in the flat terrain (combat operations/processes 1943 and 1944). This is explained by the possibility of maximum approximation/approach DMP to PMP and by the more rapid carrying out/removal of casualties from the field of combat.

Table 51. Distribution of casualties according to the periods of entry on DMP in the different combat operations/processes (in the percentages).

(1) Срок поступления на ДМП	(2) Боевые операции и местность				
	(3) карпатская наступатель- ная опера- ция 1944 г. (горы)	(4) зимнее наступление 1943 г. (равнина)	(5) стабильная оборона 1943 г. (равнина)	(6) осеннее наступление 1943 г. (равнина)	(7) весеннее наступление 1944 г. (равнина)
(8) До 1 часа	3,0	0,6	0,6	1,1	0,6
(9) С 2 до 3 часов	9,7	2,8	2,2	2,3	0,5
» 4 » 6 »	29,3	8,9	14,8	13,8	25,8
» 7 » 12 »	26,8	12,9	46,2	27,6	26,3
» 13 » 18 »	12,0	11,9	6,1	10,5	15,8
» 19 » 24 »	9,7	8,8	17,8	21,7	15,0
» 25 » 36 »	7,8	4,7	11,7	16,3	10,0
» 37 » 48 »	0,9	12,7	0,6	5,8	5,3
(10) Свыше 2 суток	0,8	0,7	—	0,9	0,7
(11) Итого	100,0	100,0	100,0	100,0	100,0

Key: (1). Period of arrival at DMP. (2). Combat operations/processes and locality. (3). Carpathian offensive operation of 1944 (mountain). (4). winter offensive of 1943 (plain). (5). stable defense of 1943 (plain). (6). autumn offensive of 1943 (plain). (7). spring offensive of 1944 (plain). (8). To 1 hour. (9). From 2 to 3 hours. (10). It is more than 2 days. (11). Altogether.

Table 52. Distribution of casualties with the bullet break of thigh according to the periods of rendering to the specialized aid [according to P. V. Krolyu (in the percentages)].

(1) День	(2) I квартал 1944 г.	(3) IV квартал 1944 г.	(4) I квартал 1945 г.
1-2-й	26,9	82,2	91,1
3-4-й	41,5	15,5	6,3
5 дней и боль- ше (3)	31,6	2,3	2,6
(4) Итого	100,0	100,0	100,0

Key: (1). Day. (2). quarter. (3). days it is more. (4). Altogether.

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The specialized aid by casualty with the bullet break of the bones of extremities proved to be at the different fronts and in different periods of war within the different periods. According to the data of P. V. Krol, who leads the surgeon of the army specialized osteoarticular hospital in by N front, the periods of the specialized aid with the bullet breaks of thigh are represented in Table 52.

These data which characterize the periods of the entry of casualties with the break of the bones of extremities into specialized osteoarticular army KHEFG of one of the fronts, they indicate the significant acceleration of delivery/procurement in last year of war.

In the I quarter of 1945 91.1% of all casualties with the break

the thighs were during the first 2 days after wound delivered into the specialized by the osteoarticular hospital and they here underwent the specialized treatment.

With the breaks of the bones of shin the specialized aid began with GBF. This means that the casualties with the break of the bones of shin underwent x-ray examination and, consequently, also to the specialized surgical treatment within the later periods than casualties ones with the break of thigh.

Thus, x-ray examination with the breaks of the bones of shin in the army and front line hospitals was produced into 51.80/o, and with the breaks of thigh - into 60.90/o.

28.80/o of casualties with the break of the bones of shin were in no way inspected roentgenologically. Unit of them, apparently must be referred due to those amputated and dead persons in the foremost stages of evacuation to that moment/torque when casualties struck into the specialized hospitals.

The periods of the delivery/procurement of casualties with the bullet break of the bones of extremities into the rear evacuation hospitals in the different periods of war, and also depending on distance from the front line hospital bases varied between very wide

limits. Thus, into hospitals of one of MEP casualties with the break of bones entered during war into the following periods: 5 days after wound - into 11.10/o of cases, after 6-10 days - into 32.70/o, after 11-15 days - into 20.80/o, after 16-20 days - into 8.20/o, after 21-30 days - into 8.50/o and in time more than 30 days - into 12.30/o of cases, the periods of entry were not established/installed into 6.40/o of cases.

In the hospitals, arranged/located in the deep rear, the large part of the casualties with the break of the bones of extremities entered within the first period of war in time from 30 to 60 days. These periods of the entry of casualties with the break of the bones of extremities must be considered most frequent for the majority of rear evacuation hospitals, since they were determined not so much by the distance of hospitals from the front, as by medical readings/indications, which required the delay of casualties in the specific stages for dealing with the complications of wound infection. These periods were measured in army area 1-3 by days, 3-10 by days in the army and 7-15 by days in the front line area.

This retention time of casualties with the bullet break of the bones of extremities in the stages of evacuation departed to the struggle with the shock and the blood loss, for the primary surgical processing of wounds, for the imposition of therapeutic

immobilization and partial drying of casts for training of casualties for the evacuation according to the designation/purpose and to the struggle with the complications of wounds of infection. In the same cases when was used skeletal/skeleton traction/extension, the periods of stay in these stages were increased.

X-ray examination played very important role in diagnosis and treatment of the bullet breaks of the bones of extremities and therefore it was to a certain degree the indicator, which testifies about the being all-inclusive diagnosis and about the rendering to the specialized aid.

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Data of the deepened development of produced in the stages of evacuation x-ray examinations with the bullet breaks of the individual bones of extremities are given in Table 53 (is indicated the stage of the first x-ray examination).

Consequently, quarter of all casualties did not undergo x-ray examination; except those not needing this research, here entered all casualties, dead persons in the army area, or subject to amputations to the rendering by them of the specialized aid.

The first two graphs of table show the frequency of x-ray examinations within the early periods after wound in the army and front line therapeutic installations (in average/mean 54.60/o). Most frequently this research was produced with the breaks of thigh (60.90/o) and most rarely with the breaks of the bones of shin (51.80/o).

Table 53. Stage of the first x-ray examination with the breaks of the bones of extremities (in the percentages).

(1) Локализация перелома	(2) Этап эвакуации	ДМП, ХППГ и ЭГ (3)	(4) Эвакуац. госпиталь		(5) Итого	(6) Не было произведе- но рент- геноло- гическо- го иссле- дования	(7) Всего
			фронт- овая (8)	тыловая (9)			
(10) Плечо		15,9	39,8	44,3	100,0	21,1	100,0
(11) Предплечье		10,4	43,4	46,2	100,0	26,8	100,0
(12) Бедро		16,6	44,3	39,1	100,0	24,1	100,0
(13) Голень		10,9	40,9	48,2	100,0	28,8	100,0
(14) В среднем . . .		12,6	42,0	45,4	100,0	25,5	100,0

Key: (1). Localization of break. (2). Stage of evacuation. (3). and. (4). Evacuation hospital. (5). Altogether. (6). It was not produced roentgenological examinations. (7). In all. (8). front line. (9). rear. (10). Shoulder. (11). Forearm. (12). Thigh. (13). Shin. (14). On the average.

Primary surgical processing of wounds with the bullet breaks of the bones of extremities.

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The systematic primary surgical processing of wounds with the bullet breaks of the bones of extremity on the large scales was for the first time applied in the Red Army in the Great Patriotic War.

Above were reported the basic general/common/total principles, by which were guided the Soviet surgeons during the treatment of bullet breaks, and was also presented the typical conventional procedure of the primary and repeated surgical processing of wounds with the bullet breaks of the bones of extremities.

Soviet surgeons in the period of the Great Patriotic War acquired large experiment/experience in the treatment of bullet breaks and, in particular, on the primary surgical processing of wounds with the bullet breaks.

The thorough analysis of this experiment/experience is produced by the deepened development of the histories of disease/illness, they give the possibility to refine the separate parts of a very complex question of surgical treatment and, in particular, primary surgical processing of bullet breaks; thus can be clarified the details of anesthetization, immobilization, character/nature of primary processing depending on the form/species of break, periods of processing, etc.

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Anesthetization during the primary surgical processing and immobilization after it. The very essential unit of the primary

surgical processing apropos of the bullet breaks of the bones of extremities compose the methods of anesthetization and the subsequent immobilization.

The data of the deepened development about the use/application of an anesthetization during the primary surgical processing are given in Table 54.

During the primary surgical processing of the bullet breaks of the bones of extremities predominantly was used local anesthetization (eliminating the breaks of thigh).

Giving during the surgical processing of the bullet breaks of the bones of extremities the advantage of local anesthesia by novocaine as to safest method, it is necessary to nevertheless recognize that this method of anesthetization increases the duration of operation/process and requires the possession anesthetization technique. With the breaks of thigh and bones of shin sometimes, especially in surgeons, not not completely who did not master the methods of local anesthesia, the anesthetization was insufficient and the quality of surgical processing from this suffered. Therefore many surgeons in order to save time and to obtain during the primary processing of wounds full/total/complete anesthetization, immediately resorted to anesthesia/narcosis, especially as it it was possible to

charge to assistant.

By these, of course, is not discredited local anesthesia and is not solved a question in favor of the use/application of anesthesia/narcosis for the anesthetization of bullet breaks. On the contrary, should be raised a question about preparation/training for this purpose of the surgeons who could faultless produce local anesthesia of any sector of body.

The information about the character/nature of the used after primary surgical processing immobilization is given in Table 55.

Thus, with the bullet breaks of femoral bone after primary surgical processing for the immobilization most frequently used splint of Diedrich (63.3c/c), and with the breaks of other bones - wire splint (62.50/o with the breaks of shoulder and 55.60/c with the breaks of the bones of shin).

As far as immobilization is concerned by gypsum bandage, then it used with the breaks of the bones of forearm into 11.00/o of cases, shoulder - in 8.30/o, those of the bones of shin - into 7.20/c and thighs - into 5.50/o of cases.

Table 54. Form/species of anesthetization during the primary surgical processing of the bullet breaks of the bones of extremities (in the percentages).

(1) Вид обезболивания	(2) Локализация перелома					(7) В среднем
	(3) Плечо	(4) Пред- плечье	(5) Бедро	(6) Голень		
(8) Местное (и регионарное)	54,3	66,3	40,9	54,1		53,3
(9) Общее	45,7	33,7	59,1	45,9		46,7
(10) Итого . . .	100,0	100,0	100,0	100,0		100,0

Key: (1). Form/species of anesthetization. (2). Localization of break. (3). Shoulder. (4). Forearm. (5). Thigh. (6). Shin. (7). On the average. (8). Local (and regional). (9). General/common/total. (10). Altogether.

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If the immobilization of shoulder, forearm and shin after primary surgical processing was easily and sufficiently satisfactorily achieved by the use/application of wire splints, gypsum casts and other splints, then for the immobilization of the bullet breaks of thigh was necessary to most frequently put to use the splint of Diedrich, which even during the fixation with its

gypsum annuli could not either ensure absolute rest of the place of the break, or hold down/retain broken ends in the correct position. The most modern form/species of immobilization with the bullet breaks of thigh was deaf gypsum bandage, but to use it during the Great Patriotic War on the wide scale was possible, only beginning from army specialized KhPPG.

Character/nature of primary surgical processing. Depending on the severity of break, degree and character/nature of the damage of soft tissues, and also on other special features/peculiarities of wound (presence of foreign bodies, etc.), the character/nature of primary surgical processing was different.

Table 56 shows the distribution of casualties with the bullet break of the bones of extremities according to the localization of break and the character/nature of primary surgical processing.

From the preceding information it is evident that the predominant means of processing was splitting up (44.6-51.9o/o), splitting up and carving with the removal/distance of bone fragments (16.0-20.0o/o) and carving (11.1-12.9o/o). Other means of processing, naturally, were encountered more rarely, since they were produced from the special readings/indications, for example, in the presence of foreign bodies, with the wounds of large vessels, etc.

It should be noted that the watched processings, most complete and complex, it was little (1.0-2.6c/o). This is also explained by the presence of special readings/indications to the complication of the primary surgical processing by additional intervention on the vessels, the bones or the joints.

Table 55. Form/species of immobilization with the bullet breaks of the bones of extremities after the primary surgical processing (in the percentages).

(1) Вид иммобилизации после первичной хирургической обработки	(2) Локализация перелома			
	(3) Плечо	(4) Пред- плечье	(5) Бедро	(6) Голень
(7) Шина Дитерихса	—	—	61,0	1,6
(8) Шина Дитерихса с гипсовыми кольцами	—	—	2,3	0,4
(9) Шина Виноградова-Томаса	—	—	3,7	1,4
(10) Проволочная шина	62,5	35,8	9,4	55,6
(11) Жартон, фанера	2,7	17,3	—	5,2
(12) Гипсовая шина	5,5	7,7	1,9	5,3
(13) Глухая гипсовая повязка	2,8	3,3	3,6	1,9
(14) Импровизированная и прочие виды иммобилизации	26,5	35,9	18,1	28,6
(15) Итого	100,0	100,0	100,0	100,0

Key: (1). Form/species of immobilization after primary surgical processing. (2). Localization of break. (3). Shoulder. (4). Forearm. (5). Thigh. (6). Shin. (7). Diedrich's splint. (8). Diedrich's splint with gypsum annuli. (9). Vinogradov-Thomas's splint. (10). Wire splint. (11). Carton, veneer. (12). Gypsum splint. (13). Deaf gypsum bandage. (14). improvised and other forms/species of immobilization. (15). Altogether.

In the therapeutic installations of army area with certain casualty with the break of the bones of extremities they not at all produced primary surgical processing. The group of such casualties will be examined particularly.

From the data of the deepened development it is evident that to the suppressing mass of casualties with the bullet break the primary surgical processing is produced on DMP (77.20/o), unit of them (16.90/o) - in KhPPG of the first line and only to units - in the evacuation hospitals: in the army evacuation hospitals - 2.40/o, in FEG - 0.90/o, in GLR - 0.50/o, in the rear evacuation hospitals - 0.10/o and in other stages - 2.00/o. Thus, in the evacuation hospitals rarely was performed primary surgical processings apropos of the bullet breaks of the bones of extremities; in these hospitals was performed reworking of wound, proved to be the specialized aid and was conducted the treatment of casualties with the break.

With the bullet wounds of extremities the severity of damage in essence depended on the form/species of break, and therefore special attention deserve the data about the relationship/ratio between the periods of primary surgical processing and the form/species of break (Table 57).

Table 56. Distribution of casualties with the bullet break of the bones of extremities according to the localization of break and the character/nature of primary surgical processing (in the percentages to a number of those processed).

(1) Локализация перелома	(2) Характер обработки	(3) Расчленение	(4) Расчленение и иссечение с									(10) Ампутация	(11) Сочетанные вмешательства	(12) Характер обработки не установлен	(13) Итого	(14) Не было обработано	(15) Всего
			(4) Расчленение и иссечение	(5) поперечное	(6) поперечное	(7) удаление инородного тела	(8) удаление костной массы	(9) удаление костных осколков	(10) удаление костных осколков	(11) удаление костных осколков	(12) удаление костных осколков						
(16) Плечо		44.6	12.6	1.9	5.5	20.0	0.9	8.6	1.8	4.1	100.0	31.3	100.0				
(17) Предплечье		51.9	11.8	4.5	4.4	16.0	0.6	5.1	1.0	4.8	100.0	44.5	100.0				
(18) Бедро		48.3	12.9	1.7	7.6	17.5	1.1	4.5	2.6	3.8	100.0	24.5	100.0				
(19) Голень		46.0	11.1	3.7	5.0	16.2	0.4	12.6	2.2	2.8	100.0	24.4	100.0				

Key: (1). Localization of break. (2). Character/nature of processing. (3). Splitting up. (4). Splitting up and carving. (5). Splitting up and carving s. (6). by dressing of vessels. (7). by removal/distance of foreign body. (8). by removal/distance of bone fragments. (9). by processing fragments of bone. (10). amputation. (11). Matched interventions. (12). Character/nature of processing is not established/installed. (13). Altogether. (14). It was not processed. (15). In all. (16). Shoulder. (17). Forearm. (18). Thigh. (19). Shin.

Table 57. Distribution of the bullet breaks of the bones of extremities according to the periods of production in the primary surgical processing after wound (in the percentages).

(1) Вид перелома	(2) Срои обработки	(3) Первые сутки			(6) Вторые сутки и позд- нее	(8) Итого	(9) Не бы- ло об- работ- ки	(10) Всего	
		(4) 6 ча- сов	7-12 часов (4)	13-24 часа (5)					
(11) Дырчатый		18,8	22,2	19,0	12,3	27,7	100,0	35,2	100,0
(12) Поперечный и продольный . .		19,2	17,5	20,2	13,8	29,3	100,0	32,8	100,0
(13) Косой		17,2	18,1	19,5	13,7	31,5	100,0	34,5	100,0
(14) Раздробленный		21,7	20,6	16,7	14,4	26,6	100,0	19,4	100,0
(15) Крупно- и мелкооскольчатый		17,9	20,4	17,7	13,2	30,8	100,0	32,1	100,0
(16) Краевой		22,2	19,0	18,7	10,9	29,2	100,0	36,4	100,0
(17) В среднем		18,5	19,5	18,3	13,3	30,4	100,0	33,1	100,0

Key: (1). Form/species of break. (2). Period of processing. (3). First day. (4). hours. (5). hour. (6). hour is not established/installed. (7). Second day and later. (8). Altogether. (9). It was not processing. (10). In all. (11). Perforated. (12). Cross and longitudinal. (13). By sand bar. (14). Crushed. (15). Large/coarse and small-splintered. (16). Edge/boundary. (17). average.

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It is possible to state/establish the following special features/peculiarities: 1) for the first 12 hours in the greatest number of cases were processed equal with the lungs, the perforated (41.00/o) edge/boundary ones (41.20/c) and heaviest, crushed breaks (42.30/o); 2) into second half of the first day a great quantity of processed breaks composed cross and longitudinal (20.20/o), and small - crushed (16.70/o); 3) during the second day most of all were processed oblique breaks (31.50/c).

These relationships/ratios are explained by the fact that the casualties with the lighter break could be moved independently and, thus, they struck for the primary processing almost simultaneously with the casualties with the crushed breaks which due to the heavy condition were evacuated earlier than others. Their comparatively large quantity was treated to the second day on the different reasons: as a result of the difficulty of carrying out/removal, onset of shock or in connection with the shipment into the specialized hospital.

Most noticeably interrelation was between the form/species of break and the character/nature of primary processing.

a) simple splitting up without the additional manipulations as the method of primary surgical processing predominated almost in all forms of the break of shoulder, forearm, thigh and shin, with exception only of the two varieties/subspecies of the break: crushed and partly multifragment (Table 58).

Thus, splitting up although predominated with all breaks, besides that crushed, nevertheless with the simple breaks (perforated and edge/boundary) it was produced more frequently than with the complex ones, and with the break it is more superficially arranged/located fine/small bones (forearm) more frequently than with the break of bones larger/coarser and it is deeper than arranged/located (thigh).

b) the carving, added to splitting up, was used within the limits from 24.3 (shoulder, cross- longitudinal break) to 6.50/o (shin, the crushed break; Table 59). Thus, carving was used most frequently with of simple breaks and most rarely with those crushed.

c) the removal/distance of foreign bodies after splitting up and carving of wound occupied modest place, since it is known that into 31.0c/o of all breaks was only noted the presence of foreign bodies (pg. 73). The frequency of the removal/distance of foreign body (table 60) oscillated from 11.8 (shoulder, thigh, edge/boundary break) to 1.40/o (shin, the crushed break). Of the shoulder and the thigh the foreign bodies are removed more frequently, because here they jammed more frequently than in other places.

Table 58. Frequency of simple splitting up during processing of the different breaks of the bones of extremities (in the percentages according to each form/species of break).

(2) Локали- зация перелома	(1) Вид перелома					
	(3) Дыр- чатый	(4) Попе- речный и про- доль- ный	(5) Косой	(6) Раз- дроб- ленный	(7) Крупно- и мелко- осколь- чатый	(8) Крае- вой
(9) Плечо	58,1	49,3	55,8	21,9	48,0	50,5
(10) Предплечье	70,9	58,6	59,2	25,9	51,8	62,3
(11) Бедро	64,6	57,9	54,0	31,4	44,8	58,9
(12) Голень	65,5	54,7	54,4	19,1	47,9	62,8

Key: (1). Form/species of break. (2). Localization of break. (3). Perforated. (4). Cross and longitudinal. (5). By sand bar. (6). Crushed. (7). It is large/coarse and small-splintered. (8). Edge/boundary. (9). Shoulder. (10). Forearm. (11). Thigh. (12). Shin.

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From the preceding information it is evident that the removal of foreign bodies during primary surgical processing was most frequently accepted in the cases of the edge/boundary and perforation breaks, since with these breaks were encountered predominantly single and sufficiently large/coarse foreign bodies. Most rarely foreign bodies were removed with the crushed breaks, since with these forms/species of break most frequently were multiple fine/small, difficult to remove foreign bodies.

The straight/direct interrelation between the frequency of the removal/distance of foreign bodies and the frequency of blind-end wounds is visible from Table 61.

Table 59. Frequency of the carvings, added to splitting up, during processing of the different breaks of the bones of extremities (in the percentages according to each form/species of break).

(1) (2) Вид перелома Локализация перелома	(3) Дыр- чатый	(4) Попе- речный и про- доль- ный	(5) Косой	(6) Раз- дроб- ленный	(7) Крупно- и мелко- осколь- чатый	(8) Крае- вой
(9) Плечо	19,7	24,3	15,2	7,3	12,2	17,0
(10) Предплечье	13,8	16,4	13,7	9,8	12,0	14,2
(11) Бедро	12,0	15,3	14,7	9,7	13,1	14,4
(12) Голень	11,6	16,2	14,6	6,5	12,3	13,2

Key: (1). Form/species of break. (2). Localization of break. (3). Perforated. (4). Cross and longitudinal. (5). By sand bar. (6). Crushed. (7). Large/coarse and chalk fragmented. (8). Edge/boundary. (9). Shoulder. (10). Forearm. (11). Thigh. (12). Shin.

Table 60. Frequency of the removal/distance of foreign bodies during the primary surgical processing in the various forms of the bullet breaks of the bones of extremities (in the percentages).

(1) (2) Вид перелома Локализация перелома	(3) Дыр- чатый	(4) Попе- речный и про- доль- ный	(5) Косой	(6) Раз- дроб- ленный	(7) Крупно- и мелко- осколь- чатый	(8) Крае- вой
(9) Плечо	4,5	7,4	9,3	2,8	5,1	11,8
(10) Предплечье	3,5	4,3	6,2	1,8	4,0	8,1
(11) Бедро	10,9	9,3	8,9	5,9	6,8	11,8
(12) Голень	5,8	4,3	6,4	1,4	5,2	10,0

Key: (1). Form/species of break. (2). Localization of break. (3). Perforated. (4). Cross and longitudinal. (5). By sand bar. (6). Crushed. (7). Large/coarse and chalk fragmented. (8). Edge/boundary. (9). Shoulder. (10). Forearm. (11). Thigh. (12). Shin.

Table 61. Frequency of the removal/distance of foreign bodies and the frequency of blind-end wounds with the bullet breaks of the bones of extremities (in the percentages).

(1) Локализация перелома	(2) Частота удале- ния инородных тел: среди дру- гих видов пер- вичной обра- ботки	(3) Частота слепых огнестрельных переломов среди других видов переломов
(4) Плечо	5,5	19,0
(5) Предплечье	4,4	10,6
(6) Бедро	7,6	33,3
(7) Голенъ	5,0	24,0

Key: (1). Localization of break. (2). Frequency of removal/distance of foreign bodies among other means of primary processing. (3). Frequency of blind artillery breaks among other forms/species of breaks. (4). Shoulder. (5). Forearm. (6). Thigh. (7). Shin.

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One must take into account that with the breaks of the bones of shin the foreign bodies were arranged/located in the bone considerably more frequently than with the breaks of the bones of other segments, whereas the removal/distance of foreign bodies from the bone during the primary processing (without the x-ray examination) presented difficulty; therefore in the second place in the frequency of the removal/distance of foreign bodies proved to be shoulder, although in the frequency of blind-end wounds in the first

place stood the shin.

d) the removal/distance of bone fragments during the primary surgical processing of the break to a considerable degree depended on the form/species of break, which is evident from Table 62.

Thus, the removal/distance of bone fragments with different breaks oscillated in the limits from 25.8 (shoulder, comminuted fractures) to 4.70/o (forearm, perforated breaks); generally most frequently bone fragments were removed with the crushed and fragmentary breaks.

Processing bone fragments during the primary surgical processing of the breaks in the army therapeutic installations was used rarely (from 0.2 to 0.60/o, and with the cross breaks of shoulder - to 2.20/o).

e) amputation was used in the dependence on the form/species of break. Thus, according to the data of the deepened development, the frequency of amputations among other means of the primary surgical processing of wound in the various forms of the bullet breaks of the bones of extremities oscillated in the very significant limits (Table 63).

Table 62. Frequency of the removal/distance of bone fragments during splitting up and carving of wound during processing of the bullet breaks of the bones of extremities (in the percentages).

(1) Вид перелома (2) Локализация перелома						
	(3) Дырчатый	(4) Поперечный и продольный	(5) Косой	(6) Раздробленный	(7) Крупно- и мелкооскольчатый	(8) Краевой
(9) Плечо	9,1	13,2	12,6	21,9	25,8	9,9
(10) Предплечье	4,7	9,5	9,4	21,2	20,9	5,5
(11) Бедро	7,4	9,3	14,5	21,9	25,2	5,2
(12) Голень	8,3	16,2	14,0	14,7	24,8	7,2

Key: (1). Form/species of break. (2). Localization of break. (3). Perforated. (4). Cross and longitudinal. (5). By sand bar. (6). Crushed. (7). Large/coarse and chalk fragmented. (8). Edge/boundary. (9). Shoulder. (10). Forearm. (11). Thigh. (12). Shin.

Table 63. Frequency of amputations during the primary surgical processing of different breaks of the bones of extremities (in the percentages).

(2) Локализация перелома	(1) Вид перелома					
	(3) Дырчатый	(4) Поперечный и продольный	(5) Косой	(6) Раздробленный	(7) Крупный и мелкооскольчатый	(8) Краевой
(9) Плечо	—	—	0,3	37,1	0,1	0,5
(10) Предплечье	—	—	—	28,8	0,2	—
(11) Бедро	—	—	0,4	20,5	0,4	—
(12) Голень	0,4	—	—	49,1	0,7	—

Key: (1). Form/species of break. (2). Localization of break. (3). Perforated. (4). Cross and longitudinal. (5). By sand bar. (6). Crushed. (7). Large/coarse and chalk fragmented. (8). Edge/boundary. (9). Shoulder. (10). Forearm. (11). Thigh. (12). Shin.

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In the minute quantity of cases the amputation was made with perforated, oblique, edge/boundary and even comminuted fractures of any department of extremities.

On the contrary, with the crushed breaks the number of produced amputations is very great: on shoulder 37.10/o, on forearm 28.80/o, on thigh 20.50/o, on shin 49.10/o.

f) the matched operations/processes the most complex means of processing, with which, besides splitting up and carving, it was produced not less than other two manipulations, were employed rarely (Table 64).

Thus, in the decreasing order/formation in the frequency this character/nature of processing occurred with the breaks: crushed, fragmented, oblique, perforated, edge/boundary, cross and longitudinal. However, the frequency of use/application on the individual bones in the decreasing order/formation was expressed as follows: thigh, shin, shoulder, forearm.

All given above data are summary on all bones of extremities represented in Table 65.

Table 64. Frequency of matched interventions with the bullet breaks of the bones of extremities (in the percentages).

(1) (2) Вид перелома Локализация перелома	(3) Дыр- чатый	(4) Попе- речный и про- доль- ный	(5) Косой	(6) Раз- дроб- ленный	(7) Крупно- и мелко- осколь- чатый	(8) Крае- вой
(9) Плечо	3,0	—	1,8	2,3	2,2	0,9
(10) Предплечье	—	—	1,6	1,5	1,4	1,3
(11) Бедро	0,5	3,3	1,5	3,4	3,4	1,7
(12) Голень	3,3	0,9	3,0	2,3	2,3	1,2

Key: (1). Form/species of break. (2). Localization of break. (3). Perforated. (4). Cross and longitudinal. (5). By sand bar. (6). Crushed. (7). Large/coarse and chalk fragmented. (8). Edge/boundary. (9). Shoulder. (10). Forearm. (11). Thigh. (12). Shin.

Table 65. Distribution of casualties with the bullet break of the bones of extremities according to the form/species of break and the character/nature of primary surgical processing (in the percentages).

(1) Характер обработки	(3)	(4)	Рассечение и иссечение с					(10)	(11)	(12)	(13)	(14)
			(6)	(7)	(8)	(9)						
(2) Вид перелома	Только рассечение	Рассечение и иссечение	перевязкой сосудов	удалением инородных тел	удалением костных осколков	обработкой фрагментов кости	Ампутация	Прочие	Сочетания	Итого	Обработано было	
(15) Дырчатый	65,0	12,9	2,5	6,8	7,9	0,3	0,1	2,5	2,0	100,0	35,2	
(16) Поперечный и продольный	55,2	17,9	2,0	6,7	11,7	1,7	—	3,6	1,2	100,0	32,8	
(17) Косой	55,8	14,6	2,1	7,9	12,9	1,0	0,2	3,6	1,9	100,0	34,5	
(18) Раздробленный . .	23,4	8,0	3,7	2,6	18,9	0,9	36,0	4,2	2,3	100,0	19,4	
(19) Оскольчатый . . .	48,5	12,3	2,8	5,2	24,0	0,7	0,4	3,9	2,2	100,0	32,1	
(20) Краевой	59,9	14,2	3,4	10,3	7,2	—	0,1	3,6	1,3	100,0	36,4	
(21) В среднем	47,9	12,0	3,2	5,5	12,2	0,7	7,8	3,7	2,0	100,0	33,1	

Key: (1). Character/nature of processing. (2). Form/species of break. (3). Only splitting up. (4). Splitting up and carving. (5). Splitting up and carving s. (6). By dressing of vessels. (7). by removal/distance of foreign bodies. (8). By removal/distance of bone fragments. (9). by processing fragments of bone. (10). Amputation. (11). Other. (12). Combinations. (13). Altogether. (14). Processings it was not. (15). Perforated. (16). Cross and longitudinal. (17). By sand bar. (18). Crushed. (19). Fragmented. (20). Edge/boundary. (21). On the average.

As a result should be noted following general/common/total data, which concern the character/nature of primary surgical processing with the different types of the breaks of the bones of extremities.

Splitting up of wound without other interventions was the predominant character/nature of the primary surgical processing of all breaks, except that crushed, with which it engaged the second place, after yielding the first to amputations.

Splitting up and carving of wound in the frequency was in the second place with the simple breaks, on the third - with the fragmented ones and on the fourth - with those crushed.

Splitting up and carving with simultaneous removal/distance of bone fragments stood in the second place (after splitting up) with comminuted fractures and on the third - with the remaining breaks.

Splitting up and carving with the simultaneous dressing of large vessels or the removal/distance of foreign bodies with all breaks were encountered significantly less frequent.

The rare means of processing was matched operations/processes and splitting up and carving with processing of bone fragments.

Primary surgical processing during individual years of war.

The character/nature of primary surgical processing was changed on the years of a great-Soviet war. From the data of the deepened development is completely it is distinctly evident (Table 66) that from year to year in the primary surgical processing of breaks increased the element/cell of radicalism according to the relation not only to the wound of soft tissues, but also to the bone broken ends and the bone fragments.

Table 66. Distribution of casualties with the bullet break of the bones of extremities according to the character/nature of primary surgical processing during the individual years of war (in the percentages).

(2) Характер обработки	(1) Год войны				
	1941	1942	1943	1944	1945
(3) Рассечение	43,3	55,1	54,7	45,1	37,2
(4) Рассечение и иссечение	20,2	13,3	9,4	11,0	13,4
(5) Рассечение и иссечение с перевязкой сосудов	3,0	3,0	2,4	3,7	3,3
(6) Рассечение и иссечение с удалением инородных тел	6,4	4,4	4,7	4,6	5,9
(7) Рассечение и иссечение с удалением костных осколков	14,2	13,3	15,5	20,7	24,0
(8) Рассечение и иссечение с обработкой костных фрагментов	0,2	0,2	0,2	1,0	1,9
(9) Ампутация	7,3	7,3	7,2	8,0	9,0
(10) Сочетанная операция	1,0	1,0	1,6	2,5	3,1
(11) Прочие	4,4	2,4	4,3	3,4	1,7
(12) Всего	100,0	100,0	100,0	100,0	100,0
(13) Не было обработки	63,1	44,6	29,4	19,1	15,2

Key: (1). Year of war. (2). Character/nature of processing. (3). Splitting up. (4) Splitting up and carving. (5). Splitting up and carving with dressing of vessels. (6). Splitting up and carving with removal/distance of foreign bodies. (7). Splitting up and carving with removal/distance of bone fragments. (8). Splitting and carving with processing of bone fragments. (9). Amputation. (10). Matched operation/process. (11). Other. (12). In all. (13). It was not processing.

The frequency of the use/application of splitting up decreased from 43.3 to 37.2o/o; it increased a number of removals/distances of bone fragments from 14.2 to 24.6o/o and (although only insignificantly) number of manipulations on bone fragments during primary surgical processing (from 0.2 to 1.9o/o), and also the matched operations/processes (from 1.0 to 3.1o/o).

A number of untreated breaks during war changed by more than four times; so, if their number during 1945 (expressed in the percentages) is accepted for the unit, then the corresponding numbers for other years of war were such: 1941 - 4.1; 1942 - 2.9; 1943 - 2.0; 1944 - 1.2.

An increase in the radical primary surgical processing with the breaks of individual bones was not identical, which is evident at least in the frequency of the removal/distance of bone fragments and processing of the fragments of bone on two segments (thigh and forearm) (Table 67).

While during processing of the bullet breaks of thigh the frequency of the removal/distance of bone fragments within the time of war increased more than three times, during processing of the

breaks of the bones of forearm it increased only one and a half times. It is completely logical that the radical methods more frequently were used during processing of the breaks of thigh, than during processing of the breaks of other bones.

By the reason for increase on the years of the war of a number of casualties, who were subjected to primary surgical processing, and also the build-up/growth of its radicalism was not only tendency toward the rendering to more rational aid casualty, but also series/number of the unfavorable factors, which increased/grew with years of war, in particular, an increase in the number:

a) fragmentation wounds and number of wounds with the foreign bodies;

b) the crushed breaks with 16.2 (in the first year) to 19.00/o (in the fourth year);

c) the breaks, which were being escorted/tracked by the combined and associated wounds, with 24.5 (in the first year) to 30.20/o (in the fourth year).

In parallel to quantitative growth and increase in the radicalism of primary surgical processing each year of war it

increased/grew number of processings, produced within the earlier periods after wounds (Table 68).

The frequency of processing for the first hour during the Great Patriotic War substantially was not changed, after remaining within limits of 1.00/o, then its frequency for the next 8 hours (2-9th hour) with each the year of war it increased/grew, fixture toward the end of the war almost doubly more than in the first year. In the subsequent hours of the first day (10-24 hours) the frequency of processing also increased, but to a lesser degree. Production in the processing during the second day and later each year of war continuously was reduced.

Table 67. Frequency of the removal/distance of bone fragments and processing of the fragments of bone on the years of war with the breaks of thigh and bones of forearm (in the percentages).

(1) Локализация перелома	(2) Год войны				
	1941	1942	1943	1944	1945
(3) Бедро	9,2	11,9	17,0	21,6	28,7
(4) Предплечье	15,3	11,8	12,0	20,3	22,6

Key: (1). Localization of break. (2). Year of war. (3). Thigh. (4). Forearm.

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From Table 68 evidently also an improvement in the documentation in the relation to primary processing on the years of war, since a number of cases when the hour of processing during the first day could not be established/installed, decreased two times.

Character/nature of primary surgical processing and complication with the bullet breaks of long tubular bones. This is a very important question, since some complications can be located in connection with the preceded processing, others, that arose before the processing, could affect the period productions and the character/nature of processing. Thus, between all complications which

were observed with the bullet breaks, and by primary surgical processing was always an interrelation (Table 69).

Analyzing given data, it is necessary to note the following.

a). Shock was complication which usually preceded primary surgical processing and it was caused by severity of damage, sometimes by abundant hemorrhage; in accordance with this most frequently (in downcoming order/formation) with it was produced amputation, processing of fragments of bone, dressing of vessels and removal/distance of bone fragments.

b) anaerobic infection in the majority of the cases was encountered after primary surgical processing, but in certain cases ("lightning form"), also, before the primary processing, when it was occasion for the amputation (from 1.8 to 26.0c/o). Furthermore, it is necessary to keep in mind that the anaerobic infection most frequently was developed with the heavy breaks (with those crushed into 12.5c/o, and with the perforated ones and the edge/boundary ones only into 1.6c/o). In view of this with the wounds, which were being complicated by anaerobic infection, was used the most complex processing. In the first place stood the amputation (thigh and forearm) or the dressing of vessels (shoulder and shin), in the second place - dressing of vessels (thigh and forearm), amputation (shin) and processing the fragments of bone (shoulder), etc.

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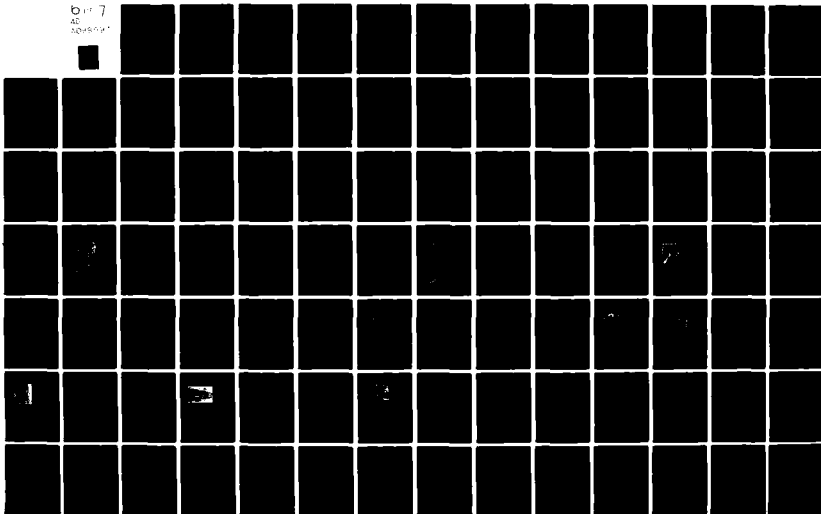


Table 63. Distribution of casualties with the bullet break of the bones of extremities according to the years of war and the periods of production in the primary surgical processing (in the percentages).

(1) Срок обра- ботки (2) Год войны	(3) Первые сутки (по часам)								(7) Вторые сутки и позже	(8) Всего	(9) Срок обработки неизвестен	
	(4) 1-я	(5) 2-3-я	(6) 4-6-я	(7) 7-9-я	(8) 10-12-я	(9) 13-18-я	(10) 19-24-я	(11) час не уста- новлен				
(10) Первый	1,1	3,1	9,7	8,4	6,6	7,5	6,8	18,9	62,1	37,9	100,0	9,7
(11) Второй	1,0	3,4	8,5	8,7	7,4	8,9	8,0	18,6	62,5	37,5	100,0	9,7
(12) Третий	0,9	4,1	11,6	11,6	8,3	10,7	8,9	13,0	69,1	30,9	100,0	9,6
(13) Четвертый	1,2	7,2	18,6	15,2	8,8	10,6	7,2	9,4	78,2	21,8	100,0	7,4
(14) В среднем	1,1	4,7	12,7	11,6	7,9	10,5	7,8	13,3	69,6	30,4	100,0	8,9

Key: (1). Period of processing. (2). Year of war. (3). First day (on hours). (4). y. (5). Hour is not established/installed. (6). Altogether. (7). Second day and thereafter. (8). In all. (9). Period of processing is unknown. (10). The first. (11). The second. (12). The third. (13). Fourth. (14). On the average.

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c). Sepsis, as a rule, was developed after heavy wounds. In certain cases development it it would be possible to place in the bond with the preceded processing and logical it was logical to expect in these cases of applying the simple means of processing; however in casualties with the complication of sepsis among different

means of processing the first place occupied processing fragments (thigh, shin, shoulder), splitting up with the carving (forearm) and most rarely was produced the removal/distance of foreign bodies (shoulder and shin) and amputation (thigh).

d). Osteomyelitis appeared independent of character/nature of primary surgical processing and was encountered during most different damages to bone, moreover difference in frequency of osteomyelitis after different means of processing was small, but nevertheless noticeable after processing bone wound.

Thus, all dismantled/selected complications by infection were located, first of all, in the tightest bond with the severity of break and, however thoroughly and radically was performed processing, nevertheless with its aid could not be completely arrested all heavy facilitating development infections of the consequence of the damages of tissues.

Table 69. Frequency of the principal complications in casualties with the bullet break of the bones of extremities, which were undergoing the primary surgical processing (cr 100 casualties, who obtained appropriate processings).

(1) Ослож- нения	(2) Характер обработки (3) Локализация перелома	(4) ⁽⁵⁾ Распечение и иссечение	(6) ⁽⁷⁾ ⁽⁸⁾ ⁽⁹⁾ Распечение и иссечение с удалением инородных тел удалением осколков кости удалением фрагментов кости перевязкой сосудов					(10) Ампутация	(11) ⁽¹²⁾ Прочие в соче- тании с	(13) ⁽¹⁴⁾ в среднем у обрабо- танных необра- ботанных	
			(6)	(7)	(8)	(9)	(13)			(14)	
(15) Шок	(16) Плечо	1,6	—	4,4	6,4	9,2	12,9	1,4	3,3	0,8	
	(17) Предплечье	0,7	0,5	1,6	7,4	1,4	12,9	—	1,4	0,2	
	(18) Бедро	5,2	4,8	12,4	29,3	26,2	32,6	1,4	8,3	6,0	
	(19) Голень	2,5	1,5	5,2	9,1	12,4	27,8	3,3	8,6	1,6	
(20) Ан- тропная инфек- ция	(16) Плечо	4,3	4,3	4,9	13,8	15,4	11,1	0,7	5,2	3,3	
	(17) Предплечье	2,2	2,4	3,3	3,7	3,8	6,3	1,3	2,6	1,4	
	(18) Бедро	12,9	13,3	13,2	9,8	23,0	27,4	3,4	13,4	7,3	
	(19) Голень	9,7	7,8	10,8	9,1	25,8	17,0	1,3	11,1	6,0	
(21) Сепсис	(16) Плечо	1,0	—	1,4	6,4	3,1	1,7	2,1	1,3	0,4	
	(17) Предплечье	10,3	1,1	0,5	—	1,4	0,4	—	0,4	0,1	
	(18) Бедро	10,1	8,6	14,5	26,8	10,8	2,3	12,2	10,8	7,0	
	(19) Голень	3,2	1,5	4,4	9,1	2,6	2,5	—	2,6	1,1	
(22) Остео- миелит	(16) Плечо	42,2	40,2	53,2	44,8	21,5	2,8	42,4	40,7	33,4	
	(17) Предплечье	27,8	31,1	44,7	37,0	37,9	1,3	33,9	30,3	18,8	
	(18) Бедро	33,8	41,4	41,9	39,0	20,0	1,7	35,4	37,4	20,1	
	(19) Голень	46,3	50,2	58,4	72,7	40,7	1,9	47,4	43,0	38,8	

Key: (1). Complications. (2). Character/nature of processing. (3). Localization of break. (4). Splitting up and carving. (5). Splitting up and carving s. (6). by removal/distance of foreign bodies. (7). by removal/distance of bone fragments. (8). by processing fragments of bone. (9). by dressing of vessels. (10). Amputation. (11). Other and combined. (12). On the average u. (13). processed. (14). not treated. (15). Shock. (16). Shoulder. (17). Forearm. (18). Thigh. (19). Shin.

(20). Anaerobic infection. (21). Sepsis. (22). Osteomyelitis.

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In the confirmation of this position/situation it is possible to cite data about the interrelation between the complications and the character/nature of the primary surgical processing, obtained during the study of the specially isolated group of casualties with the break, in which were absent many not being favorable to the healing of fracture factors; in this group were included the casualties:

- a). without accompanying wounds;
- b). those obtained first aid not later than 6 hours, and transport immobilization not later than 9 hours;
- c). obtained satisfactory transport immobilization;
- d). those processed are surgical not later than the first day.

During the comparison of the character/nature of primary surgical processing with the principal complications in the casualties of this group is established/installed, according to the data of the deepened development, the following (Table 70).

Thus, in the special group of casualties a maximum quantity of complications was observed with surgical interventions on the bones, which is explained by preponderance in these wounded more compound fractures (Table 71).

Table 70. Frequency of the complications of the bullet breaks of the bones of extremities after primary surgical processing in the specially selected group of casualties (in the percentages).

(2) Характер первичной обработки	(1) Осложнения	(3) Шок	(4) Анаэробная инфекция	(5) Сепсис	(6) Остеомиелит
(7) Обработки не было		3,5	4,8	1,0	25,5
(8) Обработаны мягкие ткани		3,7	7,6	3,0	38,9
(9) Обработаны кости и мягкие ткани		8,0	6,9	4,8	51,1
(10) Произведена первичная ампутация		33,5	10,5	1,2	1,8

Key: (1). Complications. (2). Character/nature of primary processing. (3). Shock. (4). Anaerobic infection. (5). Sepsis. (6). Osteomyelitis. (7). Processings it was not. (8). Are processed soft tissues. (9). Are processed bones and soft tissues. (10). Is produced primary amputation.

Table 71. Distribution of casualties according to the character/nature of primary surgical processing in the form/species of the break in the specially selected group (in the percentages).

(2) Характер первичной обработки	(1) Вид перелома	(3) Раздроб- ленный	(4) Осколь- чатый	(5) Прочие	(6) Всего
(7) Обработки не было		12,0	52,8	35,2	100,0
(8) Обработаны только мягкие ткани		12,5	50,4	37,1	100,0
(9) Обработаны фрагменты и удалены костные осколки		22,4	61,6	16,0	100,0
(10) Произведена первичная ампутация		98,2	1,4	0,4	100,0

Key: (1). Form/species of break. (2). Character/nature of primary processing. (3). Crushed. (4). Fragmented. (5). Other. (6). In all. (7). Processings it was not. (8). Are processed only soft tissues. (9). Are processed fragments and are removed bone fragments. (10). Is produced primary amputation.

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Repeated operations/processes after primary surgical processing.

In certain cases applied on DMF and in KhPPG of the first line primary surgical processing with the breaks proved to be insufficient, and sufficiently rapidly appeared need in the repeated operations/processes. The frequency of repeated operational ones

intervention depended on the means of primary surgical processing (Table 72).

After the removal/distance of foreign bodies and simple splitting up of wound repeated operations/processes were required most rarely, since these means of processing were produced in the mild cases. The casualties most frequently underwent repeated operations/processes after the dressing of vessels and processing of bone wound.

The character/nature of repeated operations/processes after primary surgical processing is represented in Table 73.

Table 72. Frequency of repeated operations/processes after the primary surgical processing of the bullet breaks of the bones of extremities (on 100 casualties, who obtained appropriate processings)
1.

FOOTNOTE 1. Table shows operations/processes for the elongation/extent of entire treatment of casualties. ENDFOOTNOTE.

(1) (2) Характер обработки Локализация перелома	(3) Расчленение	(4) Иссечение	(5) Расчленение и иссечение с				(10) Сочетание	(11) В среднем	
			(6) перевязкой сосудов	(7) удалением инородных тел	(8) удалением костных осколков	(9) обработкой фрагмен- тов кости		(12) у обрабо- танных	(13) у необра- ботанных
(14) плечо	51,2	50,7	49,2	43,5	57,0	51,7	67,7	50,1	38,5
(15) предплечье	34,1	38,8	42,2	35,9	45,8	40,7	56,7	41,7	21,0
(16) бедро	61,5	70,6	73,8	67,5	71,0	63,4	68,0	64,6	59,4
(17) голень	63,3	62,9	72,2	55,8	74,5	86,4	70,8	72,7	46,4
(18) В среднем	52,1	55,7	57,8	52,7	62,4	52,0	67,1	55,2	32,9

Key: (1). Character/nature of processing. (2). Localization of break. (3). Splitting up. (4). Carving. (5). Splitting up and carving s. (6). binding of vessels. (7). by removal/distance of foreign bodies. (8). by removal/distance of bone fragments. (9). by processing of fragments of bone. (10). Patched. (11). On the average. (12). in those processed. (13). in those not treated. (14). Shoulder. (15). Forearm. (16). Thigh. (17). Shin. (18). On the average.

Table 73. Frequency of the individual operations/processes, produced of the afterward different primary surgical processing of the bullet breaks of the bones of extremities (in the percentages).

(1) (2) Последующие Характер первичной обработки операции	(3) Вторич- ная обработка	(4) Вскрытие гноя затягов	(5) Пере- вязка сосудов	(6) Ампута- ция	(7) Секвестр- эктомия
(8) Рассечение	13,5	8,3	1,1	6,5	26,1
(9) Рассечение и иссечение	14,4	7,6	1,4	9,6	25,5
(10) Рассечение и иссечение с перевязкой сосудов	6,5	6,0	2,1	22,3	21,7
(11) Рассечение и иссечение с удалением инород- ных тел	12,6	8,2	1,0	7,0	28,3
(12) Рассечение и иссечение с удалением костных осколков	12,6	5,2	0,9	11,7	38,2
(13) Рассечение и иссечение с обработкой фраг- ментов кости	14,9	6,6	—	13,3	28,2
(14) Сочетанная	14,1	6,3	1,0	18,8	18,2
(15) Не было обработки	6,6	6,4	0,7	3,7	14,1

Key: (1). Subsequent operations/processes. (2). Character/nature of primary processing. (3). Reworking. (4). Autopsy of suppurative flows. (5). Dressing of vessels. (6). Amputation. (7).

Sequestrectomy, (8). Splitting up. (9). Splitting up and carving. (10). Splitting up and carving with dressing of vessels. (11). Splitting up and carving with removal/distance of foreign bodies. (12). Splitting up and carving with removal/distance of bone fragments. (13). Splitting up and carving with processing of fragments of bone. (14). Matched. (15). It was not processing.

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From Table 73 it is evident that the frequency of the individual operations/processes, produced after primary processing, on the whole it is small varied depending on the character/nature of the preceded processing. The available small differences can be explained by the character/nature of the damage apicps of which was produced that or other processing. For example, a great number of amputations it is completely logical it was logical to expect after the dressing of vessels (22.60/o); a great number of sequestrectomies (38.20/o) after the removal/distance of bone fragments it is also completely explained by the fact that this means of processing was produced in essence with comminuted fractures, etc.

Finally, a small number of different repeated operations/processes is characteristic for those cases when primary surgical processing in no way was performed, since, because of the correct selection, in this group were referred less heavy wounds.

Analysis of the group of "those not treated". As can be seen from Table 56, primary surgical processing was not performed with the bullet breaks of thigh into 24.50/o, shins - into 24.40/o, shoulder - into 30.30/o and forearm - into 44.50/o, on the average with the breaks these of bones - into 33.10/o.

This significant group, constituting almost third of all casualties with the damage to bone, deserves more detailed examination, especially as in those not treated was observed a smaller quantity of complications, the best clinical outcomes, smaller detail and a smaller number of repeated operations/processes. Consequently, abstention from the primary processing in the "shown cases" during the Great Patriotic War was correct.

Abstention from the primary surgical processing should be recognized justified, if the casualty in the process of treatment did not have what or complications, which required surgical intervention. It is possible to distinguish the following reasons by which was not performed primary surgical processing (data of the deepered development in the percentages to a number of those not treated):

- 1) the special severity of wound, which involved rapid death, from 0.3 (forearm) to 6.3 (thigh); in average/mean 1.6;
- 2) the absence of readings/indications to the processing - from 80.0 (forearm) to 57.6 (shin); in average/mean 71.2;
- 3) the reason for nonmedical character/nature - from 19.7

(forearm) to 40.8 (shin); in average/mean 27.2.

For the more detailed study of the group of those not treated were undertaken only those cases of the wounds, in which primary surgical processing was unconditionally shown, i.e., casualties, they were which, it was not produced primary surgical treatment, but subsequently followed smooth course and healing without surgical interventions.

After exclusion from a total number of all dead persons before the processing, and also operated (subsequently) casualties the group of those not treated respectively decreased, namely with the wound of thigh - from 24.5 to 12.0% of shin - from 24.4 to 12.6% of shoulder - from 30.3 to 18.1% and of forearm - from 44.5 to 34.9%: on the average - from 33.1 to 21.0%.

On the years of war a quantity of casualties, receiving primary surgical processing, was changed as follows (Table 74).

Thus, a number of untreated casualties with the subsequent smooth course of break each year of war sharply was shortened.

This is explained the mainly increased/grown with the course war by the activity of the surgeons and the expansion of readings/indications both to the primary surgical processing and to the repeated operations/processes; to a lesser degree this was explained by the increase of unfavorable factors with the course of war.

The facts, which held surgeons from the primary surgical processing of breaks, they were most frequently: a) the form/species of wounding shell, b) the character/nature of wound, c) the sizes/dimensions of entrance and especially outlet, d) the form/species of break and its localization, e) the period, which passed from the moment/torque of wound.

a). Form/species of wounding shell. Based on materials of the deepered development are acquired following data about a number of untreated casualties with the break, caused by bullet or fragment (Table 75).

Table 74. Frequency of absence of primary surgical processing with the subsequent smooth course of break on the years of war (in the percentages to a number of casualties with the break in each year).

(2) Годы войны	(1) Локализация перелома					(7) В среднем
	(3) Плечо	(4) Предплечье	(5) Бедро	(6) Голень		
1941	44,7	65,3	27,1	34,1		48,3
1942	26,9	46,7	16,6	16,9		29,8
1943	15,3	28,5	11,1	10,3		17,2
1944	10,4	19,0	7,3	7,5		11,5
1945	5,7	16,0	5,8	6,7		8,0
(8) В среднем . . .	18,1	34,9	12,0	12,6		21,0

Key: (1). Localization of break. (2). Years of war. (3). Shoulder. (4). Forearm. (5). Thigh. (6). Shin. (7). On the average. (8). On the average.

Table 75. The specific gravity/weight of the untreated bullet breaks of the bones of extremities in the dependence on the means of wound (in the percentages).

(1) Вид ранения (2) Локализация перелома	(3) Пулевое		(6) Осколочное	
	(4) всего не обработано	(5) безусловно не нуждались в обработке	(4) всего не обработано	(5) безусловно не нуждались в обработке
(7) Плечо	36,0	28,4	22,8	11,2
(8) Предплечье	51,2	42,5	37,8	18,5
(9) Бедро	28,5	16,3	19,5	6,8
(10) Голень	31,0	19,4	18,3	7,0
(11) В среднем	39,5	28,8	24,3	10,6

Key: (1). Means of wound. (2). Localization of break. (3). Bullet. (4). in all it is not processed. (5). unconditionally they did not need processing ¹.

FOOTNOTE ¹. Smooth course without the subsequent operations/processes. ENDFOOTNOTE.

(6). Fragmentation. (7). Shoulder. (8). Forearm. (9). Thigh. (10). Shin. (11). On the average.

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Deducting from a number of untreated casualties a number of

casualties, who were not unconditionally needing processing, it is possible to determine the strength of group of those casualties who were not processed for reasons for nonmedical character/nature. This group in its value was identical almost for all segments and comprised in average/mean 12.0c/c.

Thus, when processing was not performed for reasons, which do not depend on the medical personnel, the difference between the bullet and fragmentation wounds was very insignificant (10.7-13.7o/o); whereas failure of the processing from the medical readings/indications with bullet wounds (28.8c/o) was observed into more than two and one-half of times more frequently than with the fragmentation ones (10.6c/o).

b). Character/nature of wound was always considered during establishment of readings/indications to production in primary surgical processing (Table 76).

Breaks with the perforating wounds did not most frequently undergo primary surgical processing. Fairly often (23.3o/o) they abstained from processing of breaks with the tangential wounds, since with them in the majority of the cases were well opened wounds with the defect of soft tissues; the breaks with the blind-end wounds remained without the primary surgical processing into two and

one-half of times are less frequent than with the penetrating and the tangents.

c). Small sizes/dimensions of entrance and especially outlet were in most cases sufficient active for abstention from production in primary surgical processing. As example can serve the data, which concern the breaks of thigh (Table 77).

Thus, in casualties, who were not undergoing primary surgical processing, in comparison with those undergoing by it more frequently were encountered the wound apertures of the small sizes/dimensions (to 2 cm) and less frequent than the large-size aperture (more than 10 cm), moreover to the greater degree this concerns the outlet, than entrance one.

d). Localization and form/species of break. The frequency of abstention from the primary surgical processing depending on localization of break and its form/species was dissimilar (Table 78).

Table 76. The specific gravity/weight of the untreated bullet breaks of the bones of extremities in the dependence on the character/nature of wound (in the percentages).

(2) Локализация перелома	(1) Характер ранения	(3) Сквозное	(4) Слепое	(5) Касательное
(6) Плечо		21,2	10,3	20,9
(7) Предплечье		28,7	14,3	31,3
(8) Бедро		14,3	8,4	19,1
(9) Голень		16,1	8,4	19,0
(10) В среднем		25,5	9,1	23,3

Key: (1). Character/nature of wound. (2). Localization of break. (3). Through. (4). Blind. (5). Tangent. (6). Shoulder. (7). Forearm. (8). Thigh. (9). Shin. (10). On the average.

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Thus, all forms/species of the breaks of thigh and bones of shin were not treated and had smooth course almost equally frequently. One and a half times it is more frequently than the breaks of thigh and shin, were not treated the breaks of shoulder and are almost three times more frequent the breaks of forearm.

Undoubtedly, did not need the primary surgical processing (on the average) an approximately identical number of casualties with any

form/species of the break, with exception crushed, with which the processing was not performed three times less frequently than with other breaks.

With the breaks of individual bones this difference was still more, for example, with the breaks of thigh and shin to 6 times (crushed - 3.10/o, and perforation type - 19.00/o).

d). Factor of time, which passed from moment/torque of wound had value only when casualties late entered processing, and course of break was smooth. In such cases the processing was not performed.

Table 77. Distribution of casualties with the bullet break of thigh according to the sizes/dimensions of wound apertures in the groups of the casualties, who were undergoing primary surgical processing and which were not undergoing by it (in the percentages).

(1) Группа раненых	(2) Раневое отверстие	(3) Диаметр отверстия в см			(6) Всего
		(4) 2 и меньше	(5) с 2,1 до 10	(7) 10,1 и больше	
(7) Не подвергав- шиеся обра- ботке	(8) Входное	70,1	22,0	7,9	100,0
	(9) Выходное	56,7	33,3	10,0	100,0
(10) Подвергав- шиеся обра- ботке	(8) Входное	60,4	18,9	20,7	100,0
	(9) Выходное	27,8	34,7	37,5	100,0

Key: (1). Group of casualties. (2). Wound aperture. (3). Diameter of apertures in cm. (4). and it is less. (5). to. (6). In all. (7). Not treated. (8). Entrance. (9). Exit. (10). Treated.

Table 78. Frequency of the absence of primary surgical processing with the subsequent favorable course of the breaks of the bones of extremities (in the percentages to a number of breaks according to each form/species).

(1) Вид перелома (2) Локализация перелома							
	(3) Дыр- чатый	(4) Крае- вой	(5) Продоль- ный и поперечный	(6) Косой	(7) Осколь- чатый	(8) Раздроб- ленный	(9) В среднем
(10) Плечо	18,4	24,1	17,5	20,3	18,8	8,4	18,1
(11) Предплечье	41,1	46,7	39,2	41,0	31,8	17,4	34,9
(12) Бедро	19,0	15,7	13,0	17,6	11,8	3,1	12,0
(13) Голень	18,2	19,4	16,8	16,5	11,2	3,4	12,6
(14) В среднем	22,6	25,4	21,9	25,2	26,1	8,0	21,0

Key: (1). Form/species of break. (2). Localization of break. (3). Perforated. (4). Edge/boundary. (5). Longitudinal and cross. (6). By sand bar. (7). Fragmented. (8). Splintered. (9). On the average. (10). Shoulder. (11). Forearm. (12). Thigh. (13). Shin. (14). On the average.

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As a result into the group of the casualties, who were not undergoing primary surgical processing and who had the smooth course of breaks, entered 12.0o/o of all breaks of thigh and 12.6o/o of bones of shin, 18.0o/o - the breaks of shoulder and 34.9o/o - the breaks of the bones of forearm, with this 25.5o/o of all perforating wounds, 23.3o/o - of tangential and 9.1o/o blind-end wounds.

In this group were 28.8o/o of bullet and 10.6o/o fragmentation wounds; 8.0o/o of all crushed breaks, also, about quarter of entire number of each other form/species of break (perforated, edge/boundary, etc.).

In 70.1o/o of casualties with the break of thigh the diameter of inlet was to 2 cm in 29.9o/o - more than 2 cm (outlet - to 2 cm in 56.7o/o more than 2 cm - in 43.3o/o).

Thus, the group of the untreated casualties by its composition was sufficient different in the relation localization of the break, form/species and character/nature of wound, form/species of break and

value of wound apertures. According to the form/species of break it cannot be related to the light, since into its composition in the decreasing order/formation they entered: comminuted fractures (51.20/o), perforated and edge/boundary (21.80/o), oblique, cross and longitudinal (19.70/o) and crusted (7.30/o).

Generalizations on the primary surgical processing.

In the relation to bullet breaks is recommended the following line of conduct: "All casualties with the diagnosed on DMP damages of bones they are subject to surgical processing" "Conservative treatment is shown in the exceptional cases" and it is still further: "In exactly the same manner should be removed all lying wound the bone broken ends, which lost bond with the periosteum".

In accordance with this during the Great Patriotic War from year to year a number of "those not treated" was decreased and reached to 8.90/o (Table 74), was increased a number of processing with the removal/distance of bone fragments and was decreased a number of operations/processes only on the soft tissues.

As a result for entire war it proved to be the "untreated" wounded with the bullet break of bones extremities from 24.4 (shin) to 44.50/o (forearm), while in average/mean 33.10/o, including on the

absence of readings/indications to 23.50/o.

As the reasons for abstention from production in the primary surgical processing it served: the severity of wound (1.60/o), the absence of readings/indications (71.20/o), reason for nonmedical order/formation (27.20/o).

A smaller number of complications, the best clinical outcomes and smaller lethality in the group of "those not treated" depended not only on the lighter composition of casualties in this group, but also from the skillful selection of casualties for the abstention from the processing, since among those not treated there was a sufficient quantity of those obtained the wounds of average/mean severity and even heavy ones.

Are given below two cases of the favorable course of the crushed break of thigh, in spite of the absence of primary surgical processing.

1. Wounded K., 23 years, 29/VI 1941 obtained multiple wounds by fragments of aircraft bomb, including blind-end wound of left thigh with break of bone. "They immediately made a dressing".

30/VI it entered into the urban hospital; on the the posterior

of surface of left thigh, on 8 cm it is lower than the buttock fold, with the dressing was noted the wound with a diameter of 2.5 cm. Edges of wound scratched. In the preceding stage to all wounds were superimposed the first aid kits (without the primary processing).

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In the X-ray photograph of 3/VII a comminuted fracture of left thigh in middle third with the incorrect standing of broken ends.

4/VII is superimposed skeletal/skeleton traction/extension for the thigh. During 10 days subfebrile temperature due to festering of wound stops with the break of bones. 3/VIII traction is taken/removed, and is superimposed deaf gypsum bandage; 9/VIII casualty is evacuated into the rear.

During the x-ray examination 17/VIII is established/installed the crushed break of middle third of thigh and metallic fragment by the size/dimension 2x1 of cm in the soft tissues. Subsequently course smooth, no operations/processes the casualty underwent, foreign body was not removed.

It is discharged in 8 months with the shortening of thigh on 3 cm.

2. Wounded n., 30 years, 14/XI 1974 obtained perforating bullet wound of right thigh with break of bone.

First aid is shown/rendered by aidman, then is produced dressing and immobilization Kramer splints on PMP and DMP.

18/XI it entered into the front line evacuation hospital where during the x-ray examination was established/installed the crushed break in upper- average/mean third of thigh with the significant displacement. In the course of 2 months was cured by traction/extension by sticky mat/patch and by thrust for the gypsum annuli, then by deaf gypsum bandage. During the first week was observed subfebrile temperature.

25/XI 1942 it is discharged with the shortening to 6 cm, scars 1-1.5 cm.

Primary surgical processing in essence consisted of simple operations/processes (77.10/c): one splitting up - 47.90/o, splitting up and carving - 12.00/o, splitting up and carving with the removal/distance of bone fragments - 17.20/o, which corresponded to operational possibilities of DMP and ^{Kh}PPG, where were produced more

than 90.00/o all processing.

By the deepened development established/installed, that the best clinical outcomes were observed after the simple processing (one splitting up or in the combination with the carving), and the worse outcomes - after intervention on the bone whose need was usually connected with the greater severity of wounds.

By the materials of the deepened development confirmed also the advantage of early treatment (in the first twenty-four hours) before the late (into second day or later).

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Chapter VI.

PATHOLOGICAL ANATOMY OF THE BULLET BREAKS OF THE BONES OF EXTREMITIES
BASED ON MATERIALS OF THE AUTOPSIES OF THOSE BEEN KILLED ON THE FIELD
OF BATTLE AND IN THE STAGES OF EVACUATION.

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General/common/total morphology of the bullet wound of
extremities with the break of bone. The course of bullet wounds in
all organs/controls and tissues is subordinated to single
regularities. Peculiar lines to wound process add mainly
functional-morphological special features/peculiarities of the
casualty organ/control. *A* Therefore with the presentation of the
pathological anatomy of the wounds of any localization it is
necessary to investigate both the special, specific only to this
organ/control pathological processes and those morphological changes,
which although are not for it specific, have a value in the
manifestation of general regularities the evolutions of bullet

wounds. Such regularities include the processes of demarcation, condition and the dynamics of uncomplicated healing of wounds, the pathogenesis of suppurations in the wound and so forth, etc.

With the bullet breaks all processes indicated had their, specific only to these wounds clinical-morphological special features/peculiarities.

Together with this, wound process in the different departments of extremities not only in principle uniform, but it is similar and in the morphological details. Differences in this respect with the wounds of thigh, shin, shoulder and forearm carried more quantitative, than qualitative, character/nature and concerned mainly the soft tissues where the special anatomical-topographical relations predetermined different range of the dissemination both of early and late suppurations. The same factors lay/rested in essence of different final outcomes of traumata (contracture, shortening, dummy joints, etc.). Pathological processes in the damaged bones and in quantitative sense were distinguished considerably less. Mentioned quantitative variations had such greater value for the clinic, creating the peculiar clinical course of wounds in different departments of extremities.

Based on this, with the presentation of the pathological anatomy

of bullet breaks it was necessary to adhere to the basic concept of the development of morphological changes with the wound the process whose specific lines in different departments of extremities were noted, where this it was necessarily, on the course of presentation.

The inquiries of statistical character/nature in this chapter are absent, they are given sufficiently fully in unit of the IV present "Work" the "Pathology of bullet wounds and damages".

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Materials for the present chapter was the research of the Soviet anatomical pathologists and clinicians, carried out during the years of the Great Patriotic War and in the postwar period, first of all the work of I. V. Davydovskiy, S. N. Derizhanov, A. P. Avtsyn, P. G. Kornev et al., most consecutively/serially and in detail studied the dynamics of wound process and the pathogenesis of the complications of the wounds of extremities with the break of bones.

With the wounds of extremities with the damage of the diaphysis of long tubular bones bullet shell (bullet fragment) pierces the tissues, which are distinguished by the physical qualities and an anatomist-histological structure: skin, cellulose, fascia, muscle, bone. Its action on all these tissues is different, in consequence of

which and building/structure of wound canal in the different cuts proved to be dissimilar. Form and sizes/dimensions of skin wounds widely varied depending on the character/nature of the wounding shell. In the fascias were formed either torn wounds, usually greater sizes/dimensions than the diameter of shell, or fascias were split on the course of fibers. Muscles were torn and were crushed; defect in the muscles was increased due to the contraction/abbreviation of the torn muscular bundles. In the diaphysis of tubular bones almost always were obtained comminuted fractures or occurred extensive crushing. Bone fragments, after obtaining the unit of the kinetic energy of shell, were born along the axis of its movement and flew away to the sides. Being introduced in the surrounding soft tissues and after bringing in on them additional trauma, they formed numerous slits and canals which subsequently could prove to be isolated/insulated from the wound as a result of the displacement of the damaged muscular bundles and broken ends of bone.

The unit of the bone fragments under the sufficient manpower of shell was discarded from the wound, in consequence of which the outlet frequently had a character/nature of the extensive, turned wound with the torn, contused and crushed edges.

The damages of the diaphysis of the long tubular bones of extremities were characterized by the education of comminuted

fractures (Fig. 51). Sizes/dimensions and quantity of fragments varied over wide limits; however, during the macroscopic research the region of the cracking of bone with the wound from the near and average/mean distances remained more or less identical. For each bone it was stable, being expressed in the following numerals: for the femoral bone 13-15 cm, for the the tibial of 10-12 cm, for shoulder 7-10 cm and for the bones of forearm 4-5 cm. With an increase in the manpower of shell was increased only the degree of the crushing of bone in the limits of one and the same zone of cracking. However, as showed histo-topographic research of wounded extremities, which were being produced upon the amputation or in the case of death of casualties during the first days after wound, damage to bone never was limited only to this zone - very heavy damages always occurred and far beyond its limits. With an increase in the manpower of shells the zone of these damages and their intensity increased/grew.

With the wound by the large/coarse fragments of shells and by the explosive bullets, and also by ordinary bullets and by the fine/small fragments when wound was brought in from the short distance, could occur the crushing of bone with the complete destruction of this department of extremity and its disengagement.

Under the same conditions the tangential wounds of extremity led to the very significant crushing of soft tissues with the extensive turned wounds, moreover in the bone were obtained the simple fragment-free breaks, which morphologically remind of nonartillery [nonbullet]. Such breaks could be formed only under the activity of the force of the lateral impact of shell, without its contact with bone itself. The possibility of the break of this type is proved both experimentally and during the study of combat trauma (Fig. 52).

The pure/clean perforated wounds of diaphysis were not encountered. During any damage of diaphysis by bullet shell occurred the cracking of compact substance, which is explained by the physical special features/peculiarities of the structure of this department of the bone (see unit of the IV "Work" the "Pathology of bullet trauma", chapter I).

With the wound by the shells, which possess the large manpower (shots in the stop/emphasis, the wounds by fragments near the place of the break of artillery shells), the bones were crushed to many fine/small fragments, which entailed the destruction of extremity.

With the decrease of the manpower of the wounding shell the degree of the cracking of bone was decreased, and with the bullet wounds from the average/mean distances (600-800 m) were obtained

typical comminuted fractures with the restricted quantity of fragments. With the wound by bullets and by fragments on the end of flight (for the bullets, beginning from the distance of approximately 2000 m) occurred the oblique, frequently fragment free breaks and the decomposition of diaphysis, or in its compact substance appeared unitary cracks, which could and not be escorted/tracked by break. Sizes/dimensions and form of bone fragments in each bone are different and are determined by fortress, thickness of compact substance and by surface curvature of diaphysis. In the femoral and tibia the fragments were most large/coarse and they had the elongated form; in other bones of extremities they were considerably less and they had polygonal or "acicular" form.

With the cracking of bone and the education of fragments proceeded the break of periosteum, its destruction and scaling for the significant elongation/extent from the place of break. The direct activity of shell itself as the reason for this scaling in the majority of the cases did not have the leading value. The main factor, which calls this phenomenon, was the displacement of broken ends and fragments at the moment of wound. Fine/small fragments completely were torn away from the periosteum, larger/coarser could maintain with it loose bond only partially, sometimes periosteum in no way was stratified.

On the ratio of fragments to the periosteum and their topography is based the classification of fragments, proposed already by N. I. Pirogov. It distinguished: 1) the fragments, free at the wound canal and the surrounding tissues; 2) packed in into the marrow canal; 3) semifree; 4) solidly connected with the periosteum and finally 5) "bone flour" - the smallest fragments, which are generated from the surface strata of the compact substance, crushed by shell in the point of impact. This classification made it possible to to a certain degree determine further fate of fragments and their role with the diverse variants of the course of break.

The damage of soft tissues to a considerable degree depended on the character/nature of break, since it was produced not only by shell, but to by bone fragments.

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With the crushing of bone under the activity of bone fragments occurred the extensive decomposition of soft tissues, sometimes with the full/total/complete disengagement of extremities, or the latter remained connected to corpse only by means of the narrow musculocutaneous navigation bridges. The wounds of this type are possible in the presence of the maximum manpower of the wounding shell; they were observed almost exclusively on the thigh, which is

explained by the large fortress of femoral bone, in consequence of which during its damage more frequently was observed the blast effect. The resistivity of other bones of extremities to the activity of shell is weaker, and blast effect is less; therefore the disengagement of shoulder, forearm, shin occurred most frequently under the activity of large/coarse fragments or whole artillery shells, whereas the role of bone fragments in the decomposition of extremity was with these wounds incomparably less. With the decrease of the living of shell were obtained the extensive turned wounds, through, blind or tangential. And in these cases under the activity of bone fragments was very sharply increased the trauma of soft tissues. With such wounds of bone there are crushed, the fragments strongly displaced, in consequence of which appeared significant diastasis of the ends of the break.

Disengagements and extensive crushings of extremities were observed relatively rarely. The majority of the wounds of extremities had a character/nature of through or blind with the relatively small decomposition soft tissues. Typical for them was the following structure: the cut of wound canal in the soft tissues between the inlet and the bone of different diameter (depending on the ballistic qualities of shell), with the small zone of damage in the periphery; a comminuted fracture of bone with the most varied quantity of fragments of different sizes/dimensions; paraosseal tissues and the

tissues, arranged/located between the bone and the outlet (but with the blind-end wounds - place of the stop of shell), were crushed, "stuffed" by the smallest bone fragments. From the basic focus of crushing depthward muscles will withdraw the canals of different sizes/dimensions, which arose as a result of the activity of bone fragments and foreign bodies. They blindly are ended at the depth from 2-3 to 10 cm. Outlet, depending on the sizes/dimensions of shell, the genus of its movement, etc., has a character/nature of the turned, gaping wound or it differs little from the entrance (see unit of the IV "Work" the "Pathology of bullet trauma", chapter I). The sizes/dimensions of the focus of crushing in such wounds in essence depend on the degree of the crushing of bone (quantity and the value of fragments): is most great crushing with the multifragment breaks, and with fragment-free and large-splintered ones it is minimal. Wound canal in the extremity, especially when it passes through large muscular masses, does not have rectilinear direction usually it is winding or discontinuous due to the secondary deviation of muscles, ends of the break and fragments.

The structure of the wounds where there is only a contusion or a tangential damage to bone; not entailing break, sharply it differs from that described. In such cases occurred the decomposition of periosteum, the cracking of compact substance and the very disseminated contusion of bone marrow, but the structure of wound

canal was the same as with the wound of some soft tissues.

Special reference they deserve the damage of foot and the shin, obtained during the burst of antipersonnel mines. These damages were escorted/tracked by decomposition feet, frequently with the disengagement its, and bones of shin either were crushed or they broke in several places. It is most typical: the decomposition of the lower pineal system of the tibia and comminuted fractures of the diaphysis of the bones of shin in middle third. For of this genus of wounds was considered characteristic the extensive decomposition of bone marrow of tibial bones under the effect of the extremely significant force of jolt. Bone marrow was converted into the semiliquid blood-containing pulp, which included the crushed bone beams/gullies. Simultaneously occurred gap and crushing of tendons, muscles, skin, vessels and nerves, in consequence of which occurred the complete destruction of extremity.

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Fig. 51. Multifragment bullet break of femoral bone (figure from macerated preparation 5 weeks after wound). Occurred suppuration of

wound, in consequence of which at the ends of the break were visible the primary sequestrations, delimited by sequestral sulci/furrows/grooves. The same sequestrations are arranged/located on the edges of some fragments. The fragments, which have smooth surface, were torn away from the periosteum and they underwent numbness by rear sight. Preparation VMH No 936. (Artist of T. V. Belyayev.).

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Fig. 52. Fragment wound of thigh with decomposition of soft tissues, knee joint and dual break of femoral bone. Preparation VMM No 2992/151. (Artist V. S. Chumanova.).

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Thus, with the bullet breaks almost never it was obtained

typical cylindrical or cone-shaped wound canal; as a rule, wound in the different sectors took different form, but as a whole it was the focus of the crushing of bone and crushing of the soft tissues of very incorrect configurations (Fig. 53).

Under the effect of the direct activity of bullet shell in the wound appeared the large/coarse sectors of necrosis. Necrosis underwent the crushed tissues in the edges of wound, the scraps of muscles and fascias, torn away by shell on the course of wound canal, and also free bone fragments. This dead substrate with the bullet breaks was arranged/located in the different sectors of wound, being it was separated as a result of the deviation of wound canal.

Contents of wound canal. Contents of wound canal with the bullet breaks composed blood clots, crushed tissues, foreign bodies, bone fragments. The blood, spilled at the moment of wound, after arriving into the contact with the crushed tissues, rapidly was coiled, forming on the walls of wound the compact film of clot. With the hiatus of the lumen of large vessel this clot, however, did not always cause the stop of blood flow, and the blood, which continued to issue itself, broke through in the initially formed clot the narrow canals in lumen of which it for long remained unclotted or was converted only into the loose clots. This created the danger of repeated hemorrhages. In the course of time occurred the retraction of blood

clot with the liberation/excretion of plasma, in consequence of which in the period of traumatic edema the lumen of wound canal proved to be that stoppered by the masses of fibrin, which encompassed by tissue detritus and foreign bodies.

Damages of the vessels of large/coarse medium caliber. The damages of vessels with the bullet breaks of all departments of the bones of extremities were observed fairly often. Vessels could be wounded by shell itself, and then occurred full/total/complete break, much more rarely was observed perforated or tangential defect. Frequently vessels were damaged by sharp/acute bone fragments both at the moment of wound and in the subsequent time, during the movements of wounded extremity to the imposition of immobilization. Damages by bone fragments had a character/nature of slit-shaped or torn apertures.

If in the wound was not developed suppurative process, then in the damaged large vessels of thrombi barely it was observed. They were stoppered by the formed from the issuing from blood clot which penetrated into the lumen of vessel to the depth only of 1-2 mm. Only subsequently, in the process of suppuration of wound, could advance the disseminated thrombosis of the damaged vessels.

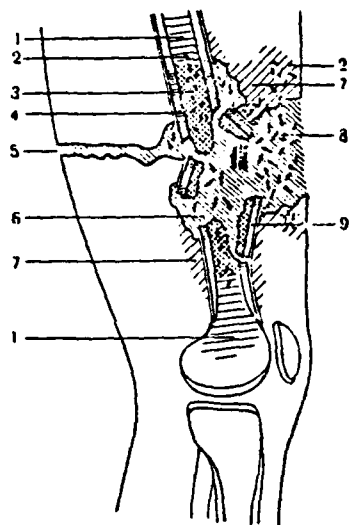


Fig. 53. Scheme become fresh the bullet wound of thigh with the multifragment break of bone. 1 - zone of flowing contusion of the point of impact hemorrhages in bone marrow; 2 - fine/small bone fragments, which were incorporated of depthward marrow canal and soft tissues; 3 - zone of the hemorrhagic infiltration of bone marrow; 4 - zone of the hemorrhagic infiltration of Haversian canals; 5 - inlet; 6 - zone of crushing soft tissues; 7 - paraosseal and intermuscular hematoma; 8 - torn away from the periosteum bone fragments.

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In this repeatedly was convinced the author, investigating those amputated in the first twenty-four hours after the wound of the

extremity when amputation was produced apropos of the damage of main-line vessels..

When large vessels (especially shin and forearm) were arranged/located in the zone of contusion near the edge of wound, then occurred only the contusion of vessel with the multiple fine/small gaps of the elastic membranes/diaphragms of intima with crushing of adventitia, but without the formation of opening in the wall of vessel. In such cases soon after wound it occurred thrombi with the obturation of the lumen of vessel, which could involve the ischemic gangrene of extremity or the ischemic necroses of muscles. As the example of injuries of this type can serve the following observation.

N. (its own observation) is wounded into the left shin. On the 4th day after wound amputation apropos of anaerobic gangrene.

At the research of the amputated extremity it is found: to anterointernal than the surface of lower half of shin the split wound with the size/dimension 20x5 of cm. that penetrates into the thickness of flexors. The extensors of shin around the wounds dry, brittle, are pierced by gas bubbles. The tibia is broken, moreover were formed many fragments; unit of them was displaced into the thickness of the flexors which were crushed for the large

elongation/extent. Under the skin of the posterior surface of knee is found the fragment of shell with the size/dimension 1x0.5 cm. The continuity of large vessels is not disrupted. Posterior tibial artery was arranged/located in the wall of wound canal. Its lumen for entire elongation/extent was obturated by dry thrombotic masses. The thrombus near the wall is discovered in the lumen of posterior tibial vein. The flexors of shin in lower third are necrotized, they appeared dry, of dull yellow color, whereas by places they took the form of semiliquid, blood-containing masses.

During the histological research of the sector of the wall of artery, located in zone wound canal, are discovered the numerous gaps of external and internal elastic membrane/diaphragm and the foci of necrosis in the muscular layer.

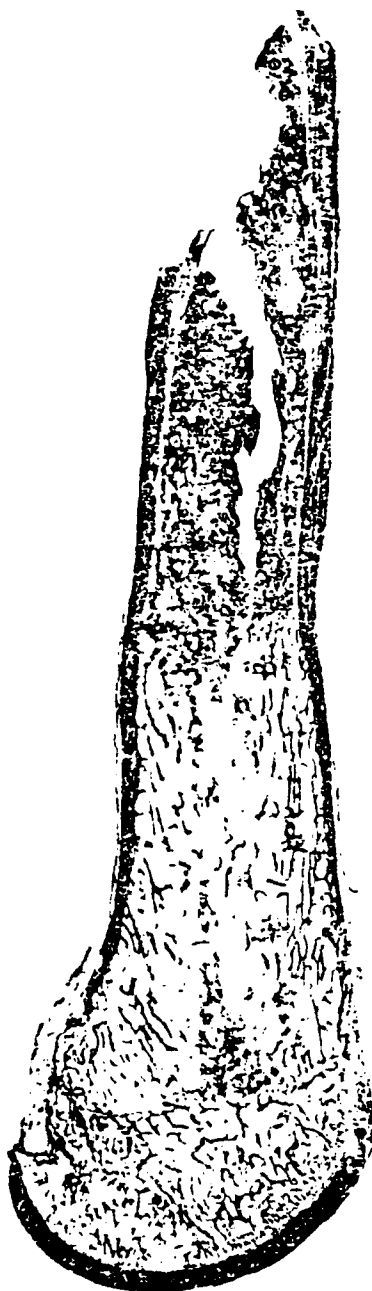


Fig. 54. concussion damage to femoral bone. Perforating bullet wound

of middle third of thigh. Death to the second day from the blood loss. Figure from the histotopographical preparation.

Wide zone of the hemorrhagic infiltration of bone marrow at the edge of break. The zone of fine/small hemorrhages and decomposition of oil cells achieves epiphysial line. Are visible the major drops of fat and the hemorrhages, arranged/located by greater unit next to the bone beams/gullies.

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The damages of the large/coarse nerve trunks of lower extremity (sciatic nerve, etc.) were noted predominantly in the cases of the extensive decomposition of bone and soft tissues when usually was produced the amputation of extremity. In the significant majority of the cases with the remaining wounds large/coarse nerve trunks were not damaged. On the upper extremities, especially on the forearm, the wound of large/coarse nerve trunks, to their gap, was observed much more frequently.

Morphological manifestations of contusion and concussion in the edges of wound with the bullet wounds of extremities. By the basic special feature/peculiarity of the structure of bullet wounds in comparison with the damage of another origin there was the fact that,

together with the direct decomposition, caused by shell and bone fragments, in the edges of wound and in the surrounding tissues were damages, which were the result of operating the force of the lateral impact of shell, that calls contusion and concussion of tissues.

The contusion of bone was developed in crushing of bone marrow on the edge of break. The maximum decomposition of this type was observed in bone marrow when the shell, which possesses large manpower, stopped in the marrow canal. In such cases bone marrow was converted in the zone of wound for the elongation/extent to 3-4 cm into the semiliquid, blood-containing masses.

The concussion of bone occurred for the significant elongation/extent, frequently capturing entire diaphysis. In the zone of concussion occurred the break of bone beams/gullies, the gap of vessels and reticular strcma, the decomposition of the oil cells of bone marrow with merging/coalescence of fat into the major drops; under the effect of the concussion appeared the prolonged disseminated stasis in the fine/small vessels.

The latter was the reason for very abundant diapedesis of erythrocytes, which was being continued all first day after wound, and sometimes also it is longer. As is known, diapedesis occurs in the period of prestasis and on its permission/resolution. The result

of diapedesis is the education of numerous hemorrhages in bone marrow and in the lumens of Haversian canals. Near the edge of break they decant into the extensive fields, causing the diffusion hemorrhagic infiltration of Haversian canals and bone marrow at the depth to 2-3 cm.

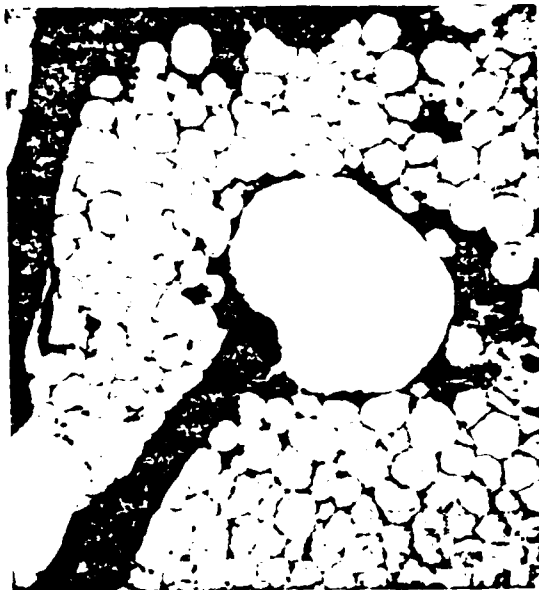


Fig. 55. Decomposition of the group of the oil cells of bone marrow in the zone of localized hemorrhages with merging/coalescence of fat into the major drop arranged/located next to the bone beam/gully (microphotogram, a small increase).

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Further is formed the wide zone of large/coarse hemorrhages, and then the zone of point hemorrhages. The latter is most wide; it frequently includes entire bone marrow of diaphysis. In all three zones among the hemorrhages are visible the cracks in the beams/gullies, the foci

of the necrosis of bone marrow and the major drops of fat, which were being formed as a result of the decomposition of oil cells (Fig. 54 and 55).

In the soft tissues and in the periosteum the phenomena of concussion were those more restricted than in the bone, which corresponds to other physical properties of these tissues. In the muscles as a result of concussion occurred the gap not only of vessels and connective fibers, but also individual groups of muscular fibers. Furthermore, in the latter were noted the changes, connected with restretching at the moment of wound, namely: by places muscular fibers and myofibrils proved to be zigzag coiled, myomers unclearly were contoured.

Frequently appeared the necrosis of myofibrils with the state of preservation of endomysium and sublemmal nuclei/kernels. As a result of diapedesis of erythrocytes rapidly occurred the extensive hemorrhagic infiltration of intermuscular connective tissue. In the muscles the phenomena of concussion were noted for the elongation/extent 5-6 cm from the edges they were equal (Fig. 56).

In subcutaneous and intermuscular cellulose the concussion was developed by the decomposition of the groups of oil cells, by the gap of vessels and fibers and by stasis with subsequent diapedesis of

erythrocytes. Furthermore, almost always had it always occurred the more or less significant lamination of intermuscular cellulose with the introduction into the formed slits of bone fragments and fine/small foreign bodies.

The degree of contusion and concussion was different and depended on the ballistic qualities of shell. Other conditions being equal, that, etc. were greatest with the blind-end fragmentation wounds, and minimum - with the through bullet ones.

The manifestations of both direct decomposition and damages, connected with the contusion and the concussion, were not identical with respect to their intensity for entire elongation/extent of wound canal. Usually into some sectors they were expressed stronger, into other weaker which is connected from different with the loss of manpower by shell in the different sectors of its route/path in the tissues.

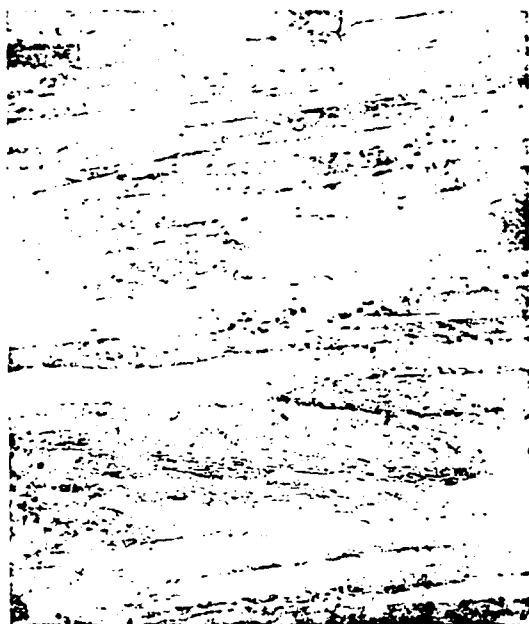


Fig. 56. Necrosis of muscular fibers in the zone of concussion, in 4 cm from the edge of wound. Hemorrhagic infiltration of endo- and perimysium. Bullet wound of thigh. Death to the second day from the blood loss (microphotogram, a small increase).

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In the extremities due to the heterogeneity of damaged by shell tissues this special feature/peculiarity was expressed especially clearly. For further course of wound it had very important value.

The concussion damages were observed in immediate proximity of the wound canal and far from it. Thus, with the bullet breaks of diaphysis in the subchondral zone of the pineal system of the damaged bone frequently it was possible to reveal/detect the break of individual bone beams/gullies, the decomposition of the groups of oil cells, hemorrhage. Evidently, in the mechanism of these damages played role energy of the shock wave, which is propagated in bone marrow. Upon the extensive decomposition of metaphysis sometimes was observed the cracking and even crushing of the pineal system of adjacent bone, which occurs, apparently as a result of the strike/shock, applied by the pineal system of the damaged bone at the moment of wound.

Given data attest to the fact that the bullet wound of extremity with the break of bone as any bullet wound, it is not possible to consider as trauma, to limitation by the place of the direct effect of shell. It is the totality of direct decomposition with the contusion and concussion damages, which occupy the extensive region of the damaged extremity. Is especially great the zone of damage in the bones.

Concussion and circulatory necrosis. Together with the damage of vessels, the contusion and concussion were the basis of the numbness of tissues both in the edges of wound and far from it. This necrosis

was called concussion and circulatory. In the soft tissues it is revealed/detected not earlier than the end of the first day, while in the bone - on the 3-4th day. To the period indicated the morphological signs of necrosis both with the macroscopic and during the histological research were not revealed. The speed of their appearance depended on the intensity of autolytic processes in the wound, which was determined first of all by the degree of bacterial contamination and by the intensity of the reproduction/multiplication of microbes in the wound.

Term concussion necrosis is somewhat conditional, since in the origin of numbness, together with the damages, caused directly by the force of the lateral impact of shell, large role play vascular disorders, mainly traumatic paralysis of fine/small vessels. As a rule, necrosis underwent entire/all zone of hemorrhagic infiltration, and frequently also the zone of large/coarse hemorrhages, in consequence of which in the edges of each wound, besides the zone of crushing, was formed the layer of dead masses of different thickness - from 0.5 to 3-4 cm and more, depending on the structure of tissue and degree of concussion. Usually the thickness of the zone of necrosis in the different sectors of wound canal widely varied. In the muscles it achieved 1-2 cm, in the bone - 3-4 cm and more. In the edges of break the necrosis applied to bone marrow and Haversian canals, located in the zone of hemorrhagic infiltration.

Furthermore, numbness underwent the narrow border of compact substance on the edges of bone cracks and the surface strata of compact substance in the area of the scaling of periosteum at the ends of the broken ends. Deep layers in such sectors retained their viability, since they are supplied with the blood due to the anastomoses of the vessels of bone marrow with the vessels of Haversian canals (Fig. 57).

Besides the edge of wound, of concussion necroses appeared also in the depth of the zone of concussion. Here they had a character/nature of military ones and, as a rule, they were arranged/located near the dense tissue education - bone beams/gullies, the fascias, etc.

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Circulatory necroses appeared both in the bone and in the soft tissues. In the bone they were formed when the break of the main trunk/stem of the feeding artery occurred simultaneously with the extensive decomposition of paracssial soft tissues, which excluded the possibility of reducing the blood circulation by means of the collaterals. In the dependence on the degree of the violation of

collateral blood circulation, the necrosis could take entire diameter of bone, skins of compact substance, bone marrow and interior layers of compact substance or only the small sectors of the periphery of bone for the different depth. Frequently circulatory necroses appeared at the significant distance from the wound. The sizes/dimensions of circulatory necroses in the bone varied from 2 to 7-8 cm for the elongation/extent of diaphysis.

Circulatory necroses in the muscles appeared very frequently, but rarely were noted by surgeons and anatomical pathologists as a result of faulty study by them the peripheries of wound and other departments of the damaged extremity. According to the observations of the author, on the large pathoanatomical material such necroses of muscles were almost in each extensive wound.

In their onset, together with the damage of the muscular branches of arteries, large role played the compression of vessels with traumatic edema and with the education of large/coarse intermuscular hematomas; therefore they frequently appeared only through several days after wound. It is necessary to assume that and the shielding thrombosis of the veins of extremities, especially lower, frequently appeared already during the first days after trauma, contributed to the development of muscular necroses, being the reason for stagnant stasis in the capillaries.

In the muscles circulatory necroses could concern either individual bundles or capture significant sectors. Frequently the sectors of numbness were scattered in the muscles in the form of the multiple foci, which added the surface of their section/cut variegated form/species. The necrotized muscles were very brittle, yellowish color, with the matte surface of section/cut, they were rather dry; later as a result of autolysis they were converted into the semiliquid blood-containing masses.

The circulatory necroses include the ischemic gangrene of extremities. It most frequently was observed with first of the main-line arteries of the extremity higher than place of the withdrawal of basic collaterals. Less frequent this gangrene occurred with the integrity of the main-line vessels when they were thrombosed as a result of the contusion or the compression by large/coarse intermuscular hematoma, which especially frequently was observed on the shin and the forearms.

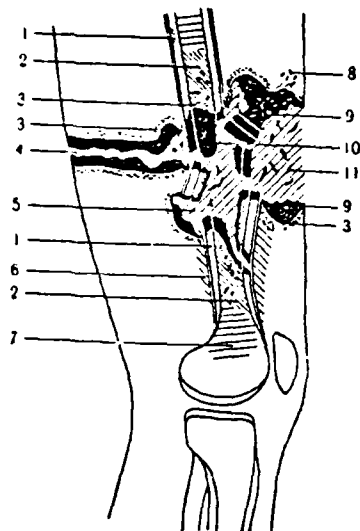


Fig. 57. Scheme of the bullet wound of thigh with the break of bone in the period of the development/detection of concussion necrosis. 1 - zone of cutting away of bone substance; 2 - zone of concussion; 3 - demarcation line; 4 - wound canal; 5 - zone of crushing soft tissues; 6 - paraosseal hematomas; 7 - zone of traumatic edema of bone; 8 - fine/small bone fragments, which were incorporated depthward of tissues; 9 - concussion and circulatory necroses in the soft tissues; 10 - concussion necrosis of bone on the edge of break; 11 - bone fragments, isolated from the pericosteum.

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We give the typical example of the gangrene of this type.

P. Poluchil wound into the right shin and 2 1/4 days it lay/rested on the field of battle due to the impossibility of carrying out/removal. Toward the end of the third day it is delivered in KhPPG with the phenomena of the ischemic gangrene of foot and shin. Amputation.

At the research of the amputated extremity it is found: on the front face of middle third of shin and on the posterior surface of upper third - they are equal by diameter in 1 cm, the cover/roof/pavement with crusts. Upper third of shin are sharply increased in the volume, skin or it is pale, strained. Skin of the extremital departments of the extremity of a blue dye-purple color, moist. Metaphyses of the bones of shin are crushed: the unit of the fragments lies/rests freely at the wound canal, unit - in the surrounding crushed muscles. Front/leading tibial veins are torn, their ends fringed; veins are constrained by the issuing from blood. In the wall of front/leading tibial artery slit-shaped defect in long

in 0.5 cm. Other large vessels are not damaged. Wound canal is filled with loose blood clots. All fascias are stratified, between them a large quantity of blood clots, which compress large vessels to the full/total/complete impassability. Entire cellulose of middle third of shin both subcutaneous, and is intermuscular, it is diffusion impregnated with the blood. Foot and lower third of shin are necrotized.

Thus, contusion, concussion and damage of the vessels of wounded extremity had by their consequence an appearance in the edges of wound, and frequently also far from it, the new sectors of necrosis, as a result of which the volume of dead substrate was increased into the first several days after wound. Necrosis applied to soft tissues and, which is especially important, on the bone. It was revealed/detected not immediately, but after the days it is more.

The second not less important result of concussion and violations of blood circulation were dystrophic and necrobiotic changes in the tissues for the significant elongation/extent about the wound. Later, as a result of traumatic edema and festering of wound, could become numb the unit of the tissues, also, in this zone.

Pathological anatomy of reactive processes after the bullet break of the bones of extremities.

Traumatic edema initial phenomena of demarcation.

Reactive processes with the bullet breaks in principle did not differ from the same with the wound of any localization. They began from traumatic edema and demarcation inflammation.

Traumatic edema of the damaged tissues was noted already into the first hours after wound, increasing during all first day. It was extended usually to entire zone of concussion, and frequently also beyond its limits, capturing the significant region of the damaged extremity.

Traumatic edema was developed as by the called hydration, i.e., by the swelling of colloids predominantly in the zone of primary traumatic necrosis, and strictly by edema, i.e., by the accumulation of edematic fluid between the tissue elements/cells in the zone of concussion. As a result of hydration the masses of primary traumatic necrosis swelled and were increased in the volume.

During the research of soft tissues around the wound in the period of traumatic edema struck the pallor, swelling and marked swelling of muscles. The muscles swelled from the wound apertures in the skin and the fascias, it is frequently tight their stoppering and creating its genus hermetic sealing/pressurization of wound canal.

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Fig. 58. Lymphostasis in skin near edge of wound into period of traumatic edema. Sharp expansion of lymphatic vessel, the accumulation in it of fluid/liquid with the insignificant admixture/impurity of leukocytes (microphotogram, average/mean increase).

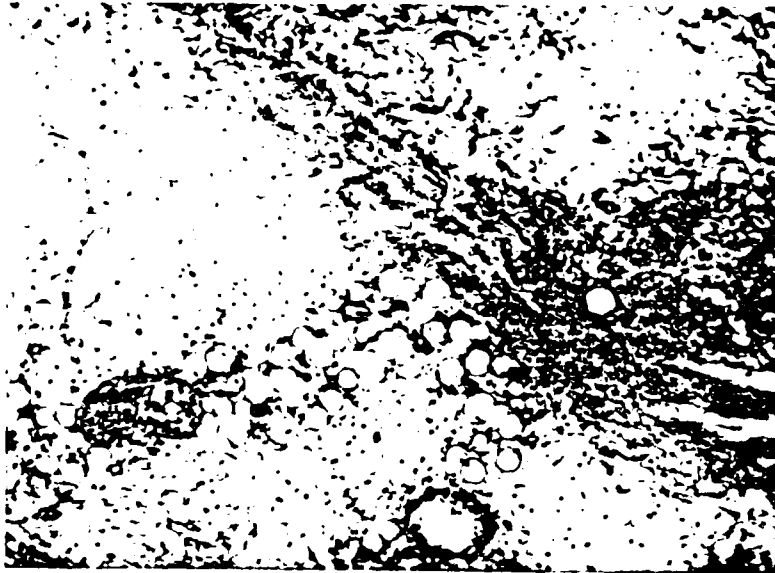


Fig. 59. Traumatic edema of muscles: loosening collagenic fibers, accumulation between them of fluid/liquid. Cellular elements/cells and capillaries are constrained. In right half - contusion hemorrhage (microphotogram, a small increase).

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In the widely split wounds the stress/voltage of soft tissues was expressed considerably weaker, if was split not only skin, but also fascias, through which is passed wound canal.

During the histological research of soft tissues in the zone of traumatic edema it proved to be that connective fibers sharply

swelled and they were fibered to the individual fibrils; with picrofuchsin they were painted in the pink color; argyrophil fibers were thickened, they are impregnated very weakly. Fibrocytes and cells of the endothelium of capillaries are subglobose, vacuclized, their nuclei/kernels took the form of follicles. The lumens of capillaries were either they were not distinguished as a result of the compression by edematic fluid/liquid, or strongly expanded under the effect of the stasis. Lymphatic vessels were always expanded due to lymphostasis (Fig. 58 and 59).

Muscular fibers proved to be those swelled, they were palaly stained with eosin; cross and longitudinal striation in them was distinguished very weakly. Furthermore, in the fibers were formed multiple vacucles. Already toward the end of the first day it was possible to observe in some fibers of the picture of waxlike necrosis and discoid decomposition.

By periosteum traumatic edema was evinced in loosening of connective fibers, in the accumulation between them of fluid/liquid and in the expansion of lymphatic vessels.

In the bones traumatic edema was usually expressed most sharply, since here edematic fluid/liquid was accumulated/stored in the spaces, not capable of the stretching, in the lumens of Haversian

canals and in the marrow area. This it conducted to the very sharp compression of blood vessels, and in bone marrow also to the compression and the peculiar "squeezing out" of the elements/cells of the parenchyma of bone marrow and oil cells. With respect to the special structure of bones, phenomenon of traumatic edema in them they were noted at the greater distance from the wound, than in soft tissues, occupying frequently entire diaphysis and even pineal systems of the damaged bone (Fig. 60).

In the period of traumatic edema during the histological research frequently were noted the phenomena of the resorption of the compact substance of the damaged bone for the elongation/extent 8-10 cm from the ends of the break. In the X-ray photographs this resorption was the noticeable not earlier than 4-5 days. During this period the resorption of bone had a character/nature of sinus (A. V. Busakov).



Fig. 60. Traumatic edema in the Haversian canal, the accumulation of edematous fluid/liquid, the compression of blood vessel; in the vessel - thrombus (microphotogram, a great increase).

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Evidently, to the early and stormy resorption of bone substance contributed significant acidosis, always accompanying traumatic edema.

In the bone wound traumatic edema led to swelling and homogenization of the masses of the concussion necrosis and the blood

clots on the edge of break, in consequence of which they were converted into the very dense massive rather dry plug, which shields the opened aperture of marrow canal (Fig. 61).

In dead sectors of muscular wound this phenomenon did not occur. Its onset in the bone wound was connected, apparently with the special hydrophilic behavior of bone marrow and depended on the peculiar conditions of the circulation in it of the blood and lymph (presence of wide venous spaces, the delayed drain of the venous blood, etc.).

As in any wound, the second reactive process, perceptible morphologically, was demarcation inflammation. It began against the background of traumatic edema after the permission/resolution of primary stasis and it led to the formation of demarcation line on the edges of wound, on the boundary with the zone of concussion necrosis (Fig. 62).

In the different cuts of wound canal the permission/resolution of stasis and shaping of demarcation were realized within different periods. This is explained by the fact that the tissues, which encircled wound canal, possess different sensitivity to the mechanical trauma, and also dissimilar degree of concussion damages in the different sectors of wound. Thus, already toward the end of

the first day in the soft tissues was noted the completely formed demarcation line in the form of the wide zone of hyperemia on the boundary with necrosis and presence of leukocyte shaft. In the depth of wound, in the zone of extensive crushing and most sharply pronounced contusion and concussion of muscles, traumatic edema in pure form could exist considerably longer, but demarcation line it was not formed sometimes even on the 3-4th day.

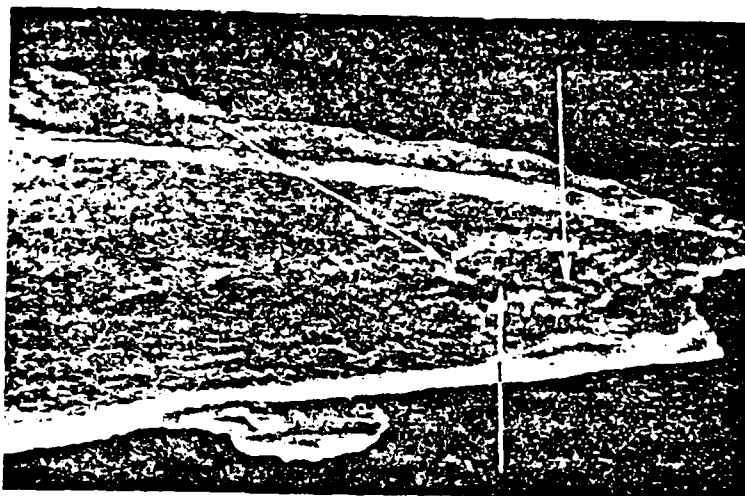


Fig. 61. Induration of the mass of concussion necrosis in the lumen of the marrow canal of the diaphysis of thigh at the edge of break (8th day after wound). In the adjacent departments of bone marrow the extensive concussion hemorrhage.

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Especially for long it did not appear in the zone of intermuscular hematomas. In the damaged bone the permission/resolution of stasis and the education of demarcation line retarded in comparison with the soft tissues on 2-3- and day.

Thus, already from the first days in the wound was noted the irregular development of reactive processes, first quantitative,

which then could overgrow, also, in the qualitatively different course of wound process in different sectors of wound.

Beginning from the second day, in the zone of demarcation was noted the proliferation of the cells of vessels and of connective tissue and the formation of the loose nets/systems of argyrophil fibers. The processes of proliferation in the different sectors of wound canal were developed also with different intensity. In the soft tissues already to the 3-4th day was formed/activated loose granulation, whereas in the bone wound proliferating phenomena at this time only just began.

With the education of demarcation line, in the edges of wound and in the entire zone of concussion was accumulated/stored a large quantity of histiocytic elements/cells; especially much - in bone marrow. They realized a phagocytosis of dead masses, erythrocytes, which strike beyond the limits of the demarcation line of microorganisms and so forth, etc.

Simultaneously with the growth of granulation occurred the organization of the masses of traumatic necrosis and contained wound canal, which was expressed by the growing in them of capillaries, cells of granulation and by the formation of the nets/systems of argyrophil ones, and it is later and the collagenic fibers.

Thus, already during the first 3-4 days around the entire zone of damage was formed/activated demarcation line and discontinuous shaft of granulation. In the sectors where their formation retarded, contents of wound canal directly came into contact with the living tissues of organism.

The education of demarcation line led to the delimitation of contents of wound and became rust tissues and to the insulation of the located here microorganisms.



Fig. 62. Demarcation line at the edge of muscular wound (second day after wound). Expanded blood vessels with the accumulation in them of leukocytes. Abundant leukocyte infiltration of endomysium. Initial stages discoid decomposition of muscular fibers (microphotogram, a small increase).

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Pathological anatomy of purulent complications of the bullet breaks of the bones of extremities.

Microbial contamination of wound. As is known, all bullet wounds are contaminated by the microorganisms which together with the foreign bodies penetrate the wound at the moment of wound, and also they strike more lately from the skin, the clothing of casualty, with

the manipulations in the wound, etc. In the bullet wounds of extremities with the break of bone were very frequently created exclusively favorable conditions for viability of microorganisms. They included the extensive crushing of tissues by shell and by bone fragments, a large quantity of dead tissues in the wound, dystrophic and necrobiotic changes of the cells in the edges of wound under the effect of the concussion, the disorders of blood circulation and traumatic edema, the dispersion of microbes in the significant sector together with the foreign bodies and the bone fragments, their incidence/impingement into the additional canals, formed by bone fragments, the isolation of such of those contaminated by the microbes of canals from the wound as a result of the secondary deviation of muscles, the delay of discharge in the wound, etc. Some of these factors did not yield to therapeutic measures, the action of others could be by these measures weakened and even it is paralyzed. It is important to note that the greatest development the microorganisms achieved in the extensive, complex, surgical not processed wounds where they frequently were propagated all over zone of damage, including the region of break, the crack of bone and additional blind canals in the soft tissues. In the wounds with the small zone of crushing and concussion necrosis, predominantly with the perforating bullet wounds, the microorganisms were encountered only in the individual cuts of wound canal. In the proper time and worthily processed wounds when surgeon removed all crushed necrotized

tissues and free bone fragments, cutting all over the edge, which constitute the "reserve of necrosis" (I. V. Davydovskiy) as well as the additional canals, which contain foreign bodies, microorganisms were multiplied only on the surface, since the conditions in these wounds did not favor the germination of them depthward. The same position/situation were created and during wide splitting up of wound. Together with the removal/distance of soil for reproducing the microbes, with these operations/processes were improved the conditions of the vital activity of tissues in the edges of wound, since was decreased their stress/voltage, were improved the conditions of the drain of discharge, and this entire undertaken together accelerated the processes of demarcation, reinforced local by tissue barrier and made the conditions worse of the vital activity of microbes.

Large role played in this respect the early abundant use/application of sulfanilamides and antibiotics. As showed clinical observations and morphological research, the presence of a large quantity of sulfanilamides in the wound impeded the stormy reproduction/multiplication of microbes which long time was observed only in the individual, most deeply lying/horizontal sectors.

This position/situation morphologically most clearly confirm the experiences of A. N. Chistovich on the infection/contamination of

rabbits by pathogenic anaerobes with the subsequent introduction to stricken area it is sulfide. During a histo-topographic research of the casualty region it was discovered, that in those sectors of the tissues where were located the crystals of sulfidine, microbes were absent, while in the surrounding tissues they were in large quantities. This especially sharply struck when the dead animal they revealed through several hours after death, i.e., when, together with the intravital reproduction/multiplication of microbes, had place putrid invasion.

Pathoanatomical research confirms whereas that the antibiotics (in particular, Soviet penicillin), applied during the first days after wound, also produced bacteriostatic effect, without harming in this case the processes of regeneration (A. P. Avtsyn).

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The structure of bullet breaks is such, that the worthy carving of wounds did not always prove to be possible. It is more right even to consider that in the significant majority of the cases the removal/distance of all nonvital tissues is unattainable. During the research on the twigs/rods and on amputated extremities of the wounds, processed even the highly skilled surgeons in the relatively calm circumstances of specialized KHPG, almost in all without the

exclusion cases she was necessary to state/establish that in the wound remained uneliminated/unremoved the free bone fragments, the sectors of crushing and even foreign bodies. It is logical that in these sectors were always multiplied the microorganisms. Gram-positive microorganisms in the tissues were well visible on the histological preparations, painted according to Gram-Weigert, in consequence of which easily it was possible to explain their distribution in the wound, and the comparison of data of histological and bacteriological research made it possible to accurately establish/install the qualitative evolution of microbial flora of wound. Considerably more badly was matter concerning the development/detection of gram-negative flora in the tissues.

For these purposes could be used the comparative parallel research of the shear/sections, painted according to Gram-Weigert, and the shear/sections, processed according to the method of Levaditi, when they are impregnated both gram-positive and gram-negative microorganisms. An increase of their number in the impregnated preparations in comparison with the preparations, painted according to Gram-Weigert's method, could serve as the indicator of presence in this wound of gram-negative flora, of course, without its further differentiation.

In the first hours after wound the microbes were determined only

in the individual sections of the zone of crushing, near the foreign bodies, but already toward the end of the first day entire/all zone of crushing was frequently appeared microorganisms; toward the end of the second day they germinated also into the zone of concussion necrosis.

During the first days after wound the microbes were usually revealed only in the wound canal of soft tissues, whereas into the zone of break they penetrated considerably later. This is explained, apparently by density and large sizes/dimensions of the masses of concussion necrosis which covered marrow canal and separated/liberated it from the remaining departments of wound, impeding the penetration of microbes into the region of break. Only when foreign bodies were introduced directly in the marrow canal, the reproduction/multiplication of microbes occurred simultaneously in the soft tissues and in the bone wound. During the study of histo-topographic shear/sections into the first several days after wound are established/installed, that the distribution of microorganisms in different sectors of wound was dissimilar: although on the whole predominated the mixed flora, frequently were encountered the sectors where were visible only cocci or rough bacilli/rods, many sectors of wound microbes in no way contained. Usually coccic flora predominated in surface sections of wound, bacillus/rod (mainly anaerobic) - in its depth.

To the formation of the expressed demarcation line the microorganisms frequently were revealed also in the zone of traumatic edema, especially in the interlayers of connective tissue, the perivascular spaces, and also in the lymphatic vessels. Up to the moment/torque of educating the demarcation line, the microbes, as a rule, were concentrated only in the necrotic masses, and those of them, which were found in the living tissues, proved to be the phagocytized leukocytes and macrophages.

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After in the walls of wound was created the continuous shaft of granulation, microorganisms were located only on the surface of granulation, composing microflora of wound. However, in those sectors where the formation of demarcation line retarded, microorganisms were frequently propagated far beyond the limits of the zone of necrosis, usually on the intermuscular interlayers of connective tissue, which are found in the condition of hemorrhagic infiltration. This fact in certain cases gained importance, because such sectors were initial for the development of infectious process (for example, anaerobic-gangrene) in the wound.

Dynamics of development and morphology of early infectious complications.

Already into the first 2-3 days after wound, in connection with the presence in wound of microorganisms, demarcation inflammation in the majority of the cases acquired the character/nature of festering, and frequently began severe infectious complications, among which, according to the data of the autopsies of twigs/rods, in the first place stood anaerobic gangrene, thinner/less frequent - vulgar phlegmon.

In the onset of these complications and, first of all, anaerobic gangrene especially large role played the noted above different degree of the damage of the edges of wound and the different intensity of the education of demarcation line, and also the presence of the sectors of the circulatory necrosis of muscles. During the histological research almost always it was possible to establish/install the intimate anatomical bond of the focus of anaerobic gangrene with the dead muscle.

As showed the research of the author, as a result of the irregular development of demarcation line in the wound were created "weak places", where the necrotic masses, which contain of microbes, were located in immediate contact with the living tissues whose barrier mechanisms were sharply weakened. Such places in the wound

were the deeply lying/horizontal sectors of hemorrhagic infiltration and crushing of muscles and wall of the additional blind canals where predominantly were fixed/recorded anaerobic microorganisms. The latter stormily were multiplied, rapidly germinating depthward tissues, beyond the limits of the zone of the primary traumatic necrosis where appeared all signs of the anaerobic gangrene: increasing edema, the formation of bubbles of gas, the progressive necrosis of the surrounding muscles with the formation of the "primary passion" of anaerobic gangrene; at the same time in the adjacent sectors was retained the picture of demarcation inflammation.

For a while, calculated, apparently by a few hours, emergent in the depth focus of anaerobic gangrene it remained that localized one unit of the wound, whence subsequently was developed process. Such foci during the histological research frequently were revealed in the tissues, removed from the wound with the primary carving, and further development of anaerobic gangrene it did not occur. In other cases it progressed also after carving, apparently due to the focus of anaerobic gangrene, clinically up to the moment/torque of the operation/process of that not yet coming to light, but already disseminated beyond the limits of the cut all over tissues.

Onset during the first days after the wound of sharp/acute

phlegmon was noted predominantly with the wounds of shin. This phlegmon was developed with the wounds with the extensive crushing of bone, muscles and educating large intermuscular hematomas where disorder of blood circulation, traumatic edema and the connected with them necrobiosis of tissues they achieve the maximum degree (see above), and demarcation inflammation retards.

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In such cases, especially in the absence of the surgical perfecting of wound and use/application of sulfanilamides, in the wound canal occurred the stormy reproduction/multiplication of the most different microorganisms as during the development of anaerobic gangrene.

Under these conditions pyogenic and rotting microorganisms sometimes penetrated depthward impregnated by the blood cellulose, causing the rotting decomposition of hematoma and phlegmonous inflammation. The latter frequently applied to the significant region not only of intermuscular, but also subcutaneous of cellular tissue, which was escorted/tracked by sharp intoxication and sometimes forced to resort to the amputation of extremity on the 7-10th day after wound.

This can illustrate following observation.

N. is wounded by bullet into the right shin. 11 Hours after wound is produced splitting up of wound. 3 Days after wound the temperature was increased to 39°, appeared sharp pains in the wound; the general condition became heavy. 6 Days after wound - amputation.

During the research of the amputated extremity is discovered sharp edema of foot and shin. On the front/leading and posterior surface of shin in middle third are gaping split wounds by the size/dimension 10x6 cm each. Kray wounds they are covered with skimpy pale granulation. In the depth of wound canal the granulation is absent; its walls form the muscles, crushed for the significant elongation/extent.

Both bones of knee are broken, moreover were formed the numerous large/coarse and fine/small fragments whose large part lies/rests freely at the wound canal and the surrounding muscles. The ends of the broken bone are covered with the dense and dry crumbly necrotic masses, which full fill canal at the depth of 2-3 cm. Intermuscular cellulose is stratified by the issuing from blood to the popliteal pit and Achilles tendon. Large vessels are not damaged. Wound canal is filled with thick greenish pus. Suppurative infiltration applies to the crushed muscles and the intermuscular interlayers of

connective tissue, in consequence of which the blood, which impregnates them, is turbid, dirty brown color. Subcutaneous cellular tissue of shin is diffusion impregnated with yellowish pus, by places purulently is molten.

During the histological research in the crushed muscles is discovered a large quantity of different bacilli/rods and cocci, and to the zone of phlegmon - predominantly short chains/networks of streptococcus.

Sometimes phlegmon acquired rotting character/nature, moreover from the exudate were secreted the follicles of the malodorous gas; however neither clinical nor the pathoanatomical signs of anaerobic gangrene there was. In the presence of multiple wounds rotting inflammation could be observed in all wounds. When rotting phlegmon applied to the region of perivascular cellulose of main-line vessels, then was developed ichorous thrombophlebitis with the subsequent rotting decomposition of thrombus. In pus in such cases they found usually *Bac. Proteus vulgaris* in combination with *Bac. perfringens* and by other anaerobic microorganisms.

Rotting phlegmon frequently caused severe, sometimes lethal intoxication. Remains open question, in what measure this course of process depended on the quality of microflora, especially microbial

associations with the participation of anaerobes, and in what it was caused by the changed reactivity of organism. As the illustration can serve the following observation.

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P. obtained the multiple fragmentation wounds of shin, foot, popliteal pit and breast. Wounds are split after 12 hours. To the third day after wound is noted the general heavy condition, the rotting inflammation of wounds. Is produced additional splitting up of the wounds of shin. Abundant use/application of streptocide into the wounds and inside. Condition was not improved, and 7 days after wound advanced death.

At the autopsy of twig/red is found the following: in the region of right talocrural joint, on heel of foot and in middle third of right shin - split by surgical route/path wounds. The head of collision bone and the I tarsal bone are crushed.

The tibia in lower third is broken, moreover was formed a large quantity of fragments whose unit was displaced into the thickness of muscles. Intermuscular cellulose of shin for the large elongation/extent is impregnated with the blood. The posterior artery of shin is torn, remaining large vessels are not damaged. Soft

tissues in the edges of all wounds are crushed and at the depth to 1-2 cm "stuffed" by bone fragments. Wounds are filled with the dirty brown decomposing masses of blood clot. The zone of crushing is impregnated with the dull gray malodorous fluid/liquid with the gas bubbles. Entire subcutaneous and intermuscular cellular tissue of shin, foot and region of talocrural joint is diffusion impregnated with the same fluid/liquid.

In the right popliteal pit and in ninth intercostal space to the right - deep split wounds whose edge they are impregnated with malodorous, dull gray fluid/liquid. Phenomena of anemia and the sharply pronounced dystrophic changes in the internal organs/controls. In posterior departments of both light ones the large/coarse confluent pneumonic foci and the foci of atelectasis.

During the bacteriological research of tissues in the depth of the wound of shin they are discovered: *Bac. perfringens*, *Bac. Proteus vulgaris*, *Staphylococcus aureus*, nonhemolytic streptococcus. in the blood of the heart cavity of a cadaver, - nonhemolytic streptococcus.

At histo-topographic research of the wound of shin is found the following: in the edges of wound and in the ends of the broken ends the wide zone of necrosis. Intermuscular cellulose is diffusion infiltrated by the decomposing leukocytes, its elements/cells in the condition of necrosis and necrobiosis; in the intercellular spaces of

the shadow of erythrocytes and grain of amorphous dirty brown pigment. On the periphery of the zone of leukocyte infiltration the skimpy proliferation of perivascular elements/cells. In some fine/small veins in the zone of phlegmon thrombotic masses. In the entire zone of necrosis and phlegmonous inflammation, and also in thrombotic masses a vast quantity of different rods and cocci.

Both vulgar and rotting phlegmon frequently I could serve as the source of the sepsis which flowed/occurred/lasted in the form of pyaemia. In its genesis high value had thrombophlebitis (Ye. A. Kishkina).

Are such the infectious processes, which develop in the wounds of extremities in the early period, i.e., during the first 10 days after wound. During this period predominated infectious processes in the soft tissues. Changes in the bone wound in this case were evinced mainly by reinforcing of degenerate-necrobiotic processes, and frequently also in the numbness of bone, which was being propagated far beyond the limits of the zone of primary fault. The especially large/coarse sectors of the necrosis of bone appeared with the anaerobic gangrene. This necrosis, in contrast to the straight/direct traumatic and the circulatory, was named secondary.

In the pathogenesis of all early infectious complications large

role played the noted above nonuniformity of the development of demarcation line, which created favorable conditions for further dissemination of microorganisms beyond the limits of the zone of primary fault, and also increase in the virulence of microbial associations and descent in common resistance of organism to the microflora in connection with the conditions of combat situation and with the trauma (blood loss, shock, the general/common/total cooling, etc.).

Initial period of festering wound. Festering wound was noted already in the initial period of demarcation in those sectors where occurred the stormy reproduction/multiplication of microorganisms. Frequently festering could be stated/established already toward the end of the first day after wound. During the festering during the macroscopic research of edge the wounds proved to be edematous, reddened; contents of wound canal was impregnated with turbid fluid/liquid or pus. If in the wound occurred putrefactive inflammation, then its edge they were covered with moist dull gray film, and in the depth of wound canal on the spot of blood clot were arranged/located dark dirty brown semiliquid masses.

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During the histological research in the sectors of suppurative

inflammation the demarcation line proved to be more powerful/thicker, increased/grew collateral hyperemia, was reinforced the emigration of leukocytes; leukocytes not only were concentrated on the boundary with the become numb tissues, but more or less abundantly infiltrated the surrounding living tissues. By places were noted the fine/small sectors of phlegmonous inflammation, predominantly in the region of intermuscular hematomas, which were being communicated with the wound canal. The masses of necrosis in the zone of suppurative inflammation were abundantly infiltrated by leukocytes and colonies of microorganisms and rapidly they were converted into the unstructured detritus. The phagocytosis of microbes as this could be established/installed histologically, it occurred predominantly near the demarcation line.

In those sectors of the wound where the reproduction/multiplication of microbes was not observed, the phenomena of inflammation were limited to the education of demarcation line without the expressed festering, after which immediately began the lively organization of necrotic masses, while subsequently attacked/advanced healing according to the type of primary tension.

Thus, already during the first days after wound in different sectors of wound reactive processes frequently acquired the different

character/nature: into some places was retained the picture of traumatic edema, in others were noted the phenomena of demarcation inflammation, in the third began the primary adhesion; finally, in the larger or smaller sector of the edges of wound was noted putrefaction, which was being frequently matched with the rotting decomposition of the masses of primary traumatic necrosis.

With respect to different morphology of wound into some cases suppurative inflammation applied to entire zone of damage, in others it captured only some sectors of wound canal, usually in the zone of the maximum crushing where were arranged/located large/coarse bone fragments. Frequently break healed without the festering, which was localized only in the soft tissues, it is more frequent in the area of outlet.

During the development of festering in the region of break the ends of the broken bone of the first 5-6 days and even longer remained those covered with the dense scab, which consists of dead masses and the blood clot. Despite the fact that they already washed by pus, neither microscopically nor histologically the signs of suppurative inflammation in the edges of break under the necrotic masses revealed/detected could not be. On the longitudinal cut of bone in the edge of the break during this period were visible the dense laminated masses of blood clot, without the sharp boundaries

which change into the zone of the hemorrhagic infiltration of bone marrow. During the histological research in bone marrow and in the Haversian canals on the boundary with the zone of numbness it was possible to reveal/detect only insignificant leukocyte infiltration and granulation, which grew in into the dead masses.

As the illustration of this development stage of suppurations in the wound can serve the following observation.

Sh. is wounded by the fragments of shell into both thighs. The carving of the wound of left thigh is produced through 3 days, the wound of right thigh is not processed. Is superimposed two-sided hip gypsum bandage. Repeatedly was produced the blood transfusion: was assigned streptocide. The condition of casualty always was very heavy. 5 Days after wound advanced death.

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Extraction from the protocol of the autopsy: on outer and internal surface of middle third of left thigh two gaping split wounds by the size/dimension 12x6 cm each, that communicate by wide canal. Near wounds and the adjacent them cuts of wound canal are covered with succulent granulation. Of the depth canal the walls consist of the crushed muscles. Femoral bone is broken it was formed

a little the fragments whose unit was displaced into the thickness of muscles. Marrow canal of both broken ends is filled at the depth of 3 cm with dry crumbly red-brown masses. The walls of wound canal and the ends of the broken bone are covered with the dull gray malodorous masses which impregnate entire area of crushing muscles and paracossal tissues of the front face of femoral bone to the upper turn of knee joint, on the course of arranged/located here hematoma.

On the internal surface of right thigh wound by the size/dimension 2x1.5 cm, covered with dry crust. Wound canal is narrow, winding, it penetrates to the bone, which is broken, moreover were formed several fine/small fragments; the lumen of canal was filled with the dry dense blood clot in thickness of which was found the fragment of shell with the size/dimension 2x1 cm.

Phenomena of anemia and dystrophia of organs. In the posterior departments of light ones the confluent pneumonic foci.

During the histological research of the wound of left thigh and surrounding tissues in the walls of wound canal is discovered the growth of loose granulation; on their surface the layer of fibrin and leukocytes. Phlegmonous inflammation of cellulose in the area of paracossal hematoma. In the marrow canal compact necrotic masses. In the adjacent to the zone of necrosis departments of bone marrow -

proliferation of capillaries, connective cells and fibers with the growing of these elements/cells of the depthward of dead masses. During the stain/staining according to Gram-Weigert in the zone of suppurative inflammation are visible in large quantities large/coarse gram-positive bacilli/rods, streptococci and the staphylococci. In the depth of dead masses in the bone wound of microbes it is not found.

The suppurative fusion of the entire mass of blood clot and concussion necrosis in bone marrow and Haversian canals usually occurred only 6-7 days after wound, which coincided since the beginning of the suppurative inflammation of bone wound. During the macroscopic research this was confirmed by the fact that the ends of the break, deprived of periosteum, washed by pus, and marrow canal at the depth of 1-2 cm more was satisfied pyo by the molten necrotic masses. Entire focus of festering was delimited from the surrounding tissues by the layer of the granulation on surface of which was developed the film of fibrin and leukocyte shaft.

In the bone fragments, connected with the periosteum and which caught into the zone of festering, just as in the edges of break, the pyoputrefactive decomposition underwent all become numb sectors, i.e., bone marrow and the terminal departments of compact substance at the depth of 1-2 cm. This stage of festering can be illustrated by

the following observation.

Wounded M. on the 9th day after the wound of shin is produced the amputation of extremity in lower third of thigh as a result of the extensive decomposition of bone and development in the wound of the ichorous inflammation, which caused sharp intoxication.

At the research of amputated extremities is found the following: on the internal and anteroexternal surface of upper third of shin two widely split wounds with the size/dimension 13x6 cm each. Kray of them they are covered with succulent red granulation and thick pale yellow pus. Metaphysis and diaphysis of the tibia are crushed to many fragments whose large part lies/rests freely at the wound. Extremital broken end is deprived of pericosteum for the elongation/extent 3 cm. In the compact substance the wide crack, which goes to middle third of diaphysis. Between the bone fragments are discovered several metallic ones by size/dimension to 0.5 cm. The muscles of upper third of shin are crushed; entire/all zone of crushing is impregnated with the dull gray malodorous fluid/liquid which impregnates also bone marrow of fragments and contents of the marrow canal of diaphysis at the depth of 2 cm. With the cut of bone on the boundary of the zone of suppurative infiltration is visible the ridge of rose-colored succulent granulation; the adjacent departments of bone marrow at the depth of 4-5 cm are impregnated with the blood.

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During the histological research in the edge of bone wound is discovered the extensive zone of necrosis, isolated from the living tissues by the layer of the loose, edematous granulation on surface of which is arranged/located the film of fibrin and compact leukocyte shaft. Dead masses take the form of unstructured detritus; they are infiltrated by leukocytes and microorganisms, among which predominate rough bacilli/rods and short chains/networks of streptococcus.

Thus, during the development in the wound of the pyoputrefactive processes along the line of demarcation already on the 6-7th day after wound was formed/activated the isolated/insulated focus of the festering whose sizes/dimensions it is wide varied. Usually this focus irregular, into its composition entered not only strictly wound canal, but also additional canals in the soft tissues, the zone of the disposition of bone fragments, the area of intermuscular hematomas, but frequently also the ends of the broken ends. Are especially whimsical were whimsical the outlines of the focus of festering in the surgical not processed wounds. This focus was communicated with the wound apertures, through which occurred the drain of discharge. Frequently, together with the basic suppurative

focus, in the depth of tissue appeared other foci as a result of the development of pyoputrefactive process in the isolated/insulated sectors of crushing and all around carried here bone fragments and foreign bodies (Fig. 63).

The free bone fragments, which are arranged/located in the zone of suppurative inflammation, underwent necrosis and as any dead tissue in the wound, became the focus of the development of microorganisms. During the festering the tissue of these fragments, with exception of inorganic substances, just as the become numb soft tissues, underwent decomposition, being converted into the unstructured detritus, which contains the colonies of microbes. The bone substance of the fragments of no noticeable changes underwent; only fine/small fragments, in the opinion of S. M. Derizhancv, being prolongedly located in the zone of festering, could under the effect of acid discharge wounds decalcination and subsequently decompose.

If in the zone of festering were located the fragments, which partially maintained bond with the periosteum, then they during the festering usually completely underwent numbness as a result of the heavy disorders of blood circulation in the periosteum, complicated by inflammatory edema. Some of such fragments are necrotized more lately, after the dissemination of suppurative inflammation to their periosteum or its feeding navigation bridges of soft tissues. Such

fragments could be easily differed from primary become numb, since in them were distinctly visible the trails of the resorption of bone substance, which occurs in the period from the moment/torque of wound to the moment/torque of the numbness of fragment.

As a result of resorption the lumen of Haversian canals in such fragments is unevenly expanded, cutlines pitted, while in the fragments, detached from the pericosteum at the moment of wound, the trails of resorption were always absent.

Besides semifree fragments, necrosis frequently underwent individual muscular bundles and sectors of subcutaneous and intermuscular cellular tissue.

The possibility of the onset of new necroses very impeded the surgical carving of wound, since not always it was possible to solve, what sectors will remain viable, but what will undergo numbness.

As a result of the appearance of new sectors of necrosis on the course of festering sometimes during the autopsy of twig/rod or the research of the amputated extremity could be created the impression, that the wound was badly/poorly processed, while in reality the operation/process was produced sufficiently radically.

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On the basis of entire of that presented relative to the onset of suppurative processes in the wound of extremity with the break of bone should be drawn the conclusion that in the vast majority of the cases the festering was limited to the zone of primary fault and was developed on the boundary of the living and become numb tissues. Suppurative inflammation had a character/nature of demarcation and led to the rejection/separation and to the elimination of dead substrate from the wound, being the factor of secondary clearing.

The healing of wound occurred rapidly, flowing/occurring/lasting over the type of secondary tension when festering was limited only to soft tissues and was not propagated both to the region of the end of the broken bone and to maintained their viability bone fragments. This is explained by the fact that the cleaning of wound was realized via the autolysis of necrotic masses and their removal/distance together with pus from the wound, which was gradually fulfilled by granulation. Simultaneously occurred an increase in the epithelium on the edges of wound, and up to the cement/torque of the rejection/separation of necrotic masses and filling of wound canal with granulation occurred the epithelization of wound apertures and the formation of scar. The education of the callus in these cases did not hinder by the presence of suppurative process and

flowed/occurred/lasted over the type of the healing of postoperational open fractures.

The described favorable course of the festered bullet wounds with the break of bone was observed rarely, since the presence in focus of festering foreign bodies and bone fragments impeded its cleaning and retarded healing. In all cases until the free fragments of bone are removed from the wound (regardless of the fact, in what way they were removed, via surgical intervention or "driving out") festering wound did not cease. Ever in the period of the cicatrization of wound in its depth, around the bone fragments and the foreign bodies, could be retained ulcers. In such cases on the spot of the wound canal remained the narrow fistulas, through which was secreted pus. Subsequently the fistulas could to the known period even be occluded, but then again they were opened/disclosed.

As illustration to the aforesaid can serve the following observation.

K. obtained the wound of forearm and left shin. Wounds on the shin they are cut all over to the third day. Is superimposed deaf gypsum bandage. Casualty on the 17th day after wound died of the anaerobic gangrene of forearm.

Extraction from record of opening: in the region of knee cap on the spot of the cut all over saw tightly wound fresh scar in long in 5 cm. On a posterior-external surface of upper third of shin the cicatrizing wound by the size/dimension 12x6 cm. Kray and its bottom they are covered by succulent granulation, they are covered with pus. The head of fibular bone and the front/leading department of metaphysis of the tibia are crushed; were formed several large/coarse fragments, which maintained bond with the periosteum. In the pineal system of the tibia the crack, which penetrates into the joint. In the area of joint transparent/hyaline synovial fluid/liquid; synovial membrane shiny.

The defect between the bone fragments is filled with the dry fragmented masses of blood clct. In the periosteum and paraossial tissues around the place of wound - growth of the succulent rose-colored granulating tissue, which unites fragments and which lines/covers the bottom of wound. In the thickness of this tissue is an ulcer with a diameter of 2 cm, that contains several fine/small fragments of the spongy substance of bone and communicating by narrow canal with the wound.

During the histological research in the edges of bone wounds are found the large/coarse sectors of necrosis, surrounded with the rich in cells tissue, which proceeds from the pericosteum and paraossial

tissues. Is noted the growing of vessels and cells into the thickness of dead masses. In these tissue structures and in the adjacent sectors of periosteum are numerous complexes of bone beams/gullies, uniting by series/number lying/horizontal fragments. On the surface of the granulation, which cover wound and the generatrices of the wall of ulcer, the thick film of fibrin and the compact layer of leukocytes. In to pus are discovered streptococci, the staphylococci, rough bacilli/rods.

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Fig. 63. Initial stage of festering bullet wound of shin. The longitudinal cut of shin it is perpendicular to the course of wound canal (10th day after wound). Large-splintered break of the tibia. Suppurative fusion of blood clot and the mass of concussion necrosis.

which closes the aperture of marrow canal in the proximal broken end. Is well visible the shaft from the granulation, which delimits the zone of festering, collateral edema and wide zone of concussion hemorrhages in bone marrow of the meta-epiphysis.

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(Artist of V. S. Chumanov).

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During the spread of festering to the bone wound the healing considerably was retarded. This is explained by the fact that the cleaning of bone wound during its festering occurred only in the process of sequestration, which lasted very long. Sequestration composed the basic special feature/peculiarity of the festered bone wound, to a considerable extent explaining the duration of festering and its other special features/peculiarities. Hence became clear the essence of sequestration during festering of bullet breaks - this is the process of the secondary cleaning of bone wound whose specificity was caused by the special features/peculiarities of the physical properties of bone substance. Inasmuch as it is solidly established/installed, that dead bone substance, remaining in connection with the living tissues, no changes undergoes, inasmuch as it became clear, that also its fusion, similar to the become numb soft tissues, in the wound it was impossible. Therefore, if in the zone of festering were included the become numb ends of the broken bone or the become numb ends of viable bone fragments, then festering was dragged out to the end of sequestration and removal of sequestrations from the wound. In such cases already on the 8-10th

day after wound around entire focus of festering was formed typical constructed pyogenic shell which was formed/activated due to the granulation, which were growing in the zone of demarcation line. Along with this, in the cuts of wound canal, situated in the soft tissues, granulation grew very abundantly and frequently already on the 2-3rd week almost wholly were filled these departments they were different. On the edges of bone wound the granulation grew less abundantly; are especially skimpy they were they in the marrow canal.

On the internal surface of pyogenic shell settled the film of fibrin and was created the powerful/thick leukocyte shaft: leukocytes infiltrated the surface strata of granulating tissue. The special feature/peculiarity of the granulation, which were being formed/activated in the marrow canal, was the presence in them of a large quantity of macrophages (Fig. 64).

Pyogenic shell was formed in the different sectors of wound with different speed. Most rapidly it was formed/activated, where the edge wounds consisted of muscles and loose cellulose. In those sectors where the wound canal perforates fascia, granulation was always skimpy; therefore here pyogenic shell was looser and thinner.



Fig. 64. Pyogenic shell into the edge of pyogenic bone wound of metaphysis of thigh (20th day after wound) (microphotogram, average/mean increase). Wide layer of granulation; to their surface of the mass of fibers of fibrin and leukocyte shaft.

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On the spot the spikes of periosteum with the bone at the edge of break appeared dense scar tissue; here in the process of the formation of sequestral sulcus/furrow/groove granulation grew in a very small quantity. In the Haversian canals granulating tissue barely grew.

By typical for this stage festering bone are different it is the following observation.

In the wounded *L* against the background general/common/total favorable course of wound on the 17th day after wound developed tetanus, and on the 20th day, in connection with the heavy secondary hemorrhage from the wound, there was conducted the amputation of thigh in lower third.

During the research of the amputated extremity are discovered on the front/leading and internal surface of lower third of thigh the cicatrizing wounds of the sizes/dimensions 10x5 cm each, filled with the succulent red, mushroom-shaped projecting granulation, as a result of which wound canal has a form of narrow slit. Femoral bone is broken; the ends of the break oblique, they touch between themselves. The extremital end of the broken bone is deprived of periosteum for the elongation/extent 3-6 cm, and proximal - on 2-3 cm. Around the uncovered ends of the break is arranged/located the area, surrounded by the dense capsule whose internal surface is covered by clear red granulation. This area is carried out by thick pus and loose blood clots and is connected by slit-shaped canals with the external departments of wound. On surface of compact substance of

bone, in that place where on it borders the capsule of area, a deep, zigzag sequestral sulcus/furrow/groove. Periosteum in the walls of area is sharply thickened in the form of wide roll, it is cut with the crunch just as the adjacent to it sectors of capsule. The narrow canal of broken ends at the depth of 1-2 cm is carried out by pus. On the cut of bone it is evident that the zone of suppurative infiltration is isolated from bone marrow by the wide layer of granulation. The compact substance of femoral bone is slightly rarefied, especially near the sequestral sulcus/furrow/groove. The surrounding the zone of break muscles are pierced by the wide strands of the scar tissue, in which are arranged/located the numerous fine/small fragments of bone. In the wall of femoral artery in the Hunter's canal - pouch-like diverticulum on head of which is a torn aperture with a diameter of 0.3 cm; near this aperture the pointed fragment of bone. The surrounding tissues are impregnated with the blood.

Each end of the formation of pyogenic shell the sizes/dimensions of suppurative focus in the bone wound slowly were decreased due to both the growth of the mass of granulating tissue and cicatrization and wrinkling of pyogenic shell.

Mechanism and the essence of sequestration. Sequestration underwent the located in the zone festering the sectors of the

primary traumatic and circulatory necrosis of bone at the ends of the break and at the ends of the viable bone fragments, depot of microorganisms. Microbes nested in the lumen of Haversian canals and in the marrow area of such sectors, causing rotting necrotic masses, and we could be removed from the wound only by the same time dead substrate, on which they were developed. Therefore of dead the putrefying portion bones became the source of the festering, which was not ceasing to the full/total/complete rejection/separation and the removal/distance from the wound of all sequestrations. The sectors of the become nusb bone, which lay/rested out of the zone of festering, were not sequestrated, being included in the regenerate, which was being developed around the suppurative focus.

The processes of sequestration have close connection with the resorption of the bone substance of the entire damaged bone. During festering of break this resorption was always sharply pronounced and already to the 15-20th day after wound it conditioned rarefication of compact substance to such degree, that it was defined as spongiozation, (A. V. Rusakov); the compact substance of diaphysis was done porous, resembling on its building/structure spongy substance.

Resorption not in all departments of the damaged bone flowed/occurred/lasted equally intensively, most sharply it was

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expressed in the zone of granulation in base of the being subject to rejection/separation sequestration.

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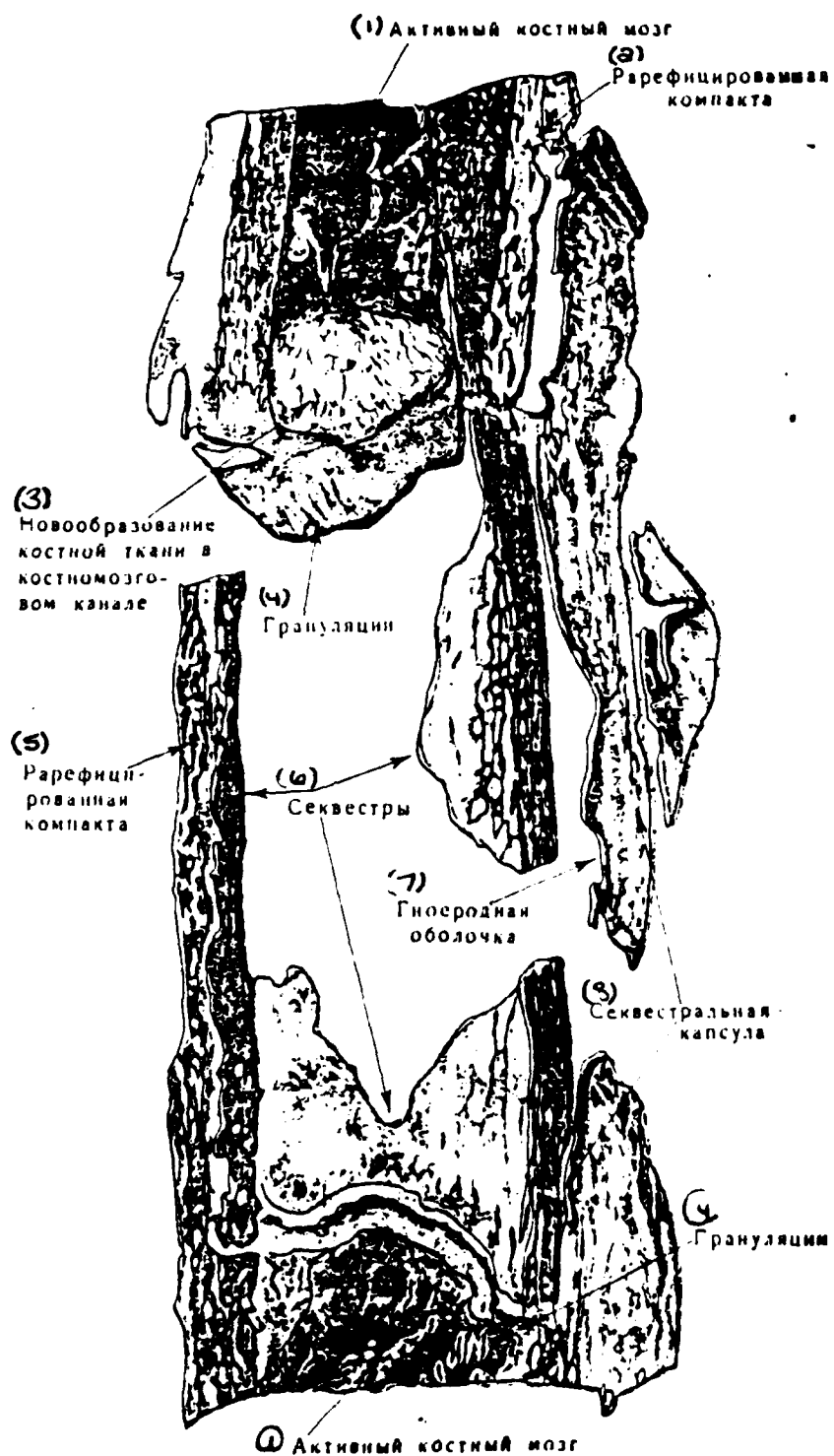


Fig. 65. Festered bone wound of thigh in the period of the rejection/separation of sequestrations. Histotopographical shear/section (35 days after wound).

Key: (1). Active bone marrow. (2). Rarefied compact. (3). Neoformation of bone tissue in marrow canal. (4). Granulation. (5). Rarefied compact. (6). Sequestrations. (7). Pyogenic shell. (8). Sequestral capsule.

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Resorption flowed/occurred/lasted either over the type of sinus or smooth with the insignificant participation osteoclastosis. Typical osteoclastic resorption was noted only in the zone of sequestration.

Unity of opinion relative to the mechanism of sequestration it was not established/installed. Some authors (S. M. Derizhanov) considered that it is realized due to the activity of the osteoclasts, which appear on the surface of granulation and which are contacted with the necrotized bone; osteoclasts dissolve dead bone substance on the boundary with living tissues, in consequence of which the sequestration is torn away from the edge of break.

According to another point of view (A. V. Smol'yannikov), the rejection/separation of sequestration occurs due to the dissolution of the viable bone substance, which borders on the sector of the necrosis which in the process of sequestration directly barely is changed. In fact, if we trace the process of sequestration in its dynamics from the beginning to the end on the successive series of X-ray photographs, then it appears that the sequestered sector of necrosis within all this time changed neither its sizes/dimensions nor its configuration. At the same time in the frontier sectors of bone occurred the progressive rarefaction, which led, after all, to the full/total/complete annihilation of bone substance in the frontier with the sequestration zone as result of what sequestrations and they were torn away (Fig. 65).

During the sequestration was formed/activated the so called sequestral sulcus/furrow/groove which gradually deepened. The lumens of Haversian canals, which are located in the zone of the education of sequestral sulcus/furrow/groove, sharply were expanded. During the histological research it proved to be that the education of sequestral sulcus/furrow/groove occurs in the zone of an increase in the granulation, i.e., in the limits of living tissue, due to the dissolution of viable bone, but not the substance of sequestration.

On the spot for the dissolved bone grew rich in cells granulating tissue. When bone substance in the zone of sequestral sulcus/furrow/groove completely was dissolved, sequestration was torn away.

In those places where the granulation came into contact with the sequestered sectors of necrosis, from the cells of granulation were formed the giant cells, tightly adjacent to the surface of dead bone. These cells, apparently caused the resorption of dead bone substance, since in the places of their adjoining gradually were obtained depressions - lacuna; however the dissolution of bone by giant cells occurred in the very restricted sizes/dimensions and in the separation/section of sequestration played small role.

It is more than the foundations for considering that the education of giant cells in the granulation and resorption by them the dead substance of the bone sequestration nothing in common have with the resorption of living bone neither with the biological nor from the physicochemical side; this different processes, having only certain morphological similarity in consequence of which in the presence of several sequestrations they rarely they were torn away simultaneously.

The duration of sequestration is different and is determined by

many factors, among which the main things are the sizes/dimensions of sequestration, the thickness of compact substance, condition of the blood supply of the ends of the break, the sizes/dimensions of the focus of festering, and also the degree of exhaustion and other special features/peculiarities of the general condition of organism. Fine/small sequestrations are frequently torn away already toward the end of the first month after wound, the large/coarse, especially cylindrical sequestrations of compact substance, remain in connection with the bone considerably longer. The more extensive the festering, the more exhausted casualty, the longer occurs the sequestration. During the significant violations of blood circulation in the ends of the break it also is involved/tightened for a prolonged time.

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In connection with the fact that with the bullet breaks the conditions of circulation of blood unit prove to be different in the different sectors of the edges of the broken bone (as a result of the dissimilar degree of the damage of periosteum and paraosseal tissues), and also different dissemination of suppurative processes, the speed of sequestration even in the adjacent sectors is dissimilar.

In connection with this arise the need for refining the concept

of term "sequestration". In the literature this term was used not always in one and the same sense. In fact to it is more right call sequestration only that sector of the necrosis of bone on the ends of the break and viable fragments which was arranged/located in the suppurative area and in the course of festering was torn away from the living bone due to the resorption of the latter, i.e., it underwent sequestration. Removal/distance by the surgical route/path of sequestrations of earlier than their spontaneous rejection/separation could lead to the fact that in the place of removal/distance were formed the new sequestrations and the process of sequestration was renewed.

The free at the focus festering bone fragments to call sequestrations was incorrect. Presence in the suppurative focus of such fragments supported festering, but surgeon could remove them at any time, after which the festering ceased.

Actual sequestrations it was easy to differ by simple eye from the fragments of the bone: sequestrations always had the pitted surface in that place where they were fastened to the bone, but fragments did not have trails of resorption.

Sizes/dimensions and form of sequestrations corresponded to sizes/dimensions and form of the sectors of primary traumatic

necrosis, from which they appeared. They could have a form of cylinders, semicylinders and plates. The sequestrations of compact substance could capture entire its thickness, only external or only interior layers.

Reactive processes in tissues, which surround the focus of festering bone wound.

Around the festered bone wound appeared inflammatory hyperemia and wide zone of collateral edema. During the first days, to the formation of the solid shaft of granulation, in the edematic fluid/liquid was a large quantity of fibers of fibrin and leukocytes. Later leukocytes decomposed and disappeared, whereas fibrin it remained long time.

From the very beginning of festering in the zone of concussion were deployed the processes of organization and reparation. Their intensity and speed were to a considerable extent conditioned on the volume of festering. In the presence of extensive suppurative focus they were developed slowly, during slight festering - much more rapid. As a result of the processes of proliferation the unit of the damages healed according to the type of primary tension, which was observed almost in each festered wound, where were disposed of the large/coarse, little displaced fragments, i.e., in the peripheral

units of wound, beyond limits of the region of festering. In these sectors occurred the organization of the become numb sectors due to the proliferation of the local connective tissues elements/cells.

In the process of organization the become numb soft tissues were resorbed via phagocytosis by histiocytic elements/cells. The contacting bone fragments were united by the rich by cells loose-fibrous connective tissue, which composes basis for the formation of bone substance. This tissue was formed from the appropriate sectors of periosteum and paraossial tissues.

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In the periosteal regenerate already on the 7-8th day was noted the formation of the spongy bone structures, which was the initial phases of the development of preliminary corn.

The healings of cracks in the compact substance beyond the limits of the zone of festering did not frequently occur very for long, which was explained by the absence in these places of stimulus for an increase in the periosteal and endosteal elements/cells whose damage in the zone of crack formation was extremely small. Therefore such cracks for long did not occlude and they were frequently the guide on which the microbes from the focus of festering penetrated

depthward bones.

As it is noted above, the reaction of the bone substance of the damaged bone already from the first days after wound was expressed the disseminated resorption noted in the compact substance entire bone, but the most noticeable for the elongation/extent 10-15 cm to the sides from the ends of the break. In the spongy substance of bone the resorption was noted more lately, from the 8-10th day, and it was developed at slower tempo.

Already from the 7-8th day the processes of the resorption of compact substance were always matched with bone formation in the periosteum which was noted in that entire region where in the compact substance it took the place of resorption of old bone. As a result beyond the limits of break appeared the spongy bone structures, which already toward the end of the first month after wound formed around the bone of their genus the clutch whose thickness varied over wide limits, depending on the intensity of proliferating processes generally. However, until lasted festering, the neoformation of bone beyond the limits of corn in quantitative sense never was closed over resorption, in consequence of which the rarefaction of bone steadily increased/grew. Therefore after 1-2 months from the beginning of festering appeared the rarefaction of the compact substance of the entire broken bone, on its building/structure which was becoming

similar to the spongy substance. Resolving of bone, which exceeded its neoformation, served as manifestation dystrophic of processes in the quite bone tissue.

The phenomena of proliferation, result of which was the elimination of concussion damages, they were noted in the entire zone of the concussion of soft tissues and bone. In soft tissues occurred the resorption of hematomas, the organization of the become numb tissue, the encapsulation of foreign bodies. The processes of organization were escorted/tracked by the resorption of hemorrhages and sectors of necrosis.

Should be particularly examined a question about the necrotized muscular fibers in the zone of concussion. Since they were located in enclosing of living tissues, their resorption and organization had specific lines. Morphology of these processes was not always identical. It is possible to note three variants:

- 1) the fusion of the necrotized muscular fibers without the visible participation of the cellular elements/cells when the substance of fibers completely is dissolved and sarcolemma proves to be that filled with the pink, homogeneous masses, which remind lymph; this fluid/liquid subsequently is resolved, sarcolemma is dropped and is lost in the proliferating cells and the fibers of endo- and

perimysium;

2) the phagocytosis become numb muscular fibers by the histiocytic elements/cells, which penetrate inside sarcolemma, with the subsequent growth on the spot of muscular fibers of vulgar granulating tissue;

3) dissolution and the resorption become numb muscular fibers in the process of reproducing the sublemmal nuclei/kernels: in this case within the sarcolemma are formed/activated the cells, it is removed reminding myoblasts.

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The latter initially encircle in the form of head the substance of muscular fiber whose outlines become uneven, with the lacunar depressions. In proportion to an increase in the cells the mass of fibers seemingly thaws and finally it disappears, in consequence of which the sarcolemma proves to be that continuously filled with the newly formed cells, in which are frequently visible the figures of nuclear fission. Subsequently these cells, being multiplied, are mixed with those growing in the the endo- and perimysium by the elements of granulation. Between the cells are formed/activated the nets/systems of argyrophil fibers. Further fate of these cells to

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