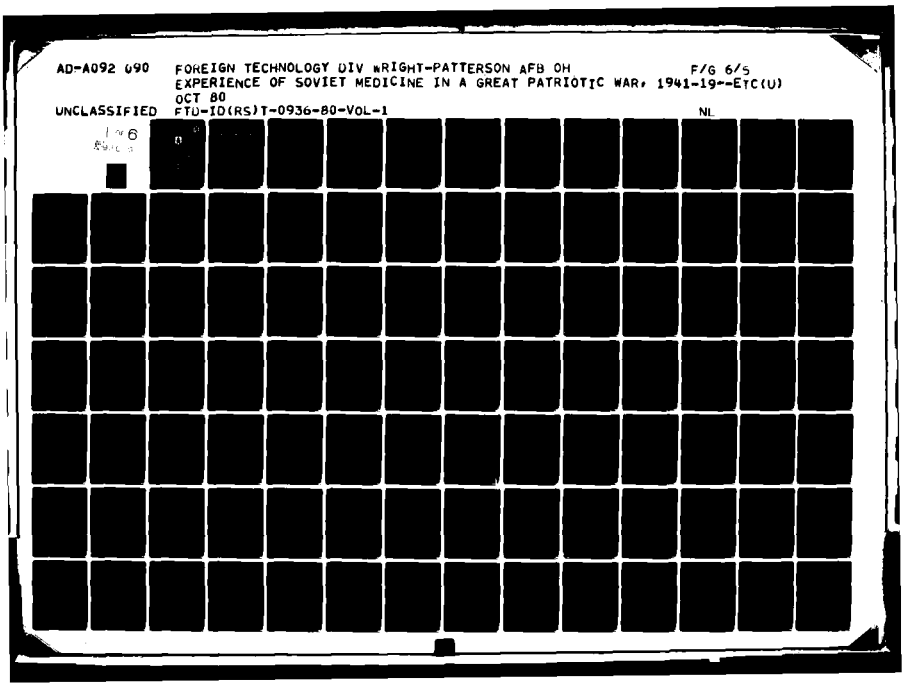

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FOREIGN TECHNOLOGY DIVISION

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

Volume 16

Section 1

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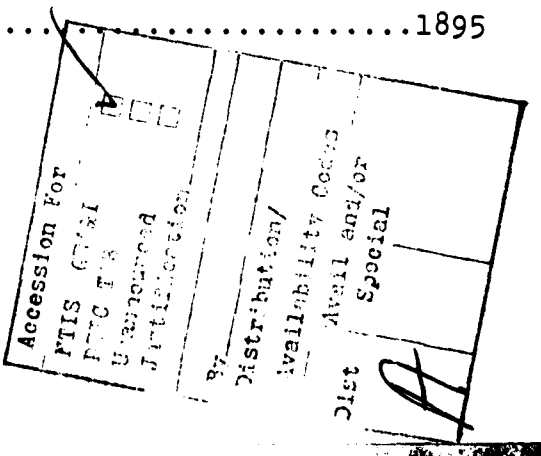
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U. S. BOARD ON GEOGRAPHIC NAMES TRANSLITERATION SYSTEM

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

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

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

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No typing.

Page 3.

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

Pages 4-5. No typing.

Page 6.

Part I.

SURGERY.

Page 7.

Section the eleventh.

Bullet injuries and damages of extremities (complication).

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No typing.

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Chapter I.

DAMAGES OF BLOOD VESSELS WITH THE BULLET BREAKS OF THE BONES OF EXTREMITIES.

Statistical survey/coverage.

Candidate of medical sciences the Major of medical service S. M. Krubangaleyev.

The most important military field surgeons since olden times noted the danger of the combined injuries of large vessels and bones. N. I. Pirogov wrote: "If during the damage to artery and bone proves to be damaged, then, of course, chances both for Gunther method and for everyone other are done are very small, and only with the break without the breaking up of bone it is possible to still hope for the retention/preservation/maintaining of term".

Noting his successful dressings of shoulder artery even with the compound fractures of shoulder bone, N. I. Pirogov expressed the following consideration: "Concerning with the bullet damages of lower

extremities, then if for me it was necessary to now treat the compound bullet fracture of thigh in his upper third, connected with the damage to artery and the hemorrhage, I would prefer amputation ligature using the method of Hunter and gypsum bandage with the windows". This remarkable proposition, directed toward the retention/preservation/maintaining of extremity with the such heavy injuries, far exceeded its epoch and only many decades later obtained its realization.

How these a considerations of N. I. Pirogov for their time were foremost, evidently from their comparison with his contemporaries' opinions. Thus, Billroth (Billroth) on the basis of his experiment/experience of 1870 considered that the ligature of vessels when the break of bone is present, threatens with the gangrene of extremity [cited in Sukhanek (Suchanek)]. In polythalamous statistics (Rabe) 1875 are given extremely heavy issues with the complicated breaks of the bones of shin after the dressing of femoral vessels. In accordance with this of Langenbek (Langenbeck) it advised with the hemorrhages after bullet injuries from the simultaneous break of bone to immediately obtain satisfaction amputation [cited according to Wolf (Wolff)]. This proposition to the first world war was divided by many surgeons.

The observations, carried out during the first world war, showed

that the injuries of vessels, complicated by the break of bones, seriously made forecast worse. A. I. Charugin to 87 injuries of the vessels of extremities and other sections of the body of 33 times noted the presence of the break of bone. With such combined injuries are very frequent were frequent the secondary, frequently repeating hemorrhages; of 43 secondary hemorrhages, which were being observed by the author, 23 fell to the injuries with the break of bone. Of 11 injured people, in whom began the gangrene, in 7 was noted the break of bone.

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Sukhanek, being connected up Billroth's opinion, considered that the danger of gangrene after the ligature of large vessels with the late hemorrhages was possible only, where there is a break of long tubular bone.

The opinions of the surgeons relatively of tactics with the break of bone and the injury of vessel in the first world war were divided. Franz (Franz), similar to Langenbeck, continued to insist on what the amputation was shown with the break of thigh with the injury of vessels and with the secondary hemorrhages. V. A. Oppel' reading to the immediate amputation considered the crushed breaks with the disturbance/breakdown of the integrity of the neurovascular bundle

when delay with the amputation creates a threat of death as a result of the subsequent infection and the secondary hemorrhage.

By that time was to the sufficient degree revealed the value of a number of factors both for the development of ischemic gangrene and for the establishment of the collateral blood circulation of the extremity: the state of general/common/total blood pressure (N. S. Korotkov, S. R. Mirotvortsev), the development of infection in the wound (N. N. Burdenko, A. P. Krymov, etc.), the deficiency of collateral ways in the first period after injury and their expansion subsequently, etc.

The account of unfavorable factors and intervention and the measures, directed toward their elimination, considerably improved the issues of vascular damages; many surgeons began to more optimistically estimate the issues of the described injuries. Tak, A. P. of Crimea in 4 injured people with aneurism and break of bone (in one - shoulder, in 3 - femoral) after operation/process attained a good function of extremity. N. A. Bogoraz in two injured people with the break of thigh together with the injury of femoral artery, after putting suture on the femoral artery and after applying stretching, attained full/total/complete recovery with the retention/preservation/maintaining of the function of foot.

Thus, many surgeons in the period of the first world war returned to N. I. Pirogov's idea about the possibility of the retaining treatment of extremity when simultaneously the damage of vessel and break of bone is present, in particular, by applying N. I. Pirogov's circular gypsum bandage.

This installation for the "saving treatment" (N. I. Pirogov) became the basis of Soviet military field surgery.

During the war with White Finns (1939-1940) M. N. Akhutin as those shown to the amputation considered the breaks, which were being accompanied by the gap of basic vessels and nerves, by cooling and explicit lack of vitality of the peripheral part of the extremity. I. G. Turovets the conditions of front evacuation hospital observed 26.0o/o, and S. P. Vilesov in the back hospital - 17.0o/o of bullet injuries of vessels in the combination with the break of bone.

During the Great Patriotic War the number of communications/reports about the simultaneous injuries of vessels and bones of extremities increased (Table 1).

From Table 1 it is evident that with the injury of the vessels of extremities the breaks were observed in the army and front region more frequently than in the back. Considerably less published data on

the bullet breaks, which are accompanied by the damage of vessels. Thus, according to the observations of N. P. Shastin in KhPPG of first line and S. A. Botashev in the deep rear, with the breaks the thighs of the damage of vessels are noted into 0.7o/o.

S. A. Rusanov personally observed 300 injured people with the damage of the large/coarse arteries of extremities. About 50.0o/o of them had simultaneously the ostecarticular damages. In his opinion, the frequency of these injuries oscillates in the different stages of evacuation from 5.0 to 8.0o/o all of those wounded in the extremity.

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Based on materials of sections the breaks of bones with the injury of blood vessels are established/installed still more frequent. Thus, V. L. Byalik noted the damage of vessel and bone in 80.3o/o of dead persons on the field of battle from the hemorrhage with the injury of extremities. V. Ya. Karupa established/installed the same percentage of the damage of vessel and bone in those been killed from the primary hemorrhages. According to V. M. Makhmudbekov's data, the break of bone was observed in 28.0o/o of dead persons from the different reasons for injured people with the damage of the vessels of extremities. S. P. Vilesov observed the break of bone in 62.2o/o of the same injured people.

According to the data of the deepened development of the histories of disease/sickness/illness/malady, the damage of large vessels was observed in 10.0o/o of injured people with the bullet break of the bones of extremities; with the bullet break of shoulder this was noted in by 9.7o/o, that of the bones of forearm - in 7.4o/o, thighs - in 8.0o/o and the bones of shin - in 14.9o/o of injured people.

In actuality the simultaneous injury of large vessels with the bullet break of bones occurred more frequently, since here did not enter injured people, whose damage of vessel was not identified for the retention time in the hospital (about such injured people communicates, for example, V. P. Radushkevich), or the dead persons on the field of battle.

The frequency of the damage of vessels, it is doubtless, was found in the dependence on the form/species of break (vol. 15, pg. 226, 284, etc.).

On the distribution of injured people in connection with the type of the damaged vessel it is possible to judge according to the data of Table 2.

Table 1. Frequency of the bullet breaks of the bones of extremities with the injury of vessels during the Great Patriotic War according to the observations of the different authors (in the percentages).

(1) Фамилия автора	(2) Год опубликования наблюдений	(3) Район наблюдений	(4) Число ранений сосудов	(5) Частота переломов
(6) В. И. Парменов	1946	ДМП	242	38,0
(7) И. Х. Хоменко	1946	(8) ДМП	700	57,7
(9) Б. В. Петровский . . .	1949	Фронтовой	318	27,7
(10) С. А. Русанов	1951	»	300	50,0
(11) А. Ф. Златман	1945	»	82	53,6
(12) В. С. Беренштейн . . .	1944	(14) МЭП	184	32,0
(13) Б. Г. Гериберг	1946	Тыловой	150	7,3
(15) Т. И. Глинер	1945	»	22	9,0
(16) В. П. Радушкевич . . .	1946	»	75	10,6
(17) Х. А. Петросян	1944	»	202	26,2

Key: (1). Author's surname. (2). Year of publication of observations. (3). Region of observations. (4). Number of injuries of vessels. (5). Frequency of breaks. (6). V. I. Parmenov. (7). I. Kh. Khomenko. (8). B. V. Petrovskiy. (9). Front. (10). S. A. Rusanov. (11). A. F. Zlatman. (12). V. S. Berenshteyi. (13). B. G. Herzberg. (14). Back. (15). T. I. Gliner. (16). V. P. Radushkevich. (17). Kh. A. Petrosyan.

Table 2. Distribution of injured people with the bullet break of the bones of extremities according to the type of the damaged vessel (in the percentages).

(2) Локализация перелома	(1) Название артерии: (3) плечевая	(4) локтевая	(5) лучевая	(6) бедренная	(7) глубокая ветвь бедренной артерии	(8) подколенная	(9) задняя большеберцовая	(10) передняя большеберцовая	(11) несколько артерий	(12) прочие сосуды и вид сосудов не установлены	Итого
(13) Плечо . . .	70,5	0,2	2,6	—	—	—	—	—	5,8	20,9	100,0
(14) Предплечье	2,9	14,5	22,9	—	—	—	—	—	37,3	22,4	100,0
(15) Бедро . . .	—	—	—	43,6	5,9	6,1	—	—	11,0	33,4	100,0
(16) Голень. . .	—	—	—	0,6	—	1,9	15,6	9,8	52,1	20,0	100,0

Key: (1). Name of artery. (2). localization of break. (3). shoulder. (4). cubital. (5). radial. (6). femoral. (7). deep branch of femoral artery. (8). popliteal. (9). posterior tibial. (10). front/leading tibial. (11). several arteries. (12). Other vessels and type of vessels are not established/installed. (12a). Altogether. (13). Shoulder. (14). Forearm. (15). Thigh. (16). Shin.

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From the preceding information it is evident that the damages of large vessels most frequently were encountered on the thigh and the shoulder; on the shin and the forearm more frequently noted the injury of several vessels. This is explained by an anatomical difference in the separate segments (presence on one basic arterial shaft on the thigh and the shoulder also of two such shafts on the

shin and the forearm). Hcwever, the account of the damaged vessels did not always prove to be sufficiently to precise ones, especially with the injuries, which ended by amputation, and in injured people, whose surgical intervention on the vessels was not conducted.

Etiology and pathogenesis.

Candidate of medical sciences the Major of medical service S. M. Kurbangaleyev.

In the presence of the break of long tubular bone with the damage of vessel occurs much the more extensive decomposition of the surrounding tissues, than with the injury of some soft tissues alone with the damage of vessel. In this case and very damage of vessel proves to be heavier than with the simple injuries. According to the data of author's development, combined injuries of vessels and bones of extremities on 118 injured people, in whom in the histories of disease/sickness/illness/malady was shown the character/nature of the damage of vessels and it was not produced primary amputation, only in 27 damage was marked as near-wall, in one - as the thrombosis of vessel without the damage of the integrity of its walls, in two - as compression, in 5 was noted hematoma and of aneurism without the indication of the form of damage and in 83 injured people was noted the full/total/complete gap of vessel. Of 231 injured people, in which was produced the amputation during the primary surgical processing/treatment, in 230 forms of the damage of vessel it was designated as full/total/complete gap and is only in one stated/established the thrombosis of vessel without the visible

damage of its wall.

If we these data ccmpare with authors' data relative to the damages of vessels, predcminantly with the injury only of soft tissues, then clearly is revealed/detected the value of the break of bone for the character/nature of the injury of vessel. Thus, A. I. Charugin on the personal material in the period of the first world war had to 66 injuries of vessels the full/total/complete gap of 14 times.

Based on materials of B. V. Petrovskiy, most frequent proved to be the tangential damages of arteries (58.2o/o), in the second place stood perforating (small-splintered and bullet) injuries (16.7o/o). More considerable decomposition was observed more rarely, the full/total/complete gaps of arteries composing only 7.6o/o, and the damage of three quarters of its periphery - 6.9o/o, and 3.0o/o composed the blind-end injuries of the artery when fragment or bullet jammed in the arterial wall and pluged its opening/aperture. In remaining 7.6o/o of injured people the form of the damage of vascular wall is not shown.

S. A. Rusanov divides the damages of vessels into the full/total/complete cross injuries, incomplete cross (with the preserved bridge), lateral (with the damage less than the semicircle

of wall), near-wall (with the damage are less than quadrant), through, tangents (not penetrating into the lumen) and the contusions. According to S. A. Rusanov, are most frequent the full/total/complete cross (45.7o/o), then - near-wall (28.7o/o), remaining forms are encountered more rarely. With the full/total/complete and incomplete cross injuries the passability/trafficability of vessel is compulsorily interrupted; through near the wall and tangents, as a rule, do not interrupt/break passability/trafficability. With the lateral ones it is retained in the part of the injured people.

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Besides the severity of the decomposition of tissues with their crushing and nonremovable discontinuities with the combined injuries, should be noted also the frequent (29.8o/o) jamming of metallic fragments and other soiling foreign bodies, the presence of bone scrap, in consequence of which appeared and were maintained the foci of heavy infection.

Most serious complication after the injury of vessel is, as is known, the ischemic gangrene which especially frequently begins after the dressing of some large vessels (popliteal artery, femoral artery higher than place of the departure/separation of a deep branch). At

the present time surgeons and physiologists sufficiently in detail studied the pathogenesis of this complication, moreover the previous purely mechanical representations, which joined the origin of this pathological process with the anatomical deficiency of collaterals, were changed into the understanding of the complexity of occurring after the interruption of basic arterial shaft pathological phenomena.

Numerous investigations showed that the vascular network/grid of extremity possesses the powerful/thick network/grid of collaterals which is often capable of easily ensuring blood circulation even after the dressing of main-line artery. Because of the vast compensator ability, inherent in these collaterals, rapidly is equalized ischemia, which attacks after the disconnection of one or the other artery. The development of ischemia and the necrosis of peripheral section after damage or dressing of vessel depend on the functional deficiency of collaterals, caused by series of unfavorable factors. Basic place in this case occupy nervous reflex effects [N. N. Burdenko, V. N. Shamov, R. Lerish (R Leriche) et al.], which are connected with the disturbance/breakdown of the regulator function of central nervous system. These reflexes appear both primary from the direct trauma of vascular wall or from the pressure by the fragment of projectile and for a second time from the compression of the intramural nerve apparatus of vessel by ligature, the painful

reaction from the place of injury with the poor immobilization, the pressure to the nerve trunks, etc. As a result appears the reflector angiospasm in the extensive region, which actively suppresses the collateral blood circulation of extremity.

Is confirmed the value of general/common/total arterial pressure on the state of collateral blood circulation. There are indications of accumulation in the blood of the vasoconstrictor substances, which are generated in the process of coagulation of the blood. Important value is added to the disturbance/breakdown of capillary blood circulation - to expansion under the effect/action of generatrices in the focus of the damage of toxic substances, which leads to stagnation and accumulation of the blood in the capillaries, insufficient admission of oxygen in the tissue, increase of the permeability and sweating through of plasma through the capillary walls. Stagnation creates predisposition to which is accelerated and is amplified under the effect of wound infection. In turn, it only possesses the strong vasoconstrictor effect/action. In view of entire this is inhibited the inclusion into the effect/action of collaterals. Begins to be manifested the value of time in the development of the underfeeding of tissues; especially such differentiated tissues as nerve and muscular. Is required urgent aid for organism, in order to derive it from this vicious circle and to reduce the blood supply of tissues.

With multiple failure of two important organs/controls of the extremity of bone framework and feeding vessel - the frequency of ischemic gangrene and other complications (gas gangrene, secondary hemorrhages) so is increased which singles out this means of damages/defeats both from the general/common/total mass of the uncomplicated vascular injuries of extremities and from of usual bone traumata of bullet origin.

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But how is explained the burdening of the vascular damages by the connection of the trauma of bone?

From the understanding of the pathogenesis of these complications one should realize that in this case is added the series/number of the new unfavorable factors, which adversely affect the reduction of the function of anastomoses. It is first of all necessary to consider the more expressed phenomena of shock which fairly often occurred with the bullet breaks of large/coarse bones, and strong painful stimulations from the place with the bullet breaks of large/coarse bones, and strong painful stimulations from the places of break, which amplify angiospasm. Further, grinding of soft

tissues, in particular, muscles, around the focus of bone trauma which is increased with the poor immobilization. Meanwhile in essence to precisely fine/small muscular anastomoses belongs that deciding tar paper in the nourishment of extremity after the interruption of large/coarse shafts.

Finally, infection especially frequently is developed in the wound with the presence of ground tissues, fragments of bones and foreign bodies, accumulations of the blood in cavities and pockets of wound.

B. V. Petrovskiy indicated that all injuries with multiple failure to the bone also of vessels rapidly are infected, moreover infection from the place of the break of bone applies to muscles and converts/transfers to hematoma. The same tendency of the combined injuries toward the infection noted also A. P. Zlatman and some others. Meanwhile the infection, causing the general/common/total suppression of organism and central nervous system, the thrombosis of fine/small and more large vessels and the compression of the preserved collaterals edema and by infiltrate, finally disturbs the yet not steady circulation. Depending on degree and abundance of ischemia appear these or other the disorders, up to the death of extremity. Soviet surgeons (N. N. Burdenko, S. P. Vilesov, G. M. of Mintz and Ye. M. Gorodetskiy et al.) especially persistently

underscored the value of wound infection in the origin of ischemic disorders, noting the frequency of gangrene with the complication of wounds of a pyo-septic infection. However, besides such explicit forms of ischemia, which become apparent in the massive gangrene of extremity, it was necessary to consider those less expressed as the necrosis of the individual sections of skin and tips of fingers/pins, the aseptic muscular necroses, which condition subsequently the limitations of the mobility of joints, contractures, atrophies and paresis of muscles. Are here involved edemas of extremities, by painful ischemic syndrome, acrocyanosis, disorders of sensitivity, lack of endurance to the cold (L. M. Ratner), etc.

In the origin of these less disorders considered, besides the noted factors, follow to have in mind also the subsequent pathological changes, which are observed in connection with the injury - development of extensive ones Rubtsov, compressive collateral methods, development growing on hematomas and formation subsequently of large aneurysmatic sacks, presence of unmoved bone scrap and bone of scrap and callus, etc.

During the frequent damage of the nerve trunks, clinical picture and complex of disorders even more become complicated: are added paralyses and paresis, traumatic neuritides, causaglia, neurogenic contractures, neuratrophic disturbances/breakdowns.

Among the infectious complications with the combined injuries special attention attracts anaerobic infection. In the literature there are indications that the mentioned complication frequently is developed after the dressing of vessels (P. A. Herzen, V. L. Khenkin, Yu. M. simpson and V. B. Neysntadt et al.).

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However, this question cannot be considered as the completely clear. There is no doubt that ischemia of extremity, which attacks after the dressing of large vessels, predisposes to the development of anaerobic infection. But ischemia is frequently conditioned on very damage (gap) of vessel independent of dressing; under these conditions the extensive decomposition of soft tissues and bones against the background of hemorrhages was an even more favorable soil for the development of anaerobic infection.

It is necessary also to keep in mind that in the practice were encountered the combined forms, when ischemic and gas gangrene they consecutively/serially converted/transferred one into another or were developed simultaneously, so that to establish/install the degree of the participation of that and other etiological factor in the genesis

of necrobiotic phenomena was not always possible.

During the damages of vessels the danger of secondary hemorrhages is more serious than even danger in infection. In the foremost stages it was necessary to more frequently deal concerning the early secondary hemorrhages, which presented nothing else but the renewal of primary hemorrhage, which began as a result of the recovery of blood pressure and washout of loose thrombus or disturbance/breakdown of the latter with the poor immobilization during the transportation, but in separate injured as a result of the secondary damages vessels by bone fragments and foreign bodies.

It is logical that the presence of the combined character/nature of the injury of vessel and bone to a high degree predisposed to the onset of such early (relapsing or repeated) hemorrhages.

Beginning from the 3rd day, appeared the danger of the secondary hemorrhages of another origin, namely caused by the development of wound infection as a result of the suppurative melting of thrombus and rejection/separation of the latter. Especially they were repeated/quickened hemorrhages, beginning from the second week when began the rejection/separation of necrotic tissues and maximally were amplified the processes of proteolysis in the wound with the rapid melting not only of dead tissues, but partially and viable.

In this case supplementary trauma frequently played essential auxiliary role. Since both named factors were especially inherent in the combined injuries, then it is completely understandable that all authors, who observed the course of injuries with the damage to the bone also of vessel, they noted the exceptional frequency with them of secondary hemorrhages (A. I. Charugin, B. V. Petrovskiy, A. F. Zlatman). Frequently were observed late hemorrhages, after 4-5 weeks are later, that appeared against the background of the expressed septic phenomena. The danger of hemorrhages is passed only if the processes of suppurative melting were inferior the place for the processes of healing, and abundant healthy/sound granulations fulfilled the bottom of wound, pushing aside the damaged vessel into the depth.

As the frequent complication after the injuries of vessels is considered, as is known, fluctuating hematoma which subsequently is developed into the false or the traumatic to aneurism (arterial or arteriovenous).

It is appropriate to emphasize that with the combined injuries of bone and vessels of extremity the development aneurisms was observed comparatively very rarely. The predominant character/nature

of the damage of vessel with these injuries (full/total/complete gap) does not favor formation aneurisms, since it is known that aneurism most frequently it is developed with the lateral injury of vessel with the presence of the small gaping defect of wall and only rarely it appears with the full/total/complete gap of vessel.

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The latter is explained by the fact that with the complete gap is observed the difference of the ends of the smashed vessel, the coagulation of the scaled intima and rapid formation in the lumen of thrombus without the considerable hemorrhage in the periphery and without the formation of hematoma, which is communicated with the lumen of vessel, what is the necessary prerequisite/premise for the development aneurisms. Under these conditions the majority of the damages of fine/small and even average/mean arteries usually heals, and if later of them appear hemorrhages, then the latter frequently are without the formation of fluctuating hematomas.

Of all segments most frequently the aneurisms were developed with the combined injuries of thigh (pg. 30). It is obvious that during the damages of large/coarse arteries and veins (femoral, popliteal) after the recovery of blood pressure the powerful/thick stream of the blood easily eluates loose thrombus from the lumen of

vessel, in consequence of which are created the conditions for forming fluctuating hematoma, and subsequently under the favorable conditions and aneurisms.

However, in this case comes forward to the scene the following factor, which is not favorable to formation aneurisms, namely - pathological mobility on the spot of the break of bone. The frequent displacement of tissues impedes formation by necessary for the development the aneurisms of durable capsule.

Finally, the third reason, so frequently interrupting the process of "ripening" aneurisms with the combined injuries, this is - the expressed infection. Infected fluctuating hematoma in particular during the disturbance/breakdown of rest in the region of injury, is very frequently, finished with the development of heavy secondary hemorrhage which it leads either to the dressing of vessel or to the amputation, or to the lethal outcome as a result of the blood loss.

Thus, favorable conditions for the development aneurisms with the combined injuries were created relatively rarely; this occurred in those injured people, who did not have the full/total/complete gap of vessel, but the damaged vessel remained without the surgical processing/treatment, which more frequently could occur with the packed in break or with the reliable, rarely disturbed

immobilization, and when infection was moderate/mild.

As far as complications are concerned such of wound process as osteomyelitis, long not healing wounds, consequences of the damages of nerves, contracture, etc., then the pathogenesis of data of complications with the combined injuries was not characterized by any special features/peculiarities in comparison with other injuries.

Diagnosis.

Candidate of medical sciences the Major of medical service S. M. Kurbangaleyev.

The treatment of the injuries in question required the timely recognition of association of the character/nature of damage. In this respect by more difficult for the recognition was the damage of vessels, while the breaks of bones were revealed/detected considerably easier.

The unsatisfactory recognition of the damages of vessels noted the majority of the authors, who published the materials of the period of the Great Patriotic War (S. P. Vel'yamovskiy, M. I. Bystritskiy and I. S. Bregman, L. A. Odes, V. P. Radushkevich, L. M. Ratner, S. A. Rusanov, S. P. Vilesov et al.). In the relation to the combined injuries B. G. Herzberg indicated that in 11 injured people with aneurism, where there was a break of bone, entire attention of the doctors of the preceding/previous stages was turned to the treatment of the latter, and the damage of vessel remained unrecognized in the army and army region, which was connected with the difficulties of diagnosis.

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If we deviate the possible diagnostic errors, connected with the examination/inspection in the circumstances of the large flow of injured people, then remain the diagnostic gaps/spacings, which could depend on the real difficulty of the recognition of the damages of vessels, what indicated already N. I. Pirogov: "Generally the diagnosis of arterial wounds and traumatic hemorrhages then was not light, as it seems. The wound of artery, as we saw, not always, it is not always connected with the hemorrhage, but for the surgeon it would be very important to learn it to the hemorrhage. But are there such signs? Position and direction of wound, if there is no hemorrhage, a little help with the diagnosis". Noting the unreliability even of this sign as the state of the pulse on the periphery, which can be retained even in the presence of the "completely severed or shot through artery", N. I. Pirogov recommends the nevertheless attentively considering of both named signs - course and direction of wound canal and absence of pulse; if they are connected with such signs "as, for example, heating paretic state, temperature decrease, etc., be it (absence of pulse. - ed.) and passing (sometimes pulse again it shows through several hours), nevertheless the damage to artery it is made by very probable. From the probable the diagnosis is made by accurate, if together with these signs is probed in the direction of arteries dense and hardish

cord/bead".

N. I. Pirogov gives also indications for the investigation of the "unbreakable" traumatic ones aneurism, recommending to repeatedly investigate them in order to establish/install the "decreased stress/voltage of neoplasm from pressing of artery above" and by stethoscope to come to light/detect/expose "babble and anechoic noise in the depth of neoplasm, sometimes permanent... in another time sufficiently clear, and into another time and completely imperceptible. - In the fresh cases it is possible to sometimes notice bluish hue in the color of skin on the neoplasm. - On truth in the peripheral end of the artery it cannot be relied; it it is not sometimes also in other not aneurysmatic neoplasms (from pressing of artery), but sometimes it is also in the aneurysmatic ones (through the lateral blood circulation). Anamnesis is even more inaccurate" [1].

FOOTNOTE [1]. N. I. Pirogov, beginning of general/common/total military field surgery, h. I, 1941, pg. 224-226 and 231. ENDFOOTNOTE.

N. I. Pirogov's these observations and now remain accurate; up to now the diagnosis of the damage of vessels is placed, on the basis of five classical straight/direct signs: neoplasm, pulsation, noise, hum, disorder of blood circulation. As underscores N. N. Burdenko, the combination of them all is simultaneously observed rarely, but

the presence at least some of them facilitates the setting of diagnosis. For the appearance of one or the other symptoms has the doubtless value the period after injury. To them are connected the indirect symptoms: in the early period - the injury of nerves, which becomes apparent by the phenomena of stimulation or paralysis, in the late period - contractures of joints, caused by the Volkmann's contracture of the anematized muscles.

A question about the symptomatology of the injuries of vessels is in detail studied by S. A. Rusanov. According to his data symptomatological special features/peculiarities are determined by the character/nature of the damage of vessel. With the full/total/complete and incomplete cross injuries of main line the disappearance of pulse is noted in 100.0o/o of injured people, noises - in 60.0o/o, the fluctuating swelling - in 30.0o/o. Pulse disappears at the moment of injury, more lately appear noises, even more lately can be formed the fluctuating swelling. With the near-wall and perforating injuries the noises available in 100.0o/o of injured people, the fluctuating swelling - in 55.0o/o, pulse disappeared in 25.0o/o.

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First of all (from the moment/torque of injury) appear noises, then -

pulsation of hematoma, even more lately disappears pulse. The lateral injuries of vessel into 68.0o/o give symptomatology according to the type of cross ones, and into 32.0o/o - according to the type of near-wall ones.

All these symptoms can be absent only in 7.0o/o of injured people exclusively with the injuries of buttock artery, deep artery of thigh and arteries of forearm and shin.

S. A. Rusanov indicates that in 9 cases of 10 it suffices to remember about the possibility of the injury of the vessel of extremity in order to recognize it with the aid of the examination of peripheral pulse and auscultation.

Tangential (nonpenetrating) injuries are asymptomatic, if it is not formed aneurism. Contusions sometimes become apparent by the disappearance of pulse.

"For surgeon rarely it is necessary to meet in those wounded the vessels the extensive, widely gaping wounds - besides the less frequent, is the more removed this stage from the field of breakage and the larger/coarser the damaged vessel. In majority their of wound have narrow, winding canals with the small openings/apertures in the skin. In this case between the localization of inlets and the

frequency of the injury of vessel there is no dependence. Vessel can be damaged, also, with the distant localization of wound, and the existing contradictory/opposite opinion is connected only with deficiencies/lacks in the recognition" (S. A. Rusanov).

During the combinations of the damages of bones and vessels it was necessary more to be based on secondary signs, since the presence of hematoma, and also acoustic phenomena is little characteristic for these damages. During the combinations of the injuries in all in 6.0o/o of injured people is noted the presence of fluctuating and nonpulsating hematomas of which in an even smaller percentage it was developed aneurism. According to the data of author's development, only in 3.0o/o of the injured people, not subjected to the amputation of injured extremity, were encountered the indications of development aneurism.

Some parts of clinical picture, which helped the recognition of the combinations of injuries in the difficult cases, are given in the analysis of injuries on the separate localizations. Of the surgeon was required large attentiveness and power of observation, so that on the basis of anamnesis (strong hemorrhage after injury, fainting, use/application of a tourniquet) and it is sometimes small the expressed symptoms (general/common/total pallor of integuments and the frequency increase of pulse, not explained by shock, the presence

of the signs of a deep or extensive subcutaneous hemorrhage, cold, pale extremity, weakening of pulse on the periphery of the damaged extremity, direction of the wound canal, frequently filled with blood clots, etc.) to recognize, together with the break of bone, also the damage of vessel. It is logical that this was very facilitated in presence of one of the straight/direct symptoms (neoplasm, pulsation, noise phenomena). When appeared doubt, was not injured vessel, even in the process of primary surgical processing/treatment was conducted active revision, i.e., the exposure of the arranged/located in the neighborhood large vessel, in order to exclude or, on the contrary, to confirm its injury. During the damage of vessel after the dissection of wound canal and removal/distance of blood clots appeared characteristic hemorrhage.

In the later periods of wound process the diagnosis of the "asymptomatic" damages of vessels became more difficult, if due to the state of wound there was not readings to its revision and secondary surgical processing which nevertheless had to be conducted with the suspicion to the damage of vessel.

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Clinic.

The candidate of medical sciences the Major of medical service S. M. Kurbangaleyev and professor is the Lieutenant Colonel of medical service D. G. Mamamtavrishvili.

Since olden times it is known that the damages even large vessels can cure independently.

With the combined injuries spontaneous recovery was large rarity, first of all in view of the sharp inclination of these injuries to the infection and the secondary hemorrhages. However, the possibility of spontaneous recovery with the combined injuries, large vessels and bones cannot be rejected completely, about this testifies the following observation.

B-O. 31 year, 27/III 1942 obtained perforating bullet injury in upper third of left thigh with the damage to bone. Wounds on DMP and in PPG were not treated, extremity was fixed/recorded with wire splint. 9/IV in the evacuation hospital the break of thigh is confirmed, is noted suppurative liberation/excretion from the wound.

20/IV inlet on the internal surface of thigh healed, outlet - small, with suppurative discharge. 8/V complaint on the pain in the left thigh. Suspected the damage to artery is superimposed provisory tourniquet. 11/V in upper third of left thigh on 5 cm lower than the pupartic ligament is noticed diverticulum by value with the fist, that fluctuates synchronously with the pulse of radial artery. During the auscultation above the neoplasm is examined the systolic noise which is spread upwards from the center of swelling and it is more down. Pulse on the popliteal posterior, tibial and back artery stops is probed. It is diagnosed the aneurism of femoral artery.

21/V is noted an increase in the swelling, but the decrease of pulsation. 28/V aneurism it does not fluctuate.

11/VI in upper third of left thigh is a neoplasm which does not fluctuate. Into the same day the injured person is converted into another hospital for the operation/process apropos the aneurisms of femoral artery. After the admission it is noted, that both wounds healed. The inlet has sharp systolic noise. Pulse on the popliteal artery of small filling , on the posterior tibial and back artery of foot is not probed.

13/VI it is looked around by the chief/leading surgeon who the aneurisms of femoral artery did not find (!). In X-ray photograph is

noted crushed break of small trochanter and cross break of upper third of diaphysis of thigh with moderate displacement of scrap at angle, apex/vertex towards the outside. Evidently, break was packed in.

31/VII it begins to discharge both feet from the bed and to get up.

7/IX at the termination of treatment it is discharged from hospital.

If all noted observations are reliable, then this case should be considered as the rarely observed spontaneous "resorption" aneurisms with the combined injury of vessel and bone.

But usually the course of the combined injury proved to be different. Greatly rarely it was necessary to observe not only "resorption" aneurisms, but its even calm "ripening", as this it has with the injury of soft tissues.

However, in the majority of the combined injuries of large vessels the tranquil flow of wound process was interrupted/broken by different complications, described below, which frequently imperiled the retention extremity or even life of injured person.

The frequency of the principal complications in the group of injured people whose bullet break of the bones of extremities was accompanied by the damage of vessels, was more (shock - 16.7o/o, gas infection - 12.7o/o, sepsis - 6.0o/o), than in injured people without multiple failure of vessels (shock - 2.5o/o, gas infection - 6.3o/o, sepsis - 2.6o/o).

The especially large difference in the relation to of gas infection and sepsis was noted in injured people, who were not subjected to amputation during primary processing (16.1 and 8.7o/o).

Should be especially emphasized the high frequency of shock in injured people with the damage of the vessels (it almost is 7 times higher in comparison with the frequency of shock in injured people without the damage of vessels).

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As far as osteomyelitis is concerned, then this complication was observed more frequently in injured people without the damage of vessel (30.8o/o), than with its damage (20.2o/o), in connection with the fact that in 42.0o/o of latter was almost produced the amputation during the primary surgical processing.

On the different segments of extremities the frequency of the principal complications was dissimilar, as this it is possible to see from the data, given in Table 3.

As can be seen from given data, shock during the combinations of breaks with the damages of vessels with all given localizations was noted more frequently than with the breaks, not complicated by the damage of vessels, morecver the difference between both means of injuries on the separate segments was expressed considerably. With the breaks of thigh, not complicated by the injury of vessel, the frequency of shock reached 6.2%, with the breaks of the bones of forearm it was equal only 0.5%; with the combined injuries the decrease of the frequency of shock on the localization occurred less sharply and even with the most light injuries such as should be considered the injuries of forearm, shock continued to occupy sufficiently considerable place (6.5%). The same data illustrate the considerably greater severity of the combined injuries in comparison with the bullet breaks without the damage of vessels.

Gas infection also detected explicit, although is smaller in comparison with shock, the preponderance with the combined injuries in comparison with the bullet breaks of the bones of extremities without the damage of vessel in all given in Table 3 localizations.

The difference between the complicated and uncomplicated bullet breaks in the relation tc sepsis was considerably more than in the relation to gas infection, what is also one of the indicators, which characterize the heavier course of the injuries, which are accompanied by the damage of blood vessels.

As far as infection is concerned suppurative, then here on all given localizations is noted its more frequent development with the combined injuries.

Table 3. Frequency of the principal complications in injured people with the bullet break of the bones of extremities during the damage of vessels and without their damage (in the percentages to a number of injured people in each group).

(1) Локализация перелома	(2) Группа раненых	(3) Осложнения				
		(4) шок	(5) газовая инфекция	(6) сепсис	(7) обильное нагноение	(8) остеомиелит[1]
(9) Плечо	(10) С повреждением сосудов	11,4	10,8	3,0	52,6	34,2
	(11) Без повреждения сосудов	1,6	4,4	0,7	26,3	42,1
(12) Предплечье	С повреждением сосудов	6,5	4,5	1,4	27,0	31,5
	Без повреждения сосудов	0,5	2,0	0,2	20,5	26,3
(13) Бедро	С повреждением сосудов	26,2	16,7	19,8	27,8	17,6
	Без повреждения сосудов	6,2	11,9	9,2	27,2	34,8
(14) Голень	С повреждением сосудов	21,5	16,9	5,2	60,9	42,1
	Без повреждения сосудов	3,1	8,9	1,8	34,4	49,5

Key: (1). Localization of break. (2). Group of injured people. (3). Complications. (4). shock. (5). gas infection. (6). sepsis. (7). abundant festering. (8). osteomyelitis [1].

FOOTNOTE [1]. Are not considered those amputated during the primary processing. ENDFOOTNOTE.

(9). Shoulder. (10). With damage of vessels. (11). Without damage of vessels. (12). Forearm. (13). Thigh. (14). Shin.

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The preponderance of osteomyelitis in the groups of injured

people without the damage of vessels is explained by the fact that in a number of injured people with the combined damages to the bone also of vessel are connected many such, in which after injury was soon produced the amputation from the secondary readings.

If we during the calculation of indicators exclude all injured people, who were undergoing amputation, then the frequency of osteomyelitis will be increased; then, for the femoral bone during the damage of vessel the frequency of osteomyelitis will compose 40.0%, and without the damage - 38.7%.

The information about the early complications of the bullet breaks of the bones of extremities with the damage of vessels in the stages of evacuation is represented in Tables 4, 5 and 6. These data concern injured people, who were not undergoing amputation during the primary processing.

The early complications and the associated diseases, revealed in the army region with the breaks of shoulder with the damage of vessels, composed 19.5%, with the breaks of the bones of forearm - 8.9%, thighs - 24.5% and the bones of shin - 22.5%.

Thus, a great quantity of complications was observed with the breaks of thigh and bones of shin, which is represented in Table 4.

From Table 4 it is evident that in the army region with the breaks of femoral bone and bones of shin most frequently was observed the shock. Gas infection with the injuries of bones and vessels of shin occupied the second, for the remaining localizations - third place. Other surgical complications, somehow: secondary hemorrhages, ischemic gangrene, silent and fluctuating hematomas, with the injuries of bones and vessels the thighs composed the second, and with the injuries of shoulder and forearm - first place.

In the army region (Table 5) a number of early complications noticeably increased and their relationship/ratio as a whole and on the separate localizations was another; the frequency of the complications of infection considerably grew/rose, moreover with the injuries of thigh and shin by it it was surprised to third of entire quantity of injured people.

Table 4. Distribution of injured people with the bullet break of the bones of extremities and multiple failure of vessels according to the early complications, which were being observed in the army region (in the percentages).

(1) Локализация перелома кости с повреждением сосуда	(2) Осложнения						(9) Сопутствующие заболевания	(10) Без осложнений	(11) Всего
	(3) шок	(4) газовая инфекция	(5) сепсис быстро текущий	(6) обильное гнойное раны	(7) гнойные затеки и флегмоны	(8) прочие хирургические осложнения[1]			
(12) Плечо	6,4	3,8	—	0,4	0,4	6,8	1,7	80,5	100,0
(13) Предплечье	2,3	1,4	—	0,4	—	4,6	0,2	91,1	100,0
(14) Бедро	15,7	2,2	—	0,6	—	5,1	0,9	75,5	100,0
(15) Голень	11,2	5,5	0,4	0,9	—	3,5	1,0	77,5	100,0
(16) Все четыре сегмента в среднем . . .	8,8	3,4	—	0,6	—	4,6	0,9	81,7	100,0

Key: (1). Localization of the break of bone with the damage of vessel. (2). Complications. (3). shock. (4). gas infection. (5). sepsis it is rapid flowing. (6). abundant festering of wound. (7). suppurative flows and phlegmon. (8). other surgical complications [1].

FOOTNOTE [1]. Ischemic gangrene, secondary hemorrhage and so forth, etc. ENDFOOTNOTE.

(9). Associated diseases. (10). Without complications. (11). In all. (12). Shoulder. (13). Forearm. (14). Thigh. (15). Shin. (16). All four segments on the average.

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As can be seen from Table 5, in the army region the complications of shock stepped back to the second plan/layout, but grew/rose the complications of gas infection, especially with the injuries of lower extremities, and also grew/rose such consequences of the bullet damages of vessels as hemorrhage and ischemic gangrene, connected with the graph of other complications which comprised in average/mean 7.7o/o.

From the complications, which appeared in the army region, was noted the increase of a quantity of rapidly current sepsis, especially with the injuries of thigh and shin. The abundant festering of wound especially is frequently noted with the injuries of shin (15.8o/o) and forearm (10.5o/o).

Data given in Tables 4 and 5, shed light on the origin of severe complications with the bullet breaks. Shock, gas infection, sepsis and other complications depended in the majority of injured people with the bullet break on the associated damage of large vessels and connected with this hemorrhage.

The exceptional severity of injury in the combination with blood loss and disturbance/breakdown of blood circulation in the extremity

is the factor which, acting on central nervous system, causes a decrease in the resistivity of organism and leads to the development of shock, sepsis and gas infection.

Given given in these tables, they indicate also the considerable progress in the treatment of these complex forms/species of break. In 50.0o/o of injured people the breaks of thigh with the damage of large vessels in the army region flowed/occurred/lasted without the complications. On other localizations of the injuries of extremities were observed the even better results.

If one takes into account, that in the previous wars the gas infection complicated to 15.0o/o and more all injuries of extremities, including the injuries of soft tissues without the damage of bones and vessels, then the given in the tables indicated quantities of complications during the such heavy combinations of the injuries of bones and vessels must be considered minimum.

In the front region (table 6) the frequency of the complications in question again somewhat was decreased. Shock was of practical use. Gas infection occupied insignificant place.

Table 5. Distribution of injured people with the bullet break of the bones of extremities and multiple failure of vessels according to the early complications, which were being observed in the army region (in the percentages).

(1) Локализация перелома кости с повреждением сосуда	(2) Осложнения											
	(3) шок	(4) газовая инфекция	(5) сепсис быстро текущий	(6) обильное нагноение раны	(7) гнойные затеки и флегмона	(8) гнойный артрит	(9) остеомиелит острый	(10) прочие хирургические осложнения	(11) Сопутствующие заболевания	(12) Без осложнений	(13) Всего
(14) Плечо	2,1	9,8	1,2	8,1	3,0	—	0,4	6,8	1,6	67,0	100,0
(15) Предплечье . . .	0,4	3,4	0,2	10,5	0,8	0,2	—	7,2	1,8	75,5	100,0
(16) Бедро	4,8	14,4	8,9	6,7	2,5	0,6	0,3	10,9	0,9	50,0	100,0
(17) Голень	1,1	15,9	4,0	15,8	1,6	0,2	0,2	6,0	2,2	53,0	100,0
(18) Все четыре сегмента в среднем	1,7	11,1	3,6	11,2	1,4	0,2	0,2	7,7	1,7	61,2	100,0

Key: (1). Localization of the break of bone with the damage of vessel. (2). Complication. (3). shock. (4). gas infection. (5). sepsis it is rapid flowing. (6). abundant festering of wound. (7). suppurative flows and phlegmon. (8). suppurative arthritis. (9). osteomyelitis (sharp/acute. (10). other surgical complications. (11). Associated diseases. (12). Without complications. (13). In all. (14). Shoulder. (15). Forearm. (16). Thigh. (17). Shin. (18). All four segments on the average.

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Then the so-called "other" surgical complications, the rapidly

current sepsis and suppurative flows were held almost at the previous level.

Osteomyelitis and associated diseases of internal organs/controls exhibited tendency toward the frequency increase.

In the administrative area (table 6) the percentage of complications was decreased in comparison with the front. At the previous level remained only "other" surgical complications; somewhat grew/rose a quantity of suppurative flows and phlegmons and sharply current osteomyelitis. Remaining surgical complications descended to insignificant numerals; then more frequently were stated/established the diseases of internal organs/controls.

Late complications in contrast to early most rarely were observed with the injuries of thigh (54.4o/o), more frequent - with the injuries of shoulder (66.6o/o) and shin (68.4o/o) and most frequently - with the injuries of forearm (79.0o/o). The frequency of different late complications is given in Table 7, which shows the distribution of injured people with the damage of vessels. From the table it is evident that on the thigh the most frequent consequences of the dismantled combined injuries was the pathological stump, osteomyelitis and contracture; with the injuries of shin most frequently was encountered osteomyelitis and pathological stump; with

the injuries of forearm and shoulder the predominant complications were contracture and osteomyelitis. The delayed consolidation most frequently was observed with the breaks of shoulder bone.

Table 6. Distribution of injured people with the bullet break of the bones of extremities and multiple failure of vessels according to the early complications, which were being observed in the front and administrative area (in the percentages).

(1) Район эвакуации	(2) Осложнения										
	(3) шок	(4) газовая инфекция	(5) сепсис быстро текущий	(6) обильное гнойные раны	(7) гнойные затеки и флегмона	(8) гнойный артрит	(9) остеомиелит острый	(10) прочие хирургические осложнения	(11) Сопутствующие заболевания	(12) Без осложнений	(13) Всего
(14) Фронтовой	—	1,4	3,6	7,8	1,6	0,9	2,3	6,0	3,6	72,8	100,0
(15) Тыловой . .	—	0,2	0,8	3,0	2,3	0,8	2,8	6,2	4,7	79,2	100,0

Key: (1). Region of evacuation. (2). Complications. (3). shock. (4). gas infection. (5). sepsis it is rapid flowing. (6). abundant festering of wound. (7). suppurative flows and phlegmon. (8). suppurative arthritis. (9). osteomyelitis (sharp/acute. (10). other surgical complications. (11). Associated diseases. (12). Without complications. (13). In all. (14). Front. (15). Back.

Table 7. Distribution of injured people with the bullet break of the bones of extremities and multiple failure of vessels according to the late complications (in the percentages).

(1) Локализация перелома кости с повреждением сосуда	(2) Осложнения										
	(3) замедленная консолидация	(4) хронический остеомиелит	(5) контрактура	(6) остеомиелит и контрактура	(7) аневризма	(8) патологическая культя	(9) гнойно-текущий сепсис	(10) камни мочевых путей	(11) прочие осложнения	(12) без осложнений	(13) Всего
(14) Плечо	3,0	4,0	30,0	20,0	0,8	8,0	—	—	0,8	33,4	100,0
(15) Предплечье . .	1,4	4,9	40,0	26,4	0,9	4,8	0,2	0,2	0,2	21,0	100,0
(16) Бедро	0,6	2,1	8,6	11,5	2,5	25,6	1,3	0,3	1,9	45,6	100,0
(17) Голень	0,5	8,5	12,5	23,0	0,4	21,5	0,4	—	1,6	31,6	100,0
(18) В среднем . .	1,2	5,4	22,1	21,7	1,0	15,5	0,5	0,1	1,2	31,3	100,0

Key: (1). Localization of the break of bone with the damage of vessel. (2). Complications. (3). delayed consolidation. (4). chronic osteomyelitis. (5). contracture. (6). ostsomyelitis and contracture. (7). aneurism. (8). pathological stump. (9). limply current sepsis. (10). calculi/stones of urinary tracts. (11). other complications. (12). Without complications. (13). In all. (14). Shoulder. (15). Forearm. (16). Thigh. (17). Shin. (18). On the average.

The high frequency of late complications with the bullet breaks of the bones of forearm finds explanation in the structure of the complications of this group whose large part occupied contracture and osteomyelitis. Late complications, naturally, most frequently were observed on those segments of the extremities which most of all were retained after injury (forearm) and, on the contrary, most rarely they were encountered on those segments which more frequently underwent amputation (shoulder, thigh, shin).

The formed aneurisms within the time of treatment in the hospitals were observed in 1.0o/o of all injured with the break bones and by multiple failure of vessels, including injured people with the incomplete break. If we from this group exclude dead persons and injured people, who were undergoing amputation, then the percentage of frequency aneurism will be increased to 2, in this case on the separate localizations of the injuries of extremities was noted the considerable difference: then, injury into the shoulder was accompanied by development aneurisms into 2.1o/o, in the forearm - into 1.1o/o, into the thigh - into 9.0o/o and into the shin - into

0.7o/o.

Comparing represented data of the deepened development of the histories of disease/sickness/illness/malady with some authors' data about the frequency aneurism during the damage of vessels generally (21.6o/o, according to M. N. Akhutin; 22.6o/o, according to A. F. Zlatman), it is easy to here ascertain that with the combined injuries this complication was observed very rarely.

With the representation about ischemia of tissues after the damage of large vessels is connected the assumption about the delayed formation of the callus with such injuries.

Table 8 depicts the average periods of the formation of durable callus with the combined injuries in their comparison with the same periods with the bullet breaks without the damage of vessels.

Comparing both series/numbers of numerals, it is easy to discover the difference within the periods of consolidation (from 0.1 to 0.5 months) in all localizations of the break of the bones of extremities in the sense of the elongation of periods with the combined injuries.

At the extremital levels (forearm, shin), furthermore, was noted

the considerable difference in a number of nonaccretions of bone; so, with the breaks of the bones of forearm, which were being accompanied by damage of vessels, a number of nonaccretions of bone was almost 4 times more (12.7o/o), than without the damage of vessels (3.4o/o), and with the breaks of the bones of shin, which were being accompanied by the damage of vessels, almost 3 times more (6.1o/o), than without the damage of vessels (2.3o/o) (see also pg. 373).

Table 8. Average periods of the formation of the callus (in the months) with the bullet breaks of the bones of extremities.

(2) Группа раненых	(1) Локализация перелома							
	(3) плечевая кость	(4) лучевая кость	(5) локтевая кость	(6) обе кости предплечья	(7) бедренная кость	(8) большеберцовая кость	(9) малоберцовая кость	(10) обе кости голени
(11) С повреждением сосуда	2,4	2,2	2,0	2,7	3,6	2,9	2,6	3,4
(12) Без повреждений сосуда	2,3	1,7	1,8	2,3	3,1	2,6	2,2	3,2

Key: (1). Localization of break. (2). Group of injured people. (3). shoulder bone. (4). radial bone. (5). ulna. (6). both bones of forearm. (7). femoral bone. (8). tibia. (9). fibular bone. (10). both bones of shin. (11). With damage of vessel. (12). Without damage of vessel.

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For the proper estimation of the obtained facts one must take into account that in injured people with the damage of vessels was observed more than the crushed breaks, in particular with the breaks of the bones of forearm and shin and only to the insignificant degree with the breaks of shoulder and femoral bone.

Thus, the damage of vessels doubtlessly was manifested (although not to the sharp degree) it is unfavorable on the consolidation of

bullet breaks; besides very ischemia of tissues negative role we could play the complications of break of infection which during the damage of vessels were observed more frequently than without their damage.

One should emphasize that the combinations of the injury of bones and vessels frequently were combined with the injuries of other adjacent organs/controls and especially frequently the nerve trunks. These associated injuries frequently laid the expressed impression on the clinical picture and the course of wound process, and also to its issue. Very unfavorable proved to be the consequences of the damages of the nerves (most frequently observed with the injuries of upper extremities), which depreciated the successes reached on the treatment of wounds by the connection of paralyses and paresis, painful symptom complex, trophic disorders, contracture, etc.

Treatment.

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During the combinations of the breaks of the bones of extremities with the damage of large/coarse circulatory vessel

therapeutic methods must correspond to period and stage of rendering to medical aid, of anatomical special feature/peculiarity of damage/defeat, to threat or presence of one or the other complications.

In the company and on BMP the principal problem was the rendering of first aid, which in essence consisted in the temporary/time (transport) immobilization, the imposition of tourniquet with circulation, the use/application of possible in these stages measures for warning/prevention of shock both the blood loss and the main thing in the urgent direction of these injured people on DMP in view of the fact that these injured people needed urgent surgical intervention and that the prolonged determination of tourniquet for them was also risky.

According to the data of the deepened development of the histories of disease/sickness/illness/malady, the styptic tourniquet wounded the shoulder with the injuries in question was superimposed by 18.5o/o of injured people, in the forearm - 25.0o/o, into the thigh - 25.0o/o, into the shin - 30.0o/o, and on the average - 26.0o/o of injured people.

Even if to consider certain incompleteness of recording, then nevertheless should be drawn the conclusion that in the majority of

injured people the hemcrrhage was, apparently so/such not strong that would be required the imposition of tourniquet. This fact is explained not only by the fact that data of the deepened development of the histories of disease/sickness/illness/malady included, besides the damages of large/coarse arteries, also certain number of damages of veins, but also by the noted above special feature/peculiarity of the combined injuries, with which predominated the full/total/complete breaks of the vessels, little which bled immediately after injury.

Representation abcut the stages, in which was applied the tourniquet, gives Table 9.

Thus, during the damage of the vessels of thigh the use/application of a tourniquet was most frequently with the repeated hemorrhages (in the frcnt and back evacuation hospitals - 27.2o/o), and with another localization of injury - with the primary hemorrhages. A great number of impositions of tourniquet it was necessary on PMP.

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This fact indicates that the gaps of fine/small and partly large vessels exhibited considerable inclinatiсn to the spontaneous

cessation of hemorrhage and that therefore by many injured person by whom the imposition of tourniquet in the foremost stages was not shown, in further stages the use/application of it also did not prove to be necessary. In contrast to this during the combinations of the injuries of femoral vessels and bone heaviest injured people with the hemorrhage, apparently not at all managed to be supplied/delivered/fed into to the basic stages of care (V. L. Byalik), but in those remaining in the living ones predominated the little bleeding either "dry" wounds, or wounds with the massive intra-tissue hemorrhage. After the output/yield of these injured people from the heavy shock and the recovery of blood pressure began profuse hemorrhages, required uses/applications of a tourniquet. To the appearance of profuse hemorrhages contributed also the connection of infection.

Primary task, which is pursued by primary surgical processing/treatment during the combinations of injuries, consisted in the careful processing/treatment of wound as a whole, including bone damage.

The infection, which easily develops in the insufficiently processed wound under conditions of ischemia of tissues, was disastrous for the extremity and for the injured person. As correctly underscored N. N. Burdenko, N. A. Bogoraz, and during the Great Patriotic War S. P. Vilesov, G. M. Mints and Ye. M. Gorodetskiy,

precisely, infection, but not only insufficient influx of the blood, it served as a reason for almost all subsequent complications, including numbness of extremity.

In the process of rendering to primary surgical aid and subsequent treatment it was proper to remove the caused by severity injuries of the phenomenon of shock and blood loss, and also all other unfavorable reflector effects on the organism as a whole, going from the place damages.

During the establishment of damaging the vessel Soviet surgeons considered it their very first responsibility to produce reliable hemostasis. The observations, known still for a long time, indicated that the dressing of large vessels in the early period frequently causes the gangrene of extremity or the series/number of others the more or less expressed ischemic disorders. This impelled many surgeons to search for output/yield in the more wide application of the vascular suture the experiment/experience of use/application of which by individual surgeons in the period of the Great Patriotic War was limited, however, mainly to treatment aneurism in injured people without the break of bone in the back therapeutic institutions. It as calculated by hundreds of observations (V. L. Khenkin, T. Ye. Gnilorybov, V. T. Radushkevich, B. V. Petrovskiy, I. K. Piniya et al.).

Table 9. The distribution of injured people with the bullet break of the bones of extremities and multiple failure of vessels in the stages of evacuations, in which was applied the tourniquet (in the percentages).

(2) Локализация перелома кости с повреждением сосудов	(1) Этапы эвакуации									
	(3) рота	ВМП	ПМП	ДМП	ППГ	(4) армейский ЭГ	(5) фронтовой ЭГ	(6) в пути	(7) не установлены	(8) Всего
(9) Плечо	11,4	5,7	40,0	8,6	2,9	5,7	14,3	—	11,4	100,0
(10) Предплечье	10,6	2,1	27,7	10,6	—	6,4	19,2	8,5	14,9	100,0
(11) Бедро	9,1	9,1	12,1	3,0	15,2	6,1	27,2	9,1	9,1	100,0
(12) Голень	19,9	7,1	28,6	7,1	7,1	3,2	7,1	1,6	18,3	100,0

Key: (1). Stages of evacuation. (2). Localization of break of bone with damage of vessels. (3). company. (4). army. (5). front and back. (6). in way. (7). not established. (8). In all. (9). Shoulder. (10). Forearm. (11). Thigh. (12). Shin.

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The results, obtained by these authors, should be recognized good ones. Many surgeons, without being the fundamental supporters of vascular suture, nevertheless applied this method in the separate injured people (N. N. Burdenko, N. N. Yelanskiy, I. G. Turovets, N. A. Derzhavets, N. N. Shalagin, Kh. A. Petrosyan et al.).

The majority of the surgeons of the foremost stages (DMP, PPG of

the first line), which published their observations on the damages of vessels, laid vascular suture extremely rarely, preferring the simpler, more rapid and more reliable in the sense of hemostasis dressing of vessels (V. I. Parmenov, N. V. Tikhomirov and Ye. M. Zimogorskaya, T. V. Putilin, I. Kh. Khomenko, V. K. Bayev, N. P. Shastin, S. A. Rusanov, A. M. Geselevich, S. M. Kurbangaleyev, A. M. Glazman et al.).

B. G. Gertsberg and L. M. Batner in the back hospitals with the observance of the known procedure, which includes the "exercise" of collaterals and other methods of prophylaxis and treatment of ischemia and wound infection, achieved the brilliant results during the use/application of a vascular suture, after removing thus the need for the amputation of extremity in all, which were being found under their observation of injured people (mainly with the injuries without the break of bone).

Some disadvantages of the use/application of a vascular suture and contraindication to its use/application especially came forward with the simultaneous injuries of bone and vessels, with which most frequently were observed the extensive and contaminated wounds, the considerable defects of vascular wall with the distant disagreement of the torn ends, the difficulty of immobilization after operation/process. As a result of these special

features/peculiarities of the combined injuries even similar the outstanding specialist in vascular suture as N. A. Bogoraz, in the period of the first world war extremely rarely found with them readings to the imposition of vascular suture; in the period of the Great Patriotic War S. P. Vel'yamovskiy laid ligature in the place of injury or for the elongation/extent, and B. V. Petrovskiy, in view of the frequent infection of hematoma with these injuries, preferred the wide autopsy of hematoma and the ligature of vessel.

In the materials of the deepened development were encountered the indications of the use/application of a vascular suture during the primary surgical treatment in a few injured people. After the exception/elimination of those amputated during the primary surgical treatment the imposition of vascular suture is noted in 0.3o/o of injured people with the break of the bones of upper extremity and in 0.1o/o - lower extremity. After the cross-linking of vessel on the upper extremity in all injured people was obtained favorable result, and on the lower - it was necessary to resort to the amputation. S. A. Rusanov on the basis of large personal experiment/experience in the treatment of the bullet damages of vessels considers the most reliable substance of hemostasis dressing of both ends of the damaged artery in the wound. The best results, in his opinion, they are obtained from the operations/processes within the earliest possible periods, before the appearance of urgent readings - hemorrhage, large

hematoma and especially to the rapid development of wound infection.

They developed the special procedure of operation/process during the bullet damages of large vessels. It operated, putting to use for the access to the vessel the not available wound, on the typical by the section/cut, according to the rules of operational surgery, which provides the minimum trauma of muscular collaterals and great convenience for the revision of vessel and manipulations on it.

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Prophylaxis of post-operation spasm was realized by resection of the damaged section of vessel with dressing of both ends and with the blockade of central stump by the circular dissection of adventitia at a distance of one centimeter from the ligature. By this reaches the interruption of centrifugal and centripetal vasomotor impulses/momenta/pulses and is prevented angiospasm.

Thus, and with the simultaneous injuries of vessels and bones of extremities the ligature of vessels was in the period of the Great Patriotic War the most widely used method of hemostasis, if we do not consider primary amputation, which proved to be necessary in many injured people with this injury.

Amputation during the primary surgical treatment was shown with the heavy breaking up of bones and crushing of extremities with multiple failure of the neurovascular beam; with such injuries to try to preserve extremity and draw back off the amputation should not. With the lighter injuries undoubtedly were permitted attempts at the retention/preservation/maintaining extremity via the dressing of the central and peripheral end of the damaged artery with the necessary dissection, and it is still better with the carving of the damaged cut of artery for the elongation/extent 3-4 cm (R. Lerish, V. N. Shamov) and the solid surgical treatment of wound and place of the break of bone, which is confirmed by Table 10, the comprised based on materials deepened development of the histories of disease/sickness/illness/malady.

From Table 10 it is evident that with the bullet breaks of the bones of the extremities, combined with the damage of vessels, the amputation (and exarticulation) during the primary treatment is carried out in 41.9o/o of all injured people. Most frequently (almost in the half injured people) amputation and exarticulation they were conducted with the injuries of shoulder and shin, almost in one third of those wounded in the forearm in almost in quarter of those wounded the thigh.

Table 10. Distribution of injured people with the bullet break of the bones of extresities and multiple failure of vessels and injured people without multiple failure of vessels according to the means of interventions during the primary surgical treatment (in the percentages).

(2) Локализация переломов с повреждением и переломы без повреждения сосудов	(1) Характер первичной хирургической обработки						
	(3) рассечение и иссечение с перевязкой сосуда			(7) ампутация	(8) прочие (без перевязки сосудов)	(9) обработки не было	(10) Всего
	(4) в ране	(5) на протяжении	(6) с удалением инородных тел, костных осколков и прочими вмешательствами				
(11) Плечо	12,8	0,2	3,7	49,5	22,9	10,9	100,0
(12) Предплечье	31,5	0,1	4,1	32,0	20,7	11,6	100,0
(13) Бедро	14,4	0,2	4,6	23,5	40,9	16,4	100,0
(14) Голень	17,0	0,2	5,8	48,5	22,6	5,9	100,0
(15) В среднем	19,3	0,2	4,7	41,9	24,8	9,1	100,0
(16) Переломы без одновременного повреждения сосудов	—	—	—	1,7	63,5	34,8	100,0

Key: (1). Character/nature of primary surgical treatment. (2). Localization of breaks with damage and breaks without damage of vessels. (3). dissection and carving with dressing of vessel. (4). in wound. (5). for elongation/extent. (6). with removal/distance of foreign bodies, bone fragments and other interventions. (7). amputation. (8). other (without dressing of vessels). (9). treatment it was not. (10). In all. (11). Shoulder. (12). Forearm. (13). Thigh. (14). Shin. (15). On the average. (16). Breaks without multiple

failure of vessels.

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Comparison with the breaks without multiple failure of vessels indicates the value of the latter as the seriously burdening factor, which dictated the need of applying more complex surgical interventions.

The dressing of vessels in the wound and for the elongation/extent was produced in 24.2o/o of injured people. Only on the forearm it was conducted more frequently and composed 35.7o/o, on the thigh it descended to 23.2o/o, and on the shoulder - to 16.7o/o.

According to the observations of S. A. Rusanov, the dressing of artery for the elongation/extent gave the relapse of hemorrhage in 58.0o/o of injured people, and dressing in the wound only of the central end of the artery - in 33.0o/o. In this case recurring hemorrhages were especially frequent when these operations/processes were accompanied by the dressing of similar/analogous vein according to V. A. Oppel'.

However, dressing in wound of both ends of the artery provided the final cessation of hemorrhage in 98.6o/o of injured people.

The injured people, in whom during the primary treatment is produced the dressing of vessels or amputation, compose that group (66.1o/o), in which to and during the rendering to primary surgical aid was identified the essence of damage and was shown/rendered most rational aid.

The part of the injured people (9.1o/o) was left without the primary surgical treatment. This number almost is 4 times lower than the number of injured people, who were not being treated, without multiple failure of vessels, which indicates the smaller possibility when the damage of vessels is present, to manage without surgical intervention.

From represented data it is evident that in 33.9o/o of injured people the damages of vessels were looked over, which was the reason for many complications, described earlier (see clinic).

These complications required supplementary surgical interventions which more frequently were conducted in the subsequent stages.

In the presence of fluctuating hematomas as occasion for

intervention served secondary hemorrhages, build-up/growth or infection of hematomas. "Mature" hematomas, which do not threaten with complications, were usually operated in the back hospitals already in the stage aneurisms, with exception the aneurism of the fine/small vessels which could be operated earlier.

With the secondary hemorrhages without the presence of heavy infection surgeon's problem was the dressing of vessel and the removal of injured person from the state of anemia. The heavily infected wounds, and also the hemorrhages, which recurred, in spite of the dressing of vessel, for the rescuing of the life of injured person they required the timely amputation, readings to which with the simultaneous break of bone, naturally, were placed much more widely than in the absence of the same.

The typical complications of wounds (phlegmon, flows, osteomyelitis, arthritis), ischemic and gas gangrene, late complications and consequences of injuries (unhealing wound, contracture, pathological cultures), consequence of the damages of nerves served as occasion for the operation/process from the usual readings.

Table 11 gives comparative information about the principal operations/processes, produced in injured people with the bullet

break and the damage of vessels and in injured people without the damage of vessels.

Data of table show that during the damage of vessels by most frequent operations/processes they were the amputation and reamputation, in the absence whereas of the damage of vessels - revision of wound and autopsy of ulcers and sequestrectomy. Focuses attention a small number of sequestrectomies in injured people with the damage of vessels.

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This corresponds to the frequency of the complications of osteomyelitis and is explained by a large number of amputations, made in the injured people of this group. If we exclude all injured people, who were undergoing amputation, then relationships/ratios are others; for example, sequestrectomy during the damage of the vessels of thigh will compose 28.4o/o, and without the damage of vessels - 24.3o/o.

Table 11. Number of principal operations/processes (besides the primary surgical treatment), produced in injured people with the bullet break of the bones of extremities and multiple failure of vessels and in injured people without multiple failure of vessels (on 100 injured people of each group).

(2) Локализация перелома	(3) Группа раненых	(1) Название операции				
		(4) ревизия ран и вскрытие гнойников	(5) перевязка сосудов	(6) ампутация	(7) реампутация	(8) секвестрэктомия
(9) Плечо	(10) С повреждением сосудов	7,4	6,5	16,6	6,0	12,7
	Без повреждения сосудов (11)	8,8	—	2,6	0,1	29,0
(12) Предплечье	С повреждением сосудов	3,9	12,6	9,2	3,2	13,4
	Без повреждения сосудов	6,3	—	1,2	—	15,5
(13) Бедро	С повреждением сосудов	9,8	12,7	38,0	19,6	9,6
	Без повреждения сосудов	16,1	—	11,7	2,8	21,4
(14) Голень	С повреждением сосудов	7,0	6,5	20,4	33,3	14,2
	Без повреждения сосудов	13,1	—	7,9	3,8	33,9
(15) В среднем	С повреждением сосудов	6,7	9,0	19,8	18,8	13,0
	Без повреждения сосудов	10,5	—	5,4	1,6	24,0

Key: (1). Name of operation/process. (2). Localization of break. (3). Group of injured people. (4). revision of wounds and autopsy of ulcers. (5). dressing of vessels. (6). amputation. (7). reamputation. (8). sequestrectomy. (9). Shoulder. (10). Damage of vessels. (11). Without damage of vessels. (12). Forearm. (13). Thigh. (14). Shin. (15). On the average.

Table 12. Distribution of injured people with the bullet break of the

bones of extremities and multiple failure of vessels according to the character/nature of the operations/processes, produced in the army and army region (in the percentages).

(2) Локализация перелома и повреждения сосудов	(1) Характер операции									(12) Операций не было	(13) Всего
	(3) ревизия раны	(4) удаление костных осколков и инородных тел	(5) обработка фрагментов кости	(6) вскрытие гнойных затеков и флегмон	(7) перевязка сосудов	(8) ампутация или экзартикуляция	(9) реампутация	(10) секвестрэктомия	(11) прочие операции		
(14) Плечо . . .	2,5	0,8	0,4	2,7	7,2	27,0	—	0,4	1,2	57,8	100,0
(15) Предплечье	0,4	1,1	0,4	2,1	8,4	8,5	0,2	—	0,6	78,3	100,0
(16) Бедро . . .	4,1	2,2	1,2	3,5	8,0	30,0	0,3	0,6	0,9	49,2	100,0
(17) Голень . . .	2,5	0,9	0,5	2,0	8,0	30,2	0,1	—	0,2	55,6	100,0

Key: (1). Character/nature of operation/process. (2). Localization of break and damage of vessels. (3). revision of wound. (4). removal/distance of bone fragments and foreign bodies. (5). treatment of fragments of bone. (6). autopsy of suppurative flows and phlegmons. (7). dressing of vassels. (8). amputation or exarticulation. (9). reamputatien. (10). sequestrectomy. (11). other operations/processes. (12). Operations/processes it was not. (13). In all. (14). Shoulder. (15). Forearm. (16). Thigh. (17). Shin.

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Surgical treatment in the army and army region (eliminating primary surgical treatment) was prcduced with the bullet breaks of shoulder with the damage of vessels in 42.2o/o of injured people,

with the breaks of the bones of forearm - in 21.7o/o, with the breaks of thigh - in 50.8o/o and with the breaks of the bones of shin - in 44.4o/o of injured people. Means of surgical intervention are represented in Table 12.

As can be seen from Table 12, most frequent operation/process in the army and army region was amputation, which corresponds to the frequency of complications in this region by gas infection, sepsis, by hemorrhage. The second in the frequency was the dressing of vessels apropos of secondary hemorrhages and the third - revision of wound, it is more frequent on the same occasion. Not greatly frequently were not undertaken the autopsy of suppurative flows and phlegmons, the removal/distance of bone fragments and foreign bodies, but it is entirely rare - sequestrectomy, reamputation, etc.

In the front region the lack in the surgical treatment noticeably decreased mainly due to the decrease of a number of amputations, reworking of wounds and dressing of the vessels which nevertheless were continued to remain most frequent surgical interventions together with sequectrectomy, a number of cases of applying which considerably grew/rose.

The relationships/ratios of the frequency of interventions on the separate segments of extremities were preserved in the previous

form/species. Thus, with the breaks of shoulder it is operated by 22.0o/o, the bones of forearm - 19.5o/o, thighs - 27.6o/o and the bones of shin - 22.6o/o of injured people.

In the deep rear with the same relationships/ratios a quantity of surgical interventions again grew on: with the injuries of shoulder it is operated by 22.7o/o, forearms - 28.8o/o, thighs - 35.3o/o and shins - 44.6o/o of injured people. The distribution of surgical interventions already carried another character/nature: in the first place with the breaks of shoulder and bones of forearm stand sequestrectomy, and with the breaks of thigh and bones of shin - reamputation of faulty stumps. Amputations were done considerably thinner/less frequent, with exception of the amputations of shin, just as the dressing of vessels. Then considerably more frequently were conducted sequestrectonies and other operations/processes with number of which were connected the operations/processes apropos of the consequences of the damages of vessels (aneurism) and apropos of the damages of nerves, the imposition of secondary sutures with the long not healing wounds and the ulcers, reducing operations/processes on the supporting-motor apparatus, etc. (Table 14).

Table 13. Distribution of injured people with the bullet break of the bones of extremities and multiple failure of vessels according to the character/nature of the cperaticns/processes, produced in the front region (in the percentages).

(2) Локализация перелома и повреждения сосудов	(1) Характер операции										(12)	
	(3) ревизия раны	(4) удаление костных осколков и инородных тел	(5) обработка фрагментов кости	(6) вскрытие гнойных затеков и флегмон	(7) перевязка сосудов	(8) ампутация или экзартикуляция	(9) реампутация	(10) секвестрэктомия	(11) прочие операции	Операций не было	(13) Всего
(14) Плечо . . .	0,8	0,8	1,7	3,0	4,9	5,0	—	5,4	0,4	78,0	100,0
(15) Предплечье	0,2	0,4	1,4	1,4	7,2	3,6	0,2	3,7	1,4	80,5	100,0
(16) Бедро . . .	0,3	0,3	0,9	2,5	5,7	15,3	—	1,7	0,9	72,4	100,0
(17) Голень . . .	0,3	0,5	1,1	2,7	3,7	7,7	0,8	4,7	1,1	77,4	100,0

Key: (1). Character/nature of operation/process. (2). Localization of break and damage of vessels. (3). revision of wound. (4). removal/distance of bone fragments and foreign bodies. (5). treatment of fragments of bone. (6). autopsy of suppurative flows and phlegmons. (7). bandaging of vessels. (8). amputation or exarticulation. (9). reamputaticn. (10). sequestrectomy. (11). other operations/processes. (12). Operations/processes it was not. (13). In all. (14). Shoulder. (15). Forearm. (16). Thigh. (17). Shin.

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As a result in 90.9o/o of injured people with the combined injury of bone and vessel was produced primary surgical treatment,

and in 61.7o/o of injured people, furthermore, were conducted other operations/processes. In the absence of the damage of large vessel primary surgical treatment was performed in 65.2o/o, and supplementary operations/processes - in 45.6o/o of injured people.

Thus, during the damage of vessels a large number of injured people needed operational aid both primary, and repeated.

Resultant data on the amputations are represented in Tables 15 and 16.

Thus, in 61.4o/o of injured people with the bullet break and multiple failure of vessels was produced amputation, of them in 41.9o/o during the primary surgical treatment. In the absence of the damage of the vessels of amputations it was made almost 10 times less (6.7o/o), moreover during the primary surgical treatment 4 times less than in another time.

Table 14. Distribution of injured people with the bullet break of the bones of extremities and multiple failure of vessels according to the character/nature of the operations/processes, produced in the administrative area (in the percentages).

(2) Локализация перелома и повреждения сосудов	(1) Характер операции										
	(3) ревизия раны	(4) удаление костных осколков и инородных тел	(5) обработка фрагментов кости	(6) вскрытие гнойных затеков и флегмон	(7) перевязка сосудов	(8) ампутация или экзартикуляция	(9) реампутация	(10) секвестрэктомия	(11) прочие операции	(12) Операция не производились	(13) Всего
(14) Плечо . . .	—	0,4	0,4	0,4	0,4	0,8	1,6	14,0	4,7	77,3	100,0
(15) Предплечье	0,2	1,4	0,2	0,9	2,0	1,1	0,4	15,1	7,5	71,2	100,0
(16) Бедро . . .	0,6	—	—	0,9	2,0	4,1	11,8	9,5	6,4	64,7	100,0
(17) Голень . . .	0,3	0,3	1,4	0,5	1,8	14,0	17,5	8,8	—	55,4	100,0

Key: (1). Character/nature of operation/process. (2). Localization of break and damage of vessels. (3). revision of wound. (4). removal/distance of bone fragments and homogeneous bodies. (5). treatment of fragments cf bone. (6). autopsy of suppurative flows and phlegmons. (7). dressing of vessels. (8). amputation or exarticulation. (9). reamputation. (10). sequestrectomy. (11). other operations/processes. (12). Operations/processes were not conducted. (13). In all. (14). Shoulder. (15). Forearm. (16). Thigh. (17). Shin.

Table 15. Frequency of the amputations, produced in injured people with the bullet break of the bones of extremities and multiple failure of vessels, and also in injured people without the damage of

vessels (in the percentages).

(1) Время производства ампутации	(2) Группа раненых	(3) Локализация перелома				(4) В среднем
		(5) плечо	(6) предплечье	(7) бедро	(8) голень	
(9) Во время первичной хирургической обработки	(10) С повреждением сосудов	49,5	32,0	23,5	48,5	41,9
	Без повреждения сосудов (11)	1,3	0,5	1,6	2,6	1,4
(12) В другое время	С повреждением сосудов	16,6	9,2	38,0	20,3	19,5
	Без повреждения сосудов	2,6	1,2	11,7	7,7	5,3
(13) Всего...	С повреждением сосудов	66,1	41,2	61,5	68,8	61,4
	Без повреждения сосудов	3,9	1,7	13,3	10,3	6,7

Key: (1). Time of the production of amputation. (2). Group of injured people. (3). Localization of break. (4). On the average. (5). shoulder. (6). forearm. (7). thigh. (8). shin. (9). During primary surgical treatment. (10). With damage of vessels. (11). Without damage of vessels. (12). In another time. (13). In all.

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The high frequency of amputations during the primary surgical treatment on the shoulder and on the shin in comparison with the thigh finds explanation, apparently in the fact that the heaviest combined injuries of shoulder and the shins, which require immediate amputation, more frequently reached the stages of therapeutic care, than this occurred in the relation to the corresponding injuries of thigh.

The treatment of the combined injuries of bones and vessels was reduced not only to the rendering to timely and rational operational aid, but also to the safeguard of the thoroughly thought-out subsequent treatment taking into account the concrete special features/peculiarities of post-operation period. Soviet surgeons not without reason attached the extremely important value of rational immobilization with these injuries. The overall diagram of this immobilization consisted in the fastest replacement of transport splints during the next days after injury by the gypsum cast which subsequently - after working of vessel and on termination of the danger of gas and ischemic gangrene - was changed by circular (anechoic) gypsum bandage. It proved to be inexpedient too early use/application of an anechoic bandage due to connected with this risk of appearance under this bandage of risky secondary hemorrhages and survey of anaerobic and heavy suppurative infection as well as its an too later imposition, and also excessive duration of motionless fixation.

B. V. Petrovskiy considers error the use/application of a circular gypsum bandage with the combined injuries immediately after operation/process on the vessel, since in this case are squeezed collaterals and is disturbed the circulation of the blood. Prolonged

fixation, impeding the use/application of functional and physical therapy treatment, often led to irreversible contractures and difficulty of movement in the jcints of extremities and in the fingers.

Although gypsum fixation was applied not by all injured person, subject to primary amputation however from year to year it is possible to establish/install expansion and perfection of immobilization. Thus, the study of the methods of the treatment of the combined injuries of shoulder over the years showed that in last 2 years to the overwhelming majority of injured people with the combined damage was laid the circular discharge gypsum bandage and besides within the earlier periods than before, namely in 1944 and 1945 by almost all injured person it was laid in the first 2 weeks, whereas in 1943 more than in the half injured people this fixation was conducted later than the period indicated. Analogous data are noted also with the injuries of forearm and other injuries.

The special features/peculiarities of immobilization technique on the separate segments are presented in the appropriate sections.

Table 16. The distribution of secondary amputations (production of which did not coincide with the primary surgical processing/treatment), by the regions of the evacuation where they were produced in injured people with the bullet break of the bones of extremities and multiple failure of vessels and without the damage of vessels (in the percentages).

(1) Группа раненых	(2) Район эвакуации			(3) Всего
	(4) армейский	(5) фронтовой	(6) тыловой	
(7) С повреждением сосудов	70,8	23,3	5,9	100,0
Без повреждения сосудов . . . . (8)	59,4	31,4	9,2	100,0

Key: (1). Group of injured people. (2). Region of evacuation. (3). In all. (4). army. (5). front. (6). back. (7). With damage of vessels. (8). Without damage of vessels.

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The colossal value of the transfusion of blood, plasma and blood-substituting fluids/liquids with the breaks, complicated by the damage of vessels, cannot be overestimated. The fast elimination of the phenomena of shock and the anemias, and also the recovery of blood pressure, which is the necessary prerequisite/premise for developing/scanning the collaterals, were not thought without the blood transfusions which were applied once and repeatedly, sometimes

at the massive doses (I. G. Turovets, M. P. Nikotin, Ya. B. Ryvlin, I. I. Bulynin et al.).

To what degree the blood transfusion with the bullet breaks of the bones of the extremities, which were being accompanied by the damage of vessels, was conducted more frequently than with the breaks without the damage of vessels, it is possible to see from following Tables (17 and 18), comprised according to the data of the deepened development of the histories of disease/sickness/illness/malady.

Thus, during the damage of vessels, which accompanied the bullet breaks of the bones of extremities, was need in the blood transfusion on the average almost 3 times more frequently than in the absence of the damage of vessels.

With the breaks of the bones of forearm the transfusion was conducted in the greatest quantity of cases (it is more than 4 times), while with the breaks of thigh - in the smallest (about 2 times). This fact is explained by the fact that such complications, with which most frequently was transfused the blood (shock, gas infection and sepsis), in the group of injured people without the damage of vessels were encountered with gun breaks of thigh, bones of shin and shoulder considerably more frequently than with the breaks of the bones of forearm; therefore exsanguination as the reason for

complications and reading in the blood transfusion is most is convexly represented on the breaks of the bones of forearm.

An average number of transfusions of blood and injured people with the damage of vessels was somewhat more than in injured people without the damage of vessels (Table 18).

Table 17. Frequency of the blood transfusion with the bullet breaks of the bones of extremities with multiple failure of vessels and without their damage, including injured people, who were subjected to amputation during the primary surgical processing/treatment (in the percentages).

(2) Группа раненых	(1) Локализация перелома				(7) В среднем
	(3) плечо	(4) пред-плечье	(5) бедро	(6) голень	
(8) С повреждением сосудов	55,2	28,8	81,7	63,8	56,5
(9) Без повреждения сосудов	19,5	6,8	43,3	23,7	20,0

Key: (1). Localization of break. (2). Group of injured people. (3). shoulder. (4). forearm. (5). thigh. (6). shin. (7). On the average. (8). With damage of vessels. (9). Without damage of vessels.

Table 18. An average number of transfusions of blood (to one injured person to whom is made the blood transfusion) with the bullet break of the bones of extremities and multiple failure of vessels and with the break without the damage of vessels.

(2) Группа раненых	(1) Локализация перелома				(7) В среднем
	(3) плечо	(4) пред-плечье	(5) бедро	(6) голень	
(8) С повреждением сосудов	2,3	1,7	3,0	2,3	2,4
(9) Без повреждения сосудов	1,8	1,6	2,7	2,1	2,2

Key: (1). Localization of break. (2). Group of injured people. (3). shoulder. (4). forearm. (5). thigh. (6). shin. (7). On the average. (8). With damage of vessels. (9). Without damage of vessels.

The repeated blood transfusions usually were conducted not apropos of blood loss, but due to the complications of wounds of infection. As is known, complications infection it was more during the damage of vessels; it is alsc known that the course of these complications was especially unfavorable and it was frequently finished with early amputation. By this is explained only the insignificant preponderance of a number of repeated transfusions during the damage of vessels.

The blood transfusion was conducted in all stages of evacuation both when the damage of vessels is present and without it; however the distribution of injured people in both these groups in the stages, in which was transfused the blood, it was not the same (Table 19).

As can be seen from Table 19, with the breaks of bones with multiple failure of vessels the most blood transfusions was on army wound (27.4o/o), but with the breaks, which were not being accompanied by the damage of vessels, the most blood transfusions fell to back evacuation hospitals (28.2o/o).

However, not by all injured person with the damage of large

vessels most blood transfusions was made on DMP, since sometimes the recognition of the damage of vessels retarded. The subjected amputations during the primary surgical processing/treatment apropos of bullet break with multiple failure of large vessels, naturally, needed the earlier transfusion of blood (Table 20).

As already mentioned, among the injured people, who were subjected to amputation during the primary surgical processing/treatment, complications shock it was 2 1/2 times more than in other injured people.

Table 19. The distribution of injured people with the bullet break of the bones of extremities in the stages of evacuations in which by it was transfused the blocd (in the percentages).

(2) Группа раненых	(1) Этап эвакуации					(8) Итого
	(3) ПМП и ДМП	(4) ППГ и армейский ЭГ	(5) фронтовой ЭГ	(6) тыловой ЭГ	(7) несколько этапов	
(9) С повреждением сосудов	27,4	24,6	10,4	8,4	29,2	100,0
Без повреждения сосудов (10)	9,5	21,8	18,6	28,2	21,9	100,0

Key: (1). Stage of evacuation. (2). Group of injured people. (3). PMP and DMP. (4). PPG and army EG. (5). Front EG. (6). back EG. (7). several stages. (8). Altogether. (9). With damage of vessels. (10). Without damage of vessels.

Table 20. The distribution of injured people with the bullet break of the bones of extremities and multiple failure of vessels in the stages of evacuations, in which was transfused the blood depending on the character/nature of primary surgical processing/treatment (in the percentages).

(2) Группа раненых	(1) Этап эвакуации					(8) Итого
	(3) ПМП и ДМП	(4) ППГ и армейский ЭГ	(5) Фронтовой ЭГ	(6) тыловой ЭГ	(7) несколько этапов	
(9) Раненые, подвергшиеся ампутации при первичной (10) хирургической обработке	38,5	18,1	8,0	6,1	29,3	100,0
Прочие раненые.	18,0	30,0	12,2	8,2	31,6	100,0

Key: (1). Stage of evacuation. (2). Group of injured people. (3). PMP and DMP. (4). PPG and army EG. (5). Front EG. (6). back EG. (7). several stages. (8). Altogether. (9). Injured people, who were subjected to amputation during primary surgical processing/treatment. (10). Other injured people.

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It is logical therefore that in injured people, who were subjected to amputation, most blood transfusions fell to the army region; among other injured people in comparison with the injured people, who were subjected to amputation during the primary processing/treatment, prevailed the complications of the diverse infection, which was being

developed in the army and front region when was required most blood transfusions.

It was represented by important to come to light/detect/expose in injured people with the combined injury of bone and vessel the dynamics of the use/application of a method of the blood transfusion in the course of the Great Patriotic War. During the damages of all localizations was noted with the years of war the more frequent use/application of blood transfusion, but especially vividly this came to light in injured people with the break of shoulder bone (table 21).

Data of Table 21 indicate an increase with the years of the war of the number of injured people by which was applied the blood transfusion and the introduction of blood-substitute fluids/liquids with the bullet breaks of shoulder with the damage of vessels, and also number of repeated blood transfusions in each injured person individually where the same was shown.

Besides massive single and repeated transfusions, an effective effect had the drop transfusions of blood and blood-substitute fluids/liquids; however due to certain complexity of use/application the method of the drop transfusions of wide acceptance in all stages evacuation did not obtain.

A considerable number of methods, proposed for dealing with local ischemia via the dressing of similar/analogous vein, desympathization, infusion of the conserved blood in the peripheral division of the damaged vessel, also found use as the effective measures (Ye. S. Khundadze, N. I. Machs, T. I. Gliner, I. G. Turovets and Ye. K. Mikhnovskaya, L. Ya. Leyfer, B. V. Ognev et al.).

Clinical issues.

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The results of the treatment of the bullet breaks of the bones of extremities with multiple failure of blood vessels, according to the data of the deepened development of the histories of disease/sickness/illness/malady, are represented in Table 22.

Table 21. The frequency of the blood transfusions and an average number of transfusions to one injured person with the bullet breaks of shoulder with the damage of vessels during the different years of the war (those amputated during the primary surgical processing/treatment in the table are not given).

(1) Год	(2) Процент раненых, получивших переливание крови	(3) Среднее число переливаний на одного раненого, получившего переливание	(4) Среднее число переливаний на одного раненого всей группы
1941	14,3	1,5	0,2
1942	47,9	2,0	0,9
1943	55,0	2,4	1,3
1944	63,0	2,9	1,8
1945	58,3	2,4	1,4
(5) В среднем	53,6	2,3	1,3

Key: (1). Year. (2). Percentage of injured people, who obtained blood transfusion. (3). Average number of transfusions to one injured person, who obtained transfusion. (4). Average number of transfusions to one of injured entire group. (5). On the average.

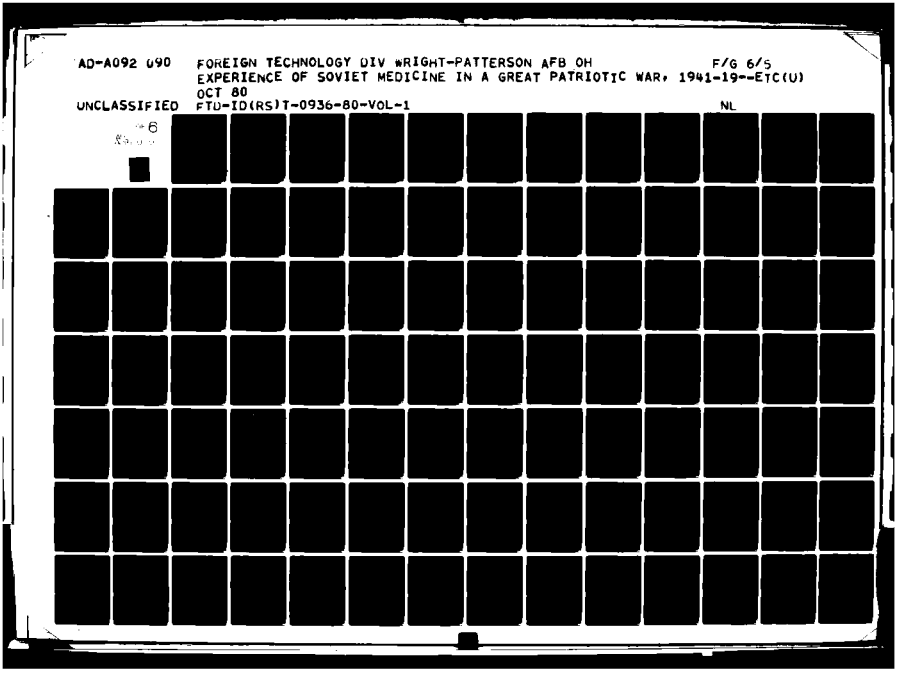
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From represented in Table 22 data it is evident that the complication of the bullet breaks of the bones of extremities of the damage of vessels was very heavy and it always gave the worse clinical issues; indicators on lethality and loss of extremity on the average proved to be 2.8-11 times higher in comparison with the indicators of relatively injured, faultlessta of vessels.

On the contrary, a good issue was observed into 2 and the more of times thinner/less frequent than in the absence of the damage of vessel.

S. A. Rusanov's data show that early operations/processes with the disconnection of main line it became in general/common/total 12.6o/o of complications of gangrene. But in injured people, operated within the early periods, but in the absence of special readings (hemorrhage, growing on hematoma with the disturbance/breakdown of the nourishment of extremity, heavy infection), the gangrene began into 4.7o/o, and in the absence of the break of bone - into 2.1o/o.

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Thus, operations/processes early, but produced in the "planned order", in the absence of vital readings, give results not worse, than to operation/process in the stage aneurisms.

It is necessary, however, to have in mind that in cases when collateral blood circulation on the operating table proved to be clearly insufficient, the dressing of vein according to V. A. Oppel' according to S. A. Rusanov's data avoided the development of gangrene only in 26.0o/o of injured people.

On the separate segments the issues and the consequences of injuries presented considerable oscillations/vibrations. The heaviest consequences of the combined injuries upon consideration of the loss of extremity and lethality were determined with the injuries of shoulder and forearm, then with the injuries of shin; the most favorable outcome of the distance of the injury of thigh. The best functional and anatomical issue gave the breaks of thigh with the damage of vessels.

Table 22. The principal issues with the bullet breaks of the bones of extremities with multiple failure of vessels and with the breaks without the damage of the vessels (issues during the damage of vessels are conditionally accepted as 10.0).

Локализация перелома (1)	Группа раненых (2)	Исход (3)		
		хороший в анатомическом и функциональном отношении (4)	конечность ампутирована (5)	умерло (6)
Плечо (7)	С повреждением сосудов (8)	10,0	10,0	10,0
	Без повреждения сосудов	21,3	0,5	2,6
Предплечье (9)	С повреждением сосудов (8)	10,0	10,0	10,0
	Без повреждения сосудов	29,0	0,3	3,0
Бедро (10)	С повреждением сосудов (8)	10,0	10,0	10,0
	Без повреждения сосудов	10,9	1,5	4,1
Голень (11)	С повреждением сосудов (8)	10,0	10,0	10,0
	Без повреждения сосудов	22,8	1,4	3,3
В среднем (12)	С повреждением сосудов (8)	10,0	10,0	10,0
	Без повреждения сосудов	22,7	0,9	3,6

Key: (1). Localization of break. (2). Group of injured people. (3). Issue. (4). good in anatomical and functional sense. (5). extremity is amputated. (6). it died. (7). Shoulder. (8). With damage of vessels. Without the damage of vessels. (9). Forearm. (10). Thigh. (11). Shin. (12). On the average.

Those obtained in the course of the great Soviet of achievement in the treatment of the bullet breaks, combined with the damage of vessels, to the greatest degree came to light in injured people with the break of the bones of forearm (Table 23), into it is somewhat smaller degree the injured people have with the break of shoulder and bones of shin and to the smallest degree with the breaks of thigh.

During the war with the breaks of the bones of forearm continuously was decreased a number of secondary hemorrhages, ischemic gangrenes and complications of gas infection, which is explained by a continuous increase in the number of dressings of vessels during the primary surgical processing/treatment; in accordance with the decrease of a number of complications invariably/unchangedly were improved clinical issues.

Table 23. Character/nature of primary surgical processing/treatment, complication and issues in injured people with the bullet break of the bones of forearm and the damage of vessels during the different years of war (in the percentages). (Amputations, produced during the primary surgical processing/treatment, into the table they did not enter).

Годы (1)	Первичная хирургическая обработка (2)		Осложнение (3)					Исход (4)		
	с перевязкой сосуда (5)	без перевязки сосуда и без обработки (6)	ишемическая гангрена (7)	вторичное кровотечение (8)	газовая инфекция (9)	сепсис (10)	другие и без осложнений (11)	конечность сохранена (12)	конечность ампутирована (13)	умерло (14)
1941 и 1942 (15)	45,2	54,8	11,6	24,8	6,8	—	56,8	79,0	18,7	2,3
1943	52,4	47,6	7,9	22,7	5,9	0,9	62,6	85,2	12,8	2,0
1944 и 1945 (15)	60,3	39,7	2,4	21,3	2,9	—	73,4	91,5	7,9	0,6

Key: (1). Years. (2). Primary surgical processing/treatment. (3). Complication. (4). Issue. (5). with dressing of vessel. (6). without dressing of vessel and without processing/treatment. (7). ischemic gangrene. (8). secondary hemorrhage. (9). gas infection. (10). sepsis. (11). others and without complications. (12). extremity is preserved. (13). extremity is amputated. (14). it died. (15). and.

Damages of blood vessels with bullet breaks of shoulder bone.

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The in question in the present section damages, although they were on their issues somewhat more favorable than the breaks of thigh and bones of shin with the damage of vessels, in any way could not be considered as the light injuries, about which testify the data, given in the general/common/total part of the chapter. As the basis of the more detailed analysis of these damages were assumed the data of the materials of author's development with the utilization of materials of the deepened development of the histories of disease/sickness/illness/malady. The studied contingent of injuries consists of two groups: the first includes 100 injured people with the combined damages to the shoulder bone also of the vessels of the shoulder (amputation during the primary processing/treatment it was not produced); the second group covers 200 injured people with the amputation or the exarticulation of extremity, produced during the primary processing/treatment.

Both these groups considerably differ from each other both in the character/nature of the connected in them injuries and according to the clinical course of injuries, the frequency of complications and certain others data.

The numerical ratios between both categories of injured people

are made in the general/common/total it is frequent, where it is shown that the amputation during the primary processing/treatment was produced approximately in the half injured people with the damage to bone and vessel.

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Injuries, not required amputations during the primary processing/treatment.

Statistical survey/coverage.

Almost the half injured people, who preserved extremity with the combined injuries of shoulder (49.0o/o), had bullet injuries. The overwhelming majority of injuries proved to be through (76.0o/o); blind-end injuries composed only 6.0o/o, crushing and breaking up - 18.0o/o. 36.0o/o Of injured people had the associated injuries of other regions, sometimes multiple. These injuries frequently strongly burdened the state of injured people. As sufficiently characteristic ones for the dismantled category or injuries should be recognized the associated (combined) injuries of the chest - penetrating and nonpenetrating which are noted in 12 injured people; one of them had open pneumothorax, in two - that closed.

Even more frequently were stated/established the combined damages of nerve trunks (57.0o/o), moreover 28.0o/o of injured people had multiple failure of several nerve trunks - radial, cubital and middle - in the different combinations, in remaining - isolated/insulated damages of the nerves of brachial plexus (13.0o/o), middle nerve (9.0o/o), radial nerve (6.0o/o) and musculocutaneous nerve of shoulder (1.0o/o). It is logical that so/such to frequency the damage of basic nerve trunks could not but lay essential impression on the clinic and the issues of the damages in question.

As far as vessel is concerned damaged, then in this group they are noted, as a rule, the injury of shoulder artery. 3 Injured people only had the damage to axillary artery, in one - deep artery of shoulder and in two - radial artery. The associated damage of veins is noted only in 8.0o/o of injured people, that should be ascribed the incomplete account of the damages of this vessel.

Clinic (diagnosis).

Recognition in the first stages of the treatment (DMP, PPG of the first line) of the combined character/nature of the injuries of shoulder, just as other parts of the extremity, is most reliably characterized by the applied procedure of primary surgical

processing/treatment, since one should recognize that during the identified damage of large vessel the surgeon considered it necessary to apply one or the other intervention, which warns the repetition of risky hemorrhage.

Primary surgical processing/treatment was produced in 82.0o/o of injured people, moreover in 11.0o/o it was conducted already during the second day, and in 3.0o/o - even after two days. In 7.0o/o of injured people the period of primary processing/treatment is not shown; in 18.0o/o primary processing/treatment of wounds was not performed. Characterizing the quality of primary surgical processing/treatment, it should be noted that disproportionately high specific gravity/weight occupied insufficiently radical for the described damages interventions, which were being reduced to the simple dissection and the carving of wounds, sometimes with the removal/distance of bone fragments and processing/treatment of fragments, but without working of the damaged vessel. Such type interventions compose 41.0o/o. The surgical working of wounds with the dressing of the damaged vessel was produced in 38.0o/o of injured people, including in one with one dressing of subclavian artery for the elongation/extent.

Relative to 3.0o/o of injured people the character/nature of primary working remained unknown.

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In 62.0o/o of injured people in the foremost stages the actual character/nature of injury remained undiagnosed. It is obvious, such injuries with the independently interrupted hemorrhage were frequently masked with the associated damage to bone, the disorder of the nourishment of hand after the damage to shoulder artery began much more rarely than, for example, after the damage of the main-line vessels of thigh. Was required special attentiveness, in order under these conditions not to pass the damage to large/coarse artery in consequence of which the active revision of vessel with the least suspicion to its injury acquired very important value.

Converting/transferring to the early complications (Table 24), one should emphasize that this section of the combined injuries examine the heavy damages when there was a full/total/complete break or the breaking up of shoulder bone and the injury of main-line vessel - shoulder, axillary radial artery. The severity of injury could not but affect the frequent development of the severe early complications among which gas infection occupies in the dismantled segment the prevailing position: it is stated/established in 25.0o/o of injured people and was main reading for the production of amputation.

Table 24. Early complications and issues with the injuries of shoulder with the character/nature of primary surgical working and without it (in absolute numbers) (author's development).

Характер первичной хирургической обработки (1)	Число раненых в группе (2)	(5) Осложнения							Всего раненых с осложнениями (11)	На общего числа раненых (12)		
		вторичное кровотечение (3)	газовая инфекция (4)	ишемическая гангрена (6)	сепсис остро текущий (7)	первичный шок и кровопотеря с летальным исходом (8)	ампутация по другим показаниям (9)	аневризма (10)		конечность сохранена (13)	конечность ампутирована (14)	умерло (15)
Хирургическая обработка без перевязки сосудов (16)	44	11	10	5	1	—	4	1	32	21	21	2
Хирургическая обработка с перевязкой сосудов (17)	38	1	11	4	1	2	1	—	20	19	14	5
Без первичной хирургической обработки (18)	18	2	4	3	1	1	6	1	18	3	12	3
Всего (19)	100	14	25	12	3	3	11	2	70	43	47	10

Key: (1). Character/nature of primary surgical working. (2). Number of injured people in group. (3). secondary hemorrhage. (4). gas infection. (5). Complications. (6). ischemic gangrene. (7). sepsis sharply flowing. (8). primary shock and blood loss with lethal outcome. (9). amputation from other readings. (10). aneurism. (11). In all injured people with complications. (12). From total number of injured people. (13). extremity is preserved. (14). extremity is amputated. (15). it died. (16). Surgical working without dressing of vessels. (17). Surgical working with dressing of vessels. (18).

Without primary surgical working. (19). In all.

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In the second place among the complications on the consequences should be placed ischemic gangrene. However, in the series/number of injured people it was not the possible to conduct sharp division between the ischemic and gas gangrene, since frequently ischemic form converted/transferred into the gas form, but sometimes one form clinically was mixed with another. In two thirds of injured people ischemic gangrene began not in connection with the dressing of vessel, but after other less radical means of surgical working - dissection and carving of wounds and the like (in 6 injured people), or even without any surgical working (in 3 injured people).

The third terrible complication (secondary hemorrhage) was observed in 14 injured people, including in one in combination with the ischemic gangrene; in 4 injured people it arose repeatedly. In the majority of the injured people (8) of hemorrhage they were noted during the first 10 days after injury; in 3 - between 11 and 15 in the daytime, in 2 - on the 22nd day and in one injured person - 1 1/2 months after injury.

The measures for aid with the secondary hemorrhages in th-

majority of injured people - in 10 people - were reduced to the dressing of the bleeding vessels (twice axillary artery). In one of the remaining 4 injured people with the late hemorrhage (on 22nd day after injury and dressing of vessel) the repeated dressing of vessel was not produced, injured person recovered; in another injured person - with the hemorrhage on the eighth and 9th day after injury - the repeated dissection of wound and the searches of the damaged vessel were not crowned by success and injured person died of the blood loss; in the third injured person on the 15th day after injury was opened/discovered secondary hemorrhage; to it with the retardation (next day) was made the dressing of vessel, which, however, could not avoid lethal outcome. Finally, in 4th injured person with crushed bullet wound which was not primary processed on the 6th day they were revealed/detected the phenomenon of the humid gangrene of hand. On the 14th day arose secondary hemorrhage, which did not require, however, special interventions. After the week is produced the amputation of shoulder in upper third.

In the majority of injured people the dressing of vessels was reliable methods for prevention of further complications. Only in two injured after secondary dressing vessels is produced the amputation: in one 2 1/2 months after the dressing of axillary artery apropos of septic hemorrhages; in another - in connection with the hemorrhage, which arose on the 3rd day after injury, is initially made the

dressing of vessel, and later - amputation of extremity.

In 11 injured amputation it is produced from other readings; evidently, it was connected with the severity of injury, the septic process and the lack of vitality of extremity.

Thus, severe complications unquestionably are developed mainly in those injured people who remained without the primary surgical working, and also in injured people with the nonradical surgical working, i.e., without the dressing of vessels. If we do not consider two lethal outcomes from the primary shock and the blood loss during the day of injury, clearly not connected with the surgical working wounds and with the ligature of vessels, then lethality in this group is not more than in other groups.

After the dressing of vessels during the primary working, which decreases a number of complications in those wounded, were observed on the whole to entire group the best issues; however the complications, which arose after the dressing of vessels during the primary working, were heavier and issues by their less favorable, than in other injured people.

Twice in the group of injured people in question is noted development the aneurisms of shoulder artery. In both injured people is produced the operation/process: in one in 1 month of 12 days - carving aneurisms, in another in 2 months of 5 days - dressing of shoulder artery.

As far as complications are concerned of late period, then they were observed in 57.0o/o of injured people; most frequently was encountered osteomyelitis and limitation of motions. Sufficiently considerable percentage (15.0) were trophic ulcers and pathological stumps.

The value of the period of primary surgical working in the development of the complications of the early period came to light from following data. Of 14 injured people, whose primary working of wounds was made during the second day or later than this period, severe complications were observed in 10: in 3 gas infection, in 4 ischemic gangrene, in one gangrenes of fingers/pins, in one secondary hemorrhage (is later osteomyelitis) and in one aneurism of shoulder artery. After the primary surgical working, produced within the earlier periods, this frequency of complications it was not observed.

It is very important to compare the frequency of early complications with the means of injury (Table 25).

From Table 25 it is evident that the gas gangrene gangrene was developed predominantly after fragmentation injuries. The fatal results from the shock and the blood loss were only after fragmentation injuries.

On the whole among the wounded by fragment fatal results and the amputations it was considerably more than among those wounded bullet. On the contrary, the majority of secondary hemorrhages was observed after the bullet injuries apropos of which primary working was frequently performed less radically.

Even more impressive stressed o sound itself the course of th combined injuries of shoulder with the damage to the bones also of vessel which were designated as crushing and breaking up, but with which surgeon initially considered it possible to restrain from the amputation.

Table 25. [Table heading and key on following page; table reads left-to-right.]

Вид ранения (3)	Число раненых (4)	(1) Осложнение							Всего раненых с осложнениями (2)
		вторичное кровотечение (5)	газовая инфекция (6)	гнилостическая гангрена (7)	сепсис остро текущий (8)	первичный шок и кровопотеря с летальным исходом (9)	ампутации по другим показаниям (10)	аневризма (11)	
Пулевое (2)	49	11	4	7	2	—	5	1	30
Осколочное (2)	51	3	21	5	1	3	6	1	40
Всего. (12)	100	14	25	12	3	3	11	2	70

Из общего числа раненых (2)		
конечность сохранена (13)	конечность ампутирована (14)	умерло (15)
26	19	4
17	28	6
43	47	10

Table 25. Early complications and issues with the breaks of shoulder with the damage of vessel in connection with the means of injury (in absolute numbers) (author's development).

Key: (1). Complication. (2). From total number of injured people. (3). Means of injury. (4). Number of injured people. (5). secondary hemorrhage. (6). Gas infection. (7). ischemic gangrene. (8). Sepsis sharply flowing. (9). primary shock and blood loss with lethal outcome. (10). amputation from other readings. (11). aneurism. (12). In all. (13). extremity is preserved. (14). extremity is preserved. (15). it died. (16). Bullet. (17). Fragmentation. (18). In all.

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Such injured people there were 18; in all began terrible complications, namely: in 9 people - anaerobic infection, in 3 - ischemic gangrene, in 2 - heavy shock and blood loss, in 4 - other complications. Of 18 injured people by 3 they died; all remaining, which nevertheless produced amputation, survived. These data make it possible with a certainty to establish/install connection/communication between the severity of injury and the development of serious complications in the early period after

trauma.

Treatment.

Surgical tactics with the combined injuries of shoulder bone and vessels was characterized by the preferred use/application of the sparing methods of surgical treatment. Taking into account the large percentage of the complications of anaerobic infection, here it was to pay exceptional attention to the solid working of wound. Intervention in this case consisted in the wide disclosure/expansion and the draining of wound, careful preparation of the damaged vessel and imposition of the ligature above and below of the place of damage, and also in the dissection of the vessel between the ligatures or even carving of the damaged section.

As showed the represented analysis of data of the deepened development of the histories of disease/sickness/illness/malady, and also from the experience of the Soviet surgeons, the dressing of shoulder artery gives the incomparably smaller percentage of complications, than the dressing of the main-line vessels of thigh.

Should be noted the heavy issue of the injury of subaxillary artery in combination with the break of bone. Of 3 injured people with the damage to this artery in one began death from the

hemorrhage, in another within the late period (in 2 1/2 months) was produced secondary amputation apropos of septic hemorrhages, and only in the third the injury of subaxillary artery ended happily without the truncation of extremity after the dressing of this artery and vein on the 10th day after injury.

The appearance of the first signs of ischemic gangrene indicates the need of accepting the urgent measures for an improvement in the nourishment of extremity by the effect on sympathetic nervous system - blockade and carving of stellate ganglion, periarterial sympathectomy higher than place of the damage, sympathectomy of neck and upper thoracic sympathetic assemblies which in a number of cases gave the favorable result (Ye. S. Khundadze, I. G. Turovets and Ye. K. Mikhnovskaya, N. I. Macns, F. I. Gliner et al.). In this case is necessary production in the repeated massive and drop blood transfusions, correction of immobilization, etc.

With the failure of the measures for treatment conducted, with the phenomena of the progressive anaerobic infection, heavy sepsis, which are frequently accompanied by secondary hemorrhages, was shown the urgent amputation or exarticulation of extremity, which in the timely production gave completely favorable prognosis.

Amputation was most frequent surgical intervention. However, the

fate of extremity usually was decided during the first days after injury. From a total number of 52 amputations 32 they are produced during the first 5 days, 10 amputations are produced to the 7-15th day and the remaining 10 - within the later periods. The latest period of the production of amputation was equal to 2 1/2 of months with the sepsis with the repeated hemorrhages.

At the following place in the frequency of interventions after primary working there were the dressing of the bleeding vessel (in 14 injured people). In the series/number of injured people are produced the revision of wounds, the autopsy of suppurative flows, the removal/distance of bone scrap, foreign bodies, etc.

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Of 43 injured people, in whom was preserved the extremity, in the late period they were produced: sequestrectomy - in 11 injured people, the resection of the head of shoulder bone - in 2, the transplantation of skin and the imposition of secondary sutures - in 3. In 5 injured people are produced special operations/processes: 2 times apropos aneurisms of shoulder artery (carving aneurisms, dressing of artery), one time the resection (plastic) of shoulder artery apropos of its thrombosis, 2 times the operation/process of neurolysis.

In contrast to other localizations of injury on the shoulder greatly rarely were conducted reamputation. Evidently, this depended on the simplicity of the anatomical ratios of this segment and absence of those increased demands to the cult of shoulder which are presented to the cult of lower extremities.

A question about the immobilization during the damages of the shoulder bone also of vessel was solved considerably simpler than with the injuries of lower extremities. The transport immobilization, which was being realized in the foremost stages, as a rule, by a Cramer splint (rarely gypsum cast, mesh splint, Deasult bandage) in the subsequent stages was replaced by therapeutic immobilization by the application of full-valued gypsum dressing. Most advisable proved to be the anechoic gypsum bandage in the diverted position of extremity (corset or semi-jacket bandage), which, however, could be superimposed only on avoidance of a threat of the ischemic and gas gangrene (under normal conditions not earlier than 4-5 days after injury).

Should be again noted the steady perfection of immobilization, and also observed from year to year expansion of readings to the blood transfusion with the combined injuries of shoulder.

Among the therapeutic measures it is very important: performing all associated injuries, creation of most favorable conditions from the side of wound for early surgical intervention on the damaged nerves (neurolysis, neurorrhaphy) and warning/prevention of Rubtsovs of contractures and muscular atrophies.

Issues. [Outcomes]

In the relation to the issues of the described injuries it is necessary to again recall that the discussion deals with the group (100 cases) of the specially selected injuries, with which simultaneously there was a full/total/complete break or the breaking up of shoulder bone and the damage to the main feeding artery, that as a result of the caused complications frequently and the life of victim. In connection with this general/common/total lethality into 10.0o/o it is not possible to count too high. The reason for death they were: shock - in 3 injured people, hemorrhage - in two, anaerobic infection, in three, sepsis - in one and other diseases (wound deplation, nephroscnephritis) - in one. Lethal outcomes in the half injured people occurred within the next few days after injury; remaining lethal outcomes were observed from the eighth to the 22nd day.

From those remaining in the living 90 injured people in two is noted a good anatomical and functional result; 47 injured people are discharged with the stump. In the remaining injured people (43) are noted isolated/insulated or in the combination with each other the following complications: strain on the spot of break, consequence of the damages of nerves, contracture and limitation of motions, ankylosis, osteomyelitis.

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Injuries of shoulder with the break of bone and the damage of vessel, the required amputations during the primary surgical processing/treatment.

This group, naturally, included the heaviest contingent of injured people (Table 26), which is evident at least from the fact that 81.0/0 of all injuries composed the breakaways also crushing of extremity. Only 48.0o/o of injured people this group did not have the associated and multiple injuries. In 86.5o/o of injured people was damaged shoulder artery, while in 13.5o/o there was an injury of several vessels.

Amputation in the overwhelming majority of injured people was conducted during the first day, and in 18.5o/o - during the second day it is later. Early complications in injured people, who were undergoing amputation during the primary processing/treatment were reduced mainly to the shock and the blood loss. Anaerobic infection was observed in 7.5o/o of injured people, sepsis - in 1.5o/o, hemorrhage - in 0.5o/o and the gangrene of extremity (ischemic) - in 2.5o/o.

Besides the complications indicated, in one injured person developed arterial of aneurism, which was eliminated by the dressing of vessel in the cult.

Of the more terrible complications, connected with the associated injuries, it is necessary to note peritonitis in connection with the penetrating injury of the stomach (to injured person was simultaneously produced laparotomy/celiotomy and amputation with the happy issue) and abscess of brain as a result of the injury of head. To this injured person, who withstood during the day of injury the amputation of upper third of shoulder, on the 4th day in connection with the heavy infection of the wound of stump it is produced exarticulation in the shoulder joint. On the 13th day is made the trepanation of skull with the favorable outcome.

In many injured people were required simpler interventions for eliminating of phlegmons and suppurative flows, osteomyelitis of the stump and other less risky complications.

Reamputation in this group of injured people it is produced only into 8.0o/o; nevertheless issues proved to be sufficiently favorable, since 76.0o/o of injured people were discharged from hospital with a good stump.

Vital prognosis in the injured people of the group in question proved to be more favorable than in the preceding/previous group, in all it is stated/established by 5.5o/o of lethal outcomes. Both the reasons for death and the periods of its onset were analogous to the preceding/previous group of the injured people, in whom during the primary processing/treatment the amputation was not conducted.

Given data show that, in spite of much the heavier character/nature of injuries in the group in question, the early produced radical surgery gave more favorable outcome in the relation to survival, than in the preceding/previous group where the amputation during the primary processing/treatment was not conducted.

DAMAGES OF BLOOD VESSELS WITH THE BULLET BREAKS OF THE BONES OF FOREARM.

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The damages of the vessels of forearm present little danger f the life and for the extremity, and the issues of operations/processes with them are most favorable. B. V. Petrovski to 6 ligatures of radial and 3 ligatures of ulnar artery did not observe complications. However, this opinion completely is not justified during the combination of the damages of bones and vess of forearm, as it was shown already in the general/common/total pa

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For the more detailed study of the course of such injuries was subjected to author's development the part of the materials, plac as the basis of the deepened development.

Are studied the histories of the disease/sickness/illness/mal of 347 injured people who are distributed to the following three groups.

To the first group were referred 100 injuries, with which is

stated/established the damage only to one of the bones and one of the vessels of forearm. With the second group were connected the injured people (51), who had damage of both bones and only one of the vessels of forearm or, on the contrary, the damage only to one bone and both vessels of forearm.

Finally, the third group covered the heaviest contingent of injured people (196 people) with damage of both bones in combination with injury of both vessels of forearm. In view of the fact that clinical course and character/nature of complications with the injuries in question to the much larger degree, than on other segments, were caused by the anatomical picture of damage/defeat, and the character/nature of primary processing/treatment, besides amputation, was more uniform, the subsequent analysis of data was carried out of the groups in accordance with the anatomical complexity of injury.

Table 26. [Table heading and key on following page; table reads left-to-right.]

(1) Раненые	(2) Распределение ранений						(5) Частота ранних осложнений				
	по виду ранящего оружия (3)		(4) по характеру ранения								
	пулевое (7)	осколочное (8)	сквозное (9)	слепое (10)	касательное (11)	отрыв и размозжение (12)	по сопутствующим ранениям (13)	газовая инфекция (14)	ишемическая гангрена (15)	вторичное кровотечение (16)	острое гнойный сепсис (17)
Не подвергшиеся ампутации при первичной обработке . . (20)	49,0	51,0	76,0	6,0	—	18,0	36,0	25,0	12,0	14,0	3,0
Подвергшиеся ампутации при первичной обработке (21)	11,5	88,5	16,5	2,0	0,5	81,0	52,0	7,5	2,5	0,5	1,5

(6) Исход	
осталось в живых (18)	из них не подвергалось ампутации (19)
90,0	43,0
94,5	—

Table 26. Characteristic of the combined injuries of shoulder bon- and vessel in injured people, who were not subjected to amputation during the primary processing/treatment, and in injured people, who were subjected the same (in the percentages) (author's development).

Key: (1). Injured people. (2). Distribution of injuries. (3). according to type of wounding weapon. (4). according to character/nature of injury. (5). Frequency of early complications. (6). Issue. (7). bullet. (8). fragmentation. (9). through. (10). blind. (11). tangent. (12). breakaway and crushing. (13). on associated injuries. (14). gas infection. (15). ischemic gangrene. (16). secondary hemorrhage. (17). sharply current sepsis. (18). it remained in living ones. (19). from them it did not undergo amputation. (20). Not subjected amputations during primary processing/treatment. (21). Subjected amputations during primary processing/treatment.

Combined damages to one of the bones and one of the vessels of forearm.

Were studied 50 cases of injuries with the break of radial bone and 50 with the break of the ulna. The damaged vessels with the break of radial bone they proved to be in 43 injured radial artery, in 7 - cubital, and with the break cubital: in 19 injured people - radial and in 31 - ulnar artery.

With this group, naturally, were connected lighter injuries. The bullet injuries were here 65.0o/o, through - 84.0o/o, but the injuries, which have the character/nature of crushings, it was not completely. The associated damages of other regions of body in this group composed 27.0o/o.

The combined damages of nerves were observed extremely frequently (in 53.0o/o of all injured people). With the breaks of radial bone in 9 injured people is noted the damage of several nerve trunks, in 8 - radial nerve, in 5 - middle and in one injured person - cubital. With the breaks of the ulna damaged most frequently proved to be ulnar nerve (17 injured people). The damage of radial and middle nerves is noted on one time, in 11 injured people - multipl

damage of the nerve trunks.

Primary surgical processing/treatment it was not produced into 11.0o/o of all injuries. In this group of injured people it is much more frequently than with the combined injuries of other parts of the extremities, there was is in proper time diagnosed and processed the damage of vessel during the primary processing/treatment, namely during the damages to radial bone the dressing of vessel was produced in 80.0o/o, during the damages to the ulna - in 62.0o/o, and in all - in 71.0o/o of injured people. Of this surgical activity in the relation to the damaged vessel it was not noted not with any another localization of the damage of extremities.

If we consider the dressings of vessels, produced, besides the primary surgical processing/treatment, with the breaks of radial bone in 9 injured people and with the breaks of the ulna in 13, then it will seem that the dressing of vessels is produced into 93.0o/o of injuries of this group. Only in one injured person with the damage to radial bone and in 5 with the damage to cubital it was not produced the dressing of the damaged vessel (in one injured person was made amputation).

Early complications in the group in question were developed sufficiently rarely. Gas phlegmon was observed in two injured people;

in both was produced the amputation of shoulder about by favorable outcome. Ischemic gangrene in this group was encountered not to time.

Secondary hemorrhages appeared, as a rule, with the suppurative complications. These hemorrhages with the breaks of radial bone were observed in 6 injured people, and with the breaks of the ulna - in 4. In these all injured people is produced the ligature of vessel, which led to the full/total/complete success; only in one injured afterward produced on the 26th day dressing of radial artery after 6 days was additionally made the dressing of this vessel also for the elongation/extent. With the injury of ulnar artery for the elongation/extent was made the dressing in 2 injured people: in one - shoulder, and in another - ulnar artery. Ischemic gangrene and in this group was observed not to time.

The abundant festering of wound, suppurative flows and phlegmons were detected in 15 injured people with the damage to radial bone and in 12 - with the damage to the ulna.

Twice it was observed the aneurism: in one injured person - the radial artery (after injury successfully was bandaged artery); in another injured person on the 49th day after injury occurred the break the aneurisms of ulnar artery, which was also bandaged.

On these complications and some other occasions were conditioned the repeated operations/processes which encompassed in army and army region 15.0o/o of injured people, in the front region - 22.0o/o and in the back hospitals still greater - 32.0o/o. Most frequently was conducted sequestrectomy (22) and the dressing of vessels (19).

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In the series/number of the injured people of operation/process they carried complex character/nature according to the type of the expanded for a second time processing/treatment of wounds. In 4 injured people are noted the operations/processes apropos of the damage of the nerve trunks (neurolysis, neurorrhaphythe carving of neuromas); all these operations/processes were made on the ulnar nerve with the break of the ulna.

Immobilization in this group was characterized by the wide application of a gypsum bandage both in the form of gypsum casts and circular bandage. In 5 injured people during the treatment were applied only transport splints (plywood or wire). In 11 of injured people these splints were replaced by gypsum cast for entire period of treatment; in remaining was laid circular gypsum bandage, it is more frequent right after transport splint.

Special attention draws the early use/application of the circular gypsum bandage: during the first 3 days - in 11 injured people, during the subsequent 3 days - in 10; thus, in by an one-heel by injured person circular gypsum bandage was superimposed during the first 6 days after injury. Where was preliminarily produced the proper surgical processing/treatment of wounds, any harmful consequences in this case it was not noted. However, in the injured people, in whom was not produced the dressing of vessel, three times under the anechoic gypsum bandage appeared secondary hemorrhages (on the eighth, 20th and 28th day after injury), which required the urgent removal/taking of gypsum bandage and dressing of vessels in two injured people, in one injured imposition of ligature it was not required.

Clinical issues after the injuries in question were sufficiently favorable. In 13 injured people during the damage to radial bone and in 7 during the damage to the ulna is noted good anatomical, while in majority and functional result.

In the majority of injured people especially burdened issue the consequences of the damage of nerves in the form of traumatic neuritides, paresis, paralyses and connected with them contractures, muscular atrophies, etc. The limitations of the motions and the contractures of large/coarse joints (mainly radiocarpal and it is

thinner/less frequent than the cubital), and also fingers, which developed in connection with the damages of nerves or independent of this, they are noted in 35 injured people, including 7 injured people had strain in the place of break. In 3 injured people is noted the ankylosis of the radiocarpal joint which in one of them was combined with difficulty of movement of elbow joint and fingers. Osteomyelitis with the extraction from the hospital is noted in 6 injured people with the damage to radial bone and in 4 injured people with the damage to cubital.

Died one injured person with the damage to radial bone and radial artery of the associated disease - diphtheritic ulcerous colitis and pneumonia. Amputation is produced, as noted above, in 2 injured people in connection with the development of anaerobic infection (Table 28).

Combined damages of two bones and one vessels or one bone and both vessels.

With the group in question they are connected, on one hand, injuries (34) with damages of both of bones and one vessel of forearm, on the other hand, injury (17) with the damage only to one bone and both vessels of forearm or one main-line vessel.

34 Injured people with break of both bones of forearm and damage of one vessel had: bullet injuries 20, through 32, which penetrate into joint 10, the damages to ulnar artery 14, radial 20, associated injuries of other regions 6, injuries of nerves 13.

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Primary surgical processing/treatment was produced in the overwhelming majority of the injured people of this group (29); however, the dressing of vessels was made only in 20. Secondary hemorrhages were observed in 6 injured people (in one it is repeated). In these all injured people was produced the ligature of vessel, moreover in 2 injured people it was produced for the elongation/extent - within the limits of shoulder artery. In 2 injured people after the dressing of vessel apropos of hemorrhage were observed the severe complications: in one by anaerobic infection, in another by heavy suppurative infection with the implication in the process of elbow joint. To both injured people was produced the amputation on shoulder; in spite of amputation, one injured person passed away.

Of 34 injured gas infection it was noted in 5, ischemic gangrene - in 3, the latter in one injured person beginning following the ligature of vessel, and in 2 injured people - without any surgical

processing/treatment of wound. In all injured people with the enumerated complications was produced the amputation of shoulder.

Of 34 injured people by 24 was superimposed circular gypsum bandage. In remaining injured people the fixation by gypsum bandage was absent due to the indicated above complications, which ended by the amputation of extremity. The periods of the application of circular gypsum dressing were different. More frequent it was laid in time from the 5th to the 10th day (in 16 injured people of 24). However, had place both the very late imposition (on 24th day 2 injured people and on 51st day after injury in one) and it is very earlier (on the 2nd day after injury in 2 injured people). In one of the latter/last two injured people developed anaerobic infection, in connection with which during the same day were produced the sections/cuts, and after 2 days - amputation of shoulder.

One cannot fail to note in the separate injured people of excessively prolonged use by circular gypsum bandage, which led to the development of ankylosis and contractures.

Issues in 34 injured people with break of both bones of forearm and injury of one vessel were following (Table 27 and 28): in 2 injured people was noted a good anatomical and functional result, in 8 injured extremity it was amputated, one died of the suppurative

infection, the remaining injured people with the extraction had this or other functional and anatomical disturbances/breakdowns, only partially presented stable consequences of the damages of nerves. These disturbances/breakdowns were reduced to the strain in the place of break, the sharp contractures and the limitation of the motions of joints, usually radiocarpal, and also fingers. The described disorders depended on the severity of injuries, and also, apparently from the deficiency of the applied methods of physiotherapy and therapeutic exercise.

In injured people (17) with the break of one bone and damage of both of vessels or one main-line vessel is noted: the damage to radial bone and both vessels of forearm (6 injured people), ulna and both of vessels (5), radial bone and shoulder artery (3), ulna and shoulder artery (3).

Among these injured people predominated perforating injuries (13). In one injured person was noted crushing of extremity, which ended by amputation during the primary processing/treatment.

Most heavy of that enumerated proved to be 6 injured people with the damage to radial bone and both vessels, three of them was produced amputation apropos of the gas infection (in one injured gas infection it developed after the dressing of vessels apropos of

hemorrhage); one injured person was discharged with a good result, two - with the fistulas, the contracture and the stable consequences of the damage of nerves.

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Similar phenomena are noted in 5 injured people with the damage to the ulna and both vessels. These all injured people had the combined damages of nerves. In one injured person without the surgical processing/treatment of wound on the 4th day was noted the complication of gas phlegmon; after exarticulation of shoulder joint the injured person passed away. In one injured person developed the ischemic gangrene (without the dressing of vessels), which required amputation. In three remaining injured people are noted the stable consequences of the damage of the nerve trunks.

Of 6 injured people with the break of radial or ulna in combination with the damage to shoulder artery 4 they had a damage of the nerve trunks. In one injured person after the surgical processing/treatment of wound with the dressing of vessel, produced of water moccasin on the 4th day, occurred the development of ischemic gangrene. In one injured person it was observed aneurism, apropos of which was produced the operation/process on the 80th day. In this injured person repeatedly was conducted the autopsy of

phlegmons and flows, and also sequestractomy apropos of osteomyelitis. In all injured people with the damage to shoulder artery were noted these or other the disorders: the paresis of nerves, strain in the place of break, contracture of the elbow and radiocarpal joints of hand and fingers/pins.

Is created impression, that the breaks of one bone of forearm with the damage to shoulder artery flowed/occurred/lasted more easil than with damage of both vessels.

Table 27 gives the information about the complications and the issues in injured people with break of both bones and damage of one of the vessels of forearm and in injured people with the break of on bone and both of vessels or shoulder artery. From the comparison of these groups of injured people it is evident that the heavy issues somewhat predominated in injured people with injury of both of vessels or shoulder artery.

Table 27. Associated injuries, complications and issues in injured people with the damage of two bones of forearm and one vessel or both of vessels and one bone (absolute numerals).

Группа раненых (1)	Сопутствующие ранения (2)		Осложнения (3)				Исход (4)		
	других областей (5)	нервов (6)	вторичные кровотечения (7)	газовая инфекция (8)	ишемическая гангрена (9)	прочие (10)	хорошие (11)	выписан по с культей (12)	умерло (13)
С повреждением двух костей предплечья и одного сосуда (34 раненых) (14)	8	13	6	5	3	1	2	8	1
С повреждением одной кости предплечья и обоих сосудов или плечевой артерии (17 раненых) (15)	5	12	1	3	2	1	1	5	1
Всего (51 раненый) (16)	13	25	7	8	5	2	3	13	2

Key: (1). Group of injured people. (2). Associated injuries. (3). Complications. (4). Issue. (5). other regions. (6). nerves. (7). secondary hemorrhages. (8). gas infection. (9). ischemic gangrene. (10). other. (11). good. (12). it is discharged with stump. (13). it died. (14). With damage of two bones of forearm and one vessel (34 injured people). (15). With damage to one bone of forearm and both of vessels or shoulder artery (17 injured people). (16). In all (51 injured people).

From Table 27 it is evident that there were heavy injuries, when in many instances discussion dealt with the damage of almost all tissues of forearm and almost in the half the cases proved to be damaged nerves. In the previous wars such all damaged extremities were subject to amputation [Pochnammer]. By Soviet surgeons' efforts/forces extremity in the majority of the injured people indicated was preserved. Although the majority of injured people had these or other disturbances/breakdowns, nevertheless this did not in any way indicate the final issue of injury, since many of them, without being they were connected with the stable consequences of the damages of nerves, yielded to recovery during the subsequent surgical treatment, mechanotherapy and labor mode/conditions.

Combined damages of both bones of forearm and both vessels.

This group unites 196 those wounded in the forearm, in which is stated/established damage of both of bones and both of vessels or shoulder artery. Are separately studied 24 injured people, which within the usual periods produced either the primary surgical processing/treatment of wounds or was produced surgical intervention in connection with the appearance of any complication. Amputation at one or the other level during the primary surgical processing/treatment was produced by 172 injured people.

The damage to shoulder artery was observed in 3 injured people of 24, who were not subjected to amputation during the primary processing/treatment, and in three of 172 injured people, who were subjected to amputation during the primary processing/treatment. In 24 injured people who underwent the conservative methods of surgical treatment, bullet injury was observed 8 times, crushing - 13, perforating injury - 9, the associated injuries - 7, the damage of nerves - 15 times.

Primary surgical processing/treatment was produced by 15 injured person of 24: in 5 it consisted in dissection and carving of wounds with the processing/treatment or without processing/treatment of bone fragments; in 9 injured people was produced working (dressing) the damaged vessels; in one was superimposed the suture to the shoulder artery.

Secondary surgical working is produced by 8 injured person, but in one no injured operations/processes it was conducted.

In this subgroup secondary hemorrhages were observed in all in 2 injured people (Table 28). These hemorrhages were stopped by the dressing of vessel (in the wound or for the elongation/extent), moreover extremity in these injured people was preserved. Most serious complications in essence were caused by the severity of

injuries themselves. In one third of injured people (8) developed the gangrene of extremity (ischemic), while in one injured person - gas infection. Both with that and during other reading was produced the amputation of shoulder either forearm or exarticulation in the elbow joint.

In 8 injured amputation it was produced in the subsequent stages of evacuation in connection with the explicit lack of vitality of extremity. As a result of 24 in 17 injured people was made the amputation and only in 7 extremity it was possible to preserve. In this case is almost in all latter/last injured people noted the strain in the place of the break (as a result of the incorrect intergrowth of bones), and also contracture and difficulty of movement, in particular in the radiocarpal joint, in the hand and in the fingers/pins. In 3 injured people is noted osteomyelitis of the bones of forearm.

If one considers that the begun complications dictated the production of higher amputation than during the primary working, then as a result of the made analysis arises question, one ought not to have in the majority of injured people immediately produced amputation, without subjecting graduation mark their health.

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Table 28. Early complications and issues in injured people with the bullet break of the bones of forearm and the damage of vessels (in absolute numbers) (author's development).

Группа раненных в предплечье (1)	Число раненых (2)	Осложнения (3)							
		вторичное кровотечение (5)	газовая инфекция (6)	ишемическая гангрена (7)	сепсис остро текущий (8)	ампутации по другим показаниям (9)	аневризма (10)	всего осложнений (11)	всего раненых с осложнениями (12)
С повреждением одной кости и одного сосуда (16)	100	10	2	—	—	—	2	14	13
С повреждением обеих костей и одного сосуда (17)	34	6	5	3	1	—	—	15	12
С повреждением одной кости и обоих сосудов или плечевой артерии (18)	17	1	3	2	—	1	1	8	7
С повреждением обеих костей и обоих сосудов (без ампутации при первичной обработке) (19)	24	2	1	8	—	8	—	19	19
Всего (20)	175	19	11	13	1	9	3	56	51
В процентах к общему числу (21)	100,0	10,8	6,3	7,4	0,6	5,1	1,8	32,0	29,1

Table 28 [Table continues; reading left-to-right.]

(4) Исход		
конечность сохранена (3)	конечность ампутирована (4)	умерло (5)
97	2	1
25	8	1
11	5	1
7	17	—
140	32	3
80,0	18,3	1,7

Key: (1). Group of those wounded in the forearm. (2). Number of injured people. (3). Complications. (4). Issue. (5). secondary hemorrhage. (6). gas infection. (7). ischemic gangrene. (8). sepsis sharply flowing. (9). amputation from other readings. (10). aneurism. (11). in all complications. (12). in all injured people with complications. (13). extremity is preserved. (14). extremity is amputated. (15). it died. (16). with damage to one bone also of on vessel. (17). With damage of both of bones and one vessel. (18). With damage to one bone and both of vessels or shoulder artery. (19). With damage of both of bones and both vessels (without amputation during primary working). (20). In all. (21). In percentages to total number.

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Indeed in the majority of these injured people it was necessary to resort, after all, finally, to the same rescue amputation.

Under the known facts, even, it would seem, during so hopeless a combination as the damage of two bones and two vessels of forearm, it was possible to preserve hand, to what unquestionably it was to be striven, if only in this case it was not threat of risky complications and heavy, that depreciated the function of the preserved extremity of the damage of nerve shafts. Table 28 depicts the reference data about the complications and the issues in the studied groups of injured people with different combinations of the break of the bones of forearm with the damage of vessels.

This table clearly illustrates the important value of the complexity (and of severity) of injury both for coursing the wound process and for the final issues.

During the primary surgical processing of amputation underwent

172 injured people with break of both bones of forearm and damage of both vessels. Among them it was: bullet injuries - 7, through - 19, that penetrate into the joint - 5, breakaways - 65, crushes - 84.

Furthermore, there was a large number of associated injuries which frequently carried very heavy character/nature and were accompanied by shock phenomena. It is possible, for example, to note that in one injured person was made simultaneously the amputation of forearm and thigh in lower third apropos of the breaking up of the bones of shin, in another - the amputation of thigh was produced later, in the third - was made the enucleation of eye, etc.

Amputations were produced predominantly during the next days and only on one time on the 2nd, 4th, 5th, 6th and 7th day after injury.

The level of amputation is established/installed in 123 injured people, moreover in 84 it was made in the limits of forearm, and in 39 amputation it was made in the limits of shoulder (table 29).

In the process of the subsequent treatment in 14 injured people was produced reamputation, moreover predominantly in those injured people, in whom previously amputation was made too economically; however, the level of amputation from this sharply did not change. If one considers that the level of the amputation (not during the

primary processing), produced in 17 injured people of 24, it fell approximately equally to the shoulder and the forearm, then from given data it appears, that the primary amputation proved to be much more economical in the relation to the economy of the sections of extremity.

Table 29. Level of the amputations, produced during the primary processing and in the succeeding periods in injured people with bullet break of both bones of forearm and damage of both its vessels (absolute numerals) (author's development).

(1) Время производства ампутации	(2) Уровень ампутации	
	(3) плечо	(4) предплечье
(5) При первичной обработке раненых (123 раненых) . . .	39	84
(6) В последующие сроки (17 раненых)	9	8
(7) Всего (140 раненых)	48	92

Key: (1). Time of production of amputation. (2). Level of amputation. (3). shoulder. (4). forearm. (5). During primary processing of injured people (123 injured people). (6). In the succeeding periods (17 injured people). (7). In all (140 injured people).

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Hence follows that in those injured people, who did not have real chances for the retention/preservation/maintaining of extremity, better it would be to immediately produce the truncation of extremity thereby preserve to injured person the longer section of the segment of extremity.

Of 172 injured people, who were subjected to amputation during

the primary processing, died 6 (3.5o/o). Almost they all had the heavy associated damages which by themselves or emergent with them complications led to the lethal outcome (in one injured person, together with the injuries, were extensive burns/scalds, in two of others developed gas phlegmon, etc.).

If we sum up that presented, then it is necessary to recognize that the timely amputation with this category of breaks was beneficial operation/process.

In addition to the aforesaid conformably to all dismantled/selected groups of injured people it should be noted that in the heavily injured in whom had in mind the retention/preservation/maintaining extremity, one ought not to have more widely put to use methods indicated above of the effect on sympathetic nervous system, (novocaine and alcoholic blockade of stellate ganglion, sympathectomy), and also by the blood transfusion.

In the period of recovery for retention/preservation/maintaining and reducing the function of extremity (in particular hand and fingers/pins) exceptionally important value had the timely and systematic use/application of methods of physiotherapy, therapeutic exercise, which could to a considerable degree smooth those serious functional disturbances/breakdowns which so frequently were developed

after the combined injuries of forearm and darkened clinical issues.

The associated injuries were subject to so careful and timely a treatment as basic injury.

As a whole the combined injuries of bones and vessels of forearm were least risky in the comparison with the analogous injuries of other segments, which was reflected in the insignificant lethality, in the smaller frequency of the development of severe complications and in connection with this in the more rare use/application of amputation.

DAMAGES OF BLOOD VESSELS WITH THE BULLET BREAKS OF FEMORAL BONE.

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Statistical survey/coverage.

As the basis of the study of the damages of large/coarse femoral vessels with the break of femoral bone were assumed the data of the author's development of 200 histories of the disease/sickness/illness/malady of archives of the military medical museum, and also the personal experience of the author in the

treatment of injured people during the Great Patriotic War. All injured people, studied based on materials of author's development, were with the full/total/complete bullet break of femoral bone and with the damage to large/coarse artery of thigh. Consequently, this contingent was heavier than studied based on materials of the deepened development of the histories of disease/sickness/illness/malady, which includes a known quantity of injured people with the incomplete (edge/boundary, perforated) break.

During the development of these data for the comparison were used two supplementary groups of the injured people by a total quantity into 25 people: in one with the damage only of secondary vessels, and in another when the injury of the large vessel of thigh is present, only with the partial (perforated or edge/boundary) damage to femoral bone.

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The information about the frequency of the damage of vessels with the bullet breaks of the thighs, represented above, can be accepted only with the known degree of approximation, since, it is doubtful that the part of the injuries of vessels was revealed not by hemorrhage, fluctuating hematoma and aneurysm, but by other complications, which led to the amputation (gangrene of extremity, heavy infection of

wound), the damages of vessels could remain unrecognized.

From table 30 it is evident that based on materials of author's development predominated the fragmentation injuries of thigh (57.5o/o) above the bullet ones (42.5o/o) in contrast to all bullet breaks of the thigh where the relations were reverse.

The injuries, which were subjected to study, considerably differed from all bullet breaks of thigh by a number of breakaways and crushes (28.5o/o instead of 0.9o/o) and by a number of associated injuries of the nerve trunks (37.0o/o instead of 10.6o/o); whereas the relationships/ratios of multiple, blind-end and perforating injuries among all injured people and among those given in the present section were almost identical (table 31).

In the frequency of the damage of vessels in the first place, naturally, stood the femoral artery, damaged in 112 injured people (of 200), from whom in 21 femoral artery was damaged together with the vein. In 20 injured people is noted the damage to a deep artery of thigh, in 13 - popliteal artery (but sometimes also vein). In 33 injured people was observed the combined injury of femoral artery and deep artery of thigh (sometimes with the veins). In 22 injured name of the damaged vessel, it is doubtless, large/coarse, it was not refined. The information about the damaged vessels in the supplementary groups is given separately.

The level of the damage of vessel did not always coincide with the level of the break of bone.

Table 30. Distribution of injured people with the bullet damage of large vessels and the break of thigh according to the means of injury in connection with the character/nature of primary surgical processing (in the percentages) (author's development).

(1) Группа раненых и ее удельный вес	(2) Вид ранения		(5) Итого
	(3) пулевое	(4) осколочное	
(6) I группа (раны первично не обработаны — 19,0%)	42,1	57,9	100,0
(7) II группа (раны обработаны, но без вмешательства на сосудах — 28,0%)	41,0	59,0	100,0
(8) III группа (раны первично обработаны с перевязкой сосудов — 15,0%)	66,6	33,4	100,0
(9) IV группа (ампутация при первичной обработке — 38,0%)	34,2	65,8	100,0
(10) В среднем . . .	42,5	57,5	100,0
(11) V и VI контрольные группы (с повреждением второстепенных сосудов или с неполным переломом бедренной кости)	72,0	28,0	100,0

Key: (1). Group of injured people and its specific gravity/weight. (2). Means of injury. (3). bullet. (4). fragmentation. (5). Altogether. (6). group (wounds are not primary processed. (7). group (wounds are processed, but without intervention on vessels. (8). group (wounds are primary processed with dressing of vessels. (9). group (amputation during primary processing. (10). On the average. (11). and VI control groups (with damage of secondary vessels or with incomplete break of femoral bone).

This is explained by the fact that the wounding projectile, having frequently oblique course with respect to the axis of extremity, first inflicted damage on to one of the adjacent organs/controls, and then in the ascending or descending direction striked another organ/control. However, in the general/common/total damage level to bone which, naturally, was distinguished more easily, gave known alignment, also, for the searches of the damaged section of vessel. Of 200 injured people almost in half (46.5o/o) was the break of lower third of thigh, in 28.5o/o - middle third, in 18.0o/o - upper, in 5.5o/o there was a break of several thirds of thigh and in 1.5o/o of injured people the level of break remained unknown.

Clinic (diagnosis).

Above it was noted, that the recognition of the damages of vessels as in the absence of bone destruction, so in particular in the presence of the latter managed hardly ever. One should emphasize that in the foremost stages the majority of such damages, unfortunately, was examined/scanned. Most easily was distinguished the damage of neurovascular bundle with breakaways or crushes of extremities. If we exclude these damages where during the primary processing was produced amputation, then of 124 injured people in 94

injury of vessel was not identified to the onset of the serious complications, which appeared in different stages of evacuation. This once more confirms the difficulties of the diagnosis of the damages of vessels with the bullet breaks. Thus, is reliably identified the damage of vessel to and during the primary surgical processing of wounds only in 30 people (24.2o/o).

Table 31. Distribution of injured people with the bullet the break of thigh and by the damage of large vessels according to the character/nature of injury in connection with the character/nature of primary surgical processing (in the percentages) (author's development).

(1) Группа раненых и ее удельный вес	(2) Характер ранения				(7) Всего	(8) В том числе	
	(3) слепое	(4) сквозное	(5) отрыв или раздробление	(6) неизвестен		комбинированные и множественные ранения (9)	сопутствующие повреждения нервов (10)
(11) I группа (раны первично не обработаны — 19,0%) . .	34,2	50,0	15,8	—	100,0	36,8	29,0
(12) II группа (раны обработаны, но без вмешательства на сосудах — 28,0%)	32,1	57,4	3,5	7,0	100,0	30,3	5,3
(13) III группа (раны первично обработаны с перевязкой сосудов — 15,0%)	23,3	76,7	—	—	100,0	23,3	6,6
(14) IV группа (ампутация при первичной обработке — 38,0%)	5,4	28,9	64,4	1,3	100,0	38,1	76,3
(15) В среднем. . .	21,0	48,0	28,5	2,5	100,0	33,5	37,0
(16) V и VI контрольные группы (с повреждением второстепенных сосудов или с неполным переломом бедренной кости)	24,0	76,0	—	—	100,0	44,0	24,0

Key: (1). Group of injured people and its specific gravity/weight. (2). Character/nature of injury. (3). blind. (4). through. (5). breakaway or crushing. (6). it is unknown. (7). In all. (8). Among other things. (9). combined and multiple injuries. (10). associated damages of nerves. (11). group (wounds are not primary processed. (12). group (wounds are processed, but without intervention on vessels. (13). group (wounds are primary processed with dressing of

vessels. (14). group (amputation during primary processing. (15). On the average. (16). and VI control groups (with damage of secondary vessels or with incomplete break of femoral bone).

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In almost all these wounds was almost produced the dressing of vessel, moreover in majority as occasion for the searches of the damaged vessel served profuse hemorrhage.

It should be noted that and under these conditions did not always have place the correct determination and working of the damaged vessel: instead of the main shaft sometimes was ligated secondary vessel, that, naturally, it did not prevent the appearance of repeated hemorrhages. This appears, for instance, from the following observation.

A-ze, 40 years, 25/IX 1942 it is injured by bullet right through into the left thigh with the break of bone. First aid is shown/rendered by medical orderly. On DMP the wounds were not treated. In PPG he entered 29/IX, wound with the inspection in the satisfactory state. Aseptic bandage is hypo-pile the cast, subsequently substituted by the anechoic gypsum bandage, with which the injured person is evacuated further. In the back evacuation hospital 17/X in injured

person arose strong hemorrhage. Is taken/removed gypsum bandage. The revision of the wounds: besides necrotic coatings, on the edges with the moderate swelling of left lower extremity nothing suspicious it is discovered. The bleeding vessel is not found. Injured person is undertaken under the careful observation. 26/X is again produced the revision of wounds. This time is made the section/cut over the posterior surface of thigh to the bone with a length of 20 cm. In one of the muscular arteries of medium caliber is discovered the opening/aperture, in connection with which this artery is dissected, and both ends are bandaged, bone processed. Tampon with the ointment of Vishnyovskiy, rare sutures, 28/X the scheme of tampon: the swelling of thigh and shin considerably decreased; temperature is held above 38°. 30/X in injured person again appeared hemorrhage. It is pale, the pulse of weak filling. Is superimposed tourniquet; hemorrhage is stopped by attendant doctor by dry tamponade and by pressure bandage; heart, physiological solution under the skin. At 9 A.M. in injured person the darkened consciousness; it is undertaken into the operating room, where is initiated the blood transfusion. However, without coming into the consciousness, injured person passed away. On the autopsy, besides the previously bandaged muscular artery, which moved away from the femoral artery, it is discovered the second defect on the wall of vessel and fine/small bone fragments near. Tissue all around proved to be those absorbed by the blood.

Upon attentive consideration of all symptoms - direction of wound canal, small ripple reduction on the peripheral artery of injured extremity, presence of a deep either subcutaneous hemorrhage, the sharp pallor of integuments, not explained by shock, indication in anamnesis to the strong hemorrhage or the unconscious state after injury and so forth - in the overwhelming majority of injured people it was possible to early recognize the damage of vessel, which had important value for the rendering to timely aid.

As could be seen from the data of the deepened development of the histories of disease/sickness/illness/malady, the combined injuries of thigh with the damage to the bone also of vessels had heavy clinical course and they were very frequently accompanied by risky complications, considerably exceeding in this respect of injury with the break of femoral bone, without multiple failure of vessels. The simple enumeration of complications with the described injuries among which large place occupied secondary hemorrhages, gas infection, ischemic gangrene, sepsis sharply flowing, leads to the conclusion that the period and the character/nature of surgical processing had very vital importance for coursing these injuries.

On the basis of these considerations, for studying the frequency of the most important complications, their course and issues, the material of author's development, based on the study of 200 histories

of disease/sickness/illness/malady, is broken into four groups in accordance with the basic types of primary surgical treatment. The characteristic of these groups on the injured vessel is represented in Table 32.

With the first group are connected the injured people, in whom was not produced primary surgical processing. Such injured people it was counted by 19.0o/o. On the severity of damage/defeat in this group speaks the enumeration of the damaged vessels. In this group there were injured people (7), who was killed into the nearest hours after injury,, before they rendered surgical assistance.

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The same group, the feed of heavy ones, hit such injured people whose damage of vessels was frequently masked with satisfactory general state. With the illusory means of perforating bullet or small-splintered injury the surgeons considered it possible to leave this wound without the surgical processing. Only the subsequent complications in the form of violent hemorrhage, outbreak of infection, development of sepsis or ischemic gangrene gave grounds for the diagnosis of the injury of vessel; however, frequently this diagnosis proved to be late.

With this group are connected such injured people, as in view of the confluence of facts could not obtain timely surgical aid in the foremost stages, in spite of the presence of clear readings to the surgical processing of wounds.

The characteristic of the studied groups in the relation to complications is represented in Table 33.

As can be seen from Table 33, among the injured people without the primary surgical processing it was not one without the complications; in 7 injured people was noted heavy traumatic shock with the lethal outcome; in half (19) injured people were observed the hemorrhages (in 3 repeated) with all characteristic to this complication of dangers; in 7 of them were noted the early hemorrhages, which are combined with the phenomena of shock.

Table 32. Distribution of injured people with the bullet break of thigh, that were subjected to different primary surgical processing, according to the damaged with the injury vessels (in the percentages) (author's development).

(1) Группа раненых и ее удельный вес	(2) Наименование раненых сосудов							
	(3) бедренная артерия	(4) бедренная артерия и вена	(5) глубокая артерия бедра	(6) подколенная артерия (и вена)	(7) комбинация артериальных и венозных сосудов	(8) неизвестный сосуд	(9) прочие сосуды	(10) Всего
(11) I группа (раны первично не обработаны — 19,0%) . .	36,9	13,1	5,3	5,3	26,3	13,1	—	100,0
(12) II группа (раны обработаны, но без вмешательства на сосудах — 28,0%)	46,4	5,4	8,9	8,9	3,6	26,8	—	100,0
(13) III группа (раны первично обработаны с перевязкой сосудов — 15,0%)	30,0	33,3	23,5	6,6	3,3	3,3	—	100,0
(14) IV группа (ампутация при первичной обработке — 38,0%)	55,3	3,8	8,0	5,2	26,3	1,4	—	100,0
(15) В среднем . . .	45,5	10,5	10,0	6,5	16,5	11,0	—	100,0
(16) V и VI контрольные группы (с повреждением второстепенных сосудов или с неполным переломом бедренной кости)	28,0	—	—	12,0	20,0	28,0	12,0	100,0

Key: (1). Group of injured people and its specific gravity/weight. (2). Designation of injured vessels. (3). femoral artery. (4). femoral artery and vein. (5). deep artery of thigh. (6). popliteal artery (and vein). (7). combination of arterial and venous vessels. (8). unknown vessel. (9). other vessels. (10). In all. (11). group (wounds are not primary processed. (12). group (wounds are processed, but without intervention on vessels. (13). group (wounds are primary processed with dressing of vessels. (14). group (amputation during

primary processing. (15). On the average. (16). and the VI control groups (with the damage of secondary vessels or with the incomplete break of femoral bone).

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In remaining injured people the periods of hemorrhage were different: in 3 - during the first 10 days, in 3 - between the 11th and 20th day, in one - on the 23rd day, in one more - repeated hemorrhage on the 38th, 39th and the 40th day with the lethal outcome; in 2 injured period it remained unknown.

In spite of the absence of primary surgical processing and, therefore, early dressing of vessel, in this group, together with the gas gangrene, was observed also the ischemic gangrene, which in one injured person of 8 was restricted to several toes of feet. In 3 injured ischemic gangrene it began after the late dressing of vessel which one time was made for the purpose of the elimination of fluctuating hematoma and two times apropos of secondary hemorrhages. In 3 injured people it was observed aneurism, which in one underwent full/total/complete reverse development.

Frequency and severity of complications, in spite of undertaken in many injured people active intervention, they conditioned high

lethality in this group of injured people.

The second group included injured people, which produced the primary surgical processing of wounds in the form of dissection and carving, but without working of the damaged vessel. Here are involved 56 injured people, this group according to the character/nature of injuries sufficiently closely adjoining preceding/previous. Here also the majority of injured people had the perforating injury, with which was conducted only the usual dissection of input and outlet. In the minority of injured people to this were added the more complex receptions/procedures of processing wounds (removal/distance of bone fragments and cutting off of fragments, etc.), but without intervention on the damaged vessels.

The absence of radical aid by this injured person, as in the dismantled/selected group of injured people without the surgical processing, it entailed different risky complications in all injured people of this group, except one.

Table 33. Distribution of the principal complications with the bullet breaks of femoral bone from the damage of large vessels in the groups of injured people according to the character/nature of primary processing (absolute numbers (author's development).

(1) Группа раненых по характеру первичной хирургической обработки	(2) Осложнения								
	(3) первичный шок и анемия с летальным исходом	(4) вторичное кровотечение (раннее и позднее)	(5) ишемическая гангрена	(6) газовая инфекция	(7) сепсис	(8) пульсирующая гематома и аневризма	(9) прочие	Всего осложнений (10)	Число раненых с указанными осложнениями (11)
(12) I группа — 38 раненых (раны первично не обработаны)	7	19	8	4	2	3	2	45	38
(13) II группа — 56 раненых (раны обработаны, но без вмешательства на сосудах)	1	36	13	9	16	3	1	79	55
(14) III группа — 30 раненых (раны первично обработаны с перевязкой сосудов) . . .	4	—	10	10	6	—	—	30	26
(15) Всего (124 раненых)...	12	55	31	23	24	6	3	154	119

Key: (1). Group of injured people according to the character/nature of primary surgical processing. (2). Complications. (3). primary shock and anemia with lethal outcome. (4). secondary hemorrhage (it is earlier and it is later). (5). ischemic gangrene. (6). gas infection. (7). sepsis. (8). fluctuating hematoma also of aneurism. (9). other. (10). In all complications. (11). Number of injured people with complications indicated. (12). group - 38 injured wounds are not primary processed). (13). group - 56 injured people (wounds are processed, but without intervention on vessels). (14). group - 30 injured people (wound are primary processed with dressing of vessels.

(15). In all (124 injured people).

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In the first place among the complications, as in the preceding/previous group, proved to be the secondary hemorrhages, which were observed in 36 injured people (in three repeated), moreover in many of these injured people secondary hemorrhages arose against the background of sepsis (11 times) or suppurative flows and phlegmons (2 times). On one time the hemorrhage complicated the course of gas infection and ischemic gangrene, moreover in the first it arose after sections/cuts, and in the second - after amputation (hemorrhage from the stump). If we do not consider two latter/last injured people whose hemorrhage had secondary value, then in remaining 34 injured hemorrhage was the first and terrible signal of the presence of the damage of vessel. The periods of the onset of hemorrhages at these 34 injured people varied from one to 62 days, namely: the inflow of the first 10 days after injury - in 16 injured people (among other things in 7 - during the first three days, in remaining 9 - from the 5th on the 10th day); from 11 to 20 days - in 7 injured people; from 21 to 30 days - in 7 injured people and in remaining 4 injured people - it is later than 30 days (among other things in two hemorrhages it occurred already from the aneurysmatic sack). The emergent hemorrhage forced surgeon to the impulse actions,

if only issue did not prove to be fateful into the nearest hours. These effects/actions in some injured people were reduced to the attempts to bandage the bleeding vessel, which was undertaken in 11 injured people. However, most frequently following this intervention began the subsequent complications - ischemic gangrene (in 3 injured people), gas infection (in 4 injured people) it deteriorated flow of sepsis (in 3 injured people), which already required the more radical measures of fight - usually amputation or exarticulation of extremity; nevertheless this was not always ended favorably for the life.

In other injured people with the hemorrhage, especially in the presence of the already heavily infected wound, the surgeon immediately was solved for the amputation, that it was not possible not to recognize as advisable. In this case one should emphasize that in 9 injured people of 34, when hemorrhage was first trouble signal of vessel, for the surgeon it nevertheless remained the unknown, such as precisely vessel it bled.

In remaining 22 this injured group the combined damage of vessel was initially revealed not by hemorrhage, and by other, not less heavy complications: ischemic of Angren (in 10 injured people), gas infection (in 5 injured people), violently progressive sepsis (in 5 injured people). In this group is referred one injured person, who

was killed on the 3rd day from the shock after multiple mine injuries. Finally, in one more injured person developed that infected of the aneurism of femoral artery and its deep branch, which was cut all over 2 months after injury. As a result developed the ischemic gangrene of several toes.

However, because of the clearer readings to radical intervention, besides produced usually under more favorable conditions than with the secondary hemorrhages when frequently appeared a direct threat for the life as a result of the heavy blood loss, the recovery of injured people with the complication without the hemorrhage was observed more frequently than with the secondary hemorrhages.

The periods of the appearance of these complications are analogous such with the hemorrhages, which makes it necessary to perceive the presence of genetic connection/communication between the latter and, it would seem, by other different from them such described complications - during the first 10 days in 13 injured people, 11-20 days - in 4 injured people, 21-30 days u - 2 injured people and within the later periods - in 3 injured people.

To the third group are referred 30 injured people, which produced the dressing of the bleeding vessels, with exception of one injured person to whom in the process of primary processing was superimposed the vascular suture. During the identified damage of vessel and simplicity of injury itself the wish to preserve extremity inclined surgeon to the production of dressing. Of 30 this injured group 20 they were injured by bullet; in 23 injured injuries they were through; the associated injuries, which did not carry heavy character/nature, they were noted in a few injured people (in 7 of 30).

In spite of the relative ease/lightness of injuries themselves in comparison with the first and second group, the course of them was also very frequently acccmpanied by the severe complications: by ischemic gangrene (10 times), gas gangrene (10 times), by sepsis (6 times, of them in 4 cases in combination with other complications). Even if not to consider 4 injured people who perished in the first twenty-four hours after injury from the shock and the anemia, then is created sufficient representation about the severity of the state of the injured people of this group in the post-operation period. However, the character/nature of complications differed here from the preceding/previous groups in terms of the fact that the injured people were completely released of more terrible than the danger of secondary hemorrhages and from such consequences of vascular injuries

as fluctuating hematoma and aneurism, that it could not but affect more favorably the vital prognosis for them. Four of this group not at all had risky ones for the life and for the extremity of complications.

As far as estimation is concerned as a whole of the method of the dressing of vessels with their injuries, then it is made below.

If we summarize all three groups of injured people enumerated above, in which there was applied sparing treatment, then should be noted the extreme seriousness of the course of this means of injuries, at least in the early period of wound process. If injured person it was possible to happily pass the period of early complications, then it frequently underwent such late complications as late secondary hemorrhages, aneurisms, heavy purulent-septic processes. Of 124 injured people, connected with these three groups, 119 had risky for the life and for the extremity complications.

Were required surgeons' strained efforts, in order under these conditions of many of the injured people to place on the way of recovery. But after these severe complications in the majority of the cases because of surgical interventions were removed, further course of wound process in these injured people no longer presented any special features/peculiarities in comparison with other injured

people, who were subjected to analogous interventions.

The value of the anatomical complexity of damage/defeat for the clinical course and the prognosis with the combined injuries of thigh appears from the comparison of the recently examined groups with two supplementary (control) groups, which included injured people with the damage of secondary vessels in the presence of the full/total/complete bullet break of bone, and also injured people with the incomplete damage to bone when the injury of the large vessel of thigh is present,.

It should be noted that almost in the half injured people with the damage of secondary vessels the name of vessel remained unknown; in some of these injured people is noted large hemorrhage, so that to exclude the possibility of the injury of the shaft of large/coarse artery is impossible. In 3 injured people is identified the damage to the femoral of veins, while in one injured person - popliteal vein.

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In one injured person after dressing v saphena is noted the thrombosis of popliteal artery with the subsequent ischemic gangrene of shin and foot; consequently, this injured person with the large basis it would be possible to relate to the group with the damage of

large/coarse main-line arteries.

As far as form/species is concerned of the break of bone, then in one injured person it is noted as by scythe, in 2 - as crushed, in 5 - as large-splintered, but in 5 injured form/species of break it is not shown.

Of observed in this group complications almost half composed the hemorrhages in connection with the absence of working vessels to the onset of the complication indicated. On one time was observed ischaemic gangrene, gas infection, sepsis and heavy traumatic shock, which ended lethally. In 6 injured people it was not noted risky complications (table 34).

As a result of the smaller frequency of the complications indicated the course of injuries was on the whole much more favorable and more rarely it led to the amputation and to the lethal outcome. More heavily flowed/occurred/lasted injuries in the following group of 12 people with the incomplete break of bone (perforated or edge/boundary), but with the injury of main-line vessel (7 times of femoral artery, 3 times of popliteal, one times of femoral artery and of its deep branch simultaneously, one time of unknown vessel). As show to tables 34, complications in this group were observed in the overwhelming majority of injured people. The first place among all

complications occupied the hemorrhage, the second - ischemic gangrene which in one injured person with combined damage of both large/coarse arteries began without the dressing of vessel, and subsequently course it was complicated by gas gangrene. After twofold amputation the injured person recovered. Twice it was observed aneurism, both times is made its carving. One of these injured people after operation/process it perished from the blood loss and the secondary shock.

If we combine both supplementary (control) groups (table 34), then of these injured more than one third did not have those terrible complications which began almost in all injured people with the combined injuries of the femoral bone and vessel, connected with material of author's development (table 33). Gas gangrene and sepsis in these supplementary groups did not play noticeable role; however, ischemic gangrene was observed fairly often after the damage to main-line artery.

Table 34. Distribution of the principal complications in injured people with the bullet break of thigh and the damage of vessels in connection with the character/nature of the damaged vessels (absolute number) (author's development).

(1) Группа раненых	(2) Осложнения						(3) Всего раненых	
	(4) первичный шок и кровопотери с летальным исходом	(5) вторичное кровотечение	(7) пневматическая гангрена	(8) газовая инфекция	(6) сепсис	(9) аневризма	(10) с осложнениями	(11) без осложнений
(12) С повреждением второстепенных сосудов	1	3	1	1	1	—	7	6
(13) С повреждением магистральных сосудов	—	5	4	—	—	2	11	1
(14) Всего . . .	1	8	5	1	1	2	18	7

Key: (1). Group of injured people. (2). Complications. (3). In all injured people. (4). primary shock and blood loss with lethal outcome. (5). secondary hemorrhage. (6). ischemic gangrene. (7). gas infection. (8). sepsis. (9). aneurism. (10). with complications. (11). without complications. (12). With damage of secondary vessels. (13). by damage of main-line vessels. (14). In all.

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The relatively tranquil flow of wound process disturbed mainly the secondary hemorrhages in those injured people, which not make a dressing of vessel during the primary surgical processing/treatment. However, these hemorrhages in the final analysis also comparatively

easily were considered and the connected with them complications had more favorable outcome than analogous complications in the previously dismantled/selected groups. The difference between both groups of injured people even more brightly is revealed/detected during the estimation of the issues which are represented below.

Special position in comparison with others occupies the group of injured people which in the process of primary surgical processing/treatment immediately produced amputation (four-group in Table 37, see pg. 78).

Into this group entered most heavily injured people. Of 76 people, who were subjected to primary amputation, only 26 were injured by bullet, 49 injured people had breakaway or crushing of extremity.

In these injured people already before the amputation, which was being conducted, as a rule, within the early periods (only in 5 injured people it is produced later than 2 days), was observed the series/number of the complications, characteristic for the described injuries, which developed especially rapidly in the injured people of this group. It is obvious, the severity of trauma contributed to the development of the lightning form of anaerobic infection and to the extremely early manifestation of the disorders of the nourishment of

the massive sections of extremity.

It is necessary to indicate that with these extremely heavy combined injuries the in proper time produced amputation for the overwhelming majority of injured people proved to be the beneficial operation/process after which further course of wound process acquired benign nature and rarely was disturbed by the risky complications, connected with the injury (hemorrhage, anaerobic infection and sepsis).

Treatment.

As a result of the special features/peculiarities of the course of the combined injuries of thigh with the damage to the bones and the vessel, about which the question was above, these injured people from the very beginning frequently required urgent therapeutic measures.

First aid with the injuries in question consisted in the temporary/time cessation of hemorrhage by the skillful imposition of tourniquet, in rational temporary/time immobilization, taking of the simplest antishock measures on BMP and PMP and in particular in the fastest delivery/procurement of injured people on DMP.

With the rendering of surgical first aid, first of all, it was important to correctly recognize the combined character/nature of these injuries, which managed easily when of the arterial hemorrhage or other clear signs of vascular damage are present,. However, this requires considerable attention and experiment/experience, if in anamnesis there was not indications of abundant hemorrhage and were detected only effaced symptoms. As showed the experience of the author and other surgecns, in the presence of suspicion to the damage of vessel serious aid rendered the revision of vessel during the primary surgical processing/treatment: after revealing/detecting even the indirect signs, which make it possible to suspect the damage of vessel, were no longer limited to stereotyped dissection wounds, but they uncovered vessel and was checked its integrity. During the damage of vessel after the removal/distance of clusters began the abundant arterial hemorrhage, which was immediately stopped by pressing by finger/pin for the elongation/extent of vessel or on the spot of injury. This made diagnosis indisputable and dictated one or another the method of surgical treatment.

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It was afterward dissimilar in injured people with the lighter damage without considerable crushing of tissues and in injured people with the heavy injury with the damage of the neurovascular bundle. In

the injured people of latter/last category was shown the urgent amputation which was conducted for the purpose of warning/prevention of risky complications.

With the lighter injuries were allowed/assumed the attempts to preserve extremity by applying the sparing treatment. The selection/analysis of clinical course and complications during the use/application of different forms/species of saving tactics showed that the attempt to manage without intervention on the damaged vessels (it is more frequent on the femoral and popliteal artery), although even these interventions led to the failures, it did not reveal/detect the advantages before the more active behavior (Table 33). If abstention from intervention on the vessel somewhat decreased the frequency of ischemic gangrene, then then was subjected the life of the injured person of an even larger danger from those not expected and violent ones, sometimes repeated ones, the hemorrhages, capable of beginning in any period of wound process, sometimes after the long time after injury. This danger remained also in those injured people, in whom on the soil of the unremoved vascular damage was developed fluctuating hematoma also of aneurism.

As it was shown above, the method of vascular suture did not put to use distribution among the surgeons of the foremost stages of evacuation during the damages of vessels, but those more with the

combined injuries with the simultaneous break of bone. Based on materials of author's development, of 200 combined injuries of t in one case was only superimposed vascular suture during the lat damage to femoral artery, after which was formed the thrombus of latter with the development of the sepsis, led to amputation.

The dressing of vessel, if it was made correctly, with its simplicity was more reliable guarantee from the subsequent hemorrhages. After such an intervention the hemorrhages appeared extremely rarely - only as a result of the cutting of ligature or arrosion of the wall of vessel due to the suppurative melting or after the imposition of ligature for the elongation/extent or onl one of the ends of the artery with the well functioning collatera Thus, the dressing of the central and peripheral end of the vesse and simultaneously careful surgical processing/treatment wounds a whole, including bone break, were necessary for the purpose of warning/prevention of the development of infection, which with th injuries flowed/occurred/lasted especially heavily.

Some injured people whose dressing of vessel did not entail noticeable ischemic disorders, nevertheless subsequently lost extremity due to the infectious complications (suppurative and anaerobic infection, sepsis). Heavy purulent-septic, and by the f the more anaerobic infection, which complicated the combined inju

of thigh, even in the absence of secondary hemorrhage forced to produce immediately amputation as only substance for the rescuing of the life of injured person.

Secondary hemorrhages with the pure/clean wound without the expressed inflammatory phenomena did not serve as occasion for a change in that tactics which was common for fresh hemorrhages, i.e., the dressing of the bleeding vessel; furthermore, the more prolonged there was the period after injury, as the those more favorable according to the observations of the surgeons was considered prognosis for the extremities after the ligature of vessel. It was of interest to explain this question, important in the practical sense, on the material of the combined injuries of thigh with the damage to the bone also of vessel.

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For this purpose was made the selection/analysis of all injured with the dressing large vessels not only in connection with belonging the dismantled/selected above groups, but also in particular - depending on the periods of dressing and significance of the damaged vessels (Table 35).

In the literature are in sufficient detail illuminated only

results of the dressing of large vessels after bullet injuries generally (P. A. Herzen, B. V. Punin, N. A. Bogoraz, M. N. Akhutin, S. L. Libov, A. M. Geselevich, B. V. Petrovskiy et al.), but completely there are no data about the injuries of the vessels, complicated by the break of the large/coarse bones of extremity. If we exclude two supplementary groups, then from a number of studied injured people the dressing of vessel was produced in 55 injured people and in one - suture of vessel.

During the primary surgical processing/treatment of wounds the dressing is made 29 times; in injured people, left without the primary surgical processing/treatment, the dressing of vessels in connection with the secondary hemorrhage is produced 8 times; in injured people whose primary surgical processing/treatment was restricted to dissection and carving of wounds, the dressing of vessels apropos of the emergent in the different stages secondary hemorrhages was made 18 times. Is not here connected a small number of injured people, whose dressing of vessels was conducted within the very late periods with the operations/processes apropos of mature/ripe ones aneurism. From the mentioned 55 injured people must attract attention those, in which was bandaged main-line arterial vessel - femoral or popliteal artery. Such there were 41. If we to them add 3 additional injured people in which was not marked the name of the bandaged vessel, but, apparently so/such large/coarse, then the total quantity of injured people with the bandaged main-line vessel will compose 44.

Table 35. Use/application of operations/processes on the vessels with the bullet breaks of femoral bone with the damage of large vessels (absolute number) (author's development).

(1) Группа раненых по характеру первичной обработки ран	(2) Операции								
	(3) сосудистый шов	(4) перевязка сосуда		(5) в том числе перевязана					
		при первичной обработке ран (6)	при последующей обработке ран (7)	бедренная артерия (8)	подколенная артерия (9)	глубокая артерия бедра и вена (10)	несколько крупных артерий (11)	неизвестный крупный сосуд (12)	бедренная вена (13)
(14) Первичная хирургическая обработка не производилась (38 раненых)	—	—	8	7	1	—	—	—	—
(15) Первичная хирургическая обработка без перевязки сосуда (56 раненых)	—	—	18	10	1	3	1	2	1
(16) Первичная хирургическая обработка с перевязкой сосудов (30 раненых)	1	29	—	18	2	7	1	1	—
(17) Всего (124 раненых)	1	29	26	35	4	10	2	3	1

Key: (1). Group of injured people according to the character/nature of the primary processing/treatment of wounds. (2). Operations/processes. (3). vascular suture. (4). dressing of vessel. (5). among other things is bandaged. (6). during primary processing/treatment of wounds. (7). during subsequent processing/treatment of wounds. (8). femoral artery. (9). popliteal artery. (10). deep artery of thigh and vein. (11). several large/coarse arteries. (12). unknown large vessel. (13). femoral vein. (14). Primary surgical processing/treatment was not performed

(38 injured people). (15). surgical first aid without dressing of vessel (56 injured people). (16). Primary surgical processing/treatment with dressing of vessels (30 injured people. (17). In all (124 injured people).

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From this number of injured people (44) with the dressing of main-line vessels relative to 16 was an indication and about the simultaneous dressing of femoral vein, relative to one - popliteal vein.

In actuality a number of associating wounds of veins and their dressings, probably, is more than it was possible to establish/install. From the number of injured people indicated the dressing of artery for the elongation/extent was produced 8 times.

The periods of the dressing of vessels were very diverse in the separate groups. Thus, in the third group of injured people, where the dressing of vessels was conducted in the process of the primary surgical processing/treatment of wound, it in all injured people was almost realized into the first or second day after injury.

Considerably more lately was conducted ligation of vessels in injured people, by which in the foremost stages it was not conducted processing/treatment of wounds, and in those which were subjected to

the primary processing/treatment of wound without intervention on the vessels: only in 3 of injured people this dressing was produced on the 2nd or 3rd day after injury. In remaining it was conducted within the following periods: from 5 to 10 days - in 4, from 11 to 20 days - in 7, from 21 to 30 days - in 4 and from 30 to 40 days - in 4 injured people.

The close outcomes after the dressing of main-line vessels in different groups were not completely identical. In the third group where was conducted early ligature of vessels, the most frequent complications they were: ischemic gangrene (in 10 injured people of 22) and gas infection (in 8 injured people). From those remaining in the living 13 injured people only in one extremities it was preserved.

Are so/such sad on the whole issues and in the two-following groups (22 injured people); however, the character/nature of the begun complications was here several different. Of 22 injured with the late dressing main-line vessels in 6 was stated/established ischemic gangrene and in one more gangrenes only of the phalanges of three toes; only in two was observed gas infection; as a result of 11 that remaining in the living ones in 4 injured extremity it was preserved.

Table 36. Most important complications and issues with the combined injuries of thigh with the damage to the bone also of vessels in connaction with the pericds of the dressing of main-line vessels (absolute number) (author's development).

(3) Перевязка после ранения	(1) Осложнения		(2) Исходы		
	(4) ишемическая гангрена	(5) газовая инфекция	(6) умерло	(7) конечность сохранена	(8) конечность ампутирована
(9) В первые три дня (25 раненых) . .	11	9	9[1]	1	15
(10) Позже 3 дней (19 раненых)	5[2]	1	11[3]	4	4[4]
(11) Всего (44 раненых) . . .	16	10	20	5	19

Key: (1). Complications. (2). Issues. (3). Dressing after injury. (4). ischemic gangrene. (5). gas infection. (6). died. (7). extremity is preserved. (8). extremity is amputated. (9). In first three for (25 injured people). (10). 3 days later (19 injured people). (11). In all (44 injured people).

FOOTNOTE [1]. Three injured people died of the wound shock and the primary blood loss.

[2]. One has injured gangrene of phalanges of three toes.

[3]. Among other things 7 injured people they died from consequences of

secondary hemorrhage, which was being observed to dressing of vessels.

*. Among other things 2 have injured amputation in direct connection with hemorrhage. ENDFOOTNOTE.

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From the analysis of given data it appears, that those injured people, whose dressing of main-line vessels was conducted within later periods after injury, had the specific tendency toward the decrease of the frequency of the onset of gangrene (Table 36).

Thus, if we combine all injured people, whose dressing of vessels was conducted during the first three days, then of 25 people ischemic gangrene it was observed in 11, i.e., almost in half, and gas gangrene - in 9 injured people.

These data, on one hand, again characterize entire severity of the primary damage/defeat of this group of injured people, on the other hand, they attest to the fact that the severe shock state and anemia, with which were supplied/delivered/fed into these injured people from the field of breakage to the foremost stages of evacuation, unfavorably reflected on the state of extremity after the

early dressing of the main feeding vessel. The weakened organism detected insufficient ability for the reduction of the collateral blood circulation of extremity, result of which proved to be weak resistivity to the virulent anaerobic infection.

Of 19 injured people, in which the dressing of vessels is produced within the later periods, ischemic gangrene is stated/established in 5, i.e., only in one fourth of the injured people, if we do not consider one more, in which the phenomena of ischemia led only to the necrosis of the phalanges of three toes. Gas infection is noted only in one injured person. Then in 9 injured people should be noted heavy consequences as a result of the secondary hemorrhage (lathal outcome or amputation), which it was impossible to prevent by the ligature of vessel, since these hemorrhages often occurred unexpectedly for the surgeons.

By given data was confirmed the large danger of the development of the gangrene of extremity after the dressing of vessels in the early period after injury and the decrease of this danger in the later period.

On the state of the extremity had an enormous effect and those therapeutic measures which were applied after the dressing of vessels, and also the periods of the stay of injured people in the

hospital, where he was shown/rendered surgical aid. First of one must bear in mind the surgeon's stability in the fastest recovery of normal blood pressure and in the reimbursement of blood loss, and also his measure with the outlined threat for retaining/preserving/maintaining the viability of extremity.

Exceptional value in this respect had, as is known, the blood transfusion in the sufficient ones of a quantity. With the familiarization with the histories of disease/sickness/illness/malady frequently was noted the insufficient use/application of blood transfusions. Thus, of 44 people after the dressing of main-line vessel only 27 was produced the blood transfusion. A considerable number of transfusions was conducted by those injured persons, whose dressing of vessels was undertaken under conditions of army and front rear after the the secondary hemorrhage. In separate injured people the blood transfusion was conducted repeatedly at the considerable doses; however, in intensely exsanguinated people it did not always reach success. Of 22 injured people, whose dressing of main-line vessel was conducted in the process of the primary surgical processing/treatment of wounds (third group), the blood transfusion produced only by 9 (of them two already next day after the dressing of vessel); the applied for the transfusion quantity of blood is completely insufficient and was equal to usually 250.0 and only in individual injured people it reached 500.0.

Of 9 this injured group which died, the blood transfusion was produced only by 3, moreover one next day after the ligature of vessel.

In injured people with the preserved extremity the blood transfusion found more wide application. Thus, of 5 injured people, where was produced the ligature of femoral artery, 3 were produced are the repeated transfusions of blood and blood replacement fluids/liquids in considerable quantities, and to the fourth - single blood transfusion right after operation/process and in the evening the same day the infusion of the blood-replacement fluid/liquid.

Rational immobilization was important link in the general/common/total complex of therapeutic measures. Heavy consequences came to light after use/application according to the usual template/pattern of M. M. Diterichs's splint, who caused by tightening of collateral vessels and compression in the region of rear of feet. Its use/application was observed in 16 injured people of 22 and, probably, in 4 more, where was noted the imposition of splint without the indication of the name. M. M. Diterichs's splint

in the majority of injured people remained during a different period, but only in a few (in 3) not had severe complications, it was substituted subsequently by anechoic gypsum bandage.

If in many injured people to surgeon was not completely clear the effect of the applied method of immobilization on the nourishment of extremity, then in separate injured people it proved to be very exponential. Thus, in injured ч. on the 3rd day after the dressing of femoral artery and vein on the rear of the feet, on the spot for fixation by the bandage of the bottom plate of M. M. Diterichs's splint, is discovered the numbness of the skin with the size/dimension 8x4 of cm.

After the dressing of vessel, produced within the later periods, usually under conditions of back hospitals, the character/nature of immobilization proved to be already different. Here predominated gypsum, more frequent circular bandages. They provided extremity rest, but created known difficulties for the observation of the state extremities and wounds after the ligature of vessel.

In 9% injured people, by which the dressing of vessel and amputation during the primary processing/treatment were not conducted and the combined character/nature of injury remained unexplained, the procedure of immobilization, apparently did not differ from the same

with the uncomplicated breaks of famoral bone.

Great use/application in these injured people found the splint of M. M. Diterichs, applied in 32 injured people: Thomas-Vinogradov's splint was applied in 5 injured people, the splints of Cramer - in 14, splints without a precise designation - in 17, plywood and improvized - in 4; plaster cast was applied in 3 injured people; method of fixation remained unknown in 19 injured people. In many of these injured people (in 32, except the mentioned above 3 injured people) in the subsequent stages before the appearance of complications was applied circular gypsum bandage.

During the treatment of these precisely injured people was revealed/detected a deficiency/lack in the anechoic gypsum bandage - difficulty of check of the appearance of secondary hemorrhages and in connection with this frequent delay with the rendering to surgical aid.

Injured A. it arrived in the the front to the evacuation hospital 24/IX 1942, on the 16th day after the perforating bullet injury of left thigh in the lower third with the fragmented break of bone. On DMP was produced the dissection of exit wound on the internal surface of thigh and the cessation of hemorrhage from v saphena. After the admission the inlet on the external surface of

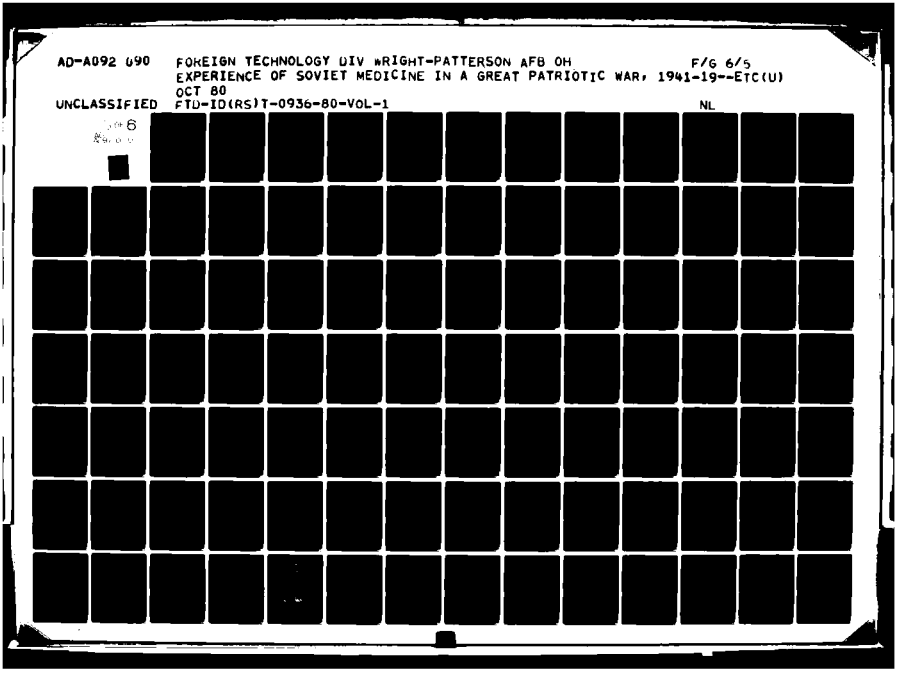
thigh under the scab, exit - that split (by size/dimension 6x3 - on the internal surface granulates well, with suppurative discharge.

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On the 20th day after injury gypsum bandage became rapidl get wet the blood which soaked through to the bed and under th Attendant nurse, detecting hemorrhage, brought hand under gyps and squeezed femoral artery and in this position she delivered injured person into the medical dressing room. Is produced bin femoral artery of higher than the available suppurative wound, immobilization of extremity by M. M. Diterichs's splint with t light stretching, with warning/prevention of the possibility o compression in the regicn of feet; repeated blood transfusions the 11th day on the admission is again superimposed hip gypsum bandage, and after 3 weeks injured person in a good state is evacuated into the rear.

Based on materials of the author's development, of 35 inj people, which superimposed a circular gypsum bandage with the combined injuries of the thigh where the vessel was not bandag during the primary surgical treatment or the latter generally absent, in 7 was detected secondary hemorrhage under the anech

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gypsum bandage. Only in one of injured person this hemorrhage did not have an essential effect on the course of the post-wound process, since it was not heavy, in 2 others is noted after hemorrhage the heavy state (in one - heavy collapse).

Injured K. with the described complication it was rescued only by timely amputation, and in 3 injured people arose the irreversible collapse with the lethal outcome.

Hence with the suspicion to the damage of vessel ensued/escaped/flowed out the need for failure of the anechoic gypsum bandage, if was absent surgical treatment with the dressing of vessel, and also within the next few days after the dressing of the main-line vessels of thigh, until there was a threat of the loss of the viability of extremity and risky complications of infection.

Best in this period it proved to be immobilization of skeletal/skeleton stretching or massive gypsum casts (B. V. Petrovskiy, S. P. Vel'yamovskiy), and sometimes even splints of Cramer which before the transportation of injured person were changed to the circular gypsum bandage or to M. M. Diterichs's splint, without strong tightening and stretching of feet, which most was realized well for the short gypsum boot, laid on the foot and the extremital half shin for a day or two before evacuation. With this

preliminarily due to the state of injured person and form/species of the exposed fingers/pins were certified in the happy state the extremities.

After the onset of the first signs of ischemia of extremity (cooling of feet, change in its stain/staining, disturbance/breakdown of sensitivity) were undertaken the most energetic measures for the fastest the peripheral pressure increase and to the reduction of the blood circulation of extremity. In this respect were efficient the massive repeated and drop transfusions of blood and blood-replacement fluids/liquids, the elimination of the compression of foot by bandages, the advisable position of extremity with the elimination of pressure on the region of nates. Is noted effect from the use/application of physical therapy procedures (currents of UHF, ionophoresis, diathermy, etc.), novocaine and alcoholic blockade of sympathetic nervous system.

By certain authors successfully was applied periarterial sympathectomy and removal/distance of lumbar sympathetic ganglia/nodes (F. M. Plotkin, N. I. Machs). Very effective for prophylaxis of gangrene proved to be the introduction to the peripheral cut of the artery of the conserved blood, produced once during the ligature of vessel (L. Ya. Leyfer) or it is drop (B. V. Ognev). On V. N. Shamov's proposition during the operation/process

was conducted the dissection or the carving of that damaged the section of artery (V. G. Weinstein, M. I. Razenberg, V. K. Bayev, I. K. Piniya et al.) and the dressing of the associated vein according to V. A. Oppel'.

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Unfortunately, these measures were applied not always, where this is necessary. Sometimes with the strong disorder of collateral blood circulation any measures proved to be useless.

One cannot fail to mention and about other unfavorable moments/torques, which influenced results of operation with the dressing of blood vessels, as is evident from the following observation.

In the injured person III on the arrival during the day of injury into the army evacuation hospital attendant doctor, obviously, in connection with the opened/discovered hemorrhage was restricted to dry tamponade of the unfinished wound and to imposition of the pressure bandage. Next day was only produced the primary surgical treatment of wound with the dressing of the damaged femoral artery. The day after treatment was discovered the outbreak of anaerobic infection. In spite of the produced amputation of thigh, during the

same day began lethal cutcome.

As showed the experiment/experience of the Great Patriotic War, tight tamponade of wound, which was being applied for the cessation of hemorrhage, greatly frequently led to the development of anaerobic infection.

Finally, it is important to emphasize the negative role of premature evacuation. Injured people, by which the amputation of extremity was not conducted, during the long time were detained in the foremost stages, especially after produced interventions on the vessels. of 9 injured people, which were subjected in the early periods to the dressing of femoral artery and later than the amputation, almost all were evacuated very early - on the 2nd, 3rd and 4th day after the dressing of vessels. This was reflected in the nourishment of extremity and influenced the development of ischemic and gas gangrene.

The treatment of the complications of ischemic gangrene was conducted according to the general/common/total rules. Only with the tranquil flow of wound and the insignificant necrobiotic phenomena was allowed/assumed conservative treatment and duration of demarcation under the condition for careful observation of the injured person and careful immobilization of extremity.

With significant phenomena of infection in the wound one ought not to have accelerated amputation, since frequently the picture of ischemic gangrene was rapidly changed by the picture of the gas gangrene or sepsis, which, unfortunately, anticipated/led sometimes surgeon's intervention.

Of 11 observed by the author injured people with the bullet break the thighs and the damage of vessels 6 arrived with the complications. In 5 of them there were phenomena of ischemic gangrene, including in one beginning alone. The replacement of N. N. Diterichs's splint to the conveniently arranged splints of Cramer, and also the taken urgent measures for elevating of blood pressure and improvement in the general state helped to completely eliminate ischemic phenomena in this injured person (with the incipient gangrene).

Another injured person, who entered from the expressed by picture gangrene of feet after the ligature of femoral vessels on DMP, it perished from the embolism of pulmonary artery on the operating table to the beginning of operation/process. remaining 3 were subjected to amputation; of them passed away one from the connected gas infection. The sixth injured person arrived with far

visited gas infection and passed away, in spite of the produced amputation.

In the presence of fluctuating hematoma and in the absence of the phenomena of the expressed infection and threat of gap was allowed/assumed expectant behavior for the purpose of relating operation/process for the later period - in the stage of mature/ripe aneurisms and under calmer back conditions.

Under the observation of the author in the evacuation hospital of front it was located injured D. with the perforating bullet injury on the boundary of upper and middle third of thigh with the break of femoral bone, in which with the original inspection was discovered fluctuating hematoma of femoral artery.

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Was applied cautious stretching on Boehler's splint during the gypsum boot, superimposed to the foot and lower third of shin, and is established/installed observation of the patient. Of pains in the extremity, vascular neoplasm and edema of the thighs, which were being observed during the first 10 days, subsequently gradually decreased. In the course of the month the break was consolidated; it was formed aneurism with size/dimension of a large egg. Injured

person in a good state in the hip gypsum bandage is evacuated into the rear.

Infected fluctuating hematoma, frequently inclined to the heavy secondary hemorrhages, required urgent intervention, which with the simultaneous break of femoral bone more frequently was reduced to the amputation of thigh.

The author twice observed the combination of combined wounds of thigh with the gas infection against the background of which appeared secondary hemorrhage. In one injured person was immediately produced the amputation with the favorable outcome. In view of the fact that second injured person from the amputation it refused, it was necessary to be restricted only to half-measure - the dissection of wound and the dressing of vessel. The hemorrhage through several days was repeated in the presence of anaerobic edema. Although at this time the injured person consented to amputation and it was produced, followed nevertheless lethal outcome.

As far as "mature/ripe ones are concerned" the aneurism, then the treatment of this complication was conducted according to the common rules in the conditions of back hospitals, moreover by this time in the majority of those wounded has already been noted the consolidation of break.

When after the damage of vessel and bone it was possible to avoid amputation, injured people needed prolonged and careful treatment for eliminating of phlegmons and flows, osteomyelitis, contractures and other complications, in particular, the consequences of the damages of nerves.

Besides surgical interventions, very important role in the treatment of these complications played different physical therapy procedures and the therapeutic exercise.

Outcomes.

Are represented below the issues of the combined injuries of thigh with the damage to the bone also of vessel on the material of author's development for the groups of injured people examined with respect to the character/nature of primary surgical treatment.

Table 37 entirely reveals/detects the very serious character/nature of this injury consequence of which was the high lethality and crippling (from observed 200 people it remained into living 117 people, of them 104 lost extremity). Most favorable in the relation to the issues (if we do not consider supplementary groups)

proved to be injuries, with which was produced the amputation during the primary treatment (of 76 it remained in living of 51, i.e., two thirds of injured people). Almost identical proved to be issues during the primary surgical operation of the vessel (of 30 it remained in living 18) and without the dressing of the same (of 56 injured people it remained in living 34). However, in the relation to the retention/preservation/maintaining extremity the group of injured people with the primary dressing of vessel had certain, true, very small advantage before the remaining. The worse issues in both relations were observed in the group of injured people, where the primary surgical treatment completely was not performed (of 38 people it remained in living 14, moreover extremity was preserved in 3). The reason for this was, on one hand, the frequency of such risky complications in this group as secondary hemorrhage, on the other hand, into this group, as about this it was said, hit many gravest injured people, who were in the shock or strongly anematized state to which even it was not possible to render primary surgical assistance.

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Estimating the issues of the dismantled injuries as a whole, it should be noted that these issues to a considerable extent deteriorated due to the injured people, frequently delivered to the foremost stages of medical service in the clearly hopeless state,

caused by the severity of their injury and by the consequences of primary blood loss. About this testifies the fact that more than half lethal of issues (42) falls on the first two days after injury, including in 28 injured death it began during the first day, and in 14 - during the following days. A great number of such injured people (early dead persons), as this logically escape/ensues from the severity of injury, falls to the group with the amputation of extremity during the primary treatment (19 of 42 dead persons during the first 2 days) and to the first group where it was not at all primary the treatment of wounds - 13. Only 10 fatal results were observed among the injured remaining two groups (with the dressing of vessel and without its dressing). It is necessary to note that in the group where is produced the amputation of extremity during the primary treatment, besides these directly those connected with the severity of the primary trauma of early lethal outcomes, were observed only 6 lethal outcomes, of which one was caused by associated miliary tuberculosis, and 5 remaining - by anaerobic infection, which was most frequently becoming apparent before the amputation. This testifies (which is confirmed also by the analysis of the clinical course of this group) about a good vital prognosis of the afterward produced during is primary the treatment amputation.

Table 37. Issues of the bullet breaks of femoral bone with the damage of large vessels in the different groups of injured people in connection with the character/nature of surgical treatment (absolute numbers) (author's develcpment).

(3) Группа раненых	(1) Исход		(4) Всего	(2) В том числе	
	(4) умерло	(5) выписано		(7) выписано с культей после ампутации бедра или голени	(8) выписано с сохранением конечности
(9) I группа (раны первично не обработаны)	24	14	38	11	3
(10) II группа (раны обработаны, но без вмешательства на сосудах)	22	34	56	28	6
(11) III группа (раны первично обработаны с перевязкой сосудов)	12	18	30	14	4
(12) IV группа (ампутация при первичной обработке)	25	51	76	51	—
(13) Итого	83	117	200	104	13
(14) V и VI контрольные группы (с повреждением второстепенных сосудов или с неполным переломом бедренной кости)	7	18	25	6	12

Key: (1). Issue. (2). Among other things. (3). Group of injured people. (4). it died. (5). it is discharged. (6). In all. (7). it is discharged with a stump after amputation of thigh or shin. (8). it is discharged with retenticn/preservation/maintaining of extremity. (9). I group (wounds not primarily treated). (10). II group (wounds are processed, but without intervention on vessels). (11). III group (wounds are primary processed with dressing of vessels). (12). IV group (amputation with primary treatment). (13). Altogether. (14). V and VI control groups (with damage of secondary vessels or with

incomplete break of femoral bone).

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Of the second and third group a great number of lethal outcomes was conjugated with different complications, which were discussed above. In a number of reasons for 35 lethal outcomes, which were being observed in three first groups after 2 days, great value had secondary hemorrhages (11), gas infection (10) and sepsis (8); for the combination of complications and shock it fell on 2 injured people, to the heavy anatomical destruction and the disease of internal organs/controls for one injured person.

As can be seen from Table 37, the majority of injured people was discharged with the amputation stump, which in 9 people was only unsatisfactory.

The frequency of the amputations, produced most frequently in the early stages of wound process apropos of heavy injury and different complications, subsequently period conditioned a large quantity of reamputations (in 50 injured people).

It was possible to preserve extremity 13 for injured people, which composes 6.5o/o of the total number of observed injured people

(200), or 10.5o/o of the number of injured people (124), which not produce primary amputatien.

The retention/preservation/maintaining extremity after so severe a trauma has high value and requires the examination of the facts which contributed to the retention/preservation/maintaining extremity. First of all this relates to the injured people with most the lungs (and they are examined) by the means of the injuries: in 10 - injury was plotted/applied by bullet. The majorities of injuries were through, simple, single, without the associated damages of nerve trunks and injuries of other regions. Two injured breaks had according to the type of those packed in. In this group the damage to a deep artery of thigh had the large specific gravity/weight (in 4 of 13 injured people), being in the second place after the injury of femoral artery (8 injured people). In one injured person was a wound of popliteal artery.

From the point of view of the applied surgical procedure this group was not independent. In this group are given the injured people with the successful issues after different receptions/procedures of treatment (dissection and carving of wounds, dressing of vessels, even abstention from any operational textbook), with exception of the method of primary amputation.

The recognition of the actual character/nature of injury in these wounded was not characterized by the special accuracy: of 13 injured people in 5 was only discovered the damage of vessel during the primary surgical treatment. In 3 injured damage of vessels it was identified already after the occurrence of hemorrhages which followed on the 8-10th day (from the femcral artery) and on the 22nd day after injury (from a deep artery of thigh). In 4 injured people about the presence of the damage of vessel it became kncwn only after the detection of fluctuating hematoma or aneurisms in the region of injury (in the odnogcth cn the 11tn day, in another - on 35th day and in two more - 2 months after injury), while in one - after the numbness of toes.

In connection with described complications from these 13 injured dressing of vessels it was produced in 9; in the majority of injured people the ligature was superimposed within the late periods: during the first days after injury during the primary surgical treatment only in 4 injured people, between the 10th and 13th day after injury - in 3, on the 22nd day - in one, in 2 months - in one. In these all injured after the dressing of vessel expressed ischemic phenomena it did not appear. Only in cne injured person after the dressing of femoral artery and its deep branch it began the gangrene of some toes and other ischemic discrders, but extremity was preserved.

The dressing of the femoral artery, having fundamental importance for the nourishment of extremity, was produced only in 5 injured people of 8 with the damage to this artery, including 3 times together with the similar/analogous vein even one time together with a deep artery of thigh.

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In the relation to the periods of ligation of femoral artery only in one injured person it was produced on the 2nd day after injury during the it was conducted beginning from the 10th day even later (on the 10th, 11th, 13th day, also, 2 months after injury). In 3 injured people with the damage to femoral artery and in one injured with the damage to popliteal artery any surgical intervention it was not at all produced; secondary hemorrhages in these injured people it did not appear.

In one of these injured people during the primary surgical treatment, produced in KhPPG on the 4th day, the damaged femoral artery proved to be thrombosed. In another injured person 2 months after injury was discovered arteriovenous of the aneurism of femoral vessels with the tranquil flow, and it was discharged from hospital without the operation/prccess. In the third injured person high of the aneurism of femoral artery was discovered on the 35th day after

injury; in the process of observations of aneurism it underwent full/total/complete reverse development. The latter/last (fourth) injured person, delivered from the guerilla detachment with the bullet injury in the region of knee joint with the probable injury of popliteal artery, already had the phenomena of the ischemic gangrene of three toes; wounds in the region of joint healed faultless and the local signs of the damage of vessel, if we do not consider certain disturbance/breakdown of peripheral pulse (arteries of feet), it was not revealed/detected.

Deserve attention applied in these injured people methods of immobilization. M. M. Diterichs's splint was applied only during the first days after injury. After this usually following surgical treatment of wound or even if it was not conducted, was laid anechoic gypsum bandage. However, with the application of this dressing without the preliminary surgical treatment of the damage of vessel in 3 injured people under the gypsum bandage arose the secondary hemorrhage, which in two of them carried extremely heavy character/nature.

In injured P. the first hemorrhage arose on the 8th day after injury. The revision of the wound through the cut out in the gypsum bandage window discovered the blood clots after removal/distance of which the hemorrhage no longer recurred and revision on this was

finished. However, 5 days after this, already in the subsequent stage, hemorrhage again arose. Gypsum was taken/removed, produced the expansion of wound, exposed and bandaged the damaged femoral artery.

In injured R. profuse arterial hemorrhage from the wound of thigh from behind, that arose under the anechoic gypsum bandage on the 22nd day, rapidly led to the heavy collapse before to injured person could being shown/rendered first aid - was taken/removed gypsum and was superimposed tourniquet, and then under ether anesthesia was produced exposure and ligation of a deep artery of thigh.

The majority of the injured people of this group by the considerable period they were detained in the foremost stages, and after the dressing of vessels in one or the other stage remained here for a prolonged time for the treatment.

In more earlier periods were evacuated injured people with the dressing of a deep artery of thigh. Thus, for instance, injured A. after the dressing of the deep artery on DMP during the day of injury after 5 days was evacuated in PPG with the immobilization of extremity in the splint M. M. Diterichs, after 3 days - into following PPG, hence after 2 days - into the evacuation hospital where was superimposed "coxitic" gypsum bandage. Through 2 weeks the

injured person was evacuated into the rear.

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Only in relation to one of the injured people of the group in question it was shown the use/application of the styptic tourniquet after 1 hour of 45 minutes after injury. by many injured person was conducted the transfusion of blood and blood-replacement fluids/liquids in the fcremost and subsequent stages.

The facts pointed cut above could not but be reflected favorably in the general state of injured person and victim of extremity in the most critical period after injury and dressing of the vessel when was solved a question about the preservation of extremity, but frequently also the life of injured person himself.

All these injured people underwent prolonged hospital treatment, especially after the dressing of femoral artery (from 257 to 483 days). Within the period of the stay in the hospital they repeatedly underwent surgical interventions apropos of appeared complications. Thus, injured L., besides early operation/process - the surgical working of wound and dressing of vessel, it transferred four additional interventions, including to three times sequestrectomy; injured B. it also underwent repeated sequestrectomies, etc.

The periods of treatment noticeably were shortened in the injured people who were discharged without surgical intervention with the unremoved consequences of the injuries (osteomyelitis, aneurism). This group characterizes the most successful outcome after this heavy damage/defeat. However, in spite of the retention/preservation/maintaining of extremity, almost all observed injured people were discharged from hospital with one or the other consequences of the injuries: with difficulty of movement and sharp limitation of motions in the joints (mainly knee), shortening of extremity (7 people), presence of osteomyelitis and fistulas (3 people). In 2 injured people were amputated several fingers/pins on the foot apropos of ischemic gangrene. All this to a considerable extent decreased the obtained effect.

Represented in this section data have vital importance for the substantiation of several conclusions/derivations. First, is confirmed the special severity of injuries with the bullet breaks of femoral bone with multiple failure of large vessels, but at the same time, in spite of the old views and the opinions of some contemporary authors (G. M. Shchekotov, Yu. M. Simpson and V. B. Neyshtadt), is established/installed (on the large material) the possibility of retaining/preserving/maintaining the extremity with these injuries,

about which told P.A. Crimea even in the period of the first world war, keeping in mind aneurisms. In the second place, documentary is revealed/detected the value of a number of factors, which adversely affected the course of these injuries, and, on the contrary, becomes obvicus the need for mastering and more wide application of a series/number of the new therapeutic methods, based on the contemporary understanding of the pathogenesis of disorders with the vascular injuries (massive blood transfusion, desympathization, rational immobilization, infusion of the conserved blood into the peripheral end of the artery). Thirdly, taking into account the unsatisfactory issues of the treatment of described wounds, are made by these justified attempts at the more wide application of a vascular suture on the femoral and popliteal artery in the field circumstances; however, only under favorable to that conditions (early delivery/procurement of injured person, small pollution/contamination cf wound in the absence of crushing of tissues and large diastasis of the ends of the vessel, possibility of the prolonged treatment cf injured person in this stage with the use/application of advisable immobilization). Finally, one cannot fail to note that vast concern and efforts/forces which were applied by surgeons and service personnel for survival and extremity by these injured person.

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DAMAGES OF BLOOD VESSELS WITH BULLET BREAKS OF THE BONES OF SHIN.

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The data represented in the relation to the combined damages of femoral vessels and bone, and drawn in this case conclusions in many respects are valid also with respect to the analogous injuries of shin. However, the special features/peculiarities of structure and function of shin conditioned some differences in the clinic, the course and the issues of these damages.

It was necessary to subject to more detailed examination some relating here questions, without being satisfied by the general/common/total characteristic of these injuries which was given in the general/common/total part. For this purpose were also used the materials of the author's development of the histories of the disease/sickness/illness/malady of the military medical museum.

The selected for the study material is divided into two groups, into each of which it is referred on 200 histories of disease/sickness/illness/malady. The first group includes the injuries with the damages only to one bone and one or both vessels of shin and injury with damage of both bones of shin and only one of the main feeding vessels - posterior or front/leading tibial artery.

The second group includes the injuries with damage of both of bones and both vessels of shin. Injuries with the incomplete (edge/boundary, perforated) break of bone were when possible excluded from development.

Were examined additionally several histories of the disease/sickness/illness/malady of injured people with the damage of the bones of shin and popliteal artery, which was dictated by the need of the account not only of pathoanatomical differences, but also dissimilar attitude of surgeons toward this category of injured people in the first stages of evacuation.

Damages to one either both of bones and one vessel or one bone and both vessels.

Statistical survey/coverage.

The damages to one bone composed 58.5o/o, both bones - 41.5o/o (Table 38). Far not in all injured people was refined the name of the damaged vessel - in 37.0c/o it remained unknown. Remaining 63.0o/o damaged vessels had: posterior tibial artery in 34.5o/o, front/leading - in 25.0c/o, both these of vessel and injury of popliteal artery - in 3.5o/o.

31.0o/o of injured people had the associated, sometimes multiple injuries of other regions of body, most frequently lower extremities, while in separate injured people - also upper extremities, persons, breasts, etc.

In 23.5c/o of injured people are recorded the associated damages of the nerve trunks, which was reflected in the clinic, the course and the issues of the injuries in question, and also in surgeon's tactics with them.

Almost the half the injuries of this group proved to be bullet (46.5o/o). During the damage only to one bone predominated bullet injuries (63 of 117), whereas in the groups of injuries damage of both bones bullet injuries met only in 30 of 83.

According to the character/nature of injury in this group the distribution, was the same as with all fractures of the bones of shin (Vol. 15): perforating injuries - 68.5o/o, blind - 21.0o/o, tangents - 3.0o/o, multiplication or breakaway - 7.5o/o.

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Table 38. Distribution of injured people with the bullet break of the bones of shin and the damage of vessels according to the water and to the character/nature of injury and according to the type of injured vessel in connection with the different combination of the injuries of bones and vessels (author's development).

(1) Группа раненых	(2) Сочетания ранений костей и сосудов	(3) Вид ранения		(4) Характер ранения			
		(7) пулевое	(8) осколочное	(9) сквозное	(10) слепое	(11) касательное	(12) отрыв или размозжение
(19) С повреждением одной кости и одного сосуда	(20) Большеберцовая кость и один сосуд	36	21	37	17	2	1
	(21) Малоберцовая кость и один сосуд	25	28	40	11	—	2
	(22) Итого	61	49	77	28	2	3
(23) С повреждением одной кости и двух сосудов (или одного магистрального)	(24) Большеберцовая кость и оба сосуда или подколенная артерия	2	2	3	—	—	1
	(25) Малоберцовая кость и оба сосуда или подколенная артерия	—	3	1	—	2	—
	(22) Итого	2	5	4	—	2	1
(26) С повреждением двух костей и одного сосуда		30	53	56	14	2	11
	(27) Всего	93	107	137	42	6	15
	(28) В процентах	46,5	53,5	68,5	21,0	3,0	7,5

cont.

(5) Раненый сосуд				(6) Итого в каждой группе	
задняя (13) большеберцовая артерия	передняя (14) большеберцовая артерия	обе артерии (15)	вид сосуда не установлен (16)	абсолютные цифры (17)	в процентах (18)
18	17	—	22	57	28,5
28	12	—	15	53	26,5
44	29	—	37	110	55,0
—	—	4	—	4	2,0
—	—	3	—	3	1,5
—	—	7	—	7	3,5
25	21	—	37	83	41,5
69	50	7	74	200	—
34,5	25,0	3,5	37,0	—	100,0

Key: (1). Group of injured people. (2). Combinations of injuries of bones and vessels. (3). Means of injury. (4). Character/nature of injury. (5). Injured vessel. (6). Altogether in each group. (7). bullet. (8). fragmentation. (9). through. (10). blind. (11). tangent. (12). breakaway or multiplication. (13). posterior tibial artery. (14). front/leading tibial artery. (15). both arteries. (16). type of vessel is not established/installed. (17). absolute numerals. (18). in percentages. (19). With damage to one bone also of one vessel.

(20). Tibia and one vessel. (21). Fibular bone and one vessel. (22). Altogether. (23). With damage to one bone also of two vessels (or one main-line). (24). Tibia both vessels or popliteal artery. (25). Little tibial bone both vessels or popliteal artery. (26). With damage of two bones and one vessels. (27). In all. (28). In percentages.

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Clinic (diagnosis).

In view of the complex anatomical relations the injuries of the vessels of shin frequently were not diagnosed, even in spite of sufficiently strong hemorrhage after injury and during the primary surgical processing/treatment of wounds. The author had a series of observations when injured people arter this not final in the preceding/previous development stage of wounds were rapidly evacuated and frequently they arrived into the field mobile hospital in the heavy state.

In injured V. with the perforating bullet injury of shin, with the break of bone during the dissection of wound openings/apertures on DMP was discovered and emptied large hematoma. Injured person was delivered with the strongly gotten wet blood by bandage and weak

pulse. During the urgent operation/process (secondary in this day) was bandaged the damaged posterior tibial artery. After 5 days the injured person is evacuated in a good state.

The part of such injured people did not undergo surgical processing/treatment in the preceding/previous stages, which, obviously, was also connected with the survey of the injuries of vessels.

Meanwhile, the clinical picture of the described injuries was sufficiently characteristic. In the absence of hemorrhage was noted the sharp thickening of gastrocnemius region with the bulging out from the wound muscles, sometimes with the blood clots. The pulsation of posterior tibial artery usually was absent or it was noticeably weakened. With the most frequently observed perforating injuries the projection of wound canal intersected a deep division of gastrocnemius region. One of the wound openings/apertures most frequently was arranged/located on the internal surface of shin, and another - on the external or antercexternal surface. Frequently suffered in this case tibial or fibular nerve.

As the indicator of the correctness of the recognition of the character/nature of injury in the foremost stages of treatment served the applied procedure of the primary surgical processing/treatment of

wounds, since, it is doubtless, the identified damage of vessel had to dictate to surgeon singularly reasonable tactics - the dressing of vessel.

Belated diagnosis could not but influence in the part of the injured people for the development of complications, in particular, secondary hemorrhages.

Early complications began to become apparent already in the army region, but great development they received in the army and front region, again decreasing in the deep rear. Most terrible of them were secondary hemorrhages, gas infection, ischemic gangrene and rapidly current sepsis; other complications (festering in the wound, phlegmon and flows, arthritis and osteomyelitis) were placed in the category of less heavy ones.

The frequency of early complications in the different groups of injured people is visible from Table 39.

Secondary hemorrhages were observed in 22.0o/o of injured people, moreover in 4.5o/o they were noted as repeated. During the damage to one bone also of one vessel secondary hemorrhages were observed somewhat more frequent (26.0o/o) than during the damage of two bones and one vessels (17.0o/o), when as a result of the large

anatomical destruction the frequency of primary hemorrhages exceeded the frequency of secondary hemorrhages. The periods of hemorrhages varied in the large limits: from the first day of injury to 2 months of 8 days, but more frequently related to the first 10 days (in 26 injured people), beginning mainly from the 3rd day, i.e. they were early secondary hemorrhages. In time from 11 to 20 days of hemorrhage they were observed in 7 people, in 9 injured people - it is later than 20 days. In 2 injured period of hemorrhages it was not shown.

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The periods of repeated hemorrhages were almost the same - they often were observed within the next few days or with the gap/interval 2-3 days after the first hemorrhages. Especially the parts of the hemorrhage were noted in injured people, where was not identified the damage of vessel or remained unknown the name of the damaged vessel.

Interventions which were undertaken with so terrible a complication, they were diverse (Table 40).

In the first place proved to be the dressing of vessels; it was produced in 26 injured people of 44. In 7 injured people it was necessary to resort to heavier intervention - amputation. In 11 injured surgical intervention it was not produced; it was unnecessary

due to the insignificance of hemorrhage or hopelessness of injured person.

Converting/transferring to the issues of these interventions, it should be pointed out that the dressing of vessels in this category of injured people with the secondary hemorrhage gave most favorable results, since after it lethal outcome began only in 3 injured people, besides in one injured person it depended not on intervention itself, but on the transferred blood loss; in another the reason for death was sepsis, which developed within the late period after intervention, and in the third - anaerobic infection. In 2 injured people is noted the rapidly current sepsis, which ended by recovery, in this case in one injured person is produced the amputation. Gas infection after the ligature of the bleeding vessels was observed in 6 injured people; they all, except one, after amputation recovered.

After the dressing of vessels with the secondary hemorrhage of 23 that remaining in the living ones in 6 injured people was required the amputation apropos of the begun complications.

Table 39. Early complications in the different groups of injured people with the bullet break of the bones of shin and with multiple failure of vessels (absolute number) (author's development).

(1) Группа раненых / (2) Раннее осложнение	(3) Вторичное кровотечение	(4) Газовая инфекция	(5) Ишемическая гангрена	(6) Сепсис остро текущий	(7) Прочие осложнения
(8) С повреждением одной кости и одного сосуда (110 раненых)	29	15	4	8	1
(9) С повреждением одной кости и двух сосудов (или одного магистрального) (7 раненых)	1	1	3	—	1
(10) С повреждением обеих костей и одного сосуда (83 раненых)	14	29	17	10	3
(11) Всего (200 раненых) . . .	44	45	24	18	5
(12) Частота осложнений в процентах . .	22,0	22,5	12,0	9,0	2,5

Key: (1). Group of injured people. (2). Early complication. (3). Secondary hemorrhage. (4). Gas infection. (5). Ischemic gangrene. (6). Sepsis sharply flowing. (7). Other complications. (8). With damage to one bone also of one vessel (110 injured people). (9). With damage to one bone also of two vessels (or one main-line) (7 injured people). (10). With damage of both of bones and one vessel (83 injured people). (11). In all (200 injured people). (12). Frequency of complications in percentages.

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Of 11 injured people, where intervention was not produced or it was

not noted, in three was observed lethal outcome from the blood loss. Death after secondary hemorrhages began in 8 injured people, in 13 injured people began the recovery after the produced amputation.

Thus, about the half injured people, who had secondary hemorrhage, seriously they suffered as a result of this complication.

So/such frequently as secondary hemorrhage, was observed the complication of gas infection (22.5o/o) (see Table 39). Gas infection was noted in the army region in 9 injured people, in the army region - in 31, in the front and in the administrative area - in 5; in all - in 45 injured people.

If we analyze the frequency of anaerobic infection of the separate groups of injured people, then becomes obvious its connection/communication with the severity of injury. Thus, in injured people with the damage only to one bone and one vessel gas infection was observed only in 15 people (13.6o/o), moreover in the half these injured people primary surgical processing/treatment was produced with the large delay (to the 2nd day it is later). In the subgroup of injured people with the damage to one bone and both of vessels or one main-line vessel (popliteal artery) of 7 injured anaerobic infection it is stated/established in one, while in the subgroup with damage of both of bones and one vessel - in 29 injured

people (i.e. in 35.0o/o). In the vast majority of injured people with this complication was required the amputation, which was most frequently finished with the recovery of injured person.

The third serious complication (ischemic gangrene) was encountered almost 2 times thinner/less frequent than secondary hemorrhage and gas infection. Ischemic gangrene played considerable role only in some groups of injured people. Thus, in injured people with the damage to one bone and one vessel ischemic gangrene was observed only 4 time, i.e. in 3.6o/o; in 7 injured people with the damage to one bone and the injury of two vessels of shin or popliteal artery ischemic gangrene was observed 3 times, and in injured people with the damage of two bones and of one basic vessel ischemic gangrene was observed 17 times, i.e. in 20.4o/o.

Thus, doubtless is the value of the complexity of injury in the onset of most terrible complications in the early period of the wound process (see Table 39).

Table 40. Complications and issues in connection with the shown/rendered operaticnal aid with the secondary hemorrhage in injured people with the damage of vessels with the bullet break of the bones of the knee (absolute numbers) (author's development).

(1) Характер помощи оказанной при кровотечении	(2) Осложнения раннего периода				(5) Умерли от кровопотери	(6) Всего умерло	(7) Ампутировано из числа оставшихся в живых
	(3) газовая инфекция		(4) острый сепсис				
	(8) выздоровело	(9) умерло	(8) выздоровело	(9) умерло			
(10) Перевязка сосудов (26 раненых)	5	1	2	1	1	3	6
(11) Ампутация (7 раненых)	1	—	2	—	2	2	5
(12) Без операции (11 раненых)	1	—	1	—	3	3	2
(13) Всего (44 раненых)	7	1	5	1	6	8	13

Key: (1). Character/nature of the aid of that shown/rendered with the hemorrhage. (2). Complications of early period. (3). gas infection. (4). sharp/acute sepsis. (5). They died of blood loss. (6). In all it died. (7). It is amputated from number of those remaining in living ones. (8). it recovered. (9). it died. (10). Dressing of vessels (26 injured people). (11). Amputation (7 injured people). (12). Without operation/process (11 injured people). (13). In all (44 injured people).

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It is virtually important it was important to also dismantle/select the frequency of complications in the dependence on

the periods and the applied methods of the primary surgical processing/treatment of wounds.

Primary surgical processing/treatment was produced in 89.5o/o of injured people the group (Table 42)in question. Not always this processing/treatment was timely, since in 19 injured people it was produced only during the second day, but in 23 - even it is later than two days.

Of 42 injured people with this late primary processing/treatment it was observed in 16 injured anaerobic infection; in 4 - ischemic gangrene; in 9 - secondary hemorrhage.

The primary surgical processing/treatment of wounds was not produced in 21 injured people (10.5o/o).

The observed complications and issues in them are represented in Table 41.

As a result of the absence of surgical processing in 14 injured people was observed secondary hemorrhage, apropos of what were undertaken urgent operations/processes - dressing of vessels or even amputation (4 times), and nevertheless 3 injured people saved could not be: they perished from the sharp/acute anemia and other

complications. In 2 injured people was observed ischemic gangrene, in 3 - gas phlegmon and in 2 injured people - sepsis.

Of 16 that remaining in living injured people by 6 they underwent amputation. From this subgroup only in 3 injured absence of primary surgical processing/treatment it passed without the complications, but in all were noted suppurative inflammatory processes.

From the applied methods of the primary surgical processing/treatment of wounds in the entire group of injured people in question the dissection and carving occupy 26.0o/o, the removal/distance of foreign bodies. - 2.5o/o, the removal/distance of bone fragments and processing/treatment of bone fragments - 9.5o/o.

The dependence of the character/nature of primary processing/treatment on the sizes/dimensions of damage (one either both bones, one or both vessels) is represented in Table 42.

Consequently, the dressing of vessels during the primary processing/treatment was made in 92 injured people (46.0o/o), but in 77 wounded (38.5o/o) the dressing of vessels it was not conducted.

Table 41. Early complications and principal issues in injured people with the bullet break of the bores of shin and the damage of the vessels, which were not subjected to the primary surgical processing/treatment (absolute numbers) (author's development).

(1) Осложнение	(2) Число раненых	(3) Исход	
		(4) умерло	ампутировано из оставшихся в живых (5)
(6) Вторичное кровотечение	14	3	2
(7) Газовая инфекция	3	1	1
(8) Ишемическая гангрена . .	2	—	2
(9) Сепсис	2	1	1
(10) Итого . . .	21	5	6

Key: (1). Complication. (2). Number of injured people. (3). Issue. (4). it died. (5). it is amputated from those remaining in living ones. (6). Secondary hemorrhage. (7). Gas infection. (8). Ischemic gangrene. (9). Sepsis. (10). Altogether.

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Is of practical interest the examination of frequency and character/nature of complications in both these groups (Table 43 and 44).

Among 77 wounded, in which during the primary surgical processing/treatment the vessel was not bandaged, injury

flowed/occurred/lasted without the complications only in 14 injured people. It is completely logical that in the absence of the dressing of vessels among the complications most frequently were encountered the secondary hemorrhages and ischemic gangrene which were noted more than in the half all injured people.

Table 42. Character/nature of primary surgical processing/treatment in the different groups of injured people during the combination of the break of the bones of shin with the injury of vessels (author's development) (absolute numerals).

(1) Группа раненых / (2) Характер первичной хирургической обработки	(3) Рассечение и иссечение: (4) с перевязкой сосуда	(3) Рассечение и иссечение: (5) с перевязкой сосуда и другими элементами обработки	(6) Ампутация	(7) Прочие виды вмешательства	(8) Без первичной обработки	(9) Итого	(10) В процентах
(11) С повреждением одной кости и одного сосуда	45	8	4	41	12	110	55,0
(12) С повреждением одной кости и двух сосудов (или одного магистрального)	2	2	—	3	—	7	3,5
(13) С повреждением обеих костей и одного сосуда	24	11	6	33	9	83	41,5
(14) Всего	71	21	10	77	21	200	—
(15) В процентах	35,5	10,5	5,0	38,5	10,5	—	100,0

Key: (1). Group of injured people. (2). Character/nature of primary surgical processing/treatment. (3). Dissection and carving. (4). with dressing of vessel. (5). with dressing of vessel and other elements of processing/treatment. (6). Amputation. (7). Other means of intervention. (8). Without primary processing/treatment. (9). Total. (10). In percentages. (11). With damage to one bone also of one vessel. (12). With damage to one bone also of two vessels (or one main-line). (13). With damage of both of bones and one vessel. (14). In all. (15). In percentages.

Table 43. Early complications and principal issues in injured people with the bullet break of the bones of shin and the damage of the vessels which during the primary surgical processing/treatment were not bandaged (absolute numbers) (author's development).

(1) Осложнение	(2) Всего раненых	(3) Из них	
		(4) умерло	(5) ампутировано из оставшихся в живых
(6) Вторичное кровотечение	17	1	—
(7) Вторичное кровотечение и анаэробная инфекция	4	—	2
(8) Вторичное кровотечение и сепсис	6	3	3
(9) Анаэробная инфекция	11	3	6
(10) Анаэробная инфекция и ишемическая гангрена	3	2	1
(11) Сепсис	7	1	6
(12) Ишемическая гангрена	11	—	11
(13) Прочие	4	1	3
(14) Итого	63	11	32
(15) Без осложнений	14	—	—

Key: (1). Complication. (2). In all injured people. (3). On them. (4). it died. (5). Amputated from those remaining in living ones. (6). Secondary hemorrhage. (7). Secondary hemorrhage and anaerobic infection. (8). Secondary hemorrhage and sepsis. (9). Anaerobic infection. (10). Anaerobic infection and ischemic gangrene. (11). Sepsis. (12). Ischemic gangrene. (13). Other. (14). Altogether. (15). Without complications.

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Somewhat more rarely was observed anaerobic infection and sepsis,

frequently followed the hemorrnage or, on the contrary, that preceded them. In 13 injured people were observed the combinations of severe complications. As a result of all injured people, in whom during the processing/treatment the vessel was not bandaged, died 11 injured people, but 32 injured person was made amputation.

Somewhat more frequent after the dressing of vessel was noted gas infection (in 22 injured people).

However, during the distribution of morbidity by gas infection according to the subgroups of injuries it turned out that in the overwhelming majority (into 18) this complication was developed in injured people with damage of both bones, i.e. it was clearly connected with the severity of injuries.

Connections/communications between the dressing of vessel and the development of the following terrible complication of the early period of wound process - the rapidly current sepsis which was noted altogether only in 3 injured people (of 92 with ligated vessels), also established/installed could not be.

In 3 injured people, in spite of the primary dressing of vessels, was observed secondary hemorrhage. In one of them during the day of injury was produced the dressing of vessel for the

elongation/extent. During the same day was observed repeated hemorrhage from the posterior tibial artery. Was twice produced the blood transfusion. The made next day amputation proved to be late - injured person died of the blood loss.

FOOTNOTE [1]. It is amputated during the primary processing/treatment. ENDFOOTNOTE.

Table 44. Early complications and principal issues in injured people with the bullet break of the bones of shin and the damage of the vessels which during the primary surgical processing/treatment were bandaged (absolute numbers) (author's development).

(1) Осложнение	(2) Всего раненых	(3) Из них	
		(4) умерло	амputировано (5) из оставшихся в живых
(6) Вторичное кровотечение . .	3	1	1
(7) Анаэробная инфекция . .	21	2	18
(8) Анаэробная инфекция и ишемическая гангрена	1	1	—
(9) Ишемическая гангрена . .	5	—	5
(10) Сепсис	3	—	3
(11) Прочие	3	1	2
(12) Итого	36	5	29
(13) Без осложнений . . .	56	—	101

Key: (1). Complication. (2). In all injured people. (3). On them. (4). it died. (5). it is amputated from those remaining in living ones. (6). Secondary hemcrrnage. (7). Anaerobic infection. (8). Anaerobic infection and ischemic gangrene. (9). Ischemic gangrene. (10). Sapsis. (11). Other. (12). Altogether. (13). Without complications.

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With the dressing of main-line vessels, as is known, frequently it was necessary to consider the possibility of the onset of ischemic gangrene. Based on materials of author's development, of 24 injured

people in whom was observed ischemic gangrene, in 5 it began after the primary dressing of vessels, in remaining whereas injured people - after other means of the treatment of wounds and in the absence of any surgical aid.

Consequently, the dressing of vessels during the primary treatment according to all indicators, except anaerobic infection, had advantages before other methods of primary treatment.

By data of author's development is established/installed the absence of the difference in the frequency of complications in connection with the dressing of that, etc. from the main vessels of shin. True, it was possible to state/establish the small preponderance of the dismantled complications after the dressing of posterior tibial artery, but this found the completely satisfactory explanation into to somewhat larger frequency of the damage to this artery in the observed injured people. Thus, to 69 dressings of posterior tibial artery were observed 16 severe complications, and to 50 ligations of front/leading tibial artery - 12 severe complications.

Other completely relationships/ratios are obtained in the examination of the damages to popliteal artery. Were observed 8 injured people with the damage to this artery; in 6 injured damage to

popliteal artery it was accompanied by break of both bones of shin, also, in 2 injured people - one tibia. In 5 injured people was produced the amputation of thigh during the primary treatment of wound, while in remaining three - subsequently: in one on the 2nd day after the dressing or vessel in connection with the ischemic gangrene, in two injured people in connection with the secondary hemorrhage on the 6th and 10th day, moreover on the following day after the dressing or vessel in one arose gas gangrene, while in another - ischemic gangrene.

From this it appears, that the frequency of early complications in the described group of injured people was located in connection/communication not with the damage of one or the other vessel of shin, but with the entire totality of damage/defeat. In this case the most serious value had a damage of both bones of shin and, apparently accompanied this more extensive crushing of soft tissues. Injuries with the damage to one bone also of one vessel became the smaller percentage of complications and most favorable outcome. The aforesaid.about the secondary value of the vessels of shin in the onset of risky complications does not relate to the injuries where was the damage of all main vessels, which provided the nourishment of the peripheral part of the extremity as this was shown based on the example of the injury of popliteal artery or combined damages of both vessels of shin.

Amputation during the primary surgical treatment was expressed by small numerals, being only 5.0o/c (table 42). The part of the amputations, being it is made within the late periods, lost the character/nature of primary surgical treatment. Thus, in 4 injured people is already up to the moment/torque of treatment stated/established gas and ischemic gangrene (on 2 times). In 3 injured people is noted heavy shock. In spite of the severity of injuries and the menticned complications, the issues of this intervention they proved to be ccmpletely favorable of 10 injured people died only one, remaining recovered.

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Treatment.

Without stopping on a question of rendering of first aid with the bullet breaks of the bones of shin, combined with the damage cf vessel, it is possible to only emphasize that the transport immobilization was applied, based on materials of author's development, almost in all injured people in question. In the overwhelming majority the discussion dealt, obviously, with the use/application of a wire splint, although the name of this splint is

mentioned only in 44.0o/o of injured people, but in 32.0o/o it is not shown. In 1.5o/o was applied M. M. Diterikhs's splint, in 2.0o/o - Thomas-Vinogradov's splint, in 3.5o/o - gypsum immobilization, in 0.5o/o - "other" splint. In 6.0o/o immobilization it was clearly unsatisfactory, since it was realized by plywood or mesh splints. 8.0o/o Of injured information about splinting did not have, while in 2.5o/o transport immobilization in the first stages in no way was applied due to the difficulty of the diagnosis of break during the damage to one bone of shin.

As with other injuries with the damage of vessels, the closest attention it turned to the diagnosis of these damages, since on this depended the selection of most rational surgical textbook on DMP and in KhPPG of the first line.

The characteristic of the primary surgical treatment of wounds based on materials of author's development was given in the preceding/previous section in connection with the analysis of the course of the combined injuries and their complications. From this analysis it is evident that the best results were obtained with the timely dressing of the damaged vessels, the dressing of one posterior or front/leading tibial artery not creating a threat both for the viability of extremity and for the development of severe complications.

Thus, damages of both of bones and one of the main vessels of shin, although they were placed in the category of heavy injuries, by themselves did not give readings to the amputation during the primary processing, especially in the presence of incomplete break of one of the bones. The full-valued surgical treatment of wound, the dressing above and below of the place of the damage of vessel and its cutting between the ligatures, the careful immobilization, which was being reached in the foremost stages (DMP and KhPPG) best anything by the gypsum casts (combination of lateral cast in the form of stirrup to the knee joint and the posterior cast to the middle of thigh), the concern about the fast restoration of blood pressure and about the completion/replenishment of the lost blood, fight with the wound infection and timely development/detection of wound complications - were such the principal measures which made it possible to hope for the satisfactory issue of injury.

The extensive crushing of muscles, the presence of intertissue hemorrhages, bone fragments, and frequently and jammed foreign bodies presented with these injuries of shin favorable conditions for the development of gas infection, even in spite of produced, it would seem, solid primary surgical treatment. Because of this the injured people with the damage of bones and vessels of shin during the

lasting time required careful observation for the early development/detection of the signs of anaerobic infection. Subsequently, after elapse of threat of anaerobic infection and secondary hemorrhages, was laid long-term gypsum bandage.

As far as injuries are concerned with damage to one of the bones and one of the vessels of shin, then during the Great Patriotic War such injuries gave completely favorable prognosis during the correct treatment.

The main concern with these injuries was warning/prevention of secondary hemorrhages, which was reliably reached by careful hemostasis during the primary surgical treatment. Another not less important concern consisted of warning/prevention of anaerobic infection.

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During the development of pyo-septic complications and anaerobic infection surgeon's tactics was determined by the degree of the development of these complications and by the general state of injured person, moreover first and foremost stood the tendency to preserve the life of injured person. This was possible to make even with the described severe complications, if in proper time they

resorted to the amputation of extremity.

With the secondary hemorrhages the most reliable substance of its cessation was the dressing of vessel in the wound; however when the suppurative infiltration of tissues is present, frequently it was necessary to make the dressing of vessel for the elongation/extent possibly nearer to the wound. Taking into account the difficulty of access to the posterior tibial artery by expanding the lateral wound, which was being arranged/located on the medial surface of shin and which served as starting point for the searches of artery, I. S. Zhorov uncovered artery by middle section/cut in the popliteal pit in the place of its departure/separation from the popliteal artery. The secondary hemorrhages, which appeared with the compound fractures, combined with the damage of vessel, when crushing of soft tissues, pyo-septic and anaerobic infection is present, dictated the need for urgent amputation.

The frequency of complications (including pyo-septic processes) conditioned the character/nature of surgical intervention (eliminating primary surgical treatment); thus it was conducted reworking of wounds with the removal/distance of foreign bodies, the autopsy of ulcers and flows (10.0o/o), amputation (42.0o/o), dressing of vessels (15.0o/o), reamputation (10.5o/o), sequestrectomy, frequently is repeated (20.0o/o), the carving of ulcer and limply

healing wound and the imposition of secondary suture, the carving of scar, the transplantation of skin, subcutaneous tenotomy of the Achillas of tendon and redressment of talocrural joint (2.5o/o).

Issues.

Clinical issues were different depending on that, one or both bones were broken (Table 45).

Table 45. Clinical issues in injured people with the bullet break of the bones of shin and damages of vessels (author's development).

(2) Группа раненых	(1) Исход								(11)
	(3) хороший анатомический и функциональный результат	(4) последствия повреждения нервов	(5) контрактуры и анкилозы	(6) остеомиелит	(7) остеомиелит в комбинации с другими осложнениями	(8) культя	(9) прочие патологические данные и неизвестные исходы	(10) умерло	Итого
(12) С повреждением одной кости и одного сосуда	15	17	26	13	4	21	5	9	110
(13) С повреждением одной кости и двух сосудов (или одного магистрального)	1	—	—	—	1	5	—	—	7
(14) С повреждением обеих костей и одного сосуда	—	3	10	4	1	51	1	13	83
(15) Всего . . .	16	20	36	17	6	77	6	22	200
(16) В процентах . . .	8,0	10,0	18,0	8,5	3,0	38,5	3,0	11,0	100,0

Key: (1). Issue. (2). Group of injured people. (3). good anatomical and functicnal result. (4). consequence of damage of nerves. (5). contracture and ankylosis. (6). osteomyelitis. (7). osteomyelitis in combination with other complications. (8). stump. (9). other pathological data and unknown issues. (10). it died. (11). Altogether. (12). With damage to one bone also of one vessel. (13). With damage to one bone also of two vessels (or one main-line). (14). With damage of both of bones and one vessel. (15). In all. (16). In percentages.

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If of 110 injured people with the damage to one bone and one vessels a good functional and anatomical result was noted in 15 people, then of 83 injured with damage of both bones and one vessel of this issue there had not one injured person. Injured people with the stump were counted by 21 of 110 with the damage to one bone also of one vessel and 51 of 83 with the damage of two bones and one vessels; died 9 of 110 injured people with the break of one bone and 13 of 83 with the break of two bones.

In the small subgroup of injured people of 7 people - with the damage only to one bone, but both vessels - 5 were discharged with the stump, remaining preserved extremity. Estimating the issues of the breaks of two bones and injury of one vessel, one ought not to forget that the discussion deals with the extremely heavy injuries of shin, with which in the majority of the cases the extremity was represented as by "gloomy" to the amputation, and in spite of this, 22.9o/o of injured people were discharged, without being subjected to amputation, although still and they needed further treatment. Should be also noted a comparatively low lethality of injured people with the very heavy injury.

On the whole if we take entire group of injured people examined

with the break of the bones of shin and the damage of blood vessels in the different combinations (besides break of both bones with damage of both vessels) as a whole (Table 45), then into 50.5o/o amputation it was not applied. From these latter almost in 16.0o/o (but to entire group - in 8.0o/o) was noted with the extraction a good anatomical and functional result, remaining needed recuperation apropos of one or the other consequences (osteomyelitis, contracture, etc.). Only in 11.0o/o of injured people began lethal outcome; 38.5o/o of injured people were discharged after the amputation, produced during the primary treatment or subsequently apropos of different severe wound complications.

Damages of both of bones and two vessels of shin.

The group of injured people with the damage of two bones and two vessels of shin consisted of 200 injured people. Bullet injuries were only 9.0o/o, 90.0o/o related to the fragmentation injuries and in 1.0o/o of injured people the genus of the wounding projectile was not established/installed.

According to the character/nature of injury in this group predominated the very heavy forms of crushing and breakaways (84.5o/o). Blind-end injuries composed 3.0o/o, through - 12.5o/o. The associated and multiple injuries were observed considerably more

frequent (45.0o/o) than in previously group (31.0o/o) examined. The injuries, which penetrate into the joint, it is noted by 1.5o/o.

In the overwhelming majority of injured people were noted the damages of the neurovascular beam, in connection with the fact that the associated damage of the nerve trunks was noted in 92.0o/o of injured people. By these data is characterized the extreme severity of injuries, which dictated to surgeon the need of applying the amputation, which was made 90.0o/o of injured people. In remaining (10.0o/o) injured people were applied the sparing forms/species primary surgical treatments, in this case in one quarter of injured people they were accompanied by the dressing of vessel.

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Radicality during the primary surgical treatment in the overwhelming majority of the described injuries revealed/detected explicit advantage. In injured people, where the surgical treatment was nonradical, in the nearest whereas stages developed severe complications - gas infection and ischemic gangrene sometimes in combination with the hemorrhage, in connection with the fact that these injured people were subjected to amputation.

In 6.5o/o of injured people (13) was observed lethal outcome,

that it is not possible to recognize as high, taking into account the extreme severity of injuries.

As the reasons for death in 5 injured people is noted the shock, in one - hemorrhage, in 3 - anaerobic infection, in one - sepsis and in 3 - combined complications.

From entire that examined in the present section with a certainty follows the conclusion that one or the other severity of clinical course was caused as by the complexity of injury itself, so by the period of primary surgical treatment and by the degree of its radicality, and also all by the system of the subsequent treatment.

As is evident from represented data, even with the heaviest injuries of shin (damage of both bones even one vessel or both vessels) the life of the overwhelming majority of injured people was preserved, and for many with these heavy injuries it was possible to save extremity.

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Chapter 11.

DAMAGES OF NERVES WITH THE BULLET BREAKS OF THE BONES OF EXTREMITIES.

Statistical survey

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Frequency of the damage of nerves and vessels with the bullet breaks of the bones of extremities.

According to the data of the deepened development of the histories of disease/sickness/illness/malady, the damage of nerves is noted with the bullet breaks of shoulder in 35.6o/o, bones of forearm - in 30.5o/o, thighs - in 10.oo/o, the bones of shin - in 22.2o/o of injured people. However, these numerals do not reflect the numerical ratios of injured people with the break, that need treatment apropos of the damage of nerves, since part the part of the injured people from this number was subjected to amputation, and part perished from

different reasons, not connected with the damage of nerves. A quantity of the injured people, who were needing special treatment apropos of the damage of nerves with the bullet breaks, is represented in Table 46 (lower row).

The dissimilar frequency of the damage of nerves with the breaks of the bones of different divisions of extremities have long ago been known and most probably it is explained the topographic-anatomic special features of these regions. The significance of topographic= anatomic special features of different divisions of extremities with the combined injuries of bones and nerves it is revealed/detected still more than with wounds only of soft tissues. The general/common/total mass of muscles on the thigh is very great in comparison with other divisions, and large/coarse nerve trunks, in particular, sciatic, they are arranged/located in the known distance from the bone.

Table 46. Frequency of the damage of nerves with the bullet breaks of the bones of extremities (in the percentages).

(1) Группа раненых	(2) Локализация перелома			
	(3) плечо	(4) предплечье	(5) бедро	(6) голень
(7) Все раненые с повреждением нервов	35,6	30,5	10,6	22,2
(8) Раненые с повреждением нервов, оставшиеся в живых с сохраненной конечностью, нуждавшиеся в специальном лечении	30,5	28,0	8,9	15,5

Key: (1). Group of injured people. (2). Localization of break. (3). shoulder. (4). forearm. (5). thigh. (6). shin. (7). All injured people with damage of nerves. (8). Injured people with damage of nerves, that remained into living ones with preserved extremity, that were needing special treatment.

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Other entirely conditions are observed on the shoulder where the nerve trunks, especially radial in middle third, are disposed of considerably nearer to the bone and easily they can be injured together with it. One should moreover, emphasize that 45.0o/o of bullet breaks of shoulder with the damage of nerves related precisely to middle third. In connection with this the damages of radial nerve with respect to other nerves comprised with the bullet breaks of shoulder 48.8o/o. The dependence of the frequency of the damage of nerves on the form/species of break is presented in 15 volume (pg.

226, 284, etc.).

Special and very heavy on the consequences group compose the damages of nerves, complicated by multiple failure of large vessels. B. S. Doynikov, Kh. G. Khodos, A. S. Kostenetskiy, Yu. M. Zhabotinskiy, D. I. Panchenko et al. in the series/number of experimental and histopathological works showed that ischemia, which appears as a result of damaging the large/coarse arteries, extremely heavily is reflected in all tissues of the damaged extremity and especially in the nerve trunks. V. N. Shamov as long ago as 1939 at the V session of neuro-surgical council in detail described clinic of the damages of the neurovascular beam and those reasons on which surgical tactics during such damages must be changed in the sense of the requirement of earlier intervention on the neurovascular beam. Further works of a number of the authors [Yu. V. Vasilenko (1943), I. I. Rusetskiy (1942), Ye. S. Chalyy (1945), K. A. Grigorovich (1940, 1943) et al.] also concerned different questions, connected with the damages of vessels and nerves.

According to the data of the deepened development of histories the diseases/sicknesses/illnesses/maladies, the damage of nerves and large vessels were noted with the dissimilar frequency with the bullet breaks of the bones of different divisions of extremities.

Data of the deepened development of the histories of diseases/sicknesses/illnesses/maladies which became the basis of present chapter, represent mainly heaviest breaks with damage of nerves and vessels with which it was necessary to resort to the amputation. However, in the clinic is necessary to consider not only the straight/direct damages of the vessels with the explicit clinical picture of their full/total/complete or partial rupture, but also injury, with which the damage of vessel does not cause early symptoms and leads as the final result to desolation either narrowing of the artery, constrained by scars, or to a fibrous change in its wall with the loss of elasticity. In these all injured people even when with fibrous changes of wall air-gap clearance of vessel is not reduced any noticeably, are developed such ischemic changes in the tissues which make forecast in the relation to the reduction of the function of extremity very doubtful.

Table 47. Frequency of damages and large vessels in injured people with the bullet break of the bones of extremities and multiple failure of nerves (in the percentages).

(1) Группа раненых	(2) Локализация перелома			
	(3) плечо	(4) предплечье	(5) бедро	(6) голень
(7) Все раненые с повреждением нервов	18,2	14,1	17,0	36,8
(8) Раненые с повреждением нервов, оставшиеся в живых с сохраненной конечностью	5,4	6,8	3,9	10,0

Key: (1). Group of injured people. (2). Localization of break. (3). shoulder. (4). forearm. (5). thigh. (6). shin. (7). All injured people with damage of nerves. (8). Injured people with damage of nerves, that remained in living ones with preserved extremity.

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Specifically, such changes were examined in works of the authors cited above. V. N. Shamov gives data about higher numbers of combined damages of vessels and nerves without specially taking into account breaks, than those which are given in the data of the deepened development of the histories of disease/sickness/illness/malady. According to the observations of the author under conditions of front and back evacuation hospitals the frequency of the neurovascular damages was not discharged below those 23.0o/o with respect to all found under the observation of wounded with the damage to upper extremity regardless of the fact, was combined this damage with the

break or not. Known "reduction" of the numerals of the combined neurovascular damages/defeats, led in the data of the deepened development of the histories of disease/sickness/illness/malady, is explained, apparently by the difficulties of diagnosis in the presence of break. The combined neurovascular damages the author most frequently observed on the shoulder, then on the forearm, it is considerably thinner/less frequent - on the shin and it is entirely rare - on the thigh (have in mind injured people, who were being treated apropos of the damages of nerves, in the majority of the cases of those coincided with the breaks).

The relative rarity of the combined injuries on the thigh is explained by the fact that the femoral artery and vein, damage of which is inevitably accompanied by the heavy consequences, risky for the life or for reducing the subsequent function of extremity, are arranged/located far from the sciatic nerve which most frequently it was damaged on the thigh. Is necessary the special confluence of facts, so that these vessels and sciatic nerve would be damaged simultaneously, and other tissues would remain in this state that the extremity it would be possible to preserve.

Damage of nerves with the breaks of the bones of the different segments of extremities.

The damages of the nerve trunks of extremities with the breaks of the bones of different segments are data of Table 48.

Table 48. Distribution or injured people with the bullet break of the bones of extremities and multiple failure of nerves according to location of break and damaged nerves (in the percentages).

(1) Локализация перелома	(2) Название нерва						(3) Всего
	плечевое сплетение (4)	лучевой (5)	локтевой (6)	срединный (7)	прочие (8)	несколько (9) нервов	
Плечо (10)	7,1	48,8	5,0	7,1	4,0	28,0	100,0
Предплечье (11)	—	20,8	23,2	15,8	3,9	36,3	100,0
	(12) седалищный	(13) бедренный	(14) большеберцовый	(15) малоберцовый	(8) прочие	несколько (9) нервов	
Бедро (16)	54,4	13,0	2,3	13,9	3,6	12,8	100,0
Голень (17)	1,6[1]	0,2[1]	11,5	62,1	3,8	20,8	100,0

Key: (1). Localization or break. (2). Name of nerve. (3). In all. (4). brachial plexus. (5). radial. (6). cubital. (7). middle. (8). other. (9). several nerves. (10). Shoulder. (11). Forearm. (12). ischiatic. (13). femoral. (14). tibial. (15). fibular. (16). Thigh. (17). Shin.

FOOTNOTE [1]. With the multiple fragmentation injuries. ENDFOOTNOTE.

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The distribution of the damages of separate nerves with the breaks of shoulder is completely explained by the existing anatomical relationships/ratios. However, according to the data of some specialized hospitals, small percentage falls also on the injuries of

a muscular-skin nerve and skin nerves. At the same time it should be noted that the damages of these nerves were observed more frequently in the combination with the damage of other nerves. This is given in the data of the deepened development of the histories of disease/sickness/illness/malady.

In the examination of the damages of separate nerves on the forearm attention is drawn to the relative frequency of the diagnosed damages of the radial nerve which, as is known, it is represented on the forearm only by its final branches. The damage of these branches is most noticeable with the localization of injury in the limits of a cubital pit and upper third of forearm. The analysis of the histories of disease/sickness/illness/malady showed that the diagnosis of the partial damage of radial nerve on the forearm was sometimes placed erroneously in those injured people, whose extensor motions of hand were restricted not only as a result of paralysis of the muscles, innervated by radial nerve, but also as a result of other damages of bones, muscles and tendons. The errors in the diagnosis are to a certain degree explained by the fact that the zone of the skin innervation of radial nerve on the rear of hand is very variable and the disturbances/breakdowns of sensitivity were not always sufficiently they were expressed even with verified by operation/process the full/total/complete interruptions of nerve on the shoulder.

A comparatively high frequency of the damage to fibular part of the sciatic nerve on the thigh and the fibular nerve on the shin was noted in all wars XX of century by almost all authors. Apart will cost in this respect of the observation of B. G. Yegorov (1943), that were being conducted on the basis of back evacuation hospital, since in it a number of operations/processes apropos of the damage of tibial nerve somewhat exceeded a quantity of same apropos of the damage of fibular. All remaining authors noted the high vulnerability of precisely fibular nerve, and in them a quantity of operations/processes apropos of the damage of fibular nerve always considerably exceeded a quantity of same apropos of the damage of tibial nerve. A comparatively high specific gravity/weight of the diagnosed damages of femoral nerve, according to the data of the deepened development of the histories of disease/sickness/illness/malady, to explain is sufficiently difficult, since these damages in the reports of the specialized back evacuation hospitals and according to another statistical data were not frequent. According to the personal experience of the author a number of operations/processes apropos of the damages of femoral nerve did not exceed 0.3o/o of all operations/processes on the nerve trunks of extremities.

It should be noted that the simultaneous injuries of sciatic nerve and posterior skin nerve of thigh fairly often were encountered in injured people in the specialized hospitals.

With the bullet breaks of the bones of the shin of the damage of the sciatic and femoral nerve are observed mainly with the multiple fragmentation injuries, but in separate injured people and with the bullet ones in the direction of wound canal along the entire extremity from bottom to top or downward. According to the observations of the author in the back specialized evacuation hospital of the damage of skin nerves with wounds of shin (with the break of bones and without the break) were noted somewhat more frequently than in the materials of the deepened development of the histories of disease/sickness/illness/malady.

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At the same time the reports of the back specialized evacuation hospitals it is very separated between themselves, which depended, apparently on the accidental concentration of the specific groups of injured people in the different hospitals. Most correct information relative to the frequency of the damage of one or the other nerves with the bullet breaks of the different divisions of extremities presents the data of the deepened development of the histories of

disease/sickness/illness/malady.

Conditions of damaging the nerves and pathological anatomy.

Mechanism of the damage of the nerve trunks with the bullet breaks.

It is necessary to keep in mind several possibilities of damaging the nerves with the bullet breaks:

1. Simultaneous injury of bone and nerve by projectile (bullet, fragment).

2. Secondary damage of nerve by fragment of primary broken bone.

3. Primary injury of nerve by bullet projectile and secondary damage to bone (nonshooting).

4. Accidental injury of nerve with surgical operation/process and other interventions apropos of bullet break or subsequent complications.

The overwhelming majority of injuries relates, it is doubtless, to the first group, i.e., to the direct damage by the projectile of bone and nerve. In this convince not only the data of neurologic

study, but also numerous investigations of the topography of wound canal during the combined damages/defeats of bones and nerves, produced both during processing of wounds and with further interventions, connected with the liberation/excretion of nerves from Rubtsov. The same group includes also those injuries, with which the scrap of bone played the role of secondary projectiles, damaging nerve.

The arrangement of nerve in the tightest topographic interrelations with the bone scrap, and also the introduction of the pieces of the bone of different value and form into the thickness of the nerve trunk in any way do not relate to a number of rare finds with the operations/processes apropos of the combined damages of bones and nerves.

The secondary damage of nerve by scrap of the primary broken bone can occur mainly at the moment of the incidence/drop in the injured person, which obtained bullet break. These injuries, just as the injury of the first group, are characterized from the clinical side by the fact that the symptoms, pathognomonic for damaging precisely the nerve, become apparent simultaneously with the injury or directly following it. Almost these all injured people in anamnesis has indication that the injury was accompanied by a characteristic feeling of the breakaway of extremity or shock by

electric current. Other possible reasons for the damage of whole to that nerve by scrap of bone as, for example, careless inversion with the injured extremity during the transference and other manipulations, occurred, apparently it is exclusively rare.

Noted by some authors even from the time of the first world war the possibility of the compression of the undamaged/uninjured nerve by the growing callus and by scars is at present very doubtful. The analysis of numerous observations does not reveal/detect in injured secondary paralyses. Is explained this by the fact that the undamaged/uninjured nerve, even which is located in the tightest neighborhood with the bone, is rather moved aside by the growing corn, rather than it is involved into it. According to author's data, in all injured people, in whom with the operation/process was detected the implication of nerve in the callus, were encountered doubtless the proof of the fact that the nerve to a certain degree was damaged simultaneously with the bone.

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Most frequently in these injured people was observed the primary fault of nerve and besides in the form of full/total/complete interruption with the shift of ends. In the part of other injured people the damage of nerve proved to be insignificant. For the

implication of nerve in the callus is necessary the damage at least of epineuria.

The primary fault of nerve by projectile and secondary break bones occur, apparently very rarely and they concern only lower extremity. In such cases the speech can go about the break of bone in the typical place with the incidence/drop in the injured, obtained damage nerve. The level of the damage of the nerve trunk and the level of break in this case can not coincide; for example, the damage of sciatic nerve occurred at the level of middle third of thigh, but the break - in lower third of shin. The possibility of this mechanism was noted already during the first world war, and at the same time was turned attention to the extreme rarity of similar damages.

The accidental injury of nerve with the surgical operation/process, in spite of relative rarity, nevertheless had place. Are here involved, first of all, the injuries of radial nerve during the primary treatment of wounds on the external surface of shoulder and with the operations/processes apropos of osteomyelitis, injury of ulnar nerve with interventions on the bone in the region of internal muscle of shoulder, injury of femoral nerve during the dissection of wounds under the inguinal ligament, injury of fibular nerve with interventions in the region of the head of fibular bone and some others. Sometimes nerve was damaged with the confluence of

the series/number of the unfavorable facts, which appeared on the course of operation/process. Were observed the damages of sciatic nerve with the cessation of hemorrhage from the large vessels with interventions in the buttock region apropos of osteomyelitis of pelvic bones or neck of thigh. To the same group of the accidental damages of nerve with rendering aid apropos of bullet break or its complications should be related the compression of nerves by the tourniquet, superimposed for the cessation of hemorrhage.

Anatomic forms of the damage of nerves with bullet breaks.

To questions of the classification of the damages of nerves concerning the anatomical sign are devoted many works, beginning from the time of the first world war. During the Great Patriotic War these questions again were examined repeatedly and in detail they were lit in appearances and articles of N. N. Burdenko, B. S. Doynikov, N. I. Grashchenkov, B. A. Favorskiy, V. A. Gusynin, M. G. Ignatov, D. A. Krasnov et al. There is a full/total/complete possibility to combine for the examination the diverse and numerous forms of damages into two basic groups according to the morphological sign: 1) the anatomical interruption of the nerve trunk, full/total/complete or partial, and 2) the intra-hanger-on damages of nerve (hematoma, foreign bodies, etc.). Full/total/complete anatomical interruption can be conditioned either on the straight/direct

disturbance/breakdown of the integrity of entire diameter of nerve with the full/total/complete disjunction of central and peripheral cut, or crushing of all beams with the relative state of preservation of outer covering (epineuria). The latter/last means of damage more frequently is described as contusion or crushing. However, with the contusion and crushing the essence of damage in essence is identical, since in the specific section begins the full/total/complete disjunction of central and peripheral cut as a result of the death of all filaments, which compose the beams of the nerve trunk.

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Term "contusion" designates faster the form/species of trauma, but not its morphological consequence which can be with the contusion very diverse: from the small hemorrhage under the epineuria to full/total/complete crushing of entire diameter of primary shaft. The relative state of preservation of epineuria, sometimes is only external, it does not introduce essential differences into the picture of further changes which lead to the formation of full/total/complete cross of neuromes of central end. Moreover, the contusion in the larger or smaller measure occurs almost with any trauma with the disturbance/breakdown of the integrity of nerve and in particular with the bullet injury.

Partial anatomical interruptions are different depending on a quantity of affected beams and abundance of damage along the length of nerve. Sometimes is determined the interruption only of several beams in the large multibeam nerve; in other injured people the continuity of the nerve trunk is maintained by very thin bridge from the undamaged/uninjured filaments, and this partial interruption differs little from the full/total/complete. Differences with the partial interruptions are noted also in the relation to the topography of injury. More frequently there was an edge/boundary damage of nerve ("lateral cut") with the subsequent development of lateral neuromes; considerably more rarely was encountered the "perforated" damage of the nerve as a result of which began the formation of intra-hanger-on neuromes, which does not seize entire diameter of nerve.

At present there are all bases in order to secrete hematomas of nerves as the independent form of the changes, which appear as a result of bullet injury. Intra-shaft hematomas of nerves frequently were detected with the early operations/processes, but more frequent (with late surgical interventions) were revealed/detected their consequences in the form than more or less disseminated, those frequently pigmented edges, changing sometimes entire diameter of nerves presenting the unsurmountable obstacle for the increase axons. The nerve trunk proves to be sharply condensed, changed in the color.

Thickenings (neuromes) in the region of damage in this case it could and not be. Histopathological data with respect to changes in the nerves in connection with nematomas within their shaft are published in the works of L. P. Lipchina (1943, 1944), V. V. Semenova-Tyan-Shanskaya n (1946). M. G. Ignatius (1943) also noted that with the operation/process he frequently observed heavy changes in the nerve trunks which carried the irreversible or little reversible character/nature.

The materials of the deepened development of the histories of disease/sickness/illness/malady, and also personal observations and study of anatomical finds with 600 operations/processes on the nerve trunks show that all forms of the damages of nerves, described with the bullet injuries only of soft tissues, are encountered also with the bullet breaks.

It cannot be asserted that the heavy forms of the damages of nerves with the bullet break of bones were encountered more frequently than with the injury only of soft tissues. However, in many injured people was noted the considerable severity of damages and bones, and nerve. As an example of this heavy injury can serve the following observation.

B, 20 years, is injured by the fragment 11/VI of 1944 into lower

third of right forearm with the breaking up of the extremital cut of radial bone and by the break of cubital. Phenomena of the full/total/complete interruption of middle nerve and radial artery in lower third of forearm. During the treatment of wound are removed bone scrap. Gypsum bandage in the course of 2 1/2 months. Fistula in the region of the former wound was closed during December 1945. During July 1946 is undertaken the attempt to put suture on the middle nerve which did not turn out well as a result of diastasis of the ends of the nerve almost on 6 cm (Fig. 1).

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Frequently with the operation/process was detected the introduction of bone scrap of different value into the thickness of the nerve trunk. In some of injured people these scrap were arranged/located superficially under the epineuria and were well noticeable already at the first moments/torques the exposures of nerve; in other injured people they were included in the thickness of neuromes and they were detected only after the section/cut of cut all over neuromes.

It is necessary also to keep in mind that late changes in the nerves with the bullet breaks can have other special features/peculiarities, than with the injury of soft tissues. With

the full/total/complete interruption of nerve, if its ends are arranged/located between the scrap of bone and are involved subsequently into the callus, the neuroma of central end sometimes is it is not expressed, despite even the prolonged period, which passed after injury. In such injured people instead of thickening of central end it was necessary to observe its gradual thinning and conversion into the narrow cicatrical strand, which is lost in the surrounding tissues. During the partial damage of nerve with the disturbance/breakdown of the integrity of epineuria the nerve also can be involved in the scars about the bone. The possibility of implication in the callus of the undamaged/uninjured nerve with whole epineuria on the basis of personal observations is doubtful.

It is necessary to note that the overwhelming majority of wounded with the implication of the damaged nerve in the region of break had the full/total/complete interruption of radial nerve in middle third of shoulder, which completely finds to itself explanation in the existing anatomical relationships/ratios in this region. The implication of the sciatic nerve between the bone scrap of thigh never is discovered neither in the personal observations nor in the observations of other authors. This is most probably explained by the presence of the muscular layer between the nerve and the bone.

Recognition and clinical course.

The recognition of the damage of nerves with the bullet breaks presents more difficult problem than with the injuries only of soft tissues. As a result of the severity of injury with the bullet breaks, especially in such divisions as thigh, during the first days and in the weeks after being wounded the diagnosis of the damage of nerve can present considerable difficulties. To conduct in the necessary volume the basic methods of neurologic experiment with the breaks of the bones of extremities is frequently complicatedly, and sometimes also it is impossible. This relates, first of all, to the investigation of motor precipitation which is hindered/hampered initially by the presence of the break, and subsequently by the gypsum bandage or by other immobilizing apparatuses. Investigation of sensitivity, especially if it is conducted once and soon after trauma, does not give sufficient bases for the reliable and precise diagnosis, but subsequently it is furthermore hindered/hampered by gypsum bandage. At the same time without precise and repeatedly verified information about the disturbance/breakdown of motions and sensitivity a question about the correct estimation of complaints of painful and other abnormal perceptions also becomes sometimes difficultly to those solved. All this explains a relatively large number of cases of the late diagnosis of the damage of nerves with the bullet breaks. By the author are studied the periods of the

setting of the first diagnosis of the damage of nerves in 321 injured people with the break of shoulder, in 295 injured people with the break of the bones of forearm, in 261 injured people with the bullet break of thigh, in 256 injured people with the break of the bones of shin. In this case the findings, given in Table 49.

Attention is drawn to a relatively large number of injured people with the early diagnosis of the damage of nerves with the breaks of shoulder (42.3o/o).

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This to a certain extent is explained by the fact that with the bullet breaks of shoulder very frequently suffers radial nerve (48.8o/o) whose damages give the noticeable typical picture of sagging hand, the well known to the doctors of any specialty, but not only to neuropathologists.

A great number of injured people with the late recognition of the damage of nerves had breaks of bones of lower extremity and especially thigh. These injuries flowed/occurred/lasted more heavily than the injury of upper extremity, which is confirmed by the data about repeated surgical interventions which were made with the combined injuries of shoulder in 49.3o/o, forearms - in 37.2o/o,

thighs - in 63.1o/o, shins - in 61.6o/o of injured people.

It should be noted that a larger number of early recognition of the damage of nerves (during the first days after injury) falls to the doctors of DMP and PPG without specialist-neuropathologists' participation.

Considerable role in the diagnosis played the correct estimation of the value of anamnesis, since precisely with the inquiry of injured people were revealed/detected complaints of the projection pains and other perceptions, characteristic for damaging the nerves. The majority of injured people with the damage of nerves noted that at the moment of injury they experienced the feeling of the breakaway of extremity, shock by electric current, etc. Doctors' preparedness to the recognition of the damages of the nerve trunks with the injuries of extremities continuously was raised during the war. Ye. I. Smirnov during August 1942 already raised a question about the need for a radical improvement in the diagnosis and treatment during the damages of peripheral nervous system. At the same time B. S. Doynikov proposed the simplast receptions/procedures of the rapid diagnosis of the damages of nerves. The same questions repeatedly examined at the numerous conferences, which generalized experimant/experience, spacial indications, short manuals and various pamphlets (B. S. Doynikov, B. A. Favorskiy et al.).

Available material make it possible to make the conclusion that the opportuneness of the correct diagnosis of the damage of nerves with the bullet breaks depends not only on the degree of doctor's preparedness, which, it is doubtless, plays very large role, but also from others moments/torques. Hiyn value has the severity of damage, a character/nature of bullet break and associated extensive decomposition of other tissues and a difficulty of objective investigation due to the presence of break. Specifically, by these reasons is explained the large part of the late diagnoses.

Table 49. Distribution of injured people with the damage of nerves with the bullet breaks of the bones of extremities according to the periods of the recognition of the damage of nerve (in the percentages).

(1) Срок постановки диагноза повреждения нервов	(2) Локализация перелома			
	(3) плечо	(4) предплечье	(5) бедро	(6) голень
В течение 1-го месяца (7) . . .	42,3	33,9	26,8	28,5
» » 2-го »	19,8	27,8	13,4	12,8
» » 3-го »	16,0	19,7	16,0	15,7
» » 4-го »	11,5	8,9	15,7	18,7
» » 5-го »	4,5	4,4	8,8	9,7
» » 6-го и позже (8) . .	5,9	5,3	19,3	14,6
Всего (9) . . .	100,0	100,0	100,0	100,0

Key: (1). Period of the setting of the diagnosis of the damage of nerves. (2). Localization of break. (3). shoulder. (4). forearm. (5). thigh. (6). shin. (7). In the course of 1st month. (8). and it is later. (9). In all.

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At the same time it should be noted that the overwhelming majority of the damages of nerves was identified in the first months after trauma, i.e., in time which, until now, still are considered favorable for the surgical treatment of the damaged nerves. In the course of the first four months from the moment/torque of injury correct diagnosis was set with the breaks of shoulder in 89.6o/o,

bones of forearm - in 90.3o/o, thighs - in 71.9o/o and the bones of shin - in 75.7o/o of injured people.

Data of the deepened development of the histories of disease/sickness/illness/malady show that the combined injuries of bones and nerves during the Great Patriotic War were heavier than injury without the damage of nerves. This is illustrated by the data, given in Table 50.

Given data show that with the injury of all regions, except thigh and partially forearm, was observed a larger number of fragmented and crushed breaks during the damage of nerves, than without their damage.

To this one should add that the breaks of shoulder with damage of nerves more frequently are noted in middle third, the breaks of the bones of forearm - on the lower and the average; the breaks of thigh - in the upper and the breaks of the bones of shin - in middle and lower third.

It is very important to indicate a comparatively frequent presence of foreign bodies during the damage of nerves, although this frequency is lower than with the bullet breaks without the damage of nerves (Table 51).

Table 50. Fragmented and crushed breaks among other forms/species of the bullet break of the bones of extremities in injured people, who remained in the living ones with the preserved extremity (in the percentages).

(1) Группа раненых с переломом костей конечностей	(2) Локализация и вид перелома							
	(3) плечо		(4) предплечье		(5) бедро		(6) голень	
	(7) оскольчатый	(8) раздробленный	(3) оскольчатый	(8) раздробленный	(3) оскольчатый	(8) раздробленный	(7) оскольчатый	(8) раздробленный
(9) С повреждением нервов . .	59,5	13,2	60,0	12,6	41,2	5,4	56,3	10,9
(10) Без повреждения нервов	52,6	8,6	61,8	11,1	45,4	7,7	45,5	8,6

Key: (1). Group of injured people with the break of the bones of extremities. (2). Localization and form/species of break. (3). shoulder. (4). forearm. (5). thigh. (6). shin. (7). fragmented. (8). crushed. (9). With damage of nerves. (10). Without damage of nerves.

Table 51. Frequency of determination in the wound of foreign bodies[1] in injured people with the bullet break of the bones of extremities with multiple failure and without the damage of nerves (in the percentages).

FOOTNOTE [1]. Frequency determination in the wound of foreign bodies is calculated on all injured with the break according to each segment without the exception/elimination injured people, who were not subjected to x-ray examination. ENDFOOTNOTE.

(1) Группа раненых с переломом и наличием инородных тел	(2) Локализация перелома			
	(3) плечо	(4) предплечье	(5) бедро	(6) голень
(7) С повреждением нервов	24,6	14,1	34,9	18,9
(8) Без повреждения нервов	29,1	14,0	37,0	24,6

Key: (1). Group of injured people with break and presence of foreign bodies. (2). Localization of break. (3). shoulder. (4). forearm. (5). thigh. (6). shin. (7). With damage of nerves. (8). Without damage of nerves.

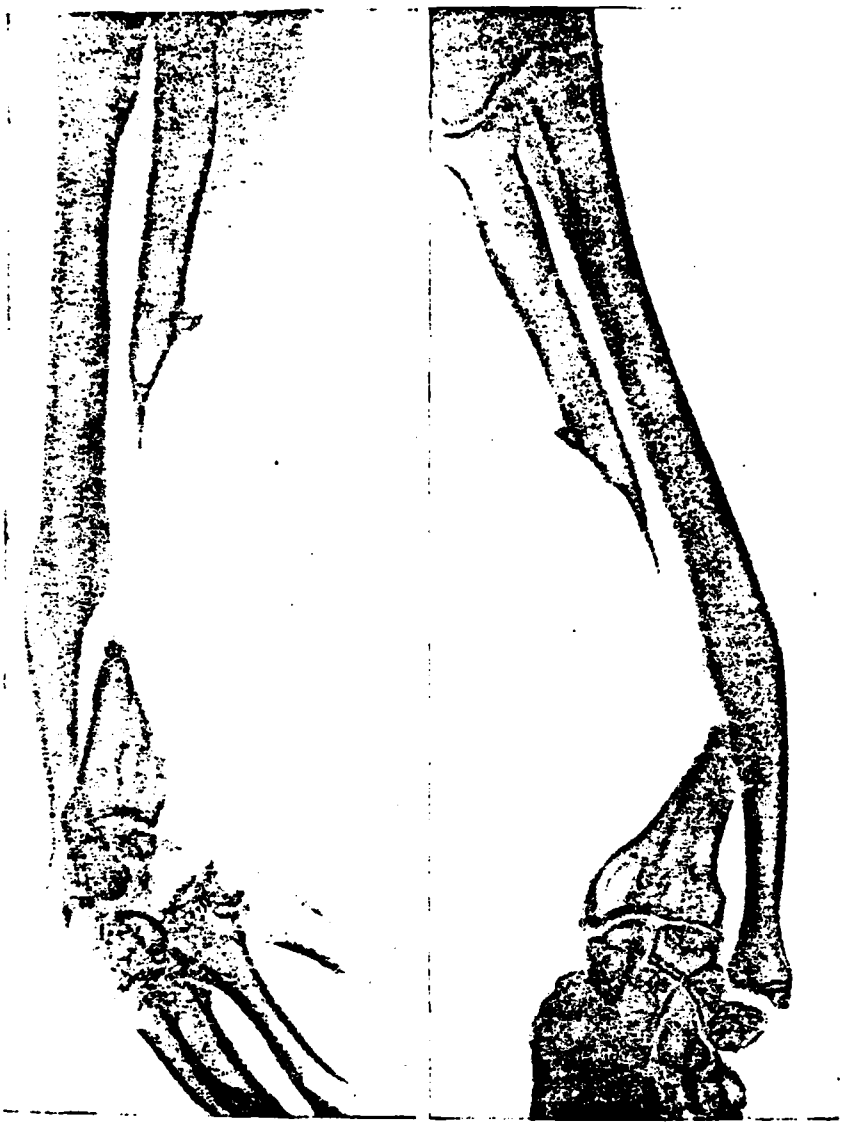


Fig. 1b. 2 Years after injury. Extensive defect of bone tissue after breaking up of the extremital cut of radial bone and grown together break of the ulna.

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Given data have an interest both for the evaluation of readings in the primary surgical processing of wound and in the sense of supplementary prerequisite/premise for expanding the readings for intervention on the damaged nerves. This side of a question attracted attention of the authors already during the Great Patriotic War. M. G. Ignatius (1942) et al. was focused attention on the fact that the heavy injuries of nerves, which led to the irreversible intra-hanger-on processes, were deposited most frequently by fragments. Such injuries in majority their were combined with the presence of foreign bodies in the tissues and the nerves. It is obvious, reading to operational intervention on the nerves with similar injuries of proper ones to be expanded.

The high severity of bullet breaks with the damage of nerves is illustrated also by the fact that the associated injuries of other parts of the body during the damage of nerves were encountered more frequently than with the breaks without the damage of nerves (Table 52).

Clinically the damage of nerves became apparent in the form of the full/total/complete or partial interruption of conductivity. The degree of interruption was defined just as with the injury of nerves among the soft tissues, of the symptoms of precipitation of motor, sensitive and vegetative function in the region of all branchings of the damaged nerve it is lower than the level of its injury. At the same time with all injuries of nerves, except the symptoms of precipitation, to a greater or lesser extent were noted the symptoms of stimulation in the sensitive and vegetative sphere, which also has a value in the diagnosis, especially during the determination of the degree of the interruption of conductivity. The clinical classification of the damages of nerves is wider than the classification, constructed only on the morphological signs, since it is necessary to secrete the picture of the jolt of the nerve trunk, caused by the indirect damage of nerve. It is the consequence of jolt, elongation or temporary/time compression as a result of the injury of adjacent tissues. B. S. Doynikov underscored that only full/total/complete reduction of the lost functions during the short period (7-15 days) gives to right diagnose of the jolt of nerve.

To questions of the classification of the clinical forms of the damages of nerves was devoted large number of works, which relate to the time of the Great Patriotic War. These questions were repeatedly the object/subject of discussion at different conferences and plenums

(N. N. Burdenko, B. S. Doynikov et al.). B. S. Doynikov, B. A. Favorskiy, G. A. Richter, N. I. Grashchenkov, V. S. Gaikin, P. M. Saradzhishvili et al. produced during the Great Patriotic War th- short textbooks which examined the different questions, connected with the injury of nerves, including questions of classification.

Table 52. Frequency of the associated injuries of other parts of the body with the bullet breaks of the bones of extremities with multiple failure of nerves and with the breaks without the damage of nerves (in percent).

(2) Группа раненых	(1) Локализация перелома			
	(3) плечо	(4) предплечье	(5) бедро	(6) голень
(7) С повреждением нервов	36,4	23,9	35,1	34,0
(8) Без повреждения нервов	36,5	16,8	31,0	31,7

Key: (1). Localization of break. (2). Group of injured people. (3). shoulder. (4). forearm. (5). thigh. (6). shin. (7). With damage of nerves. (8). Without damage of nerves.

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Were undertaken also the separate attempts to secrete the syndromes, connected with different pathological and anatomical changes. Are described, for example, the syndromes of "physiological interruption", "compressions", "contusion", etc. They all have their value for refining the diagnosis of the character/nature of the damage of nerve. However, I. Ya. Razdol'skiy as early as 1939 to V session of neuro-surgical council said that the neuropathologist, who takes upon himself courage when full/total/complete precipitation of the function of that damaged is present, waxed thread to solve the

problem about presence or absence of the full/total/complete or partial interruption of nerve, exceeds the limits of the possibilities of his method, deceiving himself and leading into deception of surgeon. Until recently the real form of the damage of nerve can be with reliability established/installed only on the operating table. N. N. Burdenko called those cases, in which the diagnosis was checked on the operating table, verified. It is necessary to keep in mind which with any of the described syndromes compulsorily takes place either full/total/complete or partial disturbance/breakdown of the conductivity of nerve. It is necessary only once more to emphasize that the full/total/complete interruption of conductivity, detected during the clinical investigation of injured person, in any way always does not have morphological substrate in the form of full/total/complete anatomical interruption. The frequently full/total/complete interruption of conductivity, revealed during the first watches and the days after injury, depended on concussion of nerve and during several days was changed by partial, and then by the full/total/complete reduction of all functions. Similar interruptions of conductivity were described sometimes by the name of "physiological ones" despite the fact that the determination "physiological" little corresponds to the essence of damage.

The analysis of the histories of

disease/sickness/illness/malady, which relate to the damages of the nerves both of upper and lower extremity, shows that in the overwhelming majority of injured people with the partial anatomical interruption directly following the injury was noted the full/total/complete interruption of the conductivity of the corresponding nerves. The clinical picture of partial interruption was explained usually not earlier than two-three weeks after injury.

The symptoms of stimulation in the form of the pains of different intensity and other abnormal perceptions are noted almost in all injured with the damage nerves. The most typical were projection pains in the region of the propagation of the final branches of this nerve. Various kinds abnormal perceptions frequently were received so heavily as pain. These perceptions include a feeling of the "numbness" of extremity, "creeping the goose pimples", sometimes phantom perceptions and pains. Phantom perceptions more frequently were observed with the full/total/complete anatomical interruption of large/coarse nerves (of sciatic, the shafts brachial plexus). The experiment/experience of the Great Patriotic War completely confirmed the observations of the period of the first world war, which showed that the pains with the partial interruptions usually are more they are sharply pronounced than with total (M. I. Astvatsaturov, B. S. Doynikov et al.).

The frequency of causalgia with the bullet breaks to come to light/detect/expose based on materials of the military medical museum it was not represented possibly as a result of the deficiency of recordings in the histories of the disease/sickness/illness/malady of the unspecialized hospitals, or in view of different content, put in by the authors into the concept of causalgia. Among the work of the Soviet authors, who were concerning the damage of nerves in war, large part relates precisely to the questions, connected with causalgia (P. K. Anokhin, P. S. Banitskiy, V. A. Baronov, to A. V. Bondarchk, M. L. Borovskiy, V. S. Galkin, D. G. Goldberg, A. M. Grinshteyn, S. N. Davidenkov, B. D. Dobychin, V. I. Ishkhanov, S. I. Karchikyan, F. M. Lampert, V. L. Lesnitskaya, S. Yu. Minkin, M. A. Nikitin, I. I. Rusetskiy, G. F. Skosogorenko, A. V. Triumfov, K. P. Chikovani et al.).

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One should, however, note that causalgia in its expressed form with the bullet breaks is not the frequent phenomenon. Data of the deepened development of the histories of disease/sickness/illness/malady support the conclusions of A. V. Triumfov, that character/nature the injuries and the special feature/peculiarity of the course of wound process do not have vital importance in the onset of causalgia.

According to the data of the deepened development of the histories of disease/sickness/illness/malady, causalgia it was observed with the bullet breaks of the bones of extremities with the following frequency: with the breaks of shoulder - in 1.4o/o, those of the bones of forearm - into 1.4o/o, thighs - into 7.7o/o and with the breaks of the bones of shin - into 2.0o/o.

With the injuries of thigh burning pains were noted by injured people almost exclusively in the zone of the final branchings of tibial nerve. With the injuries of more extremital divisions (shin) such pains appeared much more rarely, but they were also limited only to the zone of the extremital branchings of tibial nerve. The injuries, complicated by causalgia , greatly were distinguished between themselves in the ratio of the intensity of pains and duration of disease/sickness/illness/malady.

Experience from the Great Patriotic War it completely confirmed the old observations, which showed that causalgia it is almost exclusively during the insignificant damages of the specific nerves (M. I. Astvatsaturov et al.). The most firm course with the severe pains (the "symptom of wet chopper", synesthesialgia) according to the personal observation is noted only in those injured people, in

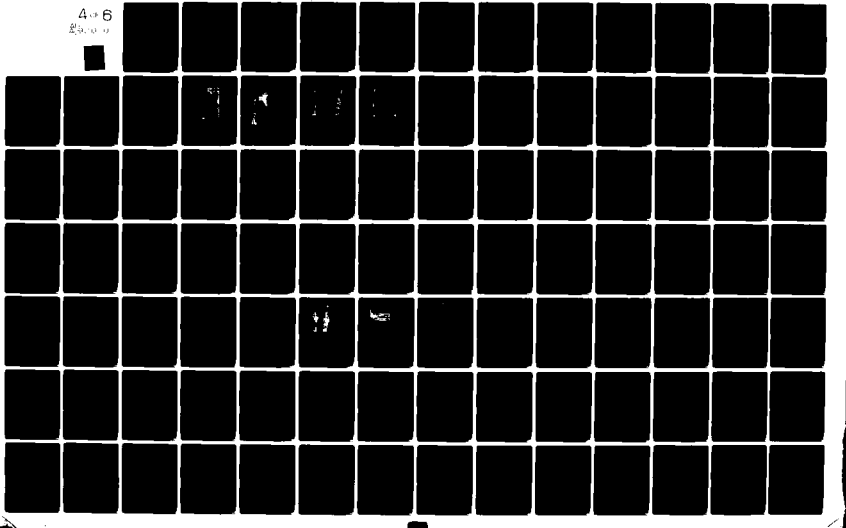
who with the operation/process in the thickness of the shaft of the interested nerve it was not found any significant macroscopic change, except edema.

Causalgia with the bullet breaks of shoulder and forearm, according to the data of the deepened development of the histories of disease/sickness/illness/malady, it is noted with the identical frequency. To explain such relationships/ratios is sufficiently difficult, since, according to published data and based on materials of personal observation, causalgia during the damages/defeats of upper extremity it was observed almost exclusively with the injuries of its proximal divisions (upper arm, shoulder). Causalgic pains during the damage/defeat of upper extremity were noted almost exclusively in the region of the final branchings of middle nerve.

The reflector or physiopathic contractures, in detail described by Babinski and Forman (Babinsky et Froment), at the end of the first world war were detected mainly with the injuries of the extremital divisions of forearm.

The onset of reflector contractures in connection with the injury (stimulation) of the precisely extremital, but not proximal cuts of nerves noted during the Great Patriotic War many authors (S. N. Davidenkov, A. V. Triumrov et al.).

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OCT 80
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According to the data of the deepened development of the histories of disease/sickness/illness/malady, with the bullet breaks of extremities reflector contractures were observed with the following frequency: with the breaks of shoulder - into 0.4%, the bones of forearm - into 1.5% and of shin - into 0.1%. With the breaks of the thigh of reflector contractures it is not noted.

According to the observations of the author under conditions of front and back evacuation hospitals with the reflector contractures during the operation/process never it was noted the anatomical damage of the nerve trunks. In this respect completely is confirmed the generality of the mechanism of the development of causalgia and reflector contractures, for onset of which the necessary condition is the state of preservation of the conductivity of nerves (M. I. Astavtsaturov, S. N. Davidenkov, A. V. Triumfov et al.).

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During the analysis of the clinical course of the damage of nerves it is necessary to keep in mind that the symptoms of stimulation on their manifestations in many respects are similar to the symptoms of reduction. This has the high value for diagnosis,

since in patients with the old damage it is frequently difficult to solve, are connected different abnormal perceptions with the begun reduction of nerve or continue to occur only the phenomena of stimulation.

The clinical course of the damage of nerves during smooth coursing bone of wound in neurologic sense noticeably does not differ from coursing of equalization during the damage only of soft tissues. The trophic disorders of skin and its appendages, muscles, and especially bone tissue in the extremital divisions of the affected extremity completely coincide with the same disturbances/breakdowns during the damage of nerves among the soft tissues.

In all injured people trophic ulcers appeared only in the sections with the disrupted sensitivity and mainly at the places, which were undergoing the mechanical stimulation (bottom, heel).

In the works of A. G. Molotkov, A. S. Viwnyovskiy et al. it is shown that the trophic disorders occurred sharper they were expressed when there was not complete interruption of nerve, but partial and especially when nerve was in the state of stimulation as a result of the inflammatory process or other reasons. It is also known that this the changes most sharply become apparent on the periphery in the region of most extremital branchings of the affected nerve.

The phenomena of osteoporosis in the extremital divisions of the victim of extremity with the bullet breaks with the damage of nerves in no way differed from osteoporosis, which was being observed with the injury only of soft tissues with the damage of nerves. It is necessary to emphasize that most sharply pronounced osteoporosis was observed in those injured people, in whom, besides the damage of nerves, were noted the damages/defeats of vessels with the phenomena of ischemia.

Considerable attention in the Soviet literature was paid to a question about the possible effect of the damage of the nerve trunks on the healing of the fracture of bone (V. I. Razumovskiy, 1884; A. L. Pilenov, 1917, 1923; A. D. Ozerov, 1923, 1925, 1929; A. G. Molotkov, 1927; G. I. Turner, 1935; Ya. G. Rubinteyn, 1935; V. D. Chaklin, 1938; A. A. Nikitin, 1938; G. Ya. Epstein, 1940; S. L. Firer, 1943; K. A. Grigorovich, 1943, 1947, etc.). A question was examined differently, and here it is possible to note two contradictory/opposite points of view. Some authors considered that the damage of the nerve trunks is reflected in the process of the healing of fracture, others did not find bases in order to assign to the damage/defeat of nerves any effect on the consolidation of the break, arranged/located on the same level, as the damage of nerve.

Among the supporters of the first point of view in turn, are noted radical contradiction. Some on the basis of the clinical observations, reinforced by data of experimental works, are inclined to consider that the damage of nerves retards the consolidation of bone scrap, others through the same bases found that the regeneration of bone tissue during the damage of nerves, on the contrary, is accelerated. The individual authors even more greatly detailed a question and indicated that the regeneration of bone tissue is detained mainly with incomplete interuptions of nerves and phenomena of their permanent stimulation. Ya. G. Rubenstein (1935), being interested in the experimental explanation of a question, noted that the applied the authors procedure was not always sufficient precise; it undertook experiments/experiences employing another procedure, but also were obtained very dissimilar results.

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In spite of the presence of the number of the investigations, produced specially for the purpose of the study of the anatomy of bone nerves (D. G. Icsselinami, 1928; A. G. Yeletskiy, 1931; P. I. Faytel'berg, 1938, etc.), little it turned attention to the fact that the bone nerves are disengaged basic nerve trunk always more proximal

than that section not which may penetrate inside the bone. In connection with this one should expect that during the interruption or other damage of nerve, which occurs on the same level with the break of bone, are intra-barrel damaged the bone nerves only to the underlying sections of bone.

Consequently, the nerve branches, which supply the section of bone, which is located on the same level with the damage of the nerve trunk, suffer to the same degree, as with the breaks without the damage of basic nerve trunks.

Contradicting injury with the damage of nerves to injuries without the damage of nerves, the authors sometimes, apparently forgot about the fact that the breaks without the injury of nerves in the essence it does not occur, since each damage, but that is more so/such rough as the break of bone, it is unavoidably conjugated with the massive damage/defeat nervous system.

Thus, error sometimes was committed in the very posing of the question when to the injuries with the damage of nerves carried only injuries with the damage/defeat of the basic nerve trunks, which frequently have no relation to the region of break, except known topographic nearness.

Already these short observations make it possible to make the conclusion that a question about the effect of the damage of the nerve trunks on the healing of fractures is very complex and unexplained.

Data of the deepened development of the histories of disease/sickness/illness/malady introduce certain clarity into this question, since they show that the large difference within the periods of the healing of the fractures in the groups of injured people in question it was not noted (Fig. 2). At the same time during the determination of the average period of the consolidation of breaks is revealed/detected the very small delay/retarding/deceleration of consolidation in the group with the injury of nerves (Table 53).

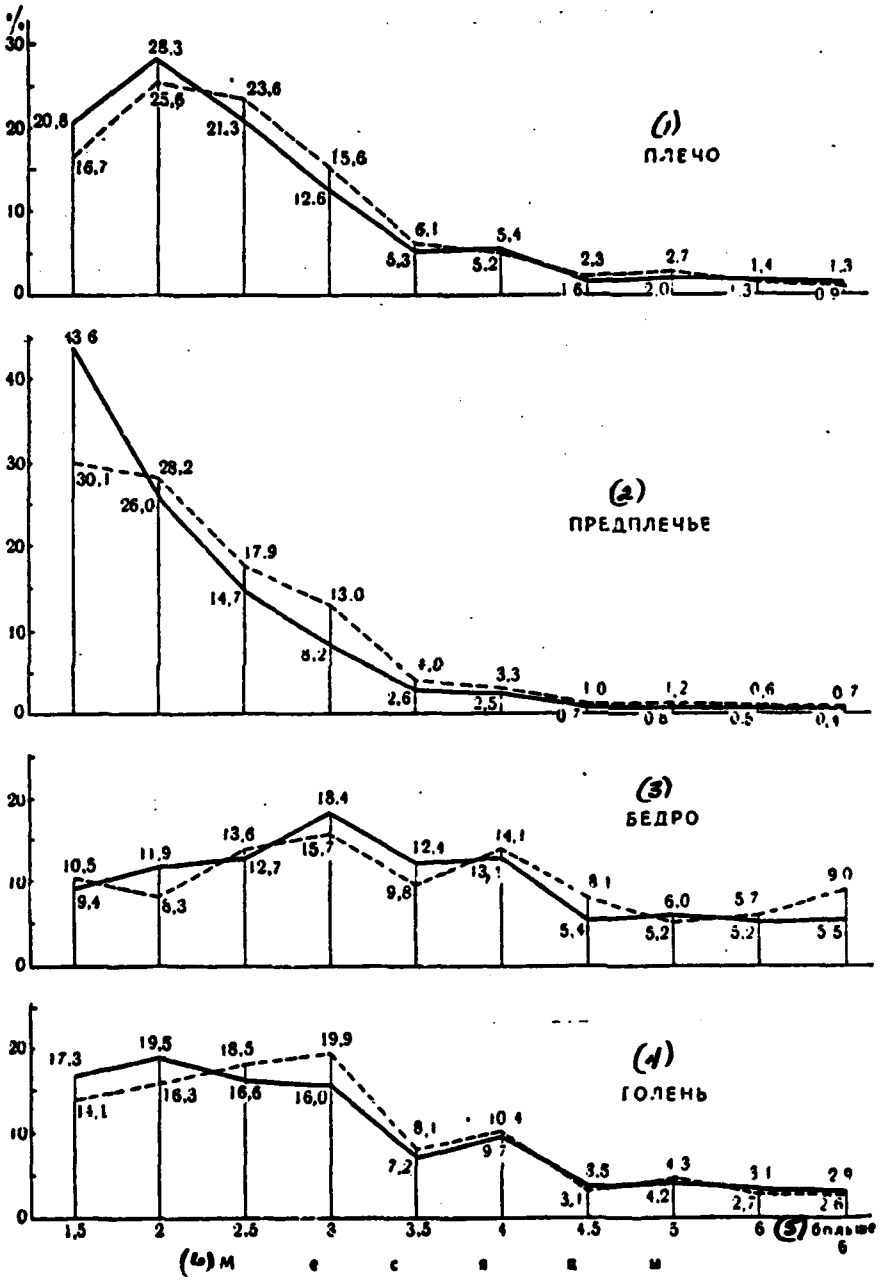
In the explanation of the sufficiently intricate question these given present a somewhat greater value than the relatively scarce clinical observations of the individual authors and contradictory data of experimental works. Apropos of the latter it is necessary to note that between the experiments/experiences with the cutting and the resection of nerves on animals and the combined bullet injuries of bones and nerves in war is a large difference.

Table 53. Average periods (in the months) of the consolidation of the bullet breaks of the bones of extremities during the damage of nerves and without their damage (in the percentages).

(1) Группа раненых с огнестрельным переломом	(2) Локализация перелома			
	(3) плечо	(4) предплечье	(5) бедро	(6) голень
(7) С повреждением нервов	2,4	2,1	3,3	2,7
(8) Без повреждения нервов	2,2	1,8	3,2	2,6

Key: (1). The group of injured people with fire [bullet] break. (2). Localization of break. (3). shoulder. (4). forearm. (5). thigh. (6). shin. (7). With damage of nerves. (8). Without damage of nerves.

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injured people without the damage of nerves - - - - injured

people with the damage of nerves.

Fig. 2. Periods of formation of durable callus with bullet breaks of bones of extremities in connection with injury of nerves.

Key: (1). Shoulder. (2). Forearm. (3). Thigh. (4). Shin. (5). It is more. (6). Months.

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Supplementary illumination a question can obtain during the analysis of the frequency of the complications of pseudoarthrosis of the combined damages of bones and nerves.

From Table 54 it is evident that the essential difference in the frequency of pseudoarthrosis with the injury of nerves and without their injury on the upper extremity it was not, but with the breaks of the bones of lower extremity a number of pseudoarthroses in the absence of the injury of nerves was even higher than with the injuries with the damage of the nerves (see also pg. 373).

These data make it possible to draw the conclusion that the injury of the nerve trunks with the bullet break cannot be considered as the moment/torque, which facilitates the formation of

pseudoarthrosis.

Attention is drawn to considerable frequency of the complications of pseudoarthrosis with the bullet breaks of shoulder.

The bullet breaks of thigh were observed more frequently in upper and middle third, where the bone most of all was covered with muscles, and the breaks of shoulder with the damage of nerve frequently were encountered in middle third (45.0o/o), where the shoulder bone was covered with muscles mainly from the front and from behind, but not from the lateral surfaces.

At present it is possible to consider sufficiently to those established/installed that the blood supply of bone is to a considerable extent provided by the vessels of muscles. The sources of the blood supply of deep muscles, periosteum and bone are general/common/total for these all tissues, in consequence of which for the nourishment of bone "muscular cover" has high value.

The analysis of data of the deepened development of the histories of disease/sickness/illness/malady and materials of the author shows that pseudcarthrosis was observed mainly after the injuries, which were being accompanied by the large loss of bone tissue, and also in injured people, repeatedly operated apropos of

osteomyelitis. Connection/communication of pseudoarthrosis with other possible etiological factors is less clear.

The following observation shows the value of the large loss of bone tissue in the pathogenesis of pseudcarthrosis.

K-y N. G., 43 years, to the wound 21/I 1943 by bullet right through into the left shoulder with the breaking up of bone. Subsequent coursing of injury was complicated by osteomyelitis apropos of which in the different stages are carried out several operations. Latter/last operation/process of the deep rear consisted of the removal/distance of sequestrations and the comparison (introduction) of scrap with the application of gypsum dressing on 3 1/2 months of the success it was not 21/I 1944 in the evacuation hospital of the deep rear superimposed suture to the ulnar nerve at the level of the false joint. o/II 1944 it was superimposed suture to the radial nerve at the same level. Post-operation coursing is smooth. X-ray photograph showed the large loss of bone tissue as a result of injury, osteomyelitis and connected with it interventions (Fig. 3).

Table 54. Frequency of pseudoarthrosis as the basic issue of the bullet breaks of the bones of extremities with multiple failure of nerves and without their damage (in the percentages to a number of revealed clinical issues, eliminating amputations).

(1) Группа раненых с переломом костей конечностей	(2) Локализация перелома			
	(3) плечо	(4) предплечье	(5) бедро	(6) голень
(7) С повреждением нервов	5,3	4,0	0,5	1,5
(8) Без повреждения нервов	5,0	3,9	0,6	2,5

Key: (1). Group of injured people with the break of the bones of extremities. (2). Localization of break. (3). shoulder. (4). forearm. (5). thigh. (6). shin. (7). with damage of nerves. (8). Without damage of nerves.

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It is at the same time necessary to note that the vastness of the damage to bone with the bullet break, if it is not connected with the large loss of tissue, does not in any way eliminate possibilities favorable coursing of the regeneration of bone tissue even with multiple failure of several nerves.

M-v K. P., 25 years, is injured 13/II 1943 by the explosive bullet into the right upper hair crest and into the right shoulder.

At the moment of injury it felt that "hand as it did not stop". The primary working of wound on DMP 30 minutes after injury. 26/II 1943 was produced superimposed anechoic Hins bandage apropos of the multifragmented crushed^break of breast bone (Fig. 4). With the satisfactory general/common/total health without any supplementary operational intervention began the consolidation of scrap, and 28/II 1944 injured person entered into the specialized evacuation hospital with the complaints of the absence of the possibility to abstract/remove shoulder and of the overhang of hand and fingers/pins. During the clinical investigation was determined a good consolidation of break during the very insignificant strain of shoulder. Apropos of the phenomena of the full/total/complete interruption of the conductivity of radial and axillary nerve was undertaken surgical intervention. With operation it was discovered the full/total/complete anatomical interruption of radial nerve and gross cicatrical intra-hanger-on changes in the axillary nerve for the elongation/extent 5 cm. Intervention ended by stitching on the radial nerve and by neurolysis of axillary. Postoperational coursing is smooth.

As is evident in the X-ray photograph (Fig. 4), there have all foundations for relating the damage to bone this injured person to the group of heavy ones; however the healing of fracture elapsed completely smoothly, without of the loss of bone tissue, without

osteomyelitis, without any supplementary surgical interventions on the bone ended by the formation of durable callus.

Quant. b. g., 21 year, it is injured 25/VII 1942 of disruptiv· (?) by bullet right through middle third of left forearm. Large torn wound on the front face of forearm with the break of radial bone in two places. Gypsum bandage was taken/removed after 25 days in connection with developing osteomyelitis. Wounds and fistulas finally were closed at the end of December of 1942. It entered into the evacuation hospital of the deep rear 22/XI 1942 with the phenomena of the full/total/complete interruption of the middle nerve and the partial damage of the cubital and of the surface branch of radial nerve 10/III 1943 produced operation/process. Is cut all over extensive scar on the front face of forearm. In the section of the damage of the muscle joined into the general/common/total scar. Peripheral end by completely broken middle nerve is soldered to the sharp/acute bone prominence of radial bone. Central end is soldered in the general/common/total scar with the muscles and is cut from it by knife (" as of the cartilage"). Bone prominence of cut away by the forceps of Lewer. The ends of the nerve are refreshed and connected by three silk sutures through epineural with diastasis 0.3 cm. Wound is sew tightly. Smooth healing. 7 1/2 Months after operation/process got stronger the muscles of forearm. It heaves by sick hand to 15 kg. There are no pains. Appeared hyperpathetic

perceptions in region of the I-III fingers/pins. In the X-ray photograph every 4 1/2 months after injury was determined the fragily grown together fragmented break of radial bone into two places. Radial bone is deformed. In the soft tissues in the region of break are visible fine/small bone and metallic fragment (Fig. 5).

After operation/process it was returned to the front. Through 3 1/2 years it could fulfill all punishments and heave by sick hand more than 20 kg. The motions of fingers/pins were reduced not fully. About the reduction of sensitivity there is no information.

In this injured person, in spite of the break of radial bone in two places, osteomyelitis, presence of foreign bodies in the soft tissues about the bone and damage of three nerves, began the completely satisfactory consolidation of scrap, which did not impede the elevation of severities by sick hand and to the execution of other works.

Data of the diagram (see Fig. 2) show that the periods of the formation of durable callus in injured people with the damage of nerves differ little from the same periods in injured people without the damage of nerves. At the same time, it is possible to indicate that in injured people with break and damage of nerves are noted the single cases of repeated breaks, completely reminding the same in injured people without the damage of the nerve trunks.

Page 112a.



Fig. 3. K. After injury. Large loss of bone tissue of shoulder as a result of injury, osteomyelitis and connected with it interventions.

Page 112b.



Fig. 4. M. After injury. Extensive damage to shoulder bone, which ended by the formation of durable callus with the very insignificant deformation.

Page 112c.



Fig. 5.



Fig. 6.

Fig. 5. K. 4 1/2 Months after injury. Fragmented break of radial bone at two levels. Completely satisfactory consolidation.

Fig. 6. G. "Fragmented break of shoulder with inclusion/connection of fine/small bone scrap and metallic fragments between ends of bone. Photograph is made 6 weeks after repeated break and 5 months after injury.

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Fig. 7.

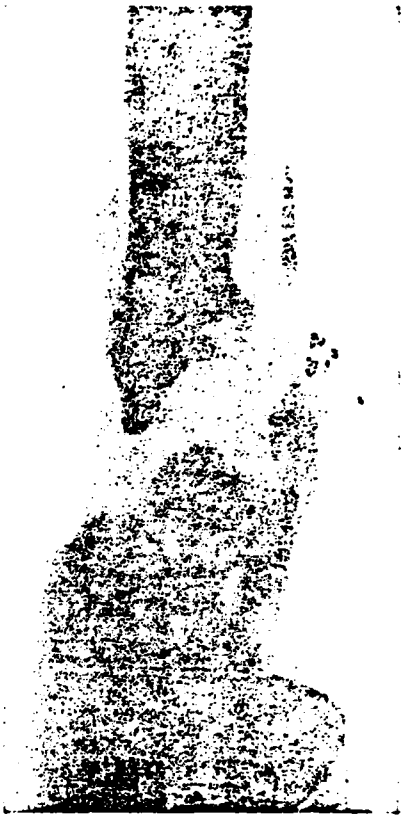


Fig. 8.

Fig. 7. A. Section of illumination in center of corn of shoulder bone and sequestration in it. Photograph is made in 4 months of 7 days after repeated break and 7 months after injury.

Fig. 8. Sh., osteomyelitis and false joint of shoulder. Photograph is made 8 months after injury.

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G-V A. I., 22 years, is injured 25/IX 1942 by bullet right through into middle third of right shoulder with the break of bone. Hand is immediately sagging. Wound was processed on DMP and healed during December of the same year. In the evacuation hospital coarse-whom rear in the X-ray photograph 28/XII 1942 was determined the fragily grown together fragmented break of shoulder bone in middle third. Between the ends of scrap are visible fine/small bone scrap and metallic fragments. 23/I 1943 with the accidental incidence/drop it again obtained break at the previous place. Was superimposed gypsum bandage to 5/III.

In the X-ray photograph of 8/III 1943 was determined the more durable bone joint between the scrap (Fig. 6). 23/III 1943 it is operated apropos of the damage of radial nerve. Are cut all over for the elongation/extent 6 cm the ends of the completely smashed radial nerve with the metallic fragment (size/dimension 2x3 of mm) and the the bone fragment (by size/dimension 10x3 of mm) in the neuroma of central cut. The central and peripheral cut of nerve they are approached by four epineural sutures without diastasis and without the tension. Anechoic suture of wound. Smooth post-operation coursing.

15/X 1943 appeared bending motions in the radiocarpal joint. The straightening of fingers/pins continued to remain disrupted, but patient obtained the possibility to write with right hand, what to the operation/process on the nerve he make could not. No of complications from the side of the former break after operation/process on the nerve it was noted.

In this injured 3 months after the bullet break shoulder in middle third with the simultaneous full/total/complete interruption of radial nerve at the same level in the X-ray photograph was determined the fragile joint between the scrap.

4 Months after injury as a result of the accidental incidence/drop is noted the repeated break at the previous place. In 1 month of 14 days after repeated break in the X-ray photograph was determined already more durable bone joint than during the first investigation. The operation/process on the nerve, made 6 months after injury, was accompanied by known success, since 6 1/2 months after stitching on the nerve is noted the partial reduction of the function of muscles, by it innervated, in spite of the considerabl. defect of the nerve trunk (6 cm).

A V- N., 25 years, it is injured 22/XI 1942 by bullet right through into middle third of right shoulder with the break of bone

and the damage of radial nerve. It entered into the back specializ-l evacuation hospital 17/I 1943 with the healed wounds. In the X-ray photograph 24/I 1943 was determined the grown together break of shoulder bone.

Bone in the section of break is thickened, deformed, there is a focus of illumination. Sequestrations in it evidently 7/II 1943 obtained with the incidence/drop new break on the spot of old. Is superimposed the gypsum bandage. 26/III 1943 it is produced operation/process on the radial nerve. Nerve hides itself in the massive, but soft callus, and it can be secreted with the aid of only the scalpel. Entire diameter of shaft in the section of damage replaced by the scars with which is connected large/coarse bone scrap. Resection 6 cm of nerve. Three epineural sutures are superimposed to the refresned ends without tension and diastasis. Post-operation coursing was complicated by festering; however, after the evacuation of pus wound granulated well and completely it healed in the course of one month. In the X-ray photograph 14/VI 1943 is determined the grown together break of shoulder bone, in the center of corn the section of illumination and sequestration in it (Fig. 7). During the percussion and the palpation on the course of the peripheral cut of nerve of lower than the level of suture for the elongation/extent 6-7 cm were noted projection pains.

In this injured 2 1/2 months after the bullet break shoulder, complicated by latent flowed/occurred/lasted osteomyelitis, with the accidental incidence/drop was obtained repeated break on the spot of old. In 1 1/2 months began again the consolidation of scrap and was undertaken intervention on the damaged nerve. Operation/process was complicated by the aggravation of latent to that infection, but wound after the evacuation of pus healed very rapidly. Any signs of osteomyelitis, besides those radiographically determining, no longer it was noted. At the same time turn to itself the attention and that the fact that, in spite of festering after operation/process, were nevertheless noted the specific signs of begun regeneration of nerve in the form of projection pains during the mechanical stimulation of extremital cut of lower than the suture.

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By the most probable explanation of repeated break in this injured person is represented the weakness of the callus as a result of infectious-toxic changes of the bone as a result of osteomyelitis.

The entire group of the repeated breaks, which were being observed by the author, does not give the thus far sufficient bases to consider that the relative weakness of the callus, the conditioned possibility of repeated break, are connected precisely with the

damage of the nerve trunks. In each of these injured people it was possible to note other reasons: in some - attention is drawn to a comparatively short period, which passed after injury, in others - the insufficient strength of corn was caused by osteomyelitis.

Complications.

Shock.

The study of lethal outcomes from the shock reveals/detects not one injured person, in which shock and death it would be possible to explain predominantly by the damage of the nerve trunks. In these all injured people is noted either heavy hemorrhage or very heavy form of break, or multiple and combined injuries of other organs/controls, which completely explain onset of shock and death from it. Based on materials of personal observation under conditions of front and back evacuation hospital, also stores/adds up the impression, that the damage of the nerve trunks of extremities by itself did not play considerable role in origin and development of shock. The study data of anamnesis and recordings of the foremost stages of evacuation in the majority of injured people shows that the shock was noted mainly with the abundant blood loss, for example, with the injury of the neurovascular bundle of upper extremity in the proximal divisions, and also in injured people with the multiple and combined injuries of

other organs/controls or in combination with the extensive breaking up of bone.

Based on materials of the deepened development of the histories of disease/sickness/illness/malady, the shock in injured people with the damage of nerves is represented by following data (Table 55).

Table 55. Frequency of the complications of shock with the bullet breaks of the bones of extremities with multiple failure of nerves and with the breaks without the damage of nerves (in the percentages).

(1) Группа раненых с огнестрельным переломом	(2) Локализация перелома			
	(3) плечо	(4) предплечье	(5) бедро	(6) голень
(7) С повреждением нервов	3,8	1,8	16,1	12,1
(8) Без повреждения нервов	1,9	0,5	6,8	4,0
(9) С повреждением нервов после исключения из учета раненых с ампутацией при первичной обработке	2,2	1,0	11,0	4,6
(10) Без повреждения нервов после исключения из учета раненых с ампутацией при первичной обработке	1,7	0,3	6,5	3,3

Key: (1). Group of injured people with the bullet break. (2). Localization of break. (3). shoulder. (4). forearm. (5). thigh. (6). shin. (7). With damage of nerves. (8). Without damage of nerves. (9). With damage of nerves after exception/elimination from account of injured people with amputation during primary working. (10). Without damage of nerves after exception/elimination from account of injured people with amputation during primary working.

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Very it is characteristic that after exception/elimination from consideration of injured people, in which is produced the amputation during primary working, the frequency of the complications of shock

during the damage of nerves was considerably lowered (with the breaks of thigh almost 1 1/2 times, and with the breaks of the bones of shin are more than b of 2 1/2 times), while with absence of the damage of nerves a reduction in the frequency of the complications of shock occurred only in the tenths or percentage. This greatly clearly attests to the fact that the severity of injuries in persons with the damage of nerves was considerably greater than in the absence of the damages of nerves. Further, if we compare the information about the frequency of the injuries or vessels in injured people with the damage of nerves (table 47) with the frequency of the injuries of vessels in all injured people (pg. 17), then it will seem that in injured people in by the damage of nerves wound of vessels was observed on all segments or extremities into 2 and the more of times more frequently than in all injured people with the break. If we to this finally add the information about the severity of the break and a number of those associating wounds in the groups (table 50 and 52) indicated, then it becomes completely obvious, that in the pathogenesis of shock primary meaning had the severity of injury and whereas blood loss, injury of the nerve trunks occupied small place.

Together with a question about the shock, there is known interest in a question about the loss of consciousness with the injury of nerves. To establish/install with the sufficient accuracy the fact of the loss of consciousness at the moment of injury or

directly following it on the basis of data of anamnesis is impossible. However, in those injured people in whom there were more or less reliable indications of the loss of creation directly following the injury, almost always was revealed/detected obvious connection/communication between the loss of consciousness and the abundant hemorrhage from the wound. Study in this direction of the histories of the disease/sickness/illness/malady of military medical museum, and also personal observations under conditions of back and front evacuation hospitals do not give grounds to consider the loss of consciousness to any pathognomonic for the injury of nerves.

Osteomyelitis.

Osteomyelitis, which complicated the bullet breaks of the bones of extremities, in many respects laid peculiar impression on clinical coursing and treatment of the damaged nerves with the combined injuries. According to the data of deepened working of the histories of disease/sickness/illness/malady, osteomyelitis is noted with the breaks with multiple failure of nerves more frequently than without the damage of the nerve trunks (Table 56), that it is necessary to place in connection/communication, first of all, with the large severity of injury.

Table 56. Frequency of the complications of osteomyelitis of the bullet breaks of the bones of extremities with the damage of nerves and breaks without the damage of nerves (in the percentages).

(2) Группа раненых с переломом	(1) Локализация перелома			
	(3) плечо	(4) предплечье	(5) бедро	(6) голень
(7) С повреждением нервов	47,0	33,9	40,3	52,9
(8) Без повреждения нервов	41,9	21,4	40,1	51,7

Note. The frequency of osteomyelitis is calculated after the exception/elimination of those amputated, but taking into account the injuries, complicated by sepsis.

Key: (1). Localization of break. (2). Group of injured people with break. (3). shoulder. (4). forearm. (5). thigh. (6). shin. (7). With damage of nerves. (8). Without damage of nerves.

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As can be seen from Table 56, is noted certain increase in the frequency of osteomyelitis in the group of injured people with the damage of nerves. With the injuries of shin and shoulder this difference partly can be explained by the fact that in the group of injured people with the damage of nerves predominated the fragmented breaks, with which was observed a great number of complications of

osteomyelitis (chapter VI).

Up to the moment/torque of extraction from the therapeutic institutions a number or injured people with osteomyelitis considerably decreased, but came to light the sharper preponderance of injured people with osteomyelitis in the group with the damage of the nerve trunks (Table 57). This is also explained by the larger severity of trauma itself, and mainly by the heavier disturbances/breakdowns of the function of extremity and general state in injured people with the damage of the nerve trunks.

A question about osteomyelitis during the damage of nerves was lit from different point or view, most frequently in connection with the readings to surgical intervention (A. N. Bakulev, 1942; Z. I. Geymanovich and D. S. Zel'dich, 1943; Ye. V. Petisov, 1945; K. A. Grigorovich, 1943, 1948, etc.). For evaluating the special features/peculiarities clinical coursing of combined injuries of bones and nerves it is necessary to have in mind that the large part of the damages, as is evident from the data of the deepened development of the histories of disease/sickness/illness/malady, it was finished with the formation of the callus within the usual periods, in spite of the injury of the nerve trunks. In another part of the injured people occurred the complication of bullet break of osteomyelitis. This process proceeded so differently that it is

possible to secrete two groups of injured people with osteomyelitis.

One group compose injured people, whose process in the bone clinically proceeded hidden, without the fistulas, without temperature reaction, without the pains, but in X-ray photographs of which it was possible to see the foci of illumination in the places of the former breaks and the arranged/located in them bone fragments, the roentgenologically resembled sequestrations. In these injured people was observed smooth healing of bone wound; however, precisely in this group of the injured people it is more frequently than in others, asymptomatic coursing of infectious process was disturbed sometimes by the repeated break, which appeared under the effect of the accidental and insignificant traumata. The corresponding extractions from the histories of disease/sickness/illness/malady were already given in connection with a question about the false joints and the repeated breaks. One of them (injured G-V) shows that the heavy bullet break of shoulder bone with many bone and metallic fragments ended by the formation of durable bone joint without surgical intervention on the bone. Operation/process on the nerve also was not accompanied by any complications.

Table 57. Osteomyelitis among the clinical issues in injured people with the bullet break of the bones of extremities with multiple failure of nerves and without the damage of the same (in the percentages).

(2) Группа раненых	(1) Локализация перелома			
	(3) плечо	(4) предплечье	(5) бедро	(6) голень
(7) С повреждением нервов	19,1	9,7	17,8	19,6
(8) Без повреждения нервов	13,0	4,2	13,5	17,8

Note. Table 57 gives the data about the injuries, which had issue osteomyelitis in the pure form/species or in the combination with other issues; furthermore, are excluded the data about the injured people, who were undergoing amputation.

Key: (1). Localization of break. (2). Group of injured people. (3). shoulder. (4). forearm. (5). thigh. (6). shin. (7). With damage of nerves. (8). Without damage of nerves.

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Another group is characterized by the fact that in connection with the presence of clinically expressed osteomyelitis was frequently shown surgical intervention not only on the nerves, but also on that damaged bone. In relation to these injured people apos-

the difficultly solvable questions about that, from what to begin the surgical treatment: from the damaged bone, from the damaged nerve or to operate on the bone and the nerve simultaneously.

The presence of suppurative focus in immediate proximity of the damaged nerve, it is doubtless, can affect adversely regeneration. B. S. Doynikov and other authors, who studied the regeneration of nerve in the experiment, repeatedly observed the delayed intergrowth, distortion and dead lock or an increase in the young axons under the effect of the infection. The commonly known observations of N. I. Pirogov of the nerve trunks in the pyonecrotic wounds caused sometimes the incorrect interpretation of the very high stability of nerves with respect to infection. It is necessary, however, to keep in mind that N. I. Pirogov noted the purely external state of preservation of the undamaged/uninjured nerves in the suppurative wounds and did not predetermine a question about those internal changes which can occur in the nerve under the influence on it of infection, especially during the damage of shells. At the present time are well known those developing as a result of the infection of the nerve of the phenomenon of ascending neuritis (D. T. Kuimov et al.) which sometimes are noted for the very large elongation/extent and can convert/transfer to opposite side of body. S. S. Pen'kevich (1944) specially investigated the outwardly undamaged/uninjured nerves on the extremities, amputated apropos of severe osteomyelitis,

and found the degenerate and inflammatory changes, which were applying to considerable elongation/extent upward and downward on the nerve trunk. It is necessary, however, to have in mind that the author investigated injured people with heavily flowed/occurred/lasted osteomyelitis, which gave occasion for the amputation. Under the same conditions Ya. M. Yanovskiy (1944) investigated muscles with osteomyelitis and also revealed/detected in them considerable changes. Heavy changes of the soft tissues as a result of the bullet break and infection of steel by sufficiently well known during the Great Patriotic War were illuminated in the works of I. V. Davydovskiy (1942), A. T. Lidskiy (1943) et al.

Contractures.

In a number of special features/peculiarities of coursing, characteristic for combined damages of nerves and bones, should be paid the attention also to the contractures. Contractures and considerable limitations of motions during the damage of nerves and soft tissues in the overwhelming majority are conditioned precisely on the damage of nerves. Especially heavy coursing was noted with simultaneous injury of vessels and nerves. During the analysis of the same disorders in injured people with the simultaneous break it is necessary to consider that considerable difficulty of movement of joints and resistive contractures could appear not only in connection

with the damage of nerves and vessels, but also in connection with the bullet break.

With the breaks the thighs the limitation of motions and contracture in the proximal divisions of extremity to the knee joint are inclusively connected, as a rule, with the damage of the bone also of the adjacent to it soft tissues, but not nerves. Characteristic disturbances/breakdowns with damage of nerves on the thigh were considerable limitation of motions and contractures in the extremital divisions, predominantly in the talocrural joint and in the fingers/pins.

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With the breaks of the bones of shin also frequently were noted the contractures of knee joint, which had obvious connection with the damage to bone and less obvious - with the damage of nerves. The damages of the nerve trunks on the shin became apparent mainly in the region of the extremital branchings of the damaged nerves.

With the breaks of the bones of upper extremity to demarcate the effect of break itself and damage of the nerve trunks on the origin of contractures is still more difficult as a result of the large requirements, presented to the mobility in all joints. By the same

time the combined injuries of the neurovascular bundle with the phenomena of ischemia were noted on the upper extremity considerably more frequently.

Treatment of damage of nerves with the bullet breaks.

Surgical treatment.

The primary surgical working of wounds, for which turned considerable attention during the Great Patriotic War, it was conducted in one or the other form in the majority of injured people with the combined damage of bones and nerves; however, dissimilarly frequently with the injury of different divisions.

Most frequently primary surgical treatment working underwent the bullet breaks of the bones of shin with the damage of nerves. The frequency of primary surgical working in injured people with the bullet break and multiple failure of nerves was the following: with the injury of shoulder - in 74.1o/o, forearms - in 65.0o/o, thighs - in 74.0o/o, shins - in 83.6o/o of injured people.

In accordance with the larger severity of bullet breaks with the simultaneous injury of the nerve trunks the frequency of primary surgical working with them was above (72.6o/o on the average on all

segments), than with all breaks both with the damage of nerves and without their damage (66.9%).

The preventive value of the dissections of dense aponeuroses was shown already to N. I. Pirogov. With the injuries of nerves primary surgical treatment those more can play very large and favorable role.

Special importance have the correctly produced dissections of dense aponeuroses on the shoulder, the forearm and the shin with the combined injuries of vessels and nerves. With such injuries frequently was noted the disseminated hemorrhage in the loose cellulose along the neurovascular bundle. Similar hematomas not only squeezed vessels and nerves, and served as medium for the development infections, but also they were that substrate on basis of which were developed subsequently the dense and disseminated scars, which damaged vessels and nerves for a second time. In connection with this the elimination of the issuing from blood should be considered imperatively shown in all injured people with the damage of the neurovascular bundle.

In spite of the wide application of primary surgical working, in the subsequent stages of evacuation also was undertaken surgical treatment apropos of data of injuries. With the injury of nerves it was undertaken more frequently than without their injury (table 58).

It should be noted that the need in the repeated operations/processes considerably more frequently appeared with the injuries of lower extremity.

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The early complications and the associated diseases, revealed during the combined with the nerves damages in the army, front region and in the deep rear, essential differed in no way from those which were observed in injured people without the damage of nerves. The analysis of the reasons for death also came to light/detected/exposed not one injury, during which the issue could be set in connection/communication with the damage of nerve.

During the Great Patriotic War occurred very considerable changes in the views on the readings to surgical interventions apropos of the damage of nerves generally, also, with the bullet break in particular. It is necessary to recall that regarding the possibility of the spontaneous regeneration of nerves Soviet authors' majority arrived at the specific conclusions even before beginning the great Patriotic War. Numerous observations showed that the independent regeneration after the anatomical damage of nerve is

observed entirely so not frequently, as this counted many authors of the period of the first world war (Tinel' (Tinel), Foerster (Foerster), etc.]. Moreover, it was completely explained that the regeneration is too frequently incomplete and incorrect (distorted). Basic points on this question were given in the "Instruction on the methods of surgical treatment in the back hospitals" (August of 1941): "A question about the independent recovery of the damaged nerves is at present no longer the object/subject of discussion. Its led in favor statistical data give very low percent of positive results and, in view of the deficiency of material, they are not conclusive. For reducing the nerve, if it occurs independently, it is necessary to wait to 8 months and more, moreover can be missed most favorable for the operation/process time" (pg. 95, p. 23). This indication sufficiently reflects the active direction of Soviet surgery, also, in the region of the injuries of the nerve trunks, that established even to the Great Patriotic War. The most posterior observations during the Great Patriotic War forced many authors to recognize the spontaneous regeneration even of more rare than this was represented initially. All this was reflected in the series/number of appearances and separate works in which the authors, examining readings to interventions on the nerves, advanced the requirement to maximally reduce the periods of duration with the operation/process. N. N. Burdenko noted that during the Great Patriotic War everywhere was outlined the general/common/total

tendency to operate during the damage of nerves "possibly more and it is earlier", in any way without losing time to the expectation of the spontaneous reduction of function.

Table 58. Frequency of operations/processes (besides the primary surgical working) with the bullet breaks of the bones of extremities with the the simultaneous damage or nerves and without their damage (in the percentages).

(2) Группа раненых с переломом	(1) Локализация перелома			
	(3) плечо	(4) пред-плечье	(5) бедро	(6) голень
(7) С повреждением нервов	49,3	37,2	63,1	61,6
(8) Без повреждения нервов	45,6	26,0	59,1	59,9

Key: (1). Localization of break. (2). Group of injured people with break. (3). shoulder. (4). forearm. (5). thigh. (6). shin. (7). With damage of nerves. (8). Without damage of nerves.

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Large number of works completely substantiated this conclusion/derivation (V. V. Lebedenko, B. G. Yegorov, M. G. Ignatius, L. A. Koreysha, A. G. Molotkov, A. V. Triumfov, S. N. Davidenkov, G. P. Kornyanskiy, A. Yu. Sozon-4rowevi et al.). A. G. Molotkov et al. already during the war with the White Finns began to operate on the nerves with the independent wounds and was obtained in the majority of injured people favorable post-operation coursing. The observations of A. G. Molotkov et al. in many respects contributed to the expansion of readings to the operations/processes within th

early periods after injuries.

Considerably more difficult it was solve the problem about the indications to the operation/process on the nerves with the bullet break and especially with osteomyelitis.

The concerns about the treatment of bullet break and the considerable frequency of osteomyelitis with these means of damaged led to the fact that surgical interventions on the nerves in this group of injured people were conducted considerably less frequent than during the damages of nerves among the soft tissues. Especially this is noticeable on the materials of the unspecialized hospitals. Data of the deepened development or the histories of the disease/sickness/illness/malady of the military medical museum are represented in Table 59.

The fact calls attention to itself that neurolysis was more frequent intervention than suture. This gives grounds to conclude that the large part of the operations/processes on the nerves was produced apropos of damages without gross changes in the shaft of nerve.

It is simultaneously necessary to note that with ccursing of war the character/nature of the operations/processes, which were being conducted on the nerves, was changed toward the limitation of readings to neurolysis and expansions of readings to stitching of nerve (Table 60).

Table 59. Frequency of different operations/processes on the nerves with the bullet breaks of the bones of extremities (in the percentages).

(2) Характер операции	(1) Локализация перелома			
	(3) плечо	(4) предплечье	(5) бедро	(6) голень
(7) Шов нерва	3,0	1,7	3,2	1,0
(8) Невролиз	5,0	3,4	5,0	1,2
(9) Прочие операции	0,6	0,3	—	0,5
(10) Всего	8,6	5,4	8,2	2,7

Key: (1). Localization of break. (2). Character/nature of operation/process. (3). shoulder. (4). forearm. (5). thigh. (6). shin. (7). Suture of nerve. (8). Neurolysis. (9). Other operations/processes. (10). In all.

Table 60. Distribution of injured people with the bullet break of the bones of extremities and multiple failure of nerves according to the character/nature of the produced on the nerve operations/processes during the different years of war (in the percentages).

(1) Годы	(2) Характер операции			
	(3) невролиз	(4) шов нерва	(5) прочие[1]	(6) Итого
1941	65,2	34,8	—	100,0
1942	68,2	29,5	2,3	100,0
1943	58,5	33,6	7,9	100,0
1944	57,8	34,3	7,9	100,0
1945	33,3	60,0	6,7	100,0
(7) В среднем	59,0	34,5	6,5	100,0

Key: (1). Years. (2). Character/nature of operation/process. (3). neurolysis. (4). suture of nerve. (5). other [1].

FOOTNOTE [1]. Other operations/processes compose transplantations, mycplasty, neurotomy, etc. ENDFOOTNOTE.

(6). Altogether. (7). On the average.

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Operations/processes were conducted within the different periods after the injuries, which were oscillating from 1 to 8 months, but the majority of interventions it was necessary for the third and fourth month. In the single injured people of operation/process they were produced also within the later periods (from 10 months to 1 year it is later) (Table 61).

As can be seen from table 61, in the different periods the wars of operation/process on the nerves were conducted approximately within the identical periods after injury.

The periods, which passed from the injury to operation were later during the damages to lower extremity. Operations/processes on the nerves with the breaks of thigh and bones of shin more frequently were conducted after five, six and more than months after injury, and with the breaks of shoulder and bones of forearm the majority of operations/processes falls for the third and fourth month after injury (Table 62).

The earlier periods of production in the operations/processes on the nerves of upper extremity (Table 62) are explained by the more rapid healing of the wounds of upper extremity. Should be also had in mind and the fact that the disturbances/breakdowns of function with the damage of nerves and the break are revealed/detected earlier and it is earlier during the damages/defeats of upper extremity.

Based on materials of the separate specialized hospitals, operation/process on the nerves with the bullet breaks they were not rare.

Table 61. Distribution of injured people with the bullet damage of nerves and with the simultaneous break of the bones of extremities according to the periods of operations/processes on the nerves during the different years of war (in the percentages).

(1) Годы	(2) Время, прошедшее от ранения до операции (в месяцах)					(4) Итого
	1—2	3	4	5	(3) 6 и более	
1941—1942	20,3	33,9	18,6	11,8	15,4	100,0
1943	10,9	21,8	30,4	13,0	23,9	100,0
1944—1945	12,0	32,8	24,0	11,2	20,0	100,0
(5) В среднем	13,0	27,9	25,9	12,1	21,1	100,0

Key: (1). Years. (2). Time, which passed from injury to operation/process (in months). (3). and more. (4). Altogether. (5). On the average.

Table 62. Distribution of injured people with the bullet damage of nerve and the simultaneous break of the bones of extremities according to the periods of operations/processes on the nerves (in the percentages).

(1) Локализация перелома	(2) Время, прошедшее от ранения до операции (в месяцах)					(4) Итого
	1—2	3	4	5	(3) 6 и более	
(5) Плечо	15,6	25,8	32,0	10,2	16,4	100,0
(6) Предплечье	13,7	37,4	26,0	8,4	14,5	100,0
(7) Бедро	8,5	11,4	14,3	17,1	48,7	100,0
(8) Голень	3,6	14,3	10,7	32,1	39,3	100,0

Key: (1). Localization of break. (2). Time, which passed from injury to operation/process (in months). (3). and more. (4). Altogether. (5). Shoulder. (6). Forearm. (7). Thigh. (8). Shin.

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According to the observations of the author under conditions of the back specialized evacuation hospital of approximately 25.0o/o of all operations/processes, which were being conducted on the nerves, fit to the damages, combined with the break of bone, in this case the suture of nerve is during the combined damages more frequent (60.0o/o) intervention than neurolysis (40.0o/o).

A question about the readings to intervention on the nerves with osteomyelitis is closely related with a question about the readings

to the same operations/processes generally among the infected tissues. A. G. Molotkov and some others performed operations/processes on the nerves with the granulating wounds already during the war with the White Finns. During the Great Patriotic War with the White Finns. During the Great Patriotic War this proposition repeated V. V. Lebedenko et al.

Some authors, considering it possible to operate on the nerve with unclosed wounds, advanced the necessary requirement to select operational access in such a way that it would be arranged/located as far as possible among the healthy/sound tissues, in go around the available wound. In this case it was not always considered that relative "asepsis" of a similar operation/process is most frequently seeming, since after roundabout access through unchanged skin intervention itself on the nerve is conducted nevertheless among the infected tissues. Nevertheless was represented the large number of observations with the favorable post-operation course and the primary healing of operating wound. This is connected with many factors among which the leading role played sulfanilamides, but an even larger value must be ascribed to the wide carving of the changed tissues in the periphery of nerve. According to the observations of the author, made mainly during the work under conditions of the back specialized evacuation hospital, smooth healing after the wide carving of the granulating wounds was observed more frequently than after

intervention on the nerves through indirect accesses without the carving of the changed tissues.

Known value, of course, had the bacteriological state of wound and all adjacent to it tissues, and also entire complex of the questions, connected with the complex reactions of organism to the infection. At present it seems that in the period of the begun and happily current healing of wound the value of infection is decreased.

The made observations about a good course of the cut all over granulating wounds with the reducing operations/processes on the nerves do not in any way determine the same favorable coursing of complex process of the regeneration of nerves and reduction of the function of extremity. The unfavorable effect of infection on the regeneration of nerve was sufficiently shown by B. S. Doynikov et al. and it is confirmed at present by newest data.

Are at the same time already from the time of the first world war known observations of a good reduction of nerves and functions of extremity after the operations/processes, which were complicated by violent suppuration. It is obvious that only the analysis of a large quantity of thoroughly studied distant results of the surgical treatment of this type of injured people will help to finally manufacture correct surgical tactics.

It is possible to distinguish three groups of interventions on the damaged nerves in the presence of osteomyelitis:

1. Separate interventions, with which at the first moment/torque are conducted the operation/process on the bone, and then, the afterward full/total/complete or partial healings of wound, operation/process on the nerve.

2. Operation/process only on nerve without intervention apropos of osteomyelitis.

3. One-time operation/process on osteomyelitic focus and on damaged nerve.

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According to the observations of the author under conditions of the back specialized evacuation hospital, in the majority of injured people with the combined injury of nerves and bones with the complication of osteomyelitis were carried out separate interventions with the operation/process on the pyonecrotic focus of bone in the first moment/torque. In the part of these injured people of

intervention on the nerves it was not produced entirely in view of the begun independent reduction of function. In another part of the injured people the operation/process, shown on the nerve trunks, was deposited/postponed, as a result of the tactics accepted, for the period from 1 1/2 to 5 months. This time loss can be to a certain degree justified by the fact that in all injured people of this group began the primary healing after operation/process on the nerves.

As the example to the late produced operation/process on the nerve can serve the following observation.

Sh-n A. A., 30 years, 9/XII 1941 is injured by the explosive bullet into middle third of right shoulder with the break of bone and by the damage of radial nerve. Subsequently coursing is noted firm osteomyelitis with the fistulas and the formation of false joint. In the evacuation hospital 19/VIII 1942 it is operated apropos of osteomyelitis. The ends of the shoulder bone are covered with durable fibrous tissue. This tissue is cut all over, removed three sequestrations, the ends of the bone are refreshed, opened marrow cavity. Diastasis between ends from the lateral side to 6 cm, from the medial side to 2 cm. Granulations from the fistulas are scraped. Wound is packed. Gypsum cast. Further conduct of wound under the ointment bandage. Wound healed 29/IX. Subsequently was superimposed the suture of radial nerve at the level of false joint; smooth

healing (Fig. 8).

Operation/process on the nerves without intervention on the bone was conducted in those injured people, whose osteomyelitis flowed/occurred/lasted hidden, without the fistulas, without the temperature reaction, and where in the X-ray photographs were determined the foci of illumination in the place of break and arranged/located in it bone fragments, roentgenologically resembled sequestrations. Thus, in injured people with latent coursing of osteomyelitis surgical tactics in the relation to the damaged nerves, according to author's data, did not differ from the same with the smooth healing of fracture. Operation/process in similar injured people, as a rule, was accompanied by the same smooth post-operation healing of wound, and in the part of the injured people were traced favorable results in the relation to the reduction of nerves.

These observations completely confirm the conclusions of other authors, which found that the operation/process on the nerves with osteomyelitis did not make coursing worse of process in the bone (Ye. V. Fetisov et al.).

To solve the problem about the readings to simultaneous intervention on the damaged nerve and osteomyelitic focus is considerably more difficult. According to author's data, such

operations/processes were only forced.

G-v D. I., 24 years, is injured 17/IX 1942 by the fragment of projectile into the right shoulder. It entered into the specialized back evacuation hospital 14/IV 1943 with the phenomena of the full/total/complete interruption of the conductivity of radial nerve and the suppurative fistulas on the external surface of shoulder (Fig. 9). One of the fistulas is carried out by extremely morbid granulations, touch to which produced the strongest projection pains in the rear of hand with respect to the gap/interval between the first and second mesopodial bone. Disseminated dermatitis on the external surface of shoulder. After the treatment of skin and decrease of the phenomena of dermatitis is produced 14/VI 1943 the operation/process. Is cut all over the extensive scar, soldered with the bone. One of the fistulas was communicated with the marrow cavity, and in another was soldered central end completely of the interrupted radial nerve. Is isolated nerve, and then are widely opened and scraped pathological cavities in the bones, which contained edematic granulations, sequestrations and fragments. Into the wound is introduced the streptocide. Epineural suture of radial nerve after the creation of the muscular bed, which separates/liberates nerve from the bone. Nerve is sheltered by the surface beams of muscles and by the remainders/residues of fascia. Bone wound is drained by the strip of the gauze, brought out toward

the front from the nerve. Smooth healing.

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Other authors somewhat more frequently produced one-time interventions apropos of osteomyelitis and damage of nerves (A. N. Bakulev, Z. I. Gyemanovich, Ye. V. Fetisov et al.). However, authors' material is very various both in a quantity and on the quality. D. S. Zel'dich (1943) communicated about 5 operations/processes of neurolysis, which ended in 4 of injured people by full/total/complete recovery within the next few days after operation/process. It is obvious that the heavier damages, with which there is necessary the resection of nerve and suture, could not so rapidly end by the reduction of the lost functions.

It should be noted that the favorable impression of the authors, who operated one-time apropos the damages of nerves and apropos of osteomyelitis, are based mainly on the observations of direct and nearest results. The latter showed that the operations/processes on the nerves in the presence of osteomyelitis, as a rule, did not produce the aggravation of inflammatory process. The character/nature of changes from the side of nerves, which was being noted after these operations/processes, is completely analogous to the changes, obtained after operations/processes on the nerves, damaged with the

injury of soft tissues, especially if these operations/processes were accompanied by carving Rubtsov. A. T. Lidskiy, S. R. Mirotvortsev et al. attached much importance to the state of soft tissues with osteomyelitis. Considerable changes in the muscles with osteomyelitis observing Ya. M. Yanovskiy, and change in the undamaged/uninjured nerves with osteomyelitis - S. S. Pen'kevich. In connection with these data even more greatly is determined the use of the carving of those infected Rubtsov in the periphery of the damaged bone.

Intervention technique on the nerves during the combined with the bones damages can be different depending on the periods, which passed from the time of injury. With the early operations/processes the liberation/excretion of nerve was conducted approximately/exemplarily under the same conditions as without the break of bone.

With the operation/process within the average periods (3-6 months after injury) almost always it was possible with the aid of the scalpel to secrete the damaged nerve, even if it was involved in fibrous joint between the scrap. In the process of liberation/excretion were sometimes necessary bone cutting pliers, but more frequent the necessity for them appeared already after the liberation/excretion of nerve for the equalization of bone prominences.

Another picture was observed with the late operations/processes, which were being undertaken through many months or even years after injury. In such injured people the nerve, if it was torn and involved between the scrap, proved to be sometimes concealed/latent for the greater or smaller elongation/extent in the bone tissue. The solution of a question about that, to what technology to resort, was determined by the fact that similar injured people usually had the full/total/complete interruption of nerve, and the section of nerve, constrained during prolonged time within the bone, underwent such changes, which by themselves were reading to its carving. Therefore by completely appropriate under the given conditions technology is the liberation/excretion of the central and peripheral cuts of nerve with the aid of the scalpel and their cut-off in immediate proximity to that level, at which they hide themselves in the bone.

K-y D. G., 28 years, it is injured I/V 1943. It entered into the clinical picture of the nerve diseases/sicknesses/illnesses/maladies of the military medical academy im. S. M. Kirov 31/V 1946 apropos of the full/total/complete interruption of the conductivity of a deep branch of radial nerve after the bullet break of left radial bone in proximal e division (Fig. 10). 13/VI 1946 is produced operation/process. Section/cut over the dorsal surface of left

forearm. Is exposed the completely painless and thinned peripheral cut of a deep branch, which hides itself in the dense callus. With the liberation/excretion of central cut is discovered the state of preservation of branches to the radial extensors of hand and to the instep. During the stimulation of these branches by the faradic current of muscle they are shortened, the remaining part of the proximal cut of a deep branch hides itself in the callus, just as peripheral cut. During the stimulation of no its motor reaction it is obtained.



Fig. 9. G. Osteomielit shoulder. Photograph is made 9 months after injury. In the injured person was undertaken simultaneous operation/process on the nerve and on the bone apropos of osteomyelitis.

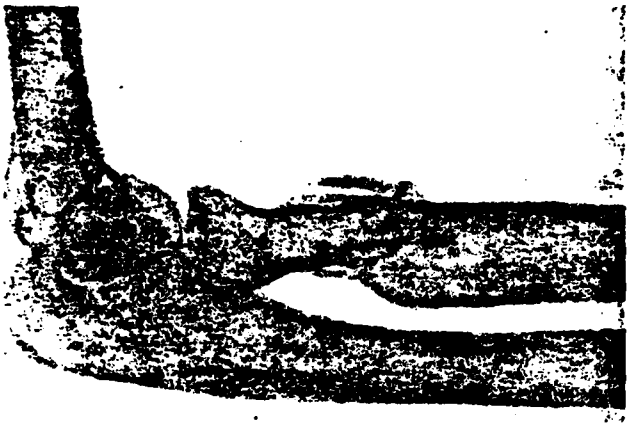


Fig. 10. The callus of the proximal cut of the radial bone 3 years after bullet break.

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Both ends are cut off close about the bone. Are superimposed epineural sutures. Post-operation coursing is smooth.

In injured people with the false joint the juxtaposition of the ends of the nerve in the presence of large diastasis frequently was so difficultly as in many other cases. False joint, especially with the large defect of bone tissue, sometimes gave the possibility to remove without the special tension even considerable diastases due to the supplementary flexure. However, stiffness or even ankylosis of adjacent joints, so/such which frequently accompanied false joints,

more frequently created for the suture of nerve the same unfavorable conditions, as ankylosis without the false joint.

Ankylosis sometimes presented insurmountable difficulties for the imposition of nerve suture. By especially unfavorable ones was represented stitching with the interruption of sciatic nerve and the ankylosis of knee joint in the driven away position. Stitching on the ulnar nerve in the cubital region with the simultaneous ankylosis of elbow at angle was facilitated by the possibility to move nerve for the front face.

Conservative treatment.

There is no doubt that the treatment of the damaged nerves with the bullet breaks available in many injured people its special features/peculiarities in connection with the late recognition. However, the therapeutic measures, which were being undertaken apropos of bullet break, were very frequently useful also for the damaged nerves. In this sense must be examined the primary surgical processing/treatment of wounds, which was being conducted in the majority of injured people. As already indicated is above, primary surgical treatment was produced with the bullet breaks of shoulder in 74.1o/o of injured people, bones of forearm - in 65.0o/o, thighs - in 74.0o/o and the bones of shin - in 83.6o/o of injured people.

The dissection of dense aponeuroses, the evacuation of hematomas, the removal/distance of foreign bodies, nonvital scrap of bone, the carving of the broken soft tissues, it is doubtless, relate to a number of interventions, which created favorable conditions for reducing all tissues and among other things of the nerve trunks.

However, the immobilization, which was being applied in the studied by us injured people from the first stages of evacuation, also must be considered as the therapeutic measure, useful and for the damaged nerves. In this case it is necessary to have in mind not only the favorable effect/action of rest, but also warning/prevention of the faulty positions which it can accept extremity during the damage of nerves as a result of the effect/action of the antagonists of the paralyzed muscles.

In the "indications in accordance with the military field surgery" was noted the need for the immobilization of extremity with the injury of the nerves: "By all injured person with the damage of nerves, after performed primary processing/treatment or without it, for warning/preventing the muscular and joint contractures is necessary the application of correct with respect to the damaged nerve immobilizing dressing" (pg. 239, p. 9). Putting into action of

this position in application to the combined damages hindered by the fact that the "Correct with respect to the damaged nerve bandage" did not always prove to be correct with respect to other tissues, especially with the break.

The requirements, presented to the immobilization apropos of break and apropos of the damage of nerves, are sometimes contradictory/opposite.

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The diverted position of shoulder, advisable for the treatment of the breaks of the proximal cut of shoulder bone, is disadvantageous during the damage of nerves in the axillary region and on the shoulder, since nerves in this case stretch, and with the interruption their ends diverge. The bent in the elbow position of hand is favorable with the breaks of shoulder and bones of forearm and is unfavorable for the ulnar nerve during its damage. On the lower extremity the driven away position also increases diastasis between the ends of the smashed sciatic nerve.

During the Great Patriotic War with the application of dressings apropos of the combined damages of bones and nerves even in those injured people, whose injury or nerves was in proper time identified,

surgeons attempted to add extremity the position, which was advantageous with respect to the break. This tactics was completely substantiated, since the attempts to add extremity with the break the position, favorable for the damaged nerves, could destroy the correct reduction of bone about condition the onset of contractures in the unfavorable positions.

One should moreover, consider that even the correct in the relation to the damaged nerves position of extremity hardly can considerably aid the regeneration of nerve in the cases of full/total/complete interruption with the shift of ends or in the presence of foreign bodies in the thickness of the nerve trunk. Old rule - or the break of bone and the simultaneous injury of nerves to create favorable conditions for the intergrowth of bone in the functionally advantageous condition, and then to already treat the damaged nerves - preserved its strength during entire war.

The need for diverse and prolonged physiotherapy, and, first of all, therapeutic gymnastics, during the damage of nerves obtained wide acknowledgement in our country long before the Great Patriotic War. In the "Indications from military field surgery" this was reflected in the following point: "In all injured people with the damage of the nerve trunks both in period to the operation/process and after it, it is, taking into account coursing of wound, possible

earlier to begin physiotherapy, massage and therapeutic gymnastics" (pg. 239, p. 13). Experiment/experience showed that almost all injured people with the damage of the nerve trunks put to use therapeutic gymnastics during more or less long time. Physiotherapy, mainly in the form of different thermal procedures and electropathy, was applied very widely, especially in the back hospitals. In the second half war the physiotherapy obtained still more wide application.

Almost all injured people underwent treatment by sulfanilamide preparations. Less wide acceptance had other antiseptics, phages, and later - penicillin.

Issues.

It is necessary to distinguish the direct, nearest and distant results or issues. This is connected with the fact that the state of the damaged nerves and extremity as a whole can be very different within the different periods after damage or operation/process. Good results, noted at first, can not prove to be similar after the more prolonged period and vice versa.

According to the data of the deepened development of the histories of disease/sickness/illness/malady, it is possible to judge

only direct and nearest results, since many injured people with the consequences of the injuries of nerves completed the cure already in the postwar years.

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The period of staticnary observation of the injured people with the bullet break was sufficiently lasting; however, in this respect the groups of injurad people with the damage of nerves and without the same differ little from eacn other (Table 63).

The prolonged periods of the treatment of bullet breaks it made possible to observe in scme injured people the independent reduction of the function of the damaged nerves. This is noted mainly with the insignificant severity of the damage of nerves with the clinical signs of the partial disturbance/breakdown of conductivity.

During the heavier anatomical damages of the nerves of the full/total/complete reduction of function within the periods indicated either it was not observed or it was incomplete (Table 64).

From represented data, first of all, it appears, that the injury of nerves with the bullet breaks of the bones of extremities decreases a number of good issues 3 or more times in comparison with

the general/common/total issues of breaks (Chapter XI). Attention is drawn to also the high percentage of the sharply pronounced consequences of the damage of nerves.

With the injury of forearm and shin of good issues it was more than with the injury of shoulder and thigh, which is explained by the heavier consequences of the injury of basic nerve trunks in their proximal cuts in comparison with the injury of final branches.

Table 63. Average duration of the hospital treatment of injured people with the bullet break of the bones of extremities and multiple failure and without the damage of nerves (in the days).

(1) Группа раненых с переломом	(2) Локализация перелома			
	(3) плечо	(4) пред-плечье	(5) бедро	(6) голень
(7) С повреждением нервов	144	123	198	177
(8) Без повреждения нервов	135	102	181	167

Key: (1). Group of injured people with the break. (2). Localization of break. (3). shoulder. (4). forearm. (5). thigh. (6). shin.

Table 64. Nearest issues of the bullet breaks of the bones of extremities with multiple failure of nerves (in the percentages to a number of revealed issues without the amputation).

(1) Локализация перелома	(2) Исход			(6) Всего
	(3) хороший в отношении перелома и нерва	(4) последствия повреждений нервов, выраженные в умеренной степени	(5) последствия повреждений нервов, выраженные в резкой степени	
(7) Плечо	4,6	57,9	37,5	100,0
(8) Предплечье	12,3	56,9	30,8	100,0
(9) Бедро	5,8	52,0	42,2	100,0
(10) Голень	9,7	60,3	30,0	100,0
(11) В среднем	9,2	57,5	33,3	100,0

Key: (1). Localization of break. (2). Issue. (3). good in relations of break and nerve. (4). consequence of damages of nerves expressed to moderate degree. (5). consequences of damages of nerves, expressed to sharp degree. (6). In all. (7). Shoulder. (8). Forearm. (9). Thigh. (10). Shin. (11). On the average.

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In those injured people whom operated apropos the damages of nerves, a number of good issues with the extraction was still less, for example: on the shculder - 1.6o/o instead of 4.6o/o, on the forearm - 3.7o/o instead of 12.3o/o. This phenomenon is completely regular, since surgical treatment they underwent, as is known,

injured people with the most serious damages and up to the moment/torque of their extraction from the therapeutic institutions it was not possible to expect the reduction of the function of nerves.

In some injured people the reduction of function should be related due to the restitution of nerves after light damages, in others could occur actual regeneration after partial damages. Among the operated injured people this full/total/complete reduction within the periods indicated was noted only after neurolysis, i.e., after the insignificant damages of shaft without the disturbance/breakdown of the anatomical continuity of beams. The injured people, in whom was superimposed nerve suture, were referred in the groups of injured people with the consequences of the damage of nerves, expressed both in that moderated and to the sharp degree (table 64).

The contractures, caused by the damage of nerves and which arose in connection with the damage of soft tissues and bones, to demarcate based on materials of the histories of the disease/sickness/illness/malady of the military medical museum is very difficult. In connection with this it is necessary during the evaluation of the direct and nearest results of treatment to consider entire number of noted up to the moment/torque of extraction contractures and limitations of motions.

The results of the treatment of the injuries of nerves during the Great Patriotic War and after weeks were already the object/subject of discussion at the XXV All-Union congress/descent of the surgeons and at the 8th session of neuro-surgical council. However, these results relate predominantly to the direct and the near ones. Materials about the distant results of the treatment of nerves generally, and with fire breaks in particular are thus far scarce.

Direct results are noted in connection with the operation/process. The majority of the authors, who operated on the damaged nerves with the consequences of bullet breaks and, in particular, with osteomyelitis, observed the favorable results of such interventions both in the relation to nerves and in the relation to bones. This relates not only to the direct results, but also to the near ones.

Most difficult to gather, to study it is correct to evaluate the distant results. So that the judgment about the distant results would be as far as possible free from the errors, it is necessary, in the first place, to have available data about form/species and degree of the damage/defeat of nerve, which is possible only when the

sufficiently precise description of the changes is present, found on the operation/process, and in the second place, to have the objective information about the results of the comprehensive neuro-surgical investigation through the large periods after operation/process. Without this second condition it is possible to fall into the error, after recognizing substitute motions due to the preserved muscles for the reduction of the eigenfunction of the damaged nerve. At present it is known that the concepts of the regeneration of nerve, reinnervation of tissues and reduction of the function of extremity are not in any way equivalent.

V. V. Semenova-TYan-ShanskaYa the extremities, amputated apropos of heavy deformations and trophic disorders after the full/total/complete interruption of nerves, the intergrowth of young axons in the peripheral cut up to the most extremital branchings. However, reinnervation of tissues, even if it occurred in such injured people, it was faulty and insufficient, and function was absent entirely.

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In the different time the author carried out about 600 operations/processes apropos of the damage of nerves in connection with the bullet injuries. Some injured people it was possible to

observe after operation/process in the course of many months, and then to inspect them repeatedly, after the more prolonged periods. About 200 injured people, operated by other surgeons, were objectively investigated in post-war years through the different periods after interventions. Relative to this group of observations it is necessary, however, to keep in mind that they concern mainly injured, who were turning for the consultative or therapeutic aid, and therefore here predominated unsatisfactory results.

The part of the distant results after operations/processes became known because of the responses/answers of injured people to the sent out questionnaires. In 154 injured period after the operation/process in nerve were calculated into 3 1/2 and 4 1/2 years; 77 responses/answers concerned the consequences of nerve suture, 77 - consequences of partial suture or neurolysis. Of 154 injured people by 42 (27.6o/o) with the damage of nerves they simultaneously had bullet break. In 40 injured people of 77 after the cross-linking of nerve is noted the reduction of conductivity and improvement in the function of extremity. In 37 injured people either is not noted the signs of the reduction of conductivity, or, in spite of the appearance of signs of regeneration, did not begin improvements in the function of extremity. After neurolysis and partial suture the reduction of nerves and improvement in the function of extremity is noted in 58 injured people of 77.

These data make it possible to nevertheless compose general idea about the reduction of separate motions, about different disturbances/breakdowns of sensitivity, and also about the pains and the trophic and vasomotor disorders.

During the analysis of our own materials and materials of other surgeons the author main attention focused on the distant results of nerve suture. Neurolysis and partial suture were applied during the very diverse in the severity damages, but therefore conclusions/derivations cannot be sufficiently precise. The correctness of readings to neurolysis can produce doubt both with the poor ones and with good results. With the poor results of neurolysis is possible the assumptcn that on the severity of damage in the data of injured people would be more than appropriate the full/total/complete suture of nerve, while during the full/total/complete reduction after neurolysis remains open a question about the possibility of the same full/total/complete, but independent reduction.

Now the special features/peculiarities of the restoration of nerves in connection with the simultaneously available break of bones noted could not be. A good and poor reduction was observed both after

the injury only of soft tissues and with the accompanied damages nerves the breaks of bones.

In the part of the injured people restoration of the function of extremity is explained not so much by the reduction of nerves, as by development of the so-called compensator mechanisms, from which the main things are the substitute motions of the muscles, which preserved innervation. A question about the ability to work has only relative connection/communication with the regeneration of nerves. The damage of some nerves even with the full/total/complete interruption of conductivity under specific conditions can greatly insignificantly limit capability for performance of different movements, for example, the isolated/insulated damage of middle or ulnar nerve in lower third of forearm and on the left hand especially allows/assumes the execution of many works after certain time after injury, in spite of the absence of the signs of regeneration.

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Studied data make it possible to make no conclusions about a comparatively best reduction of movements or sensitivity. There is sufficiently observations, which show that during the satisfactory reduction of motions sensitivity can not be improved and, on the contrary, during the satisfactory reduction of sensitivity can be

absent the corresponding motions.

It is very important to note that the trophic ulcers in the sections with the normal sensitivity never were observed. They, as a rule, were observed at the places, which were undergoing mechanical stimulation only during a deep disturbance/breakdown of sensitivity - to the degree of full/total/complete anesthesia. However, remaining trophic of disorder, as a rule, were smoothed for a period of the next 1-2 years even without the reduction of motion.

From the time of the first world war widely it is known that the reduction of function during the damage of some nerves (first turn of cubital and fibular) occurs more badly than with the injury of others (in particular, radial). These observations in essence are confirmed by many authors' experience for the time of the Great Patriotic War. However, now has the capability to note also significant difference in regeneration of different muscles. B. S. Doynikov repeatedly focused attention on the fact that the fine/small muscles are reduced comparatively worse than large/coarse. It is very probably, this is connected with the fact that the degenerate phenomena in the fine/small muscles are developed more rapid and it is deeper than in the large/coarse ones.

From available data it is evident that even with the injuries of

radial nerve, with which extensor motions in the radiocarpal joint are restored very frequently, the removal/diversion of the thumb in the majority of injured people is not reduced or is reduced incompletely. Poor prognosis in the relation to the reduction of the function of the fine/small muscles of hand, innervated by middle and ulnar nerves, is also confirmed by observations during the time of the Great Patriotic War. However, the reduction of the cubital flexor of hand following the suture of ulnar nerve on the shoulder is observed, apparently it is not at all not thinner/less frequent than the reduction of the extensors of hand after the suture of radial nerve. Thus, now are new data for the review of the so-called clinical individuality of separate nerves.

Other conditions being equal, poorest prognosis in the relation to aptitude for military service and for the work give multiple failures of several nerves and combined damages of nerves and vessels.

Most complete restoration after the suture of nerves, according to author's data, it is noted after early operations/processes both with the break of bones and without the break during the energetic and prolonged use/application and physiotherapy and therapeutic gymnastics to the operation/process and over a number of years after it.

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Chapter III.

SHOCK WITH THE BULLET BREAKS OF THE BONES OF EXTREMITIES.

Statistical survey/coverage of the complications of shock with the bullet breaks of the bones of extremities.

Lieutenant Colonel of medical service M. A. Barenbaum.

The complications of shock with the bullet breaks of the bones of extremities composed 28.3o/o of all complications of shock in injured people. Close to these numerals data of chief surgeon of one front, M. N. Akhutin, for 1942 (27.7o/o). Army surgeon V. I. Struchkov, citing data on the army for entire Great Patriotic War, noted that the shock with the bullet breaks of the bones of extremities composed 34.0o/o of all complications of shock.

According to other data, within the time of the Great Patriotic War these numerals were somewhat above. Thus, based on materials of

reports to some DMP, shock with the bullet breaks of the bones of extremities composed 52.0o/o of all complications of shock.

According to T. P. Gugel'-Morozova, 47.9o/o among all injuries, complicated by shock, related to the bullet breaks.

The frequency of the complications of the shock of the bullet breaks of the bones of extremities in all years of war, according to the data of the deepened development of the histories of disease/sickness/illness/malady, composed 3.8o/o (with respect to a total quantity of breaks of the bones of extremities).

The frequency of shock with the breaks of the bones of different segments of extremities, according to these data, which follows: with the bullet breaks of shoulder the shock is encountered in 2.5o/o, those of the bones of forearm - into 0.9o/o with the bullet breaks of thigh - into 7.7o/o and of the bones of shin - into 5.3o/o.

The large spread/scope of the frequency of shock was noted with the bullet breaks of different bones of one and the same segment of extremity.

Thus, with the bullet breaks of the tibia shock composed 1.7o/o, fibular bone -1.2o/o, both of bones of shin -13.3o/o. Are

approximately/exemplarily the same relationships/ratios of the frequency of the shock with bullet breaks of the bones of the forearm: by shock they were complicated by 0.4o/o of bullet breaks of the ulna, 0.3o/o - radial bone, 3.3o/o - both bones of forearm.

The frequency of shock with the bullet breaks of the bones of extremities within the time of the Great Patriotic War changed to a considerable degree depending on the period of war, character/nature and intensity of combat operations and conditions, under which was diagnosed and was treated the shock. According to the data of the deepened development of the histories of disease/sickness/illness/malady, the frequency of shock steadily grew/rose with each by the year of the Great Patriotic War, which is represented in Table 65.

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Data of Table 65 are at first glance paradoxical: in spite of a steady improvement in the work of the medical service of Soviet army with each year of war, increase and perfection of its frames/personnel, expansion of sanitary-preventive measures, continuously improved work of the service of the blood, the frequency of shock statistically grew on. This, however, it is completely explained. An improvement in the quality of the work of the foremost

stages of sanitary evacuation, the perfection of the doctors, the mobilization of their attention to a question about the shock improved the diagnosis of the latter. Specially conducted study of shock always gave the high indicators of its frequency.

Table 65. Frequency of shock with the bullet breaks of the bones of extremities during the separate years of the Great Patriotic War (in the percentages).

(1) Локализация перелома	(2) Годы					(3) В среднем за год
	1941	1942	1943	1944	1945	
(4) Плечо	0,9	1,5	2,7	2,9	4,6	2,5
(5) Предплечье	0,1	0,4	1,2	1,5	1,1	0,9
(6) Бедро	3,1	4,6	7,1	10,6	12,5	7,7
(7) Голень	2,8	3,6	4,4	7,3	8,3	5,3
(8) В среднем	1,4	2,2	3,5	5,4	6,5	3,8

Key: (1). Localization of break. (2). Years. (3). On the average in year. (4). Shoulder. (5). Forearm. (6). Thigh. (7). Shin.

(3) On the average.

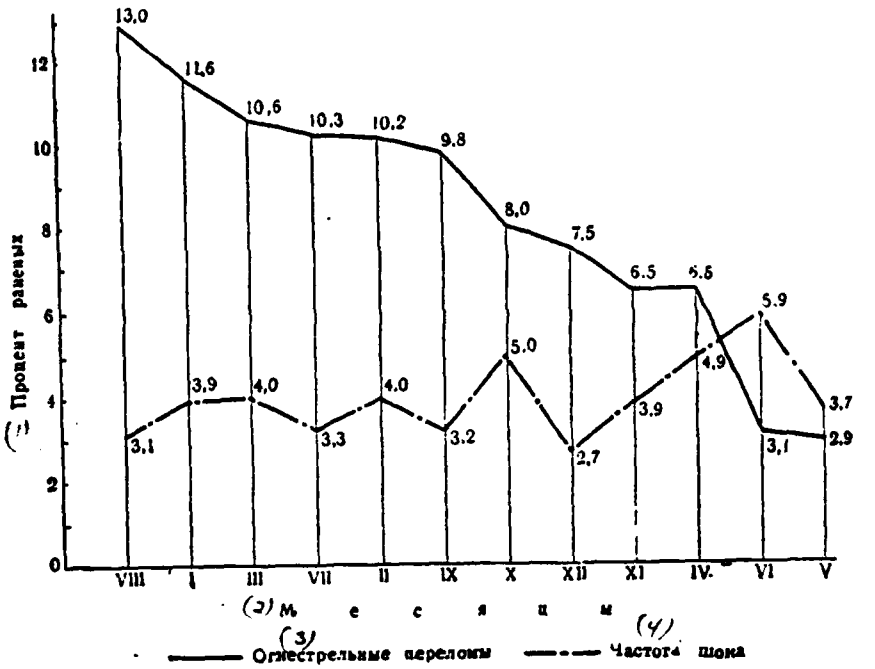


Fig. 11. Distribution of injured people with the bullet break of the bones of extremities and the frequency of shock in the separate months of war.

Key: (1). Percentage of injured people. (2). Months. (3). Bullet breaks. (4). Frequency of shock.

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Thus, at the front where the chief surgeon was V. I. Popov, into 1944 was made is an attempt at the establishment of the frequency of shock

by the general measurement of blood pressure in all injured people. In this case the frequency of shock with the injuries of lower extremities was determined in 18.4o/o injured, those of upper extremities - in 5.9o/o; the medium frequency of shock composed 8.0o/o. During the general determination of the tests of shock in injured people in one of the guard armies into 1942 shocks it was noted in 19.6o/o. Thus, the increase of the frequency of shock during the years of the Great Patriotic War testified about an improvement in the carrying out/removal of injured people from the field of breakage, about a continuous improvement in the diagnosis of shock, the determination most of the lungs, of its initial degrees, improvement in the setting of the matter of the treatment of shock. The probability of these reasons for the "increase" of the frequency of shock on the years of war is confirmed by that fact that the severity of the breaks on the years of war to a considerable degree did not change (chapter XI).

The second factor, which exerted great effect on the accuracy of diagnosis and statistics of shock, was the workload at the treatment centers.

The dependence between a quantity of injured people and (statistical) frequency of shock, as can be seen from Fig. 11, it was reverse: in the months when there was less than injured people, the

state of the shock among them was diagnosed more frequently.

Some report materials confirm this position. The chief surgeon of front M. N. Akhutin into 1942 noted that the lowest numerals of shock pertained to February - March, July - August when there were impulse combat actions.

The frequency of shock in injured people with the bullet break of the bones of extremities at the different fronts of the Great Patriotic War was determined - from 0.8 to 7.8o/o. In this case to middle 1943 diagnosis of shock was less precise, in view of which shock was diagnosed considerably less frequent - from 0.8 to 3.5o/o (on the average along all fronts 2.9o/o), than during 2 latter/last years of war - from 2.9 to 7.8o/o (on the average along all fronts 4.4o/o). These special features/peculiarities always must be had in mind during the estimation of different therapeutic factors.

For an example it is possible to use M. N. Akhutin's data about the frequency of shock, letnality and the blood transfusion into 1942 on DMP on different armies of one of the fronts (Fig. 12).

As can be seen from the given curve, in army I and III shock was encountered almost equally frequently, and lethality in army III was almost 2 times more than in army I. This can be explained by the more

frequent (10 times) blood transfusion in army I.

Furthermore, in army the II lethality was almost identical in comparison with the lethality, which was being observed in army I, although the blood transfusion was conducted in it almost into 2 times less frequent than in army I.

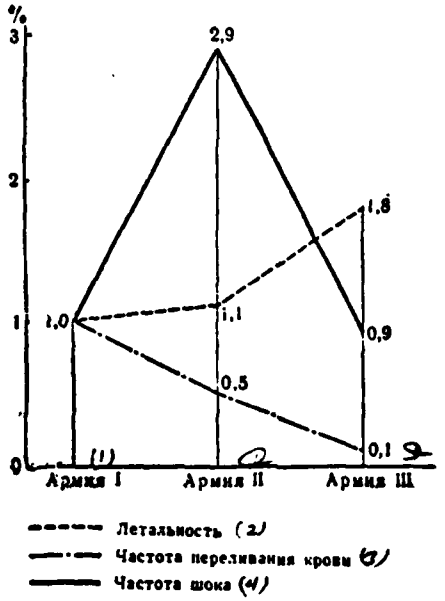


Fig. 12. Shock, lethality and blood transfusion in some armies.

Key: (1). Army. (2). Lethality. (3). Frequency of blood transfusion. (4). Frequency of shock.

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Completely eye is evident that the low lethality in army II is explained by the larger frequency of the shock (in comparison with army I it is more almost 3 times), when were taken into consideration many injured people, also, with the lighter shock.

It is necessary to think that when due to the lighter degrees of shock was increased its frequency, this to a considerable extent determined all further statistical indicators on the shock.

For these considerations it is necessary to attach importance still and because in the official reports during the Great Patriotic War the shock was recorded, as a rule, in the total numerals without the subdivision according to the degrees of severity, with exception of the individual institutions and brigades on the study of shock. However, the oscillations/vibrations of the frequency of different degrees of shock are considerable. S. I. Banaytis in the monograph "traumatic shock" gave the following data about the variations of the frequency of different degrees of the shock: while to the shock of cube on DMP and in PPG of the first line it case from 35.0 to 65.0o/o of all complications of shock (increase less than 2 times), to the shock of the first degree it fell from 4.0 to 25.0o/o (increase is more than 6 times).

The basic factor, which determined development and degree of shock in injured people, was the severity of trauma. With the shock were most frequently noted the heavy damages simultaneously of bones, vessels and the extensive damages of soft tissues. Very frequently among the injuries, complicated by shock, were observed the breakaways also of crushing which it was among the bullet breaks of

shoulder 27.9o/o, bones of forearm - 36.4o/o, thighs - 12.5o/o and the bones of shin - 45.6o/o, on the average on all segments of extremities - 29.1o/o. The percentage of breakaways and crushings among all bullet breaks of all segments was considerably below (4.6).

In accordance with these data was located the frequency of shock with different character/nature of the breaks of bones, which is shown in Table 66.

The data about the frequency of shock with the injuries by different projectiles are represented in Table 67.

Thus, of all given data it follows that most frequently the shock appeared with the considerable breaks of the guests and extensive crushings of soft tissues with the damage of vessels, it is more frequent than occurred with the fragmentation, mine injuries and with the injuries by antipersonnel mine.

Table 66. Frequency of the complications of shock with different character/nature of the bullet breaks of the bones of extremities (in the percentages).

(1) Локализация перелома	(2) Характер перелома									
	(3) косой	(4) рваный	(5) поперечный	(6) продольный	(7) раздробленный	(8) крупнооскольчатый	(9) мелкооскольчатый	(10) краевой	(11) вколоченный	(12) неизвестный
(13) Плечо	1,2	—	2,5	4,0	7,9	1,5	2,1	0,9	—	2,0
(14) Предплечье	0,7	—	0,8	—	3,9	0,4	0,5	0,2	—	0,9
(15) Бедро	4,1	0,8	3,9	2,9	17,8	6,2	17,4	2,5	—	12,2
(16) Голень	2,4	0,7	4,0	—	17,6	2,5	1,9	0,7	9,1	7,0
(17) В среднем	2,2	0,5	2,7	1,3	12,0	2,3	1,9	1,0	1,2	3,8

Key: (1). Localization of break. (2). Character/nature of break. (3). by scythe. (4). perforated. (5). cross. (6). longitudinal. (7). crushed. (8). large-splintered. (9). small-splintered. (10). edge/boundary. (11). packed in. (12). unknown. (13). Shoulder. (14). Forearm. (15). Thigh. (16). Shin. (17) On the average.

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The frequency of shock, depending on the level of the break of the bones of each segment, changed to the small degree, about which testify the data, given in Table 68.

The overwhelming majority of the complications of shock during the Great Patriotic War was diagnosed and was treated in the army

region. On BMP and PMP the shock was recorded in 6.3o/o of the injured people, who reached the following stage - DMP, where was diagnosed the majority of the complications of shock and was conducted final treatment. The distribution of injured people with the shock in the stages where was conducted its final treatment, is represanted in Table 69.

From Table. 69 it is evident that a great number of complications of shock with the bullet breaks was encountered on DMP, where the diagnosis and its treatment were frequently hindered/hampered due to the severity of working conditions of this stage of evacuation.

Table 67. Frequency of shock with the bullet breaks of the bones of the extremities, caused by different projectiles (in the percentages).

(1) Локализация перелома	(2) Пуля		(3) Осколки			
	(4) ружейная	(5) разрывная	(6) артиллерийского снаряда	(7) мины	(8) гранаты	(9) противопехотной мины
(10) Плечо	1,4	2,0	3,6	2,4	5,8	—
(11) Предплечье	0,5	0,6	2,5	1,9	9,8	—
(12) Бедро	5,5	8,8	9,1	8,2	—	20,0
(13) Голень	1,7	7,2	7,3	8,0	10,3	30,8
(14) В среднем	1,8	4,5	6,3	5,5	8,3	6,5

Key: (1). Localization of break. (2). Bullet. (3). Fragments. (4). gun. (5). disruptive. (6). artillery shell. (7). mine. (8). garnets. (9). antipersonnel mine. (10). Shoulder. (11). Forearm. (12). Thigh. (13). Shin. (14). On the average.

Table 68. Frequency of shock with the bullet breaks of the bones of extremities at the different level (in the percentages).

(1) Локализация перелома	(2) Уровень перелома			
	(3) верхняя треть	(4) средняя треть	(5) нижняя треть	(6) на протяжении нескольких третей
(7) Плечо	3,0	2,6	2,1	1,5
(8) Предплечье	1,3	0,6	0,6	3,9
(9) Бедро	7,0	7,4	8,1	10,2
(10) Голень	5,3	4,8	5,2	10,5
(11) В среднем	4,1	3,4	3,4	6,5

Key: (1). Localization of break. (2). Level of break. (3). upper third. (4). middle third. (5). lower third. (6). for elongation/extent several third. (7). Shoulder. (8). Forearm. (9). Thigh. (10). Shin. (11). On the average.

Table 69. The distribution of injured people with the shock with bullet breaks of the bones of extremities according to the type of the therapeutic institution where was conducted terminal treatment of shock (in the percentages).

(1) Локализация перелома	(2) Тип лечебного учреждения			(3) Итого
	ДМП	ППГ	прочие (4) лечебные учреждения	
(5) Плечо	82,6	14,9	2,5	100,0
(6) Предплечье	88,3	6,5	5,2	100,0
(7) Бедро	86,7	10,7	2,6	100,0
(8) Голень	90,5	7,4	2,1	100,0
(9) В среднем...	87,0	9,8	3,2	100,0

Key: (1). Localization of break. (2). Type of therapeutic institution. (3). Altogether. (4). other therapeutic institutions. (5). Shoulder. (6). Forearm. (7). Thigh. (8). Shin. (9). On the average.

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Pathogenetic factors of shock with the bullet breaks of the bones of extremities.

That most widely used among the military surgeons, the physiologists and the patnologists during the Great Patriotic War was the neurogenic theory of the origin of shock. It most completely

explained both the mechanism of the observed with the bullet breaks changes and positive result of the applied complex treatment.

From the point of view of I. P. Pavlov's physiological teaching central nervous system balances and are regulated all vital processes in the organism in connection with the interoreceptive impulses/momenta/pulses and the stimulations of environment. All phenomena of environment and all occurring in the organism changes are reflected in the brain and, because of the controlling effect/action of cortex, occurs the balancing of all vital processes in the organism and their attachment to the conditions of environment.

The stimulations feeble of environment are balanced by the controlling activity of cortex in the normal state of organism because of so-called "inhibition" of central nervous system. However, in some cases of the especially intense stimulations of cortex begins the deficiency and depletion of adjusting attachments or "beyond the limits inhibition" of brain, and are developed the phenomena of shock, i.e., the disorder of all vital functions of organism, those connected with the loss controlling the sending of the organism of the functions of brain. Especially easily and frequently are developed these phenomena of depletion when of simultaneous blood loss, cooling of organism, consequences of the transferred or

simultaneously developing infections, mental trauma, overwork and other unfavorable factors is present,.

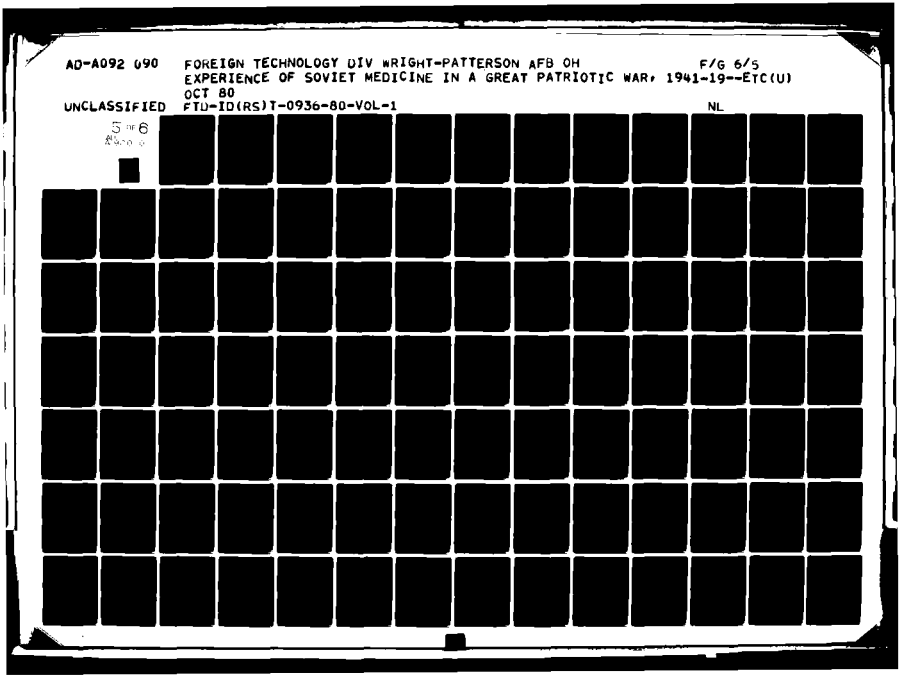
With the bullet breaks of the bones of extremities are observed precisely also the intense irritants, which frequently cause the deficiency of the regulator attachments of cortex and they lead to the development of shock.

Above were represented data relative to the frequency of shock with the bullet breaks. As can be seen from table 66, not all bullet breaks were accompanied by shock, most frequently shock was observed in injured people with the crushed break. Very frequently the shock was encountered with the bullet breaks of thigh (12.5o/o into 1945).

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Among the injured people with the shock with the breaks of the bones of extremities frequently were observed the breakaways and crushings (to 45.6o/o with the breaks of the bones of shin). The special savacity of injury, which caused shock, it affected also the duration of the subsequent treatment; so, injured people with the bullet break, that transferred complication by shock, they were found on the hospital treatment on the average of 6.1 months, whereas injured people with the break, but not transferred shock, were treated on the

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average of 4.8 months.

Unconditionally during these all heavy damages to nervous reflex factor must be diverted the leading role. In this case the high value had not only excessive stimulation at the moment of injury, but also the subsequent stimulations, which go from the place of injury to the cerebral cortex. These impulses/momenta/pulses, it is doubtless, influenced through the cerebral cortex all vital processes in the organism and was decreased the reactive ability of the latter.

In a number of factors, which exerted the unfavorable effect/action reflector way on the central nervous system, was the late or insufficient immobilization of extremity with the bullet breaks (Table 70).

From Table 70 it is evident that in injured people, who were in the state of shock, as heaviest transport immobilization was applied earlier than in all injured people with the break. However, it cannot be recognized that on the time of use/application the transport immobilization with the shock was satisfactory, since for the first 6 hours after injury they arrived without immobilization 36.9o/o of injured people with the break of shoulder, 49.1o/o - with the break of the bones of forearm, 51.9o/o - with the break of thigh and 41.8o/o - with the break of the bones of shin.

Table 70. Time of the use/application of first transport immobilization in injured people with the bullet break of the bones of extremities, that were in the state of shock, and in all injured with the break of bones extremities (in the percentages).

(1) Локализация перелома	(2) Группа раненых	(3) Время, прошедшее после ранения до иммобилизации			(4) Всего
		(5) 1 час	(6) 2—6 часов	(7) 7 часов и позже	
(8) Плечо	(9) Раненые, находившиеся в состоянии шока	18,9	44,2	36,9	100,0
	(10) Все раненые	7,8	29,2	63,0	100,0
(11) Предплечье	(12) Раненые, находившиеся в состоянии шока	22,0	28,9	49,1	100,0
	(13) Все раненые	5,0	23,9	71,1	100,0
(14) Бедро	(15) Раненые, находившиеся в состоянии шока	13,3	34,8	51,9	100,0
	(16) Все раненые	6,5	23,3	70,2	100,0
(17) Голень	(18) Раненые, находившиеся в состоянии шока	16,3	41,9	41,8	100,0
	(19) Все раненые	8,3	23,2	68,5	100,0

Key: (1). Localization of break. (2). Group of injured people. (3). Time, which passed after injury on immobilization. (4). In all. (5). hour. (6). hours. (7). 7 hours are later. (8). Shoulder. (9). Injured people, who were in state of shock. (10). All injured people. (11). Forearm. (12). Injured people, who were in state of shock. (13). All injured people. (14). Thigh. (15). Injured being in state of shock. (16). All injured people. (17). Shin. (18). Injured people, who were in state of shock. (19). All injured people.

The nervous reflex origin of shock with the bullet breaks is confirmed also to a certain degree and by the preponderance of the complications of shock in injured people with the break and multiple failure of the nerve trunks.

As it was already said, the injury of nerves with the bullet breaks in the pathogenesis of shock occupies a comparatively small place after the severity of injury and frequency of the injury of vessels. That fact that amputations during the primary processing/treatment in injured people with the break of the bones of extremities and the damage of the nerve trunks were conducted several times more frequently than in all injured people with the break (Table 71), he speaks for the special severity of these combined injuries. However, this severity in early period after injury was conditioned not on the damage of nerves, but on frequent multiple failure of large vessels (Table 47), that also served as basis for the amputation.

However, it is not possible to exclude the possibility of the onset of excessively intense stimulations during the damages of nerves both at the moment of injury itself and subsequently their course - compression of nerve by bone fragments, foreign bodies,

hematoma, etc.

With the bullet breaks of the bones of the extremities, which were complicated by shock state, were observed very frequently the considerable blood losses, which gave grounds to some authors to assign to this factor (blood loss) main role in the origin of shock (the so-called hemorrhagic shock) or even to deny entirely the presence of shock, explaining entire clinical picture by the phenomena of sharp/acute anemia.

According to the data of author's development, in injured with the bullet break of bones extremities in the state of shock considerable blood losses were observed with the injuries of shoulder into 72.3o/o, with the injuries of forearm - into 79.1o/o, with the injuries of thigh - into 30.0o/o, with the injuries of shin - into 71.2o/o. As an example it is possible to give the following observations of the author.

K., 28 years, it entered 6 hours after "blasting/detriment on the mine" with the breaking up of foot and extremital part of the shin in the very heavy state. Face had pale gray color, jaws are slightly cyanotic, skin dry. Extremities cold, nausea, thirst. Injured it is strong retarued, but consciousness is preserved. Pulse of 88 shocks per minute, very weak; blood pressure 50/30 mm.

Temperature of 35.4°. Hemoglobin 600/o, erythrocytes 4,100,000. Bandage abundantly got wet by the blood; by washing and desiccation of bandages it is determined by 1300 g of the issuing from in them blood in which pure/clean hemoglobin it proved to be 138.

Table 71. Frequency of amputations during the primary processing/treatment with the bullet breaks of the bones of extremities with the damage of the nerve trunks and in all injured people with the break (in the percentages).

(1) Локализация перелома	(3) Группа раненых с повреждением нервных стволов	(2) Все раненые с переломом
(4) Плечо	11,6	6,0
(5) Предплечье	7,0	2,8
(6) Бедро	9,3	3,4
(7) Голень	26,2	9,5
(8) В среднем . . .	12,5	5,3

Key: (1). Localization of break. (2). Company of injured people with damage of nerve trunks. (3). All injured people with break. (4). Shoulder. (5). Forearm. (6). Thigh. (7). Shin. (8). On the average.

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If one considers that entire/all blood loss from the moment/torque of injury considerably exceeded that discovered with the weighing of bandages, then to the factor of blood loss in this injured person must be diverted independent value, although the clinical picture resembled to the shock.

M., 31 year, entered 5 hours after multiple injuries by the

fragments of artillery shell. At PMP the state it was satisfactory. In the way from PMP to DMP - massive hemorrhage and sharp deterioration in the state. Injured person was pale, excited, he was sewn, consciousness matted. Pulse on the radial artery was not probed; blood pressure and temperature of body due to the strong excitation determine could not. In the bandages and the outfit there is much blood; on the stretchers the large puddle of the blood (into some bandages subsequently it is determined by 1250 ml of the blood). Hemoglobin 37o/o. After the transfusion 250 ml of blood and heating the injured person became more calmly; the pulse of 134 shocks per minute; blood pressure 65/35 mm, respiration 36 per minute, temperature of 34.1°. State became typical for torpid shock.

Diagnosis: the extensive fragmentation injury of upper third of shin with the break of fibula and the break of vessels; the injury of scrotum with the breaking up of egg, the torn wounds of perineum and nates.

The value of nervous reflex factor (extensive trauma of shin, breaking up of egg) as the basic reason for heavy state is here completely obvious; however, blood loss here, it is doubtless, it played its role, after conditioning the heavier symptoms of shock. At the moment of hemorrhage and soon after it clinical picture completely corresponded to the known description of shock, conducted

by N. I. Pirogov. The difficulty of the differential diagnosis of these two states forced army surgeons' majority to establish/install the combined diagnosis the "shock - blood loss", which, of course, did not contribute to further refinement of questions of the study of shock. In the histories of the disease/sickness/illness/malady of army region, even very short ones, it was possible to establish/install the presence of indisputable very large blood loss in 59.6o/o of injured people in the state of shock (author's development).

As proof to this it served direct indications of large blood loss and strong anaemisation of injured people, indication of the damage of large vessels, visibly noticeable hemorrhage and considerable impregnation by blood of bandages or indications of the badly/poorly superimposed tourniquet or its late imposition with by the strongly gotten wet blood bandage.

Finally, 29.1o/o of injured people in the state of shock took place crushings or breakaway of extremity, which, as a rule, always led to the very strong anaemisation of injured people.

The frequency of the noted symptoms of blood loss with the bullet breaks of the bones of different segments of extremities, which were being accompanied by shock is shown above.

More precise and more convincing data about the sizes/dimensions of blood loss in injured people, who were in the state of shock, with the injury of the extremities (independent of the presence of break) are acquired in the group on the study of shock via the washing of the blood from the bandages, the determination of its weight and the content in it of hemoglobin.

A quantity of lost blood in injured people, who were being located in the state of heavy shock, in some bandages exceeded 1000 g with the high content of hemoglobin (more than 100 g of pure hemoglobin).

Based on materials of group No 1 on the study of shock, via the thoroughly assembled anamnestic and form information (communicated by doctors of PMP) about the blood loss on the spot of injury and in the way, about a quantity of changed bandages, and the main thing, by the frequent intravital and posthumous recognition of the injuries of large vessels, extensive intra-tissue hematomas or by determining the blood in the bandages in 60.0o/o of the injured people, who were in the state of heavy shock (with the break of bones and without the break), was possible tc establish fact of very large blood loss.

The investigation of the blood of the injured people, who were being located in the state of shock, into the first hours after injury in the institutions of army region was conducted rarely. It was conducted in those injured people who fell immediately into the institutions of army or front rear. Any conclusions/derivations according to these data to make is impossible.

During the Great Patriotic War such conclusions/derivations were made only as a result of the special study of shock (V. M. Borovskaya, A. L. Lerner).

According to the materials of group No 1 on the study of shock, all wounded the extremities, which were in the state of shock, in the content of hemoglobin in the blood were distributed as follows: 40o/o of hemoglobin had below 8.6o/o of injured people, 41-50o/o of hemoglobin -33.9o/o, 51-60o/o hemoglobin -39.9o/o, 61-70o/o hemoglobin -13.2o/o, 71o/o and above had 4.4o/o of injured people.

Thus, characteristic for the considerable group of those wounded in the extremity in the state of shock (with the break and without the break) was not thickening, but rarefaction of the blood. During the same observations it was established/installed, that into the

first hours after blood loss the rarefaction of the blood frequently somewhat decelerated, creating the picture of relative thickening. As illustration to this can serve the example, given above, when 6 hours after large blood loss hemoglobin of the blood was not lowered below 60o/o. This percentage of hemoglobin corresponded to the average/mean level of hemoglobin in the healthy/sound soldiers (materials of group No 1 on the study of shock).

During the author's development of the histories of the disease/sickness/illness/malady of archives of the military medical museum it was possible to trace the distant data about the anaemisation of injured people (for a period of month) with the bullet break of the bones of extremities with the complication of shock.

At these injured people (in the absence at them of feverish state) the content of hemoglobin of the blood varied from 20 to 67o/o, comprising in average/mean 61o/o. With different localization of break this distant anaemisation of injured people was expressed in the following indicators of the percentage of hemoglobin of the blood: with the injury of shoulder -53o/o, with the injury of the bones of forearm -53o/o, with the injury of thigh -40o/o, with the injury of the bones of shin -50o/o.

The comparison of all materials given above makes it possible to draw a conclusion, then in many injured people, who were in the state of shock with the bullet breaks of the bones of extremities, together with the nervous reflex factors, blood loss could have also high value in the clinical the picture of heavy state after injury.

The numerous observations, made within the time of the Great Patriotic War above the injured people with the bullet break, that were in the state of shock, showed that especially frequently and rapidly the phenomena of shock were developed in injured people in the presence simultaneously of blood loss. It was also noticed that the fight with the shock in these injured people with the considerable blood loss is especially difficult and very frequently little effective and that the blood transfusion in combination with other antishock measures exerts usually the best effect/action.

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From the point of view of I. P. Pavlov's teaching about the completeness of organism cardiovascular and nervous systems (sympathetic, parasympathetic and animal) are unit. The cardiovascular system, abundantly equipped with vaso-receptors, is the precisely that apparatus in which, first of all, is reflected the controlling nervous reflex effect of central nervous system.

If as a result of the extensive trauma nervous reflex impulses/momenta/pulses from the place of injury cause the sharp disturbances/breakdowns of the controlling effect/action of central nervous system, then these disturbances/breakdowns with the considerable blood losses become even deeper.

The controlling effect/action of central nervous system cannot show/render proper positive effect as a result of the precipitation from the single neurovascular system of the basic link of contents of cardiovascular system - the blood.

From the point of view of the neurogenic theory of shock and correct understanding of the value of blood loss with the bullet breaks of the bones of the extremities, complicated by shock, it is possible to outline the correct treatment of shock, directed toward the reduction of the normal controlling functions cerebral cortex and toward the completion/addition of the bloodstream of cardiovascular system blood or by most approaching in composition the normal blood by blood-substitute fluid/liquid.

Symptomatology and diagnosis of shock with the bullet breaks of the bones of extremities.

The diagnosis of shock during the Great Patriotic War, as a rule, was conducted on the basis of the external clinical picture, which is characterized by the specific general view of injured (pallor, apathy, torpidity, sometimes excitation) and by poor filling pulse.

The measurement of blood pressure during the author's development of the histories of disease/sickness/illness/malady is noted only in 16.3o/o of the injured people, who were in the state of shock.

The measurement of the temperature of body at the moment of admission was made only in separate injured people, who were in the state of the shock when they entered the therapeutic institutions of army or front rear.

So approximately/exemplarily was matter also concerning the investigation of the blood in injured people, who were in the state of shock.

The more or less full/total/complete examination/inspection of the injured people, who were in the state of shock, it was conducted

only in the special brigades on the fight with the shock or in the special groups on the study of shock.

The investigations of the special brigades made it possible the more clear to determine the pathogenetic value of some symptoms of shock. The level of blood pressure although was one of the basic indicators of the severity of shock, it did not not not always clearly reflect the severity of the state of injured people. The classification of shock on the severity, given by Keith, proved to be extremely schematic and far not sufficient (A. L. Lerner, M. A. Barenbaum). Observations of the temperature of body with the shock showed that it was equally frequently both lowered/reduced and normal (A. L. Lerner, M. A. Barenbaum). In the part of the injured people was observed the elevated temperature at the shock without any clinical signs of the infectious complications of wounds, apparently in connection with the purely reflector action on the centers of thermoregulation, the fatty embolism and so forth (M. A. Barenbaum). However, it is not possible to completely exclude the possibility of infection in these wounded.

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During the Great Patriotic War came to light the need for secreting in the classification of shock the IV degree of severity

(group No 1 on the study of shock). Here usually were included injured people, who were in agonic and pre-agonal state.

Frequently these injured people were considered as completely hopeless. In practice no vital differences in the agonic or pre-agonal state from the shock and the boundaries of the transition of one state into another existed. The part of such injured people it was possible to save. The reference of such states to the shock underscored the possibility of their reversibility, especially as during the Great Patriotic War precisely for this degree of the severity of shock (IV) was approved the method of treatment - intra-arterial pressing of the blood.

V. A. Negovskiy, who specially studied in war agonic states in injured people, also considered such supplement to the classification of shock in principle as necessary.

On the need for classing shock according to the severity to four degrees communicated the surgeon of army region G. S. Surello. Army surgeon Kh. D. Gadzhiyev proposed to introduce even the fifth degree of the severity of shock.

Erectile shock, according to the data of the author's development of the histories of disease/sickness/illness/malady, it

is noted in 6.9o/o of all injured with the bullet breaks of large/coarse bones extremities, complicated by shock.

S. I. Banaytis noted that erectile shock with the injury of the upper extremities (independent of break) it composed 3.7o/o, lower -4.1o/o.

According to the data of group No 1 to study of shock, the state of erectile shock was encountered in 9.2o/o of the injured people, who were in the state of shock (irrespective of the fracture), and in only 1o/o of them was the stimulation explained as painful stimulation; in remaining injured people predominated the phenomena of blood loss even in the state of compensation, in consequence of which blood pressure was normal or increased.

The observations of group No 1 on the study of shock showed that under conditions of military field surgical practice, especially in the army region, in view of the impossibility of the detailed examination/inspection of injured people and difficulties of differential diagnosis, into the diagnosis of shock, besides actual neurogenic shock, unavoidably were included many similar to the shock states.

Pathoanatomical check, according to the data of the deepened development of the histories of disease/sickness/illness/malady, dead

persons from the shock of injured people with the bullet break of the bones of extremities into 30.9o/o of sections did not confirm the diagnosis of shock as the reasons for death, which was explained by other complications, which simulated the picture of shock. By illustration to this position it can also serve as Table 72, in which are given the data about the distribution of injured people, dead persons in the state of shock, for reasons for death in connection with the final clinical and pathoanatomical diagnosis.

As can be seen from Table 72, in the pathoanatomical diagnoses shock as the reason for death was encountered more rarely than in the clinical diagnoses.

In the equal measure as the indicator of the frequency of shock in injured people with the fatal result cannot be used pathoanatomical diagnoses, since, until now, it was not established/installed precise pathoanatomical signs of shock.

During the combination of shock and blood loss the anatomical pathologists see on the autopsy only of the phenomenon of anemia, during the shock and the anaerobic infection they see on the autopsy only anaerobic infection.

However, clinicians are obligated to consider not only local changes in the organs/controls and the tissues, but also the effect of injury and complications on entire organism and, first of all, to the nervous system.

The factor, which predisposes to the shock or those burdening the already developing shock state, is cooling. However, in many injured people the general/common/total cooling came forward as the basic reason for the heavy state, diagnosed as shock. According to the data of the military medical museum, confirm this position could not, since almost do not have data about the thermometry the injured people, who were being located in the state of shock, at the moment of their admission.

Table 72. Distribution of injured people, dead persons in the state of shock, with the bullet breaks of the bones of extremities for reasons for death in connection with the final clinical and pathoanatomical diagnosis (in the percentages).

(1) Группа умерших раненых	(2) Характер заключительного диагноза	(3) Причина смерти: (4) значительные анатомические разрушения	(5) шок	(6) кровопотери	(7) анаэробная инфекция	(8) сепсис	(9) прочие и сочетание нескольких причин	(10) Итого
(11) Умершие в 1941—1942 гг.	(12) Клинический	4,0	69,3	4,0	9,3	2,7	10,7	100,0
	(13) Патологоанатомический	4,8	28,0	14,3	24,3	14,3	14,3	100,0
(14) Умершие в 1943, 1944 и 1945 гг.	(15) Клинический	5,7	49,6	6,1	16,5	9,1	13,0	100,0
	(16) Патологоанатомический	4,4	29,2	7,1	32,8	9,7	16,8	100,0
(17) Умершие на ДМП	(18) Клинический	6,2	67,4	10,1	5,4	0,8	10,1	100,0
	(19) Патологоанатомический	11,8	41,1	23,5	11,8	—	11,8	100,0
(20) Умершие в ППГ	(21) Клинический	4,8	46,2	5,8	25,0	3,8	14,4	100,0
	(22) Патологоанатомический	3,8	32,0	3,8	41,5	3,8	15,1	100,0
(23) Умершие в армейских и тыловых госпиталях	(24) Клинический	1,7	29,4	1,7	22,4	31,0	13,8	100,0
	(25) Патологоанатомический	—	15,9	2,2	34,0	27,3	20,6	100,0
(26) В среднем по всем лечебным учреждениям	(27) Клинический	4,8	52,2	6,0	15,8	8,8	12,4	100,0
	(28) Патологоанатомический	4,6	29,0	8,4	31,3	10,7	16,0	100,0
(29) Прожившие одни сутки	(30) Клинический	8,0	67,4	8,7	2,9	—	13,0	100,0
	(31) Патологоанатомический	8,2	53,1	10,2	6,1	2,0	20,4	100,0
(32) Прожившие двое суток	(33) Клинический	5,8	65,4	5,8	11,5	1,9	9,6	100,0
	(34) Патологоанатомический	—	42,9	23,8	23,8	9,5	—	100,0
(35) Прожившие трое суток и больше	(36) Клинический	1,8	30,6	1,8	33,4	19,8	12,6	100,0
	(37) Патологоанатомический	1,5	6,2	1,5	50,8	20,0	20,0	100,0

Key: (1). Group of the dead injured people. (2). Character/nature of final diagnosis. (3). Reason for death. (4). considerable anatomical destruction. (5). shock. (6). blood loss. (7). Anaerobic infection. (8). sepsis. (9). other and combination of several reasons. (10). Altogether. (11). Dead persons in. (12). Clinical. (13). Pathoanatomical. (14). Dead persons in 1943, 1944 and 1945. (15).

Clinical. (16) Pathoanatomical. (17) Dead persons for DIP. (18) Clinical. (19). Pathoanatomical. (20). Dead persons in PPG. (21). Clinical. (22). Pathoanatomical. (23). Dead persons in army and back hospitals. (24). Clinical. (25). Pathoanatomical. (26). On the average on all therapeutic institutions. (27). Clinical. (28). Pathoanatomical. (29). Lived 24 hrs. (30). Clinical. (31). Pathoanatomical. (32). Lived two days. (33). Clinical. (34). Pathoanatomical. (35). Lived three days are more. (36). Clinical. (37). Pathoanatomical.

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On the author's development, only 1.8o/o of all injured people, who were in the state of shock, when the heavy damages of bones and vessels are present, had indications of supercooling/chilling. G. S. Surello noted supercooling/chilling in 11.6o/o of injured people. Special observations in this direction during the Great Patriotic War were conducted by brigades on the study of shock. By this brigade at the front where the chief surgeon was V. I. Popov, it was established/installed, that the cooling by itself caused a drop in the blood pressure in injured people.

In the materials, published by group No 1 on the study of shock (G. P. Shul'tsev), in 8.5o/o of injured people with the bullet break of the bones of extremities was noted a decrease in the temperature

of body in lower than 34° (in separate injured people the temperature of body was 30° and even 29°.

This reduction in the temperature of body was not only symptomatic, characteristic to shock or to blood loss, but it was the consequence of exogenous cooling during the transportation and the prolonged stay of injured people in the cold under the bad weather conditions.

The sharp hypothermia of body, which usually accompanied heavy blood loss, frequently resembled shock ("stiffness" according to N. I. Pirogov). Consciousness in many supercooled injured people was preserved completely, the voice hoarse, anechoic; the skin integuments pale, cold; pulse very weak or fiberlike, is more frequently, delayed, blood pressure low. Considerable changes were noted under the effect of the supercooling/chilling from the side of the central and vegetative nervous system: wide pupils with the flaccid reaction to the light/world, weakening of rootal refler, lagophthalmia, disappearance of skin reflexes and dermographism, tremor of hands and so forth, etc. Characteristic for the supercooling/chilling was the almost full/total/complete absence of difference with the measurement of the temperature in the rectum and the armpit.

As the pathoanatomical signs of supercooling/chilling by the anatomical pathologist of group No 1 on the study of shock by Yu. M. Lazovskiy was noted the anemia of kidney glomeruli with the paretic expansion and the plethora of interchannel capillaries (collapse of glomeruli). In the part of the dead persons on the autopsy were noted the sharp/acute erosion of the mucous membrane of stomach, the so-called maculae of Vivnyovskiy, which to a certain degree were acknowledged characteristic for supercooling/chilling of body.

The following observation of the author illustrates the clinical and pathoanatomical picture of supercooling/chilling presented.

N., 47 years, it is injured 21/I 1943. Diagnosis: the blind-end fragmentation injury of right shin in the upper third with crushing of soft tissues and by the breaking up of bones. It entered 19 hours after injury in the very heavy state. Injured person arrived in the state of strong cooling, it was pale, the skin dry, cold. Temperature of 33.2°. There was no pulse, blood pressure was not determined. Respiration - 22 per minute; consciousness was preserved, but injured person is extremely slowed, passive; questions he answered in a whisper. Hemoglobin 82o/o, erythrocytes 3500000. After 2 hours, after heating and subcutaneous introduction 3 cm^3 20o/o of camphor, blood pressure by 50/40; the pulse of 96 shocks per minute, weak. For a period of 1 1/2 hours twice was introduced intracysternally the

solution of potassium phosphate; however, the lift of blood pressure it did not begin, but the temperature of body rose to 34.4°. Intravenous infusions of D. N. Fedorov's fluid/liquid and 5o/o of solution of glucose of the effect not of distance. 4 Hours after admission was produced the amputation of thigh in lower third. Further therapeutic measures are unsuccessful. They are measured it began 6 hours after operation/process.

Pathoanatomical data: vascular collapse, atony of stomach and multiple erosion of mucosa it.

Conclusion: the general/common/total supercooling/chilling.

During the histological analysis of internal organs/controls is noted certain increase in the sizes/dimensions of kidney glomeruli and a large quantity of cells in them is similar to acute nephritis.

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The combination of shock and anaerobic infection was encountered during the Great Patrictic war frequently, since anatomical basis of both states was extensive trauma. Thus, in the army region anaerobic infection was established/installed in 11.8o/o of the injured people, who were in the state of shock. In the army region among the injured people, who transferred on DMP shock, anaerobic infection was observed still more frequent (19.5o/o), moreover with the bullet breaks of shoulder anaerobic infection after shock was observed in 16.0o/o, with the breaks of the bones of forearm - in 10.0o/o, thighs - in 24.6o/o and with the breaks of the bones of shin - in 24.5o/o of injured people.

The with lightning speed flowed/occurred/lasted sepsis was frequently the reason of early death of injured people. As the reason of death of the injured people, who transferred shock on DMP, with the bullet breaks of the bones of extremities, according to the data of the deepened development of the histories of disease/sickness/illness/malady, the sepsis was noted into 0.8o/o of

cases of the fatal results of injuries (Table 72). In the part of the fatal results about patchanatomical autopsies the especially sharply flowed/occurred/lasted sepsis was referred due to the shock.

As an example of this can serve the following observation.

N., 24 years, it entered 5 ½ hours after injury in the heavy state. Consciousness is preserved, injured person is flaccid; skin integuments are pale, the pulse of 120 shocks per minute, soft; blood pressure 95/65 mm. Respiration 24 per minute; temperature of 37.9°; Hb 59o/o, eras. 3,840,000, l. 10,000.

Diagnosis is the breakaway of right foot and extramital division of shin, the multiple fragmentation injuries of left shin and foot with the considerable contamination by the earth/ground; the shock of the first degree.

Treatment: heating, morphine, heart substances. Amputation of right shin in upper third. Wide sections/cuts on the left shin and the foot. After operation/process the state is worse: the pulse of 150 shocks per minute, weak; blood pressure 85/45 mm, respiration 26 per minute. In spite of all further therapeutic measures, state it was not improved. After 12 hours temperature of 37.8°, consciousness it is darkened; pulse on the radial artery is not probed. State is

soporic. Death 32 hours after operation/process.

Pathoanatomical data: festering the wound of left shin. Fibrinopurulent peritonitis (hematogenic origins), hyperplasia of spleen, sepsis. Bacterioscopy of discharge from the wound, the abdominal cavity, scraping from the spleen and seeding/inoculation of the blood from the cavity of the heart revealed/detected diplococcuies.

This injured person has with the breakaway of right foot and the multiple injuries of left foot and left shin, contaminated by the earth/ground, there was a doubtless combination of shock and sharply flowed/occurred/lasted sepsis in origin of which the shock played considerable role, after lowering the resistivity of organism against that carried at the moment of injury with the earth/ground of especially virulent infection.

Among the old theories of the pathogenesis of the shock of fatty embolism was assigned the role of its basic reason. Subsequently this was rejected by experimental and clinical observations.

In the materials of the author's development of the histories of disease/sickness/illness/malady in injured people, who were in shock state, among the complications of fatty embolism it is not completely

noted. However, individual doctors during the Great Patriotic war made some observations on this question. For example, L. N. Kaminer observed the pulmonary form of fatty embolism in the majority of injured people with the bullet break of the bones of extremities, dead persons in the state of shock.

The cerebral form of fatty embolism, which was being encountered considerably less frequent, it was the reason for the heavy state, similar to the shock.

S. G. Spiridonov, who specially studied the injuries, which were being accompanied by fatty embolism, noted that the heavy state with the fatty embolism frequently, especially in the first period of suffering, was diagnosed as shock.

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However, in the most posterior stages clinical picture was characterized by the darkening of consciousness, by tonic spasms, increase in the temperature, involuntary by urination and defecation, hemorrhages on the skin of stomach, difficulty of respiration, by incidence/drop in the heart activity. These symptoms frequently gave erroneous occasion for the suspicion for the development of anaerobic infection.

According to the observations of the author, the fatty embolism of the great circle of blood circulation met in 3.0o/o of injured people the bullet break of the bones of extremities in the presence of shock; the heavy state of these injured people was explained by fatty embolism.

One of such observations is given as an example.

S-ov, 32 years, entered 6 hours after fragmentation wound in the very heavy state: highly pale, skin dry, strong thirst, pulse of 144 shocks per minute, very weak, blood pressure was not determined. Respiration 28 per minute. Consciousness was at times somewhat matted.

Diagnosis: the blind-end fragmentation injury of right thigh in upper third with the break of bone, the perforating fragmentation injury of the soft tissues of left thigh.

After the transfusion of blood, warming, giving of narcotics the state barely was improved. Operation/process: the primary working of wound with the removal/distance of foreign bodies and bone fragments. After operation/process the continuous drop subcutaneous

introduction of antishock fluids/liquids. Death 14 hours after injury.

Pathoanatomical data: the breaking up of right femoral bone, the injury of the soft tissues of left thigh, the plethora of internal organs/controls.

Histological data: the fatty embolism of the vessels of the medulla oblongata.

It is possible to assume that upon the usual examination/inspection of injured people with the break of the bones of extremities in the therapeutic institutions of army and army region the fatty embolism, which complicated the state of shock or anaerobic infection, could remain unidentified.

Intoxication by the products of tissue decomposition/decay and by the incompletely oxidized products of the vital activity of the traumatized tissues during the Great Patriotic War by doctors was considered. The phenomena of toxemic shock are noted in 1.8o/o of all injured people, who were in the state of shock. It was more frequently explained by the beginning or concealed/latent infection. The removal/taking the for long lain on the extremity tourniquet, as a rule, was not conducted to avoid the development of shock. By this,

possibly, it is explained that toxemic shock was observed rarely. Are described only the separate observations of the development of heavy collapse after the removal/taking of tourniquet. Thus, V. V. Sklyarov in 1941 observed rapidly (through 3-4 minutes) the begun lethal collapse after the removal/taking of the fabric tourniquet, which lay on the thigh of approximately 30 hours. To this injured person it was in the satisfactory state. At the same time, M. A. Barenbaum reported the injured person whose tourniquet lay 7 hours, in consequence of which began the ischemic gangrene of extremity; after the removal/taking of the tourniquet of collapse it was not. In 3 injured author it observed the development of collapse after the removal/taking of tourniquet from the extremity, cooled by the melting snow for the purpose of anesthesia; in 6 injured people, who were in satisfactory state, the author observed through several hours after the removal/taking tourniquet and produced surgical working of wounds heavy collapse. Injured people became somnolent, at times excited, they complained about the fever; consciousness became matted, was noted delirum, appeared the gray pallor of face, adhesive perspiration. Pulse became fiberlike, uneven, respiration was repeated/quickened, from the mouth appeared the odor, which resembled the odor of ammonia. Appeared frequent, sometimes indomitable vomiting, temperature was always nigh. In the urine was noted the protein and a large quantity of transparent and granulated cylinders, there are many leukocytes.

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From the side of wound in all those wounded during the careful investigation it was not noted the signs which with the sufficient basis could indicate the development of infection.

The pathogenesis of the development of heavy state in these all injured people is not entirely clear: quick death in the observation of V. V. Shklyaev, the collapse during the removal/taking of tourniquet from the cooled extremities, possibly, caused by rapid cooling and entirely not identical with that described by Quenu (Quenu) by the slow development of collapse after the removal/taking of tourniquet. The picture of the heavy toxicoses, noted by the author, possibly, is explained, besides poisoning after the removal/taking of tourniquet by the decay products of tissues, also by nervous reflex factors.

The described complications of injuries - blood loss, infection, intoxication, fatty embolism and cooling - in many injured people were the factors, which contributed to the development of shock on the soil of painful stimulation.

In other injured people the shock as the manifestation of the maximum disturbance/breakdown of the function of cerebral cortex decreased the general/common/total resistivity of organism and it contributed to the development of infection, to excessive heat emission, and sometimes also to blood loss.

Treatment of shock.

At the beginning of the Great Patriotic War the medical service of Soviet Army already manufactured the basic installations on prophylaxis and treatment of shock, which were consisting in the series/number of the complex measures, which were being successively fulfilled in all stages of sanitary evacuation. Here entered: immobilization, cessation of hemorrhage, fight with the hypoxemia, the cooling, the dehydration, the pain and the disturbance/breakdown of cardiovascular activity. During the Great Patriotic War in proportion to the perfection of medical service occurred the steady approximation/approach of the complex antishock measures to foremost stages. At many fronts since 1942 was already organized the ordered system of rendering to complex antishock aid from the company to DMP and PPG. So actively began to be conducted at the fronts research work on the shock.

At the front where the chief surgeon was N. N. Yelanskiy,

already since 1942 worked the regular "group on the study of shock", which was the special scientific research institution, rich equipped by equipment and completed by the highly skilled specialists. At the fronts where the chief surgeons were V. I. Popov, S. I. Banaytis and P. A. Cyprian, also was conducted the well organized research work on study and treatment of shock.

The content of the complex of therapeutic and preventive measures for the fight with the shock was the following:

1. Fight with the hemorrhage.

2. General/common/total measures, directed to elimination of unfavorable effects of environmental factors on metabolism:

a) granting of rest;

b) heating, replacement of damp/raw linen and outfit;

c) designation/purpose by injured person of hot drinking, hot food, etc.

3. Measures, which reduce reaction of nervous system for its stimulation with trauma - designation/purpose of morphine, alcohol,

bromides and somniferous substances; novocaine blockade, infusion of antishock fluids/liquids.

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4. Fight with oxygen starvation, disorder of respiration, blood circulation and metabolism:

a) transfusion of blood and blood substitutes,

b) designation/purpose of lobeline and cardiovascular substances;

c) carbogen therapy;

d) use/application of substances, which activate metabolism - ascorbic acid and endocrine preparations.

5. Surgical intervention.

6. Post-operation attendance.

Prophylaxis of shock during the Great Patriotic War began in the company region. Rendering of first aid in the form of the imposition

of primary bandage, elementary immobilization, temporary/time cessation of hemorrhage and high value.

The periods of rendering of first aid by injured person with the bullet break of the bones of extremities with the complication of shock were shorter than with all injuries (with exception of those wounded the thigh) (Table 73).

In the company region were conducted energetic measures for the cessation of hemorrhage, about which testifies the more frequent use/application of a tourniquet in the company in injured people, who had the complication of shock (29.4o/o), than in all injured people and even in the injured, had injury large vessels (from 9.1 to 19.9o/o).

The heating of injured people was conducted in the company region by the utilization of chemical heaters.

Table 73. Distribution of injured people in the state of shock with the bullet breaks of the bones of the extremities and all injured people with the break according to the periods of rendering of first aid (in the percentages).

(1) Локализация перелома	(2) Группа раненых	(3) Срок оказания первой помощи (в часах)			(6) Всего
		1	(4) от 2 до 6	(5) 7 и позднее	
(7) Плечо	(8) Раненые, находившиеся в состоянии шока	76,6	14,3	9,1	100,0
	(9) Все раненые	70,6	16,2	13,2	100,0
(10) Предплечье	(8) Раненые, находившиеся в состоянии шока	79,4	14,7	5,9	100,0
	(9) Все раненые	79,3	11,2	9,5	100,0
(11) Бедро	(8) Раненые, находившиеся в состоянии шока	62,5	15,0	22,5	100,0
	(9) Все раненые	64,5	15,2	20,3	100,0
(12) Голень	(8) Раненые, находившиеся в состоянии шока	72,4	14,3	13,3	100,0
	(9) Все раненые	68,5	15,0	16,5	100,0

Key: (1). Localization of break. (2). Group of injured people. (3). Period of rendering of first aid (in hours). (4). from 2 to 6. (5). 7 and late. (6). In all. (7). Shoulder. (8). Injured people, who were in state of shock. (9). All injured people. (10). Forearm. (11). Thigh. (12). Shin.

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The widely conducted antishock measure it was given to th-

injured person of alcohol in different forms/species. In 1944 at confronts in the company regions was disseminated V. I. Popov's antishock fluid/liquid No 5 (for the intravenous introduction), that exerted the effective preventive effect/action, and P. A. Sel'tsovskiy's fluid/liquid, which was being applied inside.

Antishock measures were continued on BMP, where was applied transport immobilization by standard splints, the check of those of already superimposed and the imposition of the styptic tourniquets again. For the heating of injured people here were applied the blankets and heated sanitary dressings.

For the first time in this stage they began to apply under the skin morphine and heart substances. According to the data of author's development, the morphine was applied in 0.7o/o of injured people, heart substances - in 1.1o/o.

On PMP the volume of antishock measures within the time of the Great Patriotic War increased even more noticeably. Besides an improvement in the general/common/total measures - supply of injured people with hot food and drinking, the heatings, the exchanges of wet outfit, organization of the more sparing transport, were conducted the medical measures for prophylaxis and treatment of shock.

According to the data of author's development, on the average within entire period of the Great Patriotic War injured person with the bullet break of the bones or extremities, which were in the state of shock, on PMP it was made: the subcutaneous introductions of morphine 45.5o/o of injured, cardiovascular substances 24.9o/o, impositions of the styptic tourniquet 26.4o/o transfusions of blood and intravenous infusions of different antishock fluids/liquids 8.8o/o, novocaine blockade (subperiosteal and cover) 10.8o/o use/application of bromides 0.7o/o of injured people.

In connection with taking of complex therapeutic measures on PMP was noted certain delay in this stage of the injured people, who were in the state of shock. Thus, the time, which passed from the moment/torque of the admission of injured person on PMP to the admission on DMP, according to the data of the author's development of the histories of disease/sickness/illness/malady, was the following: with the bullet breaks of shoulder - 5.7 hours, bones of forearm - 5.8 hours, thighs - 5.2 hours and the bones of shin - 5.3 hours.

The antishock measures, which were being conducted in the foremost stages PMP and BMP, proved to be extremely effective: based on materials, the deepened development of the histories of disease/sickness/illness/malady, in 55.6o/o of injured people with

the break of the bones of extremities was noted the liquidation of the phenomena of shock or an improvement in the state.

The basic therapeutic institution where were conducted final antishock measures, for author's development, was DMP (for 87.8o/o of injured people), and for the part of the injured people - $\frac{KH}{A}$PPG of the first line (9.6o/o of wounded).

In view of the great similarity of working conditions of these two institutions, the presentation of the treatment of shock on DMP and in $\frac{KH}{A}$PPG is united. The periods of the delivery/procurement of the injured people, which were in the state of shock, with the pulled breaks of the bones of extremities on DMP or in $\frac{KH}{A}$PPG were sufficiently large and, according to the data or author's development, they were expressed with different localizations of the break in the following numerals: with the breaks or arm - 10.1 hours, those of the bones of forearm - 8.8 hours, thigns - 11.8 hours, those of the bones of shin - 7.8 hours.

The periods of the delivery/procurement of the injured people, which were in the state of shock, on DMP and in $\frac{KH}{A}$PPG on the average were equal to 9.8 hours and they are explained by delay indicated higher of injured people on PMP for taking of antishock measures.

To the safeguard of rest to injured people and to the special treatment of the injured people, who were in the state of shock, was added during the Great Patriotic War high value.

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Provisions of rest and taking therapeutic measures best anything were made in the antishock wards which, according to report data, at the end of the war were developed in all foremost therapeutic institutions.

According to the data of the author's development of the histories of disease/sickness/illness/malady, therapeutic measures proved to be in antishock wards 38.0o/o of all injured people, which were in the state of shock, mainly heaviest. For the remaining wounded antishock measures were conducted in the hospital separation/section or in the medical dressing room, in which for these purposes usually were secreted separate tables.

To a question of the meaning of the injured people, who were in the state of shock, as the therapeutic measure during the Great Patriotic War was given much attention, since the role of cooling in the genesis of traumatic shock was very great. On the basis of the investigations of the physiologist of "group on the study, shock" L.

P. Shika the cooling, sharply raising the necessity of organism for oxygen, aggravated under conditions of hemorrhage the phenomena of oxygen starvation. The effectiveness of heating with the shock was noticed by doctors very long ago. In many injured one heating and rest they eliminated shock state. During the Great Patriotic War on DMP some general methods alone of treatment were applied in 15.1o/o of all injured people, who were in the state of shock.

The heating of injured people was conducted by the giving of hot drinking, by facing by heaters, by wrapping with blankets, also, with the aid of the special heating installations or by bringing/finishing the temperature of air in the shock ward to 24-25°. In the last case were warmed usually several injured people.

Giving by the patient of hot drinking, food of alcohol inside sometimes was limited due to the extreme severity of the state of injured people or due to the presence of vomiting. The latter was observed in 30.0o/o of all injured with the bullet break of the bones extremities, which were being observed in the "group on the study of shock". Based on materials of the author's development of the histories of disease/sickness/illness/malady, the giving of hot drinking, food and alcohol was conducted by 17.8o/o of the injured people, who were in the state of shock, with the bullet break of the large/coarse bones of extremities.

During the treatment of shock was widespread the use/application of morphine. Based on materials of the author's development of the histories of disease/sickness/illness/malady, the morphine was applied by 80.7o/o of injured people, including 11.3o/o it is intravenous. Observations showed that morphine was most beneficial substance for the safeguard of rest and sleep of injured people. During the intravenous introduction of the morphine through 2-3 minutes began the damping of that wounded, the frequently dreamy state which was very convenient for the beginning of local anesthesia or anesthesia/narcosis.

The bromides, sufficiently widely introduced into the practice at some fronts, on the average, based on materials of the author's development of the histories of disease/sickness/illness/malady, were applied by 2.5o/o of injured people with the bullet break of the bones of extremities in the state of shock; among other things 11.1o/o was applied intravenous infusion 10-20 cm^3 10o/o solution of sodium bromide. Bromides were the important component of many antishock fluids/liquids: they were included in I. R. Petrov's fluid/liquid, E. A. Asratyan and V. I. Popov (Nos. 5 and 6). The observations of "group on the study of shock" testify about the restricted possibility of applying the bromides inside, since as

other medicinal substances with the shock in view of the frequent vomitings in injured people.

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The intravenous use/application of bromides proved to be in practice more effective, especially in the preventive targets and in the initial stages of shock. The use/application of bromides with the already developing heavy shock was barely effective.

On DMP and in PPG with bullet the breaks of the bones of extremities, according to the data of author's development, extensively was used alcohol. Inside it was applied by 26.9o/o of injured people with the shock, and intravenous - 13.5o/o of injured people in the form 10o/o solution in the physiological solution, 30o/o of solution in the mixture with 40o/o solution of glucose or in the form of antishock fluids/liquids of V. I. Popov, P. L. Sel'tsovskiy, E. A. Asratyan. The nearest immediate effect from the use/application of alcohol was always distinctly expressed: was raised blood pressure, was improved pulse, frequently set in the dreamy state of injured people which always acted as the factor of medicinal protective inhibition. These qualities of alcohol mainly and determined the success of all alcohol-containing antishock fluids/liquids.

Novocaine blockade was applied very frequently for prophylaxis of shock with the bullet breaks of the large/coarse bones of extremities, especially at some fronts. According to S. I. Banaytis's data, the blockade was conducted in 49.0-65.0o/o of all injured people with the bullet break of the bones of extremities, moreover with the injury of upper extremities it was applied by 15.0o/o, with the injury of lower ones - 85.0o/o and with the bullet breaks of thigh - 50.0-60.0o/o of injured people. The preventive value of blockade, according to S. I. Banaytis's data, was considerable.

According to the data of the author's development of the histories of disease/sickness/illness/malady, novocain blockade was conducted by 16.5o/o of injured people with the bullet break of the bones of extremity, complicated by shock, including 8.0o/o of the injured people, who were being located on PMP.

Blockade was applied, according to S. I. Banaytis's data, in the form of subperiosteal blockade 37.0o/o and in the form of case 63.0o/o of the injured people, who were in the state of shock.

According to the data of "group on the study of shock", the use/application of a blockade for prophylaxis was unconditionally

advisable, since to a considerable degree was decreased the trauma of transport. However, the use/application of a blockade for the therapeutic target with the developing heavy shock and the phenomena of a deep hypoxemia could not already eliminate the phenomena of shock. Blockade in injured people with the developing heavy shock was necessary before the traumatic manipulations (removal/taking splint, bandage), since it safeguarded injured person from the heavy consequences of supplementary trauma. Simplicity of blockade technique and possibility of its conducting even without the removal/taking of splint provided its wide use/application.

When blockade was performed not long before the operation/process, it was simultaneously and basis for further case anesthesia. During Great Patriotic War 0.6o/o of injured people (author's development), with the bullet break of the bones of extremities was conducted the vagosympathetic blockade for the purpose of obtaining antishock effect by action on the pressor nerve apparatus.

To make a conclusion/derivation on the basis of these data is impossible, since vagosympathetic blockade with the breaks of the bones of extremities was applied in these all injured people in the complex with other effective methods of treatment.

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Measures for the fight with the hemorrhage on DMP were reduced to its final cessation. However, frequently on DMP and in PPG was conducted the temporary/time cessation of the hemorrhage when tourniquet was laid on the extremity to the period of preoperation preparation. In 11.0o/c of injured people after this temporary/time cessation of hemorrhage was conducted ligation of the bleeding vessels; in remaining - other operations/processes (author's development).

Fight with oxygen starvation, disorder of respiration and blood circulation was conducted with the aid of the transfusion of blood, use/application of lobeline, carbogen therapy and infusion of blood substitutes and blood-substituting solutions.

The transfusion of blood and blood substitutes was the most basic and disseminated measure during shock. The wide application of blood transfusion was most logical and was truly causal treatment, if we consider the role of blood loss with the shock in injured people with the bullet break of the bones of extremities.

Based on materials of author's development, for the removal from the shock of injured people with the bullet break on DMP it was

applied: the transfusion of blood o7.2o/o of injured people, the introduction of blood substitutes and antishock solutions in 17.7o/o and only the methods of the general/common/total action (heat, narcotics, rest, heart) by 15.1o/o of injured people. The doses of the transfused blood were 200-1,000 ml and more depending on the severity of state and degree of blood loss. In injured people with the mild case of shock the transfusion 200-300 ml of blood was sufficient for an improvement in the state; with the average/mean degrees of shock the dose of the transfused blood was increased to 500-700 ml; with the heavy shock - to 1,000 ml and more. The frequency of the use/application of different quantities of blood, according to the data of author's development, was the following: to 500 ml of the blood were poured 70.6o/o by injured person, from 500 to 1,000 ml -20.6o/o by injured person and more than 1,000 ml -8.8o/o of injured people.

Blood transfusion in the comparison with other antishock fluids/liquids even within the most varied periods of use/application gave positive effect. When period from the moment/torque of injury was small, then even small first portions of the blood exerted the noticeable effect/action that it is evident from the following observation.

M., 32 years, it arrived 5 hours after the heavy damage of the

bones of shin and soft tissues of thigh with the very large blood loss. Injured person is excited, consciousness is darkened. Pulse on radial artery was not probed, blood pressure was not determined. After transfusion 200 ml the blcod of the phenomenon of excitation passed, appeared pulse on the radial artery; blood pressure 65/40 mm. Then was conducted furtner transfusion (it is drop) of blood and blood-substituting fluids/liquids. After 6 hours completely it left the state of shock; was operated and evacuated in a good state.

In injured people, who long was in a state of oxygen starvation, the effect from the blcod transfusion began not immediately, but it was distinct.

K., 31 year. Diagnosis: crushing of left forearm, shock of cube. Amputation of shoulder. In the post-operation of period the state is very heavy. Next day pulse fiberlike, blood pressure 80/55 mm, the cyanosis of fingers and toes. Continuous drop infusion of antishock solutions under the skin (spasm vein!), heart substances; twice suboccipital introduction of potassium phosphate without the effect. 30 Hours after injury the exposure of subcutaneous vein on the bucket. Under the large pressure with syringe is introduced to 750 ml of the blood. The direct effect is insignificant. After 9 hours injured person in the full/total/complete consciousness; the pulse of 112 shocks per minute, satisfactory fillings; blood pressure 90/60

mm. Subsequently - rapid improvement. It is evacuated.

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The absence of effect from the blood transfusion was noted with hidden the flowed/occurred/lasted or beginning anaerobic infection or fatty embolism. In the remaining injured people by the reason for the absence of effect from the blood transfusion, as showed the investigations of the anatomical pathologist of "group on the study of shock" Yu. M. Lazovskoyo, were the irreversible degenerate changes in vital organs/controls on the soil of heavy prolonged oxygen starvation. Many doctors were convinced of the advantage of the transfusion of heated blood, which is confirmed and by special observations.

The effectiveness of the blood transfusion to statistically determine is very difficult, since the frequency of its use/application was usually directly proportional to the severity of the state of injured people.

The transfusion of blood 98.2% of injured people was conducted in the usual way - stream. The drop blood transfusion, according to the data of the deepened development of the histories of disease/sickness/illness/malady, was conducted only by 1.8o/o of

injured people. In the therapeutic institutions of the army region of some armies the drop method of the blood transfusion was applied more frequently, approximately/exemplarily in 11.6o/o of injured people (Yu. P. Edel'). Based on materials of "group on the study of shock" the best results with the heavy blood losses were obtained when the drop transfusion they took up after the infusions of the first portions of the blood (200-300 ml) by stream. Drop blood transfusion, applied by author 86.0c/c of injured people, gave the possibility of prolonged gradual completion/addition by the blood of vascular system, making it possible to avoid the overload of cardiovascular system and to conveniently alternate the blood transfusion with the infusion of different fluids/liquids. Only the multihour drop infusion of the blood and blood-substituting solutions derived/concluded heavily injured from the state of shock.

S., 20 years, it is delivered 5 hours after injury by antipersonnel mine. State is the extremely heavy: consciousness is preserved, but injured person is sharply slowed. Face growing thin, pale, skin dry, extremity are cold. Pulse on the radial artery hardly is perceived, on the shoulder artery of 128 shocks per minute, blood pressure 55/40 mm.

Diagnosis: full/total/complete crushing of left upper extremity, injury of left foot with the breakaway of the fifth finger/pin.

Injury of left eyeball with the discharge of vitreous body. Is superimposed tourniquet in the quite upper part of the shoulder. After the transfusion 500 ml of blood somewhat was improved the pulse. Is continued the blood transfusion drop. 8 Hours after the admission (are poured 1,700 ml of blood and 1,000 ml of physiological solution) blood pressure 125/80 ml, pulse of 112 shocks per minute, good filling, it is rhythmic. Picture of full/total/complete coming out from the shock. It transferred well operation/process.

However, the method of the intra-arterial pressing of the blood whose testing beginnings I. A. Birillo as far back as of war with the White Finns, during the Great Patriotic War did not obtain wide acceptance, although, according to the observations of the individual authors, and it was effective. During the author's development of the histories of the disease/sickness/illness/malady of injured people in the state of shock the bullet break of the bones of extremities it met the information not about one intra-arterial blood transfusion. There have only communications/reports of the individual authors about the use/application of this method the injured people with the bullet break of the bones or extremities, predominantly in the very heavy state.

Thus, V. A. Negovskiy reported 16 intra-arterial pressings of the blood with the injuries of extremities with a good, stable effect

in 2 injured people. One of these injured people was in the agonic state, another - in the state of clinical death. From 8 observations of M. A. Barenbaum a good, stable effect was obtained in one injured person; in remaining - short-time. A. L. Lerner, who applied the method of the intra-arterial pressing of the blood, noted stable effect not to the time:

G. S. Surallo reported 5 intra-arterial pressings of the blood with the bullet breaks of the bones of extremities. V. V. Dobrin reported 18 intra-arterial infusions of the blood, realized during the Great Patriotic War with the injury of extremities.

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All authors indicated, except A. L. Lerner, consider the intra-arterial infusion of the blood with the subsequent intravenous infusion of the blood highly efficient method with the extremely heavy degrees of shock.

Is most convenient intra-arterial infusion technique via the exposure of radial artery or infusion into the stump of artery upon the amputations.

On the basis of special study V. A. Negovskiy recommended to

deliver into the artery only 200-300 ml of the blood and subsequently to convert/transfer to the intravenous infusions of the blood and solutions.

For the purpose of fight with oxygen starvation for an improvement in the respiration in heavily injured in the state of shock was applied the lobeline. Experiment/experience showed that in injured people without the sharp disorders of respiration during the subcutaneous use/application the effectiveness of lobeline was little it was expressed. However, the use/application of it together with ephedrine in heavily injured always noticeably intravenously improved the respiratory/breathing function of the lungs. In some injured people the lobeline was applied at the increased doses. Observations of the special group, which studied shock, they showed that frequently it was possible to take injured people away from the heavy agonic state during the consecutive introduction to the vein of three-fourfold dose of lobeline together with ephedrine. Of 6 injured people, brought out thus of the agonic state, 2 were evacuated in a good state, 4 died s in time from 2 1/2 hours to 3 days.

With the bullet breaks in injured people in the state of shock widely (82.0o/o) were applied different cardiovascular substances: camphor, caffeine, corazole, ephedrine, strophanthin. In the complex of all measures for the liquidation of oxygen starvation and

disorders of the functions of cardiovascular system all these substances played positive role. The special observations of the group, which studied shock, showed that with the injury of the extremities when shock was frequently that combined with the massive blood loss, cardiovascular substances had to be assigned individualized and it is moderate to avoid the excessive overexcitation of vascular center with oligemia.

Carbogen therapy. The inhalation of the mixture of oxygen with carbonic acid (from the cushions) for the purpose of fight with oxygen starvation, based on materials of the author's development of the histories of disease/sickness/illness/malady, was encountered only in 0.3o/o of all injured people. S. I. Banaytis in his monograph "Traumatic shock" communicates that at the front where it led by surgical work, the utilization of cushions with oxygen and carbonic acid was rule. Special observations of the effectiveness of carbogen therapy with the shock did not say in favor of this method. The expressed therapeutic effect, according to the data of the group, which studied shock, was obtained only upon the prolonged giving of carbogen with the utilization of oxygen installation. In view of the difficulty of satisfaction of these conditions carbogen therapy could not acquire real value in the army region.

During the Great Patriotic war wide acceptance found different

blood substitutes and blood-substituting solutions which, based on materials of author's development, were applied in 55.7o/o of injured people with the break; in 17.7o/o of injured people they were the basic means of the treatment of shock, in remaining - supplemented transfusion the blood. Among the blood substitutes should be noted plasma and blood serum, which were being applied into 2.6o/o; among the blood-substituting solutions - I. R. Petrov's fluid/liquid, which was being utilized into 44.3o/o (in the overwhelming majority under this name was applied only salt solution for the fluid/liquid I. R. Petrov), fluid/liquid E. A. Asratyan - into 3.6o/o, V. I. Popov - into 4.9o/o and P. L. Sel'tsovskogo - into 10.7o/o, the solutions of the Leningrad institute of the blood transfusion - into 3.9o/o (No. 3 - 0.7o/o, No 28 - 2.3o/o and No 43 - 0.9o/o), physiological solution, 5o/o solution of glucose, etc. - into 30.0o/o of all transfusions.

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The effectiveness of the effect/action of different antishock fluids/liquids and methods was checked during the Great Patriotic War by both the individual surgeons and by special antishock brigades. Are published the data of the group, which studied shock, about testing of the following methods of the treatment of shock with the bullet breaks of the bones of the extremities: the infusion of fluid/liquid E. A. Asratyan in 18.9o/o injured people, P. L.

Sel'tsovskiy - in 7.8o/o, D. N. Fedorov - in 9.9o/o, I. R. Petrov's complex method - in 9.9o/o, suboccipital introduction of potassium phosphate - in 19.0o/o, usual antishock complex (rest, heat, narcotics, heart substances, blood transfusion, infusion of salt and glucose solutions) - in 34.5o/o of injured people.

E. A. Asratyan proposed fluid/liquid, on the basis of I. P. Pavlov's teaching about the leading value of cerebral cortex in the vital activity of entire organism, which was designed for the protective and reducing value of sleep, the antitoxic and blood-substituting effect/action. In injured people with light, uncomplicated shock this substance proved to be very effective. In heavily injured people, when other complications of frequencies influenced the state of injured people, fluid/liquid E. A. Asratyan did not give proper somniferous and reducing effect. According to the data of group on the study of shock, in heavy injured people was expressed only immediate effect as a result of the maintenance in it of the toning substances (alcohol, calcium chloride), moreover this is effect, as a rule, it was very unstable. The somniferous effect/action of fluid/liquid was insufficient and variable.

In the report materials of front in 1944, where the chief surgeon was N. N. Yelanskiy, there is a following estimation of fluid/liquid E. A. Asratyan: "The controlled her effect/action

surgeons noted the somniferous and soothing effect/action in the first 3-4 hours. To the onset or sleep the pulse in injured people was equalized; blood pressure was raised. The stage of excitation upon the administration of anesthetic was decreased. With the continuation of sleep the state of injured person somewhat deteriorated, pulse became smaller than fill, blood pressure descended, sleep became shallow, surface. Injured person rapidly woke up during the external stimulation and for a second time did not fill. Somnolency apathy they were continued to 6 hours, and then the effect/action of fluid/liquid ceased".

G. S. Surello saw good results from the use/application of fluid/liquid E. A. Asratyan only in injured people, who were in the state of light and average/mean shock, but Kh. D. Gadzhiyev generally did not note special effectiveness from the use/application of this fluid/liquid.

P. L. Sel'tsovskiy's fluid/liquid was distinct blood substitute in injured people with the light shock, but clearly insufficient with the heavy shock. In G. S. Surello's materials are made the same conclusions. Anesthetic-antishock fluid/liquid of D. N. Fedorov, containing eucodal and ephedrine, proved to be effective supplementary substance for the treatment of the mild cases of shock.

The complex method or the therapy of shock according to I. R. Petrov (blood, blood-substituting fluid/liquid of I. R. Petrov, bromides, ascorbic acid, inhalation of carbogen) gave good results in view of the presence in basis of his such effective substances as the blood transfusion.

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However, during the comparative test by group on the study of the shock of the conventional usual complex could not be been convinced of the special effectiveness of the specific components of this method - bromides and ascorbic acid. To the same conclusion about this method arrived front surgeon I. A. Krivorotov.

The method of suboccipital introduction of potassium phosphate, according to the data of the author's development of the histories of disease/sickness/illness/malady, was applied in 1.4o/o of injured people. In practice this method itself did not justify. Data in favor of its effectiveness and independent value in the therapy of shock it is not obtained. To this conclusion/derivation, judging according to report data of the Military medical museum, arrived surgeons' absolute majority.

Applied in the group on the study of shock in 34.5o/o of injured

people with the bullet break of the bones of extremities usual antishock treatment (blood transfusion, narcotics, heart, fight with the dehydration) according to its results on was inferior to treatment by other methods and means.

To determine statistically based on materials of archives of the Military medical museum the effectiveness of treatment by different substances is extremely difficult in view of the absence of sufficient differentiation of shock on the severity, and also in view of different accessibility of the use/application of antishock substances.

Thus, for instance, widest application from its accessibility and ease of fabrication found I. R. Petrov's fluid/liquid (salt solution), which was applied widely, including in more easily injured people. It is logical that its use/application gave statistically the best issues. Treatment by other fluids/liquids (E. A. Asratyan, P. L. Sel'tsovskiy, V. I. Popov), applied more frequent in is more heavily injured people due to smaller accessibility of these fluids/liquids, it unavoidably gave the worse results.

Then one should speak also about issues depending on a quantity of poured antishock fluid/liquid. The use/application of large doses in most heavily injured people, and small - in most easily injured

people leveled the indicators of effectiveness.

Anesthetization with the shock.

The state of heavy oxygen starvation with the shock (and even after removal from it) created the extreme instability of organism to the supplementary trauma and to anesthesia/narcosis. Therefore the selection of anesthetization with the shock in injured people with the break was conducted with the large care. Anesthetization was must be maximally full/total/complete, little toxic, it had to disturb raspirations in injured people in order not to aggravate in them the phenomena of hypoxemia.

The applied during the Great Patriotic War substances of anesthetization in injured people in the state of shock with the bullet breaks and in all injured people with the break are represented in Table 74.

Local anesthesia in injured people with the break of the bones of extremity, which were in the state of shock, found smaller use/application (34.7o/o), than in all injured with the bullet break of bones extremities (53.3o/o). The frequency of the use/application of local anesthesia is inversely proportional to the massiveness of the extremity: most frequently it was applied to the forearm, less

often - thigh.

More limited application of local anesthesia in injured people, on those walking in the state of shock, was explained by the larger severity of breaks and by the difficulty of surgical working in these injured people.

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If according to the character/nature of damage local anesthesia could be applied, then the equalization of blood pressure and pulse occurred more successfully than with anesthesia/narcosis. Furthermore, with the local anesthesia never was observed deterioration in the respiration, which had exceptional value under conditions of oxygen starvation.

Case anesthesia on the extremities was frequently the continuation of case blockade and it made it possible to perform different operations/processes, including amputations. However, the use/application of local anesthesia was difficult and traumatic with the multiple injuries and with the injuries in the proximal divisions of the extremities when case anesthesia was impossible, but infiltration did not give necessary effect. Furthermore, it was frequently necessary to rapidly operate heavy injured people, especially with the hemorrhage. All this served as basis in 2/3 injured people, who were in the state of shock, to apply anesthesia/narcosis.

With the general/common/total anesthetization in the first place in the frequency of use/application stood ethyl chloride, which upon the skillful giving was the best anesthetizing substance; 1-1½ the ampule of ethyl chloride it was usually sufficient for the production of any amputation. The heavy disorders of respiration it was not observed; blood pressure descended no more than with the local anesthesia. Being basis for further ether anesthesia (11.2o/o), ethyl chloriis noticeably reduced the dose of ether/ester. Somewhat less frequent than ethyl chloride with the shock was applied pure/clean ether/ester (24.2o/o).

Table 74. Forms/species of the anesthetization, which was being applied in injured people, who were in the state of shock, with the bullet breaks of the bones of extremities and in all injured people with the break (in the percentages).

(1) Локализация перелома	(2) Группа раненых	(3) Вид обезболивания							
		(4) общее							
		(5) местное	спинномозговое (6)	(7) хлорэтил	(8) хлорэтил и эфир	(9) эфир	(10) гексенал	прочие (хлороформ и пр.) (11)	(12) Итого
(13) Плечо	(14) Раненые, находившиеся в состоянии шока	41,2	—	25,8	10,5	17,7	1,2	3,6	100,0
	(15) Все раненые	54,3	—	29,3	4,2	10,8	0,8	0,6	100,0
(16) Предплечье	(14) Раненые, находившиеся в состоянии шока	46,6	—	25,0	3,3	21,7	1,7	1,7	100,0
	(15) Все раненые	66,6	—	25,1	2,6	4,8	0,3	0,6	100,0
(17) Бедро	(14) Раненые, находившиеся в состоянии шока	28,6	0,8	28,2	12,2	28,6	0,8	0,8	100,0
	(15) Все раненые	40,5	0,4	33,7	6,4	17,6	0,8	0,6	100,0
(18) Голень	Раненые, находившиеся в состоянии шока	35,8	—	25,1	12,5	22,5	3,0	1,1	100,0
	Все раненые	51,2	2,9	27,8	5,1	11,5	0,8	0,7	100,0
(19) В среднем	(14) Раненые, находившиеся в состоянии шока	34,7	0,3	26,4	11,4	24,2	1,7	1,3	100,0
	(15) Все раненые	53,3	1,0	28,6	4,5	11,2	0,7	0,7	100,0

Key: (1). Localization of break. (2). Group of injured people. (3). Form/species of anesthetization. (4). general/common/total. (5). local. (6). cerebrospinal. (7). ethyl chloride. (8). ethyl chloride and ether/ester. (9). ether/ester. (10). hexenal. (11). other (chloroform, etc.). (12). Altogether. (13). Shoulder. (14). Injured people, who were in state of shock. (15). All injured people. (16). Forearm. (17). Thigh. (18). Shin. (19). On the average.

The latter, according to the observations of S. I. Banaytis, A. L. Lerner, M. A. Barenbaum, during the Great Patriotic War in the absence of the expressed disorders of respiration, did not exert the considerable negative effect/action on the course of shock. Frequently ether/ester even contributed to an increase in the blood pressure and to an improvement in the pulse.

Intravenous hexobarbital anesthesia was applied rarely due to its negative action on the blood pressure and the respiration. Different combined forms of narcosis also found a small use/application.

By group on the study of shock during the Great Patriotic War was tested in 32 injured with the bullet breaks of bones extremities anesthetization by cooling by the melting snow. In 14 injured people of 32 this method was applied with the shock. During processing of wounds it itself did not justify in view of the heavy cold reactions after the removal/taking of tourniquet; whereas upon the amputations it proved to be very effective.

The procedure of anesthetization by the cold: extremity under the tourniquet, superimposed most closely to the place for the predicted amputation, it was bordered for 1-1$^1/_2$-2 the hours (depending on the thickness of extremity) by the melting snow. Within the period indicated the temperature in the tissues descended to 16-12°; at this temperature was conducted the amputation. The quality of anesthetization was distinct in all injured people, with exception of one, in which was noted small pain. A drop in the blood pressure was always less than with any anesthesia/narcosis. The respiration, which was being recorded with the kymograms, at all moments of operation/process remained even and calm. Coolings of organism never began in view of stopping of blood circulation in the injured extremity (it is more extremital than the tourniquet). During all days of observation the state of the tissues of wound was good. Method is recommended for the amputations when is necessary the imposition of tourniquet due to the hemorrhage in the heavy state of injured person. In these injured within the time of conducting antishock measures was realized full/total/complete anesthetization. Cooling in the presence of the superimposed tourniquet inhibited the formation of the toxic combustion products of incomplete in the section of the future stump of extremity.

Surgical intervention with the shock.

Injured people, who were in the state of shock, with the bullet breaks of the large/coarse bones of extremities were operated in the suppressing number on DMP and it is more frequently than remaining injured people (Table 75).

In the state of the shock of the first degree in injured people usually it was not required prolonged preoperation preparation, since stability to the operation/process in them was sufficient. During the large flows of injured people frequently this state generally remained unrecognized, about which testify S. I. Banaytis's data about the variations of the frequency of the diagnosis of the shock of the first degree from 4.0 to 25.0o/o.

With the shock of the first degree antishock measures were usually realized in the medical dressing room incidentally with surgical intervention. This was done also in those injured people, whose operation/process was conducted from the special readings for the purpose of the cessation of hemorrhage or apropos of the developed anaerobic infection. According to the observations of the author, the lethality in injured people with the bullet break, complicated by the shock of the first degree, within the early periods reached only 3.2o/o and in all it was explained by severe infectious complications.

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A number of injured people in the state of shock, operated without the preliminary antishock preparation, according to the data of author's development, composed 29.4o/o. By remaining (70.6o/o) injured person was conducted preoperation antishock preparation.

Here were involved injured people with the heavy shock (second and cuba) since the sensitivity of such injured people to surgical intervention, even to the simple manipulations (removal/taking bandage, splint), it was very great. They needed the especially careful observation: constantly appeared the danger of repeated hemorrhages or development of anaerobic infection; the latter frequently shortened the period of removal from the state of shock. The continued hemorrhage frequently required breaking down of operation/process to two stages, of which there was first the cessation of hemorrhage.

P- v, 29 years, it is delivered 13 hours after injury in the extremely heavy state: it is sharply pale, torpid, pulse hardly is perceived, blood pressure was not determined, respiration 12 per minute. Diagnosis: the blind-end fragmentation injury of left shoulder with the damage to shoulder bone and collar bone; the injury of left forearm; the blind fragmentation of wounded lower third of

left thigh. Shock of cube.

To the left extensive subpectoral hematoma; from the wound in the region of left forearm continuous drop hemorrhage. Treatment: heating, transfusion of blood (750 ml). Are simultaneously under the local anesthesia removed the fragments of the crushed collar bone, is bandaged the bled arterial branch; subsequently - continuous drop infusion of I. R. Petrov's fluid/liquid with 10o/o of blood (1 520 ml), heating, heart substances. Began sleep. State gradually was improved. After 21 hours: the general state satisfactory, color of face rose-colored, temperature of 37.6°, pulse of 104 shocks per minute, good fillings; blood pressure 125/80 mm; respiration 24 per minute. Is produced processing/treatment of all wounds under the local anesthesia. Operation/process it transferred well. Through 2 days it is evacuated in a good state.

Primary surgical processing/treatment of wounded in the state of shock was performed earlier than in all injured people with the bullet break of the bones of extremities, about which testify the data, given in Table 76.

Table 75. Distribution of the injured people, who were in the state of shock with the bullet breaks of the bones of extremities, and all injured people with the break in the stages of primary surgical processing/treatment (in the percentages).

(1) Локализация перелома	(2) Группа раненых	(3) Этап производства первичной хирургической обработки			Итого (5)
		ДМП	ППГ	прочие и неизвестные (4) этапы	
(6) Плечо	(7) Раненые в состоянии шока	81,9	13,6	4,5	100,0
	(8) Все раненые	76,9	15,6	7,5	100,0
Предплечье (9)	Раненые в состоянии шока	88,4	8,8	2,8	100,0
	Все раненые	74,3	15,0	10,7	100,0
Бедро (10)	Раненые в состоянии шока	80,4	15,6	4,0	100,0
	Все раненые	73,8	18,7	7,5	100,0
Голень (11)	Раненые в состоянии шока	84,8	11,2	4,0	100,0
	Все раненые	75,5	16,9	7,6	100,0
В среднем (12)	Раненые в состоянии шока	83,0	12,9	4,1	100,0
	Все раненые	75,0	16,5	8,5	100,0

Key: (1). Localization of break. (2). Group of wounded. (3). Stage of production in primary surgical processing/treatment. (4). other and unknown stages. (5). Altogether. (6). Shoulder. (7). Injured people in state of shock. (8). All injured people. (9). Forearm. (10). Thigh. (11). Shin. (12). On the average.

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To surgical intervention with the shock were presented the requirements of speed, small trauma, minimum blood loss and greatest

radicality. It is logical that with the shock, as a result of the heavy damage of the bones of extremities and injury of large vessels, frequently only the amputation during the primary processing/treatment satisfied these requirements; therefore shock most frequently was encountered in those injured people who during the primary surgical processing/treatment underwent amputation (table 77).

Exception/elimination are injured people with the bullet break of thigh, among them the shock was observed most frequently in subjected to processing/treatment fragments of bone or to the dressing of vessels, because the large part of the injured people, who were needing immediate amputation, did not reach the stage in which could be produced primary surgical processing/treatment.

Table 76. Time of production in the primary surgical processing/treatment for a period of the first day in injured people, who were in the state of shock, and in all injured with the bullet breaks of bones extremities (in the percentages).

(1) Локализация перелома	(2) Группа раненых	Срок первичной хирургической обработки (в часах) (3)				(5) Всего
		6	7—12	13—24	(4) первые сутки без уточнения часа	
(6) Плечо	(7) Раненые в состоянии шока	34,7	36,7	18,3	10,3	100,0
	(8) Все раненые	27,0	29,6	22,0	21,4	100,0
Предплечье (9)	(7) Раненые в состоянии шока	28,8	28,8	32,2	10,2	100,0
	(8) Все раненые	29,5	27,4	23,4	19,7	100,0
Бедро (10)	(7) Раненые в состоянии шока	25,8	34,4	20,9	18,9	100,0
	(8) Все раненые	23,4	28,9	28,2	19,5	100,0
Голень (11)	(7) Раненые в состоянии шока	34,5	30,9	21,3	13,3	100,0
	(8) Все раненые	26,2	27,7	28,3	17,8	100,0

Key: (1). Localization of break. (2). Group of injured people. (3). Period of primary surgical processing/treatment (in hours). (4). first day without refinement of hour. (5). In all. (6). Shoulder. (7). Injured people in state of shock. (8). All injured people. (9). Forearm. (10). Thigh. (11). Shin.

Table 77. Frequency of shock in injured people with the bullet break of the bones of extremities, which were subjected to different primary surgical processing/treatment (in the percentages).

(1) Локализация перелома	(2) Характер первичной обработки						
	(3) рассечение и иссечение с					(9) ампутация	(10) прочие
	(4) рассечение и иссечение	(5) удалением инородных тел	(6) удалением костных осколков	(7) обработкой фрагментов кости	(8) перевязкой сосудов		
(11) Плечо	1,6	—	4,4	6,4	9,2	12,9	1,4
(12) Предплечье . . .	0,7	0,5	1,6	7,4	1,4	12,9	—
(13) Бедро	5,2	4,8	12,4	29,3	26,2	22,6	1,4
(14) Голень	2,8	1,5	4,2	9,1	12,4	27,8	3,3

Key: (1). Localization of break. (2). Character/nature of primary processing/treatment. (3). dissection and carving s. (4). dissection and carving. (5). by removal/distance of foreign bodies. (6). by removal/distance of bone fragments. (7). by processing/treatment of fragments of bone. (8). by dressing of vessels. (9). amputation. (10). other. (11). Shoulder. (12). Forearm. (13). Thigh. (14). Shin.

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Similar data are acquired during the distribution of injured people according to the character/nature of primary surgical processing (Table 78).

As can be seen from Table 78, by the most frequent means of

primary surgical processing with the bullet breaks of the bones of shin, shoulder and bones of forearm in the injured people, who were in the state of shock, was amputation. With the bullet breaks of thigh more frequently was conducted either one dissection and carving of wounds, or in combination with the removal/distance of bone fragments.

However, with so large a radicality of primary surgical processing in injured people, who were in the state of shock, frequently proved to be necessary amputation in the following stages.

This fact and very state of shock expanded always readings to the amputations and inclined surgeons to the production instead of the economical amputations in upper third of shin and forearm to the more radical (in the sense of prophylaxis of infectious complications) and simpler technically - in lower third of shoulder and thigh.

Issues of shock.

The dynamics of the issues of shock in injured people with the bullet break, according to the data of the deepened development of the histories of disease/sickness/illness/malady, is represented in curve (Fig. 13).

As can be seen from Fig. 13, the frequency of the liquidation of shock each year of war was increased, but lethality from the shock was decreased with barely changing lethality from other reasons.

Table 78. Distribution of the injured people, who were in the state of shock, with the bullet break of the bones of extremities according to the character/nature of primary surgical processing (in the percentages).

(1) Локализация перелома	(2) Характер первичной хирургической обработки							(11) Всего
	(4) рассечение и иссечение	(3) рассечение и иссечение с (5) удалением инородных тел	(6) удалением костных осколков	(7) обработкой фрагментов кости	(8) перевязкой сосудов	(9) ампутация	(10) прочие	
(12) Плечо	28,4	—	24,8	1,9	5,5	33,9	5,5	100,0
(13) Предплечье . .	27,5	1,5	17.4	2,8	4,4	44,9	1,5	100,0
(14) Бедро	38,3	4,4	27,1	3,7	5,3	17,8	3,4	100,0
(15) Голень	21,8	1,1	10,3	0,6	6,9	54,0	5,3	100,0

Key: (1). Localization of break. (2). Character/nature of primary surgical processing. (3). dissection and carving s. (4). dissection and carving. (5). by removal/distance of foreign bodies. (6). by removal/distance of bone fragments. (7). by processing fragments of bone. (8). by dressing of vessels. (9). amputation. (10). other. (11). In all. (12). Shoulder. (13). Forearm. (14). Thigh. (15). Shin.

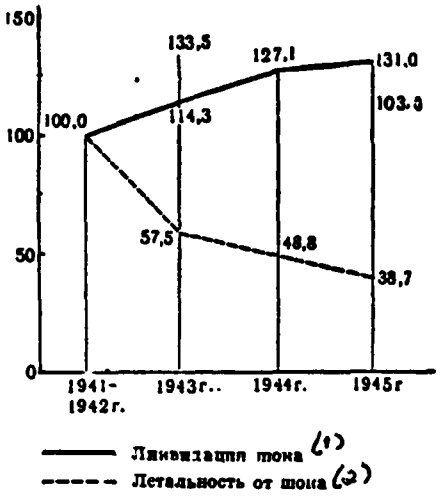


Fig. 13. Issues of shock in injured people with the bullet break of the bonas of extremities on the years of war.

Key: (1). Liquidation of shock. (2). Lethality from shock.

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For the correct understanding of these data it is necessary to consider that, because of an improvement in the diagnosis, with the years of war was increased the total number of injured people in the state of shock mainly after because of development/detection of injured people with the mild cases of shock.

Furthermore, should be introduced certain correction in the

attitude of the dead injured people, since the reasons for death calculated only on the basis of the final clinical diagnoses. However, the pathoanatomical check, produced in 45.2o/o of all dead persons, confirmed the clinical diagnosis of death from the shock only in 69.1o/o of dead persons.

Is even more difficult it was difficult to come to light/detect/expose the dependance of the obtained results from the extremely complex and variable combat circumstances and the applied methods of treatment.

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Chapter IV.

GAS INFECTION WITH THE BULLET BREAKS OF THE BONES OF EXTREMITIES.

Statistical survey/coverage.

Docent is Colonel MC A. A. Kazanskiy.

Already N. I. Pirogov, for the first time who in detail and classically described the various forms of the gas infection ("mephitic gangrene"), which complicated bullet injuries, indicated that latter/last more frequently it was developed with those injuries, with which the contusions also of grinding of soft tissues were combined with the breaks of bones. This position of N. I. Pirogov was confirmed both into the first and in the Second World War - complication of wounds by gas infection it was found in direct dependence on the degree of the decomposition of soft tissues, which was determined by the action on them not only of quite bullet projectile, but to the larger degree - fragments of the destroyed bones.

Since in the development of gas infection the decomposition of muscular and bone tissue was decisive, it is completely regular, that bulk (94.0o/o) of all complications of gas infection in the Great Patriotic War fell to the injuries of extremities mainly with the damage of bones, moreover on the lower extremities gas infection was developed with the bullet breaks in $3^1/_2$ time more frequent (10.8o/o) than on the upper ones (3.1o/o).

The more frequent development of gas infection with the injuries of lower extremity is explained by the fact that the presence of powerful musculature and large/coarse tubular bones by itself assumes their considerable decomposition under the influence of the bullet projectile, which has large kinetic energy. Furthermore, the special features/peculiarities of anatomical structure of lower extremity with the massive groups of muscles, included in the intractable fascial covers, contribute to the larger death of muscular tissue, and the killed and perishing muscular tissue is that substrate, on which easily and rapidly multiply the microbes of gas infection.

According to the data of the development of the histories of disease/sickness/illness/malady, in the Great Patriotic War among those wounded into the shoulder, the forearm, the thigh and the shin gas infaction was developed with the injuries with the damage of bones in 6.8o/o of injured people, and with the injuries with the

damage only of soft tissues - in 1.0o/o.

If the decomposition of bone tissue, which determined the degree of the damage of soft tissues, had a great effect on the development of gas infection, then this is distinctly evident during the comparison of the frequency of gas infection with the injuries of the separate segments of extremities (Table 79).

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Consequently, the the more powerful/thicker bone it underwent decomposition and the more it is disastrous in this case soft tissues, the more frequently was developed the gas infection. This position is especially convincing, if we take for the comparison of the injury of shin and forearm separately with damage of both of bones and any bone.

With the breaks of the bones of forearm gas infection was observed with break of both bones of forearm in 5.4o/o of injured people, radial bone - in 1.1o/o and the ulna - in 1.1o/o.

The frequency of gas infection with the breaks of the bones of shin was the following: with damage of both bones of shin - 18.3o/o, tibia - 4.6o/o and fibular bone - 4.8o/o.

It is necessary, apparently, to also recognize that the destroyed bone tissue contributed to the development of gas infection not only fact that it increased the decomposition of soft tissues, but also fact that it itself, especially porous substance and bone marrow, was the same good medium for the development of the microbes of gas infection as muscular tissue. To this fact paid attention already N. I. Pirogov: "the second condition to the contamination consists in ... the become numb porous pieces of bone and in rotting of ground bone marrow ... Entire more frequent it(nephitism - the author) is noted the compound (particularly bullet) fractures of extremities. It can be, that here nephitism is developed from the rapid decomposition/expansion of bone marrow, which contains in itself much grease and protein".

Although by gas infection were most frequently complicated the bullet breaks of thigh (12.3o/o), in a total quantity of the complications of gas infection predominated the breaks of the bones of shin (40.0-35.7o/o). This even gave to some authors occasion incorrect to assert that the more frequent development of gas infection was observed precisely on this segment. In reality reason is the fact that, in the first place, the injuries with the damage of bones were encountered on the shin more frequently than on the thigh

(according to the data of the development of the histories of disease/sickness/illness/malady, 43.7 and 16.5o/o), and in the second place, then that the heaviest injured with the break thighs frequently perished before the development of gas infection from other complications - shock and blood loss.

The frequency of gas infection with the bullet breaks of the bones of extremities had very small oscillations during the different years of war, which is evident from following data of the development of the histories of disease/sickness/illness/malady (table 80).

Relative to the effect of season on the development of gas infection with the bullet breaks it is necessary to note that in all periods of year the frequency of gas infection was approximately identical, since a number of injured people with the gas infection was found almost in complete agreement with increase or decrease of a number of injured people with the bullet break generally (Fig. 14).

Table 79. Frequency of gas infection with the injuries with the break and without the break of bones on different segments of extremities (in the percentages).

(1) Локализация перелома / (2) Характер ранения	(3) С повреждением костей	(4) Без повреждения костей
(5) Плечо	5,0	0,4
(6) Предплечье	2,1	0,3
(7) Бедро	12,3	0,9
(8) Голень	10,0	1,7

Key: (1). Localization of break. (2). Character/nature of injury. (3). With damage of bones. (4). Without damage of bones. (5). Shoulder. (6). Forearm. (7). Thigh. (8). Shin.

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Therefore it is possible to draw the conclusion that in the warm months of year, in spite of the great, it would seem, possibility of the massive contamination of wounds by anaerobic microbes, complication of bullet breaks by gas infection was not increased. This fact some authors joined with the fact that in the warm season the soldiers were dressed in that less contaminated as anaerobes cotton outfit.

Table 80. Frequency of gas infection with the bullet breaks of the bones of extremities during the different years of war (in the percentages).

(1) Локализация перелома	(2) Годы 1941	1942	1943	1944	1945
(3) Плечо	4,6	3,8	5,0	5,5	4,0
(4) Предплечье	1,6	2,0	2,3	2,0	3,2
(5) Бедро	12,7	11,0	12,1	13,2	12,0
(6) Голень	10,3	10,4	9,5	10,5	8,0
(7) В среднем	5,9	6,2	6,8	7,5	6,8

Key: (1). Localization of break. (2). Years. (3). Shoulder. (4). Forearm. (5). Thigh. (6). Shin. (7). On the average.

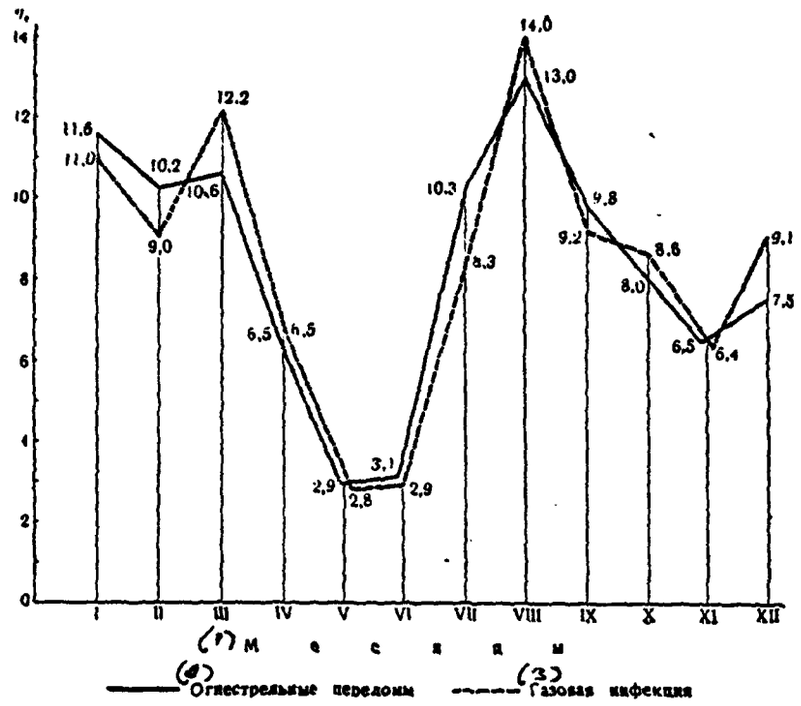


Fig. 14. Distribution according to the months of the year of all injured with the bullet break of bones extremities and injured people with the break, complicated by gas infection.

Key: (1). Months. (2). Bullet breaks. (3). Gas infection.

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According to the data of Englishmen, during the Second World War in the European theater operations where the soldiers carried predominantly wool outfit, gas infection it became apparent in the

injured more frequently than in Africa, where the outfit of soldier was prepared from the summer fabrics.

During the Great Patriotic War also was necessary to observe the development of gas infection, also, after the timely surgical processing of wounds (especially on the shin), caused by those jammed in the wound and those not noted during the primary processing by the pieces of wool outfit (overcoat, trousers) and of felt foot-wear.

As the illustration of this can serve the following observation.

T., 43 years, it is injured 25/VII 1943 by the fragment of artillery shell. Blind-end injury of upper third of left thigh with the damage to bone. To the second day after injury on DMP is produced the dissection of wound and the carving of nonvital soft tissues; is superimposed the splint of Cramer. 29/VII in the evacuation hospital it appeared edema in the region of thigh, bronze maculae to the shin, yellowness of scleras, ichorous liberations/excretions. Is produced the high amputation of thigh. In the region of break it is discovered metallic fragment and pieces of clothing. 30/VII began death. In the section is established/installed anaerobic infection.

For the selection of the most rational methods of treatment high value had the classification of the separate forms of gas infection.

Both in the first world war and after it, and during the Great Patriotic War were also proposed many different classifications of gas infection, simplified and complex, based either on anatomical data or on the sharpest local and general/common/total symptoms. But none of them could completely satisfy practicing doctor. Therefore a question about the classification of gas infection was in the state of permanent review.

In the opinion of N. N. Burdenko, the classification of gas infection then will become virtually valuable, when it is single - bacterioclinical. There is no as yet this classification.

Depending on surgical management/manual in the separate stages of the medical evacuation, the surgeons were guided by different classifications, but they frequently put to use also the division of gas infection into the following forms: gas phlegmon, gas gangrene, edematic form, mixed form.

According to this classification the injured people with the gas infection with the bullet breaks of the bones of extremities were distributed as follows (according to the data of author's development): injured people with the gas phlegmon there were 33.3o/o, with the gas gangrene. - 27.6o/o, with the edematic form - 10.7o/o, with the mixed form - 25.5o/o and with the unexplained form

- 2.9o/o.

This classification was supplemented another division of gas infection into the lightning, progressive and slowly elapsing forms, and also into the forms with the heavy, average/mean and comparatively light course.

In Fig. 15-26 it is possible to see the manifestation of the various forms of gas infection with the bullet breaks.

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Etiology and pathogenesis.

Already N. I. Pirogov noted that the injuries by the fragments of projectiles were most frequently complicated by gas infection. With the bullet breaks in the Great Patriotic War gas infection was developed after fragmentation injuries in $2^1/_2$ time more frequently than afterward bullet. However, if we examine the complications of the gas infection, which developed after bullet injuries with the break of bone, separately on one or the other segment of extremities, then relationships prove to be somewhat different (table 81).

If we turn to the data about the character/nature of the

injuries of different segments of the extremities with the break of bone, which were complicated by gas infection, then it is possible to also note that with those injuries, with which more greatly it perished soft tissues, more frequently was developed gas infection. Pulverized wounds were complicated by gas infection almost 2 times (11.2o/o), and blind almost intc 1½ time (8.1o/o) more frequently than through (5.9o/o). were more rarely complicated by gas infection tangential injuries (3.8o/o). However, on the separate segments these relationships/ratios somewhat were changed, which is evident from Table 82.

Table 81. Frequency of gas infection with the bullet breaks of the bones of different segments of extremities in the dependence on the form/species of the wounding projectile (in the percentages to a number of injuries of the corresponding segment).

(1) Локализация перелома / (2) Вид поражающего снаряда	(3) Пуля	(4) Осколки
(5) Плечо	2,9	7,0
(6) Предплечье	1,3	3,9
(7) Бедро	9,5	15,5
(8) Голень	6,1	13,1
(9) В среднем	4,2	10,2

Key: (1). Localization of break. (2). Form/species of wounding projectile. (3). Bullet. (4). Fragments. (5). Shoulder. (6). Forearm. (7). Thigh. (8). Shin. (9). On the average.

Table 82. Frequency of gas infection with the bullet breaks of the bones of extremities in the dependence on the character/nature of injury (in the percentages to a number of injuries of the corresponding segment).

(1) Локализация перелома / (2) Характер ранения	(3) Сквозное	(4) Слепое	(5) Касательное	(6) С раздроблением
(7) Плечо	4,1	5,0	3,5	12,2
(8) Предплечье	1,9	3,5	2,0	3,9
(9) Бедро	12,0	12,7	15,0	10,7
(10) Голень	9,4	7,8	3,5	13,7
(11) В среднем	5,9	8,1	3,8	11,2

Key: (1). Localization of break. (2). Character/nature of injury. (3). Through. (4). Blind. (5). Tangent. (6). grinding [pulverization]. (7). Shculder. (8). Forearm. (9). Thigh. (10). Shin. (11). On the average.

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With the bullet breaks of thigh all means of injury almost equally frequently led to complication with gas infection. This is completaly understandable, since in any case the bullet projectile, which especially had sufficient kinetic energy, produced the large decomposition of the massive sort tissues of thigh. The especially large decomposition of soft tissues on the thigh had to produce tangential injuries by the large/coarse fragments of projectiles. Pulverized wounds of thigh were complicated by gas infection, however, it is less frequent than the analogous wounds of shin, shoulder. This is explained by the fact that the injured people by

pulveriztion of thigh frequently underwent the amputation of extremities earlier than in them was developed gas infection, or they perished from other complications (shock, blood loss). Perforating injuries on the shin were also frequently complicated by the gas infection: the projectiles, which possessed large kinetic energy, naturally, strongly granulated the powerful/thick bones of shin, which led to the considerable death of soft tissues.

Data about the frequency of the complications of gas infection in the various forms of the breaks are represented in Table 83.

Consequently, gas infection was observed with each form/species of break, but it most frequently complicated the crushed breaks and are considerably less frequent - others.

Table 84 gives representation about the frequency of gas infection with the bullet breaks of the bones of extremities in the dependence on the level cf break.

Table 83. Frequency of gas infection in injured people with the different type of the bullet break of the bones of extremities (in the percentages).

(1) Локализация перелома / (2) Вид перелома	(3) Дырчатый	(4) Поперечный	(5) Продольный	(6) Косой	(7) Раздробленный	(8) Крупнооскольчатый	(9) Мелкооскольчатый	(10) Краевой	(11) Вколоченный
(12) Плечо	2,2	3,1	—	1,6	9,9	1,7	4,3	1,5	—
(13) Предплечье	0,6	2,2	—	0,7	4,2	1,6	1,3	—	—
(14) Бедро	3,2	8,3	5,7	4,1	20,3	7,8	8,2	3,4	5,4
(15) Голень	1,9	7,2	8,5	2,6	16,1	5,7	3,4	1,6	—
(16) В среднем. . .	2,0	5,2	4,0	2,3	12,5	3,9	2,9	1,6	2,4

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

Table 84. Frequency of gas infection with the bullet breaks of the bones of extremities in the dependence on the level of break (in the percentages).

(1) Локализация перелома / (2) Уровень перелома	(3) Верхняя треть	(4) Средняя треть	(5) Нижняя треть	(6) На протяжении нескольких третей
(7) Плечо	3,9	3,9	4,0	5,5
(8) Предплечье	3,0	1,8	1,0	5,4
(9) Бедро	12,8	12,6	10,8	12,0
(10) Голень	10,2	10,2	8,0	13,9
(11) В среднем	7,1	6,3	4,9	9,0

Key: (1). Localization of break. (2). Level of break. (3). Upper third. (4). Middle third. (5). Lower third. (6). For elongation/extent several third. (7). Shoulder. (8). Forearm. (9). Thigh. (10). Shin. (11). On the average.

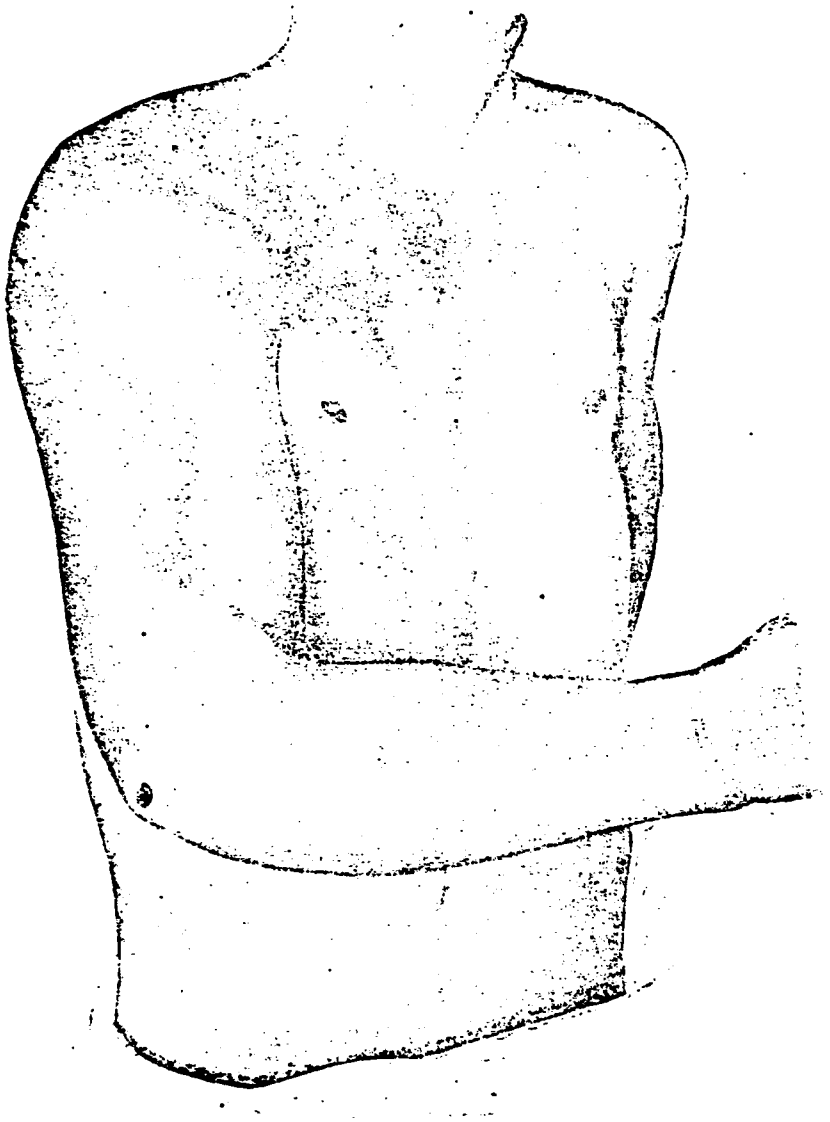


Fig. 15. Blind-end bullet injury of the region of right elbow joint with the break of shoulder bone (from the front). Gas infection. Disseminated edematic-gangrenous form. (Artist M. I. Kazitsin).

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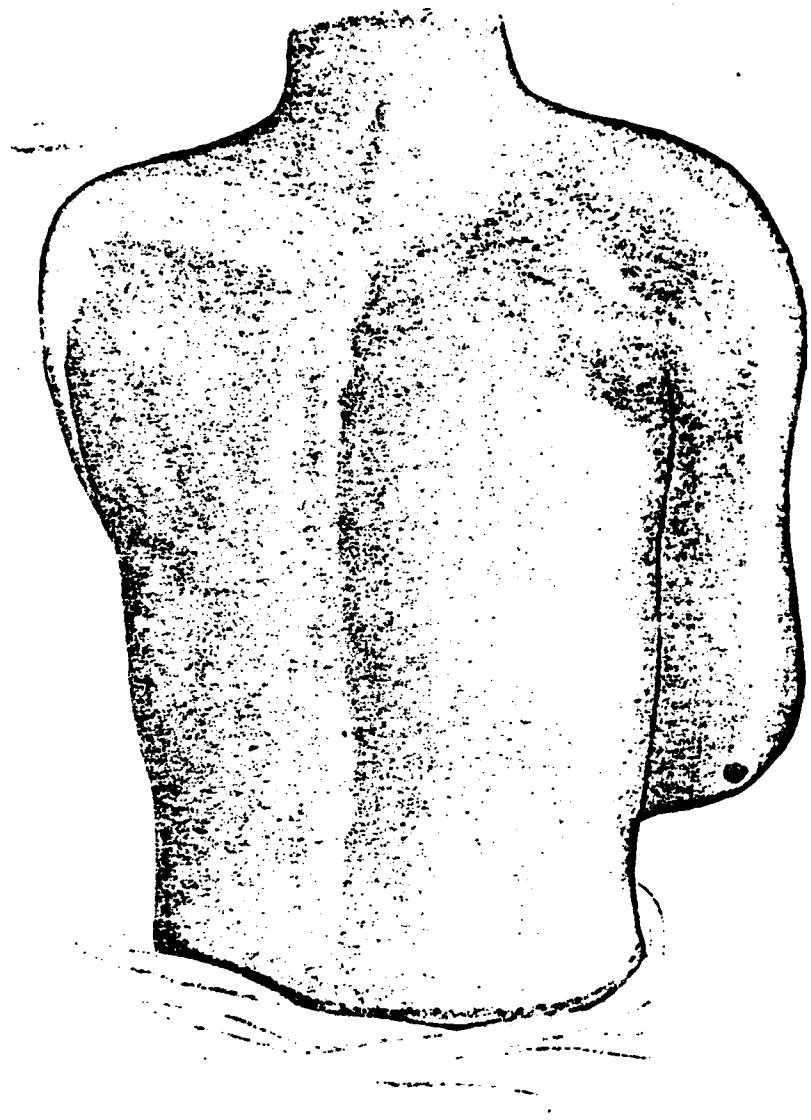


Fig. 16. Blind-end bullet injury of the region of right elbow joint with the break of shoulder bone (from behind). Gas infection. Disseminated edematic-gangrenous form. (Artist M. I. Kazitsin).

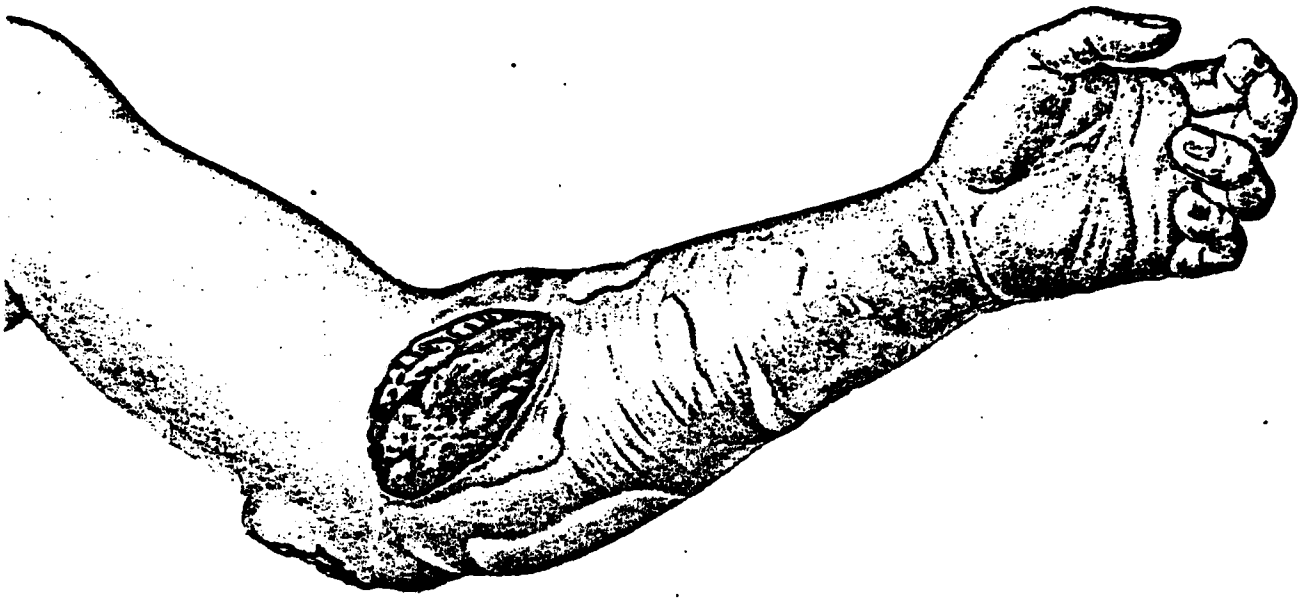


Fig. 17. Fragmentation injury of left forearm with the break of the ulna and the damage to ulnar artery. Gangrenous form of gas infection. (Artist M. I. Kazitsin).

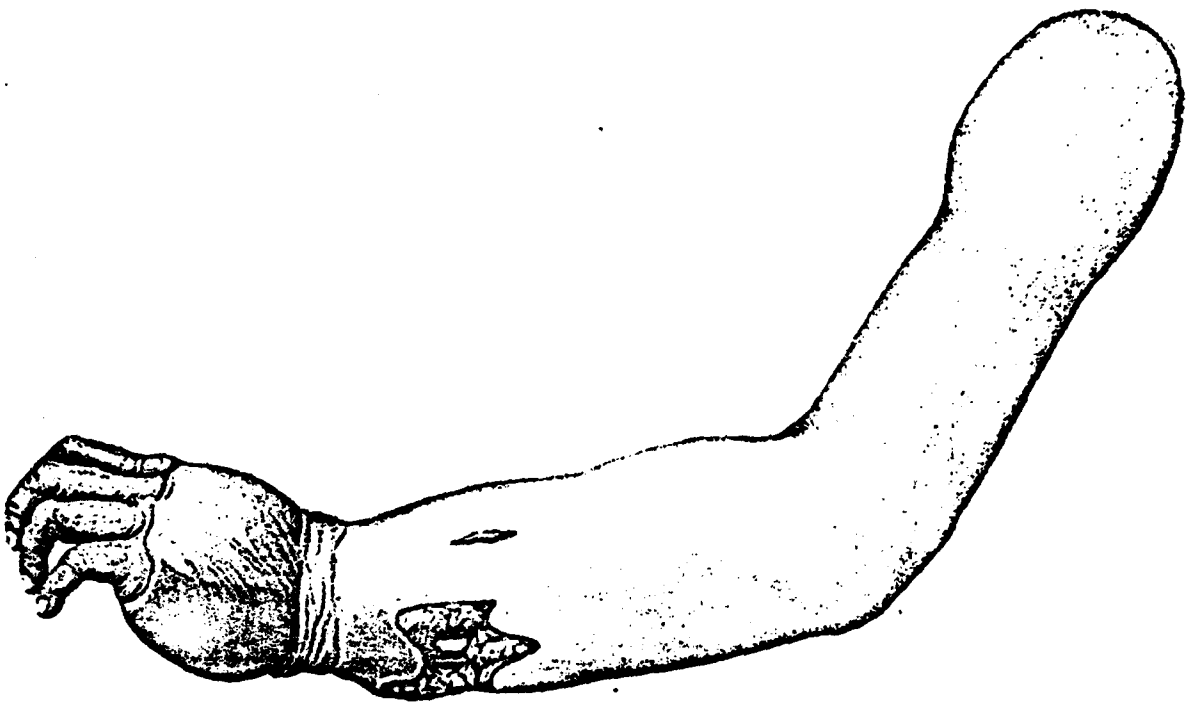


Fig. 18. Tangential fragmentation injury of lower third of left forearm with the break of the ulna. Gas infection of hand and forearm. Mixed form. (Artist M. I. Kazitsin).

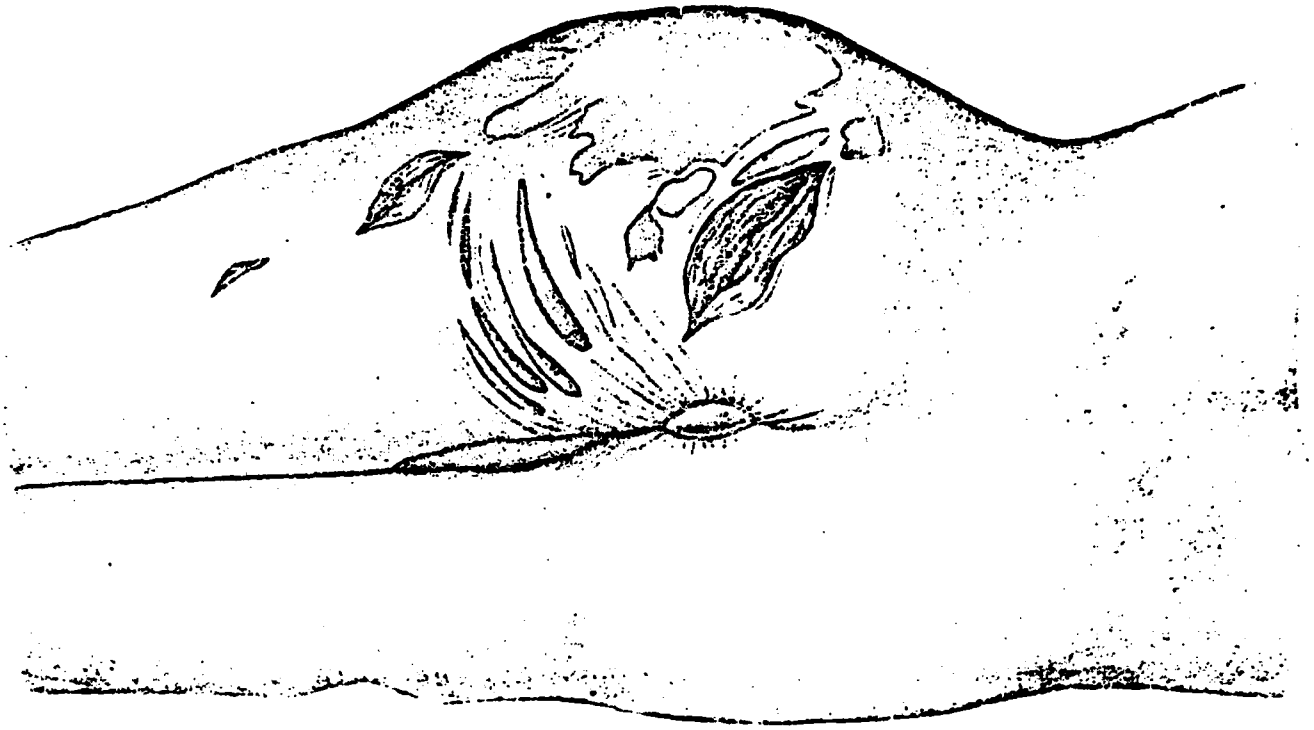


Fig. 19. Blind-end fragmentation injury of a left nates and upper third of left thigh with the damage to bone. Gas infection. a phlegmonous-edematic form. (Artist M. I. Kazitsin).

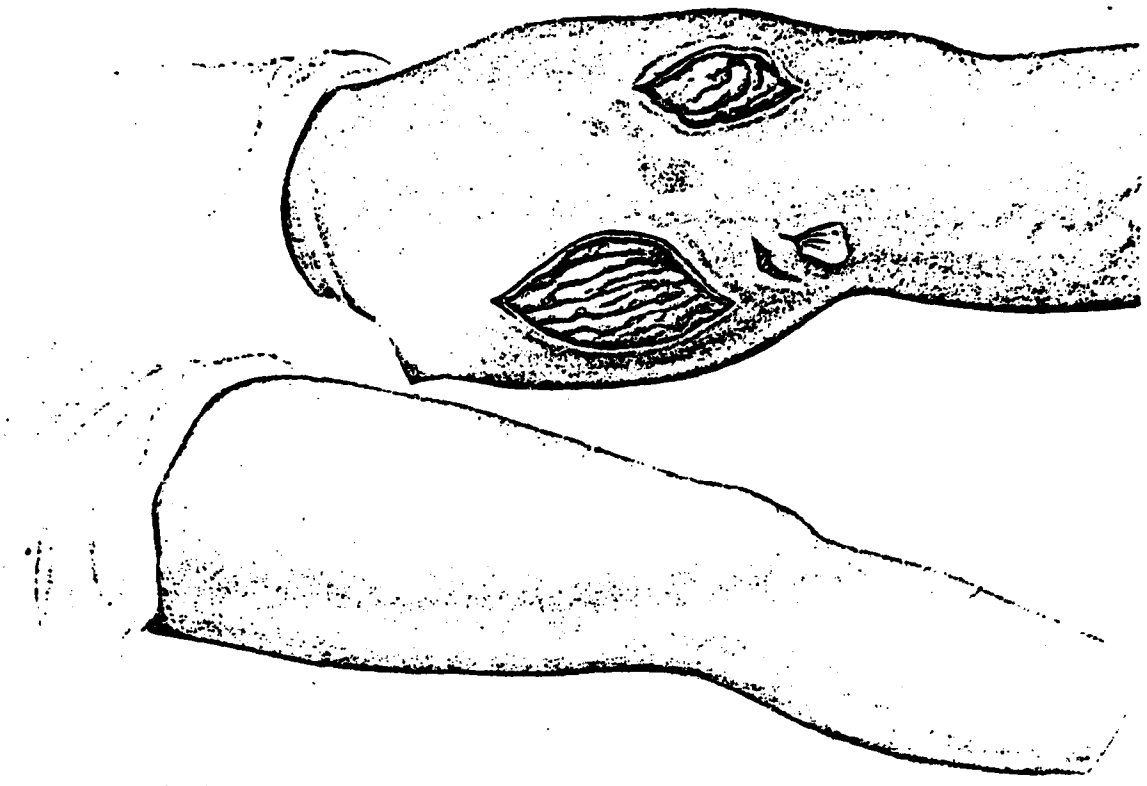


Fig. 20. Blind-end fragmentation injury is anterointernal than the surface of left thigh with the break of bone. Gas infection. an edematic-phlegmonous form. (Artist M. I. Kazitsin).

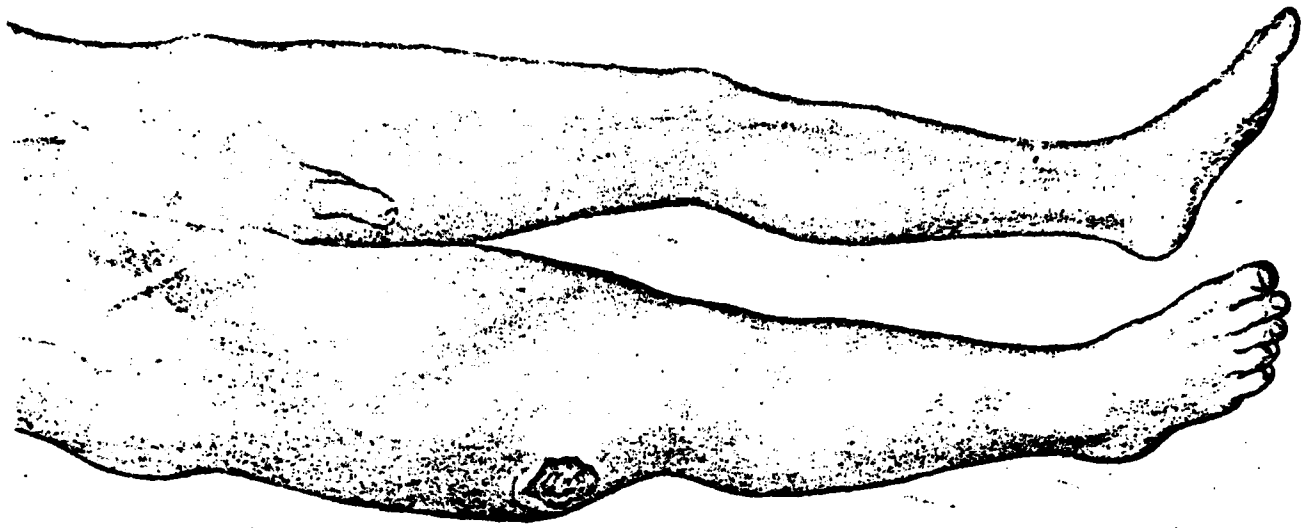


Fig. 21. Blind-end fragmentation injury of lower third of right thigh with the break of bone. Gas infection. Disseminated gas- gangrenous form. (Artist M. I. Kazitsin).

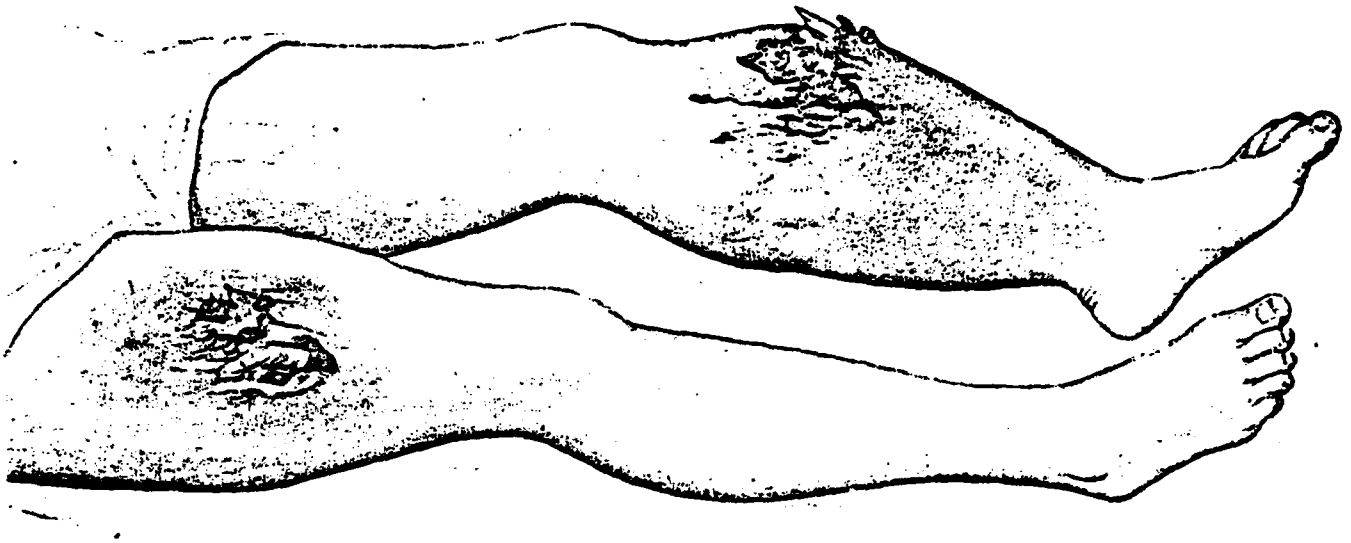


Fig. 22. open break of the bones of left shin; the damage of the soft tissues of right thigh (severe trauma). Gas infection of left shin and right thigh. a gangrenous-phlegmonous form. (Artist M. I. Kazitsin).

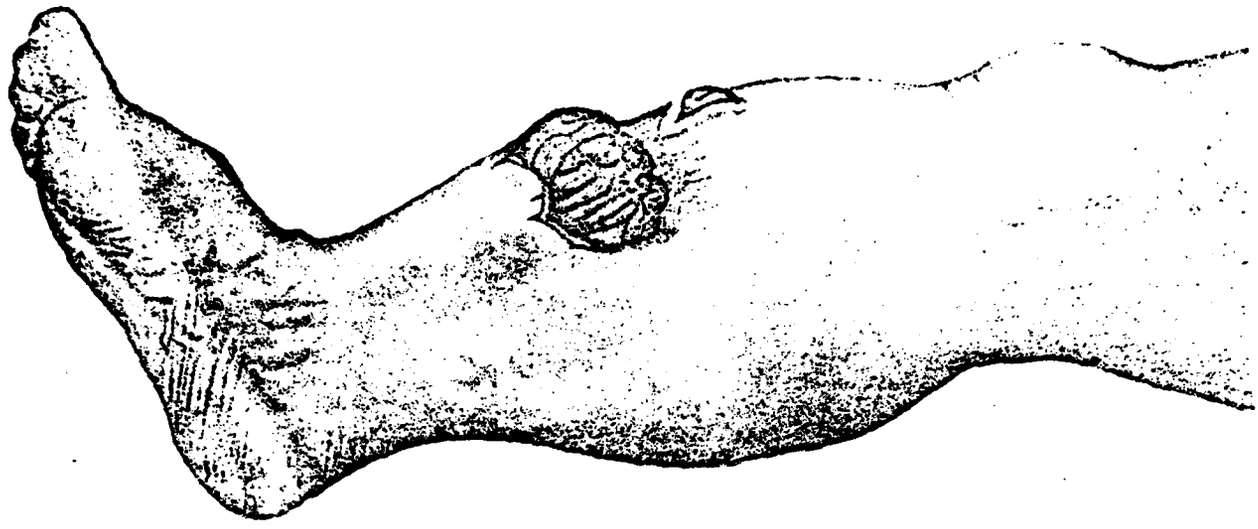


Fig. 23. Blind-end fragmentation injury of right shin with the damage to bone. Gas infection. A gangrenous-edematic form. (Artist M. I. Kazitsin).

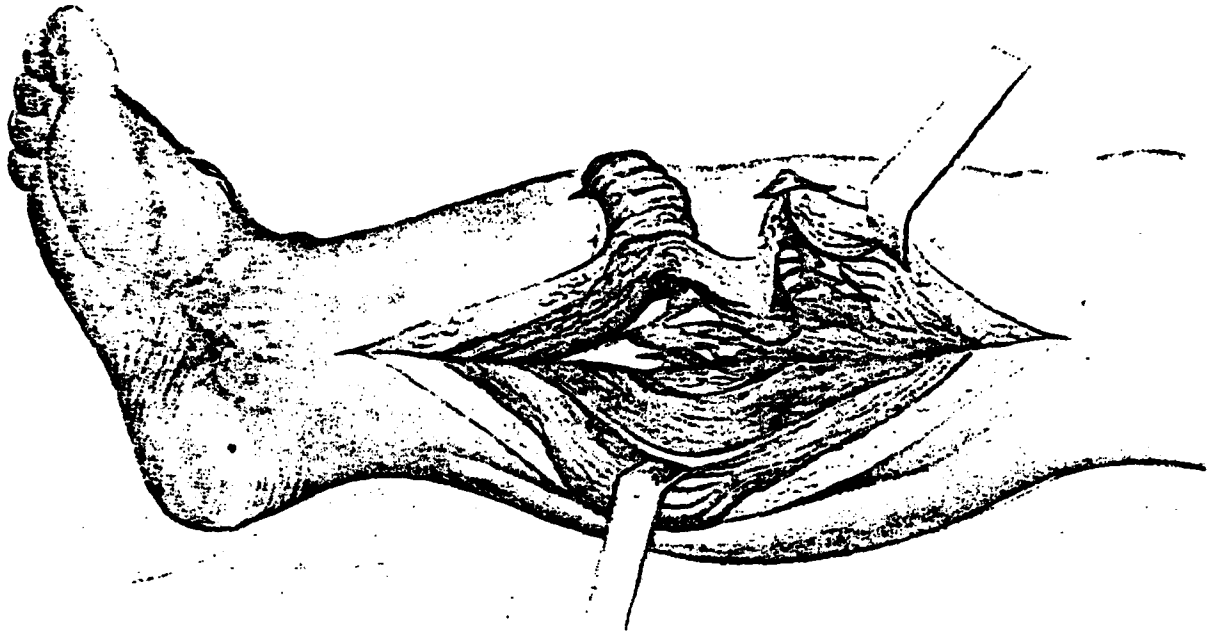


Fig. 24. Blind-end fragmentation injury of right shin with the break of the tibia. Gas infection. Gangrenous-edematic form. (Artist M. I. Kazitsin).

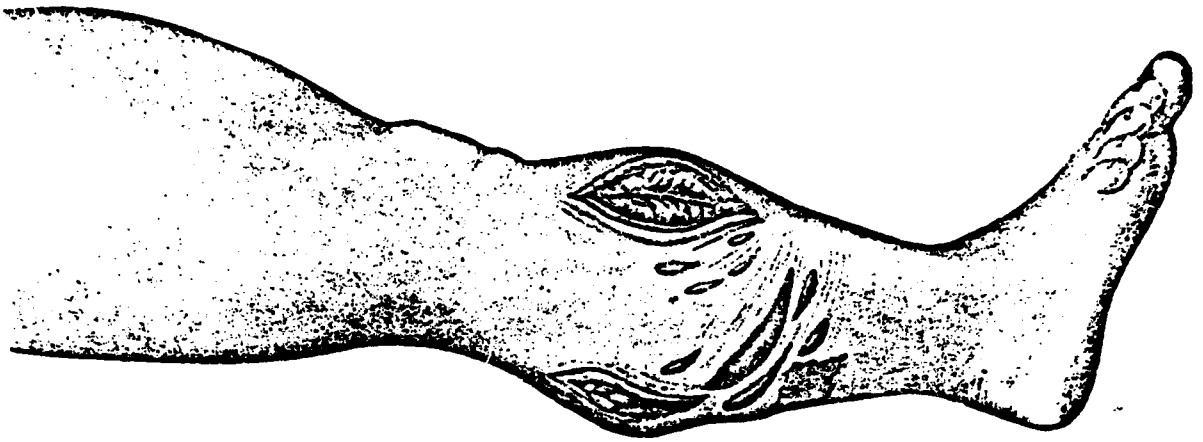


Fig. 25. Blind-end fragmentation injury of right shin with the damage to bone. Lightning form of gas infection (phlegmonous-edematic form). (Artist M. I. Kazitsin).

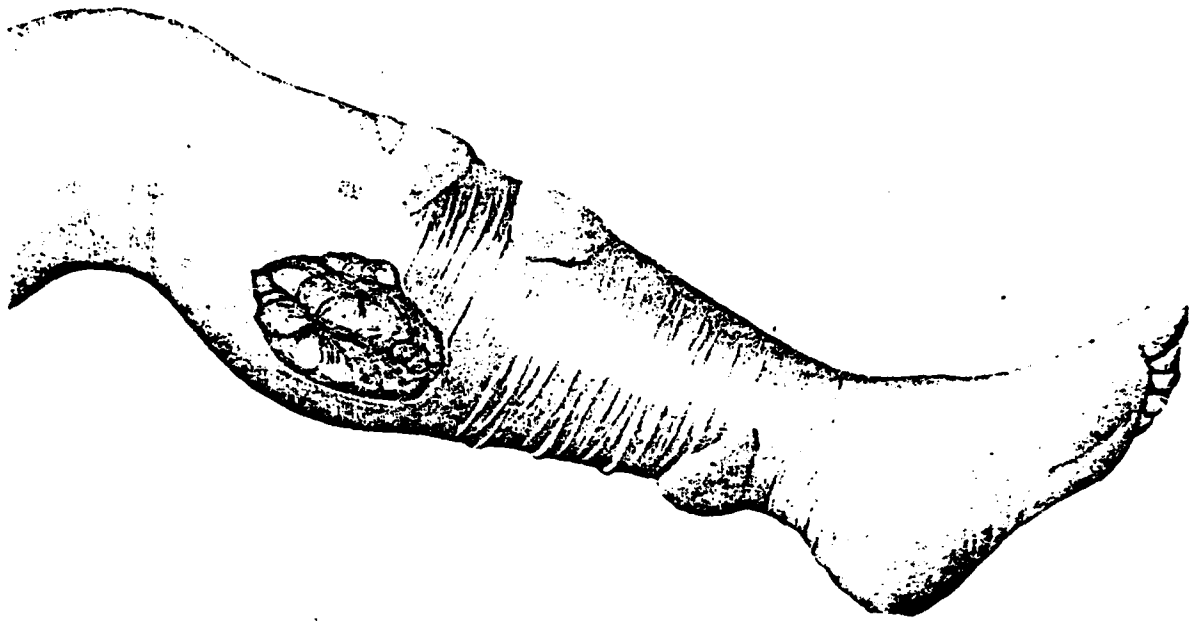


Fig. 26. Blind-end mine- fragmentation injury of left shin with the break of fibular bone. Gas infection. A gangrenous-rotting form with the gas formation. (Artist M. I. Kazitsin).

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From the data of Table 84 is visible the same law: with the injuries at that level of the segment of the extremity where were destroyed the more powerful/thicker and compact divisions of bones (upper and middle third) and when, therefore, it is disastrously more than soft tissues, gas infection was developed more frequently. It is completely logical that upon the decomposition of bone for the

elongation/extent of several ones third gas infection appeared most frequently, especially on the shin. Since the shoulder bone at all levels has almost one and the same power, gas infection was observed equally frequently upon the decomposition of this bone at any level.

If we examine the bullet breaks of the bones of forearm and the shins, which were complicated by gas infection, in the dependence on the level of the break of both or one any bone, then especially distinctly it is revealed/detected, that the decomposition of the more powerful/thicker divisions of bones most of all led to the complication of the gas infection (table 85).

It is interesting to note that the bullet breaks of upper third of fibular bone, in spite of the considerably smaller power of the latter in comparison with the tibial, they were more frequently complicated by gas infection, which finds its explanation in the specific anatomical-topographical relations on the shin.

Thus, the analysis of the material presented shows that the mo massive with the injury the decomposition of bones and, therefore, the greater the necrotized and ischemic tissue in this or another t segment of extremity, the more frequent, other conditions being equal, was developed the gas infection.

It is completely logical that all moments/torques, which disturbed in this segment of extremity blood circulation, was caused this disturbance/breakdown by the direct injury of the large/coarse feeding vessel, by the imposition of tourniquet or by a sharp drop in the arterial pressure (with the shock and the blood loss), they led to further death of muscular tissue and even more greatly they contributed to the development of gas infection.

With the bullet breaks of the long tubular bones, which were not complicated by gas infection, the damages of large/coarse arterial vessels, according to the data of the development of the histories of disease/sickness/illness/malady, were observed in 9.4o/o of injured people, while with those complicating - in 18.0o/o. On the separate segments of extremities these indicators considerably were changed, which is evident from Table 86.

Table 85. Frequency of gas infection with the bullet breaks of the bones of forearm and shin in the dependence on the level of break of one or both bones (in the percentages).

(1) Локализация перелома	(2) Уровень перелома	(3) Верхняя треть	(4) Средняя треть	(5) Нижняя треть	(6) На протяжении нескольких третей
(7) Предплечье	(8) обе кости	7,0	5,4	2,4	7,3
	локтевая кость (9)	0,9	0,9	0,3	7,2
	лучевая кость (10)	1,7	0,9	0,6	1,4
(11) Голень	обе кости (12)	20,6	19,7	15,6	18,8
	большеберцовая кость	4,5	5,0	3,2	7,7
	малоберцовая кость (13)	7,5	5,5	1,9	12,5

Key: (1). Localization of break. (2). Level of break. (3). Upper third. (4). Middle third. (5). Lower third. (6). For elongation/extent several third. (7). Forearm. (8). both bones. (9). ulna. (10). radial bone. (11). Shin. (12). tibia. (13). fibular bone.

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Consequently, with the injuries, which were complicated by gas infection, the damages of large vessels were observed considerably more frequently than with the injuries, which were not complicated by it, but especially on the shoulder, the forearm and the shin.

On the shoulder predominantly was damaged shoulder artery (84.0o/o), it is rare its deep branch (4.5o/o), and combined damage of both arteries was encountered into 11.5o/o. The damage to radial

artery with the bullet breaks of the bones of forearm was observed into two and the more of times more frequent (37.5o/o) than by cubital (16.7o/o), and the combined damages composed 45.8o/o.

Among the damaged vessels on the thigh in the fraction/portion of femoral artery it was 65.2o/o, its deep branch - 8.7o/o, large subcutaneous vein - 15.2o/o, to the combined damage of several vessels - 10.9o/o. The damages to front/leading tibial artery composed 19.5o/o, posterior - 33.5o/o, both arteries - 47.0o/o.

Attention is drawn to the fact that with the complicated by gas infection bullet breaks of the bones of shin and forearm, with which were damaged the vessels, frequently occurred injury of both main-line vessels, which as a result of the sharp disturbance/breakdown of the nourishment of this segment of extremity contributed to the rapid development of gas infection. The value of the damage of vessels for the development of gas infection is illustrated by the following example.

M., 31 year, is injured 12/VII 1944 by the fragment of mine. Perforating fragmentation injury of middle third of right shoulder with the break of bone. First aid is shown/rendered on the field of battle by medical orderly. On PMP every 4 hours after injury is superimposed the bandage and splint, is introduced antitetanus serum.

On DMP the injured person is delivered 13/VII. Tangential tear - pulverization injury of right shoulder. Break of shoulder artery. Carving of nonvital tissues, dressing of shoulder artery. It is evacuated in PPG. 14/VII 1944 state heavy, is pale, the pulse of 110 shocks per minute. Considerable edema of entire extremity. Bandage was incised in the tissue. Crepitation and symptom of razor, skin of the extremity of cyanotic color. Muscles are dark crimson. Under the chloroethyl anesthetization is produced the amputation of shoulder in upper third. the antigangrene serum intramuscularly of 7 doses, the transfusion of blood and fluid/liquid of Petrov. 28/VII the phenomenon of gas infection disappeared. 8/IX 1944 injured person it recovered.

Table 86. Frequency of the damage of large vessels with the bullet breaks of the bones of the extremities both complicated and not complicated by the gas infection (in the percentages).

(1) Локализация перелома / (2) Переломы	(3) Осложненные газовой инфекцией	(4) Не осложненные газовой инфекцией
(5) Плечо	21,6	9,1
(6) Предплечье	14,6	7,8
(7) Обе кости предплечья	21,8	
(8) Локтевая кость	9,0	
(9) Лучевая кость	8,5	
(10) Бедро	10,9	7,6
(11) Голень	24,1	13,9
(12) Обе кости голени	30,8	
(13) Большеберцовая кость	13,6	
(14) Малоберцовая кость	25,0	
(15) В среднем	18,0	9,4

Key: (1). Localization of break. (2). Breaks. (3). Complicated by gas infection. (4). Not complicated by gas infection. (5). Shoulder. (6). Forearm. (7). Both bones of forearm. (8). Ulna. (9). Radial bone. (10). Thigh. (11). Shin. (12). Both bones of shin. (13). Tibia. (14). Fibular bone. (15). On the average.

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The tourniquet, superimposed to the extremity for the cessation of hemorrhage, it is doubtless, it also contributed to the development of gas infection in some injured people. To this paid attention already N. I. Pirogov, and in the Great Patriotic War the

same noted many surgeons, who studied gas infection.

According to the data of author's development, with the bullet breaks, which were complicated subsequently by gas infection, the tourniquet was superimposed with the breaks of shoulder in 1.0o/o of injured people, bones of forearm - in 11.4o/o, thighs - in 2.0o/o, the bones of shin - in 9.0o/o of injured people.

The more frequent imposition of tourniquet with the injuries with the damage of the bones of forearm and shin is explained by the fact that the symptom of hemorrhage during the damage of vessels on the shin and the forearm was expressed more frequent than on the thigh and the shoulder, since on the forearm and the shin vessels were arranged/located more superficially; furthermore, with the high breaks of shoulder and thigh it was not always possible to put tourniquet.

The effect of tourniquet on the development of gas infection can be illustrated by the following observation.

I., 44 years, it is injured by the fragment of the mine 18/VIII 1943. Perforating injury of middle third of right forearm with the break of the ulna. First aid is shown/rendered immediately after injury by feldsher on BMP - are superimposed bandage, tourniquet on

the shoulder. 19/VIII injured person is delivered on PMP. Are superimposed bandage, splint of Cramer; tourniquet is weakened by 2 hours. 19/VIII it arrived in EG with the tourniquet which, from the words of injured person, lies/rests continuously already 10 hours. The general state is satisfactory. Tourniquet is taken/removed, there is no hemorrhage. On the volar surface of middle third of right forearm the wound of star-shaped form by the size/dimension 3x4 cm; on a volar-ulnar surface the second wound by the size/dimension 8x1 of cm with the insignificant odor. Is produced primary surgical processing and is superimposed gypsum cast. 24/VIII in SEG in injured person is noted weakness, pains in the wound and in the region of shoulder. Forearm and shoulder are edematic, strained, skin hyperemized, wound with the necrotic coating, muscle of dull gray color. Motions in the fingers/pins and sensitivity are preserved. Under ether anesthesia on the shoulder are made the sections/cuts, trimming phages of tissues around the wound. 25/VIII edema on the shoulder decreased, on the forearm it is held, tissues are strained. 11/IX the phenomena of gas infection disappeared. 15/XII 1943 injured person recovered.

The shock state, which was being accompanied by a sharp drop in the blood pressure and which led to an even larger disturbance/breakdown of that of already disrupted as a result of the injury of blood circulation in the extremity, also had, together with

other moments/torques, a value in the development of gas infection.

Gas infection was developed, according to the data of author's development, in the army region in 4.7o/o of injured people with the bullet break of the long tubular bones, which in the army region of shock did not have, and in 10.4o/o of the injured people, who were in shock state.

According to the personal observations of the author the general/common/total exsanguination as the factor, which contributed to the development of gas infection, it is noted in 5.0o/o of injured people with the break of thigh and in 11.4o/o of wounded with the gas infection, which developed after the bullet breaks of the bones of shin.

M., 23 years, it is injured 13/XII 1942 by the fragment of mine into the left thigh and the large toe of right foot. Pulverization of thigh with the break of the neurovascular bundle. 4 Hours after injury on DMP amputation. On the right foot is amputated large finger/pin. Injured person is evacuated in PPG. 21/XII sharp pains in the right foot. Bronze stain/staining of skin to upper third of shin. Sharp specific odor. Gas infection. Amputation of shin on the boundary of upper and middle third. Supplementary sections/cuts on the cult. Recovery.

Cooling as the moment/torque, which aggravates the disturbance/breakdown of blood circulation in the damaged extremity, under other unfavorable conditions also could play the leading role in the development of gas infection.

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R., 40 years, injured 13/III 1943 by fragment mine. Perforating injury of upper third of right shin with damage of both bones. After injury for 6 hours it lay/rested on snow. First aid is shown/rendered after 7 hours on PMP (dressing). On DMP - the dissection of wounds, bandage with the emulsion of streptocide, splint of Cramer. Through PPG it is delivered in SEG. State heavy, pulse of 102 shocks per minute, right shin and knee joint strongly swelled. Knee cap votes. Muscles in the wound dull gray. Foot cyanotic, cold. On the I finger/pin bubble with serous contents. 28/III state heavy, tongue of dry. Expressed phenomena of gas infection. Under the chloroethyl anesthetization is produced the amputation on the boundary of lower and middle third of thigh. 6/IV it is evacuated into the rear. Recovery.

The general/common/total reasons, as irregular nourishment and fatigue, which lead to a drop in the arterial pressure and, consequently, also to the disturbance/breakdown of blood circulation in the affected extremity, also contributed to the development of gas

infection. Thus, for instance, in one and the same offensive operation acted tired from combat troops and fresh forces; the percentage of gas infection among the injured people of the first group was equal to 2.6, and among the injured people of the second - 0.6, although the character/nature of injuries was identical (S. A. Aydinyan).

The period of the manifestation of gas infection with the bullet breaks of long tubular bones is represented on the diagram, comprised according to the data of author's development (Fig. 27).

As is evident, more than half (55.3o/o) all complications of gas infection is noted on the 2nd, 3rd and 4th day after injury, during the first five days gas gangrene developed in 71.4o/o of injured people. Somewhat more than 1/5 parts (22.0o/o) of all complications of gas infection fell on the 6-10th day, and after 10 days gas infection appeared considerably less frequent. Very rarely gas infection became apparent on the second month after injury. The observations of the late manifestation of gas infection are described by N. N. Akhutin (on the second month), B. N. Klein (on 46th day), by A. A. Kazanskiy (on 55th day).

On the period of the manifestation of gas infection with the bullet breaks of long tubular bones on the separate segments of extremities it is possible to judge by tables 87, the comprised based on materials author's development.

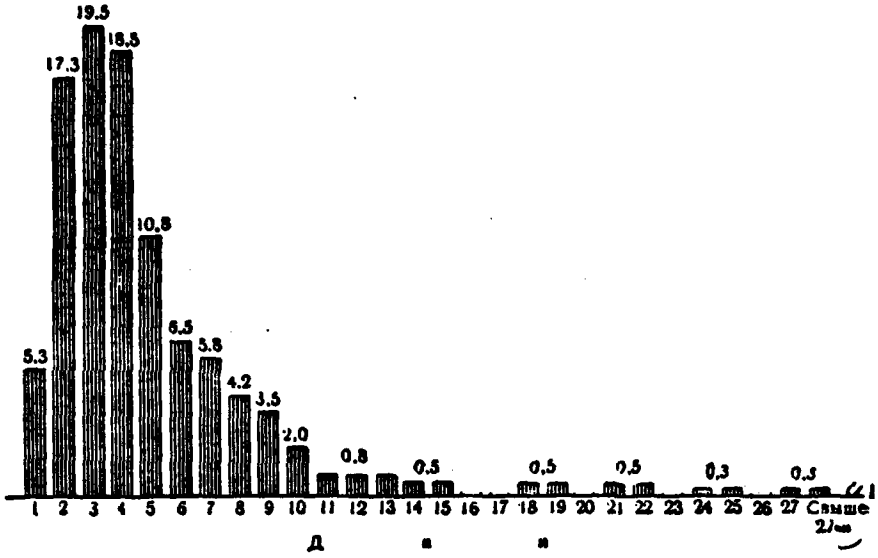
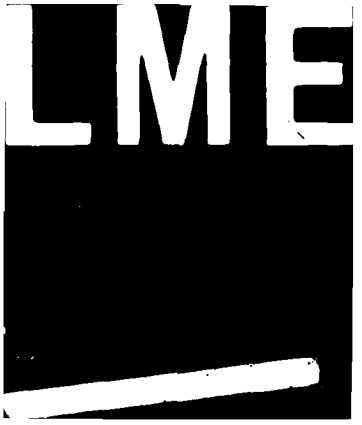


Fig. 27. Distribution of injured people with the bullet break of the bones of extremities according to the days of the manifestation of gas infection.

Key: (1). It is more than.

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As can be seen from Table 87, with the bullet breaks of the bones of forearm gas infection became apparent within the later periods than during the damages of bones on other segments. During the first day after injury gas infection most frequently was developed on the shin. This is completely regular, since, according to data, developments of the histories of


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