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AORTIC THROMBOSIS IN ATHEROSCLEROSIS

[Following is the translation of an article by V.S. Smolenskiy entitled "Trombozy Aorty pri Ateroskleroze" (English version above) in Klinicheskaya Meditsina (Clinical Medicine), Vol. XLI, No.6, Moscow, 1960, pages 95-100.]

The Department of Hospital Therapy of the Therapeutic Faculty (Director - active member of the Academy of Medical Sciences USSR Prof. A.L.Myasnikov) of the First Moscow Order of Lenin Medical Institute imeni I.M. Sechenov and Hospital No.23 imeni Medsantrud (chief physician A.P.Timofeyeva)

The timely diagnosis of the thrombo-necrotic stages of atherosclerosis of the aorta has acquired great importance at the present time in connection with the advancements in vascular surgery and in anticoagulant therapy. After Leriche (1923) drew the attention of clinicians to the problem of the diagnosis of thromboses of the inferior segments of the aorta and of the common iliac arteries (the Leriche syndrome) and demonstrated the ineffectiveness of vasodilatation therapy, including sympathectomy, a large number of surgical studies appeared, from which became apparent that the best therapeutic effect is seen in cases in which thrombosed portions of aortas affected by atherosclerosis, as well as of common iliac

arteries, are resected with replacement by transplants. Hundreds of these operations, with low post-operative mortality and good clinical result, have been described by DeBakey, and dozens of such cases have been described by other surgeons also (Welch, Julian, Grove, and others). Proper indications for operative intervention (Leriche and Morel, Massarelli and Estes), based on the data of translumbar aortography, for the most part (Chiappa; Victor and de Wolf), with the extensive use of anticoagulants, make this type of surgical this type of surgical intervention sufficiently safe according to the literature. Positive results may also be obtained with thrombo-endarterectomy as performed by Dos Santos (Z.V. Ugloblina et al), and also with the introduction of artificial anastomosis between the aorta above the thrombotic portion and any artery below, including the femoral artery, as reported at the meeting of the Moscow Society of Surgeons by B.V.Petrovskiy.

It is not necessary to prove that obstruction of the aorta of of the orifices of the major arteries originating from it almost invariably terminates in the death of the patient, although the successful development of anastomoses permits some patients, in the presence of a gradual constriction of the lumen of the aorta or of its branches, to continue to live, for instance, with complete obstruction of the lumen of the lower abdominal aorta (Chiappa, Lindstrom). Judging by experimental data (van Harreveld, Horsten, Gobbel), in these cases there inevitably develop serious hemodynamic disturbances in connection with the increase in peripheral resistance.

The frequency of aortic thrombosis is directly dependent on the frequency of ulcerative atherosclerosis, which, as is known, most seriously affects the abdominal portion of the aorta in the segment between the site of origin of the renal arteries and the bifurcation into the iliac arteries, and also the common iliac and femoral arteries. Ulcerative atherosclerosis of the aorta is seen, according to our data, in approximately 75 percent of patients dying of hypertension, and in 45 percent of patients dying of atherosclerosis. It should be kept in mind that about 15 percent of patients with atherosclerosiss have the process limited to the aorta.

The timely diagnosis of atherosclerosis of the aorta is best made through complex studies of patients by several methods, including roentgenokymography of the thoracic aorta (by the method of L.S.Matveyeva), X-rays of the abdominal portion of the aorta, and studies of the rate of the pulse wave and ballistocardiography (Z.G.Spektorova, Yu.G.Pushkar', Ye.V.Erina and S.M.Zhdanova). To demonstrate thrombi, aortography is necessary, of course.

For investigating the clinical picture of aortic thrombosis we analyzed the histories of patients with this disease in which diagnosis had been made of thrombosis of the aorta (at autopsy) arising in connection with atherosclerosis of one or another portion of the aorta (archives of hospital No.23 imeni Medsantrud). Some of the data were obtained from the department of pathologic anatomy of the First Moscow Order of Lenin Medical Institute imeni I.M.Sechenov.

We have at our disposal 100 observations of complete and mural thrombosis of the aorta. Among these cases there were 49 men and 51 women. The men constituted the younger age group. Two men were 44 and 49 years of age, whereas the youngest woman was 53 years of age; eight women and two men were older than 80. Thrombosis of the aorta was the direct cause of death in 46 of our patients: 22 patients died as the result of complete thrombosis of the aorta, 18 of gangrene of the intestine, six of gangrene of the extremities in connection with extension of a mural thrombus of the aorta into the iliac arteries. The cause of death in the remaining 54 patients was gangrene of the leg against a background of obstructing atherosclerosis of the iliac and femoral arteries (in 17), coronary insufficiency and myocardial infarction (in 15), disturbances of cerebral circulation (in 12), thrombosis and embolisation of the pulmonary artery (in four) and other conditions (in six).

The relatively large number of patients with aortic thromboses less than 60 years of age compels us to assume the participation of hypertension in the early formation of ulcerative atherosclerosis in these patients, as is reported also by other authors (V. T.Lyamtsev). Actually, upon analysis of the frequency of hypertension by age groups, an especially large number of persons with arterial hypertension proved to be in the younger age group. It is strange that there were many men in the older age group with an anatomic diagnosis of "hypertension". It cannot be ruled out that hypertrophy of the left ventricle, on the basis of which

the anatomic diagnosis of hypertension is made to a considerable degree, was associated in these cases with the presence in patients of disseminated atherosclerosis of the aorta.

In considering the question of thrombosis, with account being taken of two pathogenetic factors - the state of the vessel wall and the rate of the circulation - we did not take into account in our studies the role of the factor of coagulability of the blood, since we did not have at our disposal sufficient laboratory data, or the role of the neurovascular spastic factor (V.A.Gerke); as to the rate of the blood circulation, we indirectly and, of course, very approximately judged by the degree of coronary insufficiency and by the local hemodynamic conditions.

Of the purely clinical manifestations of aortic thrombosis, one can make two subdivisions: complete (obstructing the entire lumen of the aorta) and mural.

Obstructing Thrombosis of the Aorta. Judging by the above-mentioned data from the literature, a thrombus which gradual develops in the aorta, usually in the region of the bifurcation, may eventually obstruct the lumen of the aorta completely without leading to serious disruptions of the blood supply of the lower extremities and the pelvic organs, due to the opening up of collateral channels. As a rule, however, complete closure of the aortic lumen, usually at the site of a mural thrombus, entails the development of a comparatively stereotyped picture, at the basis of which lies a quickly-evolving gangrene of the legs and feet, accompanied by the development of toxicity

and shock.

Developing in the region of the aortic bifurcation, an obstructing thrombus relatively rarely reaches a higher level. Of 21 patients with complete thrombosis of the abdominal aorta, five had necrosis of different organs in the abdominal cavity in connection with obturation of the ostium of one or another artery arising from the aorta (in two patients there was necrosis of the sigmoid colon, in one necrosis of the kidney, in one necrosis of the wall of the urinary bladder). In these patients, the clinical picture of gangrene of the legs and feet was complicated by symptoms of peritonitis; sometimes, as occurred in two of our cases, peritonitis is not diagnosed because of the manifestations of severe toxicity and shock.

Considerable interest attaches to the mechanism of thrombosis in the aorta. It appears that a high rate of circulation would prevent this process even under conditions of ulceration of the intima; therefore, the development of thrombosis might be expected principally in patients with marked cardiac insufficiency; however, cardiac failure was present in only three of the 21 patients with obstructing aortic thrombosis.

Analysis of the history and of the pathologic findings permits us to subdivide obstructing thrombosis, from the point of view of genesis, into two types. Less frequently (in 6 of our cases), complete thrombosis of the abdominal aorta occurred at the site of an isolated mural thrombus. In forming, such a thrombus may extend in both directions, producing ascending throm-

bosis of the aorta and thrombosis of the ostia of arteries originating from it, and descending thrombosis of the iliac and femoral arteries, as occurred in three of our patients. More frequently (in 15 cases), another clinical and anatomic variant is seen. In its production the leading role is played by thrombo-ulcerative disease (atherosclerotic in nature) of the iliac and femoral arteries which, being smaller in diameter, frequently are subjected to marked stenosis in atherosclerosis and considerably impede the emptying of the abdominal aorta, thereby creating stasis of the blood in the zone of bifurcation. Thrombi also arise in the region of the bifurcation in the absence of ulcerative atherosclerosis of the aorta itself, for they represent only a continuation of the thrombi located in the iliac or femoral arteries. Precisely for this reason, the Leriche syndrome, in addition to disturbances of the sexual functions, also includes two other leading symptoms - intermittent claudication and feebleness of the arterial pulsations in the lower extremities. In seven cases, ascending thrombosis was discovered in both femoral arteries, in five in both iliac arteries, in one in the right femoral, in one in the left femoral, and in one in the left iliac artery.

The clinical picture of aortic thrombosis in the second variant, is distinguished from the clinical picture of the first variant by the presence in the history of the majority of patients of signs of circulatory insufficiency in the lower extremities ("obliterative endarteritis"). Autopsy experience

long ago showed that the so-called sclerotic form of obliterative endarteritis is most commonly a stenosis and obliteration of the popliteal, femoral, and iliac arteries by atherosclerosis, not infrequently of the ulcerative type, and often complicated by thrombosis (L.A.Rakhmanova). A long history (from one to 15 years), in which, in addition to paresthesias and intermittent claudication or unremitting pains in the feet and legs, there was amputation of the extremities, was observed in seven patients; some of the patients (nine) mentioned various unpleasant sensations in the feet and legs of weeks' to months' duration; in five patients, gangrene of both lower extremities was the first symptom of the disease. The meager history in the majority of patients was quite out of keeping with the marked pathologic picture in these cases.

Mural Thrombi of the Aorta. Whereas thrombi which obstruct the lumen of the aorta arise, as a rule, in the region of the bifurcation, mural thrombi exhibit a more extensive topography, which is responsible for the diversity of clinical symptoms in these cases.

Mural thrombi were seen in 79 patients; in three patients there were two thrombi each. If we arbitrarily divide the aorta into three segments - thoracic, upper abdominal, and lower abdominal (Fig.1) - then it is apparent that three-fourths of all thrombi are localized in the lower abdominal segment; less frequently they arise in the thoracic portion, and even more rarely yet in the upper abdominal segment. In 25 patients, mural

thrombosis of the aorta occurred against a background of severe atherosclerosis of the iliac and femoral arteries. In 22 of them mural thrombi either represented continuations of the thrombi in the iliac and femoral arteries or were situated in immediate proximity to them. In 57 patients, involvement of the iliac and femoral arteries was not pronounced and could not have played an important role in the process of thrombosis. The basis of these thrombi was ulcerative atherosclerosis. The clinical picture of thrombosis of the aorta, including mural thrombosis, is obviously determined by the arterial reservoir in which circulatory disturbances arise as the result of thrombosis of the aorta. This does not always correspond to the localization of the aortic thrombus itself.

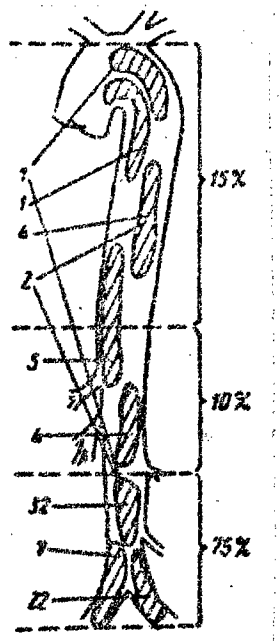

Fig.1 - Localization and frequency of mural thrombi of the aorta (figures indicate number of patients).

KEY:
1) Total necrosis of an organ
2) Spasm, thrombotic infarction
3) Embolic infarction
4) Gangrene of the extremities, thrombotic and embolic infarction
5) Thrombi
6) Emboli of thrombotic origin
7) Atheromatous emboli.

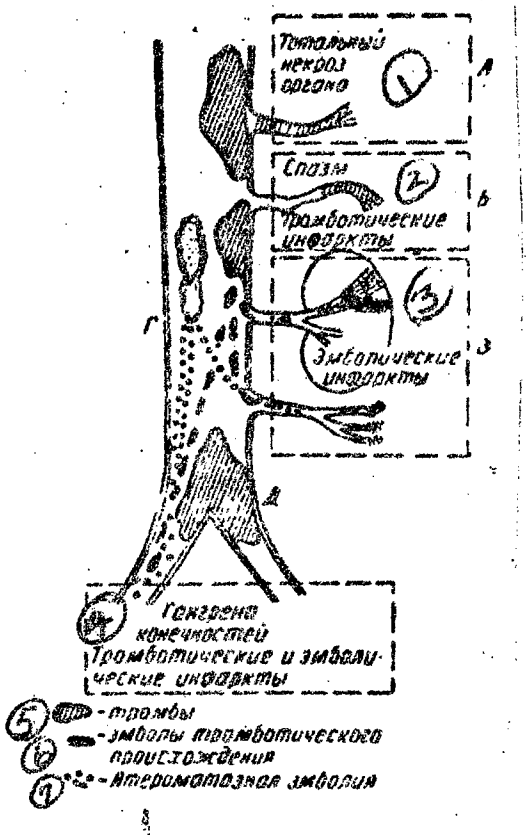

Fig. 2. Variants of circulatory disturbances in organs of the abdominal cavity against a background of ulcerative atherosclerosis and thrombosis of the aorta.

Clinical anatomic findings permit a subdivision into several variants, according to which there is disruption of circulation in organs in connection with ulcerative atherosclerosis and mural thrombosis of the aorta. Of greatest frequency is the first variant (Fig.2,a), in which a thrombus obstructing the ostium of one or another major artery leads to quick and massive necrosis of organs and tissues supplied by this artery. This occurred in ten of our cases, in four of which there was closure of the ostium of the inferior mesenteric artery with gangrene of the large intestine; in four there was obstruction of the ostium of the superior mesenteric artery with gangrene of the small intestine; in two there was obstruction of the ostium of the renal artery with necrosis of the kidney. The clinical symptoms of disease in these cases have been clearly described in numerous works and are well known, especially to surgeons (V.I.Varlamov, V.A.Gerke, Ye.A.Kashigina, Johnson, Larson).

The second variant is thrombosis of the major vessels of the abdominal viscera over a long period of time, in which the thrombus in the aorta, which partially closes the ostium of one or another artery and markedly reduces the circulation within it, makes it possible (spasm is not ruled out in these cases!) for spontaneous secondary thrombi to evolve both in the major and in the minor ramifications, usually in the mesenteric and renal arteries (Fig.2,b). In terms of clinical anatomic signs, this variant is difficult to distinguish from the third - thromboembolic developments, in which there are frequent, repeated, and

multiple emboli to the arteries of the abdominal viscera. These emboli are fragments of friable thrombi formed in the aorta (Fig.2,c).

We observed four patients with mural thrombi of the aorta who died of fresh thrombosis or embolization of the superior mesenteric arterial system. The histories of three of these patients revealed attacks of pain similar to those observed while the patients were in the hospital. One of these patients had undergone, seven months prior to admission, resection of the intestine for gangrene. In two patients, mural thrombi in the aorta led to embolization of the femoral and popliteal arteries. In one patient there had been repeated infections of the kidney.

Speaking of the embolic variant of involvement of the abdominal viscera in the presence of atherosclerosis of the aorta, it is necessary to keep in mind the atheromatous emboli (Flory, Zak and Elias, Handler), often not leading to extensive necrosis nor to the death of the patient, which are broken off at the time of opening large atheromata (Fig.2,d). Finally, as a fifth variant, we recognize the mural thrombi of the lower abdominal segment of the aorta which, by breaking off (Fig.2,e), obstruct the lumen of the iliac and femoral arteries, most frequently on one side, leading to gangrene of the extremities (six cases).

In the genesis both of obstructive and of mural thrombi of the aorta, we were unable to demonstrate a decisive role of cardiac failure. It was seenonly in 22 patients with mural thrombi of the aorta.

We deliberately are not discussing the combination of thrombosis of the aorta with thrombosis of other portions of the cardiovascular system, although in nearly all patients there were multiple thrombi in different locations. This is because of the considerable difficulty both in evaluating the duration of existence of thrombi and in the interpretation of thrombosis in these cases.

Conclusions

Thrombosis of the aorta is not infrequently a complication of ulcerative atherosclerosis. Arising in different segments of the aorta, they gradually or suddenly, by means of partial stenosis (thrombo-emboli), occlude the ostium of some arterial trunk arising from the aorta and lead to the appearance of a polymorphous clinical picture, at the basis of which lies ischemia of the organs and tissues of the abdominal viscera. The cause of a great number of thromboses of the abdominal aorta is obstructive atherosclerosis of the iliac and femoral arteries, the treatment of which will aid in the prevention of aortic thrombosis. The advances in modern vascular surgery and the extensive introduction and use of anticoagulant therapy permit us to anticipate success in the prevention of thrombosis of the aorta arising against a background of atherosclerotic involvement of the aorta.

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