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PREVENTIVE SURGICAL INTERVENTIONS AFTER VASCULAR RECONSTRUCTIONS FOR CHRONIC LOWER LIMBS ISCHEMIA

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ABSTRACT

The aim of the study: to evaluate the results of repeated reconstructive interventions on the main arteries of the lower limbs.

Materials and methods: Treatment outcomes in 43 patients were studied. Of them, the main group comprised 18 patients (Group 1) who underwent preventive vascular reconstructions. The control group included 25 patients who underwent repeated interventions for acute or chronic reocclusion of the reconstruction area. According to the degree of chronic ischemia, patients in the main group were distributed as follows: with 2A degree – 5 (27.7%), 2B degree - 12 (66.6%), 3 degree– 1 (5.55%). The 2nd Group included patients with chronic ischemia: with 2B degree – 8 (53.3%), with 3 degree – 5 (33.3%), with 4 degree – 2 (13.4%). In the 3rd group: with 2A degree of ischemia – 3 (30%), 2B – 5 (50%), 2C – 2 (20%).

Results: Shunt reconstruction was performed most frequently – 23.8% and hybrid operations - 20.9%. Endovascular operations were performed in 16.3%, anastomotic aneurysm resection in 11.6%, repeated bypass in 16.3%, and revision and/or conservative therapy in 4.7%. The duration of surgical treatment, intraoperative blood loss, and the number of complications in the preventive intervention group were significantly less than in Groups 2 and 3 ($p<0.05$). There was no mortality in Group 1, in the 2nd Group there were 2 (13.3%) amputations and no mortality, in the 3d group there were 3 (30%) amputations and 1 (10%) death.

Conclusions: 1. Prophylactic surgical interventions prevent the development of ischemia threatening limb loss.

2. Dynamic monitoring, including: routine examinations and the implementation of ultrasound with measurement of the shoulder-ankle index in the long term after primary vascular intervention, contributes to the early detection and prevention of vascular catastrophe. The group of patients with initial critical limb ischemia requires particularly close attention, due to the high risk of limb loss in case of reocclusion.

3. Performing preventive interventions is justified regardless of the degree of compensation of blood circulation in the limb.

Keywords: lower limb ischemia, preventive surgery, vascular reconstructions

INTRODUCTION

Cardiovascular diseases (CVD) belong to a group of disorders affecting the heart and blood vessels, including conditions such as coronary heart disease, stroke, hypertension, and peripheral arterial disease. These conditions lead to a poor quality of life and serious health complications such as heart attacks, strokes, heart failure, and arrhythmias, and often lead to long-term disability [1-3].

However, the prevalence of CVD among the elderly in low- and middle-income countries has increased dramatically, posing a major challenge to the sustainability of health systems. According to WHO, CVD causes 17.9 million deaths annually, accounting for 32% of all deaths worldwide. In Russia, according to the Federal State Statistics Service, cardiovascular diseases account for 38% of all deaths annually. For comparison, in Western European countries, mortality rates are three times lower: 200 cases per 100,000 [4-6]. The problem of atherosclerosis of the arteries of the lower limbs ranks the third one in the structure of cardiovascular diseases, being only preceded by coronary heart disease (CHD) and cerebrovascular pathology. The annual incidence of intermittent claudication ranges from 4.1 to 12.9 cases per 1000 population among men and 3.3 to 8.2 per 1000 among women [7]. Despite the steady progress in the field of pharmacotherapy and surgical methods of correction of this pathology, the problem of peripheral arterial diseases has not lost its relevance. Occlusive-stenotic lesion of peripheral arteries is a major medical and social problem. The complex symptoms of peripheral artery lesions significantly worsens the quality of life, and leads to disability. Within a year, 30% of such patients will undergo amputation, and only 45% have a chance of saving a limb. In addition, this group of patients has a significantly increased risk of cardiovascular events such as cerebral stroke and myocardial infarction, unlike patients without peripheral arterial pathology, which also increases the risk of mortality in general [8-10].

Reconstructive and reconstructive interventions on the main vessels in patients with chronic limb ischemia remain the main treatment method and are a way to avoid amputation. The number of reconstructive interventions on the main arteries of the lower limbs has increased in recent years; however, along with the increase in the total number of interventions, the need for repeated reconstructions is growing [11-13]. According to the Russian Society of Angiologists and Vascular Surgeons, the 5-year patency of aorto-femoral structures currently ranges from 80 to 94%, and the 10-year patency is 78-92% [14].

As a result of reconstructive operations on the femoral-popliteal arteries, the 5-year patency of auto venous shunts, synthetic prostheses,

or arteries undergoing endarterectomy ranges from 47 to 80% [15,16]. Among the complications requiring repeated intervention, along with shunt reocclusion, anastomotic aneurysms deserve no less attention. These aneurysms can also lead to a recurrence of limb ischemia, endangering both the limb and the patient's life. There are data that the duration of the infrainguinal shunts increases if the repeated intervention was preventive in nature, in contrast to those cases when the reconstruction was performed in acute thrombosis. At the same time, the probability of limb preservation is 40% higher in the case of preventive intervention [17]. According to El-Sayed HF, the duration of the shunt depends on the vigilance of surgeons, while he believes that the work of the shunt increases by 15% if it is monitored every 3 months in the first year, and once every 6 months in subsequent years. There are currently no clear indications for performing preventive intervention. According to some authors, 50% of stenosis in the shunt is an indication for intervention, according to others, stenotic changes of at least 75% are a guide to action. [18]. The critical value of blood flow through the shunt, which is the basis for the intervention, is not known. Some authors indicate that a blood flow rate of 45 cm/s is critical for the operation of an auto venous shunt in the infrainguinal position and is a predictor of thrombosis [19].

Despite the fact that surgical techniques are being improved every year, approaches to performing primary reconstructions are being developed, and there are currently no measures to prevent and treat long-term complications. The attitude towards preventive reconstructive interventions is ambiguous among surgical clinics [20-22]. The choice of the method of re-reconstruction, indications and timing of its implementation is still a matter of dispute. In the currently existing conciliation documents, there are no prescriptions for the management of such patients.

The aim is to evaluate the results of repeated reconstructive interventions on the main arteries of the lower limbs.

MATERIALS AND METHODS

We analyzed the results of repeated reconstructions in patients with chronic lower limb ischemia associated with the atherosclerosis treated in the Department of cardiovascular surgery (City clinical hospital named after SS Yudin, Moscow, Russia) in the period from 2017 to 2019. The total number of patients enrolled in the study is 43. Among them the test group consisted of 18 patients (Group 1) who underwent preventive vascular reconstructions. The control group included 25 patients who underwent repeated interventions for reconstruction zone reocclusion, among them 15 patients were with chronic ischemia (Group 2) and 10 - with acute ischemia (Group 3). The degree of acute ischemia of the lower limbs was determined by classification of V. S. Savelyev. (1972), in modification of A. V. Pokrovsky, the stage of chronic ischemia - according to Fontaine-Pokrovsky. According to the degree of chronic ischemia, patients in the main group were distributed as follows: with 2A degree – 5 (27.7%), 2B degree - 12 (66.6%), 3 degree– 1 (5.55%). The 2nd Group included patients with chronic ischemia: with 2B degree – 8 (53.3%), with 3 degree – 5 (33.3%), with 4 degree – 2 (13.4%). In the 3rd Group: with 2A degree of ischemia – 3 (30%), 2B – 5 (50%), 2C – 2 (20%). The average age of the patients was 56.8±8.2 years, there were 37 (86%) men and 6 (14%) women. 41 patients (95.3%) had multifocal vascular atherosclerosis, 29 (707%) had carotid artery disease, and 34 (79%) had coronary artery disease. Patients with type 2 diabetes mellitus were not included in the study. Tab. 1.

Table 1. Primary surgical interventions in patients

Groups	Primary interventions						Total
	Aorto-Femoral Bypass		Femoropopliteal Bypass above the cleft		Femoropopliteal Bypass below the cleft		
	Abs.	%	Abs.	%	Abs.	%	Abs.
1 (n=18)	7	38.9	6	33.3	5	27.8	18
2 (n=15)	6	40	7	46.7	2	13.3	15
3 (n=10)	3	30	4	40	4	40	11
Total	16	36.4	17	38.6	11	25	44

According to the submitted data, we see that the most common primary surgery was Aorto-Femoral Bypass surgery (36.4%), in 38.6% of cases Femoropopliteal Bypass surgery above the knee joint cleft and in 25% of Femoropopliteal Bypass below the cleft. 1 patient with acute thrombosis (23.3%) had Aorto-Femoral Bypass+Femoropopliteal Bypass surgeries.

Over the past few years, we have been actively and dynamically monitoring patients, while the examination with ULTRASOUND control is carried out within 1, 3, 6 and 12 months after reconstruction, then every 6 months. In addition, all patients coming from other medical institutions for routine examinations by polyclinic doctors are subjected to ultrasound examination in order to detect possible risks of shunt surgery early. The patients, we actively identified formed the main group. Of these, 3 had stenosis of the distal anastomosis zone of the aorto-femoral/ilio-femoral shunt (2/1), 4 patients had aneurysms of distal anastomoses with a massive thrombotic cup stenosing the lumen. As for patients who had previously undergone femoral-popliteal reconstructions above the knee joint cleft: 1 patient had iliac artery stenosis with a functioning femoral-popliteal shunt; 1 - proximal anastomosis aneurysm; 1 distal anastomosis aneurysm in a xenograft–shunted patient; 3 patients had stenosis in the distal anastomosis area (1 stenosis of the anastomosis itself; 2 stenosis in the middle portion of the popliteal artery). Similar situations were identified in the group of patients with femoral-popliteal shunts below the knee joint cleft: stenosis of the inflow artery – 1 patient, stenosis in the graft itself – 2 patients, stenosis in the distal anastomosis and outflow pathways – 2 patients. The time after the intervention ranged from 2 to 7 years after the initial reconstruction. It should be noted that in most patients, ischemia in the limb was compensated, 1 patient had a clinic for embolism of the foot arch artery, due to which there was pain at rest against the background of a functioning structure.

The data obtained were analyzed by methods of variational statistics with the calculation of the Student's t-test to determine the statistical significance of differences in averages. The statistical analysis was carried out using the programs "Statistica" v.6.0, MS Excel 10.0. The critical significance level of P when testing statistical hypotheses was assumed to be equal to or less than 0.05.

RESULTS AND DISCUSSION

The patients of the control group were hospitalized in a department with symptoms of both acute and chronic critical limb ischemia and instrumentally confirmed occlusion of the reconstruction zone. Among them, 10 had an acute ischemia symptoms upon admission. 3 patients had thrombosis of the Femoropopliteal Bypass above the knee joint cleft, 1 had thrombosis of the Femoropopliteal Bypass and Aorto-Femoral Prosthesis, 4 had thrombosis of the Femoropopliteal Bypass below the knee joint cleft (2 of them femoral-tibial

reconstruction), 4 had thrombosis of the bifurcation aorto-femoral prosthesis. The remaining 15 patients admitted to the hospital had shunt occlusion and chronic limb ischemia. Among them, 6 patients had occlusion of the branch of the bifurcation prosthesis (1 of them had complete occlusion of the prosthesis), 7 patients had occlusion of the femoral–popliteal shunt above the knee joint cleft (5 PTFE and 4 autovenous shunts), occlusion of the femoral-popliteal shunt sewn below the knee joint cleft - 2. Tab.2

Table 2. Types of repeated reconstructive interventions

Groups	Endovascular treatment	Repeated bypass surgeries		Reconstruction of the shunt		Resection of aneurysms of anastomoses		Extraanatomic bypass surgery	Hybrid interventions				Revision and/or conservative therapy
	Abs.	%	Abs.	%	Abs.	%	Abs.	%	Abs.	%	Abs.	%	Abs.	%
1	4	22.2	1	5.6	5	27.8	5	27.8	-	-	3	16.7	-	-
2	3	20	4	26.7	3	20	-	-	2	13.3	1	6.7	2	13.3
3	-	-	2	20	2	20	-	-	1	10	5	50	-	-
Total	7	16.3	7	16.3	10	23.3	5	11.6	3	7	9	20.9	2	4.7

From the table, we can see that shunt reconstruction was performed most frequently – 23.8% and hybrid operations - 20.9%. Endovascular operations were performed in 16.3%, anastomotic aneurysm resection in 11.6%, repeated bypass in 16.3%, and revision and/or conservative therapy in 4.7%. Moreover, it should be noted that in the group with preventive surgery, shunt reconstruction and anastomotic aneurysm resection were most often performed, as well as endovascular treatment in 22.2%, repeated bypass surgery in 5.6% and hybrid surgery in 16.7%. In the 2d group, repeated bypass surgeries were performed more often – 20.6%, shunt reconstruction and endovascular treatment in 20%, extraanatomic bypass surgery in 13.3%, hybrid operations in only 6.7% and revision and/or conservative therapy in 13.13%. In the 3d group with acute ischemia, shunt reconstruction was performed in 20%, and repeated shunts, hybrid surgeries in 50% of cases, and extraanatomic shunts in 10%.

Table 3. Intraoperative characteristics

Groups of patients	Duration of intervention, min	Blood loss, ml	Minor complications (lymphorrhea, hematomas, reperfusion edema)	Length of hospital stay, days	Severity of pain and need for analgesics	Endpoints amputation/death
1	156±14*	180±22*	1 (5,6%)*	6,4*	Standard doses	0/0
2	240 minutes or more	400±110	5 (33,3%)	16.5	The need for narcotic analgesics	2*/ 0
3	250 minutes or more	240±53	4 (40%)	18.3	The need for narcotic analgesics	3*/1*

**- values at p<0.05*

Based on Table 3, we see that the duration of surgical aid in the preventive intervention group was significantly less than in groups 2 and 3 (p<0.05). Intraoperative blood loss was also significantly lower in the 1st group of patients (p<0.05). Minor complications included postoperative hematomas, reperfusion edema, and lymphorrhea. The number of them in the 1st group was 5.6%, in the 2d group – 33.3% and in the 3d group – 40%. The length of hospital stay was also the shortest in the 1st group, and longer in groups 2 and 3 (p<0.05). In groups 2 and 3, the use of painkillers was significantly more necessary, and it should be noted that there were no amputations and deaths in the 1st group, and amputations and no deaths in the 2d group (13.3%). In the 3d group, amputation was performed in 3 (30%) cases and there was 1 (10%) fatal outcome.

CONCLUSIONS

1. Prophylactic surgical interventions prevent the development of ischemia threatening limb loss.
2. Dynamic monitoring, including: routine examinations and the implementation of ultrasound with measurement of the shoulder-ankle index in the long term after primary vascular intervention, contributes to the early detection and prevention of vascular catastrophe. The group of patients with initial critical limb ischemia requires particularly close attention, due to the high risk of limb loss in case of reocclusion.
3. Performing preventive interventions is justified regardless of the degree of compensation of blood circulation in the limb.

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