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Possibilities of Surgical Interventions in Severe Lower Limb Ischemia in the Stage of Trophic Disorders

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ABSTRACT

Occlusive pathology in the branches of aortic bifurcation or linear remains an urgent task of endovascular surgery in all highly developed countries throughout the world due to atherosclerotic narrowing of the vessels especially in the lower extremities. We have described the possibilities of surgical elimination of critical limb ischemia (CLI) in the stage of trophic disorders through the cohort study, which was conducted in the Grodno university clinic. The hospital and university committee approved the study. Within the last two years 2020-2022 in the hospital a total number of 68 patients were surgically treated for the CLI with trophic disorders. All of them were staged III-IV according to R.Fontine - A.V. Pokrovsky staging and ankle-brachial index (ABI). Aorto-femoral, Infringuinally femoro-popliteal-tibial revascularization and transplantation of autologous venous allograft for the reconstruction of the lower extremities in the above mentioned patients were carried out. We obtained a very positive results, in 97.1% the patients had a limb with positive dynamics and its functional state was preserved. Only in 2 patients out of 66 which is 2.9%, the limb was amputated due to complications developed and inadequate revascularization. Based on our clinical observation we have proposed that, the use of autogenous venous material, modern original de-obliterating reconstructions of arterial vasculature and transplantable allograft structures may be promising in the amelioration of occlusive pathology in severe life threatening lower limb ischemia in the stage of trophic disorders

Introduction

Critical lower limb ischemia with the stages of trophic disorders is the end stage condition of lower extremities. Mostly expedites to disability of the lower limb and unfavorable prognosis in terms of affected limb preservation and mortality. Occlusive pathology in the branches of aortic bifurcation remains an urgent task of endovascular surgery in all highly developed countries throughout the world. Simultaneously, often the pathology is characterized by the atherosclerotic etiology of unilateral or bilateral lesions of the iliac arteries. Critical ischemia of the lower extremities affects about 1% of men over 55 years of age [1]. First line diagnosis of Peripheral arterial disease is Ankle-Brachial Index (ABI). In modern times, for the diagnosis of patients with severe limb threatening ischemia, R.Fontine and WIFI (Wound Ischemia Foot Infection) classifications have been used to assess the severity of the patients [2].

Resection with prosthetics or Aorto-femoral bypass provide an adequate result in such clinical observations and generally stands as the only considerable method of management. These days, most of the endovascular surgeons prefer to perform reconstructive (Angioplasty) surgeries of iliac arteries, especially in case of distal ischemic purulent-necrotic conditions. In cross-shunting operations the “Crossover” technique has been proven to be a more gentle and appropriate aspect of surgery in the treatment of unilateral pathological processes.

Components	Score	Description		
W(Wound)	0	No ulcer (ischemic rest pain)		
	1	Small, shallow ulcer on distal leg or foot without gangrene		
	2	Deeper ulcer with exposed bone, joint or tendon with/without extensive gangrene		
	3	Extensive deep ulcer, full thickness heel ulcer with/without calcaneal involvement with/without extensive gangrene		
I(Ischemia)		ABI	Ankle pressure (mmHg)	Toe pressure or TcPO ₂
	0	≥0.80	>100	≥60
	1	0.60-0.79	70-100	40-59
	2	0.40-0.59	50-70	30-39
	3	<0.40	<50	<30
FI(foot infection)	0	No symptoms / signs of infection		
	1	Local infection involving only skin and subcutaneous tissue		
	2	Local infection involving deeper than skin /subcutaneous tissue		
	3	Systemic inflammatory response syndrome		

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In the correction of infrainguinal occlusions of the vascular bed of lower extremities in case of atherosclerotic lesions of the arterial pathways, Angioplasty (reconstructive) have been the ideal choice of surgical interventions [3]. At the same time, only half of them can perform revascularization surgery [4]. Without surgery, 40% of patients undergo amputation of the lower limb within 6 months after diagnosis, 20% of patients die [4]. To minimize the catastrophic outcomes of reconstructive surgery of the arteries the following methods which have showed promising results are, the use of modern explants with high rheological properties, the use of autologous shunting material, especially with minimal disintegration and traumatization of the endothelium, implantation of allografts with elements of transplantation techniques.

Goals of the Study

In order to determine the optimal approach of treatment for the elimination of severe ischemia, especially in the presence of clinically significant trophic disorders, the results of various modern reconstructive techniques used in ilio-femoral-popliteal occlusive lesions of the arteries in the lower extremities were evaluated among patients.

Materials and Methods

Department of Surgical Diseases-I of Grodno University Clinic within the last two years (from 2020 to 2022) performed, restoration and reconstruction of arterial blood flow in the aorto-femoral segment in 12 patients with gangrenous-ischemic limb trophic disorders (categorized as staged III-IV according to the R.Fontine - A.V.Pokrovsky staging [5]).

During the same period, femoral-popliteal-tibial arterial reconstructions were performed, 56 operated patients with a similar nature of tissue damage. In 50 patients, the occlusive process had an atherosclerotic etiology, and in 18 cases, ischemia was due to athero-diabetic lesions. The age of the patients ranged from 59 to 78 years old, among the operated there were 13 women and 45 men.

Results and Discussion

As per the analysis obtained through the above discussed study it was revealed that the choice of the reconstructive methods depends on the patient's individual conditions. Primarily determined by the presence of an adequate (at least 6 mm in diameter) main subcutaneous autogenous vessel (large subcutaneous vein), the state of the distal vascular bed during operations below the inguinal ligament, the degree and prevalence of necrotic ischemic tissue damage and somatic status of the patient played a major role in choosing the surgical option in the aorto-ilio-femoral segment.

Aorto-femoral bypass operations were performed in 5 patients with occluded aorto-iliac segment and necrotic lesions without perifocal inflammation (2 patients at bifurcation - and 3 patients in linear). In the other 5 patients, prolonged unilateral or segmental obstruction of the aorto-ilio-femoral segment was removed by the original surgical technique of multifocal tunnel de-obliteration. The method of more gentle cross-shunting operations of the "crossover" type turned out to be an expedient and preferred option for choosing surgical treatment for unilateral pathological processes in this segment in 2 patients with a pronounced comorbid status.

From the infra-inguinally operated patients with the help of autologous vascular structures, 22 had femoral-popliteal bypass surgery with a reversed vein below the knee joint gap, similar bypass surgery was performed proximally in 8 cases. In 11 patients operated with extended occlusions of the superficial femoral and popliteal arteries, distal anastomosis was super imposed with the tibial arteries below the level of distal obstruction. The restoration of the main blood flow in the popliteal and tibial arteries according to the "in situ" method was carried out in 14 people. In the 1st clinical observation, with the repeated nature of surgical intervention and in the absence of autologous material during bypass surgery in the femoral-popliteal position, an arterial allograft with elements of graft technology was successfully transplanted.

In the early postoperative period, 5 (7.3%) of the operated patients developed complications that required repeated surgical interventions (in the 1st - bleeding from the anastomosis, in the 4th-thrombosis). In 2 patients, adequate revascularization of the limb was not achieved and amputation was performed (2.9%). A limb with positive dynamics in a functional state was preserved in 97.1% (66 patients) [6-13].

Conclusion

Hence, with regards to aforementioned validation of the study, the use of autogenous venous material, modern original de-obliterating reconstructions of arterial vasculature and transplantable allograft structures may be promising in the amelioration of occlusive pathology in severe life threatening lower limb ischemia in the stage of trophic disorders.

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