

Порівняння результатів хірургічного лікування критичної ішемії нижньої кінцівки та аналіз факторів, що впливають на результат хірургічного лікування

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Comparison of surgical treatment results of critical limb ischemia and analysis of factors influencing the outcome of surgical treatment

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Реферат

Мета. Оцінити результати хірургічного лікування критичної ішемії нижньої кінцівки в двох спеціалізованих судинних центрах.

Матеріали і методи. У роботі проаналізовано результати хірургічного лікування 202 хворих із критичною ішемією нижньої кінцівки, які були прооперовані в двох спеціалізованих судинних центрах: I група (76 пацієнтів) – клініка судинної хірургії військового госпіталю, м. Ружомберок, Словацька Республіка; II група (126 пацієнтів) – клініка судинної хірургії Східно-Словацького інституту серцево-судинних хвороб, м. Кошице, Словацька Республіка.

Результати. Прохідність артеріальних реконструкцій в I групі складала: стегново-надколінний сегмент: 1 рік – 83%, 3 роки – 73%; стегново-підколінний сегмент: 1 рік – 68%, 3 роки – 52%, у II групі – стегново-надколінний сегмент: 1 рік – 91%, 3 роки – 82%; стегново-підколінний сегмент: 1 рік – 72%, 3 роки – 64%.

Висновки. Показники прохідності артеріальних реконструкцій протягом першого року у хворих, оперованих в обох судинних центрах, не мали статистичної відмінності. Найкращу прохідність протягом трьох років (>70%) мали стегново-надколінні реконструкції. На тривалість прохідності артеріальної реконструкції впливали такі фактори: тип використаного трансплантата, цукровий діабет, паління.

Ключові слова: захворювання периферичних артерій; критична ішемія кінцівок; протезування

Abstract

Objective. To evaluate the results of surgical treatment of critical limb ischemia in two specialized vascular centers.

Materials and methods. The results of surgical treatment of 202 patients with critical lower limb ischemia, which were operated in two specialized vascular centers: I Group (76 patients) – Clinic of Vascular Surgery at the Military Hospital, Ružomberok, Slovak Republic; II Group (126 patients) – Clinic of Vascular Surgery, East Slovak Institute of Cardiovascular Diseases, Košice, Slovak Republic.

Results. The patency of arterial reconstructions in I Group was: the femoro-supragenicular segment: 1 year – 83%, 3 years – 73%; the infragenicular segment: 1 year – 68%, 3 years – 52%. In II Group – the femoro-supragenicular segment: 1 year – 91%, 3 years – 82%; the infragenicular segment: 1 year – 72%, 3 years – 64%.

Conclusion. The patency of arterial reconstructions during the first year in both vascular centers was without statistical difference. The femoro-supragenicular reconstructions had the best patency over three years (> 70%). The following factors influenced the duration of arterial reconstructions: the type of graft used, diabetes mellitus, smoking.

Keywords: peripheral arterial disease; critical limb ischemia; bypass.

Introduction

Critical limb ischemia (CLI) is developed about 20% of patients with peripheral arterial disease, and about in 10% of patients with intermittent claudication in up to one year. The yearly CLI incidence is estimated as 500–1000 new cases for 1

million inhabitants [1]. In the Slovak Republic incidence of CLI is about 2500–5000 new cases per year [2]. About 30–80% patients with diabetes are affected by CLI. Patients with diabetes have 12–24 times higher probability of above-knee amputation [3]. CLI is connected not only with a high risk of limb

loss, but it is also a reliable predictor of morbidity and mortality resulting from other cardiovascular complications due to the fact that atherosclerosis is a general systematic disease affecting all arteries [4]. The occurrence of ischemic stroke in these patients is approximately 2–3–times higher, and also occurrence of myocardial infarction is about 6–times higher. The mortality of patients with CLI is alarming all over the world. The mortality of patients with CLI is about 20% in the half-year from determining the diagnosis, and up to 50% of all patients in 5 years [5]. The mortality is 20–times higher than in patients without cardiovascular disease [6]. Modern surgery or endovascular treatment of CLI should be transferred to vascular centers with access to all diagnostic and therapeutic possibilities. The right choice of the strategy of CLI treatment has based on the TASC II guidelines (Inter-Society Consensus for the Management of Peripheral Arterial Disease), about individual approach [1,7]. The goal of the CLI treatment is to provide adequate perfusion of the leg, which allows the eradication of destroyed and necrotic tissue. With the development of endovascular therapy, the CLI treatment criteria broadened and morbidity, mortality is also reduced [8]. The care of patients with CLI has improved recently, but despite that, the number of amputations because of CLI is still high [9].

Materials and methods

The paper presents 202 patients with critical lower limb ischemia, which were operated in two specialized vascular centers. All patients divided into two groups

I Group: 76 patients with CLI treated surgically on the Clinic of Vascular Surgery at the Military Hospital for four years. The age of the patients was from 35 to 83 years; the men to women ratio were 3:1, and the percentage of diabetics in this file was 40%.

II Group: 126 patients from the Clinic of Vascular Surgery, East Slovak Institute of Cardiovascular Diseases. All patients had CLI. The age of the patients was from 48 to 76 years; the men to women ratio were 3:1, and the percentage of diabetics in this file was 31%.

Retrospective analysis of anamnestic data about the duration of CLI from the documentation was used to compare the results of surgical treatment about the level of CLI, the period of CLI, and the length of the ischemic defect.

In the first step, we compared the results of the surgical treatment in patients with Fontaine III stage, and patients with Fontaine IV stage. After that, we compared the results of CLI treatment in the patient divided into two groups, according to the duration of CLI. The patients in the first group suffered from pain at rest or ischemic defect shorter than one month, and patients in the second group underwent the treatment after more than one month of pain at rest or ischemic defect. In the end, we compared the effects of surgical revascularisation treatment in patients divided into two groups according to the duration of ischemic defect (shorter than one month and more prolonged than one month). Based on the surgical revascularization treatment, where the criteria of success were time until patency of the reconstruction, we attempted

to prove and determine the importance of time factor on the success of surgical revascularisation treatment of CLI.

Results

On the Clinic of Vascular Surgery at the Military Hospital (I Group) were 76 patients with CLI treated by surgery in total, out of which 45 were on the femoro-supragenicular segment, and 31 were on infragenicular segment.

In the femoro-supragenicular segment (45 patients), there were 22 disobliterations of the common femoral artery, and deep femoral artery with profundoplasty (synthetic or vein patch), 15 femoro-popliteal proximal bypasses and 8 femoro-femoral cross-over bypasses. The patency of the reconstruction was: 1 year – 83%, 3 years – 73%.

In the infragenicular segment (31 patients), there were 17 distal popliteal bypasses, 11 femoro-crural bypasses (5 on anterior tibial artery, six on posterior tibial artery), and 3 pedal bypasses. The patency of the reconstruction was: 1 year – 68%, 3 years – 52%.

On the Clinic of Vascular Surgery, East Slovak Institute of Cardiovascular Diseases (II Group) were 126 surgically treated patients with CLI (90 on the femoro-supragenicular segment and 36 were on infragenicular segment).

In the femoro-supragenicular segment (90 patients), there were 26 disobliterations of common femoral artery and deep femoral artery with profundoplasty (synthetic or vein patch), 39 femoro-popliteal proximal bypasses with great saphenous vein, 19 femoro-popliteal proximal bypasses with prosthesis, and six femoro-femoral cross-over bypasses with prosthesis. The patency of the reconstruction was: 1 year – 91%, 3 years – 83%.

In the infragenicular segment (36 patients), there were 31 popliteal distal bypasses, five femoro-crural bypasses (2 on anterior tibial artery, three on posterior tibial artery). All distal bypasses were performed by great saphenous vein. The patency of the reconstruction was: 1 year – 72%, 3 years – 64%.

Discussion

The experience from our practice confirms that the success of surgical treatment of CLI is determined by a variety of factors, which are well known also from literature. They are divided into general and local factors. General factors include age, sex, and patient's comorbidity such as ischemic heart disease, diabetes mellitus, dyslipidemia and genetically determined coagulation disorder [1]. We also count the patient's mobility and life expectancy into the general factors. The speed of progression of the disease is also of great importance during the post-surgery period, and it depends on the conservative treatment and also from patients lifestyle [10]. The local factors affecting the results of the surgical treatment of CLI include in the first place the morphology of the obliterating arterial disease, where we distinguish the localization (if the defect is in femoro-supragenicular or infragenicular segment [11]). A general rule is that the more central the replacement is, the longer the period of its patency. Correctly indicated and technically precise surgical reconstructions are very effective in CLI

treatment. They have great results, low surgical mortality and morbidity rate, and also relatively high primary patency [12, 13]. The prospect of long-term patency lowers with the size of the impairment, and therefore are worst in the multilevel defect, where they often require combined, or hybrid treatment [7]. Other criteria related to the morphology of the arterial disease are the seriousness of stenosis and obliteration changes, quality of the inflow and the runoff, and also the capacity of the collateral bloodstream [14].

Another important local factor is the seriousness of the limb ischemia. The presence of the defect is confirmed if it is determined as a stage III or IV of the Fontaine classification. An important criterion is the presence or absence of infection (dry necrosis), and an infectious agent virulence [8]. Another factor determining the results of the treatment is the type of replacement used in artery reconstruction. In the infrainguinal segment, there is a general rule, that the most suitable vessel replacement is an autogenous vein, because of its thrombogenicity, hemodynamic properties, and its resistance to infection [2, 15]. During reoperations or in situations, where the patient does not possess a suitable autogenous vein, the method of choice is allogenic vein. Randomized studies which compare reverse and in situ techniques do not determine any significant difference in the patency of one or another method. Preference between them is a matter of choice and experience of the surgeon [9, 16].

If the patients do not possess an anatomically suitable vein, or if it was used in the past during previous reconstructions, or extirpated during varices operation, the indicated procedure is the reconstruction using the prosthetic material (PTFE

or dacron). The literature states significantly better one year patency of supragenicular venous bypasses than of the prosthetic ones (84,3% to 76,3%). There is no difference between long-term patency of PTFE and dacron grafts. In infragenicular bypasses, the best conduit is the autologous vein. The 3-year patency of venous bypasses when compared to the synthetic ones, is significantly better (60–70% to 20–40%). Usage of synthetic prosthesis is meaningful during the absence of an autologous vein, or if the place of the distal anastomosis is in the 2nd or 3rd segment of the popliteal artery. PTFE prosthesis mostly used for reconstruction above the knee. Fairly often, a type of composite bypass used, in which the PTFE prosthesis is connected by end-to-end anastomosis to the venous part of the reconstruction [5, 12]. Length of the bypass is also main factor affecting the patency of the reconstruction. If that the shorter the reconstruction, the better the prospects for long-term patency. The last local factor affecting the long-term patency of the infragenicular prosthetic bypasses are known venoplasties on the distal anastomosis of the bypass (Linton, Taylor, A–V fistula) [9]. The prospects for long-term patency are not so satisfactory in the distal prosthetic bypasses, but because of various techniques of venoplasties on the distal anastomosis, they have the long-term patency only approximately 20% lower than venous bypasses [2].

Another goal of our work was to confirm the assumption that the time factor affects the results of the surgical treatment of CLI. We based our research on the metaanalysis of Finnish authors Noronen et al. from 2016, which confirms the importance of early revascularization in patients with diabetes mellitus [3, 15]. In the retrospective analysis of the anamnestic da-

Table 1. Results of revascularisation treatment depending on the stage of the disease Fontaine III and IV

	The cumulative time of patency			
	Stage Fontaine III		Stage Fontaine IV	
	I Group	II Group	I Group	II Group
6 months	88%	91%	73%	75%
1 year	86%	89%	71%	73%
3 years	78%	82%	63%	67%

Table 2. Results of revascularisation treatment depending on the duration of CLI

	The cumulative time of patency			
	Stage Fontain III CLI < 1 months		Stage Fontain IV CLI > 1 months	
	I Group	II Group	II Group	II Group
6 months	83%	85%	83%	86%
1 year	81%	83%	81%	82%
3 years	70%	73%	69%	71%

Table 3. Results of revascularisation treatment CLI depending on the duration of the ischemic defect

	The cumulative time of patency			
	Ischemic defect < 1 months		Ischemic defect > 1 months	
	I Group	II Group	I Group	II Group
6 months	74%	79%	73%	76%
1 year	72%	75%	73%	74%
3 years	68%	73%	67%	69%

ta about the duration of CLI from their medical documentation, the patients with CLI were divided into two groups according to the timeliness of the revascularisation treatment.

In the first case, we evaluated the results of the surgical treatment of patients with CLI in stage Fontaine III – pain at rest without trophic defect to results of patients with stage Fontaine IV – ischemic defect (*Table 1*).

In the second case, we compared the results of patients divided into two groups according to the duration of CLI. One group included patients who were in the Fontaine III group shorter than one month. The second group included patients who were in Fontaine IV group more than one month (*Table 2*).

In the end, we compared the effects of surgical revascularisation treatment in patients divided into two groups according to the duration of the ischemic defect – shorter than one month and more prolonged than one month (*Table 3*).

The cumulative time of reconstruction patency was better in patients with pain at rest than in patients with ischemic defect. The results of surgery treatment according to the duration of CLI (*Table 2*) and according to the length of the ischemic defect (*Table 3*), did not show any statistically significant differences in the success of the treatment for both criteria. We believe that the reasons for not confirming the effect of duration of ischemic defect lie in various factors. The most significant factor is the wide variety of patients with CLI and their differences (age, comorbidity, active smoking, haemocoagulation, and immunological status).

It seems that more significant than the duration of the ischemic defect are the speed of its progression, its extent, and infectiousness. Small dry distal necrotic ischemic defects do not have such negative prospects as quickly extending gangrenes infected by mixed bacteria. In this context, the time factor is significant for the limb salvage in the sense of either providing the revascularisation treatment as an ultimatum refugium of limb salvage in an admissible stage of gangrene. Patients with long-term chronic trophic defects, with only slightly virulent flora, with right reconstruction conditions can have good results as for patency of the reconstructions and for limb salvage, and can paradoxically influence the statistical results in favor of the group with the duration of defect longer than one month.

Another factor is a variety of individual differences in the quality of subsequent care, mainly in patients living further from the vascular centers. There is also an important factor influencing the results of the surgical treatment – the patient's compliance, and not only in conservative treatment but also in the patient's regimen and lifestyle. A possible reason for not confirming the expected results is the small number of patients in our file.

Conclusion

Patency of reconstructions in the first year was in both workplaces without significant difference (I Group: 83% in the femoro-supragenicular segment, 68% in the infragenicular segment and II Group: 91% in the femoro-supragenicu-

lar segment, 72% in the infragenicular segment). Supragenicular reconstructions had the best patency at both workplaces and set 3 year patency above 70%. The following factors influenced the duration of arterial reconstructions: the type of graft used, diabetes mellitus, smoking.

Conflict of interest. The authors state that there are no conflicts of interest regarding the publication of this article.

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