

The nearest and one-month effects of endovascular revascularization for patients with critical limb ischemia

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Introduction: The method of endovascular revascularization has a number of key advantages in the treatment of critical lower limb ischemia in comparison with other methods alongside with a rapid advance in angioplasty procedure every year. However, the drawbacks remain that affect the pace and quality of achieving technical and clinical success in percutaneous transluminal angioplasty. For instance, the effectiveness of the treatment of critical limb ischemia is influenced by the segment level in which the arterial revascularization was performed, as well as by the number of "open" arteries following the surgery. In particular, such treatment efficiency assessment is highly relevant for patients possessing lesions of two or more arteries, as well as suffering of purulent-necrotic lesions. It should be noted that the relevant results obtained in this study will be used to guide the development of personalized revascularization tactics.

Materials and Methods: The transcutaneous partial pressure of oxygen (TcPO₂) was performed in 19 patients who were diagnosed with lesions of the vascular atherosclerosis by ultrasonic Dopplerography. In the structure of the severity of peripheral arterial disease (PAD), patients with necrotic and ulcerative foot defects predominated. In 14 patients, the course of obliterating atherosclerosis of lower limb arteries was aggravated by diabetes, in 1 patient was detected hyperglycemia. The age of the patients ranged from 54 to 82 years, averaging 65.95 ± 7.91 years. Mediana 66 [65;67]. The clinical characteristics of the patients are presented in Table 1.

Table 1. Clinical characteristics of patients (N = 19)

Characteristics	n	%
Male	14	73,68
Female	5	26,32
CLI manifestations:		
- foot ulcer	11	57,89
- Pain in rest	8	42,10
Comorbidities:		
- Coronary artery disease	5	26,31
- Arterial hypertension	19	100
- Renal insufficiency	9	47,37
- C2 (GFR < 60 mL/min/1.73 m ²)	4	21,05
- C3a (GFR < 45 mL/min/1.73 m ²)	5	26,32
Type 1 diabetes	2	10,53
Type 2 diabetes	11	57,89
Hyperglycemia	1	5,26
Including Diabetes Therapy		
- Only insulin	4	21,05
- Only tablet preparations	2	10,53
- Insulin + tablet preparations	9	47,37

According to examination results (ultrasound and peripheral angiography), all patients revealed occlusion or significant stenosis of the superficial femoral artery (SFA), popliteal

artery (PA), posterior and anterior tibial arteries (PTA and ATA). More than 47 % ($n = 9$) of cases had multilevel lesions of the femoral-popliteal and popliteal-tibial segments. All 19 patients were diagnosed with both isolated hemodynamically significant arterial stenoses – 11 (57.8 %), and multiple – 8 (42.10 %). Level of isolated lesions: SFA – 3 (15.79 %); PA – 1 (5.26 %); PTA and ATA – 5 (26.3 %). Among the multiple lesions, there was a combination of stenosis at various levels of the great vessels of the lower extremities. TcPO₂ was conducted before X-ray endovascular revascularization, after surgery on day 1, and after 1 month also.

Results: Percutaneous transluminal angioplasty of EIA and SFA was performed in 3 patients (15.79 %), EIA only – 2 (10.53 %), EIA and CFA – 2 (10.53 %), SFA – 3 (15.79 %), SFA + PA – 1 (5.26 %), POP – 2 (10.53 %), only ATA – 5 (26.32 %), ATA + TPT + PTA – 1 (5.26 %), PTA – 1 (5.26 %). Assessment of the state of the microvasculature after the endovascular intervention was carried out by measuring the TcPO₂ in standard places [1]. The severity of ischemia was assessed according to the Wifl classification [2]. Thus, the values of the TcPO₂ are in the range of less than 30 mmHg caused the 3rd degree of ischemia, 30–39 mmHg – 2nd degree, 40–59 mmHg – 1st degree [2]. Before surgical treatment the TcPO₂ values were at a critical level with an average value of 12.01 ± 8.43 mm Hg. On the 1st day after the operation, the indicator increased and averaged 16.79 ± 8.52 mm Hg. Further, a month after the operation, an increase in pO₂ was noted and the average value for patients reached 28.58 ± 12.79 mm Hg. It should be noted that a month after the operation, there was a warming of the skin of the lower limb, a decrease in the intensity of pain at rest in more than half of the cases. According to ultrasound data after endovascular therapy, the effectiveness of endovascular revascularization was 71.43 % (5 out of 7 cases) for EIA, 50.0 % (1 out of 2 cases) for CFA, 57.14 % (4 out of 7 cases) for SFA, on popliteal artery (POP) 0 % (2 cases), on ATA in 33.33 % (2 of 6 cases), on PTA in 50 % (1 of 2 cases), on peroneal artery (PA) in 100 % (1 of 1 cases), on tibio-peroneal trunk (TPT) in 0 % (1 case out of 1). The efficiency of endovascular revascularization in the iliac-femoral segment is higher than in the tibia-foot segment. This can be explained by the fact that the lesion of the tibia-foot segment is more typical for patients suffering of concomitant diabetes mellitus. Diabetes mellitus predominantly affects small-caliber vessels; multifocal arterial stenoses are also characteristic. In this regard, the number of repeated restenoses in this group of patients is much higher.

Conclusion: The increase in the transcutaneous partial pressure of oxygen (TcPO₂) the next day after surgery occurs due to dilatation of the stenotic segment, while the increase in tension occurring in a month after surgery is well correlated with a clinical picture of the disease, namely, with symptoms such as decrease in the pain intensity at night as well as warming of the skin of the operated limb. According to the ultrasound test conducted before and after surgery, there is a greater degree of the iliofemoral segment dilatation on compared to the popliteal-tibia segment. Such difference occurs due to small dimension of target arteries and concomitant diabetes mellitus suffered by the patients, which predominantly affects smaller vessels.

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