

Endovascular treatment of chronic lower limb ischemia - the first experience of consecutive patients in the Kyrgyz Republic

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Abstract

Objective: Pure atherosclerosis and diabetes mellitus are often responsible for the lesion of lower limb arteries. As a result, critical ischemia may develop. Endovascular treatment of lower extremities chronic ischemia in the modern world one of the most effective methods of limbs salvage. This report is an analysis of the first experience of endovascular treatment in consecutive patients with chronic lower limb ischemia in the Kyrgyz Republic.

Methods: In 2016-2018, there were 31 patients with chronic lower limb ischemia in IIb-IV Fontaine's stages that underwent endovascular treatment. The primary endpoint was 6-month painlessness or reduction of the Fontaine stage; freedom from amputation up to six months; active regenerative process or full recovery of ulcers/wounds up to six months. The secondary endpoints included 6-month all-cause mortality and reintervention rate.

Results: Overall, 27 (87.1%) patients reached painless form (stage I according to Fontaine ($ABI \geq 0.9$)), with complete regeneration or active reparative process observed in 20 (64.5%) patients. In general, major amputation was avoided in 29 (93.5%) patients (two patients underwent amputation by E. Burgess). Minor amputations were performed below the level of foot dorsum (Sharp) in 35.5% (11 patients). Simultaneous percutaneous coronary interventions and peripheral interventions were performed in 6 (19.4%) cases. In total, within 6 months one death was registered (3.2%).

Conclusion: The first endovascular treatment of consecutive patients showed encouraging 6-month results. Simultaneous («Ad-hoc») or stepwise (at the current hospitalization) procedures on coronary and peripheral arteries ensure safety and can provide more chances of patient's survival.

Key words: chronic lower limb ischemia, critical limb ischemia, percutaneous coronary interventions, limb salvage, freedom from amputation

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Introduction

Critical limb ischemia (CLI) caused by infrainguinal atherosclerosis is a substantial source of death and disability. One-year mortality ranges from 10% to 40% and in case without revascularization somewhere, up to 40% will suffer limb loss within six months (1, 2).

For patients with CLI or severe progressive claudication, peripheral arterial revascularization is necessary to minimize

the chance of losing a limb, neutralize the symptoms and improve quality of life. To date along with the bypass methods endovascular procedures (stenting and balloon angioplasty) are the most widespread measures (3). The main purpose of endovascular treatment - is to minimize the loss of tissue, complete recovery of the wounds and the preservation of a functioning limb. This report is an analysis of the first experience of endovascular treatment in consecutive patients with chronic lower limb ischemia.

Methods

The inclusion criteria were patients admitted with chronic lower limb ischemia at IIb-IV Fontaine's stages. In total for 2016-2018, there were 31 patients. Patients who were not subjected to endovascular revascularization with severe nephrological status (glomerular filtration rate (GFR) less than 30 ml/min) were excluded.

All patients underwent general clinical examination, constant monitoring of heart rate, blood pressure, laboratory tests. For control of cardiac activity dynamics, an echocardiogram (with a coronary artery disease history or significant lesions) and electrocardiogram (ECG) findings were analyzed. For

visualizing the anatomy of the lower extremity arteries lesions, we conducted a dynamic analysis of ultrasound and Doppler sonography (all patients) and computed tomography-angiography (CT-angio) imaging (41.9%). The main baseline characteristics are presented in Table 1.

Patients at the time of hospitalization received recommended optimal medical therapy, which included drugs: acetylsalicylic acid, clopidogrel, anticoagulants, prostaglandin E1 drugs, L forms of arginine, and others. Before endovascular intervention, angiography of the coronary and lower limb arteries was performed sequentially. Drug therapy is presented in Table 2.

Table 1. Baseline characteristics

Characteristics	Number (n=31)	%
Mean age	67.7 (7.4) years	
Male sex	22	71
Ulcers/wounds presentation	24	77.4
Gangrene	13	41.9
Foot rest pain	24	77.4
Diabetes mellitus	25	80.6
Distal polyneuropathy	20	64.5
Insulin consumption	17	54.8
Hypertension	22	71
Hypercholesterolemia	18	58.1
Renal failure (GFR < 50 ml/min/1.73m ²)	11	35.5
Coronary artery disease anamnesis	15	48.4
Smoking status	14	45.2
Critical Limb Ischemia ankle –brachial index ≤ 0.5	27	87.1
Subcritical chronic limb ischemia (IIb)	4	12.9
GFR- glomerular filtration rate		

The average age of patients was over 65 years (mean 67.7(7.4) years), and males prevailed among the patients. Most of patients had the CLI with manifestation of pain at rest and non-healing ulcers and wounds in the distal part of extremities. The

number of patients with diabetes mellitus was 80.6% (25). Of special note, the history of angina pectoris was present only in 48.4% (15) of patients.

Table 2. Drug therapy

Drugs	Number (n=31)	%
Dual antiplatelet therapy	31	100
Heparin	31	100
Statins	29	93.5
Alprostadil (PgE1)	23	74.2
L – arginine drugs	15	48.4
Ca++ channel blockers	24	77.4

Endpoints

The primary endpoint was 6-month painlessness or reduction of the Fontaine stage; freedom from amputation up to six months; active regenerative process or full recovery of ulcers / wounds up to six months. The secondary endpoints included 6-month all-cause mortality and reintervention rate.

Statistical analysis

The obtained data was processed on a computer by using the statistical program SPSS statistics 17v. Comparison of mean values was fulfilled by using standard methods of variation statistics of a medical-biological profile. Data is presented as the mean±SD for continuous variables and the number (percentage) for discrete variables. The distribution of variables was checked by using the Kolmogorov-Smirnov test. A p value of <0.05 was considered as statistically significant. Since there were no control groups, we did not use comparative intergroup characteristics.

Results

The mean time from the CLI symptoms manifestation to treatment was 1.2 (0.9) months. Angiographic success with direct blood flow to the ischemic region and indirect blood flow, with regard for angiosomes concept, was 90.3% (28 patients). The right limb (58%) was more often affected; however, bilateral intervention was also performed in 5 (16.1%) patients. Contralateral, ipsilateral and brachial approaches were used in 80.6%, 16.1%, and 12.9% of cases, respectively.

Nine (29.0%) patients underwent procedures “above the knee” (aorto-iliac segment, femoral, popliteal arteries) and 8 (25.8%) patients - stenting. The procedures “below the knee” (tibial arteries) were performed in 19 (61.3%) patients. Procedures were performed simultaneously above and below the knee in 3 (9.7%) patients (Table 3).

In 27 (87.1%) patients the painless form was reached (stages I according to Fontaine (ABI ≥0.9)), with complete regeneration or active reparative process was observed in 20 (64.5%) patients. The systolic blood flow velocity according to ultrasound diagnosis was 9.97 (5.2) vs. 40.1 (17.9) cm/s (p <0.001). The general major amputation was avoided in 29 (93.5%) patients (two patients underwent amputation by E. Burgess). Minor amputations were performed not above than the level of foot dorsum (Sharp) in 35.5% (11 patients). Despite good results in freedom from amputation, the incidence of early thrombosis (30 days) with reintervention was 12.9% (4 patients).

Simultaneous percutaneous coronary interventions and peripheral interventions were performed in 6 (19.4%) cases. Previous coronary stenting at least 1 year was in 6.5% (2 patients).

In total, in the course of 6 months one death was registered (3.2%). The patient had a three-vessel coronary artery disease and renal insufficiency corresponding to C3b grades by KDIGO 2013 (GFR was 40 ml / min / 1.73m²). The patient refused proposed simultaneous percutaneous coronary intervention.

Table 3. Angiographic findings and endovascular treatment

Segment	Angiographic findings		Endovascular treatment		
	Significant stenosis/ occlusions	%	Angioplasty only	Balloon angioplasty + stenting	%
Aorto – iliac segment	1	3.2	-	1	3.2
Superficial femoral artery	8	25.8	-	7	22.5
Popliteal artery	4	13	4	-	12.9
Anterior tibial artery	27	87.1	20	-	64.5
Posterior tibial artery	27	87.1	11	-	35.5
Peroneal artery	25	80.6	12	-	38.7

Discussion

CLI is defined as recurrent ischemic pain at rest requiring the analgesics for at least 14 days, ulceration or gangrene of the foot, or toes. Fontaine - Pokrovsky classifications, traditionally classify critical ischemia as that of III or IV stage (4).

It must be said that this article demonstrate the first endovascular treatment experience of chronic lower limb ischemia in subcritical and critical stages in consecutive patients in the Kyrgyz Republic. Also important is the creation

of a logistics approach in the management of this pathology. It is obvious that in the treatment of patients with diabetes and chronic ischemia of the lower extremities is necessary to use the principle of multidisciplinary.

Lower limb amputations in patients with diabetes are more common than in patients without diabetes, and five of six amputations occur in diabetes (5). Statistics show that 25% of hospitalizations among patients with diabetes are related to foot lesions, 40% require amputation (6). 50-70% of all non-

traumatic amputations occur in patients with diabetes (7).

From the study Imankulova A. S. et al. in 2018, performed on 820 patients with diabetic foot syndrome, the total frequency of various surgical procedures in these patients was 1072, of which minor surgical interventions were 85.1% (913). In addition, 140 patients underwent large amputations (17%) within 3 years. Staged major amputations of the lower limb after minor surgical interventions in patients with CLI were subsequently performed in 85 patients (10.4%). Reamputation was performed in 9 patients (1.0%) against the background of severe concomitant pathology (8).

The Lida et al., in a 3-year outcomes of the OLIVE registry study in 2015 showed, CLI patients with infrainguinal lesions, 3-year clinical results of endovascular treatment were reasonable despite high reintervention and moderate ulcer recurrence rate. In 3 years, overall survival rate was 63.0%, the major amputation-free rate was 87.9%, and avoidance of reintervention rate was 43.2%, however, diabetes accounted for 71% of the total number of patients. It should be noted that heart failure and wound infection only affected amputation-free survival within 6 months after endovascular treatment. Factors associated with ulcer healing were short-term predictors for amputation-free survival and presumably were linked to survival. After ulcer healing, these factors were no longer significant and other factors related to long-term prognosis tended to emerge. Six months also suggesting that this might be an appropriate duration when evaluating the usefulness of new methods of limb salvage (9).

It is not always possible to perform direct revascularization especially with lesions of the distal segment. However, with regard for the angiosomes concept, it is possible to achieve indirect optimal blood flow to the ischemic zone. It may allow to healing wounds and ulcers.

As a rule, these patients have comorbidities such as diabetes, dyslipidemia. In addition, the status of thrombogenicity is associated with endothelial dysfunction and elevated hypercoagulation. In the study by Rossi et al. in 2002, 34% of patients with symptomatic peripheral arteries atherosclerosis had a fatal or non-fatal myocardial infarction for 24 months (10). In 2005, the REACH study showed that 63% of patients with chronic lower limb ischemia had arterial multifocal lesions. These patients over the age of 50 have 68% and 42% cardiac and cerebrovascular adverse events, respectively (11). In addition to this, the study of Liistro et al. in 2013, demonstrated that aggressively endovascular treated CLI was not significantly associated with increased risk of long-term cardiac mortality in diabetic patients initially coming up with symptomatic coronary artery disease (12).

On the other hand a mortality rate of 20% within 6 months after the diagnosis and 50% ending up with fatal outcome in 5 years has been reported (13, 14). This excessive mortality may be related to the systemic cardiovascular diseases including coronary artery disease and cerebrovascular arterial disease

(15, 16). Furthermore, CLI is associated with peripheral complications such as ulceration, gangrene, infection and a high risk of lower limb amputation estimated in 10%–40% of patients in 6 months after the established onset of the disease, especially in non-treatable patients (17, 18).

To date, increasingly more attempts become important as far as simultaneous («Ad-hoc») or stepwise (at the current hospitalization) procedures on coronary and peripheral arteries, which can improve the survival of patients presented initially with complications of diabetes.

Conclusion: Among patients with CLI, the majority were with distal lesions and diabetes mellitus. The first endovascular treatment of consecutive patients showed encouraging 6-month results of both endpoints, although there is a need for a more long-term analysis, and an increasing number of participants. Simultaneous («Ad-hoc») or stepwise (at the current hospitalization) procedures on coronary and peripheral arteries are safe and can provide the better patient survival.

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