

Clinical and Hemodynamic Aspects of Treatment of Patients with Critical Ischaemia of the Lower Extremities with Severe Concomitant Diseases

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Abstract

Objective: To study the clinical and hemodynamic aspects of treatment of patients with critical ischemia of the lower extremities with severe concomitant diseases.

Material and methods of research: The study was carried out in 48 patients with LLI (III-IV stage of ischemia according to the Fontaine-Pokrovsky classification). Men - 30, women - 18. The etiological factor for the development of CLI in 34 (70.8%) patients was obliterating atherosclerosis, in 14 (29.2%) patients – thromboangiitis obliterans. In 16 (33.3%) patients, critical ischemia of the III degree was diagnosed, in 32 (66.7%) patients - in the IV degree. To diagnose and assess the effectiveness of treatment, a clinical study, rheovasography, Doppler ultrasound, multispiral computer-tomographic angiography were carried out, oxygen saturation of the skin, indicators of regional arterial and venous blood flow were studied. **Outcomes:** During their stay in the clinic, patients with stage IV chronic ischemia underwent minor amputations in 24 (75%) patients, in 8 (25%) – major amputations, in 40 (83.3%) patients out of the total number of examined patients retained the supporting function of the limb. In the remote period, within 6 months. Up to 5 years of age, 36 (83.7%) patients were re-hospitalized, 10 (23.3%) patients underwent minor amputations, 22 (51.2%) had major amputations, and 21 (48.6%) patients out of 43 re-examined patients retained the supporting function of the limb. In 48 examined patients, upon admission to the clinic, in comparison with the “reference” group, a significant ($p < 0.001$) deterioration of the indicators of RI, SSO, LVBF, RSP standing and lying, POVP standing and lying, VAI standing and lying down, RSPG, POVPG was revealed. After treatment, there was an insignificant ($p > 0.05$) positive trend. After 3-4 months. after discharge from the hospital, in comparison with the initial data, only the indicators of RI, SOO, LVBF and standing VAI significantly improved ($p < 0.05$). **Conclusion:** Traditional conservative and surgical treatment of patients with CILE with severe concomitant diseases is not significantly ($p > 0.05$) and stimulates regional circulation. In the near future, the support function was retained in 83.7%. In the remote period, within 6 months. 83.7% of patients under 5 years of age were re-hospitalized, the support function was preserved in 48.6% of patients.

Keywords: arterial obliterating disease; critical ischemia of the lower extremities; concomitant diseases; peripheral circulation; conservative treatment

Introduction

Chronic obliterating diseases of the arteries of the lower extremities occur in 3% of the general population of the population, in 35-65% of cases there is a critical ischemia of the lower extremities (CILE). and in people aged >50 years chronic obliterating diseases of the arteries of the lower extremities are detected in 5% [1]. Untimely detection chronic obliterating diseases of the arteries of the

lower extremities and the lack of complex therapy leads to the development of chronic ischemia and as a result, after 5-7 years, patients develop CILE. If revascularization of the limb is not carried out in one way or another, 25% of patients die within 1 year, and 60% after 5 years [1-3]. Reconstructive-restorative, endovascular, and hybrid operations improve the results of direct revascularization in patients with CILE [4]. In distal arterial stenooclusion, indirect revascularization operations are used in clinical practice to stimulate regional blood flow due to the absence of "outflow pathways" [5-8].

When performing reconstructive and restorative operations, in parallel with clinical and angiographic studies, the presence of severe concomitant diseases should be taken into account [9]. The influence of various factors on the treatment outcomes of patients with CILE and the incidence of concomitant pathologies in these patients has been studied in detail by Vestin G.G. et al. [10].

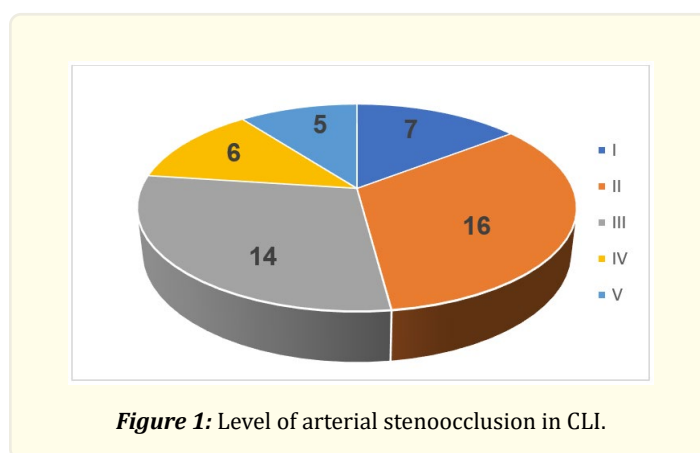
If it is impossible to perform reconstructive and restorative operations, if patients refuse indirect revascularization operations, or if there are contraindications to one or another method of revascularization operations due to severe concomitant pathologies, traditional complex conservative and surgical treatment is carried out [1, 11-16].

Objective

To study the clinical and hemodynamic aspects of treatment of patients with critical ischemia of the lower extremities with severe concomitant diseases.

Material and methods of research

Due to the impossibility of performing reconstructive operations, in case of refusal of patients from indirect revascularization operations or in the presence of contraindications to one or another method of revascularization operations due to severe concomitant pathologies, traditional complex conservative and surgical treatment is carried out in 48 patients. with CILE (III-IV degree of ischemia according to the Fontaine-Pokrovsky classification) who are on inpatient treatment in the Department of Vascular Surgery of the Scientific Center of Surgery named after Academician M.A. Topchubashev. Men - 30, women - 18. The etiological cause of chronic ischemia in 14 patients was obliterating thromboangiitis, and in 34 patients – obliterating atherosclerosis. Stage III of chronic ischemia was diagnosed in 16 patients, and stage IV of chronic ischemia was diagnosed in 32 patients. Steno-occlusion of the femoropopliteal segment was diagnosed in 7 patients, popliteal-tibial segment in 16 patients, tibial-foot segment in 14 patients, foot arteries in 6 patients, and multi-level steno-occlusion in 5 patients (Figure 1).



Note: I – femoropopliteal segment – 7 patients; II – popliteal-tibial segment – 16 patients; III – tibial-foot segment – 14 patients; IV – arteries of the foot – 6 patients; V – multistorey steno-occlusion – 5 patients.

To diagnose and assess the effectiveness of treatment, a clinical study, rheovasography, Doppler ultrasound, multispiral computer-tomographic angiography were performed, oxygen saturation of the skin, linear velocity of blood flow, indicators of regional arterial and venous blood flow were studied [regional systolic pressure standing and lying (RSP), postocclusive venous pressure standing and lying (POVP), venous arterial index (VAI) standing and lying down, regional systolic pressure gradient (RSPG), postocclusive venous pressure gradient (POVPG)] according to the method of B.S. Sukhovatykh and A.Y. Orlova [17]. The data obtained were compared with similar indicators of 48 practically healthy individuals ("reference" group).

The frequency of minor and major amputations during the period of stay in the clinic due to aggravation of critical ischemia, preservation of the supporting function of the limb were studied. From the long-term results (from 6 months to 6 years), the frequency of rehospitalization, the frequency of major amputations, and the frequency of preservation of the supporting function of the limb were studied.

The results of the research were processed on a personal computer using the Excel 2010 program and processed using the analytical program SPSS Statistics. $M \pm m$, t , p were determined. The differences were considered statistically significant at a $p < 0.05$ value.

Results of the study

Upon admission to the clinic, the patients were comprehensively examined, the underlying pathology, the degree of chronic ischemia were diagnosed, and concomitant diseases were identified (Figure 2). The following concomitant diseases were revealed: arterial hypertension – in 68.8% of patients; coronary artery disease, including myocardial infarction – in 75%; Patients; cerebral circulation disorders, including stroke – in 27.1% of patients; diabetes mellitus – in 39.6% of patients; - peptic ulcer of the stomach and 12th denum – in 10.4% of patients; chronic obstructive pulmonary diseases – in 22.9% of patients; chronic renal failure – in 10.4% of patients. Consultation was carried out by appropriate specialists and comprehensive treatment was initiated. Conservative treatment in patients with CLI was carried out.

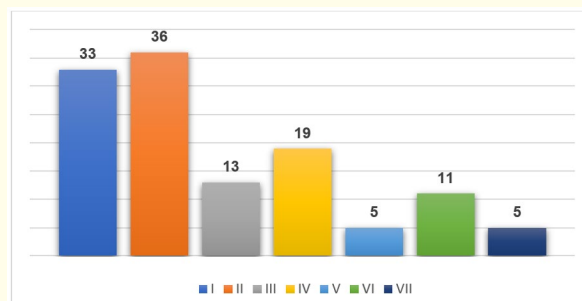


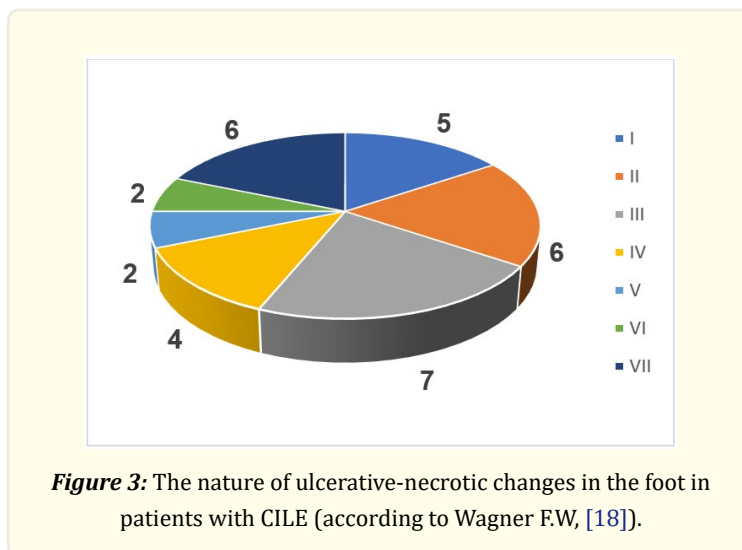
Figure 2: Concomitant diseases in patients with CILE.

Note: I – arterial hypertension – 33 patients; II – coronary artery disease, including myocardial infarction – 36 patients; III – cerebral circulation disorder, including stroke – 13 patients; IV – diabetes mellitus – 19 patients; V – peptic ulcer of the stomach and 12th denum – 5 patients; VI – chronic obstructive pulmonary diseases – 11 patients; VII – chronic renal failure – 5 patients.

Continuously, that is, the treatment started in the hospital continued on an outpatient basis. During conservative treatment, the following principles were observed: elimination of "risk factors"; elimination of pain syndrome, correction of hemostasis and hemorheology; correction of endothelial function; activate metabolic process in ischemic tissue; correction of antioxidant activity; correction of lipid metabolism and blood glucose content; antibacterial therapy (if indicated); stimulation of peripheral blood circulation with

medications and physiotherapeutic procedures [1, 11].

The nature and severity of ulcerative-necrotic processes in 32 patients with CILE with grade IV ischemia are shown in Figure 3.

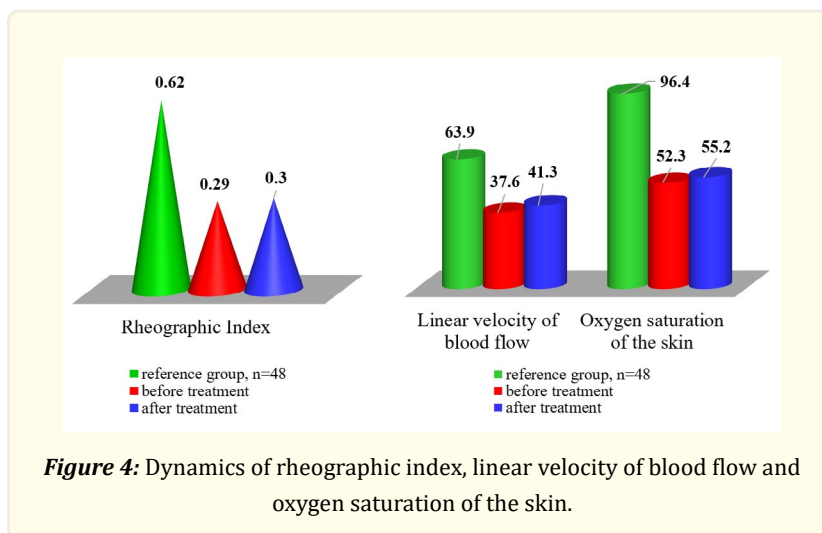


Note: I – necrotic wound of soft tissues – 5 (15.6%); II – necrotic wound of the fingers – 6 (18.7%); III – dry gangrene of 1-2 fingers – 7 (21.9%); IV – dry gangrene of 3 or more fingers – 4 (12.5%); V – dry gangrene of the distal part of the foot – 2 (6.3%); VI – limited wet gangrene of 1-2 fingers – 2 (6.3%); VII – non-healing wound of the foot after surgery – 6 (18.7%).

During his stay in the clinic, the following operations were performed: amputation of fingers in 1 patient; disarticulation of 1-2 fingers with resection of the metatarsal head in 2 patients, disarticulation of all fingers with resection of the metatarsal head in 3 patients, trans metatarsal amputation of the foot in 3 patients, trans metatarsal amputation due to aggravation of chronic ischemia in 6 patients, major amputation due to aggravation of chronic ischemia in 8 patients, despite complex treatment. The support function was preserved in 40 (83.3%) patients.

Comparison of the obtained short-term results with analogous data obtained during limb revascularization operations showed that the frequency of trans metatarsal amputations and major amputations at the level of the lower leg and thigh due to the progression of the initial chronic ischemia is significantly higher in patients with critical ischemia of the lower extremities with severe concomitant diseases, in whom revascularization operations cannot be performed due to high operative and anesthesiological risk [8, 9, 12, 14].

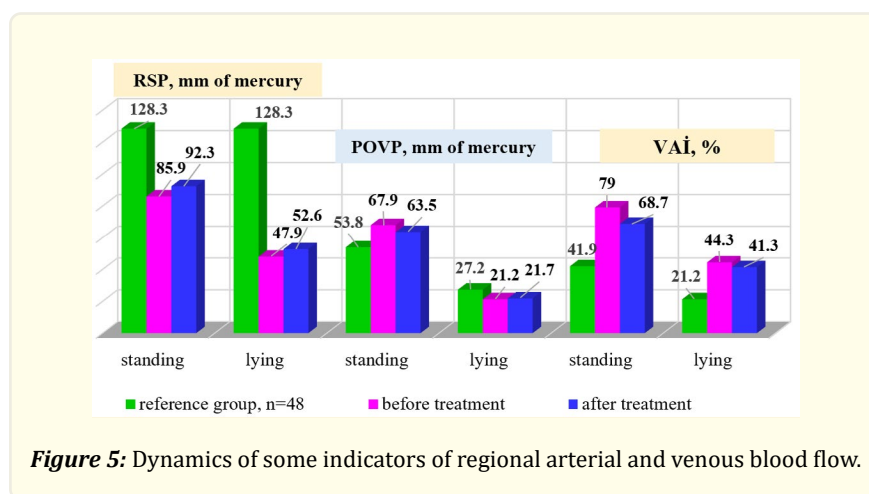
Changes in regional blood flow (arterial and venous) in patients with critical lower limb ischemia were analyzed. Upon admission to the clinic, in patients compared to the “reference” group, the parameters of RI and skin oxygen saturation, linear blood flow velocity significantly decreased by 53.2% ($t=4.71$, $p<0.001$) and 45.7% ($t=4.59$, $p<0.001$) and 41.2% ($t=4.11$, $p<0.001$). After treatment, the parameters of RI, skin oxygen saturation and linear blood flow velocity insignificantly increased by 3.4%, respectively ($t=0.36$, $p>0.05$), 5.5% ($t=0.42$, $p>0.05$) and 9.8% ($t=0.73$, $p>0.05$) (Figure 4).



Upon admission to the clinic, in comparison with the “reference” group, the indicators of regional arterial and venous blood flow deteriorated significantly (Figure 5). . As RSP standing and lying down, POVP decreased respectively by 33.1% ($t=3.62$; $p<0.001$), 62.7% ($t=7.61$; $p<0.001$) $v\grave{a}$ 22.1% ($t=2.22$; $p<0.05$), POVP standing, VAI standing and lying down, QRSP and QPOVP increased respectively by 26.2% ($t=1.98$; $p<0.05$), 88.5% ($t=5.22$; $p<0.001$), 108.9% ($t=6.08$; $p<0.001$) et 61.6% ($t=2.13$; $p<0.05$), 61,6% ($t=3,81$; $p<0,001$).

Note: RSP - regional systolic pressure standing and lying down; POVP – post occlusive venous pressure standing and lying down; VAI – Standing and Lying Venous Arterial Index.

After treatment, an unreliable positive trend was observed. Since, in comparison with the data at admission to the clinic, the RSP and standing and POVP values increased by 7.5%, respectively ($t=0.84$; $p>0.05$), 9,8% ($t=0,82$; $p>0.05$) $v\grave{a}$ 2.4% ($t=0.20$; $p>0.05$), while POVP standing, VAI standing and lying down, QRSP and QPOVP decreased by 6.5%, respectively ($t=0.57$; $p>0.05$), 8,7% ($t=1.25$; $p>0.05$), 6,8% ($t=0,56$; $p>0.05$), 2,3% ($t=0,20$; $p>0.05$) $v\grave{a}$ 8,3% ($t=0,80$; $p>0.05$). The dynamics of some indicators of regional arterial and venous blood flow is presented in Figure 5).



Guided by the recommendations on the continuity of treatment of patients with critical ischemia of the lower extremities, we continued drug treatment on an outpatient basis and after 3-4 months. After discharge from the hospital, the dynamics of peripheral circulation parameters was re-studied in 43 patients (Table 1). It was revealed that the rheographic index, the linear velocity of blood flow and the saturation of the skin with oxygen, compared to the indicators at discharge, the insignificant ($p>0.05$) increase by 26.5%, 14.0% and 19.9%, respectively. In 3-4 months after discharge from the hospital, in comparison with the indicators at admission to the clinic, the rheographic index, linear blood flow velocity and oxygen saturation of the skin significantly increased by 32.5% ($t=2.25$; $p<0.05$), 25.3% ($t=2.17$; $p<0.05$) and 26.6% ($t=2.24$; $p<0.05$).

<i>Timing of the study</i>		<i>Reference Group n= 48</i>	<i>Before treatment (n= 48)</i>	<i>After treatment (n= 48)</i>	<i>After 3-4 months. After treatment (n = 43)</i>
<i>Indicators</i>					
Rheographic index (units)		0,62±0,04	0,29 ±0,02*	0,30± 0,02	0,38 ±0,04**
Linear blood flow velocity (sm/sec)		63,9± 5,6	37,6 ±3,1*	41,3 ±4,0	47,1± 3,1**
Oxygen saturation of the skin (%)		96,4±8.4	51,9 ±4,7*	55,2 ±5,0	66,2± 4,3**
Venous Arterial Index (%)	standing	41,9±3,1	79,0±6,4*	68,7±5,2	63,4±4,6**
	лежа	21,2±1,7	44.3±3,4*	41,3±4,1	36,3±5,1
Regional systolic pressure gradient (units)		1	1,79±0,14*	1,75±0,15	1,61±0,13
Post occlusive venous pressure gradient (u)		1,98±0,17	3,20±0,27*	2,92±0,22	2,68±0,23

Table 1: Dynamics of some parameters of peripheral circulation in patients with critical ischaemia of the lower extremities under complex "traditional" treatment ($M\pm m$; p).

Note: * - the dynamics between the indicators of the reference group and in patients at admission to the clinic is statistically significant ($p<0.05$); ** - dynamics between the indicators in patients at admission to the clinic and 3-4 months after treatment is statistically significant ($p<0.05$);

It was revealed that the indicators of VAI standing, VAI lying down, RSPQ and POVPQ, in comparison with the indicators at discharge from the hospital, insignificantly ($p>0.05$) decreased by 8.4%, 13.7%, 8.7% and 8.9%, respectively. In 3-4 months after discharge from the hospital, in comparison with the indicators at admission to the clinic, these indicators decrease, respectively, 24.6% ($t=1.98$; $p<0.05$), 22% ($t=1.30$; $p>0.05$), 11.2% ($t=0.95$; $p>0.05$) and 19.4% ($t=1.48$; $p<0.05$). Thus, only after 3-4 months. after being discharged from against the background of ongoing conservative treatment, stimulation of peripheral circulation is observed. The positive dynamics of regional blood flow indicators once again indicates the expediency of continuing conservative measures on an outpatient basis. Other researchers also observe such principles [11, 12]. However, the hemodynamic efficacy of conservative treatment is significantly inferior to the results of direct and indirect revascularization in patients with critical lower limb ischemia [20-22].

Long-term results of treatment within 6 months. up to 5 years are presented in Table 2. During the follow-up period, 83.7% of patients were re-hospitalized, 51.2% of patients underwent major amputation, and 48.8% of patients retained the supporting function of the limb. The cause of lethal (37.2%) outcomes was cardiac and cerebrovascular complications against the background of multifocal lesions of the arteries.

<i>Follow-up period</i>	<i>Number of patients</i>	<i>Lethality</i>	<i>Readmissions</i>	<i>Number of operations</i>		<i>Preservation of the support function of the limb</i>
				<i>Major amputation</i>	<i>Minor amputation</i>	
6 months – 5 years	43	16(37,2%)	36(83,7%)	22(51,2%)	10(23,3%)	21(48,8%)

Table 2: Long-term results of “traditional” complex treatment in patients with lower limb critical ischemia (n=43).

A comparative analysis of the long-term results of complex conservative treatment of patients with critical ischaemia of the lower extremities with severe concomitant diseases, in whom it is impossible to perform revascularization operations due to the high surgical and anesthetic risk and treatment of patients with the use of direct and indirect revascularization, indicates the effectiveness of revascularization operations, since the latter significantly reduces the frequency of recurrent hospitalization, major amputations, and the frequency of maintaining the supporting function of the limbs increases [8, 19, 20].

Conclusion

If it is impossible to perform revascularizing operations during the hospital stay, traditional conservative and surgical treatment of patients with CLI with severe concomitant diseases does not significantly ($p>0.05$) stimulate regional blood flow. Continuation of conservative therapy on an outpatient basis only for 3-4 months leads to reliable stimulation of peripheral circulation. In the near future, the support function was retained in 83.7%, in the remote period from 6 months to 5 years, 83.7% of patients were re-hospitalized, and the support function was retained in 48.6% of patients.

Conflict Interests

The authors state that this work, its teme, subject and content do don't affect completing interests.

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