Původní sdělení | Original research article

Retrospective analysis of factors influencing the results of surgical treatment of CLI: Effect of duration of ischemic defect

Peter Beňo, Marek Rusňák

Klinika cievnej chirurgie, Ústredná vojenská nemocnica Slovenského národného povstania, Fakultná nemocnica Ružomberok, Ružomberok, Slovakia

ARTICLE INFO

Article history:
Submitted: 9. 1. 2019
Accepted: 23. 8. 2019
Available online: 9. 9. 2019

Kľúčové slová:
Chirurgická liečba kritickej končatinovej ischémie
Indikácie pre chirurgickú intervenciu
Kritická končatinová ischémia
Periférne artériové ochorenie dolných končatín

SÚHRN

Úvod: Kritická končatinová ischémia (CLI) predstavuje závažný celosvetový medicínsky, ale aj socio-ekonomický problém nielen ohrozením, resp. stratou dolnej končatiny, ale aj vysokou dlhodobou mortalitou z kardiovaskulárnych príčin. Preto je CLI v súčasnej vaskulárnej medicíne oblasťou intenzívneho záujmu ako výskumného, tak aj klinického. Základným atribútom úspešnosti liečby CLI je jednak požiadavka na jej komplexnosť, založenej na multidisciplinárnom konsenze všetkých zainteresovaných vaskulárnych špecialistov a jednak na jej včasnosť.
Materiál a metodika: V našom súbore v rokoch 2011–2015 bolo 109 chirurgicky odliečených pacientov s CLI. Retrospektívnou analýzou anamnestických údajov trvania CLI, tzn. od objavenia príznakov po vykonanú revaskularizačnú liečbu, boli pacienti rozdelení do skupín podľa včasnosti poskytnutej chirurgickej revaskularizačnej liečby. Porovnanie sme vykonali v troch nami stanovených kategóriách, a to 1. prítomnosť, resp. neprítomnosť defektu, 2. doba trvania kritickej ischémie a 3. doba trvania trofického defektu. Na základe výsledkov liečby v skupinách sme sa snažili stanoviť význam vplyvu časového faktora na úspešnosť revaskularizácie z hľadiska priechodnosti rekonštrukcie a záchrany končatiny.
Cieľ: Cieľom práce je vyhodnotiť výsledky liečby CLI na našom pracovisku za obdobie 2011–2015 a stanoviť miesto otvorenej chirurgickej revaskularizácie v manažmente liečby CLI. Štatisticky spracovať súbor so zameraním jednak na zastúpenie jednotlivých liečebných modalít a ich kombinácií a jednak na početnosť tepenných rekonštrukcií v jednotlivých segmentoch tepenného riečiska. V skupine chirurgických revaskularizácií vyhodnotiť výsledky liečby v jednotlivých podsúboroch v zmysle doby priechodnosti tepenných rekonštrukcií, resp. záchrany končatiny a porovnať naše výsledky s výsledkami udávanými v literatúre.
Ďalším cieľom tejto práce je identifikovať všetky faktory ovplyvňujúce výsledky chirugickej revaskularizačnej liečby CLI a stanovenie miery ich vplyvu na dlhodobú priechodnosť tepenných rekonštrukcií. V neposlednom rade je ambíciou tejto práce vyhodnotiť v literatúre málo zdôrazňovaný časový faktor a preukázať vplyv oneskorenej revaskularizácie kriticky ischemickej končatiny na výsledky liečby CLI.
Záver: Úspešnosť chirurgickej revaskularizácie kriticky ischemickej končatiny je determinovaná rôznymi faktormi, ako sú morfológia a distribúcia aterosklerotického postihnutia, lokalizácia a typ rekonštrukčného výkonu, voľba cievnej náhrady, ale aj vek, komorbidita, compliance pacienta, atď. Avšak v neposlednom rade aj dobrý timing revaskularizačnej liečby bez zbytočných časových strát.

ABSTRACT

Introduction: Critical limb ischemia (CLI) has been considered to be one of the most serious medical, social and economic problems not only because of the threat of limb loss, but also because of the high long-term cardiovascular mortality. Therefore, CLI is currently very popular in the field of vascular medicine, as the subject of the research as well as a clinical problem. The basic conditions for the successful treatment of CLI are: complexity of the treatment based on the multidisciplinary consensus of all interested vascular specialists, and its timeliness.
Material and methodology: There were 109 surgically treated patients with CLI between 2011 and 2015 in our file. By retrospective analysis of CLI duration history data, patients were divided into two groups according to the timeliness of surgical revascularisation treatment. Based on the results of the treatment in both groups, we tried to determine the impact of the time on the success of the revascularisation in terms of the patency of the reconstruction and the salvage of the limb.

Address: MUDr. Peter Beňo, Klinika cievnej chirurgie, Ústredná vojenská nemocnica Slovenského národného povstania, Fakultná nemocnica Ružomberok, ulica generála Miloša Vesela 21, 034 26 Ružomberok, Slovakia, e-mail: benop68@gmail.com
DOI: 10.33678/cor.2019.061

Please cite this article as: Beňo P, Rusňák M. Retrospective analysis of factors influencing the results of surgical treatment of CLI: Effect of duration of ischemic defect. Cor Vasa 2019;61:e464–e470.

Goal: The main purpose of this study is to evaluate the results of CLI treatment at our workplace between 2011 and 2015, and to determine the place of open surgical revascularisation in the management of CLI treatment. Moreover, the study statistically elaborates the file focusing on the representation of individual therapeutic modalities and their combinations and on the frequency of arterial reconstructions in individual segments of the arterial bed. In the group of surgical revascularisations we evaluated the results of the treatment in terms of time of the arterial reconstruction, respectively, in terms of the limb salvage and compared our results with the results reported in the literature. Another aim of this study is to identify all factors influencing the results of CLI revascularisation treatment and to determine the extent of their influence on the long-term patency of arterial reconstructions. Last but not least, an ambition of this study is to evaluate underestimated time factor and to demonstrate the effect of delayed revascularisation of the critical ischemic limb on the results of CLI treatment.

Conclusion: The success of surgical revascularisation of the critically ischemic limb is determined by various factors such as morphology and distribution of atherosclerotic disability, localization and type of reconstructive performance, choice of vascular conduit, but also age, comorbidity, patient compliance, etc. However, good timing of revascularisation treatment without unnecessary time loss is also very important.

Keywords:
Critical limb ischemia
Indications for surgical interventions
Peripheral arterial disease
Surgical treatment

Introduction

Critical limb ischemia (CLI) is a clinical manifestation of the terminal stage of peripheral arterial disease (PAD) of the lower extremity, which manifests as pain at rest, lasting longer than two weeks and/or presence of skin defects. Critical limb ischemia is developed in 15–20% of patients with PAD LE, and in 10% of patients with intermittent claudication in up to one year. Based on indirect evidence from studies focusing on claudication sufferers' population, PAD progress, and fate of the limb, the yearly CLI incidence is estimated as 500–1000 new cases for 1 million inhabitants. Therefore, in Slovakia there are 2500–5000 new CLI cases per year. Approximately 50% of those will require above-knee amputation, mostly in up to one year from the break out of the disease. 30–80% of diabetics suffer from CLI. Up to 45% of patients who require above-knee amputation are diabetics, who also have 12–24 times higher probability of above-knee amputation.

CLI is connected not only with a high risk of limb loss, due to the general and systemic nature of atherosclerosis, it is also a reliable predictor of morbidity and mortality resulting from other cardiovascular complications. The occurrence of fatal and non-fatal myocardial infarction is approximately 6-times higher, and the risk of ischemic stroke is 2–3-times higher. Due to this fact, the figures describing the mortality of patients with CLI are alarming. The mortality of patients with CLI is 20% in 6 months from determining the diagnosis, and up to 50% of all patients in 5 years. The mortality is 20-times higher than in patients without cardiovascular disease, including symptomatic coronary heart disease, which reflects the severe systemic effects related to CLI.[1,2]

The main attribute for successful therapy of CLI is its complexity, based on multidisciplinary consensus and all involved vascular specialists. Therefore, modern therapy of CLI should be transferred to vascular centres with access to all diagnostic and therapeutic possibilities. This includes conservative, surgical, endovascular, and stem cell treatment. The right choice of the optimal strategy is based on the indications of endovascular methods, and surgical, combined, and hybrid revascularisation, following the TASC II guidelines (Inter-Society Consensus for the Management of Peripheral Arterial Disease), with regard to individual approach.[3,4]

An irreplaceable step in the treatment of CLI is correctly indicated surgical treatment, either as a separate modality, offering a whole variety of artery reconstructing procedures on an ischemic limb, or combined with endovascular treatment in two steps, or as a hybrid method in one step. The goal of this treatment is to provide adequate perfusion, which allows the eradication of possible sepsis, destroyed and necrotic tissue, and the creation of functioning limb. With the development of endovascular treatment, there is an improvement in CLI treatment, not only in relation to the endovascular treatment benefits, but mostly because of expansion of indication possibilities of surgical revascularisation and its long-term results reached by improving the circulation conditions on the inflowing side (inflow intervention), or the outflow conditions (outflow intervention).[5] The care of patients with CLI has improved recently, mainly due to more radical distal reconstructions and technological progress in the endovascular treatment, but despite that, the number of amputations because of CLI is still high.[6,7]

Sources and methods

There were 3863 patients treated in our facility in the years 2011–2015, and out of those 1538 were diagnosed with PAD. There were 388 patients with CLI, which is 25.2% of the PAD file, and approximately 10% of all patients. The age of the patients was from 35 to 93 years, the average age was 67.1 years, the men to women ratio was 2.7 : 1, and the percentage of diabetics in this file was 39.8%.

156 patients (40.2%) were treated conservatively, 109 patients (28.1%) were treated surgically, 110 patients (28.4%) were treated by endovascular treatment, and 13 patients (3.4%) were treated by hybrid therapy.

We evaluated the file also according to separate years, which are illustrated in the Table 1 and Figure 1.

Based on these data we can say, that while the number of conservative and surgical treatments has not changed significantly during the five years, there is a clear increase in the endovascular group in the years 2011–2014, with a decrease in 2015 caused by the damaged angiographic machine (from June 2015). Due to the progress of endovascular treatment and multidisciplinary approach in pa-

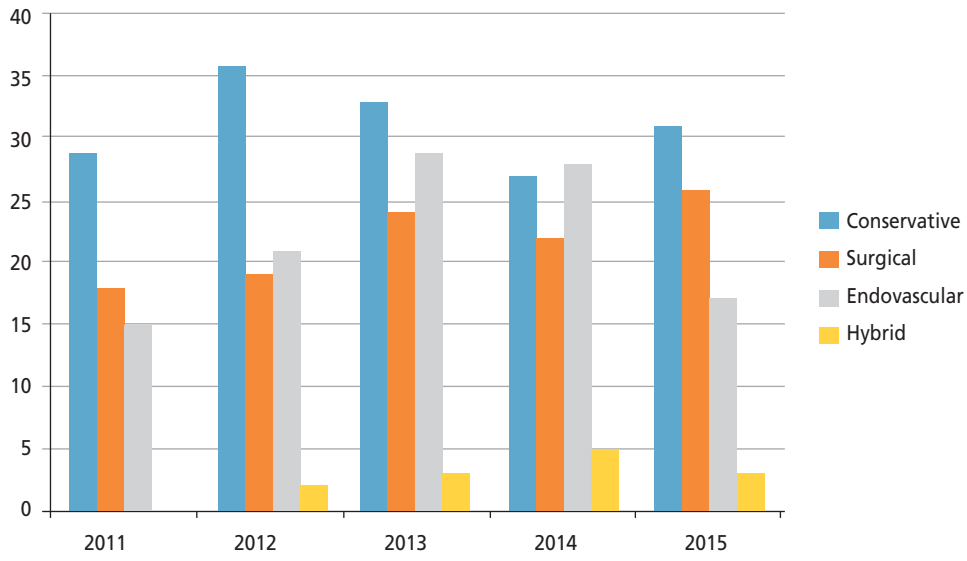

Fig. 1 – Patients with CLI in years 2011–2015 at our workplace.

tients with multilevel damage of artery bed there was an increase in hybrid treatment.

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

In the first step we compared the results of the surgical treatment in patients with Fontaine III stage (rest pain), and patients with Fontaine IV stage (ischemic defect). After that, we compared the results of CLI treatment in 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 endovascular treatment after more than one month of pain at rest or ischemic defect. In the end we compared the results of CLI treatment divided by the duration of the trophic effect.

Based on the surgical revascularisation treatment, where the criteria of success were time until patency of the reconstruction and time until saving the limb, we attempted to prove and determine the importance of time factor on the success of surgical revascularisation treatment of CLI.

Results

Results of surgical treatment

There were 109 patients treated with surgery in total, out of which 33 were on aortoiliac segment, 45 on femoro--supragenicular segment, and 31 were on infragenicular segment.

In the aortoiliac segment (109 patients), there were 18 aortobifemoral, 10 iliofemoral, and 5 iliofemoral cross-over bypasses. The results according to the patency of the reconstruction were: 1 year – 93.9%, 3 years – 90.9%. Salvage of the limb was: 1 year – 100%, 3 years in 30 patients – 90.9%. One person died during the 5-year monitoring, which makes 3.1% yearly mortality.

In the femoro-supragenicular segment (45 patients), there were 22 disobliterations of arteria femoralis communis and arteria profunda femoris with profundoplasty, 15 femoro-popliteal proximal bypasses and 8 femoro-femoral cross-over bypasses. The patency of the recon-

Table 1 – Patients with CLI in years 2011–2015 at our workplace

	2011	2012	2013	2014	2015	Together
PAD	320	310	334	315	259	1538
CLI	69 (21.5%)	87 (27.4%)	80 (23.3%)	81 (25.7%)	72 (27.8%)	388 (25.2%)
Treatment						
Conservative	29	36	33	27	31	156 (40.2%)
Surgical	18	19	24	22	26	109 (28.2%)
Endovascular	15	21	29	28	17	110 (28.4%)
Hybrid	0	2	3	5	3	13 (3.4%)

struction was: 1 year – 82.8%, 3 years – 73.3%. Salvage of the limb was: 1 year – 82.2%, 3 years 68.9%, and the 5-year mortality in our file was 11.1%.

In the infragenicular segment (31 patients), there were 17 popliteal distal bypasses, 11 femoro-crural bypasses (5 on a. tibialis anterior, 6 on a. tibialis posterior), and 3 pedal bypasses. The patency of the reconstruction was: 1 year – 67.7%, 3 years – 51.6%. Salvage of the limb was 1 year – 70.9%, 3 years 58.0%, and the 5-year mortality was 6 patients, which means 19.3%.

Results of hybrid treatment

There were 13 patients treated with the hybrid or combined treatment in total. The patients were divided into two groups.

In the first group, there were patients who underwent an endovascular procedure on the inflow level and a surgical procedure on the outflow segment – 8 patients in total. The endovascular procedures were: 4-times PVI (peripheral vascular intervention) on a. iliaca communis, 2-times on a. iliaca externa, 2-times on a. iliaca communis + a. iliaca externa. The surgical procedures were: 3-times endarterectomy on a. femoralis, 4-times profundoplasty, 3-times femoro-popliteal proximal bypass, 3-times femoro-popliteal distal bypass, and once femoro-tibial bypass on a. tibialis posterior.

The second group was comprised of patients with a surgical procedure on the proximal segment and endovascular intervention on the outflow segment – 5 patients in total. There was one iliofemoral bypass, and 4 femoro-popliteal proximal bypasses. The endovascular procedures were: 2-times PVI on a. poplitea, 3-times PVI on truncus tibiofibularis, 2-times PVI on a. fibularis, and one PVI on a. tibialis anterior. Only one patient died, the other 12 reconstructions are patent, with a successful salvage of the limb. The 5-year patency and 5-year salvage of the limb is 92.3% (Table 2).

Discussion

Factors affecting the results of the surgical treatment of CLI

A. General

- age, sex, comorbidity (ischaemic heart disease, diabetes mellitus, hyperlipidemia, chronic renal insufficiency), mobility, life expectancy;
- speed of the disease progress during conservative treatment of PAD LE and comorbidities, compliance, life style.

B. Local

1. Morphology of the obliterating arterial disease

- localisation (aortoiliac, femoro-supragenicular, infragenicular segment);
- extent (segmental, one level, multiple level damage);
- seriousness;
- inflow bloodstream, run off, collateral blood flow.

2. Seriousness of limb ischemia

- presence of defect (stage III or IV);
- extent (depth of necrosis, ulceration, distal defects, defect of the weight-bearing part of the ankle);
- presence of infection (gangrene, dry necrosis);
- infectious agent virulence (*Pseudomonas*, MRSA, VRSA, anaerobic, combined).

3. Type of vessel replacement

- autogenous vein (reverse, non-reverse, *in situ*);
- prosthetic graft;
- composite graft;
- allogenic artery graft.

4. Length of the bypass

5. Venoplasty of distal anastomosis (Linton, Taylor, St. Mary Hospital, A-V fistula)

Table 2 – Results of surgical revascularisation treatment of CLI

Aortoiliac segment	33	**Femoro-supragenicul. segment**	45	**Infragenicul. segment**	31
Aortobifemor. bypass	18	Desoblit. AFC + profundoplasty	22	F-P distal bypass	17
Iliaco-femor. bypass	10	F-P proximal bypass	15	F-tibialis ant. bypass	5
Iliaco-femor. cross-over	5	F-F cross-over bypass	8	F-tibialis post. bypass	6
				Pedal bypass	3
Time of patency					
1 year – 31	93.9%	1 year – 37	82.2%	1 year – 21	67.7%
3 year – 30	90.9%	3 year – 33	73.3%	3 year – 16	51.6%
Limb salvage					
1 year – 33	100%	1 year – 37	82.2%	1 year – 22	70.9%
3 year – 30	90.9%	3 year – 31	68.9%	3 year – 18	58.0%
Mortality					
3 year – 1	3.1%	3 year – 5	11.1%	3 year – 6	19.3%

The experience from our practice confirms, that the success of a surgical treatment of a critically ischemic limb is determined by a variety of factors, which are well known also from literature. They are divided into general and local.

General factors include age, sex, and mostly patient's comorbidity, mainly when talking about presence and seriousness of ischemic heart disease, diabetes mellitus, hypertension, dyslipidemia, chronic renal insufficiency, defect of coagulation, immunodeficiency, etc. We also count the patient's mobility and life expectancy into the general factors. The speed of progression of the first disease is also of great importance during the post-surgery period, and it depends on conservative treatment of PAD, patient's compliance and his life style.

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 localisation (if the defect is in aortoiliac, femoro-supragenicular or infragenicular segment). A general rule is, that the more central the replacement is, the longer the period of its patency. Correctly indicated and technically precise aortoiliac surgical reconstructions are very effective in CLI treatment. They have great immediate results, low surgical mortality and morbidity rate, high immediate primary patency, a high percentage of long--term patency after 5 years (80–95%), and a low number of reoperations.[8,9]

Further, when talking about the extent, we distinguish segmental, one level, or multilevel impairment. The prospect of a long-term patency lowers with the extent of the impairment, and therefore are worst in the multilevel defect, where they often require combined, or hybrid treatment.[9,10] Other criteria related to the morphology of the arterial disease are seriousness of stenosis and obliteration changes, quality of the inflow artery bed and the run off, and the capacity of the collateral bloodstream.

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. Further, we look at the extent and character of the skin lesion, whether it is necrosis, ulceration, its depth, defect of the weight-bearing part of the ankle, etc. An important criterion is the presence or absence of infection (dry necrosis – gangrene), and an infectious agent virulence (*Pseudomonas*, MRSA, VRSA, anaerobic, combined infection, etc.).

Another factor determining the results of the treatment is the type of the replacement used in the artery reconstruction. In the high-flow aortoiliac segment, the mostly used are artificial vessel replacements (dacron grafts, of PTFE) with a good long-term patency. 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.[11,12] During reoperations or in situations, where the patient does not possess a suitable autogenous vein (v. saphena magna, v. saphena parva), the method of choice are allogenic veins. Randomized studies which compare reverse and *in situ* techniques do not determine any significant difference in the patency of one or another technique. Preference between them is a matter of choice and experience of the surgeon.[13,14]

In cases, where the patients do not possess an anatomically suitable vein comparable to v. saphena magna, or if it was used in the past during previous reconstructions, or extirpated during varices obliteration, the indicated procedure is the reconstruction using the prosthetic material (PTFE, dacron). The literature states significantly better one year patency of supragenicular venous bypasses than of the prosthetic ones (84.3% to 76.3%). It appears, that there is no difference between long-term patency of PTFE and dacron grafts.[13,15] When talking about the 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 materials is meaningful during an absence of an autologous vein, or if the place of the distal anastomosis is a. poplitea (in the 2nd or 3rd segment). Grafts in the tibial branches are controversial.[13,15]

Various techniques of sequential bypasses are also used. The material mostly used for prosthesis above the knee is PTFE. On its distal part, an autogenic or allogeneic graft is interponed, usually in the position "jump" or "hitch-hike". Fairly often, a type of composite bypass is used, in which the PTFE prosthesis is connected by end-to-end anastomosis to the venous part of the reconstruction.[14–16]

Another factor affecting the patency of the reconstruction is the length of the bypass. It is said, that the shorter the reconstruction, the better the prospects for long-term patency. The last local factors affecting the long-term patency of infragenicular prosthetic bypasses are known venoplasties on the distal anastomosis of the bypass – Linton, Taylor, St. Mary Hospital, A-V fistula.[17,18]

The prospects for long-term patency are not so satisfactory in the distal prosthetic reconstructions, but because of various techniques of venoplasty on the distal anastomosis they have the long-term patency only approximately 20% lower than venous bypasses.[19,20] Using the A-V fistula does not have a positive effect on the long-term patency of the grafts.

Another goal of our work was to confirm the assumption that the time factor affects the results of the surgical treatment of CLI. There are not many data on the meaning of the time factor in the literature. We based our research on the metaanalysis of Finnish authors Noronen et al. from 2016, which confirms the importance of early revascularisation in diabetic patients with CLI.[21]

In the retrospective analysis of the anamnestic data 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 3).

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 suffered from pain at rest or from ischemic defect shorter than one month. The other group included patients, who underwent surgical

Table 3 – Results of revascularisation treatment depending on the stage of the disease Fontaine III and IV

Cumulative time of patency	Stage III	Stage IV
2 months	95.3%	86.6%
4 months	90.6%	77.7%
6 months	88.3%	73.3%
1 year	88.3%	70.8%
2 years	82.8%	66.6%
3 years	81.2%	62.4%
Limb salvage	**Stage III**	**Stage IV**
2 months	96.8%	93%
4 months	93.7%	86.6%
6 months	87.5%	80.1%
1 year	86.7%	75.8%
2 years	83.2%	73.5%
3 years	79.2%	68.5%

Table 4 – Results of revascularisation treatment depending on duration of CLI (rest pain or ischemic defect)

Cumulative time of patency	CLI < 1 m	CLI > 1 m
2 months	89.7%	89.7%
4 months	88.4%	87.6%
6 months	82.5%	82.8%
1 year	80.7%	80.6%
2 years	73.4%	70.8%
3 years	70.3%	69.5%
Limb salvage	**CLI < 1 m**	**CLI > 1 m**
2 months	97.8%	95.6%
4 months	93.3%	93.3%
6 months	89.1%	88.9%
1 year	83.9%	84.7%
2 years	77.2%	76.7%
3 years	72.9%	71.4%

revascularisation treatment after more than one month of pain at rest or ischemic defect (Table 4).

In the end we compared the results of surgical revascularisation treatment in patients divided into two groups according to the duration of ischemic defect (ID) – shorter than two months and longer than two months (Table 5).

The results of the surgical treatment of CLI in patients with pain at rest were definitely better than in patients with trophic defect, both in cumulative time of patency of reconstructions and in cumulative number of limb salvage. However, the results of CLI treatment according to duration of CLI (Table 4) and according to duration of the ischemic defect (Table 5), to our surprise, 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 biggest factor is the huge variety of patients with CLI and their individual differences (age, comorbidity, immunological status), as well as the list of local factors determining the results of the treatment (listed above).

Table 5 – Results of revascularisation treatment CLI depending on the duration of ischemic defect (ID)

Cumulative time of patency	ID < 2 months	ID > 2 months
2 months	85.8%	84.2%
4 months	79.8%	79.0%
6 months	74.1%	73.5%
1 year	72.3%	73.5%
2 years	70.5%	70.0%
3 years	68.7%	67.2%
Limb salvage	**ID < 2 months**	**ID > 2 months**
2 months	89.7%	90.2%
4 months	83.5%	82.1%
6 months	81.2%	80.8%
1 year	76.1%	75.6%
2 years	74.3%	73.5%
3 years	70.5%	69.7%

Furthermore, it seems, that more significant than the duration of defect are the speed of its progression, its extent and infectiousness. Small dry distal necrotic defects do not have such negative prospects as quickly extending gangrenes infected by mixed bacterial flora. In this context, the time factor is significant for the limb salvage in the sense of either providing the revascularisation treatment as an ultimum refugium of limb salvage in an admissible stage of gangrene or indicating the patient for primary amputation. In practise, in the vascular surgery department we usually take in patients in such a developed gangrene of the lower limb, that angiography is only performed to determine the place of the amputation line, even though some parts of arterial system can be grafted. On the other hand, patients with long-term chronic trophic defects, with only slightly virulent flora, with good reconstruction conditions can have good results as for patency of the reconstructions and for limb salvage, and can paradoxically influence the statistical results in favour of the group with the duration of defect longer than one or two months.

Another factor is a variety of individual differences in the quality of subsequent care, mainly in patients with CLI living further from the hospital, with variables as local treatment, treatment of primary disease, comorbidities, and dispensary care with regular check-ups, with the goal to secure long-term primary or secondary patency of arterial reconstructions. 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 quantity of patients in our file in relation to various listed criteria.

Conclusion

The results of the surgical revascularisation treatment of CLI are determined by a whole spectrum of described factors, both general and local, known from literature and also from our practice. The most significant factor is the morphology of the atherosclerotic defect, which is also a basis leading to correct indication to revascularisation treatment, according to TASC II guidelines. An important factor for optimal strategy of revascularisation treatment is individual approach with the knowledge of correct indications and possibilities of surgical treatment in individual segments and their whereabouts.

Besides the commonly known and by literature well described factors determining the success of CLI treatment, the goal of our work was to point out the meaning of the time factor in surgical revascularisation treatment.

Definitely better results of CLI treatment in patients in Fontaine III Stage compared to Fontaine IV stage is an indirect confirmation of our hypothesis of the effect of time factor, based on the assumption of gradual progress of PAD through the pain at rest stage to trophic defect stage, although that does not always have to be the case.

In this work we did not confirm our assumption of the effect of CLI duration, or of trophic defect duration on the results of surgical CLI treatment in our file. Reasons based on our experience are described in detail in the discussion.

Despite that, we are convinced, that timeliness of revascularisation procedures has a definite effect on their success, both in duration of patency of reconstruction, and in limb salvage.

References

1. Gergely P. High cardiovascular risk of the patient with critical limb ischemia-conservative management. Vasc Med 2011;3:95–97.
2. Vidim T. Current options of surgical treatment of critical limb ischemia. Vasc Med 2011;3:103–105.
3. Setacci C, Ricco JB; European Society for Vascular Surgery. Guidelines for critical limb ischemia and diabetic foot – introduction. Eur J Vasc Endovasc Surg 2011;42:S1–S30.
4. Randon C, Jacobs B, De Ryck F, et al. Angioplasty or primary stenting for infrapopliteal lesions: results of a prospective randomized trial. Cardiovasc Intervent Radiol 2010;33:260–269.
5. Balaz P, Rokosny S, Bafrnec J, Björck M. The role of hybrid procedures in the management of peripheral vascular disease. Scand J Surg 2012;101:232–237.
6. Vinit NV, Melissa EH, Melina RK, et al. Critical limb ischaemia: Review articles. J Vasc Surg 2010;51:230–241.
7. Slovut DP, Sullivan TM Critical limb ischemia: medical and surgical management. Vasc Med 2008;13:281–291.
8. Menard MT, Belkin M. Aortoiliac disease direct reconstruction in Rutherfords Vascular Surgery, 7th edition, Saunders Elservier, 2010:1628 p.
9. Šefránek V, Tomka J, Slyško R, Necpal R. Options of surgical treatment of critical limb ischemia of lower extremity. Vasc Med 2010;2:112–115.
10. European Stroke Organisation, Tendera M, Aboyans V, et al. ESC guidelines on the diagnosis and treatment of peripheral artery disease. Eur Heart J 2011;32:2851–2906.
11. Adam DJ, Beard JD, Clevelnad T, et al. Bypass versus angioplasty in severe ischaemia of the leg (BASIL): multicentre, randomised controlled trial. Lancet 2005;366:1925–1934.
12. Conte MS, Bandyk DF, Clowes AW, et al. Results of PREVENT III: a multicenter, randomized trial of elifoligide for the prevention of vein graft failure in lower extremity bypass surgery. J Vasc Surg 2006;43:742–750.
13. Tomka J, Necpal R, et al. Surgical treatment of peripheral arterial disease of lower extremity and crirtical limb ischemia. Cardiology for practice 2013;2:86–90.
14. Romiti M, Albers M, Brochado-Neto FC, et al. Meta-analysis of infrapopliteal angioplasty for chronic critical limb ischaemia. J Vasc Surg 2008;47:975–981.
15. Frankovičová M, et al. Our experience with reconstruction operations. Bratislava Medical Journal 1995;12:658–660.
16. Šefránek V, et al. Lower extremity arterial disease and surgical treatment. SAP Bratislava 2011;89–185.
17. Kudo T, Chandra FA, Kwun WH, et al. Changing pattern of surgical revascularization for critical limb ischemia over 12 years: endovascular vs open bypass surgery. J Vasc Surg 2006;44:304–313.
18. Soderstrom M, Arvela E, Korhonen M, et al. Infrapopliteal percutaneous angioplasty versus bypass surgery as first-line strategies in critical leg ischemia a propensity scores analysis. Ann Surg 2010;252:765–773.
19. Mills JL, et al. Section 15 – Lower Extremity Arterial Dissease (Chapter 109). In: Cronenwelt JL, et al. Rutherford's Vascular Surgery 7th edihion, Philadelphia: Elsevier, 2010:1682 p.
20. Albers M, Romit M, Brochado-Neto FC, et al. Meta-analysis of popliteal-to-distal vein bypass grafts for critical limb ischemia. J Vasc Surg 2006;43:498–503.
21. Noronen K, Saarinen E, Albäck A, Venermo M. Analysis of the elective treatment process for critical limb ischaemia with tissue loss: diabetic patient require rapid reevascularisation. Eur J Vasc Endovasc Surg 2017;53:206–213.