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Revascularization limb salvage in chronic limb-threatening ischemia: Does open surgery still the best option in the era of endovascular therapy?

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ABSTRACT

Introduction: Chronic limb-threatening ischemia (CLTI) is considered the most severe pattern of peripheral artery disease. It is defined by the presence of chronic ischemic rest pain, ulceration or gangrene attributable to the occlusion of peripheral arterial vessels who suffered from diabetes mellitus type 2, and also associated with physical, as well as psychosocial, consequences such as amputation and depression. Successful revascularization decreases the major amputation rate in patients with CLTI. The efficacy of peripheral bypass grafts and percutaneous transluminal angioplasty in accomplishing limb salvage has been recognized.

Case Description: A 42-year-old man came to the RSUZA emergency room with chief complaints claudication above the right thigh and continuous pain (rest pain) at the right lower extremity since 9 months ago. History of finger amputation 2nd, 3rd and 4th right foot since 10 months ago at local hospital, and now there are necrotic wounds on

his toes. Patients suffered from type 2 diabetes mellitus and have bad habits such as smoking 3 packs a day all the time. Physical examination has a wound in the lower leg area of more than 10 cm × 8 cm. Right ankle-brachial index (ABI) 0.6 and left ABI 1.3. CT-angiography (CTA) shows infra inguinal type D TASC II classification. A revascularization procedure is performed to salvage the limb with the right femoro-popliteal bypass technique with graft R-SVG and debridement in the right lower leg area so that chronic right lower limb ischemia can be overcome. Systemic heparinization was given post operatively and complaints of pain in the right lower limb begin to disappear. Patient was discharged on the 5th day of treatment with good results.

Conclusion: Open surgical bypass continues to be a primary treatment of choice, durable approach in a significant proportion of patients. Lower extremity bypass grafting is most successful with a good quality, long, single-segment autogenous vein of at least 3.5mm diameter.

Keywords: Chronic limb-threatening ischemia, open surgical bypass, limb salvage, TASC II type D

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INTRODUCTION

Chronic limb-threatening ischemia (CLTI) is defined as ischemic rest pain, tissue loss, or gangrene in the presence of peripheral artery disease (PAD) and hypoperfusion of the lower extremity, such as ulcers or gangrene that do not heal.^{1,2} Approximately 1% to 3% of patients with PAD may present with CLTI; however, with increasing life expectancy and the prevalence of diabetes type 2, obesity, and sedentary lifestyles, these estimates are likely to increase.²⁻⁴ History and physical examination allow early diagnosis and the provision of appropriate interventions to modify the risk of morbidity and mortality.^{4,5}

CLTI causes an unavoidable amputation unless there is an intervention that increases arterial perfusion. CLTI is divided into acute or chronic and has a different etiology and natural history.⁶ Acute limb ischemia (ALI) is a breakdown of circulation to the extremities in the absence of trauma or iatrogenic injury due to sudden embolism or thrombosis.⁷ CLTI cases with <14 days onset are considered acute, and ALI is significantly associated with high

loss of limbs and death, so early diagnosis and treatment are very important to save the extremity experiencing ischemia.^{5,6}

In contrast, CLTI occurs over several weeks to months, but is at the extreme end of the spectrum of chronic limb ischemia (Rutherford classification 4–6, Fontaine III/IV). Its importance is because of the much higher risks of limb loss and cardiovascular events than asymptomatic PAD and intermittent claudication. The poor prognosis demands more rapid assessment, a more significant role for wound care, and the earlier use of revascularization.^{8,9}

The goal of CLTI treatment is to relieve pain, allow wound healing, improve patient's function, prevent limb amputation and reduce mortality. Lower limb revascularization is the first-line treatment in CLTI patients that can tolerate this procedure. In few cases, CLTI patients with multiple comorbidities or low chance of successful revascularization may require a primary amputation. A simultaneous medical intervention is required for

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pain management, control of cardiovascular risk factors and optimization of glycemic control.¹⁰

Revascularization is the cornerstone of therapy for CLTI and has a class I recommendation by all professional guidelines, can reduce the rate of amputation.^{10,11} Without revascularization, up to 40% of patients with CLTI will require lower limb amputation by 1 year.¹² The effectiveness of open peripheral bypass grafts and percutaneous transluminal angioplasty is recognized both in saving the extremities.¹³

CASE DESCRIPTION

The 42-year-old male patient presented with a complaint of pain in the right foot that was felt for approximately 9 months ago. The pain was felt to be continuous and the pain becomes more burdensome when moving around, the feet started to blacken and widespread. Complaints weighed in 1 week before came to the hospital, complaints were felt like being stabbed in the knee radiating to the tip of the right foot. The patient performed amputation of the finger 2nd, 3rd, 4th on the right foot 5 months ago with complaints that the foot felt hot and numb because the legs were already blackened.

The patient suffered from type 2 diabetes mellitus and with bad habits such as smoking 3 packs a day. Physical examination showed wounds in the lower limb area of more than 10 cm × 8 cm. Laboratory tests showed anemia and leukocytosis. Ankle brachial index (ABI) right ankle 0.6 and left 1.3. CT-angiography showed classification of type

Figure 1 CTA of the right lower limb, showed total occlusion at infra inguinal right femoral artery due to atherosclerotic plaques, contrast seems to be filled by right popliteal artery. Type D TASC II classification

Figure 2 A revascularization procedure is performed to salvage the limb with the right femoro-popliteal bypass technique with graft R-SVG using prolene 6-0, tunneled from proximal until distal femoral. Showed also a good wound healing in the right femoral and at the left lower leg (multiple incision for R-SVG harvesting)

Figure 3 Intra operative angiogram evaluation showed; (A) that the graft was patent from inflow (white arrow), (B) to outflow vessel (white arrow) until to the popliteal trifurcation of the right lower leg

D TASC II from total occlusion in infra-inguinal right femoral artery due to atherosclerotic plaques, contrast seems to be filled by right popliteal artery (Figure 1).

He was diagnosed with CLTI Rutherford 5 TASC type D. The patient planned for elective surgery of open bypass femoro-popliteal with reversed saphenous vein graft. Revascularization was performed to save limbs in the right lower limb area thus chronic lower right limb ischemia can be overcome.

The patient was in supine position under general anaesthesia, then aseptic and antiseptic from the right inguinal to the leg. The operating field was narrowed with sterile gown. Incision in the right inguinal area, identification of right femoral artery, pulsation was found then exploration to superficial femoral artery (SFA). Performed arteriotomy, there

was a sclerotic plaque in situ. Continued with distal incision of the distal right femur. Identification of right popliteal artery, there was no sclerotic plaque, with good native intra lumen vessel. Simultaneously already performed harvesting of the left R-SVG for graft conduit (Figure 2).

A revascularization procedure is performed to salvage the limb with the right femoro-popliteal bypass technique with graft R-SVG using prolene 6-0, tunneled from proximal until distal femoral (Figure 2). Followed by debridement in the right lower leg area so that chronic right lower limb ischemia can be overcome. Patency of the graft was in good evaluation with intra operative angiogram (Figure 3). Systemic heparinization also given intra operatively and post operatively. During followed up days, the patient did not complaints of any pain in the right lower limb and begin to disappear. Patient was discharged on the 5th day of treatment with good results.

DISCUSSION

CLTI has the main symptoms of ischemic rest pain in the area that has narrowed or total occlusion of the arteries. Feet and legs will become cold and numb, the skin becomes dry and scaly and can even occur non healed ulcer.^{2,5} Diabetes and vascular inflammation has become a marker of atherothrombotic risk including PAD in CLTI. Diabetes mellitus increases the process of atheroma formation. Atheroma plaques will become unstable due to endothelial cells in diabetic patients and secrete cytokines that inhibit collagen production by vascular smooth muscle cells.¹⁵

Examination of ABI and CT-angiography can be relied upon in establishing a diagnosis of early PAD in CLTI. ABI examination is a non-invasive test that is fairly accurate to detect the presence of PAD and to determine the degree of this disease. Examination of ankle-brachial index (ABI) right ankle 0.6 indicates moderate arterial disease. CT-angiography shows classification of type D TASC II from total occlusion in infra-inguinal right femoral artery due to atherosclerotic plaques, contrast seems to be filled by right popliteal artery.^{16,17}

The purpose of revascularization is to restore blood flow, improve wound healing, and limit the level of amputation. There are several surgical revascularization approaches, including: open surgery, endovascular, and hybrid procedure. Among the three options there is no approach that is universally suitable for all patients with CLTI.¹⁶

The gold standard of treatment between bypass surgery and an endovascular approach in patients

with CLTI is still under debate. Bypass surgery is associated with encouraging patency and amputation free survival rate in the long run, especially in cases of autogenous vein conduits. On the other hand, recovery following endovascular therapy is faster than after bypass surgery, The BASIL (Bypass Versus Angioplasty for Severe Ischemia of the Leg) trial, which still remains the only published randomized controlled trial (RCT) in this field, showed comparable outcomes between the strategies, but favored bypass surgery for patients with a life expectancy >2 years.¹⁷

The CTA of this patient revealed a good distal run-off status, despite the moderate angiographic lesions TASC D. As to this issue, bypass surgery was applied more commonly in patients having already 1 or more previous vascular interventions. The patient in this case received open surgical revascularization due to the reason of long total occlusion lesion in the right SFA with a good result. Patients with CLTI often require complete revascularization at all occlusion sites to renew blood flow.^{7,16} The anatomical distribution of arterial occlusive disease is the dominant factor in developing strategies, because of its relationship to the success of treatment modalities. The hybrid procedure was carried out selectively for patients with simple lesions (TASC A or B), open surgery was performed on complex diseases (TASC C or D), as well as seen in our patient.¹⁹ Management of open surgical revascularization was performed for lesions that required extensive revascularization and long-acting and generally associated with significant morbidity and mortality and carried out for younger "healthy" patient.^{16,19,20}

Lower extremity bypass grafting can provide a high success rate, durable, and with single-segment autogenous vein with a minimum diameter of 3.5 mm. This can be seen in our patients with long-segment occlusion accompanied by type D TASC II which is highly recommended for open surgery revascularization.^{16,19}

CONCLUSION

The anatomic distribution of arterial occlusive disease is a dominant factor in developing the strategy. Open surgical bypass continues to be a primary treatment of choice, durable approach in a significant proportion of patients. Lower extremity bypass grafting is most successful with a good quality, long, single-segment autogenous vein of at least 3.5 mm diameter. As seen in our patient with long segment occlusion with type D TASC II is strongly recommended for open surgical revascularization.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding this study.

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AUTHOR CONTRIBUTION

All authors are contributed equally to the content of the study, including data gathering, statistical analysis and data synthesis.

ETHICAL STATEMENT

All data were collected using medical record and patient had received signed inform consent regarding publication of their respective photograph in journal article.

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