



Case Report

Limb Preservation with Balloon Angioplasty in Critical Limb Threatening Ischemia: A Case Report

Imelda Krisnasari^{1*}, Novi Kurnianingsih², Mohammad Saifur Rohman², Budi Satrijo², Anna Fuji Rahimah²

¹ Brawijaya Cardiovascular Research Center, Department of Cardiology and Vascular Medicine, Faculty of Medicine, Universitas Brawijaya, Malang, Indonesia.

² Department of Cardiology and Vascular Medicine, Faculty of Medicine, Universitas Brawijaya, Malang, Indonesia.

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ABSTRACT

Introduction: Chronic limb-threatening ischemia (CLTI) is a syndrome that represents the end-stage of peripheral artery disease (PAD) that increased the risk of major amputation and cardiovascular events. The initial treatment for CLTI may significantly impact the risk of major amputation or death.

Objective: This case report aims to describe limb preservation with balloon angioplasty in a Critical Limb Ischemia patient.

Case Presentation: A hypertensive 72-years old female complained of left leg pain followed by a wound on her left toe four months ago. Her toe was amputated, but the wound persists. On physical examination, the pulsation was diminished in her left foot. Duplex ultrasound showed monophasic spectral doppler from left popliteal artery to distal left anterior tibial artery (ATA) and distal posterior tibial artery (PTA). CT-Angiography showed short total occlusion (2cm) at the distal left Superficial Femoral artery (SFA), multiple stenoses with maximal 90% stenosis at the left ATA, and chronic total occlusion at the proximal-mid left posterior tibial artery (PTA). She was diagnosed with CLTI left inferior extremity Fontaine IV Rutherford 5. The angiography result was similar to the CT-angiography result. The patient was successfully treated with plain balloon angioplasty from distal left SFA to distal left ATA and drug-coated balloon angioplasty from the distal left SFA to the popliteal artery. Her wound was also consulted to the surgical department.

Conclusion: Appropriate revascularization is fundamental to limb preservation. We successfully perform endovascular strategy with TIMI flow 3 from left SFA to distal left ATA and distal PTA in our patient, but we still need further holistic CLTI management.

1. Introduction

Chronic limb-threatening ischemia (CLTI) is a manifestation of peripheral arterial disease (PAD) characterized by chronic, inadequate tissue perfusion at rest.¹ Around the world, the estimation of people afflicted with PAD was 202 million people. The prevalence of PAD was increased with older age. In patients aged over 40 years old, PAD prevalence was 5.9%.² The estimated prevalence was increased to 15% - 20% of persons over 70 years old.[3] Among persons with known PAD, CLTI reported prevalence is 1% - 2% to 11%.¹

Chronic limb-threatening ischemia is associated with decreased quality of life and substantial morbidity and mortality.¹ Cardiovascular events such as myocardial infarction and stroke occur in 30–50% of subjects with PAD over five years, but patients with CLTI face this risk over one year. The risk of major amputation is less than 5% over 5–10 years in patients with claudication.³ The risk of lower limb amputation of CLTI was estimated in 10%–40% of patients at six

months, and 25% will die after a year.²⁻⁵

The initial treatment approach for CLTI may significantly impact the risk of major amputation or death.⁶ Appropriate revascularization is a fundamental strategy for limb preservation. The revascularization was performed according to the estimation of the risk of amputation and the benefit of revascularization, based on wound, ischemia, foot infection level (WIFI stage), and the anatomic pattern of disease. We reported our experience in successfully performing endovascular revascularization in a patient with CLTI.

2. Case Presentation

A 72-years old female complained of a wound on her left leg left that did not heal after her toe was amputated three months ago. The wound was wider with local infection. Before the amputation, there was a traumatic wound in her left toes four months ago. She also

*Corresponding author at: Brawijaya Cardiovascular Research Center, Department of Cardiology and Vascular Medicine, Faculty of Medicine, Universitas Brawijaya, Malang, Indonesia
E-mail address: imeldamaryam@gmail.com (I. Krisnasari).

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A 72-years old female complained of a wound on her left leg left that did not heal after her toe was amputated three months ago. The wound was wider with local infection. Before the amputation, there was a traumatic wound in her left toes four months ago. She also complained about leg pain at rest five months ago while resting at night, and the pain was relieved when her leg was in a hanging position. Since a week ago, she felt numbness in the area around the wound. Her risk factors were menopause since 20 years ago and uncontrolled hypertension since 10 years ago.

Physical examination showed blood pressure 150/90 mmHg, heart rate 97 beats/minute regular, respiratory rate 18 times/minute, and peripheral oxygen saturation 98% on room air. Her head, neck, and abdomen were within normal limits. There was a wound in her left foot, in the area of post amputated toes, approximately 5x3 cm in size, with pus in the middle of the wound and blackening of skin color around the wound (Figure 1).

On the vascular examination, we found diminished pulsation



Figure 1. Wound on left foot of the patient

from the left anterior tibial artery (+2) to dorsal pedis artery (+1). Her right ankle-brachial index (ABI) was normal, 1.02, but the left was 0.33. The peripheral oxygen saturation was normal on her right foot but decreased on her left foot, around 68 – 71%. The sensory was decreased in the area around the wound, and we did not find muscle atrophy or motor impairment. So, due to the minor tissue loss, the clinical stage of her lower extremity was classified as Fontaine IV and Rutherford 5. Her wound score was 2, ischemia score was 3, and foot infection was 3, so the Wifl stages were 4.

Duplex ultrasound (DUS) examination of left leg showed monophasic spectral doppler at the left popliteal artery until distal left

anterior tibial artery (ATA) and distal left posterior tibial artery (PTA) (Figure 2). CT-angiography was performed with result stenosis around 30-50% at proximal-mid left Superficial Femoral Artery (SFA) with short (2cm) total occlusion at the distal SFA, 30-50% stenosis at the level of popliteal artery, 70% stenosis at the level of tibioperoneal trunk, multiple stenoses with maximal 90% stenosis that calcified at the level of ATA, total occlusion at the level proximal-mid PTA, but there was flow at the distal PTA that comes from collateral, and 80% stenosis at the level of the peroneal artery (Figure 3).

So we decided to perform revascularization with an endovascular approach with vascular access was antegrade from ipsilateral

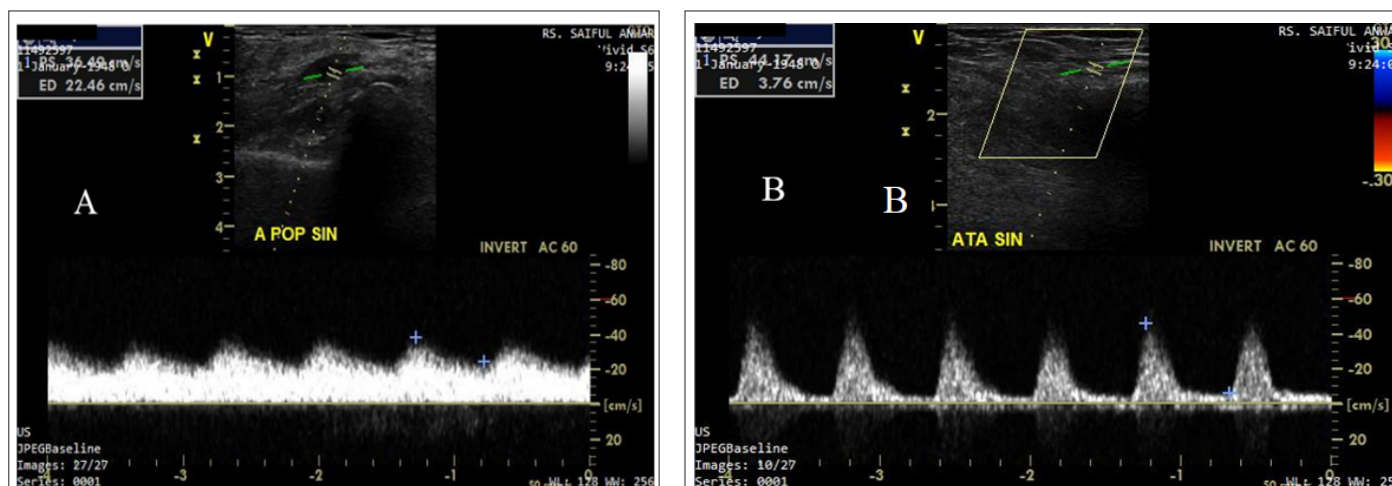


Figure 2. Duplex ultrasound showed monophasic spectral doppler from (A) left popliteal artery (B) left anterior tibialis artery

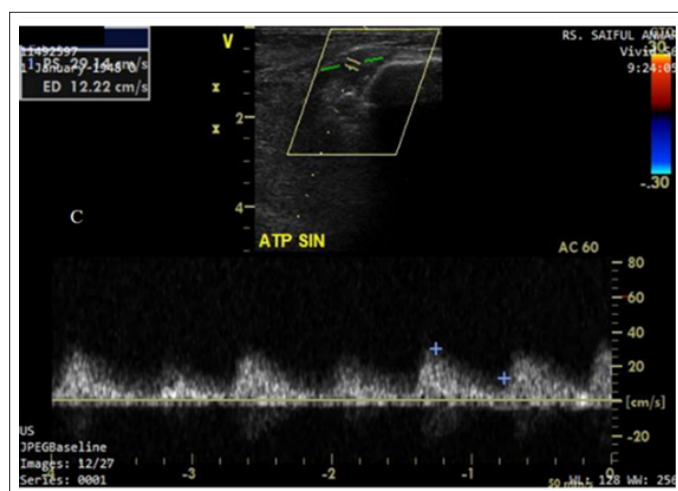


Figure 2. Duplex ultrasound showed monophasic spectral doppler from (C) left posterior tibial artery

Common Femoral artery (CFA). We perform arteriography evaluation before the revascularization with a result similar to the CT angiography result (Figure 4). The wire successfully crossing the occlusion and could reach the distal ATA with the conjunction microcatheter. Plain balloon angioplasty was performed first from the SFA until the distal ATA. We then performed drug-coated balloon (DCB) angioplasty at the distal SFA until the popliteal artery with a 5.0x150 mm paclitaxel DCB 10atm for 2 minutes. After that, cine angiographic-evaluation showed TIMI 3 flow to the distal SFA, popliteal artery, ATA, dorsalis pedis artery, and also giving collateral to the distal posterior tibial artery (PTA) (Figure 5)



Figure 3. CT-angiography of inferior extremity

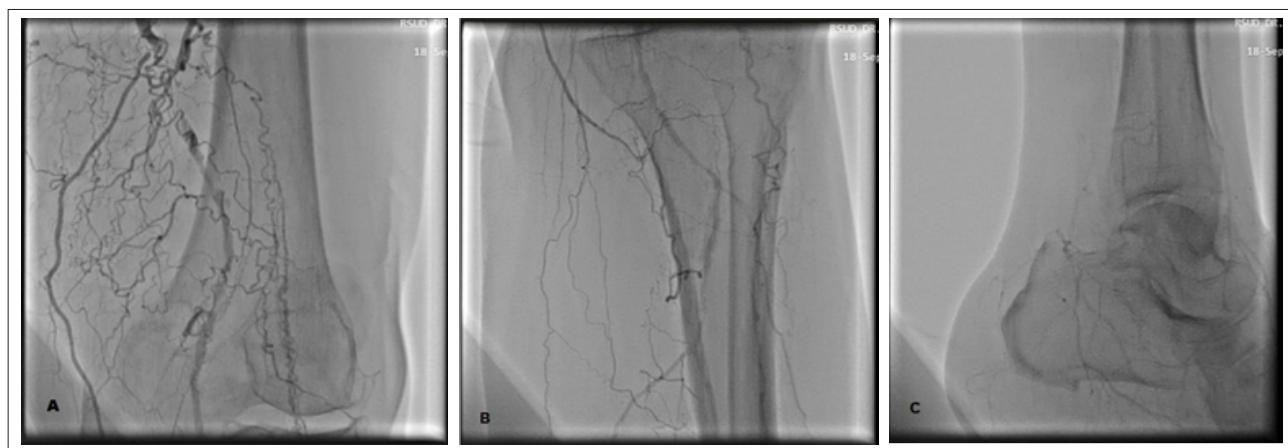


Figure 4. Arteriography pre angioplasty showed (A) short total occlusion at distal superficial femoral artery (SFA) with collaterals. (B) Collaterals blood flow to distal occlusion (C) Inadequate blood flow to distal anterior tibial artery (ATA) and distal posterior tibial artery (PTA).

The patient was discharged with a double antiplatelet and consulted to the surgical department for wound management. Evaluation after 30 days of revascularization showed the pulsation of the left dorsal pedis artery improved but still weak with the ABI was 0.58. The DUS evaluation showed monophasic spectral doppler at the left popliteal artery until left anterior tibial artery (ATA), but the peak systolic velocity was increased.

3. Discussion

Peripheral artery disease results from a chronic

atherosclerotic process in the vessel wall that progressively narrows the arterial lumen. The pre-existing vessel can grow small vessels (angiogenesis) and dilate the lumen (arteriogenesis) to develop collaterals. However, if PAD progression persists due to the overburdened, the collateral supply is no longer sufficient to compensate for tissue hypoperfusion. This results in increased cell loss, leading to inflammation. Chronic inflammation severely impairs endothelial function.

The clinical characteristics of CLTI were rest pain, gangrene, or ulceration at the lower limb that occurs more than two weeks.⁷ The progression of PAD symptoms is slow, so the appearance of CLTI can

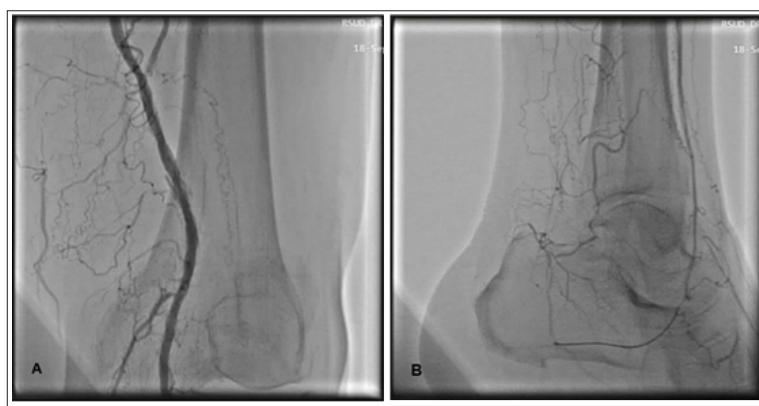


Figure 5. Arteriography post angioplasty showed (A) successful revascularization on distal superficial femoral artery (B) Adequate blood flow to distal anterior and posterior tibial artery.

“come as a surprise”.⁸ The clinical stages of CLTI have Rutherford classification 4–6 and Fontaine classification III–IV.³ Our patient has minor tissue loss, so she was classified to Fontaine IV and Rutherford 5. The objective criteria of Rutherford 5 were Ankle Pressure (AP) at rest <60 mmHg or Toe Pressure (TP) <40 mmHg.⁹ Ankle-Brachial Index (ABI) of our patient was 0.33. An ABI ≤ 0.90 was sensitive (75%) and specific (86%) to diagnose PAD.¹⁰ According to the wound, ischemia, and foot infection, the Wifl stages were 4. It showed the high benefit of revascularization.¹¹

We perform imaging with Duplex ultrasound (DUS) and non-invasive angiography with computerized tomography (CTA) to demonstrate arterial obstruction and anatomical characterization because of candidates for revascularization.¹⁰ It helps plan the mode and approach to revascularization.³ From Global Vascular Guidelines, CLTI is often associated with multilevel disease, and making the direct in-line flow to the foot is the primary technical goal with the target was called target arterial path (TAP). Technical success and sustained patency for the limb as a whole must be estimated.⁷ The angiosome concept showed in Figure 6.¹²

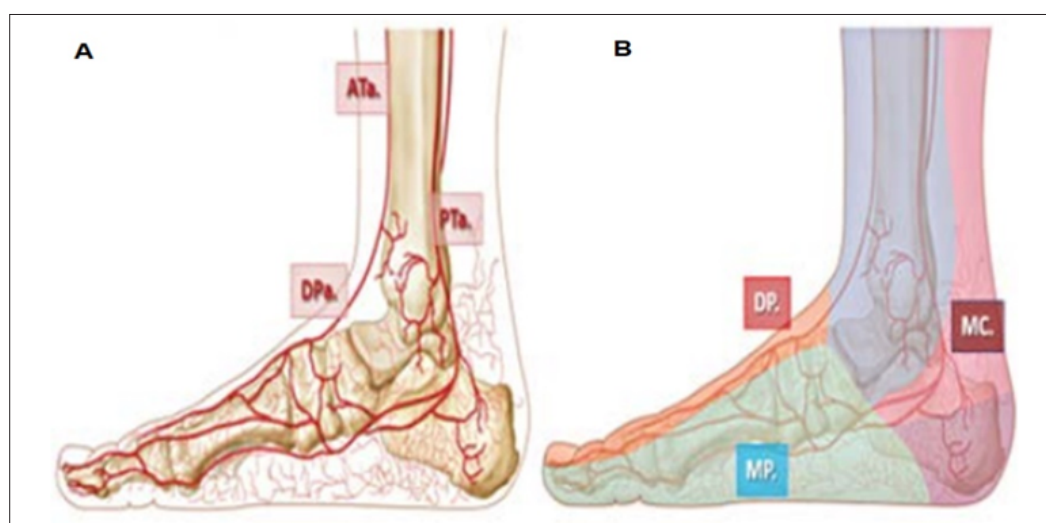


Figure 6. The arterial trunk (A) and angiosome territories (B) of pedis. ATA: Anterior Tibial artery; PTA: Posterior Tibial artery; DPa: Dorsalis Pedis artery; DP: Dorsalis Pedis angiosome (from the ATA); MP: Medial Plantar angiosome (from the PTA); MC: Medial Calcaneal angiosome.¹²

We decided to perform an endovascular approach. An “endovascular-first” approach is often advocated based on a lower procedural risk.³ The optimal revascularization strategy (endovascular versus open surgery) for the patient with infrainguinal disease according to Global Vascular Guidelines on the Management of CLTI, was based on the severity of limb threat (Wifl classification), the anatomic pattern of disease (GLASS classification), and the availability of autologous vein. (Level of Evidence 1C).⁷

The Global Limb Anatomic Staging System (GLASS) classification was grading Femoro Popliteal (FP) and Infra Popliteal (IP)

segments in series. In our patient, her FP was grade I with the total length SFA disease less than 1/3 (less than 10 cm), with single focal CTO (2 cm), not flush occlusion, and popliteal artery with mild or no significant disease. Her IP was grade III with disease up to 2/3 vessel length of ATA. So GLASS for the patient limb was stage II thus reflect intermediate-complexity disease: expected technical failure less than 20% and 1-year limb-based patency (LBP) 50% to 70%. With the Wifl was stage IV, we still could perform endovascular revascularization.⁷ It similar to the ESC Guideline that recommends performing endovascular first strategy in short (< 25 cm) FP lesions (Class 1, Level of evidence C).¹⁰

Several endovascular techniques can be chosen for short-length occlusion in SFA. From 2018 ACC/AHA/SCAI/SIR/SVM Appropriate Use Criteria for Peripheral Artery Intervention, the appropriate options for SFA and popliteal disease with lesion length < 100 mm were balloon angioplasty, drug-coated balloon (DCB), the drug-eluting stent (DES), and bare-metal stent (BMS).¹³ The rates of repeat revascularization were low with DES and DCB.³ It similar to the Global vascular guideline that recommended considering to balloon angioplasty (e.g., stents, covered stents, or drug-eluting technologies) while treating FP disease with advanced lesion complexity (e.g., GLASS FP grade 2-4) by endovascular means (level of evidence 2B).⁷ It also corresponds to a meta-analysis in a femoropopliteal lesion that showed that DCB, CS (covered stent), and BMS were associated with significant reductions in target lesion revascularization at 12 months compared to balloon angioplasty, and also DCB, DES, CS, and BMS were associated with significantly improved primary patency at 12 months compared to balloon angioplasty.¹⁴ In the THUNDER trial that performs follow-up to over 5-year, the PCB group has remained significantly lower of the cumulative number of target lesion revascularization. The benefit of PCB treatment was seen in treating femoropopliteal arteries for lesions <10 cm and for longer lesions.¹⁵

The appropriate option for endovascular techniques for below the knee lesion with length >100mm, was balloon angioplasty.¹³ It corresponds to systematic review and meta-analysis of studies published between January 2008 and November 2018, representing 1593 patients. It showed that DCB angioplasty compared with standard PTA has no significant differences in limb salvage, survival, restenosis, target lesion revascularization (TLR), and amputation-free survival (AFS) rates.¹⁶

In evaluation, there were critical technical success and acute procedural success. Critical technical success was the achievement of final residual diameter stenosis <30% for stent and <50% for angioplasty or atherectomy by angiography at the end of the procedure (and without flow-limiting arterial dissection). Acute procedural success is technical success and absence of major adverse events (e.g., death, stroke, MI, acute onset of limb ischemia, index bypass graft or treated segment thrombosis, and/or need for urgent/ emergent vascular surgery) within 72 hours of the index procedure.¹⁷

For the holistic management, after the intervention, the patient was given double antiplatelet and also statin. the patient was recommended for a healthy diet and physical activity and controlled her blood pressure less than 140/90 mmHg.^{10,18} Better wound care management was also recommended. Wound care principles include improving perfusion into the limb, treating infection, avoiding pressure on a wound, debridement, and adequate nutrition. Antibiotics may be required to treat the infection to prevent osteomyelitis. Avoiding pressure on the wound (e.g., off-loading the foot) also assists wound healing.³

4. Conclusion

Our case presents the importance of diagnosis and management of CLTI. Appropriate revascularization is a fundamental strategy for limb preservation. The option of endovascular strategy is based on anatomical characterization and the Wiffl stage of the patient. The endovascular strategy has lower morbidity and mortality that was performed successfully in our patient. However, we still need holistic CLTI management for the patient, including a healthy lifestyle, intensive medical therapy, pain management, and infection control.

4. Declarations

4.1. Ethics Approval and Consent to participate

Patient has provided informed consent prior involvement in the study.

4.2. Consent for publication

Not applicable.

4.3. Availability of data and materials

Data used in our study were presented in the main text.

4.4. Competing interests

Not applicable.

4.5. Funding source

Not applicable.

4.6. Authors contributions

Idea/concept: IK. Design: IK. Control/supervision: NK. Data collection/processing: IK. Extraction/Analysis/interpretation: IK. Literature review: BS, MSR. Writing the article: IK. Critical review: NK, BS, MSR. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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