Transpedal Approach for the Treatment of Acute Limb Ischemia in a Patient with Limited Access Sites

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Abstract
We present a 53-year-old male with a history of extensive peripheral vascular disease, including a repaired type B aortic dissection complicated by occlusion of the left subclavian artery requiring carotid to subclavian bypass. The patient then had a subsequent repair of a graft endoleak complicated by left iliac artery occlusion requiring fem-fem bypass. He presented to the ED with left foot pain concerning for acute limb ischemia needing for prompt revascularization. However, given the extensive prior vascular surgeries, traditional femoral approaches were unable to be utilized. Therefore, a retrograde ipsilateral transpedal approach was chosen as the only remaining possible access site for angiography and intervention. The left anterior tibial artery was cannulated via a 4 French access. The angiogram revealed a total occlusion in the left posterior tibial artery with poor pedal arch flow. Via the 4Fr system, treatment with mechanical thrombectomy, percutaneous transluminal angioplasty, and thrombolysis with tPA was performed and successful restoration of flow to the limb was achieved.

Keywords
Acute limb ischemia, Pedal approach, Thrombolysis, Percutaneous transluminal angioplasty, Thrombectomy

Learning Objective
Peripheral artery disease (PAD) is growing into a worldwide pandemic with a prevalence as high as 12% in developed countries [1]. Acute limb ischemia (ALI), which is the most severe form of PAD, is described as a rapid onset decrease of limb perfusion that threatens limb viability with almost all cases being related to arterial occlusion [2]. While ALI constitutes only 1-3% of symptomatic PAD, it has become more prevalent as a result of aging populations, and rising rates of diabetes and chronic kidney disease (CKD). The cornerstone of limb salvage remains early revascularization combined with maximal optimal medical therapy and wound care. However, despite multiple advances, the management of this disease remains a challenge which is reflected in prevailing high rates of mortality. Research has shown that 20% of patients will die within one year after being diagnosed with ALI [3]. Current advances in endovascular therapy enable prompt treatment of ALI however, most treatment has been performed via traditional femoral artery access sites.

The case aims to illustrate the feasibility of a retrograde ipsilateral transpedal approach when the commonly used contralateral femoral and ipsilateral anterograde femoral approaches are inaccessible for the treatment of distal lower limb ALI.

Background of the Patient
We present a 53-year-old male with an extensive smoking history and a past medical history significant for hypertension, chronic kidney disease stage (CKD) G3, and heart failure with preserved ejection fraction. Also, he has an extensive history of peripheral arterial disease (PAD). He was previously diagnosed with a type B aortic dissection complicated with sac expansion and underwent thoracic endovascular aortic repair and endovascular aneurysm repair (TEVAR/EVAR) complicated by occlusion of the left carotid and subclavian arteries...
Ultrasound-guided access of the anterior tibial (AT) artery was performed and a 4Fr Pinnacle precision sheath (Terumo) was placed. Subsequent angiography through a Vertebral catheter (Cordis) revealed a patent fem-fem bypass, chronic total occlusion of the left iliac artery, patent superficial femoral artery (SFA) and popliteal arteries and total occlusion in the left posterior tibial (PT) artery with a reduced flow into the foot and likely the embolic culprit to the patient’s acute symptoms (Figure 2).

**Therapeutic Focus and Assessment**

In order to treat the thrombus in the PT artery from the AT arterial access site, an “up and over” approach was used. Using an IM catheter (Cordis) and a 0.014” Run through wire (Terumo), we were able to cross over from the AT artery into the PT artery then cannulate the distal total occlusion of the PT and wire into the pedal arch itself.

The embolic lesion was treated with mechanical thrombectomy (Penumbra using a CAT4 catheter) and balloon angioplasty with a 3.5 × 150 Saber (Cordis). Flow in the PT artery was restored, but significant thrombus burden was noted in the pedal arch, so 10 mg of tPA was slowly perfused over 30 minutes.

A final angiogram showed restoration of flow in the pedal arch (Figure 3). A Vasostat closure device was placed over the AT access site, and the patient was transferred to the CCU for further monitoring.

**Discussion**

This case demonstrates the successful treatment of ALI via a retrograde ipsilateral transpedal approach, in contrast to the more commonly used contralateral femoral, or antegrade ipsilateral femoral approaches. In this specific case, transpedal access was the only available option. Ultrasound-guided access of the anterior tibial (AT) artery was performed and a 4Fr Pinnacle precision sheath (Terumo) was placed. Subsequent angiography through a Vertebral catheter (Cordis) revealed a patent fem-fem bypass, chronic total occlusion of the left iliac artery, patent superficial femoral artery (SFA) and popliteal arteries and total occlusion in the left posterior tibial (PT) artery with a reduced flow into the foot and likely the embolic culprit to the patient’s acute symptoms (Figure 2).
able option for endovascular treatment. It is essential to highlight the variety of treatment options available through 4 Fr transpedal access, including mechanical thrombectomy, angioplasty, and even the use of tPA in case a rare case like this patient arises.

Our patient presented with history and physical exam findings that were very concerning for ALI. He had a known extensive PAD history. It has been shown that 5-10% of patients with PAD will develop ALI in the next five years [3]. Also, most ALI patients have associated multilevel disease involving two or more territories, which our patient had in his past medical history [4]. Other risk factors associated with distal vessel involvement include older age (> 80), hypertension, diabetes, and CKD [5].

Once ALI is suspected, patients generally undergo non-invasive testing (CTA, MRA) to establish a diagnosis. That being said, it is essential to highlight that these im-

Figure 2: Pre- and post-intervention angiogram. Arrow points to posterior tibial artery, highlighting restoration of normal flow after intervention.

Figure 3: Pre- and post-intervention angiogram. Arrow points to pedal arch, highlighting restoration of normal flow after intervention.
oral access sites were not available due to prior bypass surgery.

Conflict of Interest

None of the authors involved in this case have a conflict of interest.

Declarations

• Consent to write this case from patient was obtained.
• We do not report any competing interests.
• This study was not funded.
• Authors collaborated together on all aspects of the projects, including design, statistical analysis, manuscript writing.

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