

CASE REPORT

## Stent-Apposition Salvage of an Anterior Tibial Artery After Inadvertent Angioplasty Balloon Retention During CTO Revascularization

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**Introduction:** Progressive improvement in the ability to treat complete total occlusions in the tibial level arterial circulation have made it possible to revascularize patients with critical limb ischemia.

**Report:** A 59 year old male presented with a complete total occlusion of his anterior tibial artery with distal reconstitution through peroneal artery collaterals. During attempted angioplasty a balloon was retained within the patent portion of the target vessel. Two 3.0 mm drug eluting coronary stents were deployed across the length of the balloon with excellent luminal preservation.

**Discussion:** Successful CTO revascularization was completed and a strong dorsalis pedis artery pulse was restored following intervention.

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### INTRODUCTION

Peripheral arterial interventions now include routine revascularization of complete total occlusions (CTO) for a variety of clinical entities, including critical limb ischemia.<sup>1</sup> Smaller platform crossing catheters and angioplasty balloons once thought only to be useful in the coronary circulation, have evolved into important devices for crossing difficult lesions. With the application of CTO treatment techniques, it is expected that unusual complications will result and new salvage methods will be reported to avoid emergency surgical conversion of peripheral interventions.

This study reports a complication following CTO treatment of an anterior tibial artery (ATA) involving angioplasty balloon retention with resultant arterial lumen salvage using drug eluting stents (DES).

### CASE REPORT

A 59 year old male was referred by his podiatrist for evaluation and definitive treatment of a several week old, non-healing medial right hallux ulcer. The medical history included non-insulin dependent diabetes mellitus, hypertension, hyperlipidemia, and end stage renal disease on hemodialysis. Clinical examination revealed an open wound,

1.4 × 2.3 × 0.1 cm, on the great toe, and dry ischemic changes on the second and third toes. There was no exposed bone or purulence. Vascular examination revealed palpable femoral pulses, absent pedal pulses bilaterally, and only a faint monophasic signal on the dorsum of the right foot. Local wound care was continued and non-invasive duplex studies were ordered. Plain X-ray excluded osteomyelitis.

The patient was offered angiography to define and potentially treat his arterial disease but refused intervention for 2 months. Eventually, routine weekly examination revealed purulent drainage from the wound and expressible bone fragments. The patient accepted hospital admission, intravenous antibiotics, debridement, and peripheral intervention, but not amputation or open surgical revascularization if needed.

Contralateral access diagnostic angiography revealed severely calcified aorto-iliac, femoro-popliteal, and tibial arteries. Patent vessels were seen as far as the popliteal artery below the knee, where a 40% stenosis was observed. The ATA was patent but diseased in its proximal one-third, followed by a CTO in its mid-portion, and reconstitution distally through peroneal artery collaterals (Fig. 1). The tibio-peroneal, peroneal, and posterior tibial arteries were all patent; however, none of these vessels were in the angiosome distribution of the wound (Fig. 2).

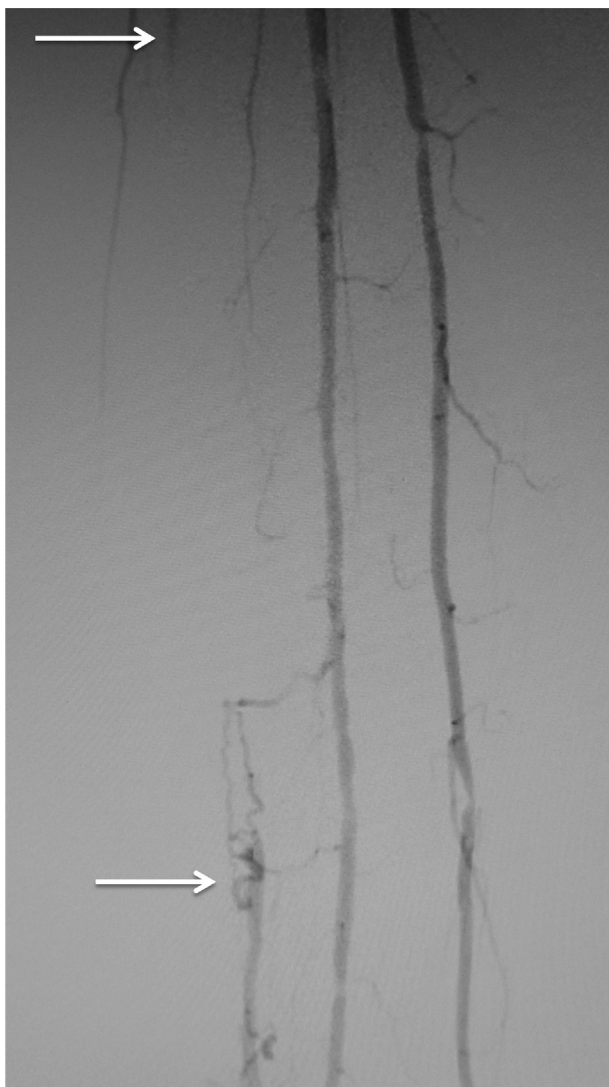
Given the circumstances, the calcified anatomy, and the patient's wishes, a decision was made to treat the ATA disease for limb salvage. Following heparinization (5000 IU), a 6 Fr destination catheter was placed into the mid-right superficial femoral artery. Selective access was obtained

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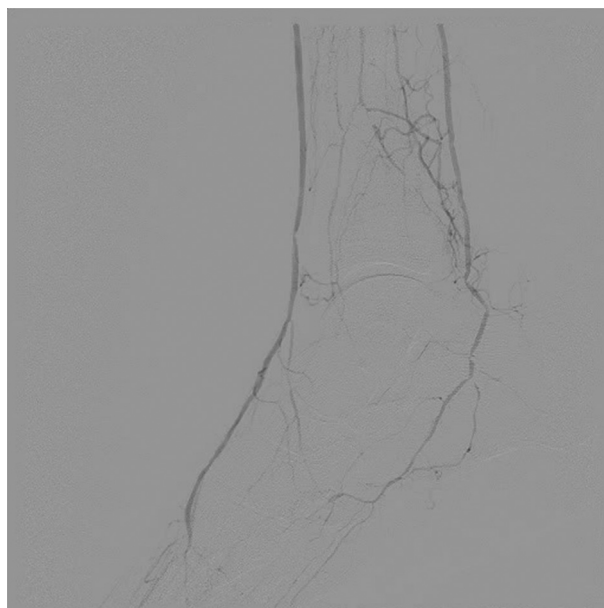
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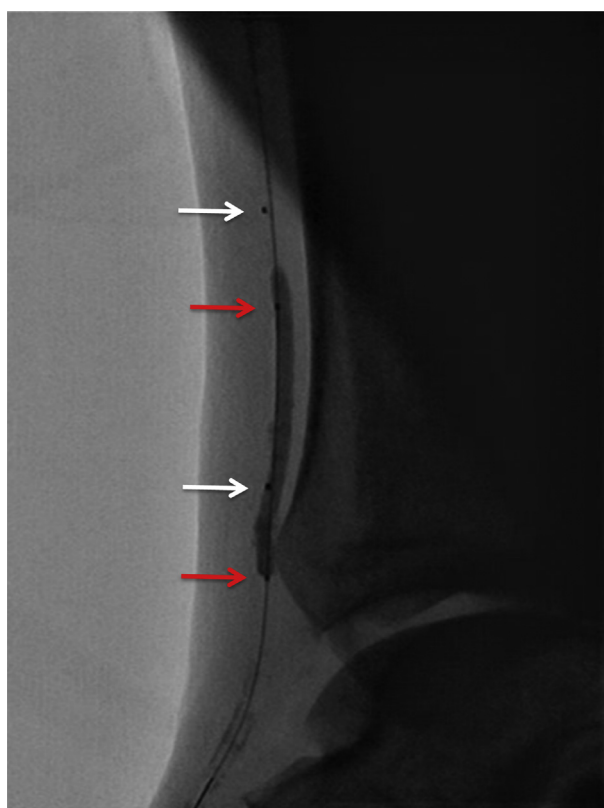


**Figure 1.** Complete total occlusion right anterior tibial artery.

into the popliteal artery, and using a 0.018 in wire (V-18 Control, Boston Scientific) and a tapered CTO crossing catheter (Rubicon, 0.018 in, Boston Scientific), the mid-ATA CTO was crossed. Contrast injection confirmed re-entry into the true lumen. The wire was guided down to the ankle and a 1.5 × 2.0 mm balloon (Sterling, Boston Scientific) was used to angioplasty the CTO cap to allow larger balloons to travel past it. A 2.0 × 40 mm balloon (Coyote, Boston Scientific) was successfully inflated to 8.0 atm and fully deflated. During removal, moderate traction was used to retrieve the balloon. It was noted that while the balloon catheter shaft was intact, the actual balloon had sheared off and was still intra-luminal as evidenced by both radio-opaque markers clearly noted on fluoroscopy of the right mid-leg. Attempts at retrieval included use of a coronary snare (Amplatz Goose Neck, 2 mm × 200 cm × 175 cm, 2.3–3.0 Fr) and a “buddy” balloon (2.5 × 150 mm, Sterling, Boston Scientific) insufflated adjacent to retained balloon (Fig. 3). Ultimately, the retained balloon came off the 0.018 wire and lodged at the distal ATA just above the ankle. A



**Figure 2.** Angiogram of the right lower extremity with run off.



**Figure 3.** Retained angioplasty balloon (white arrows) and attempted retrieval angioplasty balloon (red arrows).

0.014 in wire was placed in the dorsalis pedis artery and a 3.0 × 20 mm and an overlapping 3.0 × 24 mm series of everolimus drug eluting stents (Promus, Boston Scientific) were deployed across the retained balloon and angioplastied (2.5 × 40 mm, Coyote, Boston Scientific) (Figs. 4 and 5). Peroneal artery collaterals, distal ATA, and dorsalis pedis

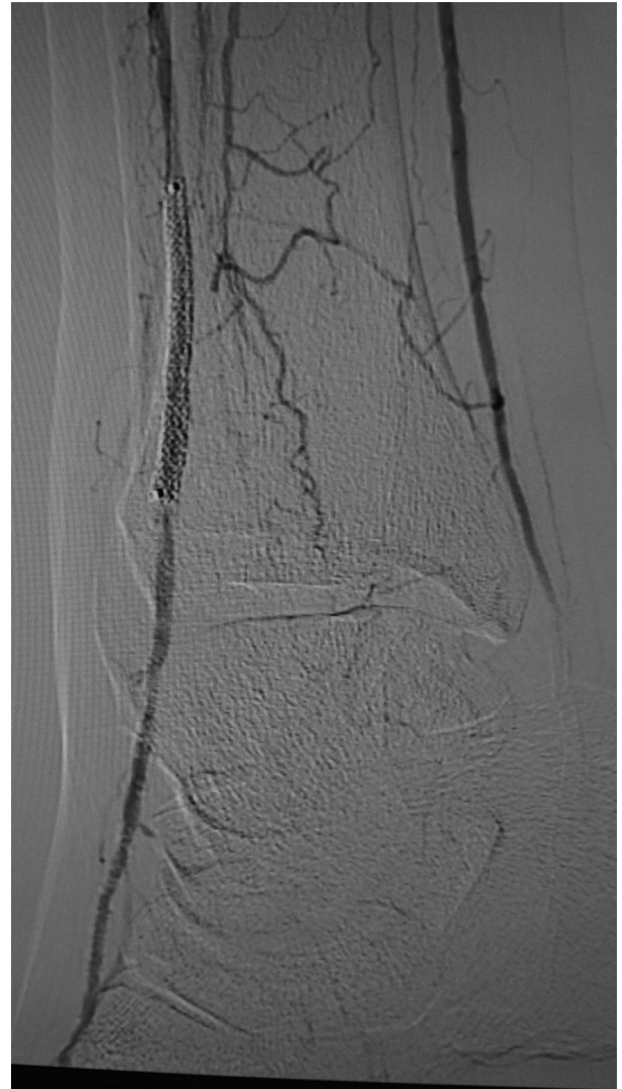


**Figure 4.** Proximal and distal markers, retained angioplasty balloon.

artery were preserved. The CTO was angioplastied with a  $2.5 \times 220$  mm and  $3.0 \times 100$  mm series of balloons (Coyote, Boston Scientific). A total of 4.0 mg of catheter directed alteplase was infused to lyse thrombus at the origin of the ATA. A strong dorsalis pedis artery pulse was restored on table.

Diagnostic angiography was repeated the following morning following loss of the pedal signal through the night despite anticoagulation with heparin and clopidogrel (600 mg). A thrombosed ATA at the level of the CTO was noted. An additional 4.0 mg of catheter directed alteplase restored arterial flow through the ATA. A  $3.0 \times 100$  mm angioplasty (Coyote, Boston Scientific) was performed out of concern that a luminal dissection may have caused the thrombosis. A palpable dorsalis pedis pulse was restored again.

Heparin was continued for an additional 48 hours and with observed vascular stability, surgical debridement including removal of an infected hallux proximal phalanx was performed. The wound was partially closed, packed daily, and long-term antibiotics planned. The patient



**Figure 5.** In line flow through stent opposed retained angioplasty balloon.

showed early signs of wound healing; however, given the clinical osteomyelitis, he was placed in hyperbaric oxygen therapy (HBO). By the third week, the wound had healed fully and pulses were maintained. He completed 19/30 total treatments, but unfortunately died as a result of a motor vehicle accident.

## DISCUSSION

Retention of endovascular equipment may be related to device malfunction or operator error. Stenting away a foreign body is not a new technique as evidenced by reports in the interventional cardiac literature; however, it is submitted that the present case is likely to be the first described in the peripheral arterial circulation. A recent report from Carroll et al. thoroughly described the types of endovascular equipment retained and the required techniques of retrieval in their analysis at a single institution.<sup>2</sup> At the time of writing this report, this is the first reported incidence of retention of a peripheral arterial angioplasty

balloon following deflation, and on the United States government based medical device safety reporting websites (MAUDE database).<sup>3</sup>

In the present case, the angioplasty balloon became dislodged from the shaft presumably because it got snared on the heavily calcified plaque constituting the CTO. Its ultimate embolization more distally was iatrogenic and occurred during unsuccessful attempts at removal using all available snaring techniques. A review of the contemporary literature regarding retained balloons only reveals description of coronary equipment and the applied treatment techniques.<sup>4–6</sup> All such reports involve endovascular or surgical retrieval in the coronary circulation.<sup>7,8</sup>

When percutaneous retrieval or surgical salvage of balloons is not feasible, a successful outcome may be measured by maintenance of the native vascular lumen. Although long-term data are lacking, very distal peripheral arterial stenting across the retained device may be the only endovascular option in this unique complication.<sup>9,10</sup>

#### CONFLICT OF INTEREST

None.

#### FUNDING

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