Subintimal Angioplasty Track of the Superficial Femoral Artery
A Histological Analysis

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Since it was first described in 1990, subintimal angioplasty (SIA) has proven to be a valuable alternative for bypass surgery in patients with atheroocclusive disease of the superficial femoral artery (SFA). In this minimally invasive technique, a guidewire is intentionally placed between the intima and the media to create a new track along the vessel wall, bypassing the atherosclerotic occlusion. However, to our knowledge, the exact route of this subintimal track has never been confirmed with histopathology.

There have been debates about the exact route of the guidewire during this procedure. Bolia et al were the first to report on this technique and emphasized that during subintimal passage, the guidewire does not pass the medial layer. On the other hand, Reekers et al observed that large, extensive, medial calcifications often result in the inability to perform this technique and concluded that the passage through the medial layer is necessary. Reekers et al, therefore, preferred to call this technique percutaneous intentional extraluminal revascularization.

In this case report, we present a patient from whom an endarterectomy specimen of an occluded SFA was obtained 2 months after an SIA procedure, which gave the unique opportunity to study the exact route of the subintimal track using histopathology.

Case
A 68-year-old woman was referred to our clinic with necrotic wounds around a former (traumatic) right-sided hallux amputation wound. Pulsations of the popliteal, anterior tibial, and dorsal pedic arteries were absent. Contrast-enhanced magnetic resonance angiography 8 weeks before the procedure revealed multiple pinpoint stenoses of a nearly occluded SFA.

Figure 1. Schematic overview of a subintimal angioplasty procedure. A, Artery with occluding atherosclerotic plaque in the lumen (dark gray), internal elastic lamina (black), and media (gray). B through D, An angle-tipped guidewire is introduced into the subintimal space (B) and encouraged to form a loop by moving the catheter tip downward (C), enabling expansion of the subintimal track (D). E, Reentry of the true arterial lumen distal of the occlusion. F, Final result, with blood bypassing the occluded artery through the subintimal neolumen. Cross-sections of the occluded artery and the occluded artery with an open subintimal track are depicted above A and F.
A schematic summary of the SIA procedure is depicted in Figure 1. After introduction of a 6-F sheath by retrograde puncture of the contralateral femoral artery, a diagnostic angiogram revealed that the stenoses had progressed to a total occlusion of the entire SFA (Figure 2A). An SIA procedure was performed; Figure 2B and 2C show the loop formed by the 0.035 guidewire within the subintimal space of the SFA, creating a novel track. This track was dilated with a 3 and 4 mm balloon; Figure 2D demonstrates the post-SIA situation, with a patent subintimal track and outflow of contrast in the SFA (4) and popliteal artery (5) toward the trifurcation, enabling bypass of the occluded segment.

Postprocedurally, the patient received clopidogrel and calcium carbasalate. The necrotic wounds did not show any healing tendency; therefore, 2 months later, a remote endarterectomy of the SFA was performed. The entire intimal core (including the atherosclerotic plaque and parts of the media of the vessel wall) of the SFA were dissected (Figure 3). The intimal core (length, 28 cm) was cut into segments of 1 cm, and every segment underwent histological study (Figure 3). In this way, we were able to reconstruct the track of the guidewire of the SIA procedure through the arterial wall.

Histology at multiple levels revealed a dissection of the arterial wall located between the internal elastic lamina and the atherosclerotic plaque (Figure 3). The newly formed route in the arterial wall was filled with thrombus at all levels. This observation confirms the early reobstruction of the SIA track and could explain the lack of postprocedural healing tendency. At distal levels, the thrombus showed more signs of organization than proximally, suggesting that the obstruction of this newly formed lumen began at the distal part of the artery. The true lumen of the artery focally was totally occluded by the atherosclerotic plaque, compatible with the observed occlusion before the SIA procedure.

**Discussion**

To our knowledge, this is the first time the track of a guidewire after a recent SIA procedure of the SFA was studied using histology to visualize the exact route of the newly developed subintimal neolumen. Important morphological changes following transluminal angioplasty have been described, but histology following SIA has not been reported. We report that the subintimal track had been formed between the internal elastic lamina and the atherosclerotic plaque at most levels. This single-case study confirms the idea that SIA is not a random extraluminal revascularization procedure but creates subintimal passage in the form of a dissection between the atherosclerotic plaque and the media of the artery.

**Acknowledgments**

The authors thank Mrs Petra Homoet-van der Kraak for her excellent technical support.

**Disclosures**

None.

**References**


**Key Words:** peripheral vascular diseases revascularization histology angioplasty
Figure 3. The entire resected intimal core is depicted at the left; the proximal part is marked with a suture. Histology of segments taken at a distance of 2, 12, 16, and 21 cm is demonstrated. Sections on the left are stained with elastic Van Gieson; consecutive sections on the right are stained with hematoxylin and eosin. The true lumen of the superficial femoral artery is almost occluded within 3 segments (*) but is open at 16 cm distance (†). The occluded subintimal track can be seen at distances of 12, 16, and 21 cm, as demonstrated by the presence of an organized thrombus (‡). Bar=1 mm. Magnification at 30×.
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Circ Cardiovasc Interv. 2012;5:e6-e8
doi: 10.1161/CIRCINTERVENTIONS.111.967026
Circulation: Cardiovascular Interventions is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 1941-7640. Online ISSN: 1941-7632

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