

# Open surgical repair of true saccular aneurysm of dorsalis pedis artery using a reversed great saphenous vein bypass graft

Marcus J. Kwon, OMS-4,<sup>a</sup> Jennifer H. Ra, OMS-4,<sup>a</sup> Jaime Said, OMS-4,<sup>a</sup> and Patrick M. Tamim, MD,<sup>b</sup> Dothan, AL; and Panama City, FL

## ABSTRACT

True aneurysms of the dorsalis pedis artery (DPA) are very rare phenomena with no obvious pathophysiology. Prompt diagnosis and treatment are important due to the high risk of thrombosis, distal embolization, hemorrhage, and rupture. We present a case of a true DPA saccular aneurysm in a 58-year-old man and highlight the feasibility of using a reversed great saphenous vein bypass graft in specifically treating true DPA aneurysms. Our treatment resulted in near-immediate resolution of the patient's foot pain and mass without complications and maintaining arterial patency. (*J Vasc Surg Cases Innov Tech* 2024;10:101378.)

**Keywords:** Dorsalis pedis artery; Idiopathic; Reversed great saphenous vein bypass graft; True saccular aneurysm

True aneurysms of the dorsalis pedis artery (DPA) are rare phenomena, with only 25 cases reported in the literature.<sup>1</sup> Most DPA aneurysms occur after trauma or iatrogenic injury and often result in the formation of pseudoaneurysms.<sup>1-5</sup> In contrast, the pathophysiology of true aneurysms of the DPA remains unclear.<sup>6</sup> Previous studies have identified atherosclerotic conditions, such as hypertension, diabetes mellitus, and hyperlipidemia, in patients presenting with true DPA aneurysms.<sup>1,2,7</sup> Physical examination findings commonly include a soft, pulsatile mass that can produce pain and discomfort with gait or wearing shoes.<sup>8,9</sup> Prompt diagnosis and treatment are important because patients are at a high risk of thrombosis, distal embolization, hemorrhage, and rupture.<sup>3,10</sup> We present the case of a true DPA saccular aneurysm in the left foot of a patient with no history of trauma or iatrogenic injury. The patient provided written informed consent for the report his case details and imaging studies.

## CASE REPORT

A 58-year-old man with hypertension, hyperlipidemia, and type 2 diabetes mellitus presented for follow-up 5 weeks after a Brostrom procedure for lateral ankle ligament reconstruction. He is a

former one pack-per-day smoker but had quit 30 years prior. He had no reported family history of aneurysmal or vascular disease. He complained of a pulsatile lesion on his left foot with associated foot pain. On further interview, it was determined that the foot mass had been present before the ankle procedure. Doppler ultrasound was obtained in the office, which demonstrated a large 3.7 × 1.5 × 1.0-cm true saccular aneurysm with bidirectional Doppler flow in the DPA (Fig 1). An examination of his lower extremities revealed 2+ pulses to the femoral, popliteal, tibial, and dorsalis pedis arteries. No neurologic deficits were noted. An ~3-cm pulsatile mass was palpable at the left flexor surface of the ankle. He was subsequently scheduled for open surgical repair with planned reconstruction and bypass after dissection of the true saccular aneurysm.

The reversed great saphenous vein bypass graft was harvested from the left lower leg in the ankle to mid-calf region and stored in heparinized solution. The patient received systemic heparin, and proximal and distal control was obtained with the anterior tibial artery and DPA. The true saccular aneurysm was subsequently identified (Fig 2) and excised in its entirety. It was apparent at that time that there was a 1-cm length disruption of the posterior surface of the DPA with a large underlying aneurysm cavity and thrombus. After excision of the aneurysm, the posterior wall of the DPA was intact. However, due to the severe friability, the posterior wall was removed. Throughout the entire open surgical repair, no evidence was found of scar tissue surrounding the identified true saccular aneurysm in the DPA. This supported our suspicion of a noniatrogenic cause, because the Brostrom procedure had not been performed in the same operative location. A longitudinal arteriotomy was then created on the distal anterior tibial artery and extending to the anterior surface of the DPA. The previously dissected reversed great saphenous vein bypass graft was interpositioned and successfully anastomosed in an end-to-end fashion with running 7-0 Prolene suture (Fig 3).

From the Alabama College of Osteopathic Medicine, Department of Research, Dothan<sup>a</sup>; and the Panama City Vascular, Vascular Surgery Division, Panama City.<sup>b</sup>

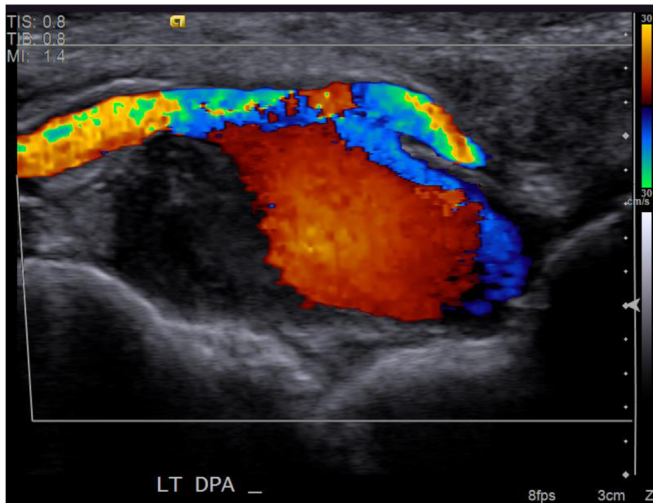
Correspondence: Marcus J. Kwon, OMS-4, Alabama College of Osteopathic Medicine, Department of Research, 445 Health Sciences Blvd, Dothan, AL 36303 (e-mail: [kwonm@acom.edu](mailto:kwonm@acom.edu)).

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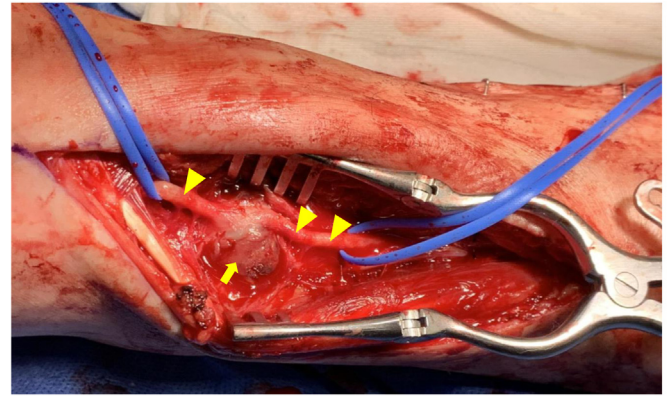
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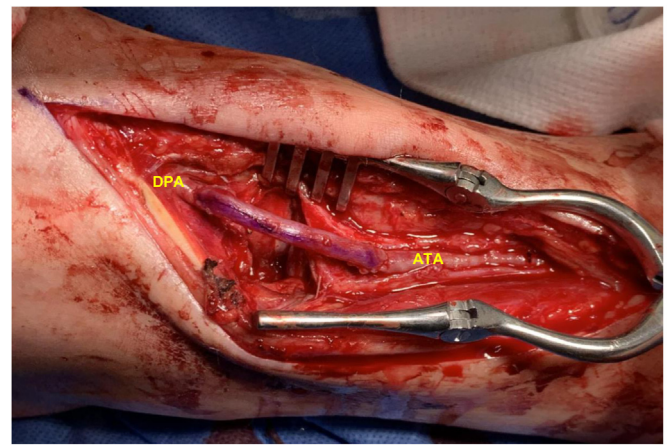
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**Fig 1.** Doppler ultrasound scan demonstrating a large  $3.7 \times 1.5 \times 1.0$ -cm true sacular aneurysm of the left (LT) dorsalis pedis artery (DPA).



**Fig 2.** True sacular aneurysm (arrow) connected to the dorsalis pedis artery (DPA; arrowheads).



**Fig 3.** Intraoperative photograph after anastomosis using a reversed great saphenous vein bypass graft from the distal anterior tibial artery (ATA) and extending to the anterior surface of the dorsalis pedis artery (DPA).

Postoperatively, the patient's symptoms of foot pain and mass were significantly improved without any complications, and he was eventually discharged home. He was instructed to take aspirin 81 mg daily with follow-up surveillance at 3, 6, and 12 months postoperatively. He subsequently presented at the outpatient clinic at 3 weeks after repair. He had experienced no sequelae and had complete resolution of his foot pain, edema, and mass. At 3 months after repair, Doppler ultrasound demonstrated that the bypass graft remained patent (Fig 4).

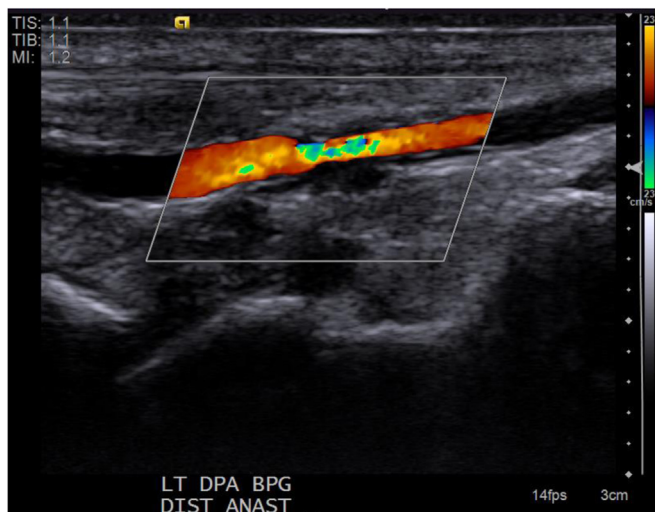
## DISCUSSION

True DPA aneurysms are highly uncommon, with only 25 cases reported in the literature.<sup>1</sup> The exact pathophysiology of true aneurysms is uncertain but is thought to be associated with several intrinsic or extrinsic factors. Intrinsic mechanisms that increase the risk of vascular wall abnormalities and the formation of true aneurysms include collagen disorders and atherosclerosis. Extrinsic mechanisms that cause mechanical stress to the arterial walls have also been associated with true aneurysm formation, including trauma and atherosclerosis.<sup>1</sup>

Clinically, DPA aneurysms are initially categorized as either true aneurysms or pseudoaneurysms.<sup>11</sup> Most reported cases of DPA aneurysms are pseudoaneurysms associated with trauma or iatrogenic injury. We report a case of a true aneurysm of the DPA. A case of a pseudoaneurysm of the anterior tibial artery after a Brostrom procedure has been reported in the literature;<sup>12</sup> however, none has been associated with a true aneurysm. Our patient reportedly had had an existing foot mass before the Brostrom procedure, in the absence of other surgical or trauma history. This appeared to suggest a more chronic and insidious onset, indicating an increased likelihood of an idiopathic true aneurysm and not a pseudoaneurysm related to the Brostrom procedure. Additionally, we

found no evidence of scar tissue throughout the entirety of the open surgical repair of the true aneurysm, further supporting our suspicion of a noniatrogenic cause. The Brostrom procedure had been performed at the lateral malleolus, which was separate and noncontiguous to the operative region of the aneurysm repair at the dorsum of the foot.

Another aspect of this case that might warrant further investigation is testing for any vascular or connective tissue disease. The patient denied any personal or family history of aneurysmal disease. The patient was not screened for aneurysms in other locations outside the anterior tibial artery and DPA. Because true aneurysms grow over time, it might be beneficial for the patient to undergo further evaluation for such aneurysms at other locations. It would have also been helpful to have additional preprocedural angiography or cross-sectional imaging studies to better characterize the aneurysm. Pathologic examination of the excised aneurysm would



**Fig 4.** Doppler ultrasound image demonstrating patent bypass graft (BPG) of left (LT) dorsalis pedis artery (DPA) at 3 months after repair. DIST ANAST, Distal anastomosis.

have been useful in confirming the diagnosis of a true aneurysm; however, this was not obtained.

Symptomatic aneurysms are at risk of thrombosis or embolization, and surgical management is recommended.<sup>5</sup> True aneurysms that arise elsewhere in the body are typically treated surgically with patch angioplasty, ligation, or grafting. Historically, arterial ligation with aneurysm excision is common, with excellent outcomes as long as the posterior tibial artery is patent enough to provide collateralization to the distal foot. More recently, DPA reconstruction and bypass have been advocated to preserve arterial patency in the case of future vascular complications such as arteriosclerosis or diabetic occlusions.<sup>7,13</sup> We report a rare case of a true DPA saccular aneurysm that was successfully repaired using a reversed great saphenous vein bypass graft. Patch angioplasty was ruled out because the DPA was too friable. Primary end-to-end anastomosis was also considered but deemed infeasible due to insufficient mobilization for repair. Given the patient's medical history of diabetes mellitus, hypertension, and hyperlipidemia, we believed it would be beneficial to preserve all routes of blood flow to the foot. To the best of our knowledge, the saphenous vein bypass graft to treat a true DPA aneurysm has been used for only four other cases, with excellent outcomes.

## CONCLUSIONS

True DPA aneurysms are almost always treated surgically. Arterial ligation with aneurysm excision has been the standard treatment option for true DPA aneurysms; however, reconstruction and bypass have been more recently advocated to preserve arterial patency in the case of future peripheral vascular disease. We highlight the use of a reversed great saphenous vein bypass graft as another treatment approach to strongly consider for surgical repair of true DPA saccular aneurysms.

## DISCLOSURES

None.

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Submitted Jun 29, 2023; accepted Nov 6, 2023.