

# Surgical Indications

## for Popliteal Artery Disease

Disease processes and anatomies best suited for open surgery.

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Until relatively recently, this article would likely have been entitled the converse: “Endovascular Indications for Popliteal Artery Disease.” Due to a multitude of factors, the purists historically considered popliteal artery disease as off limits to endovascular therapy and best served by surgical revascularization. This idea held true for occlusive disease, thrombotic/embolic disease, and aneurysmal disease. However, newer modalities and studies suggesting efficacy for the treatment of popliteal disease have placed endovascular therapies ahead of open surgical treatment. Thrombolytics, covered stents, atherectomy, smaller self-expanding stents, and newer angioplasty techniques have opened this vascular territory to endovascular treatments. However, certain disease processes and anatomic situations remain best treated by classical open surgery.

### **ANATOMY**

The popliteal artery is the extension of the superficial femoral artery. It is usually considered to begin at the adductor magnus and extend to the point at which the anterior tibial artery branches. Although the embryologic development of the artery is quite elegant, any deviation during this process can lead to anatomic variations in position. Given its location, the popliteal artery is associated with multiple flexion points and is a preferred anastomotic site (preferably, above-knee popliteal) for surgical bypass procedures. Surgical treatment of popliteal artery disease generally avoids the problems with flexion points that can result in stent fractures and restenosis. The popliteal artery

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is commonly affected by atherosclerotic and aneurysmal disease. Much less commonly affecting this vessel are rare diseases, such as vasculitis, popliteal entrapment syndrome, or cystic adventitial disease.

### **CYSTIC ADVENTITIAL DISEASE**

Originally described in the external iliac artery, cystic adventitial disease is actually more common in the popliteal artery. Cystic adventitial disease occurs when intramural mucin-containing cysts develop between the media and adventitia. Although their exact pathogenesis is not clearly defined, many vascular specialists widely support the theory of repetitive arterial trauma within the mobile knee joint causing adventitial destruction and cyst formation. These cysts can result in compression of the popliteal artery, leading to stenosis or even occlusion. Patients are frequently young men with a recent development of claudication. Knee flexion results in a diminished distal pulse, and occasionally, a bruit may be heard in the popliteal fossa. During angiography, a smooth, curvilinear (scimitar sign) or hourglass narrowing is visualized. Although some interventionists have aspirated the cysts,

the recurrence rate is high, and surgical cyst excision or evacuation is the treatment of choice. Adjunctive arterial reconstruction is easily performed at the same setting.

### POPLITEAL ARTERY ENTRAPMENT SYNDROME

The first description of the popliteal artery entrapment syndrome (PAES) was in 1879. PAES represents an uncommon anatomic anomaly and should be particularly considered in younger athletes presenting with claudication. PAES can result in deviation of the popliteal artery medially as it courses around the medial gastrocnemius muscle head. This results in intermittent compression (entrapment) of the popliteal artery between the muscle and the medial femoral condyle. It can also be compressed by fibrous bands or the popliteus muscle. This repetitive compression can lead to arterial fibrosis, stenosis, thrombosis, aneurysm formation, and distal embolization. Occasionally, this anatomic configuration can be seen after surgical misplacement of a bypass graft. Angiography, including pedal maneuvers of active plantar flexion against resistance and passive dorsiflexion, can lead to the diagnosis by demonstrating a medial course of the popliteal artery and vessel compression not seen in neutral position. Noninvasive imaging with CT or MR can also be helpful. Surgical reconstruction is the treatment of choice.

### EXTRINSIC COMPRESSION

Aside from cystic adventitial disease and PAES, the popliteal artery can be compressed by other surrounding structures. In adductor canal compression syndrome, there is an abnormal band of tissue from the adductor magnus muscle that courses over the superficial femoral artery/popliteal artery. Uncommonly, a Baker's cyst, bony prominence, or even venous aneurysm can result in arterial compression. These conditions are best treated surgically.

### POPLITEAL ARTERY ANEURYSMS

The popliteal artery is the most common site of a peripheral artery aneurysm, accounting for up to 85% of peripheral aneurysms. By definition, these are >1.5 cm, frequently bilateral, and are associated with abdominal aortic aneurysms. These aneurysms become symptomatic from distal embolization, rupture, local neurovascular compression, and most commonly, thrombosis. There have been multiple studies evaluating the efficacy of endovascular repair of these aneurysms with reasonable outcomes, often with concomitant thrombolysis if the popliteal artery is acutely occluded. Some vascular specialists, however, do not favorably view the use of a covered stent in the popliteal artery; the principle counterargument is that the covered stent in this region can thrombose—thus, the

largest risk of a popliteal artery aneurysm has not been reduced. Along these lines, mycotic aneurysms of the popliteal artery (rare) and septic or tumor emboli are likely best treated surgically.

### ATHEROSCLEROTIC OCCLUSION OF THE POPLITEAL ARTERY

Occasionally, the interventionist will encounter a completely occluded popliteal artery from atherosclerotic disease. Advances in catheter-based techniques for recanalization and the use of a retrograde pedal approach have reduced the need to consider surgical bypass at this level. However, there are some lesions for which recanalization is not possible. In patients with critical limb ischemia who have reasonable distal targets, surgical bypass is a viable alternative for limb salvage.

### CONCLUSION

Fortunately, the majority of common popliteal artery lesions can be successfully treated with endovascular techniques. The clinician should have an understanding of less common entities, such as PAES and cystic adventitial disease. Ultimately, we must tailor our treatment strategies, be it surgery or endovascular therapy, for the patient and the associated anatomic disease process. ■

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