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*Clinical Research*

# Chronic Nonatherosclerotic Occlusive Popliteal Artery Disease

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**Background:** The outcomes of revascularization of nonatherosclerotic occlusive popliteal artery disease are unknown. Therefore, the objective of this study was to analyze the outcomes of recanalization of nonatherosclerotic occlusive popliteal artery disease, the results of which would be useful in creating surgical strategies for such cases.
**Methods:** From January 2000 to December 2015, a total of 22 patients with nonatherosclerotic occlusive popliteal artery disease underwent open surgical repair. We retrospectively analyzed the data of these patients. Thrombectomy with angioplasty on the occluded popliteal artery, graft interposition, and bypass surgery were conducted for revascularization of the affected region. We analyzed the overall primary patency rate, type of graft, and surgical approach. Furthermore, we compared the primary patency rate after surgical treatment.
**Results:** Of 22 patients, 3 (13.6%) had cystic adventitial disease, 16 (72.7%) had popliteal artery entrapment syndrome, and 3 (13.6%) were diagnosed as having thromboangiitis obliterans. Five patients (22.7%) underwent thrombectomy with patch angioplasty, 8 (36.3%) underwent bypass surgery, and 9 (40.9%) underwent graft interposition of the popliteal artery. All graft interpositions and thrombectomies with patch angioplasty were performed through a posterior approach, whereas all bypass surgeries were performed through a medial approach except in 1 case. The mean follow-up period was 54.95 ± 42.99 months. The overall primary patency rate at 1, 3, and 10 years was 100%, 86.9%, and 69.5%, respectively. In the bypass group, the primary patency rate at 1, 3, and 10 years was 100%, 66.7%, and 44.4%, respectively. In the other groups, the primary patency rate was 100% during the follow-up period. The difference in primary patency rate was statistically significant ($P \leq 0.05$).
**Conclusions:** The result of surgical treatment for nonatherosclerotic occlusive popliteal artery disease was better than that of atherosclerotic popliteal artery disease. Direct popliteal artery reconstruction, such as graft interposition or thrombectomy with patch angioplasty, showed better short- and long-term patency than did bypass surgery.

## INTRODUCTION

Atherosclerotic occlusive disease is the most common cause of low-extremity ischemia. Hirsch et al.[1] reported that the prevalence of atherosclerotic peripheral artery disease is up to 29% in the general population. However, in the absence of significant atherosclerotic risk factors, especially in younger and more active persons, nonatherosclerotic occlusive popliteal artery disease (NAOPAD) must be considered as a cause for low-extremity ischemia.[2] NAOPAD includes popliteal artery entrapment syndrome (PAES), cystic adventitial

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disease (CAD) of the popliteal artery, fibromuscular dysplasia of the popliteal artery, thromboangiitis obliterans (TAO) of the popliteal artery, and medium vessel vasculitis of the popliteal artery.[3] PAES, CAD, and TAO of the popliteal artery are by far the most common of these rare pathologies. These diseases have distinctive clinical manifestations, prognosis, and pathophysiology compared with atherosclerotic occlusive disease of the popliteal artery. Accordingly, the treatment and outcomes of NAOPAD may also differ from those of atherosclerotic occlusive disease of the popliteal artery. Many studies have examined the outcomes of revascularization of atherosclerotic occlusive lesions of the popliteal artery region.[4–7] However, to our knowledge, no report exists regarding the outcomes of revascularization of NAOPAD. Therefore, the objective of this study was to analyze the outcomes of recanalization of NAOPAD, the results of which would be useful in creating surgical strategies for such cases.

## METHODS

### Patients

This retrospective, single-center, observational study was approved by the Institutional Review Board of Asan Medical Center. We analyzed patients who underwent surgical treatment for popliteal artery disease with ischemic signs or symptoms from January 2000 to December 2015. Ischemic signs or symptoms of the lower limb were categorized according to the Inter-Society Consensus for the Management of Peripheral Arterial Disease guidelines.[8] The popliteal artery region was limited to below the adductor canal above the popliteal bifurcation for the evaluation of operative findings. Patients with atherosclerotic popliteal artery disease were excluded. Patients with popliteal artery aneurysm and trauma and those who underwent myotomy only for the treatment of PAES, were also excluded (Fig. 1). Magnetic resonance imaging (MRI) was used to confirm CAD and diagnose PAES. In cases of uncertain PAES based on computed tomography (CT) angiography or MRI, conventional angiography was performed with dorsiflexion of the foot during a provocation test for diagnosis. TAO was previously diagnosed according to the TAO diagnostic criteria.[9]

### Treatment

All included patients received surgical treatment performed by 2 expert vascular surgeons. Thrombectomy with angioplasty on the occluded popliteal artery, graft interposition, and bypass surgery were conducted for revascularization of the affected region. During the operation, we used autogenous vein graft or patch whenever possible; otherwise, polytetrafluoroethylene was used. The surgical approach was determined according to the operation type. Thrombectomy with angioplasty and graft interposition were performed through a posterior approach, and bypass surgery was mainly performed through a medial approach. However, when additional surgical management such as myotomy in PAES was needed, bypass surgery was performed with a posterior approach. Moreover, patients with CAD underwent surgical cyst excision simultaneously, whereas patients with PAES underwent myotomy of the medial head of the gastrocnemius muscle or resection of any abnormal musculotendinous structure according to Rich's classification.[10] These patients needed surgical management for releasing extrinsic compression and restoring arterial flow.

### Outcomes

For the analysis of surgical treatment outcome, we evaluated the overall primary patency rate, type of graft, and surgical approach. Moreover, we compared the primary patency rate after surgical treatment. Primary patency was defined as freedom from restenosis of the target lesion during follow-up. Distal runoff was inspected by using CT angiography. Risk factors for atherosclerosis obliterans, such as diabetes mellitus, hypertension, hyperlipidemia, smoking, and end-stage renal disease, were analyzed with demographic data. Follow-up data were collected to evaluate ischemic symptoms, physical examination findings, and radiologic findings. After the operation, patients were followed up in an outpatient clinic every 3 months for 1 year. Thereafter, follow-up was conducted annually. If a patient has ischemic symptoms during the follow-up period, ankle-brachial index measurement and duplex ultrasonography were performed. If there were abnormal findings on the test, CT angiography was performed to confirm the primary patency.

### Statistical Analysis

Qualitative variables were described as frequencies and percentages and quantitative variables as mean ± standard error. Between groups, qualitative variables were compared by using the Kruskal–Wallis test, and quantitative variables were compared with Fisher's exact test. For confirming the