

# Hybrid Procedures for Patients With Critical Limb Ischemia and Severe Common Femoral Artery Atherosclerosis

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**Background:** To evaluate the immediate and midterm results of hybrid (combined open surgical and endovascular) lower extremity revascularization procedures in patients with critical limb ischemia (CLI).

**Material and Methods:** Thirty-seven consecutive patients (44 limbs) were treated for CLI using hybrid techniques during a single procedure. The CFA was involved in all limbs and was uniformly treated with endarterectomy and patch angioplasty. Hemodynamically significant atherosclerotic lesions proximal to the CFA were present in 13 limbs, distal to the CFA in 23 limbs, and both above and below the CFA in 8 limbs, and all were treated with endovascular techniques. All patients underwent a detailed clinical assessment and color duplex ultrasonography at 1, 6, and 12 months after the procedure and annually thereafter.

**Results:** The technical success rate was 96.6%, and the limb salvage rate was 95.5%. All patients except three remained free of symptoms without the need for any secondary interventions at the time of the last follow-up. Three patients presented with SFA thrombosis during the first 6 months after the procedure, and two of them had to be amputated. The median follow-up period was 17 months (range: 3-32), and the primary and secondary patency rates at 24 months were 93.2% and 95.5%, respectively.

**Conclusion:** Hybrid lower extremity revascularization procedures can be used to treat CLI with low perioperative morbidity and mortality and good immediate and midterm patency and limb salvage, thus providing an attractive alternative to larger open surgical interventions.

## INTRODUCTION

Patients with critical limb ischemia (CLI) are at increased risk for limb loss with amputation rates as high as 50% if left untreated.<sup>1</sup> Despite recent

advances in perioperative care and anesthetic techniques, extensive revascularization procedures in this patient group carry high perioperative mortality and morbidity rates.<sup>1</sup> Successful treatment of patients with CLI has always been a challenge for the vascular surgeon, as atherosclerotic lesions usually involve multiple vascular beds, requiring extensive, multilevel revascularization procedures. The combined use of endovascular and open (hybrid) techniques in the same surgical setting has been reported since the mid 1990s<sup>2</sup> and has gained popularity over time as vascular surgeons have acquired increasing experience with endovascular interventions.<sup>3</sup>

Although endovascular techniques have been successfully employed in most lower extremity arterial beds, when high-grade stenosis or occlusion of the common femoral artery (CFA) is present,

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endarterectomy is still considered the best treatment option.<sup>4</sup> It can be safely performed even under local anesthesia, thus reducing the perioperative surgical risk. When a stenotic or occluded CFA is associated with hemodynamically significant inflow and/or outflow lesions, the hybrid approach offers adequate access for the treatment of both inflow and outflow lesions while dealing with the CFA lesion in the most appropriate way. The main advantage of hybrid procedures is the ability to treat more complex anatomy by less invasive procedures in patients considered high medical risk.

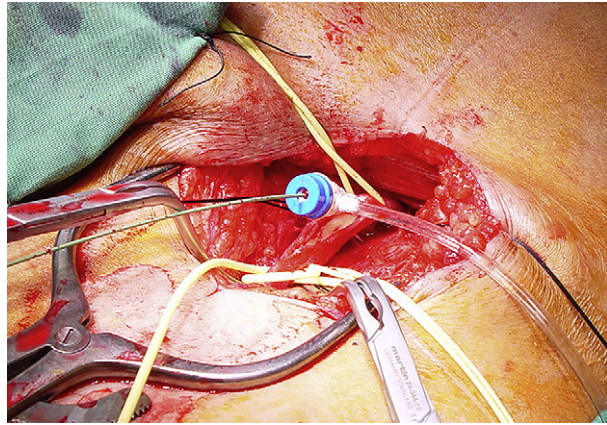
This study was designed to assess the efficacy and durability of such hybrid procedures in patients treated for CLI due to multilevel peripheral arterial disease involving high-grade stenosis or occlusion of the CFA.

## MATERIALS AND METHODS

We performed a retrospective analysis of prospectively collected data from all patients treated in the University Hospital of Ioannina, Greece, between January 2007 and June 2009 for CLI due to multilevel peripheral arterial disease involving the CFA. All patients underwent preoperative evaluation for peripheral arterial disease (PAD) with physical examination, measurement of ankle-brachial pressure index (ABPI), and duplex ultrasonography. Computed tomography (CT) angiography was performed when the duplex ultrasound was suboptimal, such as in cases of obese patients and those having heavy calcification. Preoperative digital subtraction angiography was obtained in every patient.

The Rutherford classification for limb ischemia was used to determine the clinical severity at the time of presentation as specified by the Society for Vascular Surgery (SVS) reporting standards.<sup>5</sup> The indications for intervention, location and length of the arterial lesions, diameter of angioplasty balloon, and size and type of stent deployed were recorded. Iliac and femoropopliteal lesions were stratified according to the Trans-Atlantic Inter-Society Consensus (TASC) II classification, whereas infrapopliteal lesions were classified according to the TASC I.<sup>1,5</sup> Data were entered in the vascular unit's database and included patients' demographics, atherosclerotic risk factors, and presence of comorbidities.

All patients underwent CFA endarterectomy in combination with endovascular repair of inflow and/or outflow lesions in the same surgical setting. CFA endarterectomy was performed using the



**Fig. 1.** Performance of the endovascular procedure immediately after completion of the common femoral artery (CFA) endarterectomy. A 6- to 8-F sheath was inserted retrogradely over a guidewire, and a seal around it was established using a vessel loop.

standard technique under an ipsilateral common femoral bifurcation exposure through a longitudinal groin incision. During endarterectomy, adequate profunda femoral artery (PFA) outflow was always preserved or restored. A patch angioplasty was then performed using a bovine pericardium patch (VascuGuard® Synovis Life Technologies Inc., St. Paul, MN) and a running suture closure. Our strategy for endovascular repair of all lesions proximal to the CFA was to perform the balloon angioplasty and/or stent placement immediately after completion of the CFA endarterectomy. A 6- to 8-F sheath was inserted retrogradely over a guidewire, and a seal around it was established using a vessel loop (Fig. 1). Once the endovascular part of the procedure was complete, the sheath was removed and patch angioplasty was performed. Lesions distal to the CFA were repaired by antegrade puncture of the bovine pericardium patch after the patch angioplasty and flow restoration (Fig. 2). This allowed continuous perfusion of the extremity and better imaging of outflow lesions during the endovascular procedure. Sheaths from 5 to 8F were advanced into the SFA. After the intervention completion, the sheath was removed. Hemostasis was established by placing a Prolene (Ethicon Inc., Somerville, NJ) suture at the puncture site. Completion angiography including the pedal arteries was always performed to ascertain possible peripheral embolization.

Postoperative complications such as myocardial ischemic events, respiratory insufficiency, deterioration of renal function, and wound infections were recorded during the index hospital stay. All patients were followed up with clinical evaluation,

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