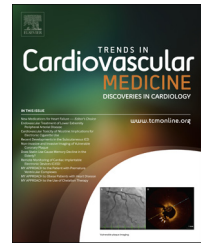


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Endovascular treatment of lower extremity peripheral arterial disease

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ABSTRACT

Peripheral arterial disease (PAD) is extremely prevalent, under-diagnosed and has a tremendous impact on the quality of life of patients with this condition. The foundation of PAD treatment is medical therapy in order to prevent its associated high rates of cardiovascular morbidity and mortality. This therapy should be instituted in all patients with PAD, regardless of symptomatic status. Though the majority of patients with PAD are asymptomatic, they remain at high risk for adverse events, underscoring the need to screen for this disease. This review will briefly touch on the medical therapy for PAD and highlight the necessity to make the diagnosis in all patients at risk. For those patients with symptoms from arterial insufficiency, the frontier of potential treatment options is ever expanding. In this review, the current options for patients with symptomatic lower extremity PAD are highlighted. Given the marked differences in treatment options and outcomes between the aorto-iliac, femoropopliteal and infrapopliteal vascular beds, each of these arenas are discussed separately. Contemporary techniques and data are discussed with respect to both vascular bed and presenting clinical scenario, i.e. claudication, critical limb ischemia and acute limb ischemia.

Key words: Peripheral arterial disease, Endovascular therapy, Claudication, Critical limb ischemia.

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Introduction

Peripheral artery disease (PAD) is a pandemic affecting over 200 million individuals worldwide and 14 million in the Americas alone [1]. These numbers have grown 23.5% since 2000 making PAD the third leading cause of atherosclerotic cardiovascular morbidity in the world [1]. These staggering numbers bring with them an alarming U.S. cost of over 3 billion dollars spent annually treating PAD [2]. Though most of these costs are spent on revascularization procedures, amputations, and hospitalizations for atherothrombosis-related events, these patients are also at a markedly elevated risk for adverse cardiovascular outcomes [3–5], including

stroke and myocardial infarction. The costs, both economic and personal, only add to the tremendous impact of this disease.

Many PAD patients have a dramatic reduction in health-related quality of life [6] through losses of mobility [7] and functional decline, though they may report being asymptomatic [8]. For these patients, when walking ability is improved by supervised exercise therapy (SET), pharmacotherapy, or revascularization, health-related quality of life has been shown to favorably respond [9–12]. Supervised exercise programs are recommended given their success in numerous studies, but widespread use has been limited. Home-based exercise programs [13,14] offer a potential

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alternative. The only pharmacologic agent that is effective in improving walking distance for patients with intermittent claudication is cilostazol [15]. Though recommended, its effect is highly variable with approximately 20% of patients reporting intolerance and it is contraindicated (black-box warning) in any patient with congestive heart failure. Given the aforementioned limitations of SET and cilostazol and the enormous impact PAD has upon patients, there has been a surge in catheter-based interventions for PAD. This is also in part due to increased screening and the adoption of endovascular techniques by both vascular surgeons and interventional cardiologists [16]. Though PAD encompasses a wide array of disorders (atherosclerosis, aneurysms, and vasculitis) involving several vascular beds, it is most often used in the context of lower extremity arteriosclerosis. This review will be limited to the endovascular intervention of the aortoiliac, femoropopliteal, and infrapopliteal vascular beds.

A comprehensive approach

All PAD patients, regardless of symptoms, are at markedly increased risk of cardiovascular morbidity and mortality and require a comprehensive approach to prevent heart attacks, strokes, and adverse limb events. In fact, 60–80% of patients with PAD have CAD in at least one vessel, and 25% have carotid stenosis >70% [17,18]. Screening for PAD [19], with an ankle-brachial index, should occur in all patients' aged 50–69 years with diabetes or any history of smoking, those over the age of 70 and any patient who has symptoms of claudication. Providers should consider the use of exercise-ABI in patients who have normal resting ABIs, because vasculogenic claudication can be confirmed by this provocative study. Though a detailed review of the medical therapy for PAD is beyond the scope of this article and has been reported elsewhere [20], all patients with PAD must undergo risk factor reduction including tobacco cessation and aggressive treatment of hypertension, dyslipidemia, and diabetes. All patients with PAD should be on an anti-platelet agent for the prevention of adverse cardiovascular events and should also be on a statin. Though the majority of patients with PAD are asymptomatic, they remain at risk for adverse cardiovascular outcomes underscoring the need to diagnose this disease and to start therapy given the diffuse nature of atherosclerosis. For those patients with symptoms who proceed to revascularization, continued lifelong risk modification is paramount.

Preventative foot care is also required in all patients with PAD. Meticulous foot and nail care is mandatory to prevent infection and possible amputation. Consultation with podiatric medicine should be considered in all patients with PAD, especially those with diabetes. For those patients with foot deformities, professional orthotic consultation is mandatory to prevent irritation, blisters, and to minimize trauma with walking. At each office visit, careful examination of the patient's feet and review of the need for daily foot care/inspection by the patient/family in addition to education regarding the signs and symptoms of critical limb ischemia is necessary.

Who should be treated with endovascular therapy?

Though the foundation of care of all PAD patients is medical via cardiovascular risk reduction and proper foot care, it has been shown that comprehensive cardiovascular care is underutilized at the time of limb revascularization resulting in poor outcomes [21,22]. This highlights the need for operators to carefully review the medical therapy of every patients presenting for revascularization. For symptomatic patients on optimal medical therapy who fail conservative management, endovascular intervention has provided a minimally invasive alternative to surgical revascularization. Numerous factors play a role in choosing the best treatment strategy for patients as surgical and endovascular therapies should be seen as complementary, not competing. Technology and techniques have advanced over the last decade, such that the acute procedural success of contemporary endovascular procedures is high, even in complex disease. Endovascular therapy has been shown to be effective in treating the following conditions: (a) lifestyle-limiting claudication, (b) critical limb ischemia, and (c) acute limb ischemia. Each of these will be addressed separately given the array of presentations with each disorder.

Patient presentations

Lifestyle-limiting claudication

Classic intermittent claudication is described as reproducible, exertional-induced calf, thigh, buttock, or leg pain that abates with rest and is a product of muscle supply-demand mismatch of oxygenated blood due to fixed arterial obstruction. Claudication is actually only present in a minority of patients with PAD, varying depending upon the cohort studied from 2.5% in the PARTNERS study (all comers) up to 33% in the WALCS study (only patients with PAD) [23,24]. A percentage of patients (~10–30%) may have atypical symptoms including heaviness, loss of power, weakness, and/or numbness. Classically, claudication has been taught to be a stable disease with a benign natural history and most patients having stabilization of their leg symptoms and absence of adverse limb events over 5 years of follow-up. These teachings, however, are based on observational studies [25–27] from 1960s to 1970s. Symptoms may abate because of reductions in levels of physical activity, and it has been shown that a previously described lack of worsening in claudication symptoms over time actually may be more related to declining functional performance than to lack of PAD progression [8]. Hence, providers need to monitor closely for typical and atypical symptoms, and a decline in functional status and consider revascularization as a treatment option, if conservative therapy fails.

The severity of claudication has been defined by the Rutherford–Becker or Fontaine classification schemes (Table 1). In contrast to CLI or ALI, the elective decision to revascularize claudicants is dependent on symptom severity and its' impact on activities of daily living and/or occupation. Pre-procedural non-invasive imaging is recommended for procedural planning and the choice of

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