

Progression of Peripheral Arterial Disease: A Case Study

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The most prevalent reason for limb loss—peripheral arterial disease (PAD)—poses a grave health and financial burden to the over 8 million Americans and 202 million people affected worldwide.^{1,2} The buildup of plaque causes the arteries to harden and narrow over time, reducing blood flow to patients' organs, tissues, and muscles.

If PAD isn't treated quickly and appropriately, it can progress to critical limb ischemia (CLI), an end-stage atherosclerosis of the limb with poor prognosis and increased mortality risk for patients.³

Risk Factors

Multiple risk factors predispose patients to PAD, including tobacco use, diabetes mellitus, hypertension, hyperlipidemia, advanced age, obesity, family history, chronic kidney disease, and coronary artery disease.⁴ African Americans, the elderly, and people who have diabetes have a higher prevalence of the disease.⁴⁻⁶

Symptoms

Claudication presents as the most prominent symptom of PAD. This fatigue, weakness, cramping, and discomfort in the patient's extremities is relieved by rest.

Patients can present with different types of claudication: intermittent claudication (IC), CLI, and acute limb ischemia (ALI). Fifty percent of patients with IC com-

plain of leg pain.⁶ The symptomatic classification of claudication is graded by the Rutherford Scale. (Table 1.)

Different Types of Claudication

Acute limb ischemia occurs within less than 2 weeks of hypoperfusion to the tissue and muscle. The 6 P's characterize the symptoms of ALI: pain, pallor, pulselessness, poikilothermia, paresthesia, and paralysis.⁶ A delay in revascularization can lead to irreversible tissue damage and progression to CLI.

As many as 1 in 10 patients with PAD develop CLI, characterized by significant pain at rest that has been ongoing for more than 2 weeks.⁴ Patients with CLI may also have slow-healing wounds, gangrene, or necrosis. The most severe presentation of end-stage PAD, CLI increases patients' mortality rate regardless of treatment.^{6,7}

Clinical Assessment

A PAD evaluation conducted by a full-service vascular practice consists of a physical examination and a thorough medical history of the patient's pulses, walking habits, leg symptoms, presence of ischemic pain, or tissue loss. Once the provider has assessed the patient for bruits and pulses, they will obtain a diagnostic workup for lower-extremity arterial doppler and ankle brachial index (ABI).

Duplex, a non-invasive angiography that does not require contrast, is essential to an outpatient vascular practice.⁸ Duplex studies are vital to visualizing the degree of ischemia that is present in the artery.

Duplex or Doppler US is utilized to measure arterial pressure; the area under the waveform is a measure of flow. In 15% of patients with peripheral vascular disease,

Table 1. Rutherford Classification For Chronic Limb Ischemia.

Grade	Rutherford Category
I	Asymptomatic
II	Mild claudication
III	Moderate claudication
IV	Severe claudication/Ischemia rest pain
V	Minor tissue loss/Dry gangrene
VI	Major tissue loss/Wet gangrene

the results are elevated due to calcium buildup on the vessel wall. Ankle-brachial index is the value at the ankle level, which is the best predictor for determining adequate inflow to the limb, any reading less than 0.40 is indicative of poor wound healing.

Based on the results of the physical examination and ultrasound, the provider will prescribe a medical management plan.

Management

Endovascular therapies include revascularization with percutaneous balloon angioplasty, stenting, and atherectomy to improve perfusion to the tissue.⁷ Providers usually do not initiate this treatment until the patient is Rutherford 3.

Patients with CLI require immediate revascularization to avoid limb loss. Often, a provider will place the patient on an antiplatelet, anticoagulant, and/or a statin. Patients also should be advised to stop smoking, which promotes vasoconstriction of the arterial and increases the level of fibrinogen and LDL while decreasing fibrinolysis.⁴ Smoking is the major cause of progression of PAD.

Case Study

G. W. is a 70-year-old, white female followed for lower extremity PAD. Three months prior to presentation, she developed COVID-19, a viral infection of the respiratory system that causes a higher prevalence of venous or arterial thromboembolisms and short-term morbidity and mortality.⁹ COVID affected her lungs, prompting multiple visits to the emergency room. She was never hospitalized. She is currently on 2 liters of oxygen per nasal cannula that was initiated with the diagnosis of COVID-19.

She reports significant weakness in the bilateral lower extremities, unresolved since she contracted COVID-19. On today's visit, she presents with a black spot on the fifth metatarsal. She is followed by podiatry. She reports rest pain that awakens her at night, tenderness on palpation and her right foot is cold to the touch with rubor.¹ Her pain is a 10/10 on a scale of 0-10. She denies claudication or cramping that awaken her at night. She has diabetes and her last hemoglobin A1c was 10, due to the high dose steroids she received for the treatment of COVID. Her blood pressure is 134/80 and she is currently on lisinopril and atenolol. Additional diagnoses are obesity, hypertension, anemia, and diabetes mellitus.

Vital Signs. Weight 202 lbs. Height 5'6. Temperature 97.3. BP 134/80. Pulse 88. Respiratory Rate 16. BMI 33.

Past Medical History: atherosclerosis of lower extremities, hypertension, morbid obesity.

Past Surgical History: hysterectomy, foot surgery for torn ligament, appendectomy, bilateral knee replacement, cataract surgery, bladder tack, and cervical screws.

Family History: Her father had glaucoma and her mother had Alzheimer's disease.

Physical Exam. Awake, alert, oriented to person, place, and time. Head is normocephalic. Face is symmetric. Am-

bulates without assistance. Cardiovascular: regular rate and rhythm, no carotid disease noted. Right foot is cold to the touch. Fifth metatarsal has a small pinpoint dot on the lateral portion of the fifth toe. Vascular Assessment: right femoral, palpable; popliteal, nonpalpable; dorsalis pedal, nonpalpable; posterior tibial, nonpalpable.

Conclusion

A progressive disease, PAD must be monitored carefully to prevent limb loss and to preserve a patient's ability to ambulate. Amputations increase mortality rate five-fold in 5 years.^{2,5} In 2005, there were approximately 2 million people living with amputation in the United States; these numbers are expected to double by 2050.¹⁰ The majority of patients who have major amputations have end-stage PAD, also known as CLI.¹¹

Atherosclerosis is a chronic disease that needs close management by a multi-faceted healthcare team. Its progression must be reduced to improve quality of life and decrease the progression of PAD to CLI.^{12,13}

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