



Review

Peripheral arterial disease in women

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ABSTRACT

Peripheral arterial disease (PAD) is chronic arterial occlusive disease of the lower extremities caused by atherosclerosis whose prevalence increases with age. Only one-half of women with PAD are symptomatic. Symptomatic and asymptomatic women with PAD are at increased risk for all-cause mortality, cardiovascular mortality, and mortality from coronary artery disease. Modifiable risk factors that predispose women to PAD include active cigarette smoking, passive smoking, diabetes mellitus, hypertension, dyslipidemia, increased plasma homocysteine levels and hypothyroidism. With regard to management, women who smoke should be encouraged to quit and referred to a smoking cessation program. Hypertension, diabetes mellitus, dyslipidemia, and hypothyroidism require treatment. Statins reduce the incidence of intermittent claudication and improve exercise duration until the onset of intermittent claudication in women with PAD and hypercholesterolemia. Anti-platelet drugs such as aspirin or especially clopidogrel, angiotensin-converting enzyme inhibitors and statins should be given to all women with PAD. Beta blockers are recommended if coronary artery disease is present. Exercise rehabilitation programs and cilostazol increase exercise time until intermittent claudication develops. Chelation therapy should be avoided as it is ineffective. Indications for lower extremity percutaneous transluminal angioplasty or bypass surgery in women are (1) incapacitating claudication interfering with work or lifestyle; and (2) limb salvage in women with limb-threatening ischemia as manifested by rest pain, non-healing ulcers, and/or infection or gangrene. Future research includes investigation of mechanisms underlying why women have a higher risk of graft failure and major amputation.

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Contents

1. Introduction	205
2. Physical examination	205
2.1. Non-invasive diagnosis	205
2.2. Prevalence	206
2.3. Modifiable risk factors	206
2.4. Coexistence with other atherosclerotic disorders	206
2.5. Cardiovascular mortality and morbidity	206
2.6. Risk factor modification	206
2.7. Anti-platelet drugs	207
2.8. Aspirin	208
2.9. Clopidogrel	208
2.10. Oral anti-coagulants	208
2.11. Angiotensin-converting enzyme inhibitors	208
2.12. Beta blockers	208
2.13. Statins	208
3. Drugs to increase walking distance	208
3.1. Exercise rehabilitation	209
3.2. Foot care	209
3.3. Lower extremity angioplasty and bypass surgery	209
3.4. Amputation	209

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4. Conclusion.....	209
Disclosures.....	210
Contributor.....	210
Provenance.....	210
References.....	210

1. Introduction

Peripheral arterial disease (PAD) is chronic arterial occlusive disease of the lower extremities caused by atherosclerosis. PAD may cause intermittent claudication which is pain or weakness while walking that is relieved with rest. The muscle pain or weakness after exercise occurs distal to the arterial obstruction. Since the superficial femoral and popliteal arteries are most commonly affected by atherosclerosis, the pain of intermittent claudication is most commonly localized to the calf. Atherosclerotic obstruction of the distal aorta and its bifurcation into the two iliac arteries may cause pain in the buttocks, hips, thighs, or the inferior back muscles as well as the calves.

The Rutherford classification of PAD includes seven stages [1]. PAD is classified as stage 0 if the person is asymptomatic, stage 1 if mild intermittent claudication is present, stage 2 if moderate intermittent claudication is present, stage 3 if severe intermittent claudication is present, stage 4 if ischemic rest pain is present, stage 5 if the person has minor tissue loss, and stage 6 if the person has ulceration or gangrene.

Only one-half of women with documented PAD are symptomatic. Women with PAD may not walk far or fast enough to induce muscle ischemic symptoms because of comorbidities such as pulmonary disease or arthritis, may have atypical symptoms unrecognized as intermittent claudication, may fail to mention their symptoms to their physician, or may have sufficient collateral arterial channels to tolerate their arterial obstruction. Women with PAD have a higher prevalence of leg pain on exertion and at rest, poorer functioning, and greater walking impairment from leg symptoms than men with PAD [2]. Poorer leg strength in women contributes to poorer lower extremity functioning in women with PAD than in men with PAD [2]. Upper extremity PAD will cause unequal blood pressure measurements in each arm. Women with PAD also have a higher prevalence of cognitive impairment [3].

If the arterial flow to the lower extremities cannot meet the needs of resting tissue metabolism, critical lower extremity ischemia occurs with pain at rest or tissue loss. Critical ischemia causes rest pain in the toes or foot with progression to ulceration or gangrene. Chronic arterial insufficiency ulcers commonly develop at the ankle, heel, or leg. Mummified, dry, black toes or devitalized soft tissue covered by a crust is gangrene caused by ischemic infarction. Suppuration often develops with time, and dry gangrene changes to wet gangrene.

Table 1
Prevalence of peripheral arterial disease in women.

Study	Prevalence
336 women, mean age 66 years [7]	22%
306 women, mean age 60 years [8]	13%
2870 women aged ≥ 65 years [9]	11.4%
1444 women, mean age 81 years [10]	13% ^a
3861 women aged ≥ 55 years [11]	20.5 %
2464 women, mean age 81 years [12]	26% ^a
620 women, mean age 72 years [13]	17.1% ^a
6979 persons (52%) women, mean age 69 years [14]	29% ^a

^a Symptomatic peripheral arterial disease.

2. Physical examination

The vascular physical examination includes (1) measurement of the blood pressure in both arms, (2) palpation of the carotid pulses and listening for carotid bruits, (3) auscultation of the abdomen and flank for bruits, (4) palpation of the abdomen and notation of the presence of the aortic pulsation and its maximal diameter, (5) palpation of pulses at the brachial, radial, ulnar, femoral, popliteal, dorsalis pedis, and posterior tibial sites, and (6) auscultation of both femoral arteries for femoral bruits [4].

The shoes and socks should be removed and the feet inspected. The color, temperature, and integrity of the skin should be evaluated and the presence of distal hair loss, trophic skin changes, hypertrophic nails, and ulcerations noted [4].

2.1. Non-invasive diagnosis

Women with PAD of the lower extremities have reduced or absent arterial pulses. Non-invasive tests used to assess lower extremity arterial blood flow include measurement of ankle and brachial artery systolic blood pressures, characterization of velocity wave form, and duplex ultrasonography. Measurement of ankle and brachial artery systolic blood pressures using a Doppler stethoscope and blood pressure cuffs allows calculation of the ankle-brachial index (ABI) which is normally 0.9–1.2. An ABI of less than 0.90 is 95% sensitive and 99% specific for the diagnosis of PAD [5]. The lower the ABI, the more severe the restriction of arterial blood flow, and the more serious the ischemia. ABIs of 0.6–0.9 usually correlate with mild to moderate intermittent claudication. ABIs of 0.4–0.6 usually correlate with severe intermittent claudication. With ABIs between 0.25 and 0.4, rest pain and tissue loss are often found. Patients with calcified arteries from diabetes mellitus or renal failure occasionally have relatively non-compressible arteries leading to falsely elevated ABI values in the normal range.

In addition to measuring arterial pressure in non-palpable arteries, Doppler ultrasound methods allow characterization of the flow versus time velocity waveform. Finding biphasic flow at the groin or monophasic flow more distally is evidence of arterial obstruction even when ABI measurements are falsely increased to normal levels because of calcification.

Duplex ultrasonography combines Doppler frequency measurements with two-dimensional images of blood vessels. The severity of flow restriction caused by an arterial stenosis can be accurately assessed by this most comprehensive non-invasive method [6].

Duplex ultrasonography, computed tomographic angiography, and magnetic resonance angiography are useful in assessing the anatomic location and severity of PAD and in selecting suitable candidates for endovascular or surgical revascularization [4].

Treadmill exercise testing with and without pre-exercise and post-exercise ABIs helps differentiate claudication from pseudoclaudication in patients with exertional leg symptoms [4]. Treadmill exercise testing may be useful to diagnose PAD with a normal resting ABI but a reduced post-exercise ABI [4]. Treadmill exercise testing may objectively document the magnitude of symptom limitation in patients with claudication [5].

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