Update on Peripheral Arterial Disease and Claudication Rehabilitation

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KEYWORDS

- Peripheral arterial disease • Claudication
- Ankle-brachial index • Exercise therapy
- Claudication rehabilitation • Medical management

UPDATE ON PERIPHERAL ARTERIAL DISEASE

Peripheral arterial disease (PAD) is an atherosclerotic syndrome in which the lumen of the arteries in the lower extremities becomes progressively obstructed by plaque. Although technically PAD can also refer to disease in other vascular beds, exclusive of the coronary vessels, in this article the authors refer to PAD as an arterial occlusive disease affecting the lower extremity arteries.

EPIDEMIOLOGY AND RISK FACTORS

Recent epidemiologic projections indicate a prevalence of PAD of 11% to 16% in the population aged 55 years or older, affecting an estimated 27 million persons in Europe and North America alone.[1–3] Moreover, the prevalence of PAD may be as high as 20% to 30% in specific high-risk populations.[4–6] The reported prevalence of PAD depends on the population selected for testing and the methods used for diagnosis.[7] At the start, intermittent claudication questionnaires were used to estimate the prevalence

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Phys Med Rehabil Clin N Am 20 (2009) 627–656
doi:10.1016/j.pmr.2009.06.004 **pmr.theclinics.com**
1047-9651/09/$ – see front matter

of PAD in a specific population. Later, a noninvasive test known as the ankle-brachial index (ABI) was developed for a more objective assessment of PAD.[8,9] The ABI is calculated by dividing the ankle systolic pressure by the higher brachial systolic pressure, with an ABI less than 0.9 considered up to 95% sensitive and 99% specific for angiographically confirmed lower extremity arterial disease[10] and a reported positive predictive value of 90%, a negative predictive value of 99%, and an overall accuracy of 98%.[11] One study conducted among 613 individuals living in Southern California used several different techniques to assess the presence of PAD.[12] The study reported that the use of a claudication questionnaire alone significantly underestimated the prevalence of PAD, whereas the use of the ABI combined with pulse wave velocity measurements increased the detection of PAD 2 to 7 times more than claudication symptoms alone. In this study, the prevalence of PAD based on ABI less than 0.9 was 18.8% among those aged 70 years or older, in comparison to a prevalence of 2.5% in those aged 60 years or younger.[12]

Other epidemiologic studies have also described an increase in the prevalence of PAD with increasing age, 1 of the most important risk factors for the development of PAD. For example, the National Health and Nutrition Examination Survey (NHANES), a cross-sectional US survey of 2174 individuals, reported a prevalence of PAD (defined by ABI <0.9) of 14.5% in those aged 70 years or older, compared with a prevalence of 4.3% in the overall population aged 40 years or older.[13] Male gender was previously considered an important risk factor for PAD, but subsequent studies have shown that while men are slightly more affected than women in the younger age groups, the distribution of PAD in the older age groups seems equal between genders.

In epidemiologic studies, race-ethnicity has also emerged as a determining factor for the presence of PAD. NHANES reported that the prevalence of PAD in non-Hispanic blacks was as high as 7.8%, compared with 4.4% in whites.[12] The Multi-Ethnic Study of Atherosclerosis (MESA) also reported a higher prevalence of PAD in blacks compared with whites and Hispanics.[14] Although NHANES and MESA showed a lower prevalence of PAD in Hispanics compared with non-Hispanic whites, Morrissey and colleagues[15] reported that Hispanics present with more advanced stages of disease, demonstrating higher rates of limb-threatening ischemia, failed lower extremity revascularization, and amputations than non-Hispanic whites.

As illustrated in **Fig. 1**, additional risk factors that increase the likelihood of PAD are similar to traditional risk factors for atherosclerosis, including smoking, diabetes mellitus, hypertension, dyslipidemia, chronic kidney disease, hyperhomocysteinemia, and elevated C-reactive protein.[16] Of those, the 2 most strongly associated with PAD are smoking and diabetes. Up to 80% of PAD patients report being current or former smokers.[4] Smoking increases the risk of PAD by 2- to 6-fold,[17] and is twice more likely to cause PAD than coronary artery disease (CAD).[18] Diabetes mellitus, present in up to 20% of patients with PAD, increases the risk of PAD by up to 4-fold;[19] in addition, PAD patients with diabetes are at increased risk for developing lower extremity complications such as major limb amputations.

CLINICAL MANIFESTATIONS OF PAD

Intermittent Claudication and Atypical Leg Symptoms

Intermittent claudication, defined as reproducible pain in the lower limbs during exercise relieved by rest, is the most common manifestation of symptomatic PAD.[7] Claudication most commonly refers to pain in the lower extremity muscle groups, though other symptoms such as fatigue, weakness, or other discomfort may also occur.