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Baseline Functional Performance Predicts the Rate of Mobility Loss in Persons With Peripheral Arterial Disease

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Objectives We compared rates of mobility loss among persons with versus without peripheral arterial disease (PAD). Associations between baseline functional performance and mobility loss in persons with and without PAD were studied.

Background Persons with PAD have poorer functional performance than persons without PAD. The prognostic value of poorer performance in persons with PAD is unknown.

Methods Participants were 398 persons with and 240 without PAD who were free of mobility impairment at baseline. Participants were followed for a median of 50 months. Baseline measures included the 6-min walk and the Short Physical Performance Battery score. Mobility status, assessed annually, was defined as the self-reported loss of the ability to walk one-quarter mile or walk up and down one flight of stairs without assistance.

Results Adjusting for age and gender, we found that PAD participants had a greater rate of mobility loss than persons without PAD (hazard ratio [HR] 1.63; 95% confidence interval [CI] 1.03 to 2.56). This difference was not statistically significant after additional adjustment for baseline performance. Among PAD participants, risk of mobility loss in the lowest versus the 2 highest quartiles of baseline performance were as follows: HR 9.65 (95% CI 3.35 to 27.77, $p < 0.001$) for the 6-min walk and HR 12.84 (95% CI 4.64 to 35.55, $p < 0.001$) for the Short Physical Performance Battery when adjusting for confounders.

Conclusions Persons with PAD experience greater mobility loss than persons without PAD. This association was explained by poorer baseline functional performance among participants with PAD. Poorer lower extremity performance predicts increased mobility loss in persons with and without PAD. (J Am Coll Cardiol 2007;50:974–82) © 2007 by the American College of Cardiology Foundation

Lower-extremity peripheral arterial disease (PAD) is common in outpatient settings (1,2). The prevalence of PAD was 29% in a national study of outpatient medical practices, in which ankle-brachial index (ABI) screening was performed among men and women ages 70 and older or age 50 to 69 with a history of diabetes or cigarette smoking (1). In a separate study, the prevalence of PAD was 25% among men and women age 55 and older who were screened (2). In cross-sectional analyses, men and women with PAD have poorer performance on objective measures of lower-extremity functioning than persons without PAD (3,4). However, the clinical consequences and prognostic significance of functional impairment in persons with PAD are unknown.

A critical factor in an older person's ability to function independently in the community is mobility, defined as the ability to walk or climb stairs without assistance (5). Older people who lose mobility are less likely to remain in the community; have greater rates of morbidity, mortality, and hospitalizations; and experience a poorer quality of life (5,6). However, the ability of persons with PAD to maintain mobility in the community over time, compared with those without PAD, is unknown. Few studies of the natural history of PAD have been performed to measure disease progression (7). Studying associations of PAD with mobility loss is important to better inform clinicians about the clinical consequences of PAD.

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In a prospective observational study, we studied during 50-month follow-up whether persons with PAD have a greater rate of mobility loss than persons without PAD. We hypothesized that persons with PAD would experience greater rates of mobility loss than persons without PAD. Second, we studied whether measures of lower-extremity performance predict risk of mobility loss in participants with and without PAD. We hypothesized that participants with and without PAD who have poorer lower-extremity performance at baseline would have a greater risk of mobility loss. Third, we studied whether associations of baseline lower-extremity performance with mobility loss are similar between participants with versus without PAD. Fourth, we tested the hypothesis that associations of PAD with greater mobility loss compared with persons without PAD are explained by differences in baseline lower-extremity performance between persons with versus without PAD. Finally, we determined whether baseline functional performance measures also predict objectively assessed functional decline by studying associations of baseline functional performance with becoming unable to walk continuously for 6 min without stopping among persons with and without PAD, respectively.

Methods

Study overview. The funding source for this study played no role in the design, conduct, reporting of the study, or decision to submit the manuscript. The institutional review boards of Northwestern University and Catholic Health Partners Hospital approved the protocol. Participants gave written informed consent. Participants were part of the WALCS (Walking and Leg Circulation Study), a prospective, observational study designed to identify predictors of functional decline in persons with and without PAD (3,4,8). Participants underwent baseline assessment and returned for annual follow-up visits. Participants unable to return for follow-up because they were ill or had moved away were interviewed by telephone. Mean follow-up was 50 months.

Participant identification. Participants with PAD were identified from among consecutive patients age 55 years and older diagnosed with PAD in 3 Chicago-area noninvasive vascular laboratories. Half of the participants without PAD were identified from persons with normal lower-extremity arterial studies at the 3 noninvasive vascular laboratories, and one-half were identified from among patients with appointments in a large general internal medicine practice at Northwestern. A few PAD participants were those recruited from general internal medicine with a low ABI at their study visit. Exclusion criteria for the WALCS have been reported and are briefly summarized here (8). Exclusion criteria included dementia, recent major surgery, above- or below-knee amputations, nursing home residence, confined to a wheelchair, and ABI >1.50. Non–English-speaking patients were excluded because investigators were not fluent in non-English languages. Individuals with PAD diagnosed in the noninvasive vascular laboratory were excluded if their baseline visit ABI indicated absence of PAD. Patients with a normal ABI with prior lower-extremity revascularization were excluded (n = 16) because they could not clearly be classified as PAD or non-PAD. Participants who were not free of mobility impairment at baseline were excluded.

Abbreviations and Acronyms

ABI = ankle-brachial index
BMI = body mass index
PAD = peripheral arterial disease
SPPB = Short Physical Performance Battery
WALCS = Walking and Leg Circulation Study

ABI measurement. A handheld Doppler probe (Nicolet Vascular Pocket Dop II, Nicolet Biomedical Inc., Golden, Colorado) was used to obtain systolic pressures in the right and left brachial, dorsalis pedis, and posterior tibial arteries (9,10). Each pressure was measured twice: in the order listed and in reverse order. The ABI was calculated by dividing the mean of the dorsalis pedis and posterior tibial pressures in each leg by the mean of the 4 brachial pressures (3,4,8,9). Zero values for the dorsalis pedis and posterior tibial pulses were set to missing for the ABI calculation. Average brachial pressures in the arm with highest pressure were used when 1 brachial pressure was higher than the opposite brachial pressure in both measurement sets and the 2 brachial pressures differed by 10 mm Hg or more in at least one measurement set, since in such cases subclavian stenosis was possible (11). The lowest leg ABI was used in analyses.

Comorbidities. Comorbidities assessed were diabetes, angina, myocardial infarction, heart failure, cancer, chronic lung disease, lower-extremity arthritis, spinal stenosis, spinal disk disease, and stroke. Disease-specific algorithms that combine data from patient report, medical record review, medications, laboratory values, and a questionnaire completed by the participant's primary care physician were used to verify and document baseline comorbidities, based on previously developed criteria (12). The American College of Rheumatology criteria were used to diagnose knee and hip osteoarthritis (13,14).

Exertional leg symptoms. Leg symptoms were classified based on responses to the San Diego Claudication Questionnaire, according to prior studies (3,4,15).

Other measures. Body mass index (BMI) was calculated as weight (kilograms)/(height [meters])^2. Cigarette smoking history was determined with patient report.

Functional measures. 6-MIN WALK. Following a standardized protocol, participants walked up and down a 100-ft hallway for 6 min after instructions to cover as much distance as possible (16,17). Research staff recorded whether or not the participant stopped to rest during this test. The 6-min walk test was repeated at each annual follow-up visit.

REPEATED CHAIR RISES. Participants sit in a straight-backed chair with arms folded across their chest and stand 5 times consecutively as quickly as possible. Time to complete 5 chair rises was measured.