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EDITORIAL COMMENT

Can Measuring the Ankle-Brachial Index Improve Public Health?*

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Peripheral artery disease (PAD) is a common manifestation of systemic atherosclerosis, with a prevalence ranging from 4% in the healthy U.S. adult population over the age of 40 years, to 29% in patients screened in primary care offices, with diabetes, cigarette smoking, and age as risk factors (1,2). Peripheral artery disease is highly associated with the risk of cardiovascular ischemic events and excess total mortality. Identification and quantification of this systemic risk have been established from numerous population-based and observational case-control studies, which have profound public health implications.

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Although the PAD risk of systemic cardiovascular events is driven primarily by concomitant coronary and cerebrovascular disease, there are several modifiers of the risk, including the symptomatic severity of the disease and the number of vascular territories affected. Patients with claudication (symptoms during walking exercise) have far lower mortality event rates (1% to 2%/year) than do patients with critical limb ischemia (defined as ischemic symptoms at rest, ulceration, or gangrene), with an annual mortality risk of up to 12%/year (3,4). In patients with PAD who have no other clinical evidence of coronary or cerebral disease, the annual risk of myocardial infarction, stroke, and vascular death is approximately 3%/year. However, adding clinical coronary disease increases the event rate to approximately 6%/year, and in patients with all three territories affected, the event rate is as high as 9%/year (5). Additional factors that incrementally define the cardiovascular risk in PAD include the functional status of the patient (6) and the level of systemic inflammation (7).

Identification of PAD is often based on a simple, risk-free, and cost-effective hemodynamic test, the ankle-brachial index (ABI). Typically, a Doppler ultrasonography instrument is used to identify the arterial pulse, and systolic pressures are measured in both arms and at the dorsalis pedis and posterior tibial arteries at the ankles. These measurements are made with the patient supine and usually can be obtained in 15 minutes (8). Each of the ankle pressures is normalized to the single highest arm pressure, and values <0.90 are considered diagnostic of the disease. In addition to using a single cut-point for the diagnosis of PAD, the hemodynamic disease severity across the range of ABI values <1.00 is also highly associated with risk (9). More recently, the independent contribution of the ABI to assessment of cardiovascular risk has been defined by an international ABI meta-analysis that included more than 480,000 person-years of follow-up in 24,955 men and 23,339 women (10). After adjustment for the Framingham risk score, the ABI provided significant improvement in predicting cardiovascular risk independent of established risk factors in a broad population. In fact, the ABI resulted in reclassification of the Framingham risk estimate in approximately 20% of men and one-third of women.

Based on this background, in this issue of the *Journal* Criqui et al. (11) evaluated changes in the ABI over time as a predictor of cardiovascular morbidity and mortality. They hypothesized that patients with a more rapid decline in the ABI value would have a higher risk than patients with a stable ABI. Patients were identified from vascular laboratories, and baseline ABI values were obtained from chart abstraction. A second visit to the vascular laboratory (on average, 5 years from baseline) was used to determine the change in the ankle-brachial index over time. At the second visit, the authors observed an independent, inverse association between ABI and all-cause and cardiovascular mortality at 3- and 6-year follow-up, as previously described (9). Patients were further evaluated based on the change score of the ABI divided into tertiles of changes >0.15, changes <0.15, and decreases >0.15. Patients with a decrease in the ABI had a significant increase in all-cause and cardiovascular mortality compared with patients with stable measurements. These associations were particularly strong at 3 years and weakened at 6 years of follow-up. Thus, both the severity of the hemodynamic disease process and the rate of progression of leg arterial disease were associated with increased risk of cardiovascular and all-cause mortality. Similar findings have also been reported in another cohort study in which patients were evaluated with resting and post-exercise ABI over time (12). The study by Criqui et al. (11) further anchors the clinical evidence that associates the severity of lower extremity arterial disease with risk of major systemic, and often life-threatening, cardiovascular events. In addition, progression of peripheral artery disease now suggests the presence of a more extensive and unstable systemic atherosclerotic disease process that further magnifies this risk.

There is now overwhelming evidence of the value of the ABI. Despite this evidence, lack of use of this test and

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associated under-recognition of PAD have been clearly documented (13,14), leading to concern that a probable consequence would be inadequate treatment of the associated high short-term ischemic risk. Patients with PAD are less intensively treated for their cardiovascular risk factors and are less likely to be prescribed antiplatelet therapies than are patients with coronary artery disease (2).

Given the wealth of information obtained from this simple hemodynamic test, current cardiovascular guidelines (with unanimous consensus from the American College of Cardiology, the American Heart Association, and international vascular specialty societies) have provided the strongest Class 1A recommendation for measuring the ABI in "at-risk" populations (15,16). These recommendations acknowledge the need to make an accurate diagnosis of PAD in order to provide proven systemic risk-lowering lifestyle and pharmacologic interventions. In contrast, the U.S. Preventive Services Task Force recommended against routine screening for PAD (17). The rationale was that screening with the ABI would not provide information "beyond treatment based on standard cardiovascular risk assessment" and that screening asymptomatic adults could lead to increased harm due to "false positive results and unnecessary work-ups." The U.S. Preventive Services Task Force did not focus on any of the studies that demonstrated the utility of the ABI in defining a high-risk, yet under-recognized population for cardiovascular events. Clearly recent data refute the first assumption, and the second assumption of the U.S. Preventive Services Task Force is unproven. Beyond controversies between conflicting guideline statements, we must avoid a sense of complacency and clinical inertia that misses opportunities to identify and treat high-risk populations, regardless of symptoms.

The challenge we face today is whether measurement of the ABI in appropriate populations would improve public cardiovascular health. There are important societal and scientific questions that remain as to how primary care physicians would incorporate the ABI into assessment of individual patient risk and how that information would change their treatment decisions. Clinical trials are needed that include measurement of the ABI as an entry criterion to determine if long-term treatment strategies targeting PAD improve outcomes. Although current treatments are effective, novel therapies are still needed to reduce cardiovascular risk and manage limb symptoms in individuals with PAD. The health care costs of PAD are extremely high, and outcomes are adverse (18). The ABI is the only tool at hand that can be deployed now to identify patients, facilitate treatment, lower costs, and improve outcomes.

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