Available online at www.sciencedirect.com

ScienceDirect

www.onlinepcd.com

Peripheral Artery Disease and Non-Coronary Atherosclerosis in Hispanics: Another Paradox?

Nketi I. Forbang, Jan M. Hughes-Austin, Matthew A. Allison, Michael H. Criqui*

Division of Preventive Medicine, Department of Family and Preventive Medicine, University of California San Diego, La Jolla, CA

ARTICLE INFO

Keywords:
Carotid artery atherosclerosis
Hispanic paradox
Peripheral artery disease

ABSTRACT

Hispanic Americans (HA) are a significant and increasing segment of the population who must be considered in future health planning. HA, compared to European Americans (EA), have a lower prevalence of coronary artery disease, but higher burden of cardiovascular disease risk factors. It remains unclear if this observation termed the 'Hispanic Paradox' also exists for vascular beds outside the heart. We present a review of the literature which suggests that this paradox may also exist for arteries in the extremities and neck.

Peripheral artery disease (PAD) is typically characterized by atherosclerotic blood flow obstruction to the upper and lower extremity.[1] The definition of PAD may be broadened to include any arterial bed exclusive of the heart (i.e. carotid and subclavian arteries, aorta and visceral arterial beds). For the purposes of this review, PAD refers to atherosclerotic obstruction of blood flow to leg arteries, occurring along the arterial tree from the aortic bifurcation to the tibial arteries. Atherosclerotic obstruction in other non-coronary arterial beds will be identified and discussed separately.

A diagnosis of PAD conveys a significant risk for cardiovascular disease (CVD) morbidity and mortality.[2–4] Also, PAD is a preventable cause of walking difficulties,[5] disability, [6] and leg amputations.[7] In 2010, 202 million individuals around the world were estimated to be living with PAD, a 25% increase in the global burden of PAD from the preceding decade.[8] In the United States (U.S.), 5% of individuals age 60–70 years, 10% age 70–80 years, and 20% age >80 years are estimated to have PAD.[9] Given our aging population, PAD represents an important public health issue, which must be considered in future public health planning.

Our knowledge of PAD in Hispanic Americans (HA) and other minority groups is limited, with the exception of African Americans (AA). In the 2000 census, HA represented 16% (50.5 million) of U.S. residents while accounting for more than half the growth of the total U.S. population in the preceding decade.[10] It is estimated that by the year 2060, 129 million HA (31% of the total population) will reside in the U.S.[11] Future public health planning must also account for this demographic change.

PAD has been characterized as a coronary heart disease (CHD) equivalent in terms of future CVD risk. Both PAD and CHD are manifestations of CVD, and share similar atherosclerotic pathology, as well as common risk factors.[12] It's been previously reported that HA have a higher prevalence of CVD risk factors compared to European Americans (EA), but lower rates of CHD and CVD death.[13,14] This observation termed the "Hispanic Paradox," was recently confirmed in a meta-analysis of 18 studies (meeting stringent criteria) conducted

Statement of Conflict of Interest: see page 242.

Support in part by Research Supplements to Promote Diversity in Health-Related Research (N01 HC95160 Administrative Supplement NIH-NHLBI) and UCSD Integrated Cardiovascular Epidemiology Fellowship (T32 HL079891 Training Grant NIH-NHLBI).

* Address reprint requests to Nketi Forbang, MD, MPH, 9500 Gilman Drive MC 0965, La Jolla, CA 92093.
E-mail address: nforbang@gmail.com (N.I. Forbang).

http://dx.doi.org/10.1016/j.pcad.2014.07.008
0033-0620/

Abbreviations and Acronyms

AA = African American

ABI = ankle-brachial index

AI = American Indian

AS = Asian American

BMI = body mass index

BP = blood pressure

CHD = coronary heart disease

CLI = critical limb ischemia

CVD = cardiovascular disease

cIMT = carotid artery plaque and intima-media thickness

DDIAM = diastolic intraluminal common carotid artery diameter

DSA = digital subtraction angiography

DYS = dyslipidemia

EA = European American

HA = Hispanic American

HTN = hypertension

IC = intermittent claudication

LDL-C = low density lipoprotein cholesterol

MAC = medial artery calcification

MICPT = maximal internal carotid artery plaque thickness

PAD = peripheral artery disease

SBP = systolic blood pressure

T2DM = diabetes mellitus

SS = subclavian stenosis

TBI = Toe Brachial Index

between 1950 and 2009.[14] The purpose of this review article is to investigate whether the 'Hispanic Paradox' exists for PAD. We will also investigate this paradox in other non-coronary vascular beds.

Diagnosis of PAD

Most individuals with PAD are asymptomatic, with less than 10% presenting with classic symptoms of intermittent claudication (IC; pain experienced in the calf, hip, and/or buttock on walking that subsides with rest).[15] In a diverse population of participants with known PAD, the prevalence of IC was low among HA (6%), EA (11%), and AA (7%). Critical limb ischemia (CLI; pain experience in the calf, hip and/or buttock at rest, or non-healing ulcers and/or gangrene in the foot) is less common than IC in the general population, and its prevalence in HA with PAD is unknown.[15] For these reasons, symptoms of IC or CLI underestimate the full PAD burden.

Standard diagnosis for PAD is with the ankle brachial index (ABI), a non-invasive physiologic test, commonly performed using a simple blood pressure cuff and a continuous Doppler ultrasound device. The ABI for each leg is calculated separately by dividing the higher of the systolic blood pressure (SBP) of either ipsilateral superficial ankle artery (posterior tibial or dorsalis pedis) by the higher of the right or left brachial artery SBP.[16] The higher of the two brachial pressures should be used because of the association between PAD and subclavian artery stenosis.[17] An ABI ≤0.90 in either leg is diagnostic for PAD, and has a 79% sensitivity and 96% specificity for ≥50% stenosis of the arterial lumen in the affected leg.[18] While a low ABI (≤0.90) has strong prognostic value, borderline ABI (0.90–1.00, 1.30–1.40) and high ABI (≥1.40) values are also significantly associated with increased risk of CVD morbidity and mortality.[19] Digital subtraction angiography (DSA), the gold standard diagnosis for PAD, is expensive, invasive, utilizes potentially nephrotoxic contrast media, and is thus reserved for the management of severe disease.[20] For this reason, most epidemiologic studies of PAD have used the ABI.

In recent years the singular threshold for and use of the ABI for PAD diagnosis has been questioned.[21] In a group of participants without PAD or major risk factors for PAD, and after extensive covariate adjustments, the ABI varied across gender and ethnic groups.[22] This suggests that optimum ABI thresholds for PAD may differ among genders and different ethnicities. Also, the ABI has reduced sensitivity for PAD in diabetic patients who often develop stiffness in their tibial arteries from medial artery calcification (MAC).[23] MAC leads to less compressible tibial arteries, which artificially elevate ankle SBP and the calculated ABI, and may obscure underlying atherosclerotic obstruction. Diabetes, a significant risk factor for PAD, is more prevalent in HA and other minority popopulations.[24]

Diabetic patients suspected with stiff vessels (ABI ≥1.3) should be further evaluated for PAD in a vascular lab with the toe brachial index (TBI, ratio of SBP in the toe to the arm).[25] A TBI ≤0.7 is suggestive of PAD, and can identify disease in individuals with stiff vessels because toe arteries are less affected by calcification.[26] Also, while the prognostic value of the ABI for CVD mortality is affected by type 2 diabetes mellitus (T2DM) status (low and high ABI convey increased risk CVD mortality), the association between the TBI and CVD mortality is linear (only low values convey increased risk).[27] The usefulness of the TBI and other vascular lab assessments for PAD has not been extensively studied in HA.

Prevalence of PAD

Our best estimates of the ethnic distribution of PAD in the U.S. are from the year 2000.[9] At that time, 6.5 million (5.8% of the population) individuals aged ≥40 years were estimated to be living with PAD, of which 3.8% were HA, 78% EA, 15.9% AA, 1.5% Asian Americans (AS), and 0.7% American Indian (AI).[9] For both men and women, and across most age groups AA had the highest rates of PAD, AI had intermediate rates, while HA and EA had the lowest rates (Figs 1 and 2). In this report, three studies provided much of the prevalence data for PAD in HA; the National Health and Nutrition Examination Survey[28] (NHANES, a national sample of non institutionalized individuals), the San Diego Population Study[29] (SDPS, mostly employees, retirees and their spouses recruited from an academic institution), and the Multi-ethnic Study of Atherosclerosis[30] (MESA, community living individuals free from clinically manifest CVD at recruitment). All three studies were heavily skewed toward individuals age ≥40 years, oversampled HA and other minority groups, and Mexican Americans comprised a large portion of the HA population.