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Prevalence of Breast Arterial Calcifications in an Ethnically Diverse Population of Women

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PURPOSE: Breast arterial calcifications (BAC) identified on routine mammography have been associated with coronary heart disease (CHD) risk factors including diabetes and hypertension, angiographically defined CHD, and increased cardiovascular mortality. Accumulating evidence suggests that the mammogram may be an important tool to identify women at risk for CHD, however, the epidemiology of BAC has been poorly defined and previous studies limited to white populations.
METHODS: The mammograms of 1905 consecutive women (51.2% Hispanic, 25.8% white, 15.3% black, 5.4% other, 2.2% Asian, ages 35–92 years) were evaluated for the presence of BAC and the number of calcified arteries.
RESULTS: The overall prevalence of BAC was 29.4% and was significantly higher for Hispanics compared with whites (34.5% vs. 24.0%, p = 0.0002) and lower for Asians compared with whites (7.1% vs. 24.0%, p < 0.02). Among BAC-positive women aged 65 years or less, blacks had more calcified arteries than whites (p < 0.01). The presence of BAC increased with age (p for trend < 0.0001). In age-adjusted models, older Hispanics were more likely to be BAC-positive than whites of similar age (p < 0.02).
CONCLUSION: These results indicate that BAC varies significantly by age and race/ethnicity. These findings should be taken into consideration when designing future studies of BAC and CHD.
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KEY WORDS: Breast Arterial Calcifications (BAC), Coronary Heart Disease Risk Factors, Epidemiology, Mammography, Women.

INTRODUCTION

Coronary heart disease (CHD) is the single leading cause of death among women in the United States (1). Despite this fact, a recent national survey conducted by the American Heart Association reported that most women identified breast cancer as their greatest health concern and not heart disease (2). The mammogram has become a widely accepted screening tool for breast cancer among women over the age of 40 years. Improvements in the resolution of modern mammography to better detect breast tissue microcalcifications, a marker of breast cancer, led to the discovery of readily identifiable calcium deposits within the media of breast arteries (3). Accumulating evidence suggests that the presence of breast arterial calcifications (BAC) on routine screening mammography is associated with CHD risk factors including diabetes and hypertension, with angiographically defined CHD, and with increased cardiovascular mortality (4–12).

Early detection of CHD is important because nearly 40% of initial cardiovascular events in women are fatal (13). Of particular concern is that the majority of women who die from sudden cardiac death had no previously recognized symptoms of disease, emphasizing the need to develop novel methods to identify women at increased risk (14). The paradigm of CHD as a categorical diagnosis has been replaced by the growing acceptance that it exists on a continuum of increasing risk (15). There is widespread agreement that risk factor assessment and stratification are essential to tailor the aggressiveness of therapy to prevent the onset or reduce the risk of progression to clinical disease. While several tools exist to detect subclinical disease such as Electron Beam Computed Tomography and carotid intimal-media thickness, there is no consensus about the added benefit of these tests over traditional CHD risk factors in general clinical practice (16). Even if these measures prove to be prognostic, there are significant barriers to their widespread implementation including cost, feasibility, patient access to the technology, and the general lack of concern about CHD among women. In contrast, routine screening mammography is widely accepted by most women, inexpensive, routinely covered by insurance, and

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Selected Abbreviations and Acronyms

BAC = breast arterial calcifications
CHD = coronary heart disease
CI = confidence interval
MAC = medial arterial calcifications
OR = odds ratio
SD = standard deviation

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has been integrated into the current healthcare infrastructure. Interest in examining the clinical significance of BAC stems from the potential utilization of routine mammography to simultaneously screen women for breast cancer and CHD risk.

The prevalence of BAC in previous studies has ranged from less than 1% to more than 50%, increasing in prevalence especially among diabetics and older women (8, 17). The disparity in the prevalence data may be due to advances in the sensitivity of the technology and to differences in the baseline risk of the populations studied. To our knowledge there are no published studies in the United States that have examined the prevalence of BAC using contemporary methods in a multiethnic community sample of women. The primary purpose of this study was to determine the prevalence of BAC and the number of calcified arteries on routine screening mammography in an ethnically diverse population of women.

METHODS

Study Setting, Participants, and Design

This was a cross-sectional study conducted at the New York Presbyterian Hospital-Columbia University Medical Center among 1905 consecutive women undergoing routine screening mammography. Women aged 35 years and older were eligible for participation in this study provided they had undergone a routine mammogram as an outpatient at the Columbia University Radiology Clinic between April and September 2003. Subjects were excluded if their mammograms were found to have a lesion suspicious for breast cancer. This study was approved by the Western Institutional Review Board.

Definition of BAC

All mammograms were conducted according to established breast cancer screening protocols recommended by the American College of Radiology and were obtained in two standard projections, craniocaudal and mediolateral oblique, for each breast (18). Mammography was performed with a standard film-screen technique on three mammographic units (Lorad M-IV Platinum, Hologic, Danbury, CT; Senographe DMR-plus, GE Medical Systems, Milwaukee, WI; Senographe 800T, GE Medical Systems, Milwau-

kee, WI). To maintain confidentiality, the mammograms were coded by a medical record number. An experienced radiologist, blinded to the patient's clinical data, reviewed the mammograms in bulk on a regular basis. If arterial calcifications were detected on the right, left, or both projections of the breast, the mammogram was defined as BAC-positive. Figure 1 is an example of a BAC-positive mammogram. The presence of BAC was also quantified by counting the number of calcified arteries in each breast and then generating a BAC score by averaging the number of calcified arteries in the two breasts.

Validation of BAC Status

The validity of the scoring methodology used to determine BAC status in this study was assessed by a second evaluation of an 11% sample, randomly generated from the initial study cohort. The primary study radiologist, blinded to the initial BAC score, reevaluated this 11% sample to determine intra-reader reliability. In addition, a second independent radiologist evaluated the same 11% sample to determine inter-reader reliability. The measure of agreement between the original reading and a second reading by the primary study radiologist was excellent (kappa = 0.87; 95% confidence interval [CI], 0.80–0.94). The agreement between the primary study radiology and an independent radiologist was good (kappa = 0.73; 95% CI, 0.63–0.83).

Data Collection

Demographic and clinical patient data were derived from the computerized hospital database. Baseline characteristics assessed included age, ethnicity, menopausal status, and presence of health insurance. Age was defined by self-report and verified by date of birth. Ethnicity was defined by self-report based on the following categorizations designated by the Columbia University Medical Center: white, black, Hispanic, Asian, and other. Menopausal status was obtained from the study mammography report based on patient self-report. Presence of health insurance was also based on self-report and classified as present or not present.

Statistical Analysis

The overall prevalence of BAC was determined and then stratified by race/ethnicity and the following age groups: 35 to 44 years, 45 to 54 years, 55 to 64 years, 65 to 74 years, and 75 to 90 years.

Comparisons were made using the chi-square test for categorical data and the Student's t-test for continuous data. Validation of BAC status was evaluated using the kappa statistic. Logistic regression analysis was performed to determine the association between menopause and BAC status and between the presence of insurance and BAC status, controlling for age as a continuous variable including