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Review article

Coronary artery calcification and ethnicity

Kashif Shaikh[a], Rine Nakanishi[a,b], Nicolas Kim[a], Matthew J. Budoff[a,*]

[a] Los Angeles Biomedical Research Institute at Harbor UCLA Medical Center, Torrance, CA, USA
[b] Department of Cardiovascular Medicine, Toho University Graduate School of Medicine, Tokyo, Japan

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ABSTRACT

Differences in risk factors do not fully explain the differences in the prevalence of atherosclerotic cardiovascular disease (ASCVD) in various ethnicities. Coronary artery calcification (CAC) is an established marker of subclinical coronary artery disease. Several published studies within and outside the United States (US) have shown that racial and ethnic differences exist regarding prevalence and severity of CAC. Although ethnic-specific CAC nomograms are used for more accurate prediction of ASCVD events, some reports suggest a linear relationship between coronary artery calcium (CAC) scoring and ASCVD regardless of age, sex and ethnicity. We performed a comprehensive review of available studies on ethnic differences in coronary calcification in MEDLINE, Cochrane library and BioMed Central databases. We review in detail the differences in CAC in predominant racial groups residing within the US, including whites, blacks, Hispanics, East and South Asians. Furthermore, we discuss available data from outside the US, mainly originating in Europe, Japan, and Korea.

1. Introduction

Coronary artery calcification (CAC) is a well-established marker of subclinical atherosclerosis.[1,2] Several studies have demonstrated the predictive value of CAC for incident coronary heart disease (CHD) beyond traditional risk factors.[3] Multiple cross-sectional and prospective cohort studies have recognized racial differences in prevalence and extent of CAC.[4–7] These differences are likely influenced by undocumented lifestyle patterns, environmental factors, and genetics. CAC implies a direct measure of atherosclerotic plaque burden irrespective of risk factors and is a robust predictor of future atherosclerotic cardiovascular disease (ASCVD) events, regardless of age, gender and ethnicity.[3,8–11] The aims of the current study are 1): to review the available literature on differences in CAC among different ethnicities, and 2) to understand why these differences exist and whether these differences in the prevalence of CAC reflect the prevalence of ASCVD in various racial groups.

2. Methods

A search on The Cochrane Library, PubMed, and Web of Science was performed without limitation on publication date to identify articles on CAC. Medical subject headings “multi-detector computed tomography” and “electron beam coronary CT” were used in combination with other groups of search items, such as: (“Multidetector Computed tomography” OR MDCT OR “Electron beam coronary tomography” OR EBCT) AND (race or races or racial or ethni* or ethno* or native american* or american indian* or afric* or afro* or asian* or non-caucasian* OR Caucasian*) AND (CAC OR ("coronary arter*" n2 calc*). References of all studies were also examined to locate additional studies that could be included in this review.

2.1. Pathology of coronary atherosclerosis in ethnicities

Pathologically, CAC develops as microcalcifications (0.5–1.5um) and evolves into larger calcium areas concurrently with the progression of plaque.[12] Historically, autopsy studies have described ethnic differences in the presence and extent of coronary calcification. Most of the studies noted that blacks had less coronary calcification when compared to the whites.[1,13–16] A series of 777 autopsies, noted that calcified lesions in three main coronary arteries were lower (20%) for blacks as compared to whites (75%).[1,15] A number of possible explanations have been presented for higher CAC in whites. For example, higher bone turnover and bone loss in whites might be associated with higher vascular calcification compared to blacks. However, pathologic studies for other ethnicities are lacking.

* Corresponding author.
E-mail address: mbudoff@labiomed.org (M.J. Budoff).

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Table 1
Studies within US on prevalence of Coronary artery calcification.

Author (Ref.#)	Sample Size	Mean Age	Population type	CAC Cutoff[a], Percentages	OR/HR/ RR[b](ref.population,white)	CI, p-value	Risk factors Adjusted
Tang et al.[7]	1461	Whites = 63 Blacks = 60 Asian = 62	High risk, asymptomatic	CAC > 0 Whites = 60% Blacks = 36% ASIAN = 60%	Blacks = 0.69	(0.55–0.88) (p = .003)	Age, sex, and Cardiac risk factors
Doherty et al.[5]	1375	Whites-64 Blacks-60	High risk, asymptomatic	CAC > 0 Whites = 59.9% AA = 35.5%	Blacks = 0.47	(0.29–0.75)	Not adjusted
Newman et al.[16]	614	White M = 81.2 White W-80.5 Black M = 79.5 Black W = 78.6	High risk, elderly community dwelling adults	Median CAC score White M = 787 White W = 233 Black M = 159 Black W = 134	Black M = 0.20 Black W = 0.73	0.11–0.38) (p < .0001) (0.45–1.17) (P = .19)	Age, CVD, risk factors for CVD
Lee et al.[6]	999	Whites = 62.8 Blacks = 62	Low risk, asymptomatic active US army M &W	CAC > 0 Whites = 19.2% Blacks = 10.3%	Blacks = 0.39	(0.20–0.78) (p = .007)	HTN, LVH, ST-T-wave abnormality, smoking, BP, HDL-C, HbA1c, lipoprotein (a), fibrinogen, TG, waist girth
Erqou et al.[27]	776	White M = 60 Black M = 58	Population-based	CAC > 100	Black = 0.50	(0.35,0.73)	SBP, smoking, diabetes, and BMI total cholesterol, HDLc, triglycerides and fasting glucose level.
Bild et al.[18]	6814	Mean age was 62–63 in all ethnic groups	Population-based	CAC > 0 White M = 70.4% Black M = 52.1% Hispanic M = 56.5% Chinese M = 59.2% White W = 44.6% Black W = 36.5% Hispanic W = 34.9% Chinese W = 41.9%	Black = 0.78 Hispanic = 0.85 Chinese = 0.92	(0.74–0.82) (0.79–0.91) (0.85–0.99)	Age, education, lipids, BMI, smoking, diabetes, HTN, treatment for hypercholesterolemia, sex, scanning center
Budoff et al.[19]	16560	White M-58 Black M-55 Asian M = 56 Hispanic M-53 White W = 59 AA W = 57 Asian W = 57 Hispanic W = 53	Physician-referred	CAC > 0 White M = 78%, Black M = 69%, Asian M = 69% Hispanic M = 72%, White W = 44%, Black W = 36% Asian W = 42% Hispanic W = 34%	black M = 0.64 Asian M = 0.66 Hispanic M = 0.88 black W = 1.58 Asian W = 0.71 Hispanic W = 0.84	(0.48–0.86) (0.55–0.80) (0.67–1.15) (1.13–2.19) (0.56–0.89) (0.66–1.06)	Age, dyslipidemia, HTN, Smoking, DM, family history of premature CHD
Hatwalkar et al.[26]	5704	Whites = 56.4 AI = 51.8 Hispanic = 52.8 AA = 55.3 Asian = 56.9	Asymptomatic, Physician-referred	Whites = 65% AI = 62% Hispanic = 53% AA = 53% Asian = 55%	AI = 1.26	(1.05–3.97)	Not adjusted
Kanaya et al.[25]	803 South Asians-compared MESA population	SA M = 58 SA W = 56	Population-based	SA M = 67.9% White M = 68.8% Black M = 51.2% Hispanics = 57.9% Chinese M = 57.8% SA W = 36.8% White W = 42.6% Black W = 35.6% Hispanic W = 35.0% Chinese W = 40.3%	OR-(ref. pop.-South Asian) White M-0.92 Black M-0.66 Hispanic M-0.77 Chinese American M-0.83 White W-1.09 Black W-0.83 Hispanic W 0.89 Chinese American W-1.25	(0.80–1.05) (0.58–0.76) (0.67–0.89) (0.71–0.97) (0.83–1.44) (0.68–1.18) (0.68–1.18) (0.93–1.68)	Age adjusted
Budoff et al.[4]	782	Whites = 58 Black = 55 Hispanics = 55 ASAM = 58	Physician-referred	CAC > 0 Whites = 84% Blacks = 62% Hispanics = 71% ASAM = 73%	Blacks = 0.48 Hispanics = 0.68 ASAM = 0.66	(0.29–0.78) (p = .003) (0.45–1.02) (p = .07) (0.33–1.34) (p = .25)	Age, sex, cardiac risk factors

Main Abbreviations Used: M = Males, W= Women, CAC= Coronary Artery Calcification, CHD = coronary heart disease, AA = African American, ASAM = Asian American, MASALA = The Mediators of Atherosclerosis in South Asians Living in America, MESA = Multi-Ethnic Study of Atherosclerosis, OR = Odds Ratio, RR = Relative risk, HR = Hazards Ratio, Ref.Pop. = Reference Population.

[a] CAC cutoff- The cutoff value of CAC that authors used to compared different ethnicities.

[b] OR/RR/HR of having CAC as compared to the reference group.

2.2. Studies describing Coronary Artery Calcification differences among different ethnicities within US

Several studies have documented ethnic differences in the prevalence of CAC (summarized in Table 1). The National Heart, Lung, and Blood Institute's (NHLBI) The Coronary Artery Risk Development in Young Adults (CARDIA) study measured CAC in adults 33–45 years of age.[17] It showed a lower prevalence of CAC in black males than in white males, but similar prevalences in black and white females at year 15 examination. NHLBI's multi-ethnic atherosclerosis study (MESA)[18] measured CAC in participants including white, blacks, Hispanic and Chinese males and females. Significant ethnic differences were noted in

Table 2
International studies on prevalence of CAC.

Authors Ref.#	Sample Size	Mean age	Population	CAC cutoff[a], Percentages	OR/HR/RR[b]	CI, P,value	Risk factors
Erbel et al. [38]	3126 Caucasian Population from HNR compared to 2220 Caucasian Population from MESA	**MESA** white M-60.6 white W-59.8 **HNR** white M-58.7 white W-58.9	Population-based- HNR Population-based from MESA	CAC > 0 MESA = 52.6% HNR = 67%	(Ref.pop. HNR) Rate Ratio MESA M-0.78 MESA W-0.82	(0.72–0.85) (0.75–0.89)	Adjusted for most of known Cardiovascular risk factors
Santos et al. [37]	Total = 17 563	USA M = 52 USA W = 55 Brazil M = 50 Brazil W = 53 Portugal M = 54 Portugal W = 55	Asymptomatic, Physician referred	CAC > 0 USA M = 67% USA W = 41% Brazil M = 54% Brazil W = 38% Portugal M = 20% Portugal W = 12%			Age, dyslipidemia, HTN, smoking, DM
Sekikawa et al. [40]	Total = 200	Caucasian = 44.6 Japanese = 44.7	American-volunteers Japanese-population-based	CAC > 0 American = 47% Japanese = 13%		(P < .01)	Not adjusted
Abott et al. [43]	Total = 611 Japanese M = 311 Japanese in Hawaii = 300	Japan = 50.3 Hawaii = 49.8	Japanese Men in Japan selected from registry of residents Hawaii-selected from a list of offspring of Honololu heart study participants.	CAC > 10 Japanese = 11.5% Japanese Hawaii = 31.4%	(ref. Pop Japanese M) RO-4.0		Age, BMI, SBP, DM, Smoking, LDL,HDL treatment for hypercholesterolemia, and C-reactive protein
Fujiyoshi et al[42].	Japanese M-832 Caucasian Men from MESA 1067	Caucasian = 50.3 Japenese = 49.8	Community based SESSA and MESA	CAC > 10	OR (Ref.Pop.Japanese M) C1-2.30 (1.12–4.70) C2-2.45 (1.46–4.13) C3-3.11 (1.88–5.15)		Smoking, SBP.LDL,plasma glucose, treated hypertension, treated dyslipidemia, treated DM,BMI and alcohol drinking
Park et al. [44]		Korean M = 53	Physician referred Compared to Caucasian M in MESA	Mean Age-50th percentile CACS 55-64-1.1 vs 28 65-74-44 vs 145 75-84-80 vs 385			
Han et al. [45]	US cohort-5427 Korean Cohort-5427	US adults-56.1 Korean = 56.1	Physician referred US, Korean selected from KOICA registry Korea	CAC > 0	OR(ref.Pop.white) For M: C1-0.48 C2-0.75 C3-1.87 For W: C1-0.13(0.09–0.19) C2-0.36(0.28–0.47) C3(0.77–1.45)	C1(0.41–0.55) C2(0.63–0.90) C3(1.36–2.59) C1(0.09–0.19) C2(0.28–0.47) C3(0.77–1.45)	

C1-Ages-45-54, C2-Ages-55-64,C3-Ages-65-74, RO = Relative odds.
KOICA = Korea Initiatives on Coronary Artery calcification.
HNR = Heinz Nixdorf Recall study, MESA = Multi-Ethnic Study of Atherosclerosis, SESSA = the Shiga Epidemiological Study of Subclinical Atherosclerosis, DM-Diabetes mellitus, LDL-low density lipoprotein.
[a] CAC cutoff- The cutoff value of CAC that authors used to compared different ethnicities.
[b] OR/RR/HR of having CAC as compared to the reference group.

the prevalence of CAC after adjustment for risk factors, with a relative risk of CAC being 8% less in Chinese, 15% less in Hispanics and 22% less in blacks compared to that in whites, respectively. Moreover, Budoff et al. published a report on 16,560 asymptomatic individuals from multiple ethnicities.[19] Their findings were concordant with MESA, except for the finding that black females had higher calcification than white females. While most published data report ethnic differences in the prevalence of CAC, some reports suggest that whites and blacks have similar calcification patterns. For example, in the Dallas heart study (DHS),[20] the prevalence of CAC was similar between blacks and whites. Given the lower prevalence of CAC in men < 40 years of age and women < 45 years of age, participants in these age brackets were excluded from final analyses. However, since the DHS study included patients with known coronary heart disease (CHD) as opposed to MESA, which was comprised of an asymptomatic population, this fact could have biased the results. In another study, Khurana et al.[21] reported on 128 black and 733 white postmenopausal women without known CAD. Black females had CAC scores similar to those of white females despite higher prevalence of cardiac risk factors, such as hypertension, smoking, and diabetes[22,23] Another ethnic group that has been the growing interest of research studies is South Asians (SA), due to their higher mortality rates from ASCVD compared to other Asian groups and whites.[24] SA(From India, Pakistan, Bhutan, Nepal, the Maldives and Sri Lanka) are likely to have a higher burden of CAC compared to the other mentioned ethnic groups(24–26). The Mediators of Atherosclerosis in South Asians Living in America (MASALA) study, a population based cohort of SA in the United States, showed that the prevalence of any detectable CAC was similar between SA and white males (68%). It was also shown that these groups had greater prevalence of any detectable CAC than black (51.2%), Chinese (57.8%) and Hispanic males (57.9%). Contrarily, SA women had a lower prevalence of CAC as compared to white women (37% vs. 43%, respectively) after adjustment for risk factors.[25] Data from most of the above-mentioned studies demonstrated, SA and whites had the highest CAC while blacks had the lowest in men. In women, many studies showed that whites had a higher burden of CAC compared to other ethnicities.[4,7,13,18,19,25,27] (see Table 2)

Patterns in the national statistics of CHD events in various ethnicities follow, for the most part, the patterns seen in CAC data, save for a few discrepancies, seen mostly in blacks. For example, the National Health and Nutrition Examination Survey (NHANES) from 2011 to 2014[28] shows an agreement between CHD and CAC data: prevalence for black males and females were 7.1% and 5.9%, respectively, while prevalence for white males and females were 7.7% and 5.3%, respectively. Furthermore, CHD prevalence was lower in Hispanics than in whites and blacks, and it was lowest in Asians, all patterns that are in accordance with CAC data. Other studies, such as those carried out in Charleston, South Carolina [28] and Evans County, Georgia, also showed similar results: black men, experienced lower coronary death rates than white men, while black females experienced more coronary death rates than white females [29]. On the contrary, the NHLBI-sponsored Atherosclerosis Risk in Communities (ARIC) study[28] showed some data that was seemingly discordant with the patterns shown in CAC. For example, there was a higher prevalence of CHD among blacks than in whites. The reasons for these discrepant outcomes among different ethnicities could be due to differences in health insurance, awareness programs, availability and utilization of preventive services.[29,30] A more nuanced possibility for this discrepancy between CHD and CAC patterns may be related to the differing mechanisms of plaque formation and its progression. Some ethnicities may have strong correlations between total calcified area and overall plaque burden, making CAC a good predictor for a non-calcified plaque as well. For example, autopsy data from white men found a robust correlation between total calcified area and overall plaque burden.[31] However, there may not be as robust an association in other ethnicities. In a report from the Multicenter Aids Cohort, black males had less calcified plaque and lower prevalence of coronary stenosis > 50%, but similar extent of non-calcified plaque compared to whites, suggesting that CAC was not as good a predictor of the prevalence of non-calcified plaque in blacks as it was for whites.[32–34] Previously Doherty et al.[5] reported, despite a lower prevalence of coronary calcification in blacks compared to whites (50% vs. 35%, respectively), blacks were more likely to suffer a cardiovascular event after a follow-up of seventy months. And so, authors concluded, “Coronary calcium therefore does not carry same pathobiologic significance in blacks that it does in whites”. Lastly, differences in plaque density may cause discrepancies in CAC and CHD data. Recent report from MESA showed for any level of CAC volume, CAC density was inversely association with CHD events, indicating that dense calcified plaques were protective as opposed to less dense and spotty calcium.[35] Additional reports are needed to elucidate the role that calcified plaque, non-calcified plaque and CAC density play in causing ASCVD in various ethnicities. Cardiac CT, with its capability to deconstruct total plaque burden into its different components, could provide a unique opportunity in this regard.

2.2.1. Epidemiologic studies outside US

Sub-clinical atherosclerosis varies across populations depending on geographical factors and ethnic diversity.

2.2.1.1. Comparison of populations in America and Europe. Some discrepant reports in prevalence and extent of subclinical atherosclerosis between European countries and the United States (US) have been published. Schermund et al.[36] reported coronary calcification was comparable in European and US cohorts after adjustment for risk factors. Contrarily, Santos et al.[37] reported lower CAC in European (Portuguese) and Brazilian men than in their Caucasian US counterparts. No differences were noted between US and Brazilian women, but US and Brazilian females demonstrated higher coronary calcification than Portuguese females. In another study, Erbel et al.[38] reported a lower prevalence of CAC > 0 in US population from MESA than in the German population from the Heinz Nixdorf Recall (HNR) study. Authors, however, noted that these differences might be attributable to differences in risk factor management in the US vs. Germany. For example, more participants in MESA were treated with antihypertensives than those in the HNR study.

2.2.1.2. Comparison of populations in the United States and ASIA. According to published literature, East Asians tend to have a lower prevalence of CAC and ASCVD compared to whites.[39] In a population-based study, Sekikawa and Fujiyoshi et al. reported[40–42] that Japanese men had lower CAC as compared to whites, despite higher blood pressure, total cholesterol, low-density lipoprotein and smoking rates.

Abbott et al.[43] reported on Japanese men in Japan and Japanese men in Hawaii. Over 13% of the men in Hawaii had CAC < 100 as compared to 2.3% in Japan. Similarly, Koreans seem to have a lower prevalence of CAC when compared to the United States population. Park et al.[44] showed that asymptomatic Korean individuals had lower 50th percentile values compared to whites. Another cross-sectional study[45] comparing CAC between asymptomatic propensity-matched Korean and US adults showed the prevalence of CAC in Korean adults was lower than that in white US adults (P < .001, all). Differences were more prominent in Korean women compared to white women. Taken together, the above studies show lower prevalence of coronary calcification in east Asians. Moreover, lower CAC parallels lower ASCVD mortality[39]

2.2.2. Why differences in CAC across different ethnicities exist

Does coronary calcification accurately represent an amount of underlying coronary atherosclerosis in different ethnicities? Pathologic studies have found strong correlations between histological plaque and

Table 3
Studies on relationship of coronary artery calcium scoring with Coronary events.

Authors Ref#	Population type	Follow-up,yrs	CAC category	Events/total	Outcomes studied	OR/RR/HR
Vliegenthart et al.[50]	Population based Rotterdam coronary calcification Study	3.3	0–100 101–400 401–1000 > 1000	7/905 13/425 13/269 17/196	Cardiovascular events[e]	1.0(Reference) 3.1(1.2–7.9) 4.6(1.8–11.8) 8.3(3.3–21.1)
Detrano et al.[3]	Population-based MESA[a]	3.8	Risk associated with doubling of calcium score	White-41/2619 Chinese-6/803 Black-18/1898 Hispanic-24/1494	Major Coronary Events[b]	1.00(Reference) 1.17(1.06–1.30) 1.25(0.95–1.63) 1.35(1.16–1.57) 1.15(1.02–1.29)
Budoff et al.[11]	Population-based MESA[a]	3.75	0 1–100 101–400 > 400 **Age-sex-ethnicity specific** CAC = 0 < 75th percentile 75th-90th > 90th **Absolute CAC** 0 1–100 101–400 > 400 **Age-sex-ethnicity specific percentiles** CAC = 0 < 75th 75th-90th > 90th	**Women** 8/2167 17/859 11/373 12/202 8/2167 13/632 15/455 12/347 **Men** 8/1249 22/935 41/554 44/475 8/1249 47/1181 26/476 34/307	Coronary heart disease[d]	1(Reference) 6.09(2.52–14.7) 9.58(4.96–22.6) 9.94(4.06–24.3) 1(reference) 6.09(2.52–14.7) 9.58(4.96–22.6) 9.94(4.06–24.3) 1(reference) 6.09(2.52–14.7) 9.58(4.96022.6) 9.94(4.06–24.3) 1(reference) 6.51(3.08–13.8) 8.97(4.06–19.8) 18.9(8.73–40.8)
Budoff et al.[10]	Population-based MESA	> 10 years follow-up	Risk association with each doubling of CAC	White Chinese Black Hispanic	ASCVD Events[c]	1 (reference0 1.13(1.08–1.18) 1.16(1.05–1.28) 1.13(1.08–1.18) 1.14(1.09–1.20)

[a] MESA-based sample of 6722 men and women, of whom 38.6% were white,27.6% were black, 21.9% were Hispanic, and 11.9% were Chinese.
[b] Major coronary events were myocardial infarction and death from coronary heart disease.
[c] Definite or probable MI, resuscitated cardiac arrest, fatal CHD, fatal and non-fatal stroke (not transient ischemic attack), atherosclerotic death, and cardiovascular death.
[d] Myocardial infarction, angina, resuscitated cardiac arrest, or CHD death.
[e] Incident myocardial infarction, CABG, PTCA, Stroke and Coronary heart disease mortality.

calcium area.[31] Unfortunately, these studies did not adjust for or evaluate ethnic differences.

Racial differences in coronary calcification are still not well understood, but several possible explanations have been suggested. The unmeasured differences in genetic polymorphism provide some explanation. Huang et al.[46] identified 25 calcium mobilization genes that were involved in the immune/inflammatory response. For example, one such gene, GAB2, was expressed at lower levels in blacks compared to whites, possibly explaining the lower CAC in the former. Moreover, soluble epoxide hydroxylase gene polymorphism has been associated with variable coronary calcification among different races,[47] but the precise genetic impact on calcification remains to be elucidated. Furthermore, racial differences in osteoporosis may provide some insights into differences in vascular calcification. According to one report, bone density is inversely related to aortic calcification.[48] This association is supported by the finding that bone density tends to be higher, and CAC tends to be lower in blacks than in whites. Though, findings such as, higher coronary calcification in Japanese men living in Hawaii as compared to Japanese living in Japan, suggested that western lifestyles may play an important causal role in extent and prevalence of sub-clinical atherosclerosis. Furthermore, some ethnicities have stronger dispositions to certain risk factors that lead to the development of advanced sub-clinical atherosclerosis. For example, SA tend to have higher insulin resistance and diabetes than other ethnicities.[24] Additionally, differences in obesity and diet—particularly fish intake—may also account for some variations in the prevalence of coronary atherosclerosis. Higher fish consumption has been reported to be protective against atherosclerosis by increasing the particle size of LDL and reducing the levels of C-reactive protein.[40,49]

2.3. The association between CAC, ethnicity and future cardiovascular risk

Results from population-based studies suggest graded relationships of CAC scores with CHD events regardless of ethnicity (Table 3). In the population-based Rotterdam Study of elderly asymptomatic subjects, during a mean follow-up of 3.3 years, coronary calcification was a strong and independent predictor of CHD.[50] In MESA, Detrano et al.[3] showed that CAC provided similar predictive value for coronary events in whites, Chinese, blacks, and Hispanics (HRs ranged from 1.15 to 1.39 for each doubling of coronary calcium). However, the median follow-up period was only 3.8 years, and the study was limited by the small number of clinical events. Additionally, Nakanishi et al. demonstrated that for the most part, increased CAC was associated with higher mortality in different ethnic groups in a long-term observational study of 13092 asymptomatic patients.[51] However, some results were not statistically significant (i.e in blacks), likely due to smaller sample size (n = 436). Previous reports have also shown CAC to be a strong predictor of cerebrovascular events as well. From the MESA cohort, with an average follow-up of 9.5 years, Gibson et al. showed that ACC/AHA CAC cutoff (CAC > 300 or > 75th percentile for age, sex and ethnicity) was an independent predictor of cerebrovascular events (HR:1.70, 95% CI:1.24 to 2.35).[52] Similarly, in a report of 4180 subjects from the

populations based HNR study, Herman et al. showed that patients suffering from stroke had higher CAC scores at baseline than non-stroke subjects (median, 104.8 vs 11.2).[53] Budoff et al.[10] recently demonstrated that CAC predicted ASCVD events similarly across all ethnic groups in 6814 persons from the MESA study with > 10 years follow up. For each doubling of CAC, there was an estimated increase of 14% in ASCVD events regardless of age, gender and ethnicity. The current American College of Cardiology/American Heart Association (ACC/AHA) guidelines recommend that if a risk-based treatment decision is uncertain after a quantitative risk assessment, assessment of CAC may be considered to inform treatment decisions. CAC score > 300 Agatston units or > 75th percentile for age, sex and ethnicity may be considered for statin therapy.[11,28,54]

3. Conclusion

Racial differences do exist in the prevalence and severity of CAC. These differences are more prominent in men than in women. whites and SA have been noted to have higher prevalence of CAC as compared to other ethnic groups, even after the adjustment for risk factors. In the light of these studies, the prevalence and extent of coronary calcification considerably differed among ethnic groups. From current data, mostly from MESA and HNR, these differences do not seem to reduce the predictive value of this robust subclinical marker. As we continue to follow these patients from various epidemiological studies, our understanding of coronary calcification and its predictive value among various ethnicities will continue to grow. Further studies will be needed to elucidate the differences in plaque composition (calcified and non-calcified) among various ethnicities. Whether absolute CAC or ethnic-specific nomograms should be used for precise prediction of ASCVD events, remains up for debate.

Disclosures

Dr. Matthew J. Budoff is a consultant for General Electric; the other authors have no conflict of interest.

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