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Breast Arterial Calcification In Screening Mammograms And Its Correlation With Carotid Intima Media Thickness: A Cross-Sectional Study

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ABSTRACT

Introduction: Globally, atherosclerosis is a major contributor to cardiovascular death. In order to detect breast cancer early, screening mammography is optional for all women over 40, according to guidelines set forth by the American Cancer Society (ACS). Mammograms can show Breast Arterial Calcification (BAC). If there is a substantial link found between Carotid Intima Media Thickness (CIMT) and BAC, women with BAC and additional risk factors such as diabetes or hypertension may be sent for cardiovascular risk assessment in the future.

Aim: To evaluate BAC in female patients having screening mammography and ascertain whether BAC and CIMT are correlated.

Materials and Methods: Between May 2024 and October 2024, 152 women who had screening mammography at the Vinayaka mission Kirupananda Variyar medical college, Department of Radiodiagnosis participated in a cross-sectional study. The BAC's existence and rating were established using the Mediolateral Oblique (MLO) and Craniocaudal (CC) views are the two standard views that were captured by the mammography machine. Using B-mode ultrasonography and an 8–13 MHz linear transducer, two adjacent sites CIMT was measured at intervals of 1 cm, and the average was computed. Spearman's rho correlation was used to determine the link, and a 5% threshold of statistical significance was examined.

Results: The study population had a mean age of 55.7±11.05 years. Of these, only 37 (24.3%) had

evidence of calcification in the arteries that supply the breasts. In the BAC (+) group, the mean CIMT was 0.92±0.25 mm, while in the BAC (-) group, it was 0.72±0.24 mm (p-value=0.001).

Conclusion: The authors developed the BAC grading system after evaluating several previous studies, and the current study found a high positive correlation between BAC and CIMT

INTRODUCTION

Atherosclerosis is the primary cause of cardiovascular death. It is a chronic inflammatory disease that results from lipid oxidation and hyperlipidemia. It affects the intima of vessels, from the aorta to the coronary arteries, causing the formation of intimal plaques. Imaging methods such as CT and radiographs can be used to detect arterial calcifications or from ultrasound to show an increase in Carotid Intima Media Thickness (CIMT). Screening mammograms are given to asymptomatic women in order to identify breast cancers early and treatable. The American College of Cardiology recommends screening mammograms every year for average-risk women between 40 and 44 and 45 and above.

Women who are at high risk should begin screening around age thirty. Mammograms frequently reveal Breast Arterial Calcifications (BACs) as unintentional findings. The tunica media of small to medium-sized muscle arteries in the breast contain benign dystrophic calcifications. They are also referred to as arteriosclerosis or Mönckeberg calcifications. CIMT is a recognized proxy indicator of atherosclerosis that is linked to cardiovascular risk factors and consequences. The thickness of the tunica intima and tunica media, the innermost two layers of the artery wall, can be measured non-invasively. B-mode ultrasonography, which produces still images, is used to get CIMT. Atherosclerosis is indicated by diffuse artery wall thickening, which is indicated by an increased CIMT.

Additionally, it is used to track the development of atherosclerosis in order to start medicinal interventions early. It is now known that elevated CIMT and vascular calcifications in the breast may be indicators of a woman's risk for coronary artery disease. Therefore, it is important to take into account the chance of future cardiovascular events for patients whose BAC was inadvertently discovered during breast cancer screening mammography.

The current study set out to measure breast cancer risk assessment (BAC) in women having screening mammography by applying the Grade system and analysing the relationship between BAC and CIMT.

MATERIALS AND METHODS

Between May 2024 and October 2024, 152 women who had screening mammography at the Vinayaka mission Kirupananda Variyar medical college, Salem India, Department of Radiodiagnosis, underwent a cross-sectional study. All subjects gave their informed consent, Women between the ages of 31 and 89 receiving mammography are eligible to participate.

STUDY PROCEDURE

The Mammography machine was used to acquire standard Mediolateral Oblique (MLO) and Craniocaudal (CC) images following the acquisition of pertinent clinical and prior history data and informed consent. Arterial Calcification of the Breast (BAC) was described as the parallel linear calcified deposits along the vessel wall on at least one mammography image. The presence and grading of breast cancer were evaluated in the mammography pictures.

The authors devised the scoring/grading method for breast arterial calcifications utilized in this investigation after analysing a number of publications. The following standards were used to assess the quantity, length, and density of calcified vasculature in women with BAC: The average of both breasts indicates the quantity

of calcified vessels in each breast.

- First score: <2 vessels - 1
- Second score: 2-4 vessels - 2
- Third score: >4 vessels – 3

The average length of the calcified vessels in both breasts.

- First score: <3 cm - 1
- Second score: 4-6 cm - 2
- Third score: > 7 cm – 3

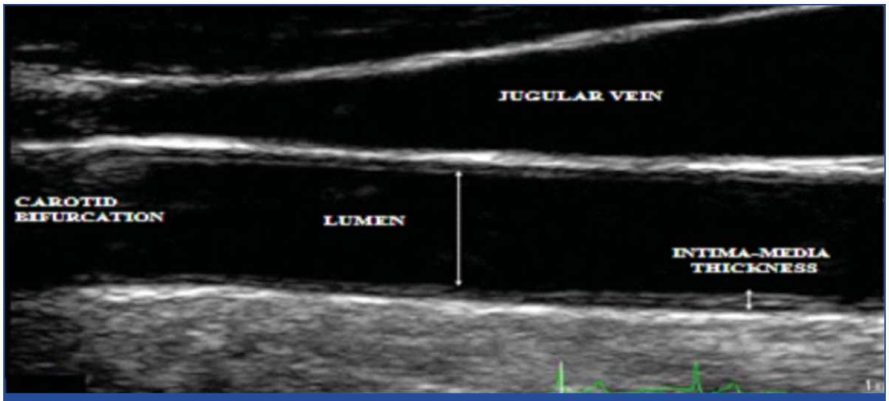
Density in the densest portion of a calcified artery;

- Score 1: BAC with clear lumen-1;
- Score 2: BAC with obscured lumen-2
- Score 3: Dense BAC without lumen visualization – 3

These three figures were added up to determine the BAC grade, which was assigned as follows:

- Grade-I (Mild): Score ≤3.
- Grade-II (Moderate): Score 4-6
- Grade-III(Severe): Score ≥7

The Carotid Intima Media Thickness (CIMT) was measured with a linear transducer operating at 8–13 MHz. Two adjacent sites provided CIMT data at intervals of one centimeter, and the analysis relied on the average of the two measurements. The average of the left and right Common Carotid Arteries (CCA) was given as the CIMT measurement [Table1].



[Table/Fig-1]: Ultrasound image showing Carotid Intima Media Thickness (CIMT).

STATISTICAL ANALYSIS

Statistical Package for Social Sciences (SPSS) was used to conduct the statistical analysis. The mean±standard deviation was used to represent continuous measurements, whereas the number (%) symbol was used to represent categorical measurements. The significance threshold was set at 5%. The Fishers' extract test was used to analyze the relationship between BAC and age. The relationship between various BAC grades determined by mammography and CIMT was examined with the application of Spearman's rank correlation. The Chi-square test was utilized to analyze the correlation between BAC and CIMT.

RESULTS

The minimum CIMT was 0.1 mm on the left side and 0.3 mm on the right. The maximum CIMT was 1.8 mm on the left side and 1.9 mm on the right. The mean CIMT was 0.7 mm (0.4 SD) on the right side and 0.7 mm (0.2 SD) on the left, for a total of 0.7 mm.

The patients' average age was 55.77±11.05 years. Of these, only 37 had evidence of calcification in the arteries supplying the breasts. The age range of 51 to 60 years old was the most frequently impacted [Table/Fig-2]. The majority of female participants had moderate BAC grades [Table/Fig-3,4]. The minimal CIMT is indicated on the right side.

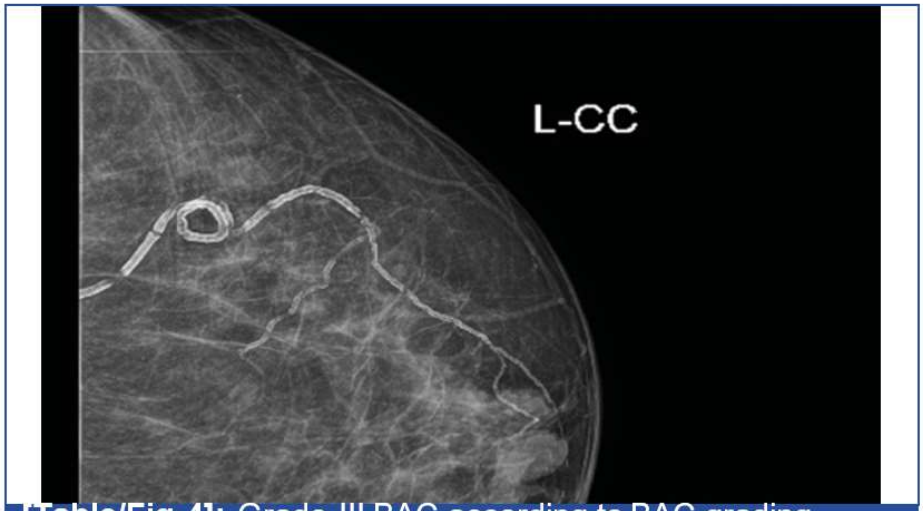
Roughly 97 (63.8%) of the total participants had CIMT ≤0.8 mm, and roughly 55 (36.2%) had CIMT > 0.8 mm, based on a cutoff of ≤0.8 mm as normal CIMT [Table/Fig-5]. A p-value of less than 0.05 indicated a significant difference in CIMT between the BAC positive and negative groups [Table/Fig-6]. There was no correlation between an increase in BAC grade and an increase in CIMT, according to a logistic regression analysis between mean CIMT and BAC grades [Table/Fig-7].

Age (years)	BAC		Total	p-value (Fisher-exact test)
	No	Yes		
31-40	10 (6.5%)	0	10 (6.5%)	0.0001
41-50	43 (28.3%)	1 (0.7%)	44 (28.9%)	
51-60	41 (26.9%)	10 (6.5%)	51 (33.6%)	
61-70	12 (7.9%)	15 (9.8%)	27 (17.8%)	
>70	9 (5.9%)	11 (7.2%)	20 (13.2%)	
Total	115 (75.7%)	37 (24.3%)	152 (100%)	

[Table/Fig-2]: Frequency of age distribution between BAC positive and BAC negative. Values presented as n (%).

Grading	Count	Percentage (%)
I	2	5.4
II	26	70.2
III	9	24.3

[Table/Fig-3]: Grading of BAC.



[Table/Fig-4]: Grade-III BAC according to BAC grading.

BAC	CIMT		Total	p-value (Chi-square test)
	≤0.8 (mm)	>0.8 (mm)		
Present	15 (40.5%)	22 (59.4%)	37 (24.3)	0.0001
Absent	82 (71.3%)	33 (0.28%	115 (75.6%)	
Total	97 (63.8%)	55 (36.18%)	152 (100%)	

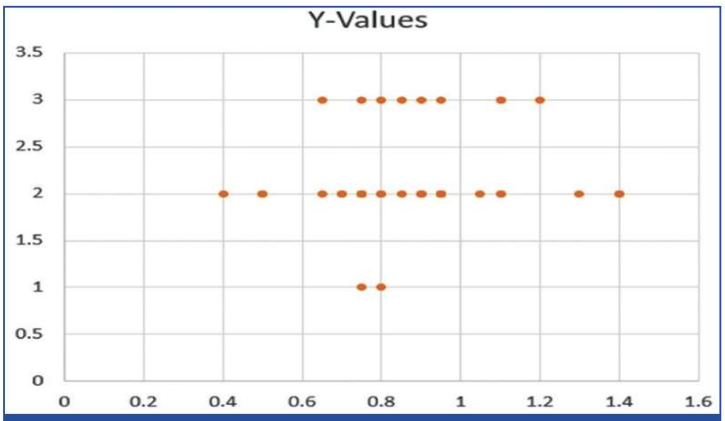
[Table/Fig-5]: CIMT in BAC positive and negative women.

Variables	BAC	N	Mean	Std. Deviation	p-value (Chi-square test)
CIMT RIGHT	No	115	0.759130	0.4516822	0.043
	Yes	37	0.921622	0.3038047	
CIMT LEFT	No	115	0.717391	0.2103718	0.047
	Yes	37	0.808108	0.3165600	

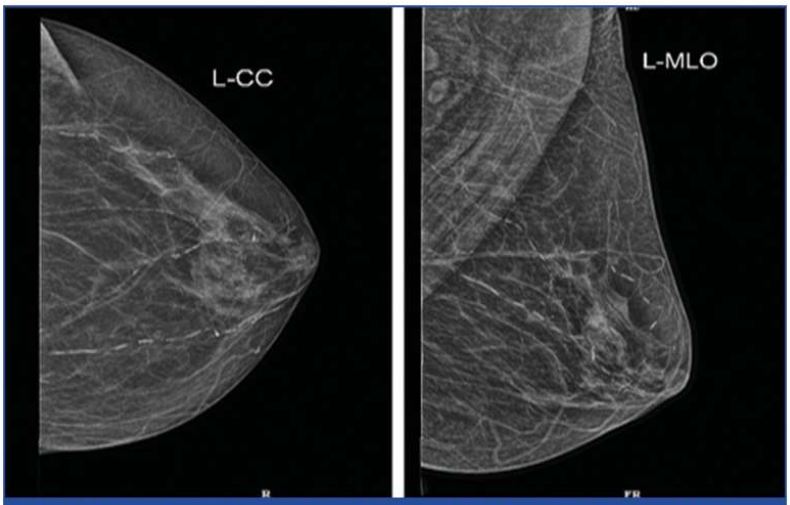
[Table/Fig-6]: CIMT values in BAC + and – women.

DISCUSSION

The term "BAC" describes calcium deposits that are incidentally found along the vessel wall on mammography. The intermediate layer of the vessel wall has deposits that cause the vessel to become more rigid and stiff [Table/Fig-8]. Disorders linked to increased or accelerated atherosclerosis may also be connected with BAC seen on breast cancer screening mammography. Early on, linear tramtrack calcifications result from punctate medial artery calcifications that eventually unite and thicken.



[Table/Fig-7]: r_s=0.16751, p (2-tailed)=0.3217.
There was a positive correlation between CIMT and BAC grade, but they are statistically



[Table/Fig-8]: Breast arterial calcification in a left breast in CC and MLO views.

The BAC is rarely found before the age of 50 and is only accidentally detected in 9.1% of mammograms. Between 9 and 17% of people have BAC, and its frequency rises with age, especially in women over 65. A higher BAC has also been linked to increased parity. According to Kemmeren JM et al., 9% of women who took part in a program for breast cancer screening had a BAC. In the current investigation, only 24.3% of participants had BAC detected, and there was only one instance of BAC in a subject who was under 50 years old. According to Maas AH et al., the prevalence of BAC rose as people aged, rising from 5% in the first quartile to 6% in the second and 14% in the third, and 20% in the quadrant's fourth. those in the top quartile of age had an odds ratio of 4.7 (95% CI: 2.9-7.6) more likely to have BAC than those in the lowest quartile [10]. According to the current study, BAC was shown to rise with age and was more common in women over 60.

Sankaran P et al. discovered an independent correlation between BAC in mammography and CIMT in their study including 100 women. Furthermore, regardless of age or menopausal status, they discovered a statistically significant positive correlation with CIMT. The current investigation did not find that the thickness of the breast vasculature increased in tandem with an increase in the grade of calcification. In a

study including 454 patients, Hanafi MG et al. found that while those with BAC had higher CIMTs than the control group, there was no correlation between the carotid artery thickness and the grade of this calcification.

In a multi-modality study examining the relationship between coronary artery calcification, CIMT, and BAC, Kadioglu A and Bahadir S discovered a substantial correlation between BAC and aging. There was a statistically significant association identified between high blood alcohol content (BAC) and cardiac risk factors such as diabetes, as well as a correlation between high BAC and high CAC scores. Moreover, they proposed that the BAC scoring system can serve as a marker for cardiovascular disease in women under the age of 60.

In their study of 54 Nigerian women, Akinola RA et al. discovered that while the presence of BAC in a mammography is associated with age, it might not be a meaningful marker or a dependable signal for cardiovascular diseases in women who live in their community. In their investigation of 100 female patients, Ali EA et al. came to the conclusion that women over 60 with BACs unintentionally found on mammography ought to have their coronary atherosclerotic state and chance of having major coronary artery disease further evaluated.

The current investigation discovered that moderate BAC grades rose with age after 50.

According to standards, most women over 40 get screening mammograms each year. Our research indicates that measuring breast anatomy circumference (BAC) may be a non-invasive way to screen women for cardiovascular disease without exposing them to further radiation. Clinicians may therefore find it easier to advise and suggest lifestyle modifications, cardiovascular risk assessment, and the avoidance of subsequent cardiovascular events if incidentally identified BAC is included in mammography reports.

LIMITATION

A significant drawback of the current study was the relatively small number of individuals, the majority of whom were follow-up patients following a mastectomy. Another restriction is that there isn't a BAC grading scheme that is widely used.

CONCLUSION

Therefore, after reviewing a number of earlier studies, the authors created the BAC grade system. Co-morbidities' impact on CIMT thickness was not taken into account. Since this scoring system is only used in a limited group, more testing in various contexts and with diverse populations is necessary before any conclusions about its correctness can be made. To ascertain the accuracy of this objective scoring method, more research is necessary.

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