Vascular calcification in breast and its association with atherosclerosis in common carotid artery

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ABSTRACT

Introduction

Breast arterial calcifications (BAC) seen in mammogram are calcifications of the internal mammary artery. Atherosclerosis, in general, is an independent predictor of acute coronary, cerebrovascular and other vascular diseases. We evaluated the association between common carotid artery intima media thickness (C-IMT) in patients with and without breast arterial calcifications (BAC) on mammogram.

Methods

This case control study included 108 women who underwent mammographic examination of breast in department of Radiology, TUTH, Maharajgunj, Kathmandu, Nepal. Cases were defined as patients with BAC on mammogram and matched controls without BAC were selected after obtaining ethical clearance from the Institutional Review Committee. Grading of BAC was done. Mean IMT of bilateral Common Carotid Artery (CCA) in cases and controls was measured on sonography. All the relevant data were entered in predesignated proforma and the findings tabulated. The mean IMT was calculated in cases and controls and compared using SPSS statistics. The null hypothesis was tested using independent t test.

Results

The age ranged from 34 to 78 years. Maximum number of cases had grade BAC score of 1. The mean value of

IMT in right CCA was 0.79mm and 0.57mm, that of left CCA was 0.78mm and 0.57 mm in cases and controls, respectively. The mean IMT was higher in patients with higher BAC score. Null hypothesis was rejected by independent t test and odd's ratio was> 1, showing significance of association between vascular calcification in breast and CCA IMT.

Conclusions

Our study shows a significant association between the BAC and intima media thickness of CCA, latter being higher in patients with BAC and increasing with grade.

Keywords: **Atherosclerosis, Breast, Mammography.**

Introduction

Mammogram is done for screening and diagnosis of various breast pathologies. Different benign calcifications are often seen, of which vascular calcification comprise a major part. Breast arterial calcifications (BAC) are the tram track calcifications of the internal mammary artery. Age advanced vascular calcification in breast may be caused by renal disease, hyperparathyroidism, liver disease sometimes leading to calciphylaxis[1]. Atherosclerosis is a major cause of vascular calcification older age group. BAC can be classified based on the number of vessels involved, the length and the density of the calcification[2].

Atherosclerosis is an independent predictor of acute coronary syndromes, acute cerebrovascular accident, chronic kidney disease, diabetes and peripheral vascular disease[3]. BAC and plaques or

increased intima media thickness in common carotid artery may represent spectrum of atherosclerosis and occur concurrently. If such an association can be proved, this benign mammographic finding may be considered suspicious marker for more catastrophic cardiovascular, cerebrovascular and renal events and such patients can be timely evaluated and intervened for atherosclerotic disease elsewhere, thus reducing associated morbidity and mortality[2, 4].

In this study, we evaluated the association between common carotid artery intima media thickness (IMT) in patients with and without BAC on mammogram and also graded BAC.

Material and methods

This was a prospective analytical case control study done in department of Radiology, Institute of Medicine, TUTH, Maharajgunj Medical Campus, Kathmandu from June 2019 to November 2020 after obtaining ethical clearance from the Institutional Review Committee. Non- probability convenience sampling method was chosen. The study population consisted of female patients referred to the department for screening or diagnostic mammography who agreed to participate in the study. Women with previous breast surgery, distorted breast due to any cause and known hypertension, diabetes or chronic kidney disease were excluded from the study. A total number of 108 patients were selected in the study, of which 54 were cases and an equal number controls. The cases were defined as those with vascular calcifications that is, tram-like calcification of internal mammary arteries on mammogram. Equal number of females without mammographic vascular calcifications were selected as the control group. The mean age of the cases and controls were matched as far as possible.

All mammograms were performed in Mammomat fusion unit and standard cranio-caudal (CC) and medio-lateral oblique (MLO) views were taken. The images for further reviewed visually using magnification as needed for calcification, its pattern and density in the work station YLXRO19095, on the basis of which BAC grading adapted from the previously proposed scoring systems, was done as follows.[2,5]

0 - No vascular calcification;

1 - Few punctate vascular calcifications with no coarse, tram track or ring calcifications;

2 - Abundant punctate vascular calcification or tram track calcifications;

3 - Severe coarse or tram track calcification obliterating or clouding the lumen.

Following mammogram, the females were subjected to ultrasonography (USG) examination of neck for common carotid vessels evaluation done in grey scale. A linear 7.5 MHz transducer was used for common carotid artery (CCA) examination. The patient was kept supine, neck was hyperextended and the patient was turned opposite the side under examination. The IMT which represents the sum of thickness of tunica media and tunica intima, was measured in CCA 1 cm proximal to the carotid bifurcation on both sides. CCA including carotid body were evaluated for the presence of plaque. Atherosclerosis was defined as IMT> 1mm and / or presence of plaque in any part of CCA including carotid bulb to categorize cases and controls for obtaining the odd's ratio.

All the relevant data and measurements were entered in the predesignated proforma. Then mean right and left IMT was calculated in both cases and control using SPSS software. Independent t- test was used to verify the hypothesis. Odd's ratio was also calculated to support the association.

Results

The age of included patients ranged from 34 to 78 years with mean of cases being 56 and that of controls 50 years. The age distribution of IMT was as shown in figure 1 with maximum mean LIMT in the 70 to 80 years age group, RIMT in age group of 60 to 70 years and minimum mean IMT was in 30 to 40 years, demonstrating age as an independent risk factor for atherosclerosis.
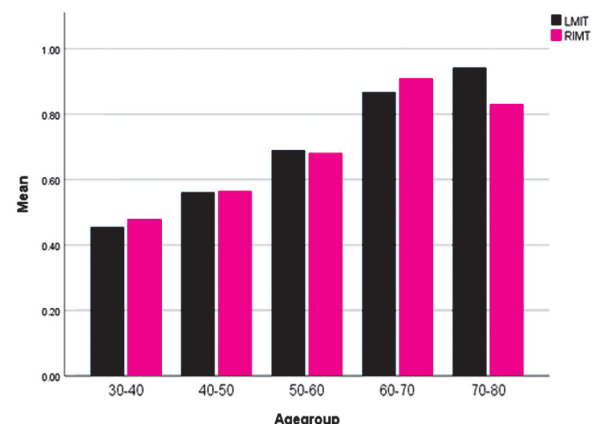

Figure 1: Overall mean LIMT and RIMT in different age groups including both cases and controls.

The RIMT (Right CCA IMT) in our study ranged from 0.29 to 1.6mm and of LMIT (Left CCA IMT) ranged from 0.3 to 2.3mm with means and standard deviation as shown in the table 1. The mean IMT value of right and left CCA was higher in cases than in controls (table 1).

Table 1: Mean IMT in cases and controls in left and right CCA

Groups	Left CCA			Right CCA		
	Mean (mm)	N	SD	Mean (mm)	N	SD
Overall	0.67	108	0.27	0.68	108	0.22
Cases	0.78	54	0.32	0.79	54	0.22
Controls	0.57	54	0.15	0.57	54	0.16

The null hypothesis of no significant association between BAC and CCA IMT at significance level of 0.05, was rejected by the study. P value of < 0.05 in both right and left CCA rejected the null hypothesis and showed significant association between BAC and CCA IMT. To calculate Odd's ratio, atherosclerosis was defined as IMT> 1mm and / or presence of plaque in any part of CCA including carotid bulb. The odd's ratio was >1, that is 5.4 on right and 7.2 on left side, suggesting relation between vascular calcification in breast and atherosclerosis as determined by CCA IMT (table 2).

Table: A 2x 2 table for odd's ratio calculation in case control study for left and right CCA.

	Left CCA IMT		Right CCA IMT	
	>1mm	< 1mm	>1mm	< 1mm
CASES	7	47	5	49
CONTROLS	1	53	1	53
Odd's Ratio	7.8		5.4	

Out of total 54 cases, 33 had grade 1, 15 grade 2 and 6 grade 3 BAC score (Figure 2). The maximum value of IMT in both right and left CCA was found in patients with higher BAC score (Figure 3).
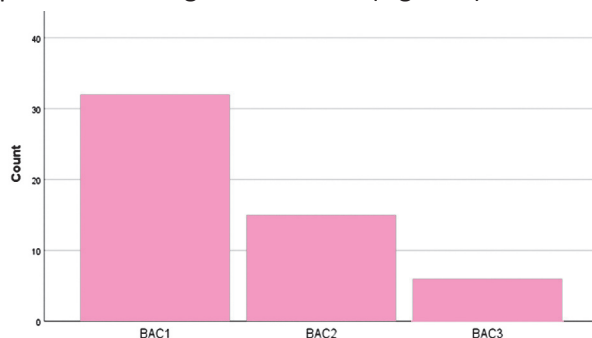
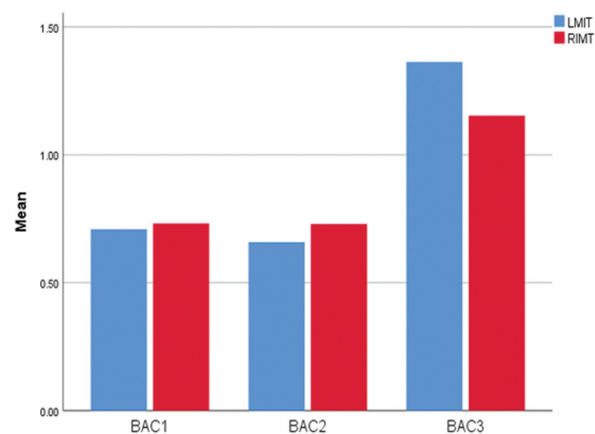
Figure 2: Distribution of BAC grades among the cases.

Figure 3: Relation of BAC score with RIMT and LIMT.

Discussion

Arterial calcification may be intimal, characterized by large, irregular and discontinuous calcium deposits occurring in larger muscular arteries, or medial which are smooth, granular with circumferential deposits in smaller muscular arteries[6,7].Vascular walls become thick and stiff in atherosclerotic disease which is reflected by thickened intima media complex in the carotid arteries along with formation of plaque. Likewise, vascular calcification in breast results from thickening of intima media complex and plaque formation in internal mammary artery. Though it is difficult to differentiate the two in breast, vascular calcifications may be identified as linear and parallel appearing deposits in tram-track or railway track configuration. C-IMT is closely related with coronary artery calcifications and cardiovascular diseases that would develop in future. Therefore, C-IMT measurement is suggested as a useful tool to detect early atherosclerotic changes[8, 9].

BAC are seen in mammogram done routinely for screening and diagnostic purpose. These calcifications as mentioned in different literature are the atherosclerotic changes occurring in the internal mammary arteries and represent benign findings without risk for breast malignancy. It may reflect concomitant atherosclerotic changes occurring elsewhere in the body namely the CCA, coronary arteries, renal arteries and peripheral limb arteries and the need for evaluating patients[10]. Previous studies have analyzed and found positive correlation between BAC and cardiovascular risk with relatively less evaluation of correlation between BAC and IMT.

We found that the mean IMT value of right and left CCA was higher in cases than in controls,

and greater thickness was seen in patients with higher BAC score. This suggests higher chances of atherosclerosis with increasing grade of BAC. The mean IMT on either side was highest in older age groups more than 60 years of age and minimum in younger group that is 30-40 years. This is consistent with other studies suggesting age is an independent risk factor for atherosclerosis[11].

So, BAC must be mentioned in mammogram report as these are the suspicious markers of atherosclerosis and timely screening and intervention can reduce both morbidity and mortality from atherosclerosis related complications[12]. Our study is limited by the sample size. A prospective study of correlation of BAC with other risk factors like body mass index, lipid profile and co-existent morbidities like cardiac disease is suggested.

Conclusions

Our study shows a significant association between the IMT of CCA and BAC, former being higher in patients with BAC and increasing with grade. BAC must always be mentioned in the mammogram report. We recommend that women with vascular calcification in breast should be screened for atherosclerosis.

Acknowledgements

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