CLINICAL AND ANGIOGRAPHIC PROFILE OF CALCIFIC VS. NON-CALCIFIC CORONARY LESIONS

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ABSTRACT

BACKGROUND

We wanted to assess the clinical and angiographic characteristics associated with coronary lesion calcification as compared to non-calcified lesions in those with significant angiographic stenosis.

METHODS

This was a cross-sectional**,** descriptive**,** analytical**,** single centre study of 120 patients who were diagnosed with significant angiographic coronary artery disease during April 2018 to June 2018. Patients were divided into two groups**;** those with calcified lesions and those with non-calcified lesions. Calcified and non-calcified coronary lesions were compared retrospectively for any difference in clinical**,** investigatory and coronary angiographic data.

RESULTS

A total of 120 patients were included in this study. 52 patients had calcified lesions and 68 patients had non-calcified lesions. Mean age was higher in the calcified group (59 years vs. 51 years p 0.003). Multivessel disease with proximal LAD involvement and coronary ectasia were significantly more in calcified group (29% vs. 6% p 0.01 and 29% vs. 5% p 0.001 respectively). Higher lesion complexity was seen more in calcified lesions (SCAI lesion category IV 32% vs. 7% p 0.03**;** ACC-AHA lesion category C 46% vs. 23% p 0.04). Chronic total occlusion was more often seen in calcified group (52% vs. 23%**,** p 0.003). CABG was the most proposed treatment in calcified group compared to PCI in non-calcified group (40% vs. 24% p 0.04 and 47% vs 27% p 0.02 respectively).

CONCLUSIONS

The present study concluded that higher lesion severity**,** total occlusion and ectasia was more frequently seen in calcified lesions and consequently coronary artery bypass graft surgery was more frequently advised to patients with calcified lesions. Calcification in the coronary artery was more commonly seen in older patients. Other traditional risk factors were comparable between the calcified and non-calcified group.

KEYWORDS

Angiography, Calcification, Total Occlusion.

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BACKGROUND

Coronary artery disease (CAD) is the leading cause of death in developing as well as developed world.[1,2] The number of deaths due to CAD has doubled in the past three decades. Coronary angiography is the gold standard for diagnosis and management of CAD. Fluoroscopic detection of calcium during angiography can provide prognostic information in addition to angiographic findings.

Atherosclerotic plaque is the hallmark of coronary artery disease. Accumulation of lipid laden foamy macrophages and vascular smooth muscle cells causes initiation of atherosclerotic plaque formation which ultimately leads to intimal thickening and narrowing of the artery. Coronary artery calcification and stenosis are simply different manifestations of atherosclerosis. Calcification of coronary artery is accumulation of calcium in the intimal and/or medial layer of coronary artery wall. Calcification can be found in different forms ranging from cellular calcium to spotty calcification to calcified nodules associated with thrombus to dense calcium shelves.[3] Coronary calcium has a fair correlation with the extent of atherosclerosis and are difficult to treat with percutaneous coronary intervention with increased risk of stent under-expansion and stent malapposition.[4] The study objectives were to determine whether (1) Traditional coronary artery disease risk factors are associated with coronary calcification (2) Coronary calcification has any association with presenting clinical syndrome or angiographic lesion severity/complexity. This was done by assessing the clinical and angiographic characteristics associated with calcified coronary lesions in

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comparison to non-calcified lesions in those with significant angiographic stenosis.

METHODS

This was a cross-sectional, descriptive, analytical study. 120 patients who were diagnosed with significant angiographic coronary artery disease during evaluation at a tertiary care centre in India from April 2018 to June 2018 were included in this study. Patients with history of CABG or history of any coronary intervention procedure were excluded from the study. Clinical history, general and cardiovascular system examination findings were collected from prospectively maintained database. All the patients underwent investigations including complete blood count (CBC), random blood sugar (RBS), serum creatinine, 12-lead electrocardiography, chest X-ray and echocardiography. The echocardiography included M-mode, 2D and Doppler studies. Patients were divided into two groups; the first group consisting of those with calcified lesions and the second group with non-calcified lesions.

Philips Allura XPER FD 2005, the Netherlands flat panel cath-lab system was used for recording coronary angiogram. Femoral or radial routes were used for angiography. Angiographic calcification was defined as multiple persistent opacifications of the coronary wall, visible in more than one projection at the site of the lesion. Calcified and non-calcified coronary lesions were evaluated retrospectively for comparison of clinical, investigatory and coronary angiographic data.

Statistical Analysis

Continuous variables are presented as mean ± standard deviation (SD) and categorical variables as counts and percentages. Variables were compared using independent sample t-test for normally distributed data and Mann-Whitney U test for non-normally distributed data. P-value <0.05 was considered statistically significant. All the data were analysed using the Statistical Package for Social Sciences Software (Version 15.0, SPSS; Chicago, IL, USA).

RESULTS

A total of 120 patients were included in this study. 52 patients had calcified lesion and 68 patients had non-calcified lesions. Males were predominant in both the groups; 71.2% in calcified group and 70.6% in non-calcified group. Mean age of calcified group was significantly higher than the non-calcified group (59 years and 51 years, p 0.003). Traditional risk factors i.e., history of smoking, systemic arterial hypertension, diabetes mellitus and dyslipidaemia, were comparable in both groups (p >0.05). History of effort angina was equal in both groups and history of acute coronary syndrome was higher in non-calcified group than the calcified group (26.47% and 11.53%, p 0.01) (Table 1).

Single vessel disease without proximal left anterior descending (LAD) involvement occurred more frequently in non-calcified group (40% and 15%, p 0.03). On the contrary, multivessel disease with proximal LAD involvement and coronary ectasia were significantly more in calcified group (29% and 6%, p 0.01; 29% and 5%, p 0.001 respectively). The lesions were categorised as per Society of Coronary Artery Intervention (SCAI) and American College of Cardiology/American Heart Association (ACC/AHA) lesion classification systems. In both the systems lesions are classified based on various parameters like lesion length, angulation, tortuosity, bifurcation involvement, presence or absence of calcium, thrombus and chronic total occlusion. Both the systems predict immediate and long-term complications post coronary intervention. Higher lesion complexity was seen more in calcified lesions (SCAI lesion category IV 32% vs. 7% p 0.03; ACC-AHA lesion category C 46% vs. 23% p 0.04) (Table 2). Chronic total occlusion was more often seen in calcified group (52% and 23%, p 0.003).

Calcification was most commonly found in LAD artery followed by left circumflex artery (LCX), right coronary artery (RCA) and left main coronary artery (LMCA). (Figure 1) Considering the severity of lesions, patients were advised either coronary artery bypass graft (CABG) or percutaneous coronary intervention (PCI) or medical management. 40% of patients in the calcified group were advised for CABG while almost half of the patients (47%) in the non-calcified group were advised for PCI (p 0.04 and 0.02 respectively) (Figure 2).

Characteristics	Calcified Lesions, n=52	Non-Calcified Lesions, n=68	p-Value
Demographic Characteristics			
Age, (mean ± SD, years)	59.0±8.2	51.0±9.6	0.003
Male, n (%)	37 (71.2%)	48 (70.6%)	
Risk Factors			
Current smokers, N (%)	30 (57.69%)	26 (38.24%)	0.1
Hypertension, N (%)	28 (53.85%)	23 (33.82%)	0.5
Diabetes mellitus, N (%)	20 (38.46%)	18 (26.47%)	0.36
PVOD, N (%)	26 (50.00%))	31 (45.59%)	0.06
Previous ACS, N (%)	6 (11.53%)	18 (26.47%)	0.01
EA, N (%)	9 (17.31%)	6 (8.82%)	0.08
RBS >200 mg, N (%)	12 (23.00)%	10.2 (15.00%)	0.100

Table 1. Baseline Demography of Patients

Characteristics	Calcified Lesions, n=52	Non-Calcified Lesions, n=68	p-Value
Lesion Categories (ACC/AHA Score)			
Type A,%	3%	7%	0.08
Type B1,%	51%	70%	0.09
Type C,%	46%	23%	0.04
Lesion Categories (SCAI Lesion Categories)			
I,%	27%	56%	0.03
II,%	13%	10%	NS
III,%	27%	27%	NS
IV,%	32%	7%	0.01
Chronic Total Occlusion,%	52%	23%	0.003

Table 2. Lesion Characteristics of Patients

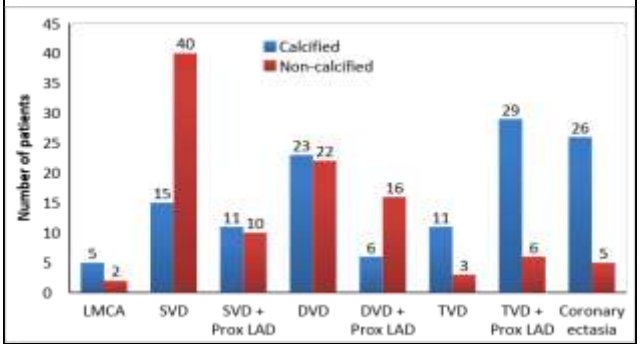

Figure 1. Angiographic Findings

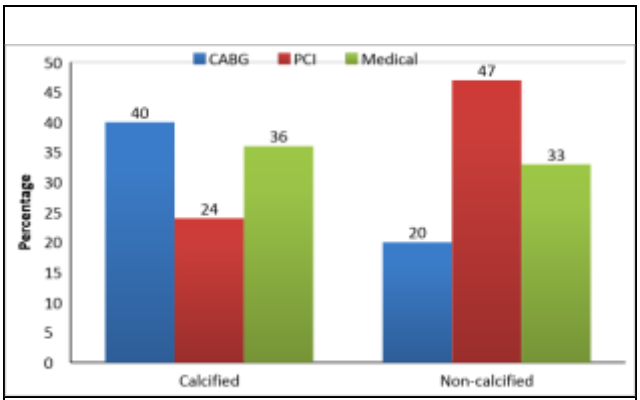

Figure 2. Advised Treatment Comparison Between the Groups

DISCUSSION

Calcium screening in the coronary artery is based on two integrated factors**:** (1) calcium quantity is representative of severity and extent of atherosclerosis**;** (2) the severity and extent of atherosclerosis is tied to the probability of coronary event.[5,6] These findings form the basis for calcium screening tests in identifying persons at risk of coronary events and excess mortality. Coronary angiogram is highly specific (90 to 100%) but less sensitive to detect calcium (25% to 85%) compared to intravascular ultrasound. Angiographic sensitivity increases when calcium exists in two or more quadrants (more than 180^0) in the arterial wall**,** extends more than 5 mm in length or is superficial. Detection of calcium in otherwise angiographically normal vessel suggest significant disease at that level.

Acute episodes of erosion and rupture occur commonly in plaques with large lipid core, a thin cap and a high density of macrophages that are in an activated stage. A plaque with these characteristics is considered as a vulnerable plaque.[7] Observational studies have indicated no direct relation between plaque rupture and calcification. Tears do not develop in spatial relation to the nodules of calcium. One exception is in subjects older than 70 years in whom tear of fibrous plaque at the edge of a plate of calcium tends to occur. However, there is no established relation between the factors conferring vulnerability of the plaque and calcium. But coronary calcium has a fair correlation with extent of coronary athroclesrosis.[8] It has been shown that presence and extent of calcium modestly predicts the risk of future coronary events although the association is not uniform across literature.[9,10] The present study showed negative association between angiographic calcium and acute coronary syndrome contrary to the results of most previous studies. This may be attributed to the occurrence of plaque rupture at a relatively younger age in this part of the world where as calcium tends to increase with age. The possible explanations for a positive association in previous studies are**,** more extensive atherosclerosis has more probability to contain vulnerable plaques.[11] Selection bias could also have contributed to the outcome of trials which showed a positive association. The association of coronary calcium with severe angiographic CAD is an expected finding as had been shown in previous studies. Coronary artery ectasia is an altered form of expression of atherosclerosis and hence associated calcification is likely consequential to extensive atherosclerosis. But it is unlikely that ectasia simply reflects more severe atherosclerosis**,** as shown in a study of familial hypercholesterolemia patients who did not show an excess of coronary ectasia**,** thereby suggesting that any pathophysiology causing ectasia could also be linked to more calcium.

The question of how presence of calcium would add to the prognostication obtained by coronary angiogram need to be answered with prospective evaluation with more number of patients. Follow up evaluation to look for occurrence of acute coronary events in those with equal coronary artery disease burden but with different calcium burden need to be done to answer this question.

CONCLUSIONS

History of acute coronary syndrome was more in subjects with non-calcified lesions. Higher lesion severity**,** total occlusion and ectasia was more frequently seen in subjects with calcified lesions and consequently coronary artery bypass graft was more frequently advised to the same group. Those with coronary calcification had higher mean age. Barring age**,** all other traditional risk factors were comparable between the calcified and non-calcified group.

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