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STUDY OF CORONARY ARTERY CALCIUM SCORING SIGNIFICANCE IN PATIENTS WITH STEMI IN A TERRITORY CARE CENTER

Cardiology

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ABSTRACT

Introduction: Coronary artery calcification (CAC) is part of development of atherosclerosis, occurs almost exclusively in atherosclerotic arteries and is absent in the normal vessel wall. Coronary artery calcification occurs in small amounts in the early lesion of atherosclerosis that appear in the second and third decades of life, but it is found more frequently in advanced lesions and in older age. The aim of this paper is to study the comparison of CAC score in patients with obstructive and non obstructive CAD and in patients with single and multi vessel disease.

Materials and Methods: This study is a prospective observational study involving 100 patients who were admitted in the department of cardiology of Govt.Mohan Kumaramanagalam Medical College between June 2015 to Feb 2018

Results: The study population included 100 patients (89 males and 11 females) admitted to department of cardiology, GMKMCH, Salem. The mean age of study group is 55±15 years. This study population contains predominantly males (90%). One half of population had hypertension and one fourth of the study group are diabetic. CAC scores showed good correlation in patients with obstructive CAD especially in elderly, Diabetics and family history of CAD

Conclusion: Our study reported that 128 slice MDCT derived CAC score is a useful tool to assess angiographic scoring in post MI population. CAC score is not useful to identify infarct related artery and there was no linear correlation between CAC score and the number of vessel involvement.

KEYWORDS

CAC: Coronary Artery Calcification Score STEMI : ST Segment Elevation Myocardial Infarction CAD : Coronary Artery Disease

Introduction:

Coronary Artery Calcification occurs in small amount in the early lesion of atherosclerosis that appear in the second and third decades of life, but it is found more frequently in advanced lesions and in older age. A positive CT study (defined as presence of any CAC) is nearly 100% specific for atheromatous coronary plaque. Since both obstructive and non obstructive lesion can have calcification present in the intima CAC is not specific for obstructive coronary disease.

The site and the amount of coronary artery calcium and the percent of coronary luminal narrowing are the same anatomic site, the relation is non linear, and has large confidence limits. As the occurrence of calcification reflects an advanced stage of plaque development, some researchers have proposed that the correlation between coronary calcification and acute coronary events may be suboptimal based largely on angiographic series. In order to understand this apparent conflict between the sta ging of a calcified lesion and CHD event rates, one must recognize the association between atherosclerosis plaque and more frequent calcified and non calcified plaque. That is patient who have calcified plaque are also more likely to have non-calcified or soft plaque that is prone to rupture of acute coronary thrombosis.

Materials and Methods:

This study was conducted at department of Cardiology Govt.Mohan Kumaramangalam Medical College, Salem from June, 2015 to February, 2018. Informed consent obtained from every patients included in the study. The inclusion criteria 1. All patients following STEMI including both recent and old Myocardial infarction irrespective of age and sex. 2. Both thrombolysed and not thrombolysed patients. 3. Patients with or without LV dysfunction. The exclusion criteria are 1. All acute coronary syndrome patients. 2. All chronic stable angina patients.

All patients underwent a proper history and clinical examination including the presence of risk factors like diabetes mellitus, hypertension, smoking and family history of CAD. Baseline investigations were done in all patients including complete blood count, blood sugar, renal functional test, lipid profile, chest x ray, ECG, Echo and Cardiac enzymes.The study population included 100 patients (89 males and 11 females) for coronary angiographic evaluation following STEMI.

Table -1 Showing patients characteristics

	Group I (n=50)	Group II (n=50)	Total
Age < 40 years	5	9	14 (14%)
40 to 60 years	10	6	16 (16%)
>60 years	35	35	70 (70%)
Male	46	43	89 (89%)
Female	6	5	11 (11%)
Hypertension	16	9	25 (25%)
Diabetes	9	12	21 (21%)
Smoking	17	5	22 (22%)
F/H of CAD	4	1	5 (5%)

Our study population contains predominantly Male (89%). One half (50%) of population had hypertension and one fourth of study group are diabetic. One fifth are smoker. All patients following STEMI admitted to undergo coronary angiography in the department of cardiology for CAG using Toshiba cath lab machine, GMKMCH, Salem. CAG was done through right radial and femoral routes using properly sized sheath, Judkins, catheter, Amplatz catheter and Tiger catheters Multiple angulations and views were used. The CAG was analyzed and the lesions are quantified in detail. Lumen diameter narrowing was graded as 0, 25, 50, 75, 90 and 100%. A detail report with picture are prepared and tabulated.

Based on CAG findings the study population is categorized into study Group I –with obstructive CAD (defined as ≥ 50% luminal obstructive irrespective of the infarct related artery) and Group II-with non obstructive CAD (≤ 50% Luminal obstructive in any of the epicedial coronaries)

After completion of CAG, the patient was referred to Radiology department, GMKMCH, Salem for assessment of CAC Score. It was done using Toshiba 128 slice Aquilon machine based on Agatston Scoring system by a expert radiologist who has no knowledge about the CAG lesion of the patient concerned. Any score greater zero is considered as positive score based on Agatston scoring and the results of both groups who underwent CAG scores were tabulated, compared and analyzed by chi-square test and multiple regression analysis statistical methods.

Results:

Totally, 100 patients were included in the study. About 86% of AWMI patients showed LAD involvement whereas LCX and RCA are predominant culprit vessels among patients with IWMI/ RWMI

Table -2 Showing patient's CAG baseline Profile in Group - I

Vessel Involvement	LAD	LCX	RCA	LAD and LCX	LAD and RCA	LCX and RCA	LAD LCX and RCA
No of Cases	14	3	6	6	15	2	4

Table -3 Showing Types of MI and the vessels involved

Vessel Involvement	AWMI	IWMI/ RWMI
LAD	14	1
LCX	1	3
RCA	2	3
LAD and LCX	4	1
LCX and RCA	3	5
LAD and RCA	5	2
LAD, LCX and RCA	6	1

The below analysis are done using chi-square test regarding the significance of the above variable and total CAC score among group I patients.

Table-4 Showing the significance of risk factor and CAC scores in patients with Group-I

S.No	Variable	Positive CAC	Negative CAC	P Value	Significance
1	Diabetes	09	4	0.069	Significant
2	Hypertension	9	6	0.902	Not Significant
3	Smoking	10	6	0.101	Not Significant
4	Family History	4	0	0.045	Significant
5	Sex	M-24, F- 2	M-21, F- 3	0.572	Not Significant
6	Age	Mean 51.04	Mean 47.03	0.027	Significant

shsIt has been noted that though the conventional risk factors like hypertension, smoking and male sex are associated with increased CAC scores, they are not statistically significant whereas the diabetes, age and positive family history is predictive of increased CAC scores in patients with obstructive CAD and it is statistically significant.

Table-5 showing the significance of risk factor and CAC scores in patient in Group –II

S.No	Variable	Positive CAC	Negative CAC	P Value	Significance
1	Diabetes	6	2	0.119	Not Significant
2	Hypertension	1	9	0.040	Significant
3	Smoking	2	3	0.921	Not Significant
4	Family History	1	0	0.156	Not Significant
5	Sex	M-18, F- 3	M-28, F- 3	0.572	Not Significant
6	Age	Mean 51.87	Mean 48.26	0.072	Significant

It showed that though the conventional risk factors like diabetes, smoking, family history and male sex are associated with increased CAC scores, they are not statistically significant except age which has good relation with statistical significance. It was also found that history of hypertension shows negative predictive value for CAC scores in patients with non obstructive CAG and it is statistically significant (P-0.040)

Table-6 Showing the significance of individual vessel involvement and CAC scores in patients in Group-II

S.No		LAD CAC	LCX CAC	RCA CAC	Total CAC	'P' Value
1	LAD CAG	0.0596 P=0.66	0.0598 P=0.68	0.761 P=0.6	0.0739 P=0.62	Not Significant
2	LCX CAG	0.0037 P=0.978	0.1617 P=0.289	0.1526 P=0.288	0.0439 P=0.762	Not Significant
3	RCA CAG	0.0895 P=0.536	0.075 P=0.605	0.1718 P=0.233	0.1204 P=0.405	Not Significant

The above details of Group II comparing CAG with CAC score were analyzed using the correlation coefficient method and the details revealed no statistical significance. The below details of Group I comparing CAG with CAC score were analyzed using the correlation coefficient method and the details revealed no statistical significance.

Table-7 Showing the significance of individual vessel involvement and CAC scores in patients in Group-II

CAC		CAD	LCX	RCA	Total	'P' Value
CAG	LAD	0.1540	0.0256	0.0162	0.1126	Not Significant
		P=0.281	P=0.92	P=0.911	P=0.435	Not Significant
	LCX	0.0036	0.1617	0.1529	0.0297	Not Significant
		P=0.982	P=0.289	P=0.289	P=0.836	Not Significant
	RCA	0.0895	0.076	0.1718	0.1684	Not Significant
		P=0.536	P=0.606	P=0.273	P=0.246	Not Significant

Discussion:

We have analyzed totally 100 consecutive patients with CAD. Our study clearly showed that though conventional risk factors like hypertension, smoking and male sex are associated with increased CAC scores, they are not statistically significant whereas the diabetes, age and positive family history is predictive of increased CAC scores in patients with obstructive CAD and it is statistically significant.

It was also noted that though the conventional risk factors like diabetes, smoking, family history and male sex are associated with increased CAC scores they are not statistically significant except age which has good correlation and history of hypertension shows negative predictive value for CAC scores in patients with non obstructive CAG and it is statistically significant.

It has been observed a strong dose-response relationship between cigarette smoking and CAD has been observed in both sexes, in the young in the elderly and in all racial groups[11]. Cigarette smoking increase risk two to threefold and interacts with other risk factors to multiple risk with Pipe smoking and cigarette smoking increases the risk of CAD More than 1 in every10 cardiovascular deaths in the world in the year 2000 were attributable to smoking. Smoking does not carry a significant risk factor for coronary calcification as compared to international studies. There were 17 patients (34%) in group I and 5(10%) patients in group II with smoking history but in groups does not show a statistically significant correlation of increased CAC score (P- 0.103) in Group I, P-0.922 in Group II.

Gender differences in incidence and prevalence of CAD are most marked in middle aged population, the typical target age group for CAD screening. Gender differences in utility and accuracy of imaging test are typically related to differences in the epidemiology of coronary heart disease with women having later onset of clinical CAD than men. There are limited data broadly specific to women on the relationship between CAD outcomes and CAC. Existing data confirm an association between CAC scores and all cause mortality and CAD events in elderly women. In our study there are 6 female in Group I and 5 female in Group II. There is no positive correlation of CAC score in males compared to females in both groups.

Age is an important predictive factor for CAC in our study independent

of CAG lesions. For age group 40 to 49 and 50-59 years, a total score of 50 realized in a sensitivity of 71% and 74% of specificity of 91 and 70% respectively. CAC maintains its utilizing for risk stratification in the elderly. The **author's group**[1] reported an expected increase in all cause mortality risk with increasing age. In our study, the mean age is 50.02 in Group I and showed a significant association with increased CAC score with statistical significance (P-0.025). In Group II the mean age of the population 50.82 and showed significant associations with increased CAC score with statistical significance (P-0.006) and this matches with the above mentioned various international studies.

Frank diabetes is associated with a greater risk of CAC compared with those in non-diabetic population. Several clinical studies here shown that glucose intolerance and insulin resistance are associated with increased prevalence of CAC. **Raggi and his colleagues**[6] showed a higher all-cause mortality rate for any extent of CAC for diabetic subjects than the non-diabetic patients (P> 0.0001). It is not an important predictive factor for coronary artery calcification in our study independent of CAG lesion.

From our study, in group I there are 9 diabetics, 9 cases (18%) showing positive CAC and 4 cases (8%) negative CAC with a good statistical significant association with CAC in patients with observed CAD with statistical significance. Hence diabetes showed a significant association with CAC in patients with obstructive CAD with Statistical significance. In group II, there are 12 diabetics (24%) with 6 cases (12%) was showing positive CAC of 2 (4%) cases showing negative CAC with no statistical association. Hence diabetics showed no significant association with CAC patients with non obstructive. CAD (P-0.11) and this matches in certain aspects with the above aspects with the above mentioned various international studies. The CAG show was analyzed by multiple regression analysis between double of triple vessel involvement with that of single vessel disease. It was found that there is no increase in either the positivity or the degree of CAC score with multi vessel when compared to single vessel disease.

Conclusion:

This single center prospective study provides that patients with obstructive CAD showed good relation with CAC score, especially in elderly. Diabetics and in those with a family history of CAD. There is less correlation of CAC score with regard to other conventional risk factors like gender Hypertension and in both obstructive and non-obstructive CAD. It has been noted that CAC score was not useful to infarct-related artery and there was no linear correlation between CAC score and the number of vessel involvement.

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