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Prevalence of Aortic and Mitral Valves Calcification in Patients with Coronary Artery Disease Detected by Computed Tomography Angiography..

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ABSTRACT:

Background: The risks of coronary artery disease and valvular heart disease are identical. Consequently, it is possible for CT scans to mistakenly indicate valvular heart disease. CT angiography is a common first test for those who could have coronary artery disease. So, CT angiography can show incidental valvular calcification, which could be very important for screening and figuring out risk. Aim of the Study: The aim is to detect the prevalence of aortic and mitral valve calcification among patients suspected of having coronary artery disease, and to study the correlation between calcification and various risk factors and clinical implications. Methodology: prospective cross-sectional study, included 340 patients were referred to Al-Sader Medical City/Al-Najaf Al-Ashraf, Iraq's Al-Najaf Center of Cardiac Surgery and Catheterization, all patients underwent calcium scoring and coronary CT angiography. Results :Aortic valve calcification was found in 32 patients (11.2%) while mitral valve calcification was found in 4 patients (1.2%), Aortic valve calcification was statistically correlated to other cardiovascular risk factors including advanced age ($p<0.001$), male gender($p<0.001$),obesity($p=0.017$), hypertension($p<0.001$), diabetes($p=0.028$), hyperlipidemia($p=0.028$), smoking($p=0.003$), history of IHD($p=0.013$), calcification severity is positively related to coronary artery calcium score ($p<0.001$). Conclusions: Aortic and mitral valve calcification was observed in 12.4% of patients undergoing CCTA, and this was found to be associated with concomitant coronary atherosclerosis ($P < 0.001$)..

Keywords: CAD, Coronary CT Angiography, coronary calcium score, valve calcification..

INTRODUCTION

Calcifications in the heart are frequently detected by imaging. The degree of coronary artery disease (CAD) is correlated with the amount of coronary artery calcification (1). Calcification aorta or mitral valve can be a marker of hemodynamically adequate valvular stenosis. Pericardial calcification is closely associated with narrowed pericarditis, while myocardial calcification indicates previous heart attack. As a result, identification and detection of heart -related calcifications can be found on chest radiography and other detection methods such as fluoroscopy, CT and echocardiography have significant clinical effects. (2).

Valvular heart disease is shown to share risk factors with coronary arterial disease and is an important source of disease and mortality globally (3). In contemporary medical contexts, coronary CT angiography (CCTA) has emerged as a popular non-invasive imaging model (4). This approach is often preferred as a medical intervention for patients showing symptoms of coronary artery disease (5).

Patients and Methods

Study design: cross-sectional studies were conducted between February 2023 and February 2024; all patients were examined at the Heart Center at Al-Sadir Medical City/Al Najaf Al Ashraf Governor. Inclusion criteria: patients suspected with coronary artery disease. Exclusion criteria: Patients with congenital heart disease, Patients with a history of previous cardiac surgery (CABG, valve replacement), and History of previous coronary artery stenting. All individuals received contrast-enhanced coronary computed tomography angiography (CCTA) and a non-

contrast electrocardiogram-gated CT scan is used to calculate the score for coronary calcium.

Protocol: Before the procedure, the patients were prepared and given instruction to stop eating for 12 hours before the examination and avoid drinks that may contain caffeine which may increase heart rate, all patients receive an oral beta blocker to keep heart rate below 70 bpm, sublingual nitroglycerin also given to dilate the coronary arteries, Routine investigation were done before the procedure including renal functions tests, complete blood count, liver functions tests and virology screening.

Valvular Calcification Evaluation: The calcification was determined by conducting a visual evaluation of all CCTA images. The Agatston scoring approach was used to quantitatively evaluate the calcification. The weighted density score was determined by multiplying the area of the calcification speck by the high attenuation value (HU) as follows: The following scale was utilised to assign grades: Grade 0= 0-129 HU, Grade 1= 130-199 HU, Grade 2= 200-299 HU, Grade 3= 300-399 HU, and Grade 4= 400 HU. The score for each calcified speck was then totaled to yield the total calcium score. Consequently, the severity of coronary artery disease (CAD) was categorized according to the total calcium score as follows: The absence of any evidence of CAD is indicated by a score of zero. Scores ranging from 1 to 10 indicate minimal risk of CAD, while scores between 11 and 100 indicate mild risk. Scores between 101 and 400 indicate moderate risk, and scores above 400 indicate severe risk.

(6).

Results

The study was included 340 patients, their mean age was (61.21 ± 10.39) years, ranging from 29 - 91 years, males were more common 204 (60%) while female were 136 (40%). Most of the patients were overweight 142 (41.8%) or obese 134 patients (39.4%) only 64 patients (18.8%) were within the normal BMI limits , table 1.

Table 1: Demographic Characteristics of the Study Sample (n=340).

Age	Range	N	%
	20-30	2	0.6%
	31-40	6	1.8%
	41-50	40	11.7
	51-60	118	34.7
	61-70	100	29.4
	> 70	74	21.8
Gender	Male	204	60
	Female	136	40
BMI	Normal (18.5-24)	64	18.8
	Overweight (25-30)	142	41.8
	Obese (>30)	134	39.4

Hypertension was the most common associated co morbidity 272 (80%), followed by dyslipidemia affecting 240 patients (70.6%), history of previous ischemic event was reported in 182 patients (53.5%). 102 patients (30%) were diabetic and 30 patients (8.8%) had chronic renal disease. Among the 340 patients 150 patients (44.1%) were actively smoking, the other 190 patients (55.9%) reported no smoking history or had quit smoking , table 2.

Table 2.: Past Medical History and Smoking History of the Study Sample.

Past Medical History		Frequency	Percent
Diabetes Mellitus	NO	238	70
	YES	102	30

HTN	NO	68	20
	YES	272	80
CRD	NO	310	91.2
	YES	30	8.8
IHD	NO	158	46.5
	YES	182	53.5
Hyperlipidemia	NO	100	29.4
	YES	240	70.6
Smoking	NO	190	55.9
	YES	150	44.1

Out of 340 patients under went coronary CT angiography, 286 were right coronary dominant (84.1%) while 40 patients (11.8%) had left side dominancy and 14 patients (4.1%) had both sides Co-dominant. The calcium score of coronary arteries was calculated for each patient using Agatston scoring method, the whole sample yielded a mean score of (307.72 ± 558.27), 28 patients (8.2%) had zero calcium score, another 28 patients (8.2%) had a minimal score of 1-10, 104 patients (30.6%) had a mild score of 11-100, 106 patients (31.2) had moderate score of 101-400, and 74 patients (21.8%) had a sever score above 400 Agatston, table 3.

Table 3.: Coronary Dominancy and Coronary CA score

CTA Coronary		Frequency	Percent
Coronary Dominancy	Right	286	84.1
	Left	40	11.8
	Co Dominance	14	4.1
Coronary Calcium Score	Mean ± SD	307.72 ± 558.27	
	Severity	Frequency	Percent
	Zero	28	8.2
	Minimal	28	8.2
	Mild	104	30.6
	Moderate	106	31.2
	Sever	74	21.8

CCTA showed, grade 1 stenosis was found in 56 patients (16.4%), while76 patients (22.4%) had grade 2 stenosis, 48 patients (14.1%) had grade 3 stenosis and 160 patients (47.1%) had grade 4. (Table 4, Figure 1)

Table 4.: Degree of Coronary Artery Stenosis in CCTA(CAD-RADS)

Coronary Artery Stenosis	Frequency	Percent
Grade 1 (minimal)-	56	16.4
Grade 2 (mild)	76	22.4
Grade 3 (moderate)	48	14.1
Grade 4 (severe)	160	47.1

Total	340	100

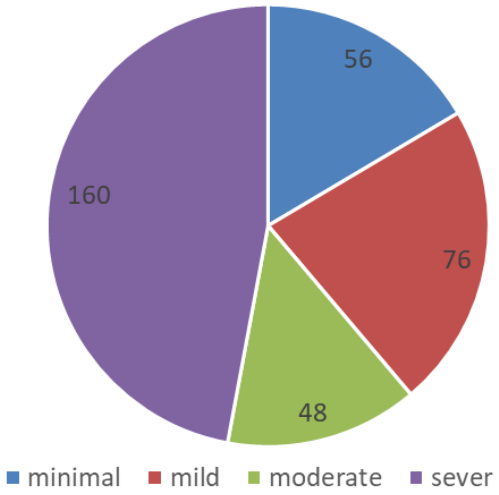

Figure 1.: coronary artery stenosis prevalence and severity

Valves calcification was found in 42 patients (12.4%) off the study sample patients, aortic valve calcification was more common it was found in 38 patients (11.2%) patients, 8 patients with minimal calcification grade 0, 10 patients with mild calcification grade 1, 12 patients with grade 2 and 8 patients with grade 3. while mitral valve calcification was less common and it was found in only four patients (1.2%), two of them had mild calcification grade 1 and another couple had grade 2 calcification. (Tables 5, 6)

Table 5: Valve calcification frequency and percent among the study participants (n=340)

Valve Calcification	Frequency	Percent
None	298	87.6
Mitral	4	1.2
Aortic	38	11.2
Total	340	100

Table 6: Valve Calcification Severity.

Valve Calcification Severity	Mitral	Aortic
Grade 0	0	8
Grade1	2	10
Grade 2	2	12
Grade 3	0	8
Total	4	38

Furthermore, smoking was identified as an independent risk factor for aortic valve calcification (P=0.003). A range of factors were identified as predictors of aortic valve calcification, including age (P<0.001), male gender (P<0.001), higher BMI (P=0.017), a positive past medical history of diabetes mellitus (P=0.028), hypertension

(P<0.001), hyperlipidaemia (P=0.028), and a prior history of ischemic heart disease (P=0.013). However, the statistical power (n=4) was inadequate to ascertain the significance or applicability of the predictors of mitral valve calcification.

Table 7: Data show that cardiovascular risk factors increase aortic valve or mitral calcification.

Cardiovascular Risk Factors		Mitral valve calcification	P value	Aortic valve calcification	P value
Age groups	20-30	0	not applicable	0	<0.001
	31-40	0		2	
	41-50	0		2	
	51-60	2		8	
	61-70	1		16	
	> 70	1		10	
Gender	male	2	0.178	26	< 0.001
	female	2		12	
BMI	normal	1	0.191	8	< 0.017
	overweight	2		12	
	obese	1		18	
diabetes mellitus	NO	4	not applicable	22	0.028
	YES	0		16	
HTN	NO	0	not applicable	8	< 0.001
	YES	4		30	
CRD	NO	4	not applicable	36	0.089
	YES	0		2	
IHD	NO	2	0.077	12	0.013
	YES	2		26	
Hyperlipidemia	NO	2	0.077	12	0.028
	YES	2		26	
Smoking	NO	2	0.189	18	0.003
	YES	2		20	

A higher coronary artery calcium score was observed in patients with aortic valve calcification [mean=584.32, range=0–3473) Agatston units, compared to patients with mitral valve calcification [mean= 173.5, range= 103–141) Agatston units, and patients without valve calcification (mean= 129.36, range= 0–3086) Agatston units, calcium score was highly statistically correlated to the severity of Aortic stenosis (P<0.001), but not with mitral stenosis (P=0.182).

Table 8: the statistical correlations between valve calcification and other coronary CT angiographic findings.

CCTA results	Mitral valve calcification	P value	aortic valve calcification	P value

Calcium score	Mean	173.5	0.182	584.32	< 0.001
	Range	103–141		0–3473	
Coronary calcification	minimal	0	0.091	8	< 0.001
	mild	0		6	
	moderate	4		8	
	sever	0		16	
Coronary artery stenosis	minimal	1	0.133	4	< 0.001
	mild	1		6	
	moderate	0		10	
	sever	2		18	

Discussion

In this prospective cross-sectional study, the mean age of the patients was (61.21 ± 10.39) years several studies have showed that age is a risk factor for coronary artery disease, 8 patients were younger than 40 years, Chhabra et al., 2018(7) had conducted a study on 35259 patients with ACS and were concluded that there is an increasing trend in the prevalence of ACS among very young patients. Potential risk factors contributing to this trend include overweight, obesity, urbanization, and smoking [7]. (44.1%) of the current study sample were smokers, only (18.8%) lie within the normal BMI. Chang et al. 2018 also conducted a large cohort on 25,251 patients undergoing coronary computed tomographic angiography (CTA), their results show a mean age of 62 years, 63% male, these results are close to the findings of the current study in terms of age and gender distribution [8].

The current study sample patients had higher incidence of co-morbidities factors including hypertension (80%), Hyperlipidemia (70.6%) and diabetes mellitus (30%), Marini et al., 2017 study, involving 584 consecutive patients undergoing coronary angiography.

Additionally, fasting glucose levels and systolic and diastolic blood pressure were found to be elevated, consistent with the findings of the current study [9]. In all 340 patients, coronary arteries stenosis was fond at various degrees, out of them only 28 patients had zero calcium score, this is convenient with a large based study by den Dekker et al., 2012 which reviewed the results of 51 studies examining the impact of calcium scoring on the diagnostic performance of coronary computed tomography angiography (CCTA), yielded significant conclusions. On a patient-basis, the sensitivity of CCTA for significant stenosis was reported as 95.8%, 95.6%, 97.6%, and 99.0% for calcium scores of 0–100, 101–400, 401–1,000, and >1,000, respectively. These findings indicate that CCTA demonstrates a high ability to predict coronary artery stenosis, with its predictive capacity increasing with higher calcium scores [10].

The current study results demonstrate that valve calcification is frequently seen as an accidental finding, occurring in 42 patients (12.35%), with aortic calcification accounting for 38 patients (11.2%) and mitral valve calcification in four patients (1.2%), Williams et al. (2021) According to the findings of a research of 1769 patients undergoing CCTA for chronic chest pain, valve calcification occurs by chance in one out of every six people. Of these, 241 (14%) had aortic valve calcification, and 64 (4%) [11].

The results of this investigation demonstrated a strong correlation between coronary atherosclerosis and valve calcification, as well as other cardiovascular risk factors. we observed that age, male gender, obesity, hypertension, D.M., hyperlipidemia, smoking and previous history of IHD were independent predictors of aortic valve calcification, the current study results did not yield a sufficient prediction for the association between cardiovascular risk factors and mitral valve calcification because of the low incidence (n=4).

Boon et al., 1997 showed that there were strongly and significantly correlation between hypertension, diabetes mellitus, and hypercholesterolemia and with aortic valve calcification [12]. Another study by Diederichsen et al.,2022 have found a similar conclusion with the current study they found that Men had significantly higher incidence of aortic valve calcification and higher calcium scores at baseline (Agatston Units range 0–94) versus females with a range of (0–22 AU), (P<0.001) [13].

Aortic valve calcification was statistically correlated to the coronary calcium score (P<0.001), a study by Brodov et al.,2015 on 1648 asymptomatic patients who had zero baseline coronary artery calcium score and no aortic

valve calcification and followed up with CT angiographic scanning 5 years later, 380 patients (23%) developed coronary artery calcium score of > 0 AU, and 14% of them developed aortic valve calcification (P<0.001) [14].

Conventional cardiovascular risk factors and underlying coronary artery disease are associated with calcifications in the aortic and mitral valves, as well as coronary artery calcium score. However, the current study did not find a significant link between mitral calcification and coronary calcium score because there were not many people in the study.

Only eight patients with aortic valve calcification(25%) did not exhibit evidence of co-existing coronary calcification and had no evidence of significant coronary artery stenosis.

There was significant correlation (P<0.001) between aortic valve calcification, this observation underscores the pathological overlap between atherosclerosis and the early stages of valvular calcification. This suggests a shared underlying mechanism and risk factors that contribute to the development of both conditions, Gondri et al., 2015 [15, 16]. Koulouzidis et al., 2013 showed that the aortic valve was more widespread than calcification of mitral valve calcification, with the respective speeds 64% and 2.5%. In particular, the study population did not demonstrate at 12.7% not coronary artery calcification [17].

Conclusions

Aortic valve calcification was statistically correlated to other cardiovascular risk factors of advanced age, male gender, obesity, hypertension, diabetes, hyperlipidemia, smoking and previous history of ischemic heart disease..

REFERENCES

1.Bogaert J, Francone M. Pericardial disease: value of CT and MR imaging. Radiology. 2013 May. 267(2):340-56.

2. Roosens B, Bala G, Gillis K, Remory I, Droogmans S, Somja J, et al. Echocardiographic integrated backscatter for detecting progression and regression of aortic valve calcifications in rats. Cardiovasc Ultrasound. 2013 Jan 26. 11:4.

3. Knuuti J, Wijns W, Saraste A, Capodanno D, Barbato E, Funck-Brentano C et al. 2019 ESC Guidelines for the diagnosis and management of chronic coronary syndromes: the Task Force for the diagnosis and management of chronic coronary syndromes of the European Society of Cardiology (ESC). Eur Heart J 2019;41:407–77.

4. Barasch E, Gottdiener JS, Marino Larsen EK, Chaves PH, Newman AB. Cardiovascular morbidity and mortality in community-dwelling elderly individuals with calcification of the fibrous skeleton of the base of the heart and aortosclerosis (The Cardiovascular Health Study). Am J Cardiol2006;97:1281–6.

5.Kizer JR, Wiebers DO, Whisnant JP, Galloway JM, Welty TK, Lee ET et al. Mitral annular calcification, aortic valve sclerosis, and incident stroke in adults free of clinical cardiovascular disease: the Strong Heart Study. Stroke 2005;36:2533–7.

6. Hadamitzky M, Distler R, Meyer T, Hein F, Kastrati A, Martinoff S, Schömig A, Hausleiter J. Prognostic value of coronary computed tomographic angiography in comparison with calcium scoring and clinical risk scores. Circulation: Cardiovascular Imaging. 2011 Jan;4(1):16-23.

7. Chhabra ST, Kaur T, Masson S, Soni RK, Bansal N, Takkar B, Tandon R, Goyal A, Singh B, Aslam N, Mohan B. Early onset ACS: An age based clinico-epidemiologic and angiographic comparison. Atherosclerosis. 2018 Dec 1;279:45-51.

8.Chang HJ, Lin FY, Lee SE, Andreini D, Bax J, Cademartiri F, Chinnaiyan K, Chow BJ, Conte E, Cury RC, Feuchtner G. Coronary atherosclerotic precursors of acute coronary syndromes. Journal of the American College of Cardiology. 2018 Jun 5;71(22):2511-22.

9.Marini A, Naka KK, Vakalis K, Bechlioulis A, Bougiakli M, Giannitsi S, Nikolaou K, Antoniadou EI, Gartzonika C, Chasiotis G, Bairaktari E. Extent of coronary artery disease in patients undergoing angiography for stable or acute coronary syndromes. Hellenic journal of cardiology. 2017 Mar 1;58(2):115-21.

10. den Dekker MA, de Smet K, de Bock GH, Tio RA, Oudkerk M, Vliegenthart R. Diagnostic performance of coronary CT angiography for stenosis detection according to calcium score: systematic review and meta-analysis. European radiology. 2012 Dec;22:2688-98.

11.Williams MC, Massera D, Moss AJ, Bing R, Bularga A, Adamson PD, Hunter A, Alam S, Shah AS, Pawade T, Roditi G. Prevalence and clinical implications of valvular calcification on coronary computed tomography angiography. European Heart Journal-Cardiovascular Imaging. 2021 Mar 1;22(3):262-70.

12. Boon A, Cheriex E, Lodder J, Kessels F. Cardiac valve calcification: characteristics of patients with calcification of the mitral annulus or aortic valve. Heart. 1997 Nov 1;78(5):472-4.

13. Diederichsen A, Lindholt JS, Møller JE, Gerke O, Rasmussen LM, Dahl JS. Sex differences in factors associated with progression of aortic valve calcification in the general population. Circulation: Cardiovascular Imaging. 2022 Jan;15(1):e013165.

14. Brodov Y, Gransar H, Rozanski A, Hayes SW, Friedman JD, Thomson LE, Dey D, Slomka PJ, Min JK, Shaw LJ, Shah PK. Extensive thoracic aortic calcification is an independent predictor of development of coronary artery calcium among individuals with coronary artery calcium score of zero. Atherosclerosis. 2015 Jan 1;238(1):4-8.

15. Gondrie MJ, van der Graaf Y, Jacobs PC, Oen AL, Mali WP, PROVIDI Study Group. The association of incidentally detected heart valve calcification with future cardiovascular events. European radiology. 2011 May;21:963-73.

16. Hassan SM, Obeid HA, Hasan IS, Abbas AN. Etanercept Ameliorated cerebral Damage During Global Cerebral Ischemia-Reperfusion Injury in Male Rats. Azerbaijan Pharmaceutical and Pharmacotherapy Journal. 2023;22(1):53-8.

17. Koulaouzidis G, Nicoll R, MacArthur T, Jenkins PJ, Henein MY. Coronary artery calcification correlates with the presence and severity of valve calcification. International journal of cardiology. 2013 Oct 15;168(6):5263-6.

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