

Incidence of Coronary Artery Disease in Patients with a Zero-Calcium Score on Coronary CT Angiography: A Cross Sectional Study

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Abstract

Aim: The objective of this study is to determine the incidence of CAD in patients whose Coronary computed tomography angiography (CCTA) results showed that their calcium levels had a score of zero.

Study design: The study design was a Cross sectional study.

Place and duration of study: This study was conducted at Peoples University of Medical and Health Sciences for Women Shaheed Benazirabad Nawabshah, Pakistan from March 2019 to March 2020.

Methodology: The study population was a total of 90 patients, whose ages ranged from 18 years to 67 years. These patients were advised by their physicians to take a coronary CT angiography due to suspicion of coronary artery disease. The Coronary computed tomography angiography (CCTA) of the patients showed that their calcium levels had a score of zero. Patient diabetes score, their gender and the existence of coronary artery disease were treated as frequency and percentage in the graphical analysis on the SPSS software version 22. The co-founding variables of the study were stratified, and the chi-square test was applied on the cofounding variables after post stratification.

Results: The mean age of the study population was 51.63 ± 7.2 years. The study had 76 males which was 84.4% of the study population and 14 female patients which was 15.5% of the study population. A total of 41 (45.5%) patients had been previously diagnosed with diabetes. The results from the study showed that 7.78% (7) of the patients were diagnosed with CAD. A total of 83 people from the study population (92.2%) had normal coronary arteries.

Conclusion: The results from the research study concluded that 7.78% (7) of the patients were diagnosed with coronary artery disease and their calcium levels had a score of zero score on their Coronary computed tomography angiography (CCTA) .

Keywords: zero-calcium score, CT angiography, coronary artery disease

Introduction

Coronary artery disease is spreading globally, and it is a serious disease which effects the lives of million people across the globe (1). According to a recent survey by the American heart association 217.1 people out of 100,000 died due to CAD (2). According to the World Health Organization an estimated of 17.9 million lives are lost each year due to CAD and it is one of the the most troubling and major causes of cardiac deaths worldwide (3). Studies and statistics have found that countries that help majority of the population living below the poverty line have more cases of patients with CAD. There is a gap in the research linking adults diagnosed with coronary artery disease in Pakistan and their mortality rate, however experts have stated that the a majority of the population is susceptible to coronary artery disease (4). According to a survey conducted by the national health department, one out of every three Pakistani who is over the age of 40 years has diagnosed or undiagnosed hypertension.

While first world countries have started to take control of this epidemic through the proper medication, diagnosis and the necessary modifications to their lifestyle, third world countries are still struggling to diagnose and provide the proper medication in order to stem the rise of deaths related to this disease. One of the leading causes of death in the subcontinent proven by statistics obtained from a study show that , in third world countries, $3/4^{\text{th}}$ of the deaths is due to coronary artery disease (5). Coronary artery disease can be diagnosed by the presence of calcium present within the atherosclerotic arteries. This coronary artery calcium is measured by the coronary CT angiography which helps in diagnosing coronary artery disease (6). Many studies and experts globally have used the coronary artery calcium to predict the existence of coronary artery disease (7).

However additional investigation is needed to explore the significance of evaluating the coronary artery calcium scores to predict coronary artery disease. Studies have reported that 3 to 34% of the patients with a zero score on their calcium levels on their CCTA were diagnosed with CAD (8). Similarly, another study found that 13. 1% of patients with a zero score on their calcium levels had coronary artery disease (9). However, there is still a gap in the research conducted in Pakistan about the relationship between patients with a zero-calcium score and CAD. This is at odds with the percentage of patients in Pakistan diagnosed with coronary artery disease.

The objective of this study was to determine from a CCTA, the number of patients with a score of zero on their calcium levels that have CAD. These results will give a better picture of patients with coronary artery disease having a zero-calcium score on the coronary CT angiography. However, it is important to note that while a zero-calcium score can be an indicator towards the presence of coronary artery disease it is not a 100% reliable or foolproof method to diagnose coronary artery disease, which is why the study is important for determining what percentage of patients with a score of zero on their calcium levels have CAD (10).

Methodology

A total of 90 patients were referred from the outpatient department to evaluate the existence of CAD. Consent was taken from all these patients and the study proceeded after getting the approval of the

ethical committee of the institute. Patients with only a zero score of their calcium levels on their CCTA were included in the study. The study included patients whose ages ranged from 18 to 67 years. These patients were advised by their physicians to take a coronary CT angiography due to suspicion of CAD. The CCTA of the patients showed a zero-calcium score. This study had an exclusion criterion for patients who had heart disease, myocardial infraction, where under suspicion of ACS, previously had a coronary artery bypass, and patients who had chronic or acute kidney disease. The data of these 90 patients was analyzed using the SPSS software version 22 in order to establish the frequency of patients who had coronary artery disease. At the time of admission in the hospital, patient history was taken which included their demographic data. Patient diabetes score, their gender and the existence of coronary artery disease were treated as frequency and percentage in the graphical analysis. The co-founding variables of the study were stratified, and the chi-square test was applied on the cofounding variables after post stratification was done. For analysis the value of p was taken to be equal or less than 0.05 was considered. CAD was only diagnosed by a cardiologist with a fellowship experience of more than 10 years.

Results

The age of each patient in this study was noted and its mean was calculated to be 51.63 ± 7.2 years. The age range for the patients was between 18-67 years old. The study had 76 males which was 84.4% of the study population and 14 female patients which was 15.5% of the study population. A total of 41 (45.5%) patients had been previously diagnosed with diabetes. The results from the study showed that 7.78% (7) of the patients were diagnosed with coronary artery disease. Total 83 patients (92.2%) had normal coronary arteries. The results showed that age and gender did not affect existence of CAD. Whereas 5 patients who were diagnosed with diabetes mellitus were also diagnosed with coronary artery disease and the remaining two patients with coronary artery disease were non-diabetic. The results did show that the frequency of patients diagnosed with CAD and diabetes mellitus was high however no statistical significance could be formed between the two. Coronary artery disease was diagnosed in 4 male patients and three female patients however since the value of p was 0.17, it was not taken as a statistically significant value.

Table 1: Frequency of patients with CAD according to gender

Gender	Coronary Artery Disease		P- Value
	Yes	No	
Male	4	72	0.17
Female	3	11	0.17

Table 2: Frequency of Diabetic patients with CAD

Diabetes Mellitus	Coronary Artery Disease	
	Yes	No
Diabetic Patients (n = 41)	5	36
Non-Diabetic Patients (n = 49)	2	47

Table 3: Frequency of patients with CAD

Number of patients (n=90)	Coronary Artery Disease	
	Yes	No
Patients (n = 90)	7	83

Discussion

This study showed that there was a statistically low number of patients who were diagnosed with coronary artery disease and had a zero-calcium score. In our study a total of 7.78% of the patients had coronary artery disease and had a zero-calcium score. A similar strategy conducted, on the frequency of patients with coronary artery disease who had zero calcium score on their coronary CT angiography, show the percentage of 1.7% (11). Another study concluded that an estimated 8.2% of patients were diagnosed with coronary artery disease having a subset of zero calcium score (12). These studies have been conducted that explored the frequency of patients with coronary artery disease and the link with having a zero-calcium score on a coronary CT angiography, however there are differing results based on their demographics and geological location. Some studies found a higher prevalence of coronary artery disease such as 34% whereas other studies found a relatively lower prevalence of coronary artery disease (4.5%) in patients with a zero-calcium score on their coronary CT angiography (13).

CTCA, without a doubt, provides a thorough assessment of coronary artery disease, including plaque demonstration and stenosis measurement, resulting in improved accuracy in diagnosis and prognosis (14). CTCS, on the other hand, is a rudimentary approach that is significantly easier to perform because it does not require contrast or beta-blockers, and it also takes less time to report (15). CTCS was suggested as the first test to rule out coronary disease in low-risk individuals in the 2010 nice chest pain guideline, however the newly updated recommendation recommends CTCA as the first line examination for all patients with angina, regardless of CTCS (16). Our findings show that up to 50% of individuals with conventional or atypical angina will have a ZCS with a favorable prognosis. Our findings show that up to 50% of individuals with conventional or atypical angina will have a ZCS with a favorable prognosis. Although the absence of calcium does not rule out the occurrence of coronary artery disease, our findings imply that it is associated with a very low risk of obstructive lesions (17). This was especially true in patients with low and intermediate pre-test coronary artery disease risk, as evidenced by a study in which the prevalence of obstructive coronary artery disease was only 3.6 and 4.2 percent in patients with low and intermediate pre-test coronary artery disease risk, respectively, in the absence of calcium (18). This is consistent with the great prognosis seen in patients who have a calcium score of zero. About 5.81 percent of the stable patients referred for a potential cad investigation who had a calcium score of zero had obstructive coronary artery disease (>50 percent stenosis) (19). As a result, while the zero-calcium score does act as an indicator for Coronary artery disease, it does not always indicate the existence of CAD (20).

Conclusion

The results from the research study concluded that 7.78% (7) of the patients were diagnosed with coronary artery disease and had a zero-calcium score on their Coronary computed tomography angiography (CCTA).

Permission:

It was taken from the ethical review committee of the institute

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Conflict of interest:

None

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