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ORIGINAL ARTICLE

Correlation of Coronary Artery Disease with Risk Factors on Computed Tomography Angiography

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ABSTRACT

Background: Coronary Artery Disease (CAD) was the contraction of coronary arteries that was frequently began through the atherosclerosis which primes to restraint of blood flowing to cardiac muscles. Atherosclerosis was an accumulation of plaque or fats deposition upon the internal walls of arteries.
Aim: To correlate coronary artery disease with risk factors on Computed Tomography Angiography.
Duration and place of study: This study was conduct from 17-July-2019 to 13-Oct-2020 at Punjab Institute of Cardiology Lahore.
Methods: A cross sectional analytical study was conducted at Punjab Institute of Cardiology, Lahore. Data were collected according to the age, gender and risk factors such as diabetes mellitus, hypertension, hyperlipidemia; high cholesterol level, contrast with volume, vessels involved and extent of vessels involvement.132 participants including 103 males (78%) and 29 females (22%) were selected through convenient sampling technique.
Results: Data examination exhibited that out of 132 patients, 101 patients (76.5%) had CAD and 31 patients (23.5%) had no CAD. Out of 29 females, 21 female patients (20.8%) had CAD whereas out of 103 males, 80 male patients (79.2%) had coronary artery disease. According to our study, as correlated the coronary artery disease with various risk factors on computed tomography angiography. The patient had one or more than one risk factors; out of 132 patients, 72 patients (54.5%) had diabetes mellitus, 102 patients (77.3%) had hypertension, 55 patients (41.7%) had hyperlipidemia, 56 patients (42.4%) familial hypercholesterolemia, and 30(22.7%) were smokers.
Conclusions: We concluded from our study that patients with Diabetes Mellitus (DM) were more prone to develope coronary artery disease CAD. Males were more at risk (79.2%) than females (20.8%) for CAD. Diabetes mellitus and hypertension were stronger predictors of CAD than smoking, hyperlipidemia and familial hypercholesterolemia.
Keywords: Coronary Artery disease, Computed Tomography Angiogrpahy, Diabetes Mellitus, Hypertension

INTRODUCTION

Coronary Computed Tomography Angiography (CCTA) is cardiac image assessment for determining if plaque accumulation has tapered the Coronary Arteries[1]. Plaque is made-up of numerous materials like calcium, fats and cholesterol that accumulate in the arteries which become cause of prevention of blood flow. Patients undertaking coronary computed tomography angiography examination[2]. Alike outmoded X-rays, it produces many images of body[4]. Cross sectional pictures made through Computed Tomography examination may be re-formatted in various planes[5]. The contrast injected shows the blood vessels clearly. CTA was enhanced significantly by decreasing section thickness and increasing scan speed. Now in clinical practice, Computed Tomography system among abilities and acquirement of unto 64-sections per scaffold revolution are presented.

Coronary artery disease is due to narrowing of artery that may be attributed to deposits (plaques) in coronary arteries containing cholesterol, calcium and other fats[2]. If plaque turns out to be thin, then breakdowns can rapidly cause blood accumulation that can become the cause of blood vessel blockage which can lead to myocardial infarction and cause heart attack[6]. In the developed countries, CAD is just the ultimate common cause of death[7,8]. In the US, the prevalence of CAD is 2.5%[8]. For non-diabetic patients and 21.4% for diabetic patients, the prevalence of CAD risks in Indians is 11%[9]. CAD concentrations in rural and urban populations vary across the Indian subcontinent. In the rural population, the incidence of CAD is half that of the urban population[10]. In the rural population aged 35-64, the prevalence of CAD is 6%[11]. In a developing country like Pakistan, research on cardiovascular diseases has been restricted. CAD impacted 110 million individuals in 2015 and resulted in 8.9 million deaths. It accounts for 15.6% of all deaths, making it the most prevalent cause of death globally[12]. Between 1980 and 2010, the risk of death from CAD at a given age decreased, especially in developed countries[13]. Approximately 20% of those over 65 had CAD in the United States in 2010, while 7% of those 45 to 64 had CAD, and 1.3% of those 18 to 45 had higher rates among men than women of a given age. 15 The prevalence of risk factors for coronary heart disease such as hypertension in South Asia is 3.2%, diabetes 2.6% CAD 3.2%, serum cholesterol level 180-200mg/dL, obesity incidence 5-8%[16]. A significantly increased incidence of coronary artery disease is associated with diabetes mellitus[16]. As measured by different diagnostic methods, the average prevalence of CAD is as high as 55% among adult patients with DM, compared to 2 to 4% for the general population[17].

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The purpose of this study was to correlate the risk factors with CTA findings, a lot of information can be discerned and made use by both cardiac physician and cardiac surgeon for timely diagnosis, surveillance, revascularization and treatment of patient.

MATERIAL AND METHODS

A cross sectional analytical study was conducted after approval of Ethical Review Board at Punjab Institute of Cardiology, Lahore. Data were collected with help of convenient sampling technique according to the age, gender and risk factors such as diabetes mellitus, hypertension, hyperlipidemia, high cholesterol level, contrast with volume, vessels involved and extent of vessels involvement.132 participants including 103 males (78%) and 29 females (22%) were selected through convenient sampling technique. After collection data were managed in Microsoft excel sheet and were analysed SPSS version 21 was used for data analysis.

RESULTS

Analysis of data showed that out of 132 patients, 101 patients (76.5%) had CAD and 31 patients (23.5%) had no CAD. Out of 29 females, 21 female patients (20.8%) had CAD whereas out of 103 males, 80 male patients (79.2%) had coronary artery disease. According to our study, as correlated the coronary artery disease with various risk factors on computed tomography angiography. The patient had one or more than one risk factors; out of 132 patients, 72 patients (54.5%) had diabetes mellitus, 102 patients (77.3%) had hypertension, 55 patients (41.7%) had hyperlipidemia, 56 patients (42.4%) familial hypercholesterolemia, and 30 patients (22.7%) were smokers. According to number of vessels, out of 132 patients, 20 patients (15.2%) had plaque in single vessel 14 patients (10.6%) involved LAD, 3 patients (2.3%) involved LAC & 3 patients (2.3%) involved RCA branch of coronary artery considered single vessels disease, 20 patients (15.2%) had plaque in two vessels 8 patients (6.1%) involved LAD & LCA, 10 patients (7.6%) involved LAD & RCA, and 2 patients (1.5%) involved LCA & RCA branch of coronary artery considered two vessels disease and 61 patients (46.2%) had plaque in three vessels (involved LAD, LCA & RCA branch of coronary artery considered three vessels disease of their coronary arteries). 31 patients (23.5% had no plaque) had not involved vessels of coronary artery that considered normal.

Table 1 shows total number of 132 patients were included in this research comprising 101 patients (76.5%) had CAD and 31 patients (23.5%) had no CAD

Table 2 shows total numbers of 132 patients were included in this research comprising 103 males (78%) and 29 females (22%)

Table 3 shows the result of frequency distribution of diabetes Mellitus. Total number of 132 patients, in which 72 patients (54.5%) had diabetes mellitus, 60 patients (45.5%) had no diabetes mellitus.

Table 4 shows the result of frequency distribution of hypertension. Total number of 132 patients, in which 102 patients (77.3%) had hypertension and 30 patients (22.7%) had no hypertension.

Table 5 shows the result of frequency distribution of hyperlipidemia. Total number of 132 patients, in which 55 patients (41.7%) had hyperlipidemia and 77 patients (58.3%) had no hyperlipidemia.

Table 6 shows the result of frequency distribution of familial hypercholesterolemia. Total number of 132 patients, in which 56 patients (42.4 %) had Familial Hypercholesterolemia and 76 patients (57.6%) had no familial hypercholesterolemia.

Table 7 **s**hows the result of frequency distribution of smoking. Total number of 132 patients, in which 30 patients (22.7%) had smoking and 102 patients (77.3%) had no smoking.

Table 8 shows total number of 132 patients in which, 31 patients had no plaque in coronary artery vessels, 20 patients had plaque in single vessels, 20 patients had plaque in two vessels and 61 patients had plaque in three vessels of their coronary arteries.

Table 9 shows number of 132 patients, in which 14 patients had involved LAD branch of coronary artery, 3 patients had involved LAC branch of coronary artery, 3 patients had involved RCA branch of coronary artery considered single vessels disease. 8 patients had involved two vessels LAD & LCA branch of coronary artery, 10 patients had involved LAD & RCA branch of coronary artery, 2 patients had involved LCA & RCA branch of coronary artery considered two vessels disease. 61 patients had involved LAD, LCA & RCA branch of coronary artery considered three vessels disease. 31 patients had not involved vessels of coronary artery that considered normal.

Table 10 shows number of 132 patients, in which 22 patients with no history of diabetes mellitus and 9 patients with history of diabetes mellitus but they had no coronary artery disease. Patients with history of diabetes mellitus that had CAD were 63 and the patients with no history of diabetes mellitus that had CAD were 38.

Table 6 shows the result of frequency distribution of familial hypercholesterolemia. Total number of 132 patients, in which 56 patients (42.4%) had Familial Hypercholesterolemia and 76 patients (57.6%) had no familial hypercholesterolemia.

Table 7 **s**hows the result of frequency distribution of smoking. Total number of 132 patients, in which 30 patients (22.7%) had smoking and 102 patients (77.3%) had no smoking.

Table 8 shows total number of 132 patients in which, 31 patients had no plaque in coronary artery vessels, 20 patients had plaque in single vessels, 20 patients had plaque in two vessels and 61 patients had plaque in three vessels of their coronary arteries.

Table 9 shows number of 132 patients, in which 14 patients had involved LAD branch of coronary artery, 3 patients had involved LAC branch of coronary artery, 3 patients had involved RCA branch of coronary artery considered single vessels disease. 8 patients had involved two vessels LAD & LCA branch of coronary artery, 10 patients had involved LAD & RCA branch of coronary artery, 2 patients had involved LCA & RCA branch of coronary artery considered two vessels disease. 61 patients had involved LAD, LCA & RCA branch of coronary artery considered three vessels disease. 31 patients had

not involved vessels of coronary artery that considered normal.

Table 10 shows number of 132 patients, in which 22 patients with no history of diabetes mellitus and 9 patients with history of diabetes mellitus but they had no coronary artery disease. Patients with history of diabetes mellitus that had CAD were 63 and the patients with no history of diabetes mellitus that had CAD were 38

Table 1: Coronary artery disease

	Frequency	%age
No	31	23.5
Yes	101	76.5
Total	132	100.0

Table 2: Gender

	Frequency	%age
Female	29	22.0
Male	103	78.0
Total	132	100.0

Table 3: Diabetes mellitus

	Frequency	%age
No	60	45.5
Yes	72	54.5
Total	132	100.0

Table 4: Hypertension

	Frequency	%age
No	30	22.7
Yes	102	77.3
Total	132	100.0

Table 5: Hyperlipidemia

	Frequency	%age
No	77	58.3
Yes	55	41.7
Total	132	100.0

Table 6: Familial hypercholesterolemia

	Frequency	%age
Yes	56	42.4
No	76	57.6
Total	132	100.0

Table 7: Smoking

	Frequency	%age
Yes	30	22.7
No	102	77.3
Total	132	100.0

Table 8: No of Vessels involved

	Frequency	%age
Zero	31	23.5
One	20	15.2
Two	20	15.2
Three	61	46.2
Total	132	100.0

Table 9: Vessels involved

	Frequency	%age
LAD	14	10.6
LAD, LCA	8	6.1
LAD, LCA, RCA	61	46.2
LAD, RCA	10	7.6
LCA	3	2.3
LCA, RCA	2	1.5
Normal	31	23.5
RCA	3	2.3
Total	132	100.0

Table 10:

Coronary Artery Disease		Diabetes Mellitus		Total
		No	Yes	
No	Count	22	9	31
	% within Coronary Artery Disease	71.0%	29.0%	100%
Yes	Count	38	63	101
	% within Coronary Artery Disease	37.6%	62.4%	100%
Total	Count	60	72	132
	% within Coronary Artery Disease	45.5%	54.5%	100%

Fig 1: Three vessels disease. RCA show diffuse Shows severe diffuse disease in proximal segment due to calcified plaque. LAD and LCA shows total occlusion.

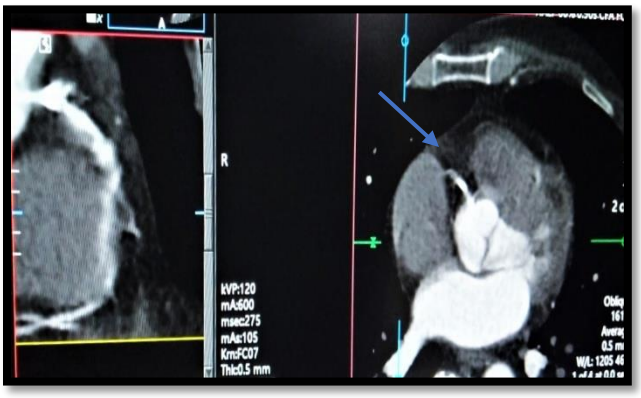
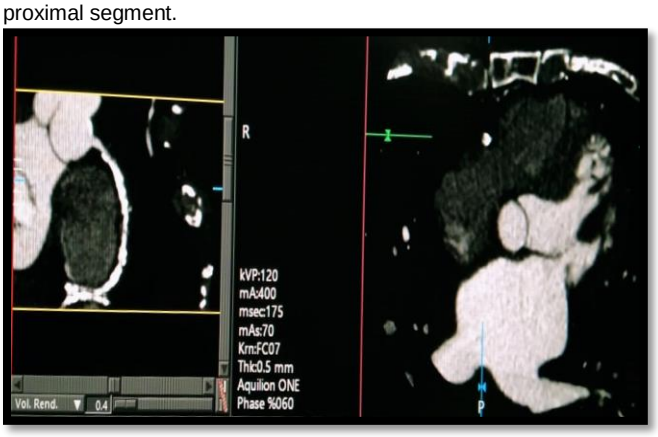


Fig 2: Two vessels disease. LAD show normal at proximal, mid and distal segment. RCA and LCA show complete occlusion at proximal segment.



DISCUSSION

Our study was designed to correlate coronary artery disease with risk factors on Computed Tomography Angiography. On the basis of diagnostic performance for exclusion of CAD and detecting plaque in vessels of coronary artery, CTA is considered a reliable method for assessing patients with suspected CAD. In current study, attempt was made to correlate coronary artery disease with risk factors. Data were collected according to the age, gender and risk factors such as hypertension, diabetes mellitus, smoking, hyperlipidemia and familial hypercholesterolemia, vessels involved and extent of vessels involvement. Data of 132 patients (78% of males and 22% of females) were collected. All patients were

clinically suspected cases of coronary artery disease with and without risk factors. According to results, out of 132 patients, 76.5% of patients had CAD and 23.5% of patients had no CAD.

Yang et al., 2015 purposed that hypertension, smoking, diabetes mellitus, dyslipidemia, overweight, and obesity are all major risk factors of coronary heart disease. The incidence of coronary artery lesions in the high-risk population with multiple risk factors is significantly higher than in the control population. Findings of their study support our results where CAD was more in males (78%) than females (22%)[18]. In our study patient had one or more than one risk factors, 62.4% of patients had diabetes mellitus who developed coronary artery disease (P-Value=.002 significant), 77.3% of patients had hypertension, 41.7% of patients had hyperlipidemia, 42.4% of patients had Familial Hypercholesterolemia, and 22.7% of patients had smoking out of 132 patients

According to John W. McEvoy et al, 2015 study conducted that 14% were smokers, 39% were former smokers and 47% were non-smokers and in our study 77.3% participants were non-smokers which implies that in our population, smoking is not a major contributing factor toward CAD as in our study 22.7% smokers were contributing in CAD[19].

According to the Tilea et al, 2018 the prevalence of CAD is more in Patients with several related cardiovascular risk factors that are hypertensive.[20] Their sample size was large compared to ours. 283 hypertensive patients were classified into three grades: single, double and triple artery CAD. Correlated with CAD with respect to hypertension grades. 173(61.13%) of 190 males and 93 females had severe CAD. Single vessel disease was recognized in 88.8% of grade 1 hypertensive patients. Triple vessel disease was recognized in 29.3% of patients with grade 2 hypertension, 24.0% in grade 3 hypertensive patients. According to our study, 77.3% of patients had hypertension, Findings of their study supports our results that most of the hypertensive patients suffer from CAD. The frequency of people with hypertension was greater than smoking, hyperlipidemia, familial hypercholesterolemia and diabetes mellitus. Another study was conducted by Nathan D. Wong et al., they compared the extent and prevalence of metabolic syndrome, diabetes. They also had a large sample size as compared to us (1,823). They reported that 67% of patients with diabetes[22]. In our study 54.5% of patients had diabetes mellitus.

In 2019, Dal Canto et al identified that people with diabetes remain at a significantly higher cardiovascular risk relative to people without diabetes, and CVD among people with diabetes is a major cause of comorbidity and death[21].

The study of J.P.S. Sawhney et al., 2018 in coronary artery disease, a high prevalence of familial hypercholesterolemia was observed[22]. Compared to us, they also had a broad sample size (635). A total of 635 CAD patients were evaluated for FH based on ratings, patients were diagnosed as definite, probable, likely or no FH, 4% were diagnosed as positive, 11% were diagnosed as apparent, 37% were diagnosed as imaginable and 48% were diagnosed without FH. In our study 42.4% of patients had familial hypercholesterolemia. The association of HLP with atherosclerotic cardiovascular disease is largely based on epidemiological studies. Elevated levels of blood lipids are well documented risk factors for cardiovascular disease as our results showed that 41.7% of patients had hyperlipidemia with CAD. However, HLP remained a predictor of lower mortality in several studies. Another study was conducted by A Marie N Boggan et al., 2015 studied that hyperlipidemia in early adulthood increases long term risk of coronary heart disease. Adults with prolonged exposure to even moderate elevations in non–high-density lipoprotein cholesterol have elevated risk for future CHD. From our study, it is concluded that male patients are more affected than females. Research makes it clear that both diabetes mellitus and hypertension were found to be stronger predictors of coronary atherosclerosis than smoking.

CONCLUSION

We concluded from our study that patients with diabetes mellitus as a risk factor were more prone to develop coronary artery disease CAD. Males were more at risk (79.2%) than females (20.8%) for CAD. Diabetes mellitus and hypertension were stronger predictors of CAD than smoking, hyperlipidemia and familial hypercholesterolemia.

Conflict of Interest: There is no conflict of interest
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