Original Article

Frequency of Coronary Artery Disease Pathologies Detected on Computed Tomography Angiography in Patients with Acute Chest Pain

Lyba Ahmed[1*], Javeria Qasim[1], Moeeza Naveed[1], Aruj Latif[1], Sabrina Rashid[1], Aqsa Zulfiqar[1] and Saad Qayyum[1]

[1]University Institute of Radiological Sciences & Medical Imaging Technology, The University of Lahore, Lahore, Pakistan

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ABSTRACT

Coronary Artery Disease (CAD) is the buildup of plaque in the arteries that supply oxygen-rich blood to your heart. Plaque causes a narrowing or blockage that could result in a heart attack. **Objective:** To detect the frequency of coronary artery disease pathologies on Computed tomography angiography (CTA) in patients with chest pain. **Methods:** It was a descriptive study and 258 patients with symptoms of chest pain were selected from the Department of Radiology. It was conducted from 16th March 2021 to January 25, 2022 at Punjab institute of cardiology Lahore and Al-Razi Hospital Lahore. The data was analyzed using SPSS V-21. **Results:** This thorough study depicts a large number of patients belonging to the middle age group ranging from 43-62 years old have the highest frequency of involvement of triple vessel disease. LV dysfunction was found to be present in severe in these middle-aged patients. Our study also helped rule out that the male gender had a higher frequency in the prevalence of coronary heart disease and involvement of the triple vessel disease with severe left ventricular dysfunction and that of female patients was far less in numbers and severity respectively. **Conclusions:** Triple vessel disease is more common in males than females and especially belonging to a middle-aged group and simultaneously more affected left ventricular function.

INTRODUCTION

The constriction of the blood vessels is known as coronary artery disease (CAD) [1,2]. CAD is produced by the narrowing of the large blood vessels that supply the heart with oxygen. The constriction of the major blood arteries delivers oxygen to the heart. Plaques accumulation on inside walls of the arteries causes them to stiffen and shrink. Atherosclerosis is the accumulation of plaque. The interiors of the coronary arteries constrict as the plaque grows in size, allowing less blood to pass via them. Flow of blood to the heart tissue gradually decreases, and because blood carries oxygen, the cardiovascular system has been unable to achieve the proper oxygen levels. Cardiovascular disease, heart problems, and myocardial infarction are all terms for the same thing [3,4]. Indications of CAD can vary from breathing difficulties to different degrees of chest discomfort. CAD is the medical term for this type of chest discomfort. It's frequently accompanied by a sense of tightness or worry, and it might spread to the arms, back of the neck, back, upper abdomen, or jaw [5]. Physical activity is the most common cause of these signs because the heart muscle requires more oxygen. They happen when there isn't enough blood flowing through the coronary arteries [6]. With age, the likelihood of developing CAD rises. Your risk of CAD rises as you get older. After the age of 45, men's risk increases. After the age of 55, the risk of breast cancer rises in women. CAD is one of the most prevalent chronic diseases, affecting over 10% of adults between the ages of 40 and 80, with males being afflicted more frequently than women. Early Heart Disease in the Family. Just before the period of 56, a dad or brother was

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detected with a heart defect, and until the period of 66, a mom or sister was confirmed with a heart condition. Having a cigarette, being highly overweight, showing high cholesterol, high blood pressure, and diabetes are all potential causes of CAD[7,8].

METHODS

It was a descriptive study and 258 patients with the symptoms of chest pain were selected from the Department of Radiology. Data were collected with a convenient sampling technique according to the age, gender, vessels involved, and extent of vessels involvement. This study was conducted from 16th March 2021 to January 25, 2022, at Punjab Institute of Cardiology Lahore and Al-Razi Hospital Lahore. The data was analyzed using SPSS V-25. Statistical analysis was done using SPSS version 25. Mean ± standard deviation was calculated using age and gender. The frequency of gender and CT findings (vessels involved) were calculated.

RESULTS

There were 202 males (78.3%) and 56 females (21.7%) out of 258 patients. On CTA, it was observed that 160 male patients and 40 female patients had CAD as shown in Table 1.

| Gender	CAD	Total Patients (%)
Male	160	202 (78.3)
Female	40	56 (21.7)
Mean Age (Years)		52.84 ±12.17

Table 1: Demographic Details

People belonging to the 23-42years age group, LAD (single) was involved in 7(13.2%) patients, double vessel disease (involving LAD, LCA) was found in 3(5.7%) patients, 19(35.8%) patients had triple vessels involved (LAD, LCA, RCA). LCA and RCA were involved in 2(3.8%) and 1(1.9%) patients respectively. In this same age group, 23(43.4%) patients had normal LV function, 3(5.7%) patients had mild LV dysfunction, 14(25.4%) had moderate LV dysfunction and 13(24.5%) patients had severe LV dysfunction. Similarly, for people in the middle age group of patients ranging from 43-62, LAD (single) was involved in 15(10.2%) patients, double vessel disease (involving LAD, LCA) was found in 10(6.85%) patients, 68(46.3%) patients had triple vessels involved (LAD, LCA, RCA). In this same age group of patients, LCA was involved in 4(2.7%) patients. 2(1.4%) patients had double vessel disease (involving LCA, RCA). And 2(1.4%) 29 patients had single-vessel involving RCA. Patients of this age group had the most affected LV function, as 42(28.65%) patients had normal LV Function, 18(12.25%) patients had mild LV dysfunction, 36(24.5%) had moderate LV dysfunction and 51(34.7%) patients had severe LV dysfunction. For people belonging to 63-85

years, LAD was involved in 7(12.15%) patients, double vessel disease (involving LAD, LCA) was found in 3(5.2%) patients, 31(53.4%) patients had triple vessels involved (LAD, LCA, RCA). LCA was involved in 2(3.45%) patients. 2(3.4%) patients had double vessel disease (involving LCA, RCA). And 2(3.4%) patients had single-vessel involving RCA. On the basis of Left ventricular function in patients of this age group, 14(24.1%) patients had normal LV function, 7(12.1%) patients had mild LV dysfunction, 19(32.8%) had moderate LV dysfunction and 18(31.0%) patients had severe LV dysfunction as shown in Table 2.

Age Group (years)	Vessels involved								
	LAD	LAD LCA	LAD LCA RCA	LAD RCA	LCA	LCA RCA	Normal	RCA	
22 -42	7	3	19	3	2	0	18	1	53
	13.2%	5.7%	35.8%	5.7%	3.8%	0.0%	34.0%	1.9%	100.0%
43 -62	15	10	68	14	4	2	32	2	147
	10.2%	6.8%	46.3%	9.5%	2.7%	1.4%	21.8%	1.4%	100.0%
63 -85	7	3	31	3	2	2	8	2	58
	12.1%	5.2%	53.4%	5.2%	3.4%	3.4%	13.8%	3.4%	100.0%
Total	29	16	118	20	8	4	58	5	258
	11.2%	6.2%	45.7%	7.8%	3.1%	1.6%	22.5%	1.9%	100.0%

Table 2: Vessels involved according to age distribution
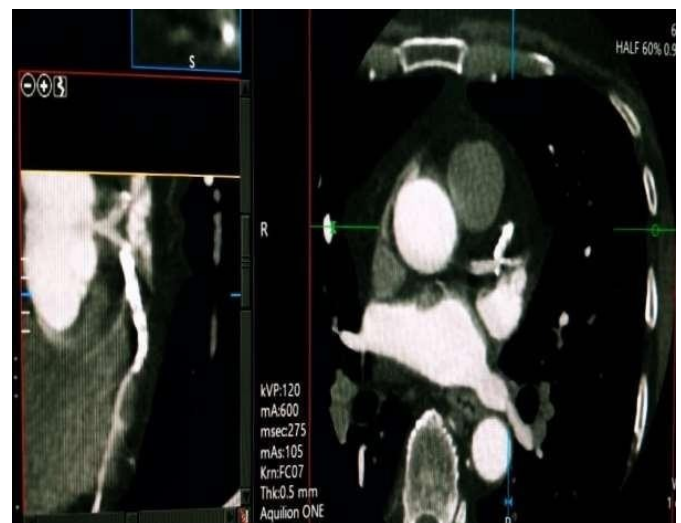
Figure 1: shows three vessels disease. LAD show total occlusion at proximal segment. LCA and RCA are not visualized
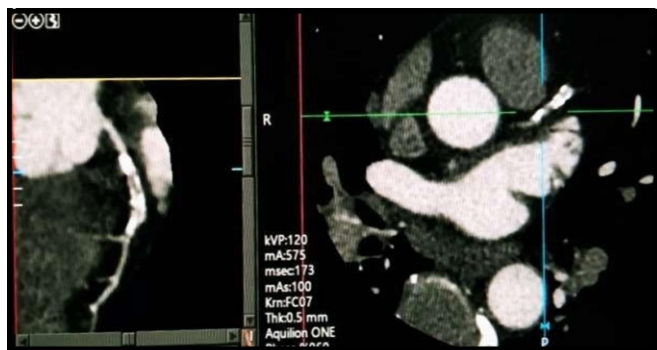
Figure 2: shows three vessels disease. LAD shows subtotal proximal occlusion due to mixed plaque; LAD is visualized in its mid and distal course(1.5mm)

DISCUSSION

According to the previous study, a greater number of patients belonging to the middle age group had more cases of triple vessel disease which correlates with our study in which 258 patients were included with a mean age of 52.84 ± 12.17 years. Patients had presented with chest pain and when Coronary Tomography Angiography was performed for those patients it turned out that, for the middle age group of patients ranging from 43-62 years had a higher rate of triple vessel disease and affected systolic function [9,10]. According to a previous study by Benjamin Chow JW *et al.,* in 2008 patients with higher severity of CAD interrelates with more reduction in left ventricular function [11]. Several groups examined the prognostic value of CTA and showed that normal CTA findings confer an excellent prognosis and abnormal CTA findings are associated with adverse events [12]. The results of the current study showed that more patients had diagnosed that those patients came with the symptom of chest pain had diagnosed with triple vessels and most of those patients had severe left ventricular dysfunction. One of the really common clinical concerns is acute chest discomfort. Acute chest pain is the second most common presentation in the emergency department (ED) after stomach pain, accounting for roughly 40 percent of total among all ED diagnoses in the United States [13]. In this study, we aimed to demonstrate the diagnostic yield of CTA in patients with chest pain to evaluate patients with single, double, and triple vessel disease. Regarding the percentage of gender and mean age of the subjects, the current study is in agreement with the study of Eltabbakh AR et al., in 2019 [14], whose male patients were more than female patients. The current study included 258 patients who presented with chest pain, 200 patients were diagnosed with CAD and most of the patients were male and middle-aged groups [15,16]. In both male and female instances of CAD, age was found to be a major determinant, and those with positive CTA findings tended to be older. In the whole study population and when female and male cases were analyzed separately, the prevalence of CAD was considerably greater in cases over 40 years of age as compared to those less than 40 years of age for both genders. Age was linked to CAD in both male and female cases, according to the findings. As the patients of age group 23 to 62 years and among those male gender was more affected than other age group people and also females [17]. In the current study, among 258 patients with CAD, 200 (77.5%) patients were positive for CAD. These results are in agreement with the findings of studies [18,19] because they also reported the presence of CAD in 79% of patients with chest pain. In the study of Nagui Sabri *et al.,* [18], The mean age was 50 years, with more frequency of male patients and the presenting symptom were chest pain and congestive heart failure, and dizziness on admission and on CTA, 5 patients had 1 vessel involved, 4 patients had 2 vessels involved and 13 patients had 3 vessels involved. Similarly, in the current study include mean age is 52 years and patients had appeared with chest pain, on CT Angiography, there were 93 male patients who had triple vessel disease, 35 male patients had double vessel disease and 32 patients had single-vessel disease. Similarly, 25 female patients had triple-vessel disease, 10 had single-vessel disease and 5 had double-vessel disease [20]. The main objective of using CT to determine both the anatomical and hemodynamic state of the coronaries may be realized in the not-too-distant future. This will be especially useful when examining people who are experiencing acute chest pain. CAD is higher in rates in males instead in females as progesterone plays an important role here: Despite mounting evidence that progesterone reduces blood pressure, inhibits coronary hyperactivity, and has potent vasodilatory and natriuretic effects, the preventive role of progesterone in the cardiovascular system has received little attention.

CONCLUSIONS

This study concluded that triple vessel CAD is more common in middle-aged male patients, also it is related to severe left ventricular dysfunction. And CTA is a reliable modality to diagnose CAD.

REFERENCES

[1]   Abbas S, Kitchlew AR and Abbas S. Disease burden of ischemic heart disease in Pakistan and its risk factors. Ann Pak Inst Med Sci. 2009;5(3):145-50. doi.org/10.1201/b15132-2.

[2]   Raman Mishra M. Determinants of cardiovascular disease and sequential decision-making for treatment among women: A Heckman's approach. SSM-Population Health. 2019;7:100365. doi.org/10.1016/j.ssmph.2019.100365.

[3]   Kumar A and Cannon CP. Acute coronary syndromes: diagnosis and management, part I. Mayo Clin Proc. 2009;84(10):917-38. doi.org/10.4065/84.10.917.

[4]   Sekhri T, Kanwar RS, Wilfred R, Chugh P, Chhillar M and Aggarwal R et al. Prevalence of risk factors for coronary artery disease in an urban Indian population. BMJ Open. 2014;4(12):e005346-e. doi.org/10.1136/bmjopen-2014-005346.

[5]   N'Guetta R, Yao H, Ekou A, N'Cho-Mottoh MP, Angoran I and Tano M et al. Prevalence and characteristics of acute coronary syndromes in a sub-Saharan Africa population. Ann Cardiol Angeiol (Paris). 2016;65(2):59-63. doi: 10.1016/j.ancard.2016.01.001.

[6]   Sanchis-Gomar F, Perez-Quilis C, Leischik R and Lucia A. Epidemiology of coronary heart disease and acute coronary syndrome. Ann Transl Med. 2016;4(13):256-. doi.org/10.21037/atm.2016.06.33.

[7]   Singh A, Museedi AS and Grossman SA. Acute Coronary Syndrome. StatPearls. Treasure Island (FL). 2021. doi.org/10.31579/2641-0419/189.

[8]   Goyal N and Stillman A. Coronary CT angiography in acute chest pain. F1000Res. 2017;6:1125. doi: 10.12688/f1000research.11250.1.

[9]   Hertzer NR, Beven EG, Young JR, O'Hara PJ, Ruschhaupt 3rd WF and Graor RA et al. Coronary artery disease in peripheral vascular patients. A classification of 1000 coronary angiograms and results of surgical management. Annals of surgery. 1984;199(2):223. doi.org/10.1097/00000658-198402000-00016.

[10]   Shao C, Wang J, Tian J and Tang YD. Coronary artery disease: from mechanism to clinical practice. Coronary Artery Disease: Therapeutics and Drug Discovery. 2020:1-36. doi.org/10.1007/978-981-15-2517-9_1.

[11]   Lopes NH, Paulitsch FD, Gois AF, Pereira AC, Stolf NA and Dallan LO et al. Impact of number of vessels disease on outcome of patients with stable coronarary artery disease: 5-year follow-up of the Medical, Angioplasty, and bypass Surgery study (MASS). European journal of cardio-thoracic surgery. 2008;33(3):34954. doi.org/10.1016/j.ejcts.2007.11.025.

[12]   Athappan G and Subramanian T. Medical, angioplasty or surgery for stable coronary artery disease; do we have an answer!!!. European Journal of Cardio-Thoracic Surgery. 2008;34(3):702-3. doi.org/10.1016/j.ejcts.2008.05.032.

[13]   Hamon M, Biondi-Zoccai GG, Malagutti P, Agostoni P, Morello R and Valgimigli M et al. Diagnostic performance of multislice spiral computed tomography of coronary arteries as compared with conventional invasive coronary angiography: a meta-analysis. J Am Coll Cardiol. 2006;48(9):1896-910. doi: 10.1016/j.jacc.2006.08.028.

[14]   Nazeri I, Shahabi P, Tehrai M, Sharif-Kashani B and Nazeri A. Impact of calcification on diagnostic accuracy of 64-slice spiral computed tomography for detecting coronary artery disease: a single center experience. Arch Iran Med. 2010;13(5):37383..doi.org/10.1016/j.amjcard.2008.10.040.

[15]   Eltabbakh AR, Dawoud MA, Langer M, Moharm MA, Hamdy EA and Hamisa MF. 'Triple- rule-out' CT angiography for clinical decision making and early triage of acute chest pain patients: use of 320-multislice CT angiography. Egyptian Journal of Radiology and Nuclear Medicine. 2019;50(1):1-0. doi.org/10.1186/s43055-019-0003-1.

[16]   Goehler A, Mayrhofer T, Pursnani A, Ferencik M, Lumish HS and Barth C et al. Long-term health outcomes and cost-effectiveness of coronary CT angiography in patients with suspicion for acute coronary syndrome. J Cardiovasc Comput Tomogr. 2020;14(1):44-54. doi: 10.1016/j.jcct.2019.06.008.

[17]   Lindsell CJ, Anantharaman V, Diercks D, Han JH, Hoekstra JW and Hollander JE et al. The Internet Tracking Registry of Acute Coronary Syndromes (i*trACS): a multicenter registry of patients with suspicion of acute coronary syndromes reported using the standardized reporting guidelines for emergency department chest pain studies. Ann Emerg Med. 2006;48(6):666-77, 677.e1-9. doi: 10.1016/j.annemergmed.2006.08.005.

[18]   Om A, Warner M, Sabri N, Cecich L and Vetrovec G. Frequency of coronary artery disease and left ventricular dysfunction in cocaine users. The American journal of cardiology. 1992;69(19):1549-52. doi.org/10.1016/0002-9149(92)90701-y.

[19]   Jerjes-Sánchez C, Betancourt H, Valdés F, Rodríguez D, Vázquez Guajardo M and Toro-Mijares RD. Acute Coronary Syndromes in the ER. Springer. 2019:73-99. doi.org/10.1007/978-3-030-13679-6_5.

[20]   Frauenfelder T, Appenzeller P, Karlo C, Scheffel H, Desbiolles L and Stolzmann P *et al.*, Triple rule-out CT in the emergency department: protocols and spectrum of imaging findings. Eur Radiol. 2009;19(4):789-99. doi: 10.1007/s00330-008-1231-3.