

ORIGINAL ARTICLE

FREQUENCY OF TRIPLE-VESSEL CORONARY ARTERY DISEASE IN ADULT TYPE 2 DIABETICS VERSUS NON-DIABETICS IN CORONARY ARTERY DISEASE POPULATION OF ISLAMABAD, PAKISTAN

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ABSTRACT

Background: Coronary artery disease is a major cause of morbidity and mortality globally as well as in Pakistan. The objective of the study was to compare the frequency of triple-vessel coronary artery disease (triple-vessel CAD) in adult type 2 diabetics versus non-diabetics in coronary artery disease (CAD) population of Islamabad, Pakistan.

Materials and Methods: This cross-sectional study was conducted in Department of Cardiology, Pakistan Institute of Medical Sciences, Islamabad, Pakistan from June 21, 2016 to December 20, 2016. 300 patients were selected from population including adult CAD patients who were candidates for coronary angiography. Those with conduction defects, renal failure and prior CABG surgery were excluded. 150 diabetics and 150 non-diabetics were subjected to coronary angiography. Age, sex and presence of triple-vessel CAD were research variables. Age was analyzed by mean and SD while sex and presence of triple-vessel CAD were analyzed by count and percentage for each group separately. Confidence interval for proportion was calculated at 80% confidence level for each group. Frequency of presence of triple-vessel CAD in two groups was compared using McNemar chi-square test at alpha 0.5.

Results: Mean age was 55.02 ± 8.48 for diabetics and 54.02 ± 24.4 years for non-diabetics. Out of 300 patients with CAD, 184 (61.33%) were men and 116 (38.67%) were women. Triple-vessel CAD was present in 60/150 (40%) cases in diabetics and in 3/150 (2%) cases in non-diabetics. Frequency of triple-vessel CAD was significantly higher in adult type 2 diabetics versus non-diabetics in CAD population of Islamabad, Pakistan ($p < 0.0001$).

Conclusions: Frequency of triple-vessel CAD was significantly higher in adult type 2 diabetics versus non-diabetics in CAD population of Islamabad, Pakistan.

KEY WORDS: Coronary artery disease; Diabetes mellitus; Type 2 diabetes mellitus; Triple-vessel coronary artery disease; Coronary angiography.

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INTRODUCTION

1.1 Background: Coronary artery disease (CAD) is a major cause of morbidity and mortality in developed

countries, has declining mortality rates over the past four decades. However, in individuals over the age of 35, it still is the reason for about one-third or more of all deaths.^{1,2} The severity of CAD depends upon the number of coronary arteries involved. Percutaneous coronary intervention (PCI) is the mainstay of treatment; however, it can be managed medically if the disease is mild (single-vessel disease) and blockage of vessels is diffuse or partial less than 50% (double-vessel disease). Triple-vessel coronary artery disease is almost always managed by coronary artery bypass grafting (CABG). The risk factors for CAD i.e. hypertension, cigarette smoking, diabetes mellitus

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(DM), elevated cholesterol levels, and obesity are the top five causes of death globally.³

CAD accounts for >17 million annual deaths worldwide and is expected to touch the figure of 23.6 million until 2030.⁴ Ischemic heart disease alone caused seven million deaths worldwide in 2010, an alarming increase of 35% since 1990. It is the most frequent cause of mortality in diabetics causing more than half of all deaths. Myocardial infarction in diabetics carries a worse prognosis. PCI at the time of its introduction was used only in patients with refractory angina due to isolated lesions of a single major epicardial artery. On the other hand, CABG surgery has been shown to prolong the survival of patients with left main or triple-vessel CAD, significant ischemia, or left ventricular dysfunction. Another technique, i.e. multivessel coronary stenting, is believed to be feasible in selected patients with a short-term survival comparable to CABG.⁵

Diabetes mellitus is defined as a fasting plasma glucose of >7.0 mmol/L (126mg/dL), or a two hours postprandial glucose of >180 mg/dL. Its prevalence in adults aged 20-70 years is expected to rise from 285 million in 2010 to 438 million by the year 2030.⁷ In data from 2011 according to the World Health Organization (WHO), it was estimated that Pakistan is the seventh-largest country in terms of diabetics and it will be fourth-largest by the year 2030. DM is a chronic metabolic disorder that has a great socio-economic burden for the developing world, being the fourth leading cause of death, with Pakistan rating at seventh position among them.⁸ A Pakistani study showed that the prevalence of DM in Pakistan is 13.1%.⁹

Girdhar et al. in their study demonstrated that diabetic patients (20/61) had a higher prevalence of triple vessel CAD (32.78% versus 27.15%) as compared to non-diabetics (19/70).¹⁰

Silva et al. from Clydebank, Scotland found in his study published in 1995 that diabetic patients had a higher prevalence of triple-vessel CAD (47% versus 31%) and lower prevalence of single-vessel disease (18% versus 32%) versus non diabetic patients on coronary angiography.¹¹

Also higher prevalence rate of triple-vessel CAD in diabetics 44% (22/50) versus non-diabetics 16% (8/50) was reported by Hedge, et al.¹² in a sample (n=100) of acute coronary syndrome patients for the years 2014 from Davangera, Karnataka, India.

1.2 Research Problem, Knowledge Gap & Research Question: We have adopted "Marwat's Logical Trajectory of Research Process" for our project.^{13,14} Our Research Problem was unawareness of the frequency of triple-vessel CAD in adult type 2 diabetics versus non-diabetics in CAD population of Islamabad, Pakistan. No relevant studies were available on different search engines/ databases

like PakMediNet, PubMed, PubMed Central, ScienceDirect, Emerald Publishing, Google Scholar, Google, Pakistan Research Repository; this was our Knowledge Gap. Which one group out of adult type 2 diabetics versus non-diabetics would have higher frequency of triple-vessel CAD in our population was our Research Question. To answer this research question, to fill this knowledge gap and to solve this research problem were justifications of our project.

1.3 Research Objective: The objective of the study was to compare the frequency of triple-vessel coronary artery disease in adult type 2 diabetics versus non-diabetics in coronary artery disease population of Islamabad, Pakistan.

1.4 Research (Null) Hypothesis (H₀): The frequency of triple-vessel coronary artery disease is same in adult type 2 diabetics versus non-diabetics in coronary artery disease population of Islamabad, Pakistan.

1.5 Significance and Applicability of the study: This study will generate comparative base line data for future research in this domain for global, regional, national and local research.

MATERIALS AND METHODS

2.1 Design, Settings & Duration: This comparative cross-sectional study was conducted in the Department of Cardiology, Pakistan Institute of Medical Sciences, Islamabad, Pakistan from June 21, 2016 to December 20, 2016. The proposal of the study was approved by the Institutional Research & Ethics Committee. An informed consent was taken from all the patients after explaining the study protocol.

2.2 Population & Sampling (size, technique & selection): The population of our study included adult (> 19 years) CAD patients who were candidates for coronary angiography from Islamabad Capital Territory & its surrounding areas; Islamabad the capital city of Pakistan. With prevalence rate of 10% of CAD in the reference population, population at risk was estimated to be 100,000. A sample size of 300 patients was calculated with margin of error of 3.39%, confidence level of 95%, population size of 100,000 and prevalence rate of 10% through an online sample size calculator Raosoft®.¹⁵ Sampling technique was non probability consecutive. The CAD patients with established conduction defects, renal failure and prior CABG surgery were excluded. A total of 150 diabetics and 150 non-diabetics were registered.

2.3 Conduct of Procedure: All these patients were admitted, detailed history was taken and thorough examination was performed. Routine investigations including fasting blood sugar and HbA1c were performed. ECG and echocardiography of the patients were performed to look for old ischemic changes and wall motion abnormalities. Then coronary angi-

ography was performed by a consultant Cardiologist.

2.4 Data Collection Plan: Age in years and sex were two matching variables while presence of triple-vessel CAD was a research variable. The data type for age in years was ratio (numeric), while it was nominal for both the sex and presence of triple-vessel CAD (two attributes of yes and no).

2.5 Data Analysis Plan: Age in years was analyzed by mean and SD for each group separately. Sex and presence of triple-vessel CAD were analyzed by count and percentage for each group separately. Interval estimate for presence of triple-vessel CAD was calculated as confidence interval (CI) for proportion at 80% confidence level (CL) by an on line statistical calculator¹⁶ for each group separately. The frequency (count) of presence of triple-vessel CAD in the two groups was compared using McNemar chi-square test¹⁷⁻¹⁸ at alpha 0.5 using an online statistical calculator GraphPad.¹⁹

RESULTS

3.1 The mean (SD) age in years was 55.02 ± 8.48 for diabetics (n=150) and 54.02 ± 24.4 for non-diabetics (n=150), almost similar in both the groups.

3.2 Out of a sample of 300 patients with CAD, 150 (50%) were diabetics and 150 (50%) were non-diabetics. Out of a sample of 300 patients with CAD, 184 (61.33%) were men and 116 (38.67%) were women. (Table 1)

3.3 Triple-vessel CAD was present in 60 (40%) cases in diabetics and in 3 (2%) cases in non-diabetics. Triple-vessel CAD was not present in 90 (60%) cases in diabetics and in 147 (98%) cases in non-diabetics. Corresponding estimated prevalence in the specified population is given as confidence interval (CI) for proportion at 80% confidence level (CL). (Table 2)

3.4 Frequency of triple-vessel CAD in diabetics versus non-diabetics was compared by McNemar chi-square test at alpha 0.05. With p-value of <0.0001 (less versus alpha), the null hypothesis was proved to be false and hence rejected, showing highly statistically significant difference between the two groups in our population. In simple words, the frequency of triple-vessel CAD was significantly higher in diabetics versus non-diabetics in CAD population of Islamabad, Pakistan. (Table 3)

DISCUSSION

4.1 Prevalence rate of triple-vessel CAD in adult type 2 diabetics and non-diabetics in CAD population of Islamabad, Pakistan

In our study we had a sample of 300 subjects undergoing coronary angiography (CAG); out of these, 150 were diabetics and 150 were non-diabetics. The prevalence rate of triple-vessel CAD in our adult type 2 diabetic sample and population was 40% (80% CI 34.87-45.13%) and in non-diabetics it was 2% (80% CI 0.54-3.5). We had a much higher prevalence rate of triple-vessel CAD in diabetics.

Similar to our study, higher prevalence rate in diabetics 32.78% (20/61) versus non-diabetics 27.15% (19/70) was reported by Girdhar, et al.¹⁰ in positive CAG patients for the period from December 2016 to June 2018 from Bangalore, India.

Similar report is from Silva et al. from Clydebank, Scotland, published in 1995 that diabetic patients (8/17) had a higher prevalence rate of triple-vessel CAD (47.05% versus 31.57%) than non-diabetic patients (12/38) on coronary angiography.¹¹

Also higher prevalence rate of triple-vessel CAD in diabetics 44% (22/50) versus non-diabetics 16% (8/50) was reported by Hedge, et al.¹² in patients of acute coronary syndrome for the year 2014 from Davangera, Karnataka, India.

Higher prevalence rate in diabetics 32.43% (12/37) versus non-diabetics 26.19% (11/42) was reported by Afsar, et al.²⁰ in patients having positive coronary angiographic lesions for the period from January 2013 to June 2013 from Sylhet, Bangladesh.

Higher prevalence rate in diabetics 42.1% (85/202) versus non-diabetics 19.63% (116/591) was reported by Sharma, et al.²¹ in suspected CAD patients undergoing CAG for the period from March 2017 to January 2019 from Udaipur, Rajasthan, India.

Higher prevalence rate in diabetics 56% (28/50) versus non-diabetics 32% (16/50) was reported in 2006 by Moosavi, et al.²² in suspected CAD patients undergoing CAG from Tehran, Islamic Republic of Iran.

Higher prevalence rate in diabetics 58% (28/50) versus non-diabetics 38% (16/50) was reported in 2006 by Uddin et al.²³ in patients undergoing clinically indicated elective CAG from Mymensingh, Bangladesh ($p < 0.001$).

Table 1: Frequency of men and women in adult type 2 diabetics and non-diabetics in CAD population of Islamabad, Pakistan (n=300)

Sex	Diabetics (n1=150)	Non-diabetics (n2=150)	Total
Men	84 (56%)	100 (66.67%)	184 (61.33%)
Women	66 (44%)	50 (33.33%)	116 (38.67%)
Total	150 (100%)	150 (100%)	300 (100%)

Table 2: Frequency of triple-vessel coronary artery disease in adult type 2 diabetics and non-diabetics in CAD population of Islamabad, Pakistan

Presence of triple-vessel coronary artery disease			80% CI for Proportion	
Group	Yes Count (%)	No Count (%)	Lower	Upper
Diabetics (n1=150)	60 (40%)	90 (60%)	34.87	45.13
Non-diabetics (n2=150)	03 (02%)	147 (98%)	0.54	3.50

Table 3: Comparison of frequency of triple-vessel CAD in adult type 2 diabetics versus non-diabetics in CAD population of Islamabad, Pakistan

Groups		Diabetics (n1 = 150)		Row Totals	χ^2 value	P-value
		Triple-ves- sel CAD	No triple-vessel CAD		Alpha .05, d.f. = 1	
Non-diabet- ics (n2=150)	Triple-vessel CAD	(a) 02	(b) 01	3	53.15	<0.0001
	No triple-vessel CAD	(c) 58	(d) 89	147		
	Column Totals	60	90	150 Pairs	H ₀ rejected	
McNemar chi-square test			Yates continuity correction applied			

Higher prevalence rate in diabetics 35.2% (132/375) versus non-diabetics 24% (42/171) was reported in 2009 in patients undergoing selective CAG from Shanghai, PR China ($p=0.009$).²⁴

No studies were found showing similar or higher prevalence of triple-vessel CAD in non-diabetics versus diabetics.

4.2 Comparison of prevalence rate of triple-vessel CAD in adult type 2 diabetics versus non-diabetics in CAD population of Islamabad, Pakistan

Frequency of triple-vessel CAD in adult type 2 diabetics versus non-diabetics was compared by McNemar chi-square test. With p-value of <0.0001 (less versus alpha), the null hypothesis was proved to be false and hence rejected, showing that the frequency of triple-vessel CAD was significantly higher in adult type 2 diabetics versus non-diabetics in CAD population of Islamabad, Pakistan.

No studies were found in local, national, regional and global literature where proper inferential analysis through relevant hypothesis testing is conducted like our study to compare the two groups for the frequency of triple-vessel CAD, so our study will be an innovated addition to the global literature.

CONCLUSION

The frequency of triple-vessel CAD was significantly higher in adult type 2 diabetics versus non-diabetics in CAD population of Islamabad, Pakistan.

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CONFLICT OF INTEREST
Authors declare no conflict of interest.
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AUTHORS' CONTRIBUTION

The following authors have made substantial contributions to the manuscript as under:

Conception or Design:	MB, MUR
Acquisition, Analysis or Interpretation of Data:	MB, MUR, ARK, AA
Manuscript Writing & Approval:	MB, MUR, ARK, AA

All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.



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