CORONARY ARTERY DOMINANCE IN CASES WITH INFERIOR WALL MYOCARDIAL INFARCTION

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ABSTRACT:

BACKGROUND:	Acute coronary syndrome is one of the most common life-threatening emergency and one of the leading causes of sudden death. If diagnosed in time, the patient can be saved. Angiography is the gold standard and helps in identifying the affected vessel.
AIMS & OBJECTIVE:	To see the frequency of coronary artery dominance in cases presenting with inferior wall myocardial infarction.
MATERIAL & METHODS:	This cross sectional observational study was done in the emergency department of Punjab Institute of Cardiology, Lahore from March to August 2017. All the patients between 18-60 years of age, both genders, diagnosed with IWMI and had been given thrombolytic therapy within 24 hours of MI were included in this study. Those patients having history of heart failure as determined by the past medical record, patients with renal failure (serum creatinine on admission > 1.1 mg/dL), patients with a history of rheumatic heart disease, hypertension >5 years, uncontrolled diabetes (determined by HbA1C > 7%), patients having history of previous myocardial infarction or concomitant involvement of other coronary artery areas like an anterior wall or septal wall and those were excluded from this study who did not give informed consent.
RESULTS:	227 patients were enrolled in this study. Mean age of the patients was 45.07±8.17 years. Males were 51.98% (n=118) and females were 48.02% (n=109). Mean BMI was 26.13 ± 3.29 kg/m2. The dominant left circumflex artery (LCX) was found in 25.55% and Right Coronary Artery (RCA) was found to be dominant in 74.45% of our subjects.
CONCLUSION:	Presentation of IWMI with RCA as the dominant artery is three times more common as compared to LCx in our local population.
KEY WORDS:	IWMI, LCX, RCA, BMI, sudden death, coronary artery dominance.

INTRODUCTION

Chest pain is one of the most common presentation in the emergency department and cardiology clinics and it is a life threatening emergency. Acute coronary syndrome includes unstable angina and myocardial infarction (MI), which includes two subtypes; ST segment elevation myocardial infarction and non ST-segment elevation myocardial infarction.

It remains a leading cause of morbidity and mortality globally. It can also be subdivided as inferior and anterior wall MI depending upon the leads of involvement [1, 2].

Several conditions can complicate patients with acute coronary syndrome which include rhythm disturbances, heart failure, cardiogenic shock, mechanical cardiac complications, and recurrent myocardial infarction. Coronary angiography and intervention are considered as the gold standard now to avoid such complications.[3-6]

Inferior wall myocardial infarction(MI) is a common presentation in our tertiary care hospitals. The inferior wall is either supplied by either right coronary artery (80%) or by the left circumflex artery (16%).[7] The blood supply to the posterior inter-ventricular septum determines the dominancy of the vessel either right or left dominant.[8] Regional coronary flow and myocardial perfusion are affected by the dominance of the coronary system.[9] The severity of complications varies with the dominance of either artery.[10, 11]

RATIONALE:

Several studies have shown that coronary artery dominance is linked with cardiovascular prognosis in patients presenting with acute coronary syndrome.[12,13] The data from PIC shows enormus numbers of patients of ACS.[14] We felt the need to explore & investigate the dominant coronary artery in IWMI cases, so we can add local data to existing national and international literature.

MATERIAL AND METHODS:

After getting ethical approval, this cross sectional observational study was conducted at emergency department of Punjab Institute of Cardiology, Lahore over a period of six months from March 2017 to August 2017. The patients were explained regarding this study and informed consent obtained. All patients were between 18-60 years of age, both genders, diagnosed with IWMI and had been given thrombolytic therapy within 24 hours of MI included in this study. Those patients who had a history of heart failure as determined by the past medical record, patients with renal failure (serum creatinine on admission > 1.1 mg/dL), patients with a history of rheumatic heart disease, hypertension >5 years, uncontrolled diabetes (determined by HbA1C > 7%), patients having history of previous myocardial infarction or concomitant involvement of other coronary artery areas like an anterior wall or septal wall and those who did not give informed consent were excluded.

SAMPLE SIZE ESTIMATION:

The sample size was 295 on sample size calculator, using the estimation of population size 100,000. The confidence Interval was 95%, and the accepted margin of error was 5%. Five subjects opted out and 18 subjects didn't fulfill our criteria. A total of 227 consecutive patients admitted via the emergency department with inferior wall myocardial infarction. Patients were treated with thrombolytic therapy according to standard departmental protocols. As per departmental protocol, patients subsequently underwent angiography via radial artery access. Coronary artery dominance was noted. Software SPSS version 21.0 was used for data analysis. Numerical variables were presented by mean and standard deviation and qualitative variables as frequency and percentage. To determine the level of significance Chi-Square test was applied. P value < 0.05 was considered statistically significant.

RESULTS:

227 patients enrolled in this study. The mean age of the patients was 45.07 ± 8.17 years. Males accounted for 51.98% (n=118) whereas females accounted for 48.02% (n=109) of the subjects [figure 1]. The mean basal metabolic index (BMI) was 26.13 ± 3.29 kg/m2 [Table 1 & 2]. In our study, the LCx dominant artery was found in 25.55% (n=58) and RCA was found in 74.45% (n=169) of the subjects. There was no

Table 1: Study variables (n= 227)		
Variables	**Mean ± SD**	**Range**
Age	45.07±8.17	18-60
BMI	26.13±3.29	21-34

Table 2: Comparison of gender with dominant artery.

		Dominant artery		Total	p-value
		LCX	RCA		
Gender	Male	33	85	118	
	Female	25	84	109	
Total		58	169	227	0.385

Table 3: Comparison of age with dominant artery

		Dominant artery		Total	p-value
		LCX	RCA		
Age groups	18-39	16	47	63	
	40-60	42	122	164	0.974
Total		58	169	227	

Table 4: Comparison of smoking with dominant artery

		Dominant artery		Total	p-value
		LCX	RCA		
Smoking	Yes	24	89	113	
	No	34	80	114	0.138
Total		58	169	227	

Table 5: Comparison of BMI with dominant artery

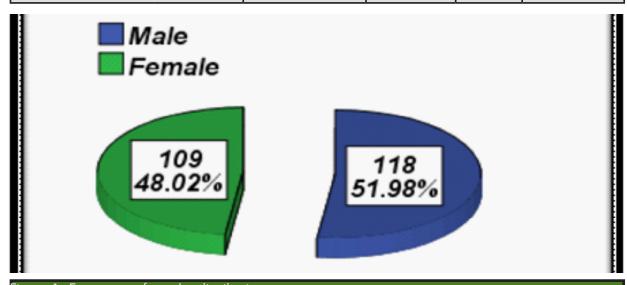|		Dominant artery		Total	p- value
		LCX	RCA		
BMI	>30	35	86	121	
	Upto 30	23	83	106	
Total		58	169	227	0.213

Figure 1: Frequency of gender distribution

significant difference in any confounding variable concerning the dominance of the artery as shown in tables 2 to 5.

DISCUSSION:

Rupture of plaque in epicardial artery is one of the major causes of acute myocardial infarction. The outcome of prognosis between anterior wall myocardial infarction and inferior wall myocardial infarction has been thoroughly investigated. In co-dominance (balanced) circulation, however, both RCA and LCx give branches to interventricular septum. The occurrence of co-dominance in general population is around 4%.[15] Information about comparison between inferior wall myocardial infarction caused by occlusion of Right coronary artery and Left circumflex artery is limited.

In this study out of 227 patients heart failure occurred in 27.75% (n=63) patients in which 25.39% (n=16) patients had LCx dominant artery and 74.6% (n=46) had RCA. Statistically, an insignificant risk was found between heart failure with the dominant artery. Some of the studies are discussed below showing their results. Coronary artery supply for the inferior wall is either through RCA (80%) or LCx (16%). The supplying artery to the posterior interventricular septum is labeled as a dominant vessel.[3-9]

A study by Sohrabi et al. found out that Right coronary artery and Left circumflex arteries found occluded in 64.7% and 35.3% of patients, respectively. Baseline characteristics were similar in studied groups except LCx occlusion was more associated with multiple-vessel disease (p= 0.008). Occlusion of Left circumflex artery was associated with higher release of cardiac enzyme (p< 0.001), significant mitral regurgitation (p= 0.015), and reduced left ventricular ejection fraction (p= 0.01). Multivariate analysis showed that independent factors that lead to poor outcome include release of cardiac troponin I, reduced left ventricular ejection fraction and occurrence of mitral regurgitation.[16]

Nienhuis et al., revealed that inferior wall myocardial infarction was associated with more favorable short and long-term clinical outcomes compared to anterior wall MI. Extent of damage to myocardium is commonly larger in occlusion of left anterior descending artery(LAD) as compared to occlusion of acute RCA or LCx artery because it supplies a large area of myocardium.[17]

CONCLUSION:

The presentation of IWMI with RCA as the dominant artery is three times more common as compared to LCx. Timely intervention can significantly reduce morbidity and mortality in these patients. Angiography should be performed on an emergent basis in all patients presenting with IWMI.

LIMITATIONS TO STUDY:

Our study had a few limitations, the biggest one being that this is a single-center data and more studies need to be done at the national level for assessment of pattern of coronary artery dominance in IWMI. Furthermore, we didn't get cardiac MRI due to financial restraints. MRI & MRA would have refined our results.

References:

1. Folsom AR, Shah AM, Lutsey PL, Roetker NS, Alonso A, Avery CL, Miedema MD, Konety S, Chang PP, Solomon SD. American Heart Association's Life's Simple 7: Avoiding Heart Failure and Preserving Cardiac Structure and Function. Am J Med. 2015;128(9):970-6.

2. Tanai E, Frantz S. Pathophysiology of Heart Failure. Compr Physiol. 2015;6(1):187-214.

3. Badar AA, Perez-Moreno AC, Hawkins NM, Jhund PS, Brunton AP, Anand IS, McKelvie RS, Komajda M, Zile MR, Carson PE, Gardner RS, Petrie MC, McMurray JJ. Clinical Characteristics and Outcomes of Patients With Coronary Artery Disease and Angina: Analysis of the Irbesartan in Patients With Heart Failure and Preserved Systolic Function Trial. Circ Heart Fail. 2015;8(4):717-24.

4. Arso IA, Setianto BY, Taufiq N, Hartopo AB. In-hospital major cardiovascular events between STEMI receiving thrombolysis therapy and primary PCI. Acta Med Indones. 2014;46(2):124-30.

5. Fazlinezhad A, Dorri M, Azari A, Bigdelu L. Frequency of ischemic mitral regurgitation after first- time acute myocardial infarction and its relation to infarct location and in-hospital mortality. J Tehran Heart Cent. 2014;9(4):160-5.

6. Qureshi AE, Jafri NA, Noeman A, Yasmin S, Khalil H. Streptokinase for acute myocardial infarction in the elderly. J Ayub Med Coll Abbottabad. 2014;26(4):535-8.

7. Futami C, Tanuma K, Tanuma Y, Saito T. The arterial blood supply of the conducting system in normal human hearts. Surg Radiol Anat. 2003;25(1):42-9.

8. Wang L, Li J, Gao Y, Li R, Zhang J, Su D, Wang T, Yang G, Wang X. Association between coronary dominance and acute inferior myocardial infarction: a matched, case-control study. BMC Cardiovasc Disord. 2019;19(1):35.

9. Mynard JP, Smolich JJ. Influence of anatomical dominance and hypertension on coronary conduitarterial and micro-circulatory flow patterns: a multiscale modeling study. Am J Physiol Heart Circ Physiol. 2016; 311(1): H11-23.

10. Iannetta L, Puddu PE, Missiroli B, Morabito G, Grillo P, De Gregorio C, Schiariti M. Pathophysiology and ECG patterns of isolated right ventricular infarction with non-dominant right coronary artery. J Cardiovasc Med (Hagerstown). 2013;14(10):740-4.

11. Bolorunduro O, Khouzam RN, Dishmon D. Resolution of complete heart block after revascularization of acute marginal branch of the right coronary artery. Turk Kardiyol Dern Ars. 2014;42(7):667-70.

12. Veltman CE, de Graaf FR, Schuijf JD, et al. Prognostic value of coronary vessel dominance in relation to significant coronary artery disease determined with non-invasive computed tomography coronary angiography. Eur Heart J 2012;33:1367–77.

13. Kuno T, Numasawa Y, Miyata H, et al. Impact of coronary dominance on in-hospital outcomes after percutaneous coronary intervention in patients with acute coronary syndrome. PLoS One 2013;8:e72672 10.1371/journal.pone.0072672

14. Statistics [Internet]. Punjab Institute of Cardiology. 2018 [cited 3 February 2020]. Available from: https://pic.punjab. gov.pk /Statistics

15. Ghaffari S, Kazemi B, Dadashzadeh J, Sepehri B. The Relation between Left Coronary Dominancy and Atherosclerotic Involvement of Left Anterior Descending Artery Origin. J Cardiovasc Thorac Res. 2013;5(1):1-4.

16. Sohrabi B, Separham A, Madadi R, Toufan M, Mohammadi N, Aslanabadi N, Kazemi B. Difference between Outcome of Left Circumflex Artery and Right Coronary Artery Related Acute Inferior Wall Myocardial Infarction in Patients Undergoing Adjunctive Angioplasty after Fibrinolysis. J Cardiovasc Thorac Res. 2014;6(2):101-4.

17. Nienhuis MB, Ottervanger JP, de Boer MJ, Dambrink JH, Hoorntje JC, Gosselink AT, Suryapranata H, van't Hof AW; Zwolle Myocardial Infarction Study Group. Prognostic importance of creatine kinase and creatine kinase-MB after primary percutaneous coronary intervention for ST-elevation myocardial infarction. Am Heart J. 2008;155(4):673-9.