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**ORIGINAL ARTICLE**

# Prevelence of Multivessel Anatomy in Primary Percutaneous Coronary Intervention (PCI) after Acute ST Elevation Myocardial Infarction

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## ABSTRACT

**Objective:** This study aims to determine the frequency of multivessel anatomy in patients with Primary Percutaneous Coronary Intervention (PPCI) after Acute ST-Elevation Myocardial Infarction (STEMI).

**Methodology:** From February 2017 to August 2017, this descriptive cross-sectional study was conducted in National Institute of Cardiovascular Diseases Karachi. P-value<0.05 was considered statistically significant. Patients of Either gender, having comorbid of Diabetic, hypertensive, obese, smokers or ex-smokers, from age ≥35 years and ≤65 years were included for the research subject. However, patients with a previous history of coronary angioplasty or thrombolytic therapy, valvular heart disease, CABG, and all those patients with non-ST-elevation myocardial infarction (NSTEMI) do not meet the criteria for STEMI on electrocardiography were excluded.

**Result:** A total of 97 patients were evaluated with a mean age of 52.5 and standard deviation ±9.76 and weight mean was 68.65±10.86. A significant result was observed with the help of chi-square t-test analysis in the stratification for MVDA. Age was proportionally related to MVDA with a p-value of 0.001. Diabetes Mellitus is another significant factor in association with MVDA with a p-value of 0.001. Hypertension and current smoking status in association with multivessel disease reflect moderate evident significance while gender and ex smoking status have no association with MVDA.

**Conclusion:** Patients with multi-vessel disease comprise the majority of patients undergoing PCI today and will likely remain so. With improved techniques, stents, and adjunctive drugs, outcomes have improved significantly.

**Keywords:** Multivessel Disease Anatomy **(MVDA),** Standard Modified Cardiovascular Risk Factor **(SMuRF),** Primary Percutaneous Coronary Artery Intervention **(PPCI),** Acute ST segment Elevation Myocardial Infarction **(STEMI)**

## INTRODUCTION

An occasion of myocardial death caused by any unstable ischemic syndrome usually occurred due to crack or disintegration of defenceless, lipid-loaded, or atherosclerotic coronary plaque formed with thrombogenic core and matrix material extent in the open circulatory blood vessel. The occlusion partially or completely blocks the arteries leads to “ST-elevation myocardial infarction (STEMI)” [1]. It is defined as more than fifty percent blockage in luminal diameter of two or more than two coronary arteries on the basis of visual assessment with the help of fluoroscopic imaging. About 40% to 65% of cases show “ST-elevation myocardial infarction (STEMI) with multi-vessel disease (MVDA)”. The vital goal of “percutaneous coronary mediation (PCI)” in these cases is to bring back epicardial flow in the culprit's vessel and after that myocardial perfusion will be functional to normal. As per coronary artery disease (CAD), pathophysiology during myocardial infarction (MI) is not always restricted to define culprit vessel only. However, the Revascularization of non-culprit lesions is yet too ruled out in literature [2].

The standard modifiable cardiovascular risk factors (SMuRF) are Cigarette smoking, hypertension, hyperlipidemia, and diabetes mellitus adhered coronary artery disease severeness. Across 20 years, the multicenter registry studies, 19% of patients with STEMI having no history of CVD and SMuRFs. The patients with 1 or more SMuRFs had a lesser in-hospital death rate in comparison to SMuRFs-less STEMI patients [3]. Patients with diabetes and STEMI have high chances of multi-vessel disease (MVDA) and are connected with high cardiac mortality rates [4]. On the other hand, it is realized that about 50% of patients with STEMI have the multi-vessel disease (MVDA). Their results are more terrible as compared to patients with the single-vessel disease [5].

A multicentre study was conducted on archive data in 2019 to intervene the percentage of SMuRF-less ST-segment–elevation myocardial infarction (STEMI) patients and they found a high number of comorbid cases i.e., hypertension, hypercholesterolemia, Diabetes mellitus, and smoking. [1] Another study was conducted in the same year in which 50% of their patient arrived in acute ST-segment elevation infarction (STEMI) and non-ST segment elevation myocardial infarction (NSTEMI) have multi-vessel (MV) anatomy of coronary artery disease [6] Previously, with the same approach meta-analysis conducted by Suzanne W, et al, enrolled patients with cardiogenic shock messing with acute myocardial infarction mostly have multi-vessel diseases (MVDA), and it reflected high death rates

as contrasted with patients with the single-vessel disease [7]. Eric R B, et al, concluded in their research that the temporary prediction after ST-elevation myocardial infarction is more bizarre with multi-vessel coronary artery disease (MV CAD) as compared to single-vessel coronary artery disease. (CAD), possibly as a result of extra plaque volatility. As per the stats of the study the grown-up age, atherosclerotic risk factors and lower left ventricular ejection fraction also play a role in patients with MV CAD [8].

Patients with STEMI and diabetes have high chances of neurohormonal activation and inflammation at hospital admission in contrast with patients without diabetes. This may assume a part in the high deaths in patients with STEMI and diabetes [9]. In-hospital stay with 30 days after multivessel PCI for STEMI, 1 of every 10 patients including repeat MI and Heart Failure exacerbation were altogether connected with the readmission threat [10].

Another study was also conducted that looked into the analytical force by using nationwide data of multi-vessel PCI in patients with STEMI and cardiogenic shock. According to their findings, by 1-year Multi-vessel revascularization for non-IRA stenosis in patients with STEMI multi-vessel infection presented with cardiogenic shock reveals essentially lower threat of all-cause mortality, contrasted and IRA-just PCI [11]. Later in 2019, Denial CG et al also assured that a technique of multi-vessel PCI with complete revascularization is essentially better than offender culprit artery only primary PCI in patients with STEMI not muddled via cardiogenic shock [12]. In 2017 Jacob L et al conducted a study, their results show that in ST-segment–elevation myocardial infarction patients with the multi-vessel disease. The profit with fractional flow reserve–guided complete revascularization was subject to the presence of 3-vessel disease and non-infarct distance across stenosis ≥90% [13].

Another study was done in 2017 and they suggest that single system multivessel PCI may give the best advantage, with critical decreases in the composite threat of mortality or MI, MI alone, and recur revascularization, with a mathematically lower pace of death when contrasted with culprit-only PCI [14]. At the national level, National Institute of Cardiovascular Disease Karachi conducted two researches previously which covered the Multivessel anatomy during revascularisation in PCI. Farooq G, et al, conducted 2 years on the severity and extent of coronary artery disease patients among diabetic and nondiabetic. Left Anterior Descending (LAD), Right Circumflex Artery (RCA), Left Circumflex Artery (LCA), and Multi Vessel Diseases (MVDA) were evaluated, resulted in multivessel diseases were more common in diabetic patients rather than nondiabetic [15]. Another study Batra MK et al, in 2018 was conducted to compare the single vessel disease with multivessel disease among 282 consecutive sample sizes. The study concluded that multivessel disease computed the highest degree of hospital stay, in-hospital mortality, complication, and referral for CABG. [16]

For the purpose of highlighting the importance of the research topic, significant scholarly articles and research studies have been examined through the aid of pakmedinet. Thus, this study was the first study locally to fill the literature gap and was beneficial for future research in this regard. The main objective of the study was to evaluate all the variables which have the highest effecting rate on multivessel anatomy during PCI targeting STEMI patients specifically. This study aims to determine the frequency of multivessel anatomy in patients with Primary Percutaneous Coronary Intervention (PPCI) after Acute ST-Elevation Myocardial Infarction (STEMI).

## MATERIAL AND METHOD

From February 11, 2017, to August 11, 2017, this descriptive cross-sectional study was conducted in a single center i.e., National Institute of Cardiovascular Diseases Karachi. The sample size is calculated with the confidence interval at 95% and margin of error at 10%, taking multivessel anatomy as (p) = 50% 5, putting this information in WHO software; the sample size was 97. P-value<0.05 was considered statistically significant. Non-probability consecutive sampling was utilized for data collection within 06 months timeline. This study was extracted from the dissertation submitted at the College of Physicians and Surgeons Pakistan (CPSP). Ethical approval was obtained prior to the data collection from the Institutional Review Board-National Institute of Cardiovascular Disease (IRB-NICVD).

For patients who meet the inclusion criteria, informed consent was taken from the patient or attendee. Senior Cardiologist or patient's cardiologist consent was also taken when extracting the data from the file. Selection of the patients was made on the basis of presenting complain of chest pain, diagnosed as STEMI based on ECG interpretation and as per the inclusion criteria in the emergency department of NICVD. Inclusion criteria of the study are patients of either gender, having comorbid of Diabetic, hypertensive, obese, smokers or ex-smokers, from age ≥35 years and ≤65 years.

However, patients with a previous history of coronary angioplasty or thrombolytic therapy, valvular heart disease, CABG, and all those patients with non-ST-elevation myocardial infarction (NSTEMI) do not meet the criteria for STEMI on electrocardiography were excluded. Patients were further scrutinized after being shifted to the cardiac catheterization lab angiography and identified as two or more vessels having greater than 50% blockage declared as the multivessel disease. All the patient's demographic characteristics and the baseline information like age, gender, hypertension, diabetes mellitus, smoker, ex-smoker, the weight of the patient, and family history of coronary artery disease will also be recorded on defined proforma. To avoid confounding variables, the exclusion criteria were strictly followed. Confidentiality of the data was maintained by keeping the identity of the patient hidden and data is restricted to the primary investigator only. The data and material will be represented on request.

Data were analyzed using the statistical package for social science (IBM SPSS, Statistics for Windows, version 21.0, IBM Corporation, NY, USA). For qualitative variables, i.e. gender, comorbidities (e.g. diabetes mellitus, hypertension, weight of the patients, family history, smoker, ex-smoker) cardiogenic shock, and multivessel anatomy, frequency, and percentages were calculated. Mean and standard deviation was calculated for age and ECG measures. Stratification was done for age, gender,

comorbidities (as mentioned above), cardiogenic shock by applying chi-square test. P-value ≤ 0.05 was considered significant.

## RESULT

Out of 97 patients, 54n (55.7%) patients were recorded to have the multivessel disease. The mean age was observed at 52.5 with a standard deviation ± 9.76. Weight was observed 68.65 mean with SD ± 10.86. Among 97n patients, 40n (41.2%) were female and 57n (58.8%) were male patients. In association with STEMI with multivessel disease 38n (39.9%) patients were diabetic. 54n (55.7%) study sample was hypertensive in nature, while 62n (63.92%) patients with a family history of CAD. On the other hand, past history of smoking status was measured very low in sample size with the value of 32n (33%) while a high value of current smokers was observed i.e., 65n (67%) smokers. 58n out of 97 (59.8%) patients reported as obese.

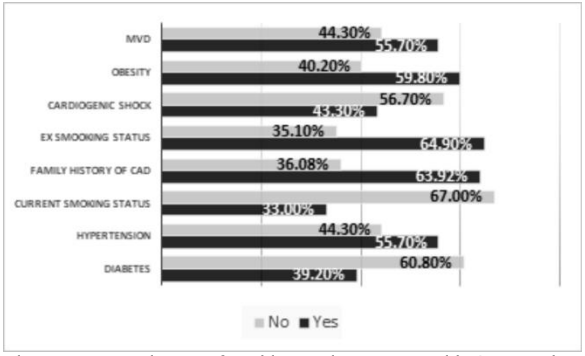


Figure 1: Prevalence of Multivessel anatomy with SMuRF in Acute STEMI Patients after PCI Procedure

Table 1: Stratification of Multivessel Disease Anatomy data in respect of dependent variables on 95% confidence interval chi-square applied.

| | Multivessel Disease Anatomy | | P-Value |
|---|---|---|---|
| | YES | No | |
| Age Group | | | |
| <50 years | 15 (31.9%) | 32 (68.1%) | 0.001 |
| > 50 years | 39 (78%) | 11 (22%) | |
| Gender | | | |
| Female | 20 (50%) | 20 (50%) | 0.23 |
| Male | 34 (59.6%) | 23 (40.35%) | |
| Hypertension | | | |
| HTN | 25 (46.3%) | 29 (53.7%) | 0.03 |
| Non-HTN | 29 (67.4%) | 14 (32.56%) | |
| Diabetes Mellitus | | | |
| DM | 32 (84.2%) | 6 (15.8%) | 0.001 |
| Non-DM | 22 (37.2%) | 37 (62.8%) | |
| Current Smoking Status | | | |
| Smoker | 22 (68.8%) | 10 (31.25%) | 0.05 |
| Non-Smoker | 32 (49.2%) | 33 (50.8%) | |
| Ex-Smoking Status | | | |
| Smoker | 34 (53.9%) | 29 (46.1%) | 0.41 |
| Non-Smoker | 20 (58.8%) | 14 (41.2%) | |
| Cardiogenic Shock | | | |
| Present | 30 (71.4%) | 12 (28.6%) | 0.007 |
| Absent | 24 (43.6%) | 31 (56.4%) | |
| Obesity | | | |
| Obese | 42 (72.4%) | 16 (27.6%) | 0.01 |
| Non-Obese | 12 (30.8%) | 27 (69.2%) | |

A significant result was observed with the help of chi-square t-test analysis in the stratification for MVDA. Age was proportionally related to MVDA with a p-value of 0.001 i.e., patients who were less than 50 years were 31.9% while 78% of patients who were more than 50 years indicated a more significant association with MVDA, as the age increases the risk for MVDA increases. Diabetes Mellitus is another significant factor in association with MVDA with a p-value of 0.001. However, the frequency and percentage of the sample size population had not fallen in an alarming state. Cardiogenic Shock which was targeted as the important variable to be observed resulted from weak significance with MVDA with a p-value of 0.007. Hypertension and current smoking status in association with multivessel disease reflect moderate evident significance while gender and ex smoking status have no association with MVDA. [Table 01]

## DISCUSSION

55.7% of patients of multivessel disease were presented in this study with acute STEMI treated with PPCI. This result is similar to previous research studies. Patients showed the same pattern of co-morbidities as well. Varunsiri A, et al, have done ten randomized controlled trials of patients having STEMI and MVDA and multivessel PCI and it showed low chances of reinfarction [17]. Consequently, the conventional approach for decades has been based on the principle that “less is more” when it comes to non-culprit vessel PCI. The understanding that increased circulating catecholamines in the setting of STEMI leads to vasoconstriction, thereby exaggerating the severity of non-culprit lesions, has primarily driven this “do less” approach. Our data shows that there was a weak association between hypertension and MVDA in patients. 67.4% of patients had no history of hypertension but they had multivessel disease. . These findings may be explained by the fact that patients with STEMI can have several unstable plaques involving non-culprit vessels. The lack of revascularization of these unstable plaques may lead to increased adverse events. In addition, severe disease in non-culprit vessels may hamper myocardial contractility and may impair collateral development, leading to increased incidence of revascularization (repeat PCI) in patients. Besides various studies emphasized that hypertension plays important role in the development of MVDA in young acute coronary syndrome patients [18].

According to our results, 84.2% of patients have diabetes mellitus (DM) and reflected strong relation between DM and MVDA in patients undergoing PCI. The recent study also suggested that those diabetic patients who were undergoing PCI procedures with MVDA showed worse long-term mortality as compared to those, who go for coronary artery bypass grafting (CABG) [19-20]. Moreover, obesity has also a positive association with MVDA. Another study showed that except for smoking, other conventional cardiovascular risk factors such as diabetes mellitus, hypertension, and dyslipidemia were more pervasive in overweight patients going through PCI [21]. Cardiogenic shock was less significant factor related to MVDA 42(43.3%), out of absolute 58n (59.8%) patients was observed in our study. Up to 80% of patients with cardiogenic shock have multivessel coronary artery

disease. It has also been observed that around 5 to 10% of patients with AMI are confounded via cardiogenic shock (CS). CS in the setting of STEMI has related with high mortality (40–50 scoring) with more terrible results [22]. Some studies presume that in patients with STEMI and multivessel disease, culprit lesion and staged evaluation of remaining areas of myocardial ischemia during PCI are still best. According to our data, there was a critical outcome after the separation for MVDA concerning age, 31.9% of patients were under 50 years and 78% of patients were over 50 years demonstrated a more huge relationship with MVDA. Irfan et al recommended that the frequency of STEMI has a downfall graph among youngsters rather than in elder/older patients. Acute coronary syndrome (ACS) in youngsters has characterized by single vessel contribution where thrombosis would be the dominating pathophysiology besides 33% of patients have the multivessel disease [23].

Multivessel coronary artery disease in 46.3% (n=342) patients were more established diabetic patients in contrast with those with single-vessel disease [24]. Our results show males were the dominant variable for MVDA as compared to females in a coordinated investigation pooling percutaneous and surgical revascularization, female sex was related with more regrettable results at 1 year in literature in spite of the fact that there were no sex contrasts at 5 years follow-up [25]. MVDA in our study was observed in a 55.7% sample size with the highest association significance with age and diabetes mellitus. Batra MK et al concluded the same result in their study that worsening of the study variables increases in multivessel disease patients as compared to single-vessel disease [16]

## CONCLUSION

Patients with multi-vessel disease comprise the majority of patients undergoing PCI today and will likely remain so. With improved techniques, stents, and adjunctive drugs, outcomes have improved significantly. PCI would become a preferred strategy for the majority of patients needing revascularisation. We may state from this limited experience that a multi-vessel stenting approach for patients with acute STEMI and multi-vessel disease is feasible and probably safe during routine clinical practice. Our data suggest that this approach may help to limit the infarct size. However, larger studies, perhaps using drug-eluting stents, are still needed to further evaluate the safety and efficiency of this procedure, and whether it is associated with a lower need for subsequent revascularization and lower costs.

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