ORIGINAL ARTICLE

IN-HOSPITAL MORTALITY AFTER INCOMPLETE PERCUTANEOUS REVASCULARIZATION IN PATIENTS WITH MULTIVESSEL CORONARY ARTERY DISEASE PRESENTING WITH ACUTE CORONARY SYNDROME

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Objectives: Patients with significant multi-vessel coronary artery disease (CAD) are approximately one-half to two-thirds of patients presenting with acute coronary syndrome (ACS). Therefore, this study aimed to evaluate the in-hospital mortality of incomplete percutaneous revascularization in a patient with multi-vessel CAD presenting with ACS at a single tertiary care hospital in Karachi, Pakistan.

Methodology: This descriptive study with 282 included consecutive patients from March 22, 2021, to September 21, 2021, fulfilling the inclusion criteria of aged between 18 and 75 years and of any gender, diagnosed with ACS, multi-vessel diseases, and undergone percutaneous revascularization of culprit artery only. Patients with pre-existing chronic kidney disease or cardiogenic shock at presentation were excluded. All patients were kept under observation during the hospital stay for up to one week, and in-hospital mortality was recorded.

Results: Mean age was 55.7±10.8 years with 185 (65.6%) male patients. Types of ACS were noted as ST-elevation myocardial infarction (STEMI) in 109 (38.7%), 117 (41.5%) non-STEMI, while unstable angina was noted in 56 (19.9%) patients. Three-vessel disease was noted in 126 (44.7%), 108 (38.3%) were diabetics, 164 (58.2%) were hypertensive, and 128 (45.4%) were smokers. In-hospital mortality was documented in 22 (7.8%) patients.

Conclusion: A significant proportion of in-hospital mortality was observed after incomplete percutaneous revascularization in ACS patients with multi-vessel CAD.

Keywords: acute coronary syndrome, in-hospital mortality, multi-vessel coronary artery disease, percutaneous coronary revascularization

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INTRODUCTION

Percutaneous coronary intervention (PCI) is the most common form of coronary revascularization for patients with acute coronary syndrome (ACS) and stable coronary artery disease (CAD).[1] Multi-vessel (MVD) CAD affects more than half of patients who suffer from ACS.[2] Half of the patients undergoing coronary angiography for non-ST segment elevation myocardial infarction (NSTEMI) suffer from MVD.[3] Recently published studies suggest and propose that the frequency or incidence of the ACS is declining sequentially in high- and middle-income countries.[1] Despite this, NSTEMI has been rising. Moreover, it has been observed that NSTEMI is associated with higher mortality than ST-elevation myocardial infarction (STEMI).[4, 5] NSTEMI patients with MVD are often older, suffering from multiple comorbidities such as diabetes, hypertension, smoking, and worse clinical outcomes.[6, 7]

Therefore, the interventional treatment of these patients is often a challenge in everyday clinical practice. Some randomized control trials and meta-analyses reported that complete coronary revascularization (CR) of MVD is superior to culprit-only revascularization in patients with STEMI.[1, 8, 9] However, this is unclear in the case of patients with NSTEMI.[10] In standings of long-term mortality rates, CR appears superior to culprit-only vessel, incomplete revascularization (IR), PCI in NSTEMI patients with MVD by reducing unplanned repeat revascularization for all- cause mortality, cardiac mortality, and repeat infarction.[11]

Chest pain is the most common clinical symptom among patients undergoing incomplete revascularization (IR), with the incidence rate ranging from 30% to 60%. This consideration may be more in men with two or more significant coronary risk factors (10%), particularly in patients with known CHD.[12] Regardless of the type of revascularization, IR has significant prognostic weight on survival and major cardiovascular events, which appears to be linked to left behind ischemia, increasingly elderly, with multiple comorbidities and complex coronary lesions.[13, 14] A study conducted on 15,165 patients with incomplete revascularization; reported, re-intervention as the most common event which accounted for 3,580 (23.6%), while 1080 (7.1%) deaths were reported in this study.[15]

Some studies have suggested prognostic benefits of CR for ACS patients. However, the timing of revascularization and superior to complete revascularization remind a debatable topic. Therefore, this study was conducted to determine the mortality of incomplete percutaneous revascularization in ACS patients with MVD in our population.

METHODOLOGY

This cross-sectional study examined 282 consecutive ACS patients with MVD treated with PCI during March 22, 2021 to December 28, 2021, at tertiary cardiac single centers in Karachi, Sindh. This study was conducted for the dissertation and thesis research work for FCPS (cardiology) from the College of Physicians and Surgeons Pakistan (CPSP). Study was approved by the CPSP and it was conducted at the National Institute of Cardiovascular Diseases (NICVD), Karachi, Pakistan. All the included patients were diagnosed with ACS and fulfilled the criteria for primary PCI or early invasive PCI as per the institutional protocols. Using the expected mortality rate of 7.1% after IR at 95% confidence level and the desired precision of 3%, sample size of 282 ACS patients was calculated. The inclusion criteria were patients aged 18-75 years and of any gender within 24 hours of ACS (unstable angina, NSTEMI, STEMI) diagnosed with multi-vessel diseases. All the participants were informed about the research before the start of the study and verbal inform consent was taken. Those patients who had pre-existing chronic kidney disease or with cardiogenic shock were excluded. Demographic characteristics (age (years) and gender) and comorbidities (hypertension (HTN), diabetes (DM), family history, and smoking) were recorded.

All patients were pretreated with ACS protocol as per the current recommendations. All the procedures were performed by a consultant cardiologist with five years of working experience. A standard definition according to the guidelines of MVD was used, and multi-vessels involved (2VD or 3VD) were recorded. Multi-vessel diseases (MVD) were defined as angiography evidence of >70% stenosis in more than one major coronary artery, such as left anterior descending artery (LAD), left circumflex (LCX), and right coronary artery (RCA). In patients with STEMI, only culprit artery was revascularized, while, in cases of unstable angina and NSTEMI, the culprit artery was identified as the artery with most severe diseases based on multiple angiographic characteristics such as thrombus burden, length of lesion, initial TIMI flow, presence of collaterals, and calcification etc. All the patients were kept under close observation during their hospital stay and outcome (in-hospital mortality) was recorded.

Data was entered and analyzed using SPSS version 21.0. Quantitative variables were described as mean ± standard deviation (SD). Categorical variables were expressed as relative frequency, like gender, age groups, type of ACS, number of vessels involved, HTN, DM., family history, smoking, and in-hospital mortality. Effect modifiers like age, gender, types of ACS, diabetes mellitus, family history, smoking, hypertension, and the number of vessels involved were compared post-stratification using the Chi-square/Fisher exact test. P-value <0.05 was taken as significant at a confidence interval of 95%.

RESULTS

A total of n=282 consecutive patients with ACS who presented within 24 hours of symptoms were recruited having ages between 18-75 years of both genders to determine the frequency of in-hospital Mortality. Table 1 demonstrates the demographics and baseline characteristics of the study. Mean ± SD of age was 55.7±10.8 with a confidence interval (CI) of 54.4 to 56.96 years. In the distribution of gender, 185 (65.6%) were male, while 97 (34.4%) were female. Types of the acute coronary syndrome were noted as STEMI in 109 (38.7%) patients, 117 (41.5%) NSTEM, while unstable angina was noted in 56 (19.9%) patients. Two vessel disease (2VD) was found in 156 (55.3%) patients, while three-vessel disease (3VD) was noted in 126 (44.7%). Diabetes mellitus was documented in 108 (38.3%), 164 (58.2%) were hypertension, and 128 (45.4%) were smokers. Furthermore, 36 (12.8%) had a positive family history. In-hospital mortality was documented in 22 (7.8%).

Table 2 demonstrates the comparison of in-hospital Mortality with the demographics and clinical characteristics of the study sample. For hospital

mortality, stratification of age group, gender, type of ACS, number of vessels involved, hypertension, diabetic Mellitus, smoking status, and family history was done to assess the statistical difference.

Table 1: The Descriptive and demographics of baseline characteristics of the study sample

	Frequency	Parentage (%)
Age group		
18 – 50 years	78	27.7%
>50 years	204	72.3%
Gender		
Male	185	65.6%
Female	97	34.4%
Types of acute coronary syndrome		
ST-segment elevation myocardial infarction	109	38.7%
Non-ST-elevation myocardial infarction	117	41.5%
Unstable Angina	56	19.9%
Number of vessels involved		
Two (2VD)	156	55.3%
Three (3VD)	126	44.7%
Hypertension		
Hypertensive	164	58.2%
Non-hypertensive	118	41.8%
Diabetes mellitus		
Diabetic	108	38.3%
Non-diabetic	174	61.7%
Smoking status		
Yes	128	45.4%
No	154	54.6%
Family history of IHD		
Positive	36	12.8%
Negative	246	83.7%

IHD=ischemic heart disease

Table 2: Comparison of in-hospital Mortality with demographics and clinical characteristics of the study sample

	In-hospital Mortality			P-value
	Yes	No	Total	
Age group				
18 - 50	3 (3.8%)	75 (96.2%)	78	0.095
>50	19 (9.3%)	185 (90.7%)	204	
Gender				
Male	15 (8.1%)	170 (91.9%)	185	0.791
Female	7 (7.2%)	90 (92.8%)	97	
Types of acute coronary syndrome				
STEMI	13 (11.9%)	96 (88.1%)	109	0.098
NSTEMI	5 (4.3%)	112 (95.7%)	117	
USA	4 (7.1%)	52 (92.9%)	56	
Number of vessels involved				
Two (2VD)	15 (8.1%)	170 (91.9%)	185	0.795
Three (3VD)	7 (7.2%)	90 (92.8%)	97	
Hypertension				
Hypertensive	14 (8.5%)	150 (91.5%)	164	0.587
Non-hypertensive	8 (6.8%)	110 (93.2%)	118	
Diabetes mellitus				
Diabetic	5 (4.6%)	103 (95.4%)	108	0.058
Non-diabetic	17 (9.8%)	157 (90.2%)	174	
Smoking status				
Yes	3 (2.3%)	125 (97.7%)	128	0.002*
No	19 (12.3%)	135 (87.7%)	154	
Family history of IHD				
Positive	2 5.6%)	34 (94.4%)	36	0.421
Negative	20 (8.5%)	216 (91.5%)	236	

IHD=ischemic heart disease, USA=unstable angina, NSTEMI=non-ST-elevation myocardial infarction, STEMI=ST-segment elevation myocardial infarction
** Significance at 5*

DISCUSSION

PCI procedures with multi-vessel have a significantly higher mortality rate than PCI of patients with single vessel disease. Incomplete revascularization (IR) remained a common practice for patients with MVD. Several factors that influence IR include advanced age, race, failed PCI, lesion characteristics and operator choice and many more comorbidities such as heart failure (HF), peripheral arterial disease (PAD), diabetic mellitus (DM) and renal failure as reported in several studies.[3, 5, 8] In this study we evaluated in-hospital mortality after IR of ACS patients with multi-vessel, we observed a significant in-hospital mortality rate.

Some early non-randomized, retrospective studies evaluated the relative merits of complete and incomplete primary PCI with the multi-vessel coronary disease without a decisive conclusions about the role of initial incomplete revascularization on the clinical outcome.[8, 9] The choice of the treatment plan for patients with MVD is not very clear. Although, studies have shown that patients risk of mortality or a chances risk of MI are significantly reduced with CR compared to stenting of the symptomatic artery alone PCI.[16, 17] In contrast,

some other studies reported that patients who undergone complete or IR for either STEMI or NST-ACS did not report any clinically significant difference.[18, 19] Additionally, the staged revascularization also did not improve these outcomes.

In a comparative study by Sustersic M et al.[20] reported a significantly lower cardiovascular death and all-cause mortality after median follow-up of seven years among patients who undergone complete revascularization as compared to those who undergone IR. However, when adjusted for the confounders, the differences in the survival was driven by the factors independent of type of revascularization. The main determinants of adverse outcomes were found to be cardiogenic shock, impaired kidney function (serum creatinine), diabetes, and age. Similarly, another study by Hambraeus K et al.[21] reported higher rates of all-cause mortality, re-infarction, and repeat revascularization among IR than CR groups after one year of revascularization with a composite adjusted hazard ratios of 2.12 [1.98 - 2.28].

In another observational study of 37,491 patients by Rathod KS et al.,[22] reported that despite higher in-hospital mortality rates, CR in NSTEMI patients with MVD had lower long-term mortality rate as compared to IR with a hazard ratio of 0.90 [0.85 - 0.97]. According to a study by Rumiz et al.[23] CR is comparatively a better therapeutic option in young STEMI patients, while, its benefits are not confirmed for elderly patients (over 75 years old) during long term follow-up.

Even though, this is first data reported from over regions regarding outcomes of IR in ACS patients with MVD, however, this was a single center study with relatively small sample size. Secondly, type of artery treated or left untreated can have possible confounding effects on outcome which was not studied in current study due to insuficiancy of data and sample size. Additionally, the comparator group (CR) was also not available for comparison, therefore, generalizability of study findings are limited. Futher studies are warranted to address these limitations.

CONCLUSION

A significant proportion of in-hospital Mortality was observed in ACS patients with multi-vessel CAD after incomplete percutaneous revascularization. With the favorable results of multiple studies, complete revascularization should be preferred in these patients. However, the timing of complete revascularization remained a topic of discussion. Patient-related factors other than ischemia, such as increased age with multiple comorbidities, should also be considered possible predictors of adverse events. Further, large-scale randomized studies are needed for conclusive recommendations regarding incomplete versus complete revascularization of ACS patients with MVD.

AUTHORS' CONTRIBUTION

MNI, SR, MNK, NAS, SZ and SA: Concept and design, data acquisition, interpretation, drafting, final approval, and agree to be accountable for all aspects of the work. MNI, and SR: Data acquisition, interpretation, drafting, final approval and agree to be accountable for all aspects of the work.

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