

CARDIOGENIC SHOCK IN PATIENTS WITH ACUTE NON ST-ELEVATION MYOCARDIAL INFARCTION (NSTEMI)

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ABSTRACT

Objective: To determine the frequency of cardiogenic shock in patients with acute non-ST-elevation myocardial infarction (NSTEMI).

Study Design: Cross sectional study.

Place and Duration of Study: Department of Cardiology, National Institute of Cardiovascular Diseases (NICVD), Karachi Pakistan, from Apr 2018 to Oct 2019.

Methodology: All patients with NSTEMI were included in the study after taking informed consent. Patients with recurrent NSTEMI or previous NSTEMI, patients with valvular heart disease or neurological problems, and those with comorbid conditions such as renal failure were excluded. All patients underwent ECG in order to assess the cardiogenic shock. Data was collected on a semi-structured questionnaire. The first part of the questionnaire consisted of demographic information such as gender, age, body weight and height, and their comorbidity status. Second part of the questionnaire assessed cardiogenic shock.

Results: Mean \pm SD of age was 56.9 ± 9.2 years. Out of 203 patients, 131 (64.5%) were male while 72 (35.5%) were female. Hypertension was noted in 111 (54.7%) patients. Cardiogenic shock was found to be positive in 17 (8.4%) patients while negative in 186 (91.6%). Duration of symptoms was significantly associated with the occurrence of cardiogenic shock ($p=0.05$).

Conclusion: It is concluded that cardiogenic shock is somewhat common in NSTEMI patients. The necessity of a stroke unit is highly appreciated to increase the care and decrease morbidities and mortalities.

Keywords: Cardiogenic Shock, NSTEMI, Acute Coronary Syndrome, Myocardial Infarction, Percutaneous Coronary Intervention.

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INTRODUCTION

Non-ST elevation myocardial infarction (NSTEMI) is the partial to near complete occlusion of a coronary artery due to which blood flow to the myocardium is compromised resulting in myocardial tissue injury.¹ NSTEMI is usually preceded by narrowing of coronary arteries, transient and partial occlusion, or micro-embolization of atheromatous material. In NSTEMI-even without ST elevation - the circulating levels of cardiac enzymes are increased; which is not a case in unstable angina.²

Cardiogenic shock is seen in patients with severe myocardial dysfunction as a result of impaired tissue perfusion. It is a major complication of anterior wall MI accounts for up to 10% cases, and the severity of dysfunction correlates with the extent of myocardial injury.³ It is characterized by decreased cardiac output, end-organ hypoperfusion, and hypoxia. Clinical presentation of cardiogenic shock in patients with AMI

includes hypotension refractory to volume resuscitation with features of end-organ hypoperfusion requiring pharmacological or mechanical intervention. Eighty-one percent of patients with cardiogenic shock have underlying AMI.⁴ In the SHOCK registry, 64% of patients presented symptoms typical of cardiogenic shock-hypotension, low cardiac output, and tachycardia, altered level of consciousness, oliguria, peripheral coldness, and pulmonary congestion.⁵

Cardiogenic shock has been reported to occur in 5-8% of patients hospitalized with ST-elevation myocardial infarction (STEMI).⁶ It may occur in 2.5-5% high risk patients of NSTEMI as reported in the literature.⁷⁻⁹ Being a life-threatening complication, its early identification and timely invasive management are critical to determine patient prognosis. Cardiogenic shock is widely recognized in STEMI patients. However, it is still under-recognized in NSTEMI which has less-aggressive management and consequently a higher risk of mortality in these patients.⁸ In view of the scarcity of relevant data from this particular region of the world, this study aimed to identify the frequency of cardiogenic shock in patients with NSTEMI.

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METHODOLOGY

A cross-sectional study was conducted at the Department of Cardiology, National Institute of Cardiovascular Diseases, Karachi, from April 2018 to October 2019. The study was conducted after approval from the Institutional Review Board (Ref # 38510).

Non-probability consecutive sampling techniques were adapted. Sample size was calculated using WHO Sample Size Calculator. With an estimated frequency of cardiogenic shock as 5% in non-ST elevation myocardial infarction (NSTEMI) patients, margin of error 3% and confidence level 95%, the sample size calculated was 203.8

Inclusion Criteria: The inclusion criteria consisted of patients of both genders, of age 30-70 years, admitted in the hospital with NSTEMI. NSTEMI was defined as chest pain >30 minutes, transient ST segment elevation ≥ 0.5 mm or ST segment depression of >0.5 mm or symmetrical T-wave inversion >2 mm on ECG with troponin >99 th percentile of upper reference limit.

Exclusion Criteria: Patients with recurrent NSTEMI or previous NSTEMI, patients with valvular heart disease or neurological problems, and those with comorbid conditions such as renal failure were excluded. All participants were included after obtaining informed consent from the patients themselves/their next of kin.

Data was collected on a semi-structured questionnaire. The first part of the questionnaire consisted of demographic information such as gender, age, body weight and height, and their comorbidity status. Second part of the questionnaire assessed cardiogenic shock. Patients with any two of the following three criteria were taken as positive cases of cardiogenic shock (i) Systolic blood pressure <90 mmHg for at least 30 min without hypovolemia (ii) Cardiac Index <1.8 /min/m² without support or 2-2.2 l/min/m² with support and (iii) Raised pulmonary capillary wedge pressure (>18 mmHg).

Data was analyzed through Statistical Package for Social Sciences version 23. Mean and standard deviation (SD) were calculated for continuous variables age and duration of NSTEMI. Frequency and percentage were calculated for categorical variables gender, smoking status, diabetes mellitus, hypertension, and cardiogenic shock. Data was stratified for age, gender, duration of NSTEMI, smoking status, diabetes mellitus and hypertension. Post-stratification, chi square was applied. A $p \leq 0.05$ was taken as criteria of statistical significance.

RESULTS

A mean age of 56.9 ± 9.2 years was observed with a mean duration of symptoms of 7.6 ± 4.1 days. Male dominance was noted with a frequency of 131 (64.5%). More than half of the patients had hypertension. The incidence of cardiogenic shock in our study was 17 (8.4%) (Table-I).

Table-I: Sociodemographic characteristics of study participants.

Characteristics	Mean \pm SD
Mean Age	56.9 \pm 9.2
Mean Duration of Symptoms	7.6 \pm 4.1
Gender	n (%)
Male	131 (64.5)
Female	72 (35.5)
Comorbidities	
Hypertension	111 (54.7)
Smoking	
Yes	78 (38.4)
No	125 (61.6)
Cardiogenic Shock	
Positive	17 (8.4)
Negative	186 (91.6)

Stratification of age group, gender, duration of symptoms, smoking status, diabetes mellitus and hypertension were done with respect to cardiogenic shock in order to assess significant difference (Table-II). Duration of symptoms was significantly associated with the occurrence of cardiogenic shock ($p=0.05$).

Table-II: Association of demographic and clinical variables with risk of cardiogenic shock among patients.

Characteristics	Cardiogenic Shock		p-value
	Yes (%)	No (%)	
Age Group (Years)			
30-50	2 (1)	36 (17.7)	0.443
>50	15 (7.4)	150 (73.9)	
Gender			
Male	12 (5.9)	119 (58.6)	0.553
Female	5 (2.5)	67(33)	
Duration of Symptoms			
1-5	9 (4.4)	56 (27.6)	0.053
>5	8 (3.9)	130 (64)	
Smoking Status			
Smoker	7 (3.4)	71 (35.0)	0.807
Non-smoker	10 (4.9)	115 (56.7)	
Diabetes Mellitus			
Yes	8 (3.9)	82 (40.4)	0.831
No	9 (4.4)	104 (51.2)	
Hypertension			
Yes	11 (5.4)	100 (49.3)	0.386
No	6 (3.0)	86 (42.4)	

DISCUSSION

Cardiogenic shock is a common complication of non-ST elevation myocardial infarction (NSTEMI). It is known to complicate 5-10% of acute MI cases and is

the leading cause of death after MI.^{10,11} Cardiogenic shock is known to adversely influence the short- and long-term prognosis of MI patients. Literature reports that 6-12-month mortality associated with cardiogenic shock is almost 50%.¹²⁻¹⁴ In Pakistan, in-hospital mortality rate of 55% has been reported for cardiogenic shock in myocardial infarction.¹⁵ Higher incidences of cardiogenic shock are observed in female patients, Asian/Pacific Islanders, and old patients of age 75 years and above.^{11,13}

In this study, the mean age of NSTEMI patients was 56.9 ± 9.2 years as compared to 52 ± 5.8 years in a study reported by Jafary *et al*¹⁶ and 62 ± 5 years in a COURAGE trial conducted in the United States.¹⁷ Another study of Gouda *et al* noted the mean age as 55.46 ± 10.95 years.¹⁸ This signifies that Pakistani patients are relatively younger as compared to the Western countries. In this study, 131 (64.5%) patients were male while 72 (35.5%) patients were female. Similar results were given in a study conducted by Saleheen *et al* in which 65% patients were male and 35% patients were female.¹⁹ In the study of Ilyas *et al* there were 55 (55%) males and 45 (45%) females.²⁰ Gender differences in coronary heart disease risk are also important. Middle-aged men have a 2-5 times higher risk than women, but this risk ratio differs between populations.

This study shows that the incidence of cardiogenic shock in adult patients with non-STEMI was 17 (8.4%). The incidence was higher in older patients-15/17 patients were of age >50 years. Comparable results were seen in Jafary *et al*.¹⁶ Their reported incidence of cardiogenic shock in NSTEMI patients was 5% in which most of the patients were above 50 years of age. However, Jacobs *et al*, reported cardiogenic shock in 2.5% of patients with non-STEMI.²¹ According to Jacobs *et al*, patients of NSTEMI with cardiogenic shock have a greater risk profile than similar patients with STEMI.²¹

Our results show that the incidence of cardiogenic shock in patients with NSTEMI was more in males (63.3%) as compared to females (36.7%). Moreover, most of the cases were recorded at 9-16 hours of onset time. Similar results were reported by Jafary *et al* in which incidence of cardiogenic shock in NSTEMI was more in male as compared to female patients.¹⁶

Most of the reported data show that smoking is the commonest risk factor encountered in patients with acute myocardial infarction. This study is not an exception, as smoking was indeed the leading risk factor present in 78 (38.4%) of the patients. The male prepon-

derance and smoking being the major risk factors has been well documented in many local studies. All the patients were allocated to appropriate treatment strategies after being received in the referral center from peripheral hospitals and managed in accordance with guidelines for AHA, discussion of which is beyond scope of this study.

In our study, the mean duration of symptoms was 7.6 ± 4.1 hours, diabetes mellitus was documented in 90 (44.3%) patients, and hypertension in 111 (54.7%). Gouda *et al* reported that 72 (33.3%) were diabetic patients and 84 (38.9%) were hypertensive.¹⁸ Abreu *et al* reported hypertension in 56.6% patients.²² The role of hypertension in AMI patients developing cardiogenic shock remains controversial. In conclusion, the necessity of a stroke unit is highly appreciated to increase the care and decrease morbidities and mortalities. Further research is required to better understand the factors associated with cardiogenic shock.

LIMITATION OF STUDY

We faced certain limitations in our study. For instance, the study was only conducted in a single center institution which caters to the majority of the Karachi Urban population; however, the rural population was only in the minority. Furthermore, due to a small and undiversified sample population, the findings of the study cannot be generalized to a larger population. We recommend that further large-scale studies with diversified sample size should be conducted to explore the risk factors and predictors associated with cardiogenic shock and mortality in MI patients.

CONCLUSION

The present study concludes that cardiogenic shock is not an uncommon entity in patients with non-ST elevation myocardial infarction (NSTEMI) patients in our setting. Elder patients with hypertension and male patients are more prone to develop cardiogenic shock. The high-risk patients should be closely monitored for development of cardiogenic shock early during their hospital stay to enhance their prognosis.

Conflict of Interest: None.

Author's Contribution

WH: Conceptualization & study design, AY: Literature review and study design (questionnaire), NAS: Critical review and editing, ZS & SS: Data acquisition and result interpretation, MH & MA: Draft writing and data analysis.

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