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MORTALITY DETERMINANTS IN CARDIOGENIC SHOCK FOLLOWING ACUTE MYOCARDIAL INFARCTION: A COMPREHENSIVE ANALYSIS

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Abstract

Background: Cardiogenic shock (CS) secondary to acute myocardial infarction (AMI) is a critical condition that significantly elevates mortality risk. Understanding the determinants of mortality in these patients is essential for improving outcomes.

Methods: This descriptive case series was conducted at the National Institute of Cardiovascular Diseases, Karachi, from December 2018 to June 2019. A total of 144 patients diagnosed with AMI-induced CS were included through non-probability consecutive sampling. Data on demographic profiles (age, gender) and clinical characteristics (presence of diabetes, hypertension) were collected. Mortality outcomes were analyzed using IBM SPSS Statistics version 21, with statistical significance set at $p \leq 0.05$.

Results: The study revealed an in-hospital mortality rate of 36.8%. Mortality was significantly associated with older age ($p < 0.05$), female gender ($p < 0.001$), diabetes ($p < 0.001$), and hypertension ($p < 0.001$). Notably, females and patients with comorbid diabetes or hypertension exhibited higher mortality rates. Age stratification further highlighted that patients over 60 years faced worse outcomes compared to younger cohorts.

Conclusion: The high mortality rate among AMI patients developing CS underscores the influence of age, gender, and comorbid conditions as key determinants. These findings suggest a critical need for tailored management strategies that address these risk factors more aggressively to enhance survival rates. Future research should explore intervention strategies that mitigate these risks and evaluate their effectiveness in multicenter trials to generalize findings.

Keywords: Acute Myocardial Infarction, Cardiogenic Shock, Mortality Determinants, Comorbidities, Clinical Outcomes

Introduction

Cardiogenic shock (CS) following acute myocardial infarction (AMI) represents one of the most severe complications associated with high mortality rates, particularly when immediate and effective interventions are not applied (1). Despite advancements in cardiovascular medicine, the survival rates for AMI patients who develop CS remain significantly lower compared to those who do not, with in-hospital mortality rates reportedly as high as 40% (2). This alarming statistic highlights the urgent need for comprehensive studies that can contribute to a deeper understanding and better management strategies for this high-risk patient group.

The existing literature underscores the complexity of CS as a consequence of AMI, attributing high mortality rates to factors such as delayed reperfusion, inadequate response to initial medical therapy, and the presence of comorbid conditions such as diabetes and hypertension (3). Current treatment guidelines emphasize rapid mechanical intervention and tailored pharmacological therapies; however, the mortality rate remains substantial, indicating possible gaps in the optimal management and understanding of risk factors that could influence treatment outcomes (4).

This study was conceived to address the critical knowledge gap regarding the specific demographic and clinical characteristics that correlate with higher mortality rates in AMI patients with CS. The rationale for this research stems from the observation that specific variables such as age, gender, and comorbidities like diabetes and hypertension may significantly influence survival outcomes, yet a detailed analysis of how these factors interact could provide new insights into tailored patient management.

The objective of this study was to determine the frequency of in-hospital mortality among AMI patients who develop CS and to analyze the association of various demographic and clinical characteristics with mortality outcomes. By identifying the most impactful factors, this research aims to contribute valuable data that could influence clinical practices and improve survival rates.

The significance of this study lies in its potential to enhance clinical decision-making and patient care in a setting fraught with high risk and uncertainty. By elucidating the factors that are most predictive of poor outcomes, healthcare providers can prioritize interventions more effectively and potentially improve the prognosis for patients suffering from this severe complication of AMI.

Materials and Methods

Study Setting and Duration: This descriptive case series study was conducted at the Department of Adult Cardiology, National Institute of Cardiovascular Diseases (NICVD), Karachi, over a six-month period from December 13, 2018, to June 12, 2019.

Sample Size and Sampling Technique: The sample size was determined based on the prevalence of in-hospital mortality in acute myocardial infarction (AMI) patients with cardiogenic shock (CS), which was 39.6% (5). Using a confidence level of 95% and a margin of error of 8%, the WHO sample size calculator version 2.0 calculated a required sample size of 144 patients. A non-probability consecutive sampling method was utilized for patient selection.

Study Design: The study was designed as a descriptive case series.

Sample Selection: Inclusion Criteria:

- Patients of either gender.
- Age between 18 to 70 years.
- Diagnosed with AMI as per operational definition.
- Diagnosed with cardiogenic shock (CS) as per operational definition.

Exclusion Criteria:

- Patients with a prior history of AMI.
- Patients with any previous cardiac-related surgery.
- Patients who refused to give consent.

Data Collection Procedure: After receiving approval from the Ethical Review Committee of NICVD and CPSP, patients presenting with AMI and CS who met the inclusion criteria were consecutively enrolled in the study. The purpose and benefits of the study were explained to all participants, and verbal informed consent was obtained by the principal investigator. The demographic profile (gender and age) and clinical history (hypertension, diabetes mellitus, smoking status, family history of IHD) were collected using a predesigned proforma. All patients were observed for 48 hours, and the outcome variable of all-cause in-hospital mortality was recorded according to the operational definition. Patient confidentiality was maintained, with data access restricted to authorized personnel only.

Data Analysis Procedure: Data were entered into and analyzed using IBM SPSS Statistics version 21. The Shapiro-Wilk test was applied to assess the normality of the age distribution. Descriptive statistics such as mean ± SD, median (IQR), and range were used to describe continuous variables, while frequencies and percentages were used for categorical variables. Stratification was employed to control for effect modifiers such as age, gender, hypertension, diabetes mellitus, smoking status, and family history of IHD. Post-stratification, the chi-square test or Fisher's exact test was applied as appropriate. A two-sided p-value of ≤0.05 was considered statistically significant. Graphical representations of data were made using bar graphs and pie charts.
This methodology ensures a comprehensive and systematic approach to examining the critical factors associated with mortality in AMI patients with cardiogenic shock, allowing for an in-depth understanding of demographic and clinical influences on patient outcomes.

Results

This retrospective cohort study examined 144 patients with acute myocardial infarction (AMI) complicated by cardiogenic shock, focusing on in-hospital mortality at a leading cardiovascular institution from December 2018 to June 2019.
The patient cohort predominantly consisted of males (81.9%), with a significant discrepancy in mortality based on gender; 69.2% of females versus 29.7% of males succumbed to their condition ($p < 0.001$). The overall mean age was 60.63 ± 7.92 years, and age significantly influenced survival outcomes, with non-survivors averaging 63.39 ± 5.26 years compared to 59.02 ± 8.75 years for survivors ($p < 0.05$).
Diabetes mellitus was present in 41% of the patients and was significantly more prevalent among non-survivors (76.3%) than survivors (23.7%), indicating a strong association with higher mortality ($p < 0.001$). Similarly, hypertension was noted in 36.8% of the cohort and was more common in non-survivors (75.5%) compared to survivors (24.5%), further corroborating its impact on mortality ($p < 0.001$).

Table 1: Patient Demographics and Clinical Characteristics

Characteristic	Total (n=144)	Survivors (n=91)	Non-survivors (n=53)	P-value
Gender				
Male	118 (81.9%)	83 (70.3%)	35 (29.7%)	<0.001*
Female	26 (18.1%)	8 (30.8%)	18 (69.2%)	
Age (years)				
Mean ± SD	60.63 ± 7.92	59.02 ± 8.75	63.39 ± 5.26	<0.05
Diabetes Mellitus				
Yes	59 (41%)	14 (23.7%)	45 (76.3%)	<0.001*
No	85 (59%)	77 (90.6%)	8 (9.4%)	
Hypertension				
Yes	53 (36.8%)	13 (24.5%)	40 (75.5%)	<0.001*
No	91 (63.2%)	78 (85.7%)	13 (14.3%)	

Smoking status significantly affected mortality; smokers constituted 26.6% of non-survivors compared to 73.4% of survivors (p = 0.023). However, a family history of ischemic heart disease (IHD) did not demonstrate a significant impact on mortality (p = 0.715).

Table 2: Impact of Smoking Status and Family History on Mortality

Factor	Total (n=144)	Survivors (n=91)	Non-survivors (n=53)	P-value
Smoking Status				
Smoker	64 (44.4%)	47 (73.4%)	17 (26.6%)	0.023*
Non-smoker	80 (55.6%)	44 (55.0%)	36 (45.0%)	
Family History of IHD				
Yes	12 (8.3%)	7 (58.3%)	5 (41.7%)	0.715
No	132 (91.7%)	84 (63.6%)	48 (36.4%)	

Age distribution revealed that patients over 60 years experienced a higher mortality rate of 45.3% compared to 27.5% for those 60 years or younger, which was statistically significant (p = 0.027).These are given in (Table 3).

Table 3: Age Distribution Analysis by Mortality Status

Age Group	Total (n=144)	Survivors (n=91)	Non-survivors (n=53)	P-value
≤60 years	69 (47.9%)	50 (72.5%)	19 (27.5%)	0.027*
>60 years	75 (52.1%)	41 (54.7%)	34 (45.3%)	

- A histogram in (figure 1) illustrates the age distribution, emphasizing the prevalence of higher age among non-survivors.

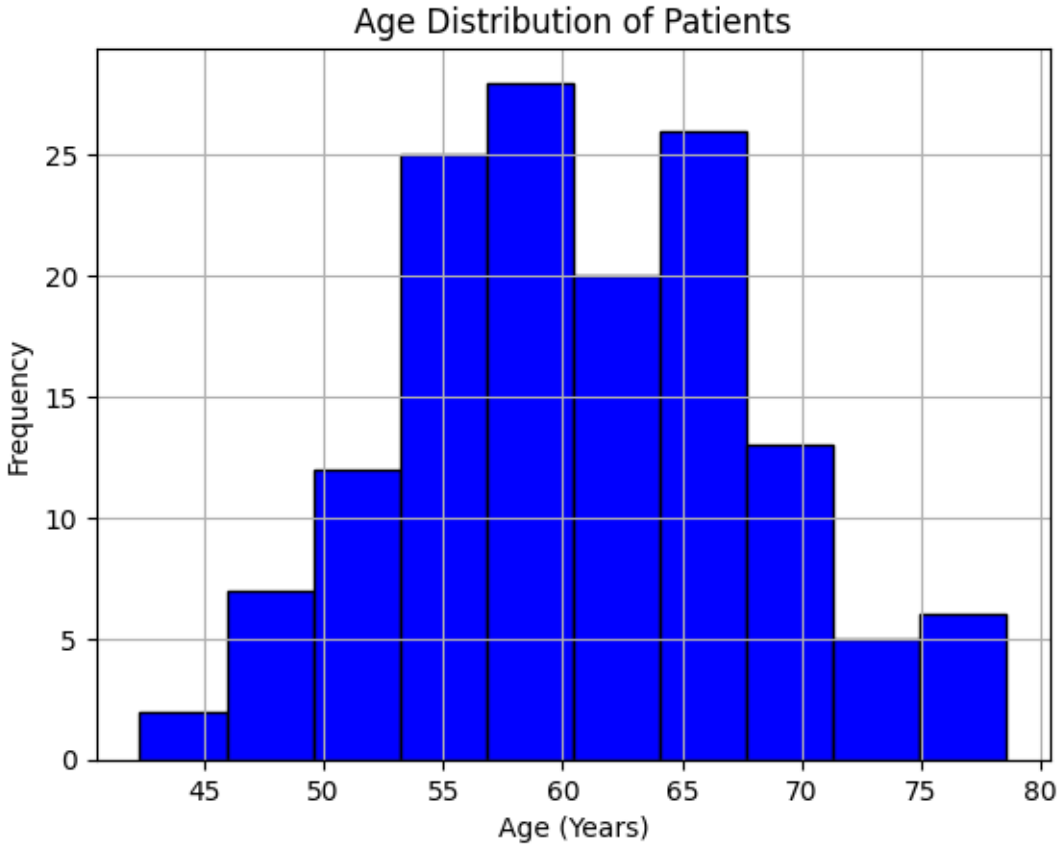
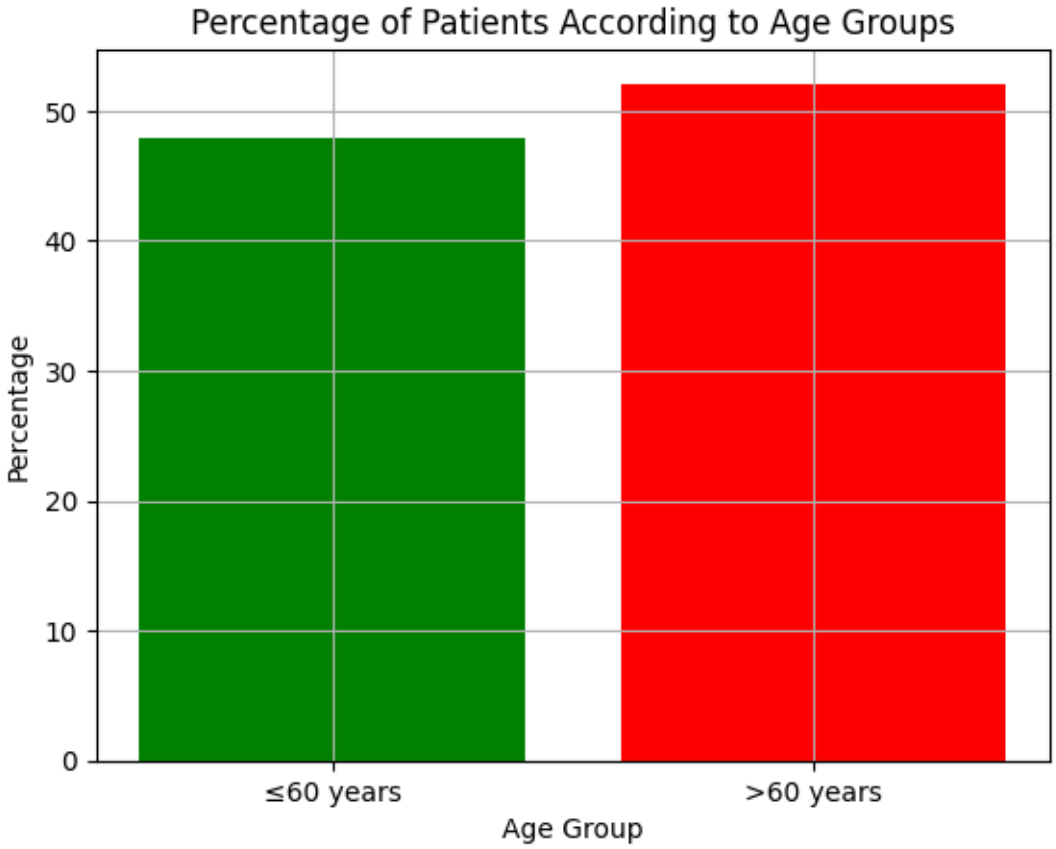


Figure 1: Age Distribution of Patients –

Similarly, a bar chart displays the percentage of patients within two age categories, highlighting the increased mortality risk associated with older age.



- **Figure 2: Percentage of Patients According to Age Groups** –

This comprehensive analysis underscores the profound impact of age, gender, diabetes mellitus, hypertension, and smoking status on mortality outcomes. It emphasizes the necessity for targeted interventions in these high-risk groups to enhance survival rates. The detailed data and visual representations provide a clear, scientific overview of the risk factors influencing mortality in AMI patients with cardiogenic shock.

Discussion

The current study highlights the substantial in-hospital mortality rate of 36.8% among patients with acute myocardial infarction (AMI) who developed cardiogenic shock (CS), underlining a significant health concern. This finding aligns with global mortality rates reported for this condition, albeit slightly lower than some of the higher estimates (6). Notably, the impact of demographic factors such as age and gender, as well as clinical characteristics like diabetes mellitus and hypertension, were profound, influencing the mortality outcomes significantly. Older age, female gender, presence of diabetes, and hypertension were associated with increased mortality risk, which is consistent with literature identifying these factors as crucial determinants of poor outcomes in CS (7).

Comparatively, this study's mortality rates are somewhat consistent with the findings from other regional studies, which report similar outcomes in demographic impacts but are slightly lower than those reported in some Western studies (8). This discrepancy may be attributed to variations in healthcare systems, accessibility to care, and intervention timings, which can vary significantly across different geographic and economic settings (9). The higher mortality rate observed among females and patients with comorbidities such as diabetes and hypertension underscores the need for targeted interventions and supports the findings from recent studies emphasizing the role of tailored management strategies for these patients (10).

The implications of these findings are critical for clinical practice. They advocate for heightened awareness and more aggressive management strategies tailored for older adults and females, who appear to be at a higher risk. Moreover, the management of AMI patients with CS should involve a

more integrated approach that addresses co-existing conditions such as diabetes and hypertension, potentially adjusting treatment protocols to mitigate the associated risks (11).

Limitations

This study, while robust in its demographic and clinical analyses, is not without limitations. The single-center design may limit the generalizability of the findings to other settings. Also, the non-probability sampling method could introduce selection bias, which might influence the mortality outcomes. Additionally, the study did not account for all possible confounders, such as the severity of myocardial infarction, which could affect mortality rates (12).

Conclusion

In conclusion this study confirms that older age, female gender, and comorbid conditions such as diabetes and hypertension significantly increase mortality risk in AMI patients with cardiogenic shock. These findings underscore the importance of tailored treatment strategies and enhanced monitoring for these high-risk groups to improve survival outcomes. Ultimately, adopting a more personalized approach to managing cardiogenic shock could lead to better clinical practices and patient care. Further research is recommended to explore targeted interventions that could mitigate these risks.

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