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MORTALITY OF PATIENTS WITH ST-ELEVATION MI AND ASSOCIATED RENAL IMPAIRMENT - ONE MONTH FOLLOW-UP STUDY

Original Research

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ABSTRACT

Background: ST-elevation myocardial infarction (STEMI) remains a leading cause of morbidity and mortality worldwide, and outcomes are further influenced by the coexistence of comorbidities such as renal impairment. Renal dysfunction is prevalent among cardiovascular patients and has been shown to worsen prognosis, yet limited local data exist on its short-term impact in STEMI. Evaluating this association is essential to guide risk stratification, improve clinical decision-making, and enhance patient care in populations at higher risk.

Objective: To determine the frequency of one-month follow-up mortality in patients presenting with STEMI, with a focus on the effect of renal impairment.

Methods: This descriptive study was conducted in the Department of Cardiology, Lady Reading Hospital (LRH), Peshawar, over the defined study period. A total of 111 patients, aged 30 to 75 years and diagnosed with STEMI, were enrolled through consecutive non-probability sampling. Diagnosis was based on clinical presentation of central chest pain with significant ST-segment elevation on electrocardiography. Patients were excluded if they had eGFR <15 mL/min/1.73m², were on renal replacement therapy, or had a prior history of coronary interventions or CABG. Baseline demographic and clinical characteristics were recorded, and patients were followed up for 30 days to assess mortality outcomes. Data were analyzed using SPSS version 26.

Results: The mean age of participants was 55.03 ± 11.22 years, with 62.2% older than 50 years and 60.4% being male. The mean pain duration before presentation was 12.72 ± 3.79 hours. Obesity (BMI >24.0 kg/m²) was present in 63.1%, while hypertension and diabetes were observed in 28.8% and 29.7% respectively. Renal impairment was identified in 26 patients (23.4%). Overall one-month follow-up mortality was 12.6% (14/111). Mortality was significantly higher among patients with renal impairment at 78.6% (11/14) compared to only 15.5% (3/14) in those without renal impairment (p = 0.000). Elderly males with raised BMI were particularly more vulnerable to adverse outcomes.

Conclusion: A statistically significant association was observed between renal impairment and increased short-term mortality in STEMI patients. These findings emphasize the prognostic importance of renal function and support the incorporation of strict renal monitoring into the routine management of STEMI to reduce early mortality.

Keywords: Aged, Body Mass Index, Myocardial Infarction, Prognosis, Renal Insufficiency, Risk Factors, ST Elevation Myocardial Infarction.

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INTRODUCTION

Acute myocardial infarction (MI) remains one of the leading causes of morbidity and mortality worldwide, with significant public health implications (1). It is broadly classified into two clinical types: ST-segment elevation myocardial infarction (STEMI) and non-ST-segment elevation myocardial infarction (NSTEMI) (2). Patients often present with characteristic symptoms such as chest pain, apprehension, profuse sweating, and electrocardiographic changes that assist in diagnosis (3). Among these subtypes, STEMI accounts for a greater proportion of cases, representing nearly two-thirds of myocardial infarction presentations, while NSTEMI constitutes approximately one-third (4). Despite advances in diagnosis and management, MI continues to be associated with high mortality, and outcomes are further complicated when additional comorbidities are present. Renal impairment has been increasingly recognized as a critical factor influencing both short- and long-term survival in patients with MI (5). Several studies have reported that the presence of renal dysfunction significantly elevates the risk of one-month mortality after MI, with estimates ranging from 13.7% to over 60% in affected patients, compared to much lower rates in those with preserved renal function (6-8). In STEMI patients specifically, one-month mortality has been reported at 7.8%, with renal impairment conferring an additional, markedly higher risk (24% vs. 3.9%) (9). However, the evidence is not entirely consistent, as some studies have failed to demonstrate a significant association between renal impairment and early mortality in MI patients ($p = 0.42$) (10). The coexistence of MI and other systemic comorbidities has been shown to increase mortality risk by nearly 26%, underscoring the importance of identifying high-risk subgroups for timely intervention (11). Similar associations between cardiovascular comorbidities and adverse outcomes have also been documented in regional populations, where atrial fibrillation was found to be a frequent contributor among ischemic stroke patients (12) Given these variations in reported outcomes and the recognized prognostic significance of renal function, it remains essential to further clarify the role of renal impairment in shaping one-month mortality among patients with acute MI, particularly those presenting with STEMI. The present study was therefore undertaken to determine the frequency of one-month follow-up mortality in STEMI patients and to compare outcomes between those with and without renal impairment, with the objective of providing evidence that could guide clinical decision-making and risk stratification in this vulnerable population.

METHODS

The present descriptive study was carried out in the Department of Cardiology, Lady Reading Hospital (LRH), Peshawar, over a defined study period. A total of 111 patients, both male and female, aged between 30 and 75 years and diagnosed with ST-segment elevation myocardial infarction (STEMI) were enrolled. The participants were followed for a period of one month to determine mortality among those with and without renal impairment. Patients with an estimated glomerular filtration rate (eGFR) less than 15 mL/min/1.73m², those already on renal replacement therapy, and individuals with a prior history of coronary interventions or coronary artery bypass grafting (CABG) were excluded from the study to minimize confounding factors. The diagnosis of STEMI was confirmed by the presence of significant ST-segment elevation on electrocardiography (ECG) in patients presenting with central chest pain, with a pain intensity score of ≥4 on the visual analogue scale (VAS). The territory of myocardial infarction was determined according to the ECG leads involved: V1–V2 for anteroseptal, V3–V4 for anteroapical, V5–V6 for anterolateral, leads I and aVL for lateral, and leads II, III, and aVF for inferior wall myocardial infarction. Mortality within 30 days following STEMI was considered one-month follow-up mortality. Renal impairment was defined either by a documented history of renal dysfunction persisting for more than six months in medical records, or by a new diagnosis established after STEMI, based on an increase in serum creatinine >0.3 mg/dl within 48 hours. The sample size of 111 was calculated using the World Health Organization (WHO) sample size calculator, taking into account an anticipated proportion of one-month mortality among STEMI patients of 7.8% (7), with a margin of error of 5% and a 95% confidence level. Participants were selected using a non-probability consecutive sampling technique to include all eligible patients presenting during the study period.

Prior to enrollment, the study protocol was reviewed and approved by the relevant ethical review committee and the College of Physicians and Surgeons Pakistan (CPSP). Informed consent was obtained from all patients or their attendants after explaining the purpose, procedures, and potential risks of the study. Baseline demographic data, clinical characteristics, and risk factors were documented in a predesigned proforma. All patients were managed according to standard treatment protocols, with medications administered as appropriate and percutaneous coronary intervention (PCI) performed in patients who presented within 12 hours of

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symptom onset, depending on their clinical condition and availability of resources Participants were followed for 30 days post-STEMI to assess survival status. Patients and their caregivers were provided with the researcher's contact number to report any mortality or concerns during the follow-up period. All outcomes were documented by the principal investigator. Data were entered and analyzed using SPSS version 26. Continuous variables such as age, body mass index (BMI), and duration from onset of chest pain to hospital arrival were expressed as mean ± standard deviation (SD). Categorical variables including gender, infarction territory, smoking status, diabetes, hypertension, socioeconomic status, educational status, area of residence, presence of renal impairment, PCI status, and one-month mortality were presented as frequencies and percentages. Mortality at one month was stratified by baseline demographic and clinical variables to control for effect modifiers. Post-stratification analysis was conducted using the Chi-square test, and a p-value ≤ 0.05 was considered statistically significant.

RESULTS

The mean age of the study participants was 55.03 ± 11.22 years, while the mean duration of pain prior to presentation was 12.72 ± 3.79 hours. The mean body mass index (BMI) was 24.47 ± 1.62 kg/m². A majority of the patients were aged more than 50 years (62.2%) and males constituted 60.4% of the cohort. Obesity, defined as BMI greater than 24.0 kg/m², was present in 63.1% of participants, and 31.5% had a history of smoking. Hypertension and diabetes were reported in 28.8% and 29.7% of patients respectively. Rural residents accounted for 59.5%, and 71.2% had education of matriculation level or below. Socioeconomic background was poor in 61.3% of the cases. Inferior wall myocardial infarction was the most frequently observed infarct territory, recorded in 49.5% of patients, followed by anterior wall involvement in 28.8% and lateral wall infarction in 21.6%. Renal impairment was identified in 23.4% of the patients. Overall, one-month follow-up mortality was observed in 12.6% of the study population. Mortality was strikingly higher among patients with renal impairment, recorded in 78.6% compared to only 15.5% in those without renal impairment, and this difference was statistically significant ($p = 0.000$). Age did not significantly influence one-month mortality, with a rate of 14.3% in patients aged 50 years or younger compared to 11.6% among those older than 50 years ($p = 0.679$). Similarly, gender differences were not statistically significant, though mortality appeared higher in males (16.4%) compared to females (6.8%) ($p = 0.136$). Obese patients had a higher mortality rate of 15.7% compared to 7.3% in those with BMI ≤24.0 kg/m² ($p = 0.198$). Smoking history also showed a non-significant trend, with mortality of 17.1% among smokers compared to 10.5% among non-smokers ($p = 0.329$). Patients with hypertension experienced a mortality of 18.8% versus 10.1% in non-hypertensives ($p = 0.215$). Mortality in diabetic patients was 9.1%, lower than the 14.1% recorded among non-diabetic participants ($p = 0.467$).

In terms of infarct location, mortality was 16.4% for inferior wall, 9.4% for anterior wall, and 8.3% for lateral wall myocardial infarction ($p = 0.495$). Pain duration also showed no significant impact on mortality; patients presenting within 10 hours had 15.6% mortality compared to 10.6% in those with longer pain duration ($p = 0.441$). When mortality was further stratified simultaneously by renal impairment and baseline clinical characteristics, it was observed that the presence of renal impairment consistently amplified mortality across nearly all subgroups. Among patients older than 50 years, mortality in those with renal impairment was 62.5% compared to only 4.9% in those without impairment. Similarly, in patients aged 50 years or younger, mortality was 100% in the renal impairment group versus 7.1% in those without. Male patients with renal impairment had a mortality rate of 81.8% compared to 7.1% in those without, while female patients with renal impairment demonstrated 66.7% mortality compared to 4.9% in those without. Obese participants (BMI >24 kg/m²) with renal impairment showed a markedly higher mortality of 81.8% compared to 6.8% in obese individuals without impairment. The same trend was evident in non-obese patients, where mortality with renal impairment was 66.7% compared to 7.9% without. In participants with hypertension, mortality rose to 83.3% with renal impairment versus 7.1% without, and in non-hypertensives, mortality was 75.0% versus 4.2%. Among diabetic patients, mortality with renal impairment was 66.7% compared to 6.7% without, while in non-diabetics, mortality with renal impairment was 81.8% compared to 6.0% without. These findings highlighted that renal impairment was an independent and consistent predictor of one-month mortality irrespective of age, gender, obesity, or comorbid conditions.

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Table 1: Descriptive statistics of study participants (n = 111)

Parameters	Mean	Std. Deviation
Age (years)	55.03	11.225
BMI (kg/m^2)	24.476	1.6228
Pain Duration (hours)	12.72	3.793

Table 2: Baseline characteristics and one month follow up mortality among study participants (n = 111)

Parameters	Subgroups	Frequency	Percent
Age (years)	50 or below	42	37.8
	More than 50	69	62.2
Gender	Male	67	60.4
	Female	44	39.6
BMI (kg/m^2)	24.0 or below	41	36.9
	More than 24.0	70	63.1
Smoking	Yes	35	31.5
	No	76	68.5
Hypertension	Yes	32	28.8
	No	79	71.2
Diabetes	Yes	33	29.7
	No	78	70.3
Residence	Rural	66	59.5
	Urban	45	40.5
Education	Matric or below	79	71.2
	Above matric	32	28.8
SES	Fair	43	38.7
	Poor	68	61.3
Pain duration (hours)	10 or below	45	40.5
	More than 10	66	59.5
Infarct area	Inferior	55	49.5
	Lateral	24	21.6
	anterior	32	28.8
Renal impairment	No	85	76.6
	Yes	26	23.4
One month follow mortality	No	97	87.4
	Yes	14	12.6

Table 3: Comparison of one month follow up mortality among patients with and without renal impairment (n = 111)

		Renal Impairment		Total	P value
		No	Yes		
One month follow up mortality	No	82	15	97	0.000
		84.5%	15.5%	100.0%	
	Yes	3	11	14	
		21.4%	78.6%	100.0%	
Total		85	26	111	
		76.6%	23.4%	100.0%	

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Table 4: Stratification of one month follow up mortality with various baseline characteristics (n = 111)

		One month follow up mortality		Total	P value
		No	Yes		
Age (years)	50 or below	36	6	97	0.679
		85.7%	14.3%	100.0%	
	More than 50	61	8	14	
		88.4%	11.6%	100.0%	
Gender	Male	56	11	67	0.136
		83.6%	16.4%	100.0%	
	Female	41	3	44	
		93.2%	6.8%	100.0%	
BMI (kg/m^2)	24.0 or below	38	3	41	0.198
		92.7%	7.3%	100.0%	
	More than 24.0	59	11	70	
		84.3%	15.7%	100.0%	
Smoking	Yes	29	6	35	0.329
		82.9%	17.1%	100.0%	
	No	68	8	76	
		89.5%	10.5%	100.0%	
HTN	Yes	26	6	32	0.215
		81.3%	18.8%	100.0%	
	No	71	8	79	
		89.9%	10.1%	100.0%	
Diabetes	Yes	30	3	33	0.467
		90.9%	9.1%	100.0%	
	No	67	11	78	
		85.9%	14.1%	100.0%	
Infarct territory	Inferior	46	9	55	0.495
		83.6%	16.4%	100.0%	
	Lateral	22	2	24	
		91.7%	8.3%	100.0%	
	Anterior	29	3	32	
		90.6%	9.4%	100.0%	
Pain Duration (hours)	10 or below	38	7	45	0.441
		84.4%	15.6%	100.0%	
	More than 10	59	7	66	
		89.4%	10.6%	100.0%	

Table 5: Subgroup analysis of one-month mortality stratified by renal impairment and baseline characteristics (n = 111)

Variable	Category	Mortality with Renal Impairment n (%)	Mortality without Renal Impairment n (%)
Age (years)	≤50	6/6 (100.0%)	0/36 (0.0%)
	>50	5/20 (25.0%)	3/61 (4.9%)
Gender	Male	9/11 (81.8%)	2/56 (3.6%)
	Female	2/3 (66.7%)	1/41 (2.4%)
BMI (kg/m²)	≤24	2/3 (66.7%)	1/38 (2.6%)
	>24	9/11 (81.8%)	2/59 (3.4%)
Hypertension	Yes	5/6 (83.3%)	1/26 (3.8%)
	No	6/8 (75.0%)	2/71 (2.8%)
Diabetes	Yes	2/3 (66.7%)	1/30 (3.3%)
	No	9/11 (81.8%)	2/67 (3.0%)

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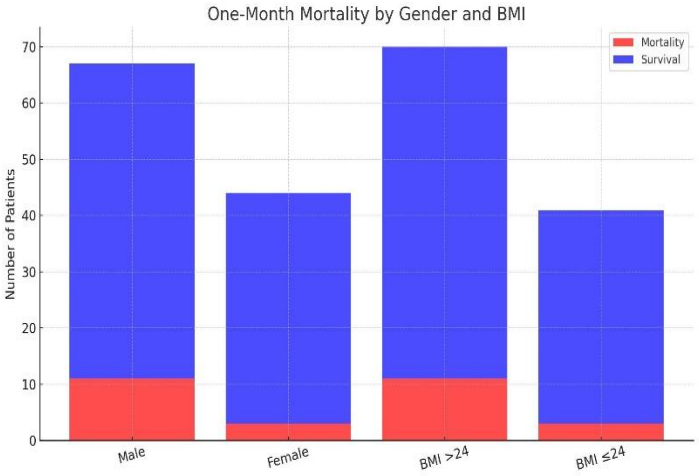

Figure 1 One-Month Mortality by Gender and BMI

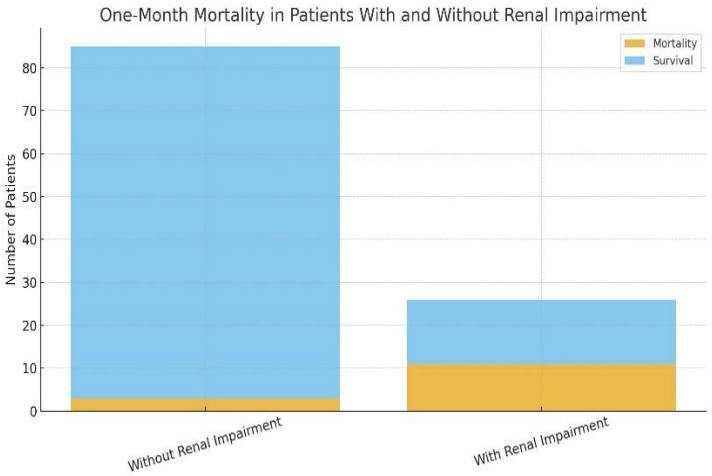

Figure 2 One-Month Mortality in Patients with and without Renal Impairment

DISCUSSION

This study was undertaken to assess the effect of renal impairment on short-term mortality in patients presenting with STEMI, and the findings demonstrated a strong association between renal dysfunction and higher one-month mortality. Mortality in patients with renal impairment was strikingly elevated compared to those without, confirming that renal function is a crucial determinant of prognosis in the acute phase of myocardial infarction. These results align with previous research in which renal dysfunction has consistently been associated with both increased 30-day and long-term mortality among patients with STEMI (13–16). Evidence from other clinical evaluations has also shown that a decline in estimated glomerular filtration rate significantly raises the risk of adverse cardiovascular outcomes, further supporting the observations of this study (17,18). The proportion of patients with renal impairment in the present cohort was 23.4%, which is lower than some international registry data where nearly one-third of STEMI patients had an eGFR below 60 mL/min/1.73 m² (19). Differences in patient demographics, comorbidities, and clinical practices across populations may explain this variation. In particular, higher prevalence of diabetes and hypertension in other registries may account for the elevated frequency of renal dysfunction. Despite such differences, the consistent finding across studies has been that renal impairment significantly worsens survival outcomes following STEMI. The present study also observed that patients with renal impairment tended to be older, male, and more frequently affected by diabetes, hypertension, and other comorbid conditions. Although these characteristics are often linked to poorer outcomes, renal impairment itself appeared to carry an independent prognostic weight, in line with findings from other observational studies where mortality was more closely tied to renal dysfunction than to demographic factors alone (20-22). The adverse impact of renal impairment on mortality is likely multifactorial, reflecting not only the systemic burden of comorbidities but also the heightened susceptibility to complications such as fluid overload, arrhythmias, and contrast-induced nephropathy.

A notable strength of this study was the inclusion of consecutive and unselected patients, which minimized selection bias and reflected real-world clinical practice. All patients were managed according to standard protocols, with primary PCI offered where feasible, ensuring that treatment pathways were comparable between those with and without renal impairment. This strengthens the reliability of the observed association between renal dysfunction and mortality. Nonetheless, certain limitations must be acknowledged. The study design was observational, which precludes the ability to establish causality. Potential confounding variables not captured in the dataset may have influenced outcomes, as is inherent in all observational analyses. Patients with cardiogenic shock were not excluded, which may have disproportionately increased mortality rates. Furthermore, detailed laboratory follow-up, including serial creatinine measurements and evaluation of contrast-induced nephropathy, was not consistently available (21,23). The relatively small sample size may also have limited the ability to perform multivariate analyses that could adjust for all relevant risk factors. The implications of this study are significant, as they reinforce the prognostic importance of renal function in STEMI and highlight the need for careful risk stratification and monitoring in this subgroup of patients. Future research should focus on large-scale prospective studies incorporating

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standardized assessments of renal function, exclusion of acute reversible causes of renal impairment, and adjustment for confounders through multivariate modeling. Further exploration into tailored treatment strategies for STEMI patients with renal dysfunction, including safe use of contrast agents and optimization of pharmacotherapy, is warranted to improve outcomes in this high-risk population. In summary, the findings of this study support the established evidence that renal impairment markedly increases short-term mortality following STEMI. Despite its limitations, the study adds valuable local data to the growing body of evidence and emphasizes the importance of integrating renal function assessment into prognostic evaluation and clinical decision-making for patients with acute myocardial infarction.

CONCLUSION

This study concluded that renal impairment significantly worsens short-term outcomes in patients presenting with STEMI, with mortality risk notably higher in those with compromised kidney function. The findings highlight the critical role of renal function as an independent prognostic factor and underscore the importance of integrating routine renal monitoring into the management of STEMI patients. By recognizing renal dysfunction early and addressing it as part of standard care, clinicians may be able to improve survival and optimize overall treatment outcomes in this high-risk population.

AUTHOR CONTRIBUTION

Author	Contribution
Muhammad Azam Khan	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Muhammad Asif Iqbal*	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Waseem Iqbal	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Roman Khan	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Usama Fahad	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Saddam Hussain	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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