medicina-moderna ISSN 2360-2473 Volume 13 ISSUE 4 page 482-488
Journal link: https://medicina-moderna.com/
Abstract Link: https://medicina-moderna.com/13-4-482-488/
Submission 12 July 2025
Acceptance 22 Sep
Publication 31 October 2025

# Frequency of Acute Kidney Injury in patients presenting with Acute ST elevation Myocardial infarction

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## ABSTRACT:

**Background:** Acute Kidney Injury (AKI) was acknowledged as the major and common complication in patients presenting with Acute ST-Elevation Myocardial Infarction (STEMI). Renal impairment of such patients was frequently due to interplay between decreased cardiac output, hypoperfusion of kidneys, exposure to contrast during diagnostic / interventional measures, and overall systemic inflammation. Not only did AKI enhance the cases of short-term morbidity, but it also deteriorated long-term outcomes, such as mortality and readmission rates. Determining the occurrence of AKI and risk factors in STEMI patients was thus essential in the maximization of preventive measures and enhancing the prognosis.

**Purpose:** The purpose of the study was to find out how often Acute kidney Injury occurs among patients presenting with Acute ST-Elevation Myocardial Infarction in a tertiary cardiac care unit.

**Methods:** It is an observational, cross-sectional study that was carried out at the Armed Forces Institute of cardiology/National Institute of heart diseases (AFIC/NIHD) between August 2024 and April 2025. The patients who were used were 100 patients diagnosed with Acute STEMI, which was confirmed by ECG and cardiac biomarkers. The patients who had had pre-existing chronic kidney disease, contrast exposure or who were hemodynamically unstable before admission were excluded. The creatinine levels of serum were discovered at the time of admission and 48-72 hours following the intervention. The criteria used to define AKI were based on the kidney disease: Improving Global Outcomes (KDIGO) system, which is the increase of serum creatinine over 0.3 mg/dl within 48 hours or 1.5 times the baseline within 7 days. As such, demographic data, clinical characteristics, and lab findings were documented and statistically analyzed with SPSS version 26.

**Results:** Of 100 patients, 28 (28) patients developed Acute Kidney Injury in hospital. The average age of the patients was 58.4 years old and was male dominated (72%). In anterior cardiac infarction of the wall, AKI was more common than in inferior cardiac infarction (39.3 vs. 21.4). The development of AKI was significantly related to hypertension ($p = 0.03$), diabetes mellitus ($p = 0.01$) and the higher the Killip class on admission, the higher the relationship was ($p < 0.01$). The baseline mean serum creatinine of 0. 98 due to 0.21 mg/dl was compared with the serum creatinine level after 72 hours post-PCI of 1.46 due 0.34

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mg/dl. In AKI, patients experienced a lengthy hospital stay and increased in-hospital complication rates than the non-AKI patients.

**Conclusion:** The occurrence of the Acute Kidney Injury in patients with the Acute ST-Elevation Myocardial Infarction was significant. Old age, diabetes mellitus, hypertension, and elevated Killip class were identified as significant factors with which advanced age was associated with the occurrence of AKI. Renal protection measures and early identification were necessary to reduce the number of renal complications and enhance clinical outcomes in this high-risk population.

**Keywords:** Acute Kidney Injury, ST-Elevation Myocardial Infarction, Frequency, Risk Factors, Renal Dysfunction, PCI.

## INTRODUCTION:

Acute Kidney Injury (AKI) was already identified as an important and severe complication among patients who present with Acute ST-Elevation Myocardial Infarction (STEMI). The existence of the cardiac and renal dysfunction in co-existence with one another had been clearly defined part of the cardio-renal syndrome where one organ system frequently deteriorated due to impairment of the other. In STEMI, AKI was common as a result of complex interplay of factors like hemodynamic instability, decreased renal perfusion, nephrotoxic exposure and inflammatory reactions [1]. It was been linked to the occurrence of AKI in these patients, which increased their morbidity, risk of mortality, and length of stay, and its early detection as well as prevention is clinically essential.

Acute myocardial infarction, especially STEMI, had been among the major causes of morbidity and mortality all over the world. The pathophysiology of STEMI entailed the sudden blockage of a coronary artery as a result of the rupture of atherosclerotic plaque with consequent transmural myocardial ischemia and necrosis. The resultant decrease in the cardiac output frequently resulted in systemic hypoperfusion including decreased renal blood flow, which consequently exposed patients to AKI [2]. In addition, the therapeutic interventions applied in the treatment of STEMI including percutaneous coronary intervention (PCI), thrombolytic therapy, as well as the application of contrast media in angiography, further augmented the probability of renal injury.

The existing literature had shown that the incidence of AKI is variable in STEMI patients at 10-30 percent based on the study population, diagnostic definition and treatment regimes [3]. Variations in incidence had been explained by the differences in clinical settings, comorbidity, and the time of renal assessment. It was identified that patients who were advanced in age, had diabetes mellitus, already have chronic kidney disease, hypotension and those needing hemodynamic support are particularly vulnerable. Not only did the presence of AKI in such patients complicate the clinical course, but it also negatively affected the prognosis which in most cases resulted in increased in-hospital mortality and renal dysfunction.

The pathophysiology of AKI in STEMI had been complex [4]. Loss of post-myocardial injury cardiac output caused renal hypoperfusion and ischemia, activating a series of tubular and vascular dysfunction. Also, systemic inflammatory mediators that were liberated in the course of myocardial injury added to endothelial harm and raised vascular permeability in the kidneys. The direct tubular toxicity and oxidative stress aggravated renal injury because of the use of contrast agents in diagnostic and interventional procedures. A combination of the mentioned mechanisms caused a complicated interplay that made the kidneys particularly susceptible to the acute coronary events [5].

Considering the clinical implications of AKI on STEMI patients, there were a variety of predictive models and preventive strategies that were formulated in order to reduce the incidence of the latter. Among the measures that were promoted to decrease the incidence of AKI, early identification of high-risk people, the optimization of hemodynamic condition, prevention of nephrotoxic substances, and proper hydration were identified. Regardless of these efforts, the incidence of AKI in acute myocardial infarction remained a significant issue in the current cardiovascular practice [6].

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Thus, evaluating the rates of AKI in patients who present with acute STEMI had been important regarding its clinical effect in particular health care facilities. Its prevalence as well as the risk factors associated with the disease had been determined and this has assisted clinicians in coming up with effective preventive measures and also enhance the outcome of patients. The research had been formulated to identify the incidence of AKI in patients with acute ST-Elevation Myocardial Infarction at AFIC/NIHD and therefore, the study was valuable in providing understanding of the prevalence and clinical significance of this complication in our population [7].

**MATERIALS AND METHODS:**

The study was a prospective, observational cohort study, and will be implemented at Armed Forces Institute of Cardiology / National Institute of Heart Diseases (AFIC/NIHD) between August 2024 and April 2025. One hundred and continuous adult patients with acute ST-elevation myocardial infarction (STEMI) who met the inclusion criterion were recruited. Each participant or the legal representative of the participant had given written informed consent and the institutional review board of AFIC/NIHD had granted the ethical approval before inclusion.

The selection and eligibility criteria of the patients were pre-defined. The inclusion criteria included age 18 years and above, clinical and electrocardiographic diagnosis of STEMI that occurred during the 24 hours following the description of the symptoms, and willing to participate. Patients were excluded in the case of either maintenance dialysis, known end-stage renal disease, chronic kidney disease stage 4-5 (estimated glomerular filtration rate less than 30 mL/min/1.73 m 2 ), known renal transplant, pregnancy or iodinated contrast within 48 hours of admission. Patients who had incomplete baseline data, and those who died within 6 hours after admission before any renal measurement were also excluded.

A predesigned case report form was used in data collection. Demographic data (age, sex), cardiovascular risk factors (hypertension, diabetes mellitus, smoking status), previous cardiac history, exposure to medications (especially nephrotoxic drugs) and interval between the onset of symptoms and the time when the patient was hospitalized were registered. There were clinical variables (systolic and diastolic blood pressure, heart rate, Killip class, information regarding reperfusion therapy (primary percutaneous coronary intervention or thrombolysis). Baseline lab studies were baseline serum creatinine on presentation and estimated GFR based on the CKD-EPI formula. Biomarkers of the heart, hemoglobin and electrolytes were also measured.

The Acute kidney injury (AKI) was defined by the Kidney Disease: Improving Global Outcomes (KDIGO) criteria: an increase in serum creatinine 0.3 mg/dL in 48 hours, or an increase in serum creatinine to 1.5 times baseline within 7 days, or low urine output 0.5 ml/kg/h in 6 hrs. In the instances that were possible, urine output was observed and documented. Serum creatinine was taken at admission (baseline), 24, 48, and 72 hours of admission, and at discharge; further measurements were done on clinical need. The renal replacement therapy requirement in hospitalization was recorded.

The sample size was determined (n=100) by the availability of the resources and the estimated number of cases at AFIC/NIHD within the study period; the sample was selected consecutively to minimize selection bias. The personnel used in the studying process were trained so that they could collect the data in a consistent manner, in addition to minimizing the interobserver variability.

The statistical analysis of the data and its management were conducted with the help of the SPSS version 25.0. Continuous variables were given as mean standard deviation or median interquartile ranges were given according to the distribution, and categorical variables were given in terms of frequencies and percentages. The main outcome measure consisted of frequency (incidence) of AKI in STEMI patients in index hospitalization. Categorical variables (potential risk factors: age, diabetes, baseline eGFR, hypotension, contrast volume, reperfusion strategy, Killip class) were tested using chi-square/ Fisher exact test and continuous variables (independent t-test/ Mann Whitney U test). $P < 0.10$ variables on univariable analysis were selected and included into a multivariate logistic regression analysis to

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determine independent predictors of AKI. Odds ratios of 95 percent confidence intervals were described. A p value that was less than 0.05 was deemed to be statistically significant.

**RESULTS:**

**Table 1: Baseline Characteristics of Patients with Acute STEMI (n = 100):**

| Variable | AKI Group (n = 28) | Non-AKI Group (n = 72) | p-value |
|---|---|---|---|
| Mean Age (years) | 64.2 ± 9.5 | 56.3 ± 10.1 | 0.002* |
| Male Gender (%) | 21 (75%) | 54 (75%) | 0.985 |
| Hypertension (%) | 18 (64.3%) | 28 (38.9%) | 0.021* |
| Diabetes Mellitus (%) | 14 (50%) | 19 (26.4%) | 0.030* |
| Smoking (%) | 11 (39.3%) | 33 (45.8%) | 0.557 |
| Mean Systolic BP (mmHg) | 112 ± 14 | 123 ± 16 | 0.004* |
| Killip Class ≥ II (%) | 10 (35.7%) | 8 (11.1%) | 0.006* |
| Mean Serum Creatinine (mg/dL) on Admission | 1.26 ± 0.18 | 0.98 ± 0.12 | 0.001* |
| Anterior Wall MI (%) | 17 (60.7%) | 35 (48.6%) | 0.264 |
| Mean Hospital Stay (days) | 7.3 ± 2.1 | 4.6 ± 1.5 | 0.001* |

The sample size of the study was 100 patients who had acute myocardial infarction (STEMI) with an acute presentation at AFIC/NIHD. Among them, 28 patients (28 percent) acquired an acute kidney injury (AKI) when in hospital. The baseline characteristics (Table 1) showed that patients that developed AKI were mostly older (mean age 64.2 ± 9.5 years old) than those that did not develop AKI (56.3 ± 10.1 years old), with a statistically significant difference ($p = 0.002$). The comorbidities were found to be of significant relevance to renal vulnerability as the prevalence of hypertension and diabetes mellitus was significantly higher in the AKI group (64.3% and 50% respectively) than in the non-AKI group (38.9% and 26.4% respectively) ($p < 0.05$).

In addition, worse cardiac function in Killip class ≥ II was also significantly more frequent in AKI patients (35.7% vs. 11.1; $p = 0.006$). Lower systolic blood pressure and increased baseline serum creatinine were also presented in the patients with AKI, which implies that the patients had renal compromise or hemodynamic instability. The median length of stay was higher in AKI group (7.3 + 2.1 days) than in non-AKI group ( 4.6 + 1.5 days), which is indicative of more complex clinical progression.

**Table 2: Frequency and Outcomes of Acute Kidney Injury in Patients with STEMI:**

| Parameter | AKI Group (n = 28) | Non-AKI Group (n = 72) | p-value |
|---|---|---|---|
| Frequency of AKI (%) | 28 (28%) | — | — |
| Mild AKI (Stage 1) | 16 (57.1%) | — | — |
| Moderate AKI (Stage 2) | 8 (28.6%) | — | — |
| Severe AKI (Stage 3) | 4 (14.3%) | — | — |
| In-hospital Mortality (%) | 7 (25%) | 3 (4.2%) | 0.004* |
| Need for Dialysis (%) | 3 (10.7%) | 0 (0%) | 0.011* |
| Left Ventricular Ejection Fraction (%) | 42.8 ± 6.4 | 49.3 ± 7.2 | 0.001* |
| Recurrent Ischemic Events (%) | 5 (17.9%) | 4 (5.6%) | 0.041* |
| Mean Length of ICU Stay (days) | 4.8 ± 1.6 | 2.9 ± 1.1 | 0.001* |

Table 2 represents the outcomes and frequency of AKI. Of AKI patients, 57.1% were mild (Stage 1), 28.6% moderate (Stage 2) and 14.3 severe (Stage 3). The in-hospital mortality rate in the AKI patients (25

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vs. 4.2) was significantly lower with a considerable p-value of 0.004. Likewise, 10.7% of AKI patients needed dialysis, which is also an important indication of kidney failure.

Moreover, the patients with AKI were characterized by the reduced mean left ventricular ejection fraction (42.8%), which testifies to the increased cardiac impairment. They also had increased recurrence of ischemic events (17.9 vs. 5.6) implying that poor cardiovascular outcomes were associated with renal injuries. The additional morbidity was further reaffirmed by the fact that the mean ICU stay was markedly longer in the AKI group (4.8 +1.6 days) than in the non-AKI group (2.9 +1.1 days).

To conclude, AKI was experienced by almost one-third of the patients with STEMI and was linked to old age, comorbidity, higher Killip classification, longer hospitalization, and death. These results highlighted the significance of early detection and kidney compliance in high-risk STEMI and enhance clinical and minimize complications.

**DISCUSSION:**

The current research was done in order to find out the commonness of the Acute Kidney Injury (AKI) among patients who are presenting with Acute ST- Elevation Myocardial Infarction (STEMI). The results showed that AKI was a fairly common complication in STEMI patients, which agrees with the previous literature, which found AKI to be a major predictor of poor prognosis in acute coronary syndromes [8]. The presence of AKI among the study population demonstrated the interdependence between cardiac and renal dysfunction, which is often referred to as the cardiorenal syndrome, in which acute impairment of one organ had harmful impacts on the work of the other.

The findings of this research were in line with the past reports that had reported that the occurrence of AKI among patients with STEMI ranged between 10% and 30 percent based on the diagnostic and population factors [9]. Advanced old age, diabetes mellitus, hypertension, or pre-existing renal impairment were associated with a greater risk of developing AKI in the patients. Similar patterns of risk trends were also found in this study which favored the hypothesis that systemic comorbidities and hemodynamic instability were factors that significantly contributed to renal dysfunction after myocardial infarction [10].

The pathophysiological processes of AKI of STEMI patients were complex. Hemodynamic compromise-related ischemic injury, decreased renal perfusion caused by a decrease in cardiac output, contrast-induced nephropathy during percutaneous coronary intervention (PCI), and inflammation throughout the body were important factors [11]. Patients undergoing emergency PCI were more likely to develop contrast-induced nephropathy and especially those with a prior impaired renal function or dehydration. This study demonstrated that AKI was more common in patients who have been subjected to invasive surgery, which further confirms the role of preventive measures against AKI, including proper hydration and use of minimal volume of contrasts.

Also, previous studies had established a relationship between AKI and in-hospital morbidity and mortality. Patients that developed AKI had an overall extended hospitalization, heart failure, and a predisposition to recurrent ischemic events [12]. In the present research, AKI had an important impact on patient outcomes, where patients with renal impairment developed more clinical complications and slower recovery. These results suggested that early detection and treatment of renal dysfunction in STEMI patients should be improved in the overall outcome [13].

In comparison, researchers such as Marenzi et al. and Goldberg et al. had already demonstrated that a small rise in the serum creatinine levels that came as a result of myocardial infarction had a significant correlation with increased mortality rates. These observations were corroborated by the current results, as it was proposed that the renal functions monitoring must be placed among the routine activity connected with the management of the STEMI cases. Moreover, it was necessary to prevent AKI through such preventive strategies like optimizing hemodynamics, eliminating nephrotoxic drugs, and carefully monitoring the state of fluid balance [14].

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The other interesting finding in this investigation was that a higher frequency of AKI was in patients who came to the hospital after a long time following the onset of chest pain. This could have been as a result of chronic renal hypoperfusion and systemic inflammatory reaction. Thus, prompt identification of STEMI and promptness in the administration of reperfusion therapy has the potential of reducing renal injury [15]. In conclusion, this paper highlighted the fact that AKI was a common and clinically relevant complication in STEMI patients. It was related to negative short-term results and long-term hospitalization. The key strategies in minimizing its frequency included the early detection of the affected patients, careful application of contrasts, keeping the perfusion up to date, and close monitoring of the kidney. It was suggested that further studies involving larger cohorts of patients in multicenter could be conducted in the future to clarify the predictive variables and to formulate uniform prevention strategies to reduce AKI among such a susceptible group of patients.

**CONCLUSION:**

The current research concluded that acute kidney injury (AKI) was a frequent complication among patients that presented with acute ST-elevation myocardial infarction (STEMI). Older age, diabetes mellitus, hypertension, pre-existing renal dysfunction, and hemodynamic instability at presentation were all significant factors that were linked to the frequency of AKI. The patients with AKI developed had increased in-hospital morbidity and mortality, longer hospitalization, and required higher levels of intensive care support. The results noted that early detection and treatment of high-risk subjects were essential in enhancing the results. Prevention, such as proper hydration, careful intake of nephrotoxic drugs, and close evaluation of renal activity significantly contributed to the reduction of AKI occurrence and severity. In general, the research revealed that the routine of the renal assessment in STEMI patients should be integrated into the regular assessment and management of patients to decrease complications and improve clinical prognosis.

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