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Prevalence of St-Elevation Myocardial Infarction in End Stage Renal Disease Patients Admitted with Acute Coronary Syndrome at Shifa International Hospital Islamabad

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Abstract

Background: End-stage renal disease (ESRD) is associated with a significantly increased risk of cardiovascular morbidity and mortality, with ST-elevation myocardial infarction (STEMI) representing one of the most serious cardiac complications. Due to the unique pathophysiological changes in ESRD, traditional cardiovascular risk factors may not fully predict STEMI in this population.

Objective: To determine the prevalence of ST-elevation myocardial infarction (STEMI) among ESRD patients admitted with acute coronary syndrome (ACS) and to assess its association with baseline patient characteristics.

Material and Methods: This descriptive cross-sectional study was conducted at the Inpatient Department of Shifa International Hospital, Islamabad, over a six-month period from November 2024 to April 2025. A total of 71 ESRD patients aged 30–60 years on maintenance hemodialysis for at least three months and admitted with ACS were included. Data were collected on demographics, comorbidities, and laboratory parameters. STEMI was diagnosed based on ECG changes and elevated troponin levels. Associations with baseline variables were assessed using the chi-square test.

Results: Among 71 patients, the mean age was 46.72 ± 8.88 years, with a mean BMI of 25.43 ± 4.84. STEMI was diagnosed in 14 patients, yielding a prevalence of 19.7%. STEMI was more frequently observed in patients aged 30–40 years (28.6%), females (20.9%), obese individuals (27.3%), and non-smokers (22.2%); however, no association with age, gender, obesity, smoking, diabetes, or hyperlipidemia was statistically significant.

Conclusion: STEMI is a common cardiac event in ESRD patients admitted with ACS. Traditional cardiovascular risk factors did not significantly predict STEMI in this cohort, suggesting the need to explore uremia-specific contributors.

Keywords: ST-elevation myocardial infarction, ESRD, acute coronary syndrome, dialysis, cardiovascular risk factors, prevalence

Introduction:

Cardiovascular disease still causes the majority of morbidity and mortality in End Stage Renal Disease (ESRD) patients (over half of all deaths) [1]. Within the spectrum of ACS, STEMI represents the most severe manifestation with complete coronary artery occlusion. On the intersection of ESRD and STEMI lies a particularly high risk scenario as a result of complex pathophysiology, diagnostic difficulties and suboptimal treatment outcomes [2].

Higher traditional cardiovascular risk factors including hypertension, diabetes mellitus, dyslipidaemia, as well as non-traditional factors including vascular calcification, uremic toxins, chronic inflammation and endothelial dysfunction are also common in ESRD patients [3]. These factors predispose to a prothrombotic state, accelerated atherosclerosis and increased plaque vulnerability leading to acute events such as STEMI [4].

The number of ESRD patients who had STEMI seems to be disproportionately high compared to STEMI rates in the general population with ACS. A study done on Taiwan showed that the presence of multivessel coronary artery involvement in STEMI was independently associated with severe renal impairment, indicating a positive relationship between progression of kidney function and severity of coronary disease [5]. There has also been shown to be an increased risk for life threatening arrhythmias in the STEMI patient presenting with impaired renal function, making their management additionally complex [6].

Furthermore, renal dysfunction has constantly been recognized as an independent predictor of poor in hospital outcomes in STEMI. Reduced glomerular filtration rate (GFR) patients, who underwent the PCI procedure according to the guideline developed higher rates of complication (atrial fibrillation and acute heart failure) [7]. With ESRD, STEMI patients are at a higher risk of AKI, which was strongly associated with both short and long term mortality (ESRD, End Stage Renal Disease) [8].

Of note, renal status can have a bearing on procedural decisions where clinicians are reluctant to pursue invasive strategies because they fear contrast induced nephropathy. Nevertheless, there is evidence that primary PCI may actually result in better renal function outcomes in the setting of African American patients and those with baseline moderate renal impairment [9].

However, detection of STEMI in ESRD patients continues to present difficulties in diagnosis, and reperfusion therapies are still underutilized. A recent study from Indonesia showed that 50% of these patients did not receive fibrinolysis (delayed arrival or diagnostic uncertainty) and this was associated with 19% in-hospital mortality [10]. Moreover, the early recognition and treatment of patients is complicated also by the atypical or silent ischemia these patients tend to present with [11].

The mortality due to co-morbidities, especially cardiovascular events, is higher in dialysis dependent population than in other chronic illnesses worldwide. Contribution of cardiovascular events affecting ESRD patients is not known in our local population, Unfortunately, limited studies are performed to know the burden of STEMI in dialysis dependent patients. Among these patients, primary PCI could improve the prognosis. The purpose of this study is to know the frequency of STEMI in dialysis dependent ESRD patients admitted with acute coronary syndrome. This will help identifying the burden of the disease, as well as help to formulate local guidelines for early referrals of selected patients for percutaneous interventions.

Material and methods:

This was a descriptive, cross-sectional study conducted in the Inpatient Department of Shifa International Hospital, Islamabad. The study duration extended from November 20, 2024, to April 2025. A total of 71 patients were included in the study. The sample size was calculated using a STEMI prevalence of 18.2% from a reference study, with a 95% confidence level and a 9% margin of error, using the WHO sample size calculator. [12] Non-probability consecutive sampling was employed for patient selection.

Participants aged between 30 to 60 years of either gender, who were on maintenance hemodialysis for at least three months, were included. Patients were excluded if they had a previous history of myocardial infarction, poor compliance with the hemodialysis schedule, thyroid illness, BMI above 35, a history of PCI or CABG, or psychiatric illness such as anxiety disorders.

After obtaining approval from the hospital's research ethical committee (CPSP/REU/NEP-2023-043-974 dated November 20, 2024), the study was initiated. Written informed consent was obtained from all participants who met the inclusion and exclusion criteria. The study

objectives, procedures, and nature were clearly explained to all participants. Dialysis dependency was confirmed through medical history, physical examination, and a review of medical records including GFR values. Patients on dialysis who were admitted with typical chest pain radiating to the jaw, back, or epigastrium were further evaluated with ECG and serum troponin levels.

A 12-lead electrocardiogram was performed by an experienced ECG technician to identify ST-elevation. Additionally, 5 cc of blood was drawn from each participant by a trained phlebotomist using sterile technique and was immediately sent to the hospital laboratory for troponin levels and lipid profile assessment. Patients with both ST-segment elevation on ECG and raised troponin levels were diagnosed as having STEMI. All findings, including demographic information such as age, gender, weight, and address, were recorded in a predesigned proforma.

Data were analyzed using IBM SPSS Version 23. Mean and standard deviation were calculated for continuous variables such as age, weight, height, BMI, and troponin levels. Frequencies and percentages were calculated for categorical variables including gender, smoking status, diabetes, hyperlipidemia, BMI category, and presence of STEMI. STEMI was stratified by age, gender, smoking status, diabetes, hyperlipidemia, and BMI using the chi-square test. A p-value of ≤ 0.05 was considered statistically significant. The results were presented using charts and tables.

Results:

A total of 71 patients were included in the study. The mean age of the participants was 46.72 ± 8.88 years. The average weight was 69.29 ± 9.57 kg, while the mean height was 166.07 ± 10.18 cm. The mean body mass index (BMI) was calculated as 25.43 ± 4.84. The mean troponin level among the study population was 0.0393 ± 0.02598 ng/mL.

Among the 71 patients included in the study, 14 (19.7%) were diagnosed with STEMI. (Table 1) The association of various baseline characteristics with the presence of STEMI was assessed using the chi-square test.

In terms of **age groups**, STEMI was more frequently observed in patients aged 30–40 years, with 6 out of 21 patients (28.6%) affected. In the 41–50 year group, 4 out of 22 patients (18.2%) had STEMI, while in the 51–60 year group, 4 out of 28 patients (14.3%) were affected. Although the highest proportion was seen in the youngest age group, this association was not statistically significant ($p = 0.451$).

With regard to **gender**, 5 out of 28 male patients (17.9%) and 9 out of 43 female patients (20.9%) were diagnosed with STEMI. The difference in STEMI frequency between genders was minimal and not statistically significant ($p = 0.750$).

In evaluating **obesity status**, STEMI was present in 3 out of 11 obese patients (27.3%) and in 11 out of 60 non-obese patients (18.3%). Although the proportion appeared higher in the obese group, the association did not reach statistical significance ($p = 0.493$).

Looking at **smoking status**, STEMI was found in 4 out of 26 smokers (15.4%) compared to 10 out of 45 non-smokers (22.2%). Interestingly, STEMI was slightly more frequent among non-smokers in this sample, though the difference was not statistically significant ($p = 0.485$).

Among patients with **diabetes**, 6 out of 30 (20.0%) had STEMI, while in non-diabetic patients, 8 out of 41 (19.5%) were affected. The proportions were nearly identical, and no significant association was found ($p = 0.959$).

Lastly, regarding **hyperlipidemia**, 3 out of 20 patients (15.0%) with hyperlipidemia developed STEMI compared to 11 out of 51 patients (21.6%) without hyperlipidemia. Again, the difference was not statistically significant ($p = 0.531$). (Table 2)

Table: Frequency of STEMI in the Study Population

STEMI	**n (%)**
Yes	14 (19.7%)
No	57 (80.3%)
Total	**71 (100%)**

Table: Association of Baseline Variables with STEMI (n = 71)

Variable	**Category**	**STEMI Yes n (%)**	**STEMI No n (%)**	**p-value**
Age Group	30–40 years	6 (28.6%)	15 (71.4%)	0.451
	41–50 years	4 (18.2%)	18 (81.8%)	
	51–60 years	4 (14.3%)	24 (85.7%)	
Gender	Male	5 (17.9%)	23 (82.1%)	0.750
	Female	9 (20.9%)	34 (79.1%)	
Obesity Status	Obese	3 (27.3%)	8 (72.7%)	0.493
	Non-obese	11 (18.3%)	49 (81.7%)	
Smoking Status	Smoker	4 (15.4%)	22 (84.6%)	0.485
	Non-smoker	10 (22.2%)	35 (77.8%)	
Diabetes	Diabetic	6 (20.0%)	24 (80.0%)	0.959
	Non-diabetic	8 (19.5%)	33 (80.5%)	
Hyperlipidemia	Yes	3 (15.0%)	17 (85.0%)	0.531
	No	11 (21.6%)	40 (78.4%)	

Discussion:

Our study highlights a significant frequency of ST-elevation myocardial infarction (STEMI) among patients with end-stage renal disease (ESRD) presenting with acute coronary syndrome (ACS). This finding is consistent with multiple recent studies reporting similarly elevated STEMI prevalence in this high-risk population.

Gupta et al. identified a STEMI prevalence of 18.2% among ESRD patients admitted with acute myocardial infarction (AMI) using U.S. national data—strikingly similar to the frequency observed in our study [12]. This correlation reinforces the generalizability of our results.

Khan et al., in a comprehensive analysis from the National Inpatient Sample (2012–2016), also confirmed that ESRD patients frequently present with STEMI, comprising a large proportion of dialysis-related cardiovascular events. They reported a 29.7% in-hospital mortality rate, further illustrating the clinical severity of STEMI in this population [13].

Bilal et al. identified 25,435 ESRD patients with STEMI between 2016 and 2020. Not only did the number of STEMI cases rise steadily over this period, particularly in hemodialysis patients, but there was also a slight improvement in inpatient mortality—suggesting better awareness and care protocols [14].

Gajjar et al. reported that out of 12,000 ESRD patients with STEMI, 1,225 were on peritoneal dialysis (PD) and 10,675 on hemodialysis (HD). While prevalence was high in both groups, PD patients showed lower odds of complications and hospital costs [15].

Sakhuja et al. demonstrated that the incidence of STEMI is 7 times higher in dialysis patients than in the general population, with 11,383 of 882,447 STEMI admissions occurring in ESRD patients on dialysis—supporting the assertion that renal failure significantly increases STEMI risk [16].

Ismail et al., analyzing data from Malaysia, showed that CKD patients with STEMI had in-hospital mortality odds of 4.55 and one-year mortality hazard ratio of 3.79. Their cohort had a high proportion of diabetics, which mirrors the comorbidity profile in our study population [17].

Chang et al. highlighted that ESRD and advanced CKD patients presenting with STEMI often had multivessel coronary artery disease and complete occlusions, indicating more aggressive atherosclerosis [18].

Further supporting the high burden of STEMI in ESRD, Bolad found that STEMI incidence was 7.7 times greater in dialysis patients than in the general population, citing data from over 880,000 hospitalizations [19].

Kawsara et al. analyzed 4,220 STEMI cases in dialysis patients from the National Inpatient Sample and found that while dialysis patients constituted just over 1% of all STEMI cases, they had disproportionately higher mortality. Importantly, PCI reduced short-term mortality by nearly 12% in this group, suggesting early intervention remains beneficial [20].

In a multicenter cohort, Koh et al. observed that STEMI was a strong independent predictor of mortality (HR 2.31) in ESRD patients with severe coronary artery disease. STEMI prevalence was notably high among those needing invasive procedures, emphasizing the disease burden in this population [21].

Schmucker et al. demonstrated that acute kidney injury occurred in 18% of STEMI patients and was linked with higher short- and long-term mortality, highlighting the interaction between renal and cardiac complications [22]. Çınar et al. similarly noted that CKD is an independent risk factor for new-onset atrial fibrillation during STEMI, further complicating clinical outcomes [23].

Fatuyi et al. reported a 30-day readmission rate of 20.6% in ESRD-STEMI patients post-PCI or CABG, reflecting persistent vulnerability and the need for careful post-discharge planning [24].

Januszek et al. found that while PCI improved outcomes in ESRD patients with myocardial infarction, the survival advantage was reduced compared to patients with preserved renal function [25].

Altogether, our study supports the prevailing evidence that ESRD patients are not only more likely to present with STEMI but also do so with higher risk factors and complications. This emphasizes the importance of early risk assessment and individualized treatment pathways to manage this vulnerable population effectively.

Conclusion:

In this study of 71 end-stage renal disease patients admitted with acute coronary syndrome, the prevalence of ST-elevation myocardial infarction (STEMI) was found to be 19.7%, indicating a considerable burden of acute cardiac events in this high-risk population. While STEMI appeared more frequent among younger patients (28.6% in the 30–40 age group), females (20.9%), obese individuals (27.3%), and non-smokers (22.2%), none of these associations reached statistical significance. Similarly, the presence of diabetes or hyperlipidemia showed no meaningful relationship with STEMI occurrence. These findings suggest that traditional cardiovascular risk factors may not independently predict STEMI in dialysis-dependent ESRD patients, emphasizing the need for further research into non-traditional and uremia-specific risk contributors in this population.

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