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"PREVALENCE OF CHRONIC KIDNEY DISEASE IN ACUTE CORONARY SYNDROME PATIENTS ADMITTED TO A TERTIARY CARE ICU IN NORTHERN KARNATAKA: IMPACT ON MANAGEMENT AND OUTCOMES."

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Abstract

Objectives: Chronic Kidney Disease (CKD) is marked by progressive reductions in glomerular filtration rate (GFR) and abnormal kidney function, with End Stage Renal Disease (ESRD) representing its final stage. CKD significantly increases cardiovascular disease (CVD) risk, with a high prevalence of cardiovascular complications. Acute Coronary Syndromes (ACS) are common among CKD patients, complicating their management due to the scarcity of targeted randomized trials. This study aims to determine CKD prevalence among ACS patients and evaluate its impact on management decisions and outcomes.

Method: This prospective observational study was conducted at tertiary center, with ethical approval from the hospital's ethics committee. Between 2023 and 2024, 1,280 ACS patients were admitted to the cardiac ICU. Of these, 328 had CKD, and 120 were newly diagnosed. Data on age, gender, ECG findings, symptoms, risk factors, coronary angiogram (CAG) results, and treatment outcomes were collected.

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Results: CKD prevalence among ACS patients was 25.6%. The cohort was predominantly male (64.2%) with a mean age of 65.5 years. Risk factors included diabetes mellitus (19.3%), hypertension (40.0%), and both (40.75%). Diabetic kidney disease was the most common cause (75.8%). Symptoms included chest pain (45.0%) and pulmonary edema (50.8%). ECG findings revealed 46.7% with STEMI and 53.3% with NSTEMI. CAG showed single-vessel disease (6.7%), double-vessel disease (20.8%), and triple-vessel disease (41.7%). CAG was not performed in 30.8% of cases due to high creatinine levels. Mortality was higher in STEMI patients (17.5%) compared to NSTE-ACS patients (3.3%).

Conclusion: CKD does not necessarily reduce the success rate of reperfusion therapies but is linked to a higher incidence of major adverse events. In STEMI patients with CKD, increased mortality rates despite optimal therapy suggest that early PCI could be beneficial. Determining the optimal strategy for STEMI patients with CKD remains challenging and requires further research.

Keywords: Chronic Kidney Disease (CKD), Acute Coronary Syndrome (ACS), Intensive Care Unit (ICU) & Management

Introduction: Chronic Kidney Disease (CKD) encompasses a range of physiological processes linked to abnormal kidney function and a progressive reduction in glomerular filtration rate (GFR) [1]. End Stage Renal Disease (ESRD) refers to the final stage of CKD, characterized by uremic syndrome [1]. According to the Kidney Disease Improving Global Outcomes (KDIGO) CKD work group, CKD is defined as abnormalities in kidney structure or function persisting for more than three months [1]. KDIGO further specifies CKD as a GFR of less than 60 mL/min/1.73 m^2 for a period of ≥3 months [2].

Diabetes mellitus and hypertension are responsible for the majority of patients receiving treatment for ESRD. Other common causes include glomerulonephritis, interstitial nephritis, polycystic kidney disease (PCKD), and obstructive uropathy [3]. In India, the management of ESRD patients significantly contributes to the financial burden on the healthcare system [3].

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Cardiovascular disease (CVD) is the leading cause of morbidity and mortality at all stages of CKD. The risk of cardiovascular disease in patients with CKD compared to the general population (matched for age and sex) is 10 to 200 times higher, depending on the CKD stage. Consequently, many patients with CKD die from cardiovascular disease before reaching stage 5 CKD, with between 30% and 45% of stage 5 CKD patients experiencing advanced cardiovascular complications [4].

Acute coronary syndromes (ACS) are common in CKD and are a major cause of morbidity and mortality in this population. CKD is a potent and independent risk factor for adverse outcomes in patients with ACS. The management of ACS in CKD patients is more challenging than in the general population due to the lack of well-designed randomized trials evaluating therapeutic strategies in such patients. Studies on the prevalence of CKD in patients presenting with ACS are scarce.

Given these challenges, this study was conducted to determine the prevalence of CKD among patients presenting with ACS. It also examines how CKD influences decision-making in the management of acute coronary events.

Material & methods: This prospective observational study was conducted in collaboration with the cardiology department following permission from ethical committee of hospital during the study period from 2023 to 2024, a total of 1,280 patients admitted to the cardiac ICU presented with acute coronary syndromes (ACS). Of these, 328 patients were identified to have chronic kidney disease (CKD), with 120 being newly diagnosed with kidney disease. Our inclusion criteria focused exclusively on patients newly diagnosed with CKD, excluding those with previously known kidney disease. The objective of this study was to evaluate the prevalence of CKD among the cohort presenting with ACS and to assess how deranged renal function tests impacted treatment decisions and patient outcomes.

Data from 120 patients, including information on age, gender, ECG findings, symptom analysis, and risk factors, were recorded. Details of coronary angiograms (CAG), treatment given, and outcomes were meticulously documented. Categorical variables, such as age groups, gender, symptoms, CAG status, and mortality, were reported as percentages. Creatinine levels were categorized into two groups: <2 mg/dL and >2 mg/dL, and these were reported as percentages and compared with patient outcomes.

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The collected data were entered into Microsoft Excel and analyzed using SPSS version 17.0. To assess associations, the Chi-square test was used to analyze the relationship between STEMI and CAG status, creatinine categories, and outcomes, as well as to compare symptoms with CAG findings. A p-value of <0.05 was considered statistically significant.

Results: In this study of 120 participants, the prevalence of chronic kidney disease (CKD) was found to be 25.6%. The majority of participants, 46 (38.3%), were aged 60 years or younger, followed by 35 (29.2%) in the age group of 61 to 70 years, and 39 (32.5%) who were over 70 years old.

The gender distribution showed a higher proportion of males, with 77 (64.2%) male participants, compared to 43 (35.8%) females. Regarding risk factors, 23 participants (19.3%) had diabetes mellitus (DM), 48 (40.0%) had systemic hypertension (HTN), and 49 (40.7%) had both diabetes and hypertension (DM+HTN). These findings provide valuable insights into the demographic characteristics and risk factors of the study population.

When assessing the causes of CKD, 91 participants (75.8%) were attributed to diabetic kidney disease. Additionally, 28 participants (23.3%) were found to have bilateral small kidneys, while one participant was suspected to have glomerular disease, specifically probable IgA nephropathy. No kidney biopsies were performed; the diagnosis of kidney disease was based on urine analysis and ultrasound (USG) findings.

Regarding kidney function, 83 participants (69.2%) had serum creatinine levels below 2 mg/dL, while 37 individuals (30.8%) had levels above 2 mg/dL. These results highlight important trends in kidney function among the study subjects.

In this study of 120 participants, the symptoms varied significantly. Chest pain was reported by 54 individuals (45.0%), pulmonary edema by 61 individuals (50.8%), and syncope by 5 individuals (4.1%). The symptom analysis revealed that pulmonary edema was the most common presentation. Participants experiencing chest pain (n = 54) had an average hospital stay of 7.6 days (SD = 4.3), which was notably shorter compared to those with pulmonary edema (n = 61), who had an average stay of 8.4 days (SD = 9.6). The P-value for the duration of stay among participants with chest pain was <0.001, indicating statistical significance. This suggests that pulmonary edema may contribute more prominently to prolonged hospitalization compared to chest pain.

Regarding ECG findings, 56 participants (46.7%) experienced ST-segment elevation myocardial infarction (STEMI), while 64 (53.3%) had non-ST-segment elevation myocardial

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infarction (NSTEMI). Non-ST-segment elevation acute coronary syndrome (NSTE-ACS) was more common among participants with chronic kidney disease (CKD). Among those with STEMI, inferior wall myocardial infarction (IWMI) occurred in 33 cases (27.5%) and anterior wall myocardial infarction (AWMI) in 26 cases (21.7%). Complete heart block (CHB) and posterior wall myocardial infarction (PWMI) were less frequent, with 3 cases (2.5%) and 1 case (0.8%), respectively.

Coronary angiography (CAG) was performed in participants with serum creatinine levels below 2 mg/dL. However, 37 individuals (30.8%) did not undergo CAG due to creatinine levels above 2 mg/dL, which could increase the risk of bleeding and contrast-induced nephropathy (CIN). As a result, the severity of coronary artery disease could not be assessed in these individuals. Among the 37 participants who did not undergo CAG, 27 (48.2%) had STEMI, and 10 (15.6%) had NSTEMI. Of the 56 subjects with STEMI, 27 (48.2%) did not undergo CAG due to elevated creatinine levels.

For those who underwent CAG, 8 individuals (6.7%) were found to have single-vessel disease (SVD), 25 (20.8%) had double-vessel disease (DVD), and 50 (41.7%) had triple-vessel disease (TVD). Additionally, 16 participants (13.3%) were noted to have coronary calcification, a characteristic finding in individuals with kidney disease.

The treatment of participants was guided by their coronary angiography (CAG) findings and general condition at the time of presentation. Percutaneous transluminal coronary angioplasty (PTCA), a definitive procedure, was performed on 47 participants (39.2%) whose creatinine levels were below 2 mg/dL. Thrombolysis was administered to 28 participants (23.3%) who could not undergo PTCA due to elevated creatinine levels exceeding 2 mg/dL. The outcomes for those who underwent thrombolysis were poorer, with 9 individuals (7.5%) succumbing to their condition.
Coronary artery bypass grafting (CABG) was performed on 23 participants (19.2%), while 22 (18.3%) were treated with dual antiplatelet therapy (DUAT). One participant received both thrombolysis and CABG.

Of the 120 participants, 11 individuals (9.2%) required hemodialysis (HD) due to elevated creatinine levels at initial presentation and subsequent worsening of renal function. Among those who underwent HD, 6 patients could not be salvaged as they were on multiple inotropic support and had poor cardiac reserve.

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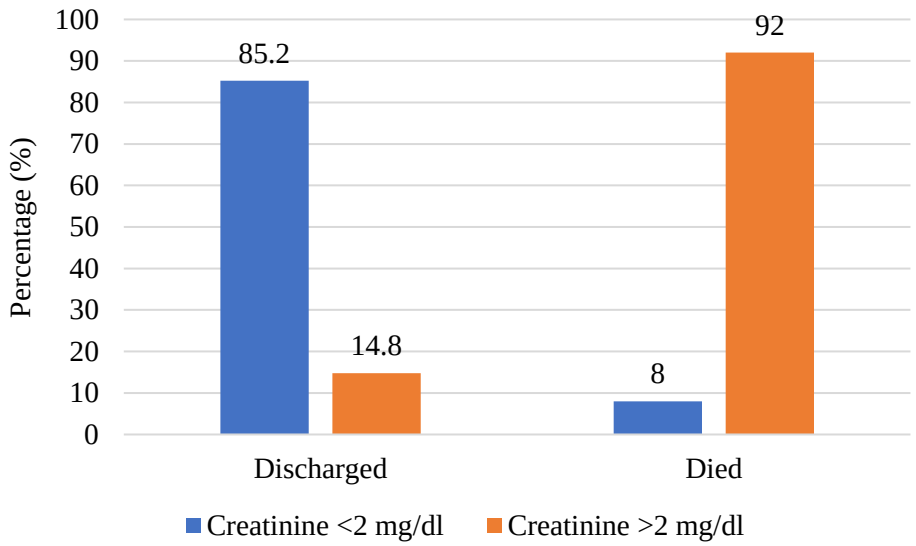

Figure 1: Outcome among study subject depending upon serum creatinine level

The data indicates that participants with an initial creatinine level above 2 mg/dL experienced higher mortality rates. This increased case fatality rate is attributed to multiple factors, not solely due to impaired renal function.

Of the 120 study participants, 25 (20.8%) died. Among the 37 participants (30.8%) who could not undergo coronary angiography (CAG), 23 (62.2%) died, and six required hemodialysis. In terms of age distribution, the majority of deceased patients were 60 years or younger (52.0%), followed by those over 70 years (32.0%), with a smaller proportion aged between 61 and 70 years (16.0%). Males accounted for 60.0% of the deceased, while females made up 40.0%.

Chest pain was the most common symptom among the deceased, occurring in 72.0% of cases, while pulmonary edema was seen in 28.0%. Notably, 92.0% of the patients who died did not undergo CAG. Diabetic kidney disease was present in 72.0% of the cases where information was available, suggesting it as a significant contributor to the mortality risk. Among the risk factors, hypertension (HTN) was the most prevalent, affecting 50.0% of the deceased, followed by the combination of diabetes mellitus (DM) and hypertension in 37.5% of cases.

Discussion: In this study, 120 subjects with Acute Coronary Syndrome (ACS) were evaluated for Chronic Kidney Disease (CKD) at a tertiary care medical center. The prevalence of CKD among ACS subjects was found to be 25.6%. CKD is a major risk factor for coronary artery disease, as CKD patients are prone to early atherosclerosis and coronary calcifications.

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The literature shows that CKD is present in a substantial proportion of patients with ACS. Large registries report that nearly 40% of patients with non-ST-elevation myocardial infarction (NSTEMI) and 30% of those with ST-elevation myocardial infarction (STEMI) have CKD, as defined by an estimated glomerular filtration rate (eGFR) < 60 mL/min per 1.73 m^2 [5,6]. The prevalence of CKD in our study aligns with the findings in available literature.

For example, Malleshappa P et al. found a CKD prevalence of 39.2% among 125 subjects with coronary artery disease (CAD) [7]. Similarly, Liu et al. reported a CKD prevalence of 24.8% among 3,513 participants with coronary heart disease in the China Heart Survey (CHS) [8]. Mielniczuk et al., in their study involving 4,181 patients with non-ST or ST-elevation acute coronary syndromes, estimated a baseline eGFR of 67.8 mL/min/1.73 m^2 (range, 9.7–149.2 mL/min/1.73 m^2), showing that a significant number of patients had underlying CKD [9].

In the present study, among subjects with Acute Coronary Syndrome (ACS) and Chronic Kidney Disease (CKD), 64.2% were male, and 35.8% were female. The mean age of the subjects was 65.5 years. Additionally, 19.3% had diabetes mellitus (DM), 40% had hypertension (HTN), and 40.75% had both DM and hypertension. Malleshappa P et al. [7] also observed a male predominance, with a mean age of 62.9 ±13.4 years among ACS subjects with CKD, and reported that 79.4% had DM as a risk factor. Kabir CM et al. [10] found a mean age of 60.4 ± 8 years among ACS subjects with CKD, with 75% having HTN as a risk factor. These studies demonstrate that CKD among ACS patients is predominantly seen in individuals over 60 years old, with DM and HTN being key comorbidities associated with both CKD and ACS.

The prevalence of symptoms among the 120 participants varied significantly: 54 individuals (45.0%) reported chest pain, 61 (50.8%) had pulmonary edema, and 5 (4.1%) experienced syncope. In a study by Moisi M I et al. [11], symptomatology at presentation included thoracic pain, dyspnea, and syncope. Specific thoracic pain showed a significant incidence ($p < 0.01$) in the non-CKD group, while dyspnea was more common in the CKD group ($p < 0.01$). Loss of consciousness at admission was rarer and not statistically significant ($p = 0.16$).

In terms of ECG changes, 53.3% of newly diagnosed CKD subjects in this study had non-ST-elevation ACS (NSTE-ACS), while 46.7% had ST-elevation myocardial infarction (STEMI). In the study by Moisi M I et al. [11], 62.77% of ACS subjects with CKD had NSTE-ACS, and 37.23% had STEMI. Similarly, Al Suwaidi et al. [12] found that 42% of ACS subjects had NSTEMI

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and 41% had STEMI on ECG. These findings confirm that NSTE-ACS is the predominant ECG presentation among CKD subjects, consistent with other studies.

In the present study, coronary angiography (CAG) findings revealed that 6.7% of participants had single-vessel disease (SVD), 20.8% had double-vessel disease (DVD), and 41.7% had triple-vessel disease (TVD). CAG was not performed for 37 participants (30.8%). In comparison, the study by Moisi M I et al. [11] among ACS subjects with CKD found that 10.95% had SVD, 27.01% had DVD, 14.6% had TVD, and 8.76% had normal CAG. Similarly, C M Shaheen Kabir et al. [10] observed that 15.6% had SVD, 28.2% had DVD, 45.3% had TVD, and 0% had normal CAG.

In this study, 19.2% of participants underwent coronary artery bypass grafting (CABG), 20.8% experienced mortality, 18.3% were managed medically, 39.2% had percutaneous transluminal coronary angioplasty (PTCA) with stenting, and thrombolysis was performed in 22.5% of subjects. There was a significant association between mortality and the severity of coronary artery disease (CAD) in CKD patients.

In the present study, subjects presenting with ST-elevation myocardial infarction (STEMI) had a higher mortality rate (17.5%) compared to those with non-ST-elevation acute coronary syndrome (NSTE-ACS), which had a mortality rate of 3.3%. This contrasts with most other studies, which report higher mortality rates in NSTE-ACS subjects compared to STEMI.

Of the 120 subjects, 56 (46.7%) had STEMI. Percutaneous coronary intervention (PCI) is the preferred treatment for STEMI as it can salvage many patients. However, due to the increased risk of contrast-induced nephropathy (CIN) and bleeding associated with uremia in CKD patients, PCI was only performed for those with creatinine levels below 2 mg/dL in our center. PCI was deferred for 27 subjects (48.2%) due to elevated creatinine levels, which likely contributed to increased morbidity as timely intervention could not be performed.

Early coronary angiography and revascularization have been shown to be more effective for high-risk patients with NSTE-ACS [13]. However, in CKD patients, a critical issue arises: whether the worsened hospital outcomes are due to the decline in renal function or the coronary revascularization procedures (PCI or coronary bypass surgery). This dilemma complicates the management of CKD patients with ACS, as interventions must balance the risks of renal function deterioration with the benefits of revascularization.

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Conclusion: Chronic Kidney Disease (CKD) should not necessarily hinder the success rate of percutaneous or pharmacological reperfusion therapies. However, it may be linked to a higher incidence of major adverse events. In the context of ST-elevation myocardial infarction (STEMI), CKD is associated with increased mortality, even with the use of optimal therapy. Nevertheless, this association suggests that early percutaneous coronary intervention (PCI) could still be beneficial for these patients. Despite the documented benefits of pharmacologic and mechanical coronary reperfusion in STEMI, determining the most effective strategy for STEMI patients with CKD remains challenging.

Ethics Approval and Consent to Participate: Ethical approval for conducting the study was obtained from the KIMS, Hubballi. Written informed consent was obtained from the patient for their participation in the study.

Authors' Contributions: All authors combined contributed to the study in the data collection, analysis, drafting, and critical revision of the manuscript. Both authors have read and approved the final manuscript.

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