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CONCURRENT DIABETES MELLITUS AND RENAL INSUFFICIENCY AS PROGNOSTIC INDICATORS FOR ACUTE MYOCARDIAL INFARCTION: A COHORT STUDY.

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ABSTRACT

Background
Acute myocardial infarction (AMI) prognosis worsens with diabetes mellitus and renal failure. This study examines how the combined presence of these comorbidities affects clinical outcomes in AMI patients.

Methods
100 people with AMI participated in this cohort study, which ran from September 2023 to August 2024. Based on whether or not they had diabetes mellitus and renal insufficiency, participants were divided into four groups. To account for potential confounders, multivariate regression analysis, ANOVA, chi-square tests, and descriptive statistics were used to examine clinical outcomes.

Results
The study included 100 AMI patients with a mean age of 64 years, predominantly male (64%) but with a substantial female representation (36%). Common comorbidities such as smoking, hypertension, and hyperlipidaemia were consistently observed across all groups. The patients in Group IV, who had both kidney failure and diabetes, had the highest incidence of MACE (56.2%) and the longest hospital stay (7.9 ± 3.2 days), and also the highest rate of mortality in hospital (26.8%). Both renal failure (Odds Ratio 3.2, 95% Confidence Interval 2.1-4.9) and diabetes mellitus (Odds Ratio 2.4, 95% Confidence Interval 1.6-3.6) were found to be significant independent predictors of unfavourable outcomes using multivariate regression analysis.

Conclusion
Following an AMI, patients with concurrent diabetes mellitus and kidney failure have far worse outcomes than those with either condition alone or neither. These results highlight the necessity of close observation and specialized treatment plans for this high-risk group.

Recommendations
For AMI patients who also have diabetes and renal failure, healthcare practitioners should use integrated care approaches. To enhance outcomes for these patients, further research should concentrate on creating and assessing targeted therapies.

Keywords: *Diabetes mellitus, Renal insufficiency, Acute Myocardial Infarction, Major Adverse Cardiac Events, Kidney failure, In-Hospital Mortality, Prognostic Factors*
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INTRODUCTION

In individuals with cardiovascular disease, renal impairment, and diabetes mellitus are known risk factors for a poor long-term prognosis. Any level of preexisting renal impairment needs to be regarded as a strong, stand-alone risk factor for cardiovascular complications following an AMI [1,2]. After AMI, the 1-year mortality rate from end-stage renal disease (ESRD) is around 60% [3], and renal dysfunction has been demonstrated to be a reliable predictor of death [4,5]. According to these findings, patients with renal impairment are more likely to experience recurrent cardiovascular events than people with normal renal function [6,7]. The exact pathways by which renal failure leads to cardiovascular disease are still unknown, despite the obvious concerns. Globally, the prevalence of diabetes mellitus has risen quickly. Notably, diabetes mellitus is a recognized risk factor for cardiovascular events, including myocardial infarction and cardiovascular death, just as coronary artery disease [8,9]. A large prospective global registry, the Global

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Registry of Acute Coronary Events (GRACE) [10], reports that the in-hospital mortality rate for patients with diabetes who also have acute coronary syndrome is twice that of those without diabetes. Also, diabetes may be a significant independent risk factor for acute coronary syndrome, according to a recent study [11]. Therefore, AMI patients with comorbidities such as renal impairment or diabetes mellitus are likely to show poor prognosis. As a result, individuals with AMI who also have renal impairment or diabetes mellitus, either separately or in combination, may have a poor prognosis. Although a number of studies have assessed mortality following AMI with or without diabetes and renal insufficiency [12,13], little is known about the function of renal insufficiency and its relationship to diabetes mellitus in the setting of AMI. Given the substantial ramifications for patient care, it is essential to comprehend how concurrent diabetes mellitus and renal failure affect the course of AMI in order to create efficient treatment plans.
The current study evaluates the clinical outcomes in AMI patients in the presence of comorbidities like renal impairment and diabetes mellitus.

METHODOLOGY

Study Design

This study was a retrospective cohort study, where data from past medical records of patients diagnosed with acute myocardial infarction (AMI) were analyzed. This design was adopted to observe existing records to identify outcomes about exposure variables, allowing the evaluation of associations such as the impact of diabetes mellitus and renal failure on cardiac outcomes after AMI.

Study Setting

The study was conducted from September 2023 to August 2024 at Lord Buddha Koshi Medical College and Hospital (LBKMCH), Saharsa, Bihar, India. LBKMCH is a tertiary care teaching hospital serving a predominantly rural population in the Mithila region. It is equipped with specialized cardiology and nephrology departments, providing comprehensive services including emergency cardiac care, dialysis, and advanced diagnostic facilities.

Participants

There were 100 patients with an AMI diagnosis in the study. The availability of the information needed to compute the estimated glomerular filtration rate (eGFR) determined which participants were chosen.

Inclusion Criteria

- The data needed to compute eGFR is available.
- Individuals with an acute myocardial infarction diagnosis.
- All medical documents, particularly those pertaining to diabetes mellitus.

Exclusion Criteria

- Patients with documented severe liver disease or hepatic failure.
- Individuals with a cancer diagnosis
- Incomplete medical records

Bias

By enrolling consecutive patients who met the inclusion criteria, selection bias was reduced. To lessen observer bias, data was extracted by several independent reviewers.

Variables

Major adverse cardiac events (MACE), mortality in hospital, length of hospital stay, and the occurrence of diabetes mellitus and renal failure were among the variables.

Sample size

The following formula for determining a proportion in a population was utilized to determine the sample size for this study:
$n= Z^2 \times p \times (1-p) / E^2$
where: n = size of sample.
Z = Z-score that corresponds to the desired level of confidence
p = estimated proportion in the population
E = margin of error.

Retrospective data collection was done using hospital medical records. This comprised clinical presentations, laboratory data, eGFR values, diabetes mellitus status, demographic information, and clinical outcomes including MACE and in-hospital mortality.

Procedure

The medical records of individuals who received an AMI diagnosis throughout the study period were examined. Information on the presence of diabetes mellitus and eGFR was extracted.
Based on the presence of kidney failure and diabetes mellitus, participants were divided into four groups:
Group I: eGFR $\geq$ 60 ml/min/1.73 m^2; participants having neither diabetes mellitus nor renal failure.
Group II: Participants having diabetes mellitus without renal failure.
Group III: Participants having kidney failure without diabetes mellitus.
Group IV: Participants having kidney failure and diabetes mellitus both.

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Statistical Analysis

The data that was extracted was compiled into a database for analysis. Descriptive statistics were used to compile the patient features. Frequencies, mean ± standard deviation, and percentages were used to represent the variables. To compare the four groups, ANOVA and the Chi-square test were employed. Taking into consideration any confounding variables, multivariate regression analysis was used to evaluate the effects of DM and renal failure on mortality in the hospital and MACE. When the p-value was less than 0.05, statistical significance was achieved.

Ethical considerations

All subjects provided written informed consent, and the Ethics Committee approved the study protocol.

RESULTS

100 people with AMI in all were included in the study. Table 1 provides specific information about each person's demographics and baseline clinical characteristics. The average age was 64 years for all groups, with Group IV having the highest mean age (66.9 years). Male participants made up the majority (64%) while females made up 36%. Smoking, hypertension, and hyperlipidaemia were prevalent in all categories. The most severe renal failure was indicated by Group IV's lowest mean eGFR (22.83 ± 11.4).

Table 1: Study Participants' Baseline Features

Characteristic	Group I (n=38)	Group II (n=24)	Group III (n=22)	Group IV (n=16)	Total (n=100)
Male (%)	24(63.1)	16(66.6)	14(63.6)	10(62.5)	64(64.0)
Female (%)	14 (36.9)	8 (33.4)	8 (36.4)	6 (37.5)	36 (36.0)
Age (years)	61.3 ± 12.1	63.6 ± 11.5	64.4 ± 13.0	66.9 ± 12.8	64.0 ± 12.4
Hyperlipidaemia (%)	19(50.0)	12(48.9)	10(47.5)	9(53.3)	50(50)
Hypertension (%)	16(42.9)	11(44.4)	10(45.0)	8(50.0)	45(44.9)
Mean eGFR (ml/min/1.73 m²)	43.70 ± 12.5	41.71 ± 14.2	25.08 ± 10.6	22.83 ± 11.4	34.8 ± 22.9
Smoking (%)	11(28.6)	6(26.7)	6(27.5)	5(30.0)	28(28.1)

The study's primary goal was in-hospital mortality; significant adverse cardiac events (MACEs), which are characterized as a mix of recurrent AMI, stroke, and the requirement for revascularization, and duration of hospital stay were its secondary goals. The clinical results for every group are shown in Table 2.

Table 2: Clinical Results for Study Participants

Results	Group I	Group II	Group III	Group IV	Total
MACE (%)	5(14.3)	6(26.7)	7(32.5)	9(56.2)	27(27.0)
Mortality rate in hospitals (%)	2(4.4)	3(11.2)	3(15.0)	4(26.8)	12(11.9)
Duration of Hospitalization (days)	5.3 ± 2.2	6.2 ± 2.5	6.6 ± 2.7	7.9± 3.2	6.3 ± 2.7

At 26.8%, the in-hospital death rate was highest among patients in Group IV, followed by Group I at 4.3%, Group II at 11.1%, and Group III at 15.0%. Furthermore, with an average hospital stay of 7.9 days, Group IV patients had the longer clinical courses, suggesting more severe and drawn-out conditions. Those with both diabetes mellitus and kidney failure had significantly higher chances of experiencing adverse cardiac events, as seen by the significantly increased frequency of MACE in Group IV (56.2%). Significant variations in clinical outcomes across the four groups were found by comparative analysis using the Chi-square test and ANOVA ($p < 0.05$).

In Table 3, the specific statistical results are displayed. Age, gender, hypertension, hyperlipidaemia, and smoking status were among the possible confounders that were taken into account using multivariate regression analysis. Both diabetes mellitus and renal failure were found to be significant independent predictors of MACE and mortality in the hospital ($p < 0.01$) in the analysis. Gender was coded as a binary variable with females as the reference group. The odds ratio for males compared to females was 1.1 (95% CI 0.8–1.5), which was not statistically significant ($p = 0.42$).

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Table 3: Multiple Variable Regression Analysis for MACE and Mortality in Hospital

Variable	Odds Ratio	95% Confidence Interval	p-value
Smoking	1.4	0.9-1.9	0.16
Hypertension	1.2	0.9-1.7	0.23
Hyperlipidaemia	1.1	0.6-1.3	0.76
Age	1.3	1.1-1.4	0.03
Gender (Male)	1.1	0.8 – 1.5	0.42
Diabetes Mellitus	2.4	1.6-3.6	<0.01
Kidney failure	3.2	2.1-4.9	<0.01

Among 100 AMI patients, 62 were unexposed (no kidney failure) and 38 were exposed (with kidney failure). MACE occurred in 26.7% of unexposed versus 44.7% of exposed patients. In-hospital mortality was 6.5% in the unexposed compared to 21.1% in exposed groups. Exposed patients also had longer hospital stays (7.3 vs. 5.8 days). These results show that diabetes and kidney failure significantly increase adverse outcomes during hospitalization.

DISCUSSION

100 individuals with AMI were examined in the study, and they were divided into four groups according to whether or not they had kidney failure and diabetes mellitus. The main conclusions showed that there were notable variations between the groups. Group IV, which includes individuals with the greatest in-hospital death rate, was 26.8% for both diabetes and renal failure, compared to 4.4% for Group I, 11.2% for Group II, and 15.0% for Group III. Additionally, this group's 7.9-day average hospital stay was the longest, suggesting longer and more severe clinical courses. In addition, Group IV had the highest incidence of MACE at 56.2%, whereas Group I had the lowest at 14.3%, and Groups II and III had 26.7% and 32.5%, respectively. These results imply that the prognosis for individuals with AMI is considerably worsened when diabetes mellitus and renal insufficiency coincide.

These results were corroborated by multivariate regression analysis, which showed that renal failure and diabetes mellitus were both substantial independent predictors of MACE and in-hospital mortality. Even after controlling for other variables like age, smoking status, hypertension, and hyperlipidaemia, this remained the case. Diabetes mellitus and renal failure had significant effects on patient outcomes, as evidenced by their respective odds ratios of 2.4 and 3.2. The findings unequivocally show that people who have both diabetes mellitus and renal failure are significantly more likely to experience negative consequences after an AMI. Because of the cumulative impact on cardiovascular health, the much higher mortality rate in Group IV indicates that the combination of these disorders constitutes a high-risk patient profile. These patients' prolonged hospital stays indicate more severe or complex clinical courses that call for close monitoring and treatment of any consequences. Furthermore, the significant prevalence of MACE highlights how important it is for this patient group to receive thorough cardiovascular treatment and monitoring. Current research is shedding light on the predictive importance of renal failure and diabetes mellitus in people with AMI. According to a study of AMI patients, people who had both kidney failure and diabetes mellitus had noticeably worse clinical outcomes than people who had either illness alone or neither condition. During the 1- and 12-month follow-ups, this group in the study experienced higher rates of mortality in hospital as well as a higher incidence of MACE. The study highlighted the compounding danger posed by these comorbidities by showing a stepwise increase in 12-month composite MACE rates from patients without either disease to those with both [14]. Another recent study examined the effects of long-term treatment with SGLT-2 inhibitors (SGLT-2i) and GLP-1 receptor agonists (RA) in patients with diabetic AMI. GLP-1 RA and SGLT-2i patients had better in-hospital outcomes than those who did not get these treatments, according to this study, which included a large group of AMI patients. Patients receiving these medications specifically experienced fewer cases of acute cardiac failure and acute renal damage necessitating renal replacement treatment, indicating a protective benefit of these agents in the context of AMI [15]. The results of individuals without standard modifiable cardiovascular risk factors were examined in a multiethnic study involving a large group of Asian AMI patients. The prognosis of these patients was shown to be considerably worse when kidney failure was present, and patients with reduced renal function had higher fatality rates [16]. The kidney function at the time of AMI also retained its predictive relevance for almost a decade, according to a study. In comparison to individuals with normal renal function, those with lower eGFR values had significantly higher all-cause mortality rates, according to the study, which tracked patients for ten years. Kidney failure's long-term effects on patient survival after AMI are shown by this long-term analysis [17]. The combined impact of renal failure and diabetes on AMI outcomes was calculated in another study. Within a year following the original AMI occurrence, the researchers discovered that the presence of both diseases was associated with higher risks of mortality, heart failure, and recurrent myocardial infarction. The necessity of rigorous management and follow-up care for individuals with chronic comorbidities is further supported by this study [18].

GENERALIZABILITY

The study findings are applicable primarily to AMI patients in similar hospital settings in Bihar, but caution is needed when extrapolating results to other populations with different demographics or healthcare systems.

CONCLUSION

The study's conclusions highlight the need for strong and focused care approaches for AMI patients who also have diabetes mellitus and renal failure. In order to enhance these patients' results, clinicians should watch them closely and use more stringent preventative and treatment measures. In order to address the complex demands of this high-risk patient population and lessen the compounded negative impact of various comorbidities on cardiovascular health, the study emphasizes the significance of integrated care approaches.

LIMITATIONS

A small sample population that was included in the study is one of its shortcomings. Additionally, the results of this study are limited by the absence of a comparison group.

RECOMMENDATIONS

For AMI patients who also have diabetes and renal failure, healthcare practitioners should use integrated care approaches. To enhance outcomes for these patients, further research should concentrate on creating and assessing targeted therapies.

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LIST OF ABBREVIATIONS

CKD - Chronic Kidney Disease
CAD - Coronary Artery Disease
AMI - Acute Myocardial Infarction
DM - Diabetes Mellitus
eGFR - Estimated Glomerular Filtration Rate
MACE - Major Adverse Cardiac Events
SGLT-2i - Sodium-Glucose Cotransporter-2 Inhibitors
GLP-1 RA - Glucagon-like Peptide-1 Receptor Agonists

FUNDING SOURCE

There was no funding received.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest related to this study.

AUTHOR CONTRIBUTIONS

All authors contributed to study conception, data collection, analysis, and manuscript preparation; all have read and approved the final version.

DATA AVAILABILITY

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

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