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Original Research Article

Concomitant Renal Insufficiency and Diabetes Mellitus as Prognostic Factors for Acute Myocardial Infarction

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Abstract:

Background: Acute myocardial infarction (AMI) remains a significant cause of morbidity and mortality globally. The presence of comorbid conditions such as renal insufficiency and diabetes mellitus exacerbates the prognosis for AMI patients. Understanding the combined impact of these conditions is crucial for improving patient outcomes.

Aim: This study aims to evaluate the prognostic impact of concomitant renal insufficiency and diabetes mellitus on patients with acute myocardial infarction.

Methods: A retrospective cohort study was conducted at Anugrah Narayan Magadh Medical College and Hospital (ANMMCH), Gaya, Bihar, from December 2020 to February 2022. A total of 200 patients diagnosed with AMI were included. Participants were divided into four groups: renal insufficiency, diabetes mellitus, both conditions, and neither condition. Data were collected from medical records and analyzed using SPSS version 23.0. Kaplan-Meier survival analysis and Cox proportional hazards regression were utilized to assess one-year mortality and secondary clinical events.

Results: The one-year mortality rates were highest in patients with both renal insufficiency and diabetes mellitus (40%), followed by those with renal insufficiency alone (33.3%) and diabetes mellitus alone (24.3%). Patients without either condition had the lowest mortality rate (10%). Cox regression identified renal insufficiency as a significant independent prognostic factor (HR: 2.25, 95% CI: 1.46 - 3.48, $p < 0.001$). Secondary clinical events such as recurrent myocardial infarction, heart failure, and stroke were more frequent in patients with comorbid conditions.

Conclusion: Renal insufficiency and diabetes mellitus significantly worsen the prognosis of AMI patients, with the combined presence of both conditions posing the highest risk. These findings underscore the need for aggressive management and close monitoring of these high-risk patients.

Recommendations**:** Healthcare providers should prioritize comprehensive care strategies for AMI patients with renal insufficiency and diabetes mellitus to improve survival rates and reduce complications. Further research is recommended to explore targeted interventions for this vulnerable patient subgroup.

Keywords: Acute Myocardial Infarction, Renal Insufficiency, Diabetes Mellitus, Prognosis, One-Year Mortality.

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Introduction

Heart attacks or (AMI), continue to be the world's leading cause of morbidity and mortality. Diabetic mellitus and renal insufficiency are two comorbid diseases that continue to impact the prognosis of AMI patients despite advances in conventional therapy and interventional procedures. The clinical care is complicated by these comorbidities, which also considerably decrease patient outcomes.

Patients with AMI frequently suffer from renal insufficiency, which is defined by a decline in glomerular filtration rate (GFR). About 15% of persons in the US have chronic kidney disease (CKD), which raises the risk of cardiovascular events. AMI is among the adverse cardiovascular events (ACEI) that patients are more likely to have due to reduced renal function, which also hastens the course of atherosclerosis [1]. Furthermore, renal insufficiency makes it more difficult to use several pharmaceutical therapies and interventional

techniques, which frequently results in less than ideal therapeutic outcomes.

Similarly, patients with AMI have a much worse prognosis when they have diabetes mellitus, a metabolic condition marked by persistent hyperglycemia. According to recent estimates, 463 million persons worldwide were estimated to have diabetes [2]. The prevalence of diabetes has been increasing over time. Through a number of pathways, such as endothelial dysfunction, enhanced platelet aggregation, and pro-inflammatory states, diabetes is known to worsen coronary artery disease (CAD) [3].

The combination of diabetes mellitus and renal insufficiency increases the risk and makes a segment of patients especially vulnerable. Individuals with both disorders have synergistic effects that raise the risk of unfavourable outcomes and hasten the development of cardiovascular diseases. Research indicates that patients with AMI who both have diabetes mellitus and (CKD) have considerably greater death rates and poorer clinical outcomes than those who just have one of the conditions [4].

It is critical to recognise and appropriately treat these comorbidities given their significant influence on the prognosis of AMI. The purpose of this research is to assess the predictive significance of diabetes mellitus and concurrent renal insufficiency in patients suffering from acute myocardial infarction. Healthcare professionals can enhance patient outcomes by better stratifying patients and customising treatment interventions by knowing the degree of risk given by certain illnesses.

Methodology

Study Design: This is a retrospective cohort study conducted to evaluate the impact of concomitant renal insufficiency and diabetes mellitus on the prognosis of patients with acute myocardial infarction (AMI).

Study Setting: The study was conducted at Anugrah Narayan Magadh Medical College and Hospital (ANMMCH), Gaya, Bihar, from December 2020 to February 2022.

Participants: A total of 200 participants diagnosed with acute myocardial infarction were included in the study.

Inclusion Criteria

- Patients diagnosed with acute myocardial infarction based on clinical, electrocardiographic, and biochemical criteria.
- Patients aged 18 years and above.
- Patients with documented renal insufficiency (defined as an eGFR < 60 mL/min/1.73 m²) or diabetes mellitus (diagnosed based on fasting glucose levels, HbA1c, or history of diabetes treatment).

Exclusion Criteria

- Patients with a history of myocardial infarction within the last six months.
- Patients with severe comorbidities that could independently influence prognosis (e.g., advanced malignancy).
- Patients with incomplete medical records.
- Patients unwilling or unable to provide informed consent.

Bias: To minimize selection bias, participants were consecutively selected based on the inclusion and exclusion criteria. Information bias was mitigated by using standardized data collection procedures and ensuring data consistency through cross-referencing medical records.

Data Collection: Data were collected retrospectively from the hospital's medical records. The collected data included demographic information, medical history, clinical presentation, laboratory results, treatment details, and outcomes.

Procedure

1. Identification of eligible patients based on the inclusion and exclusion criteria.
2. Extraction of relevant data from medical records using a standardized data collection form.
3. Verification of data accuracy and completeness by cross-referencing multiple sources within the medical records.

Statistical Analysis: SPSS version 23.0 was used to analyse the data. The study population's clinical and demographic features were compiled using descriptive statistics. Categorical variables were shown as frequencies and percentages; whereas continuous variables were given as mean ± standard deviation. The mortality rate within a year following an acute myocardial infarction incident was the main outcome. The log-rank test was utilised to compare survival rates between groups, and Kaplan-Meier survival analysis was performed to estimate survival rates. After accounting for possible confounders, an independent predictive factor analysis for mortality was established using Cox proportional hazards regression analysis.

Results

Participant Characteristics: A total of 200 patients with (AMI) were included in the study. The demographic and clinical characteristics of the participants are summarized in Table 1.

Table 1: Demographic and Clinical Characteristics of Participants

Characteristic	Total (n = 200)	Renal Insufficiency (n = 60)	Diabetes Mellitus (n = 70)	Both Conditions (n = 40)	Neither Condition (n = 30)
Age (years, mean ± SD)	63.5 ± 11.8	67.5 ± 10.2	64.1 ± 10.7	69.8 ± 11.3	60.2 ± 12.0
Male, n (%)	140 (70)	45 (75)	48 (68.6)	28 (70)	19 (63.3)
Hypertension, n (%)	110 (55)	45 (75)	40 (57.1)	30 (75)	15 (50)
Hyperlipidemia, n (%)	95 (47.5)	30 (50)	35 (50)	20 (50)	10 (33.3)
Smoking, n (%)	85 (42.5)	25 (41.7)	32 (45.7)	17 (42.5)	11 (36.7)
Family history of CAD, n (%)	60 (30)	20 (33.3)	22 (31.4)	12 (30)	6 (20)
eGFR (mL/min/1.73 m², mean ± SD)	52.3 ± 17.4	38.5 ± 10.8	56.1 ± 14.6	35.2 ± 9.7	78.6 ± 19.2
HbA1c (%), mean ± SD	7.6 ± 1.3	7.2 ± 1.1	8.2 ± 1.5	8.8 ± 1.6	5.5 ± 0.7

Table 2: One-Year Mortality and Secondary Clinical Events

Group	One-Year Mortality Rate (%)	Recurrent MI, n (%)	Heart Failure, n (%)	Stroke, n (%)
Renal Insufficiency	33.3	12 (20)	18 (30)	6 (10)
Diabetes Mellitus	24.3	10 (14.3)	15 (21.4)	5 (7.1)
Both Conditions	40	14 (35)	20 (50)	6 (15)
Neither Condition	10	3 (10)	4 (13.3)	2 (6.7)

Patients with only renal insufficiency (33.3%) and only diabetes mellitus (24.3%) had the lowest one-year mortality rates, while patients with both renal insufficiency and diabetes mellitus had the highest one-year mortality rate (40%). The lowest one-year death rate (10%) was seen in patients without either disease. A substantial independent predictive predictor for one-year mortality was found to be renal insufficiency, although diabetes mellitus was on the verge of significance.

Discussion

The purpose of the research was to find out how diabetes mellitus and renal insufficiency affected the prognosis of individuals suffering from acute myocardial infarction (AMI). The study comprised 200 patients, who were categorised into groups according to whether they had diabetes mellitus, renal insufficiency, both conditions, or neither condition. According to the findings, patients with diabetes mellitus and renal insufficiency combined had the highest one-year death rate (40%) followed by patients with renal insufficiency alone (33.3%) and diabetes mellitus alone (24.3%). The one-year death rate was 10% lowest for patients without either disease. These results show that there is a distinct gradient in the risk of death linked to these concomitant diseases. According to the statistics, individuals with AMI have a much worse prognosis when they also have diabetes mellitus and renal insufficiency. This emphasises the necessity for aggressive care and continuous patient observation.

Patients with both disorders had considerably lower survival rates than other groups, according to survival analysis using the Kaplan-Meier technique; the log-rank test revealed a p-value of less than 0.001. This provides more evidence in favour of the theory that the presence of these comorbid illnesses influences patient outcomes after AMI.

Renal insufficiency was found to be a significant independent prognostic factor for one-year mortality by the Cox proportional hazards regression analysis, with a hazard ratio (HR) of 2.25 (95% CI: 1.46 - 3.48, $p < 0.001$). As an independent predictor, diabetes mellitus was becoming close to statistical significance (HR: 1.45, 95% CI: 0.97 - 2.17, $p = 0.068$). The risk of death was considerably higher for patients with both diseases (HR: 2.80, 95% CI: 1.75 - 4.48, $p < 0.001$). Additionally, age was found to be a significant prognostic factor (HR: 1.03, 95% CI: 1.01 - 1.05, $p = 0.003$), suggesting that patients who are older are more likely to die.

In patients with one or both problems, the incidence of secondary clinical events such as heart failure, stroke, and recurrent myocardial infarction was higher. Particularly, the highest incidence of heart failure (50%) and stroke (15%), as well as recurrent MI (35%), was seen in individuals with both diseases. This emphasises the combined danger that these comorbidities provide, both in terms of mortality and the possibility of developing further harmful cardiovascular events.

The inflammatory response is a major factor in predicting the prognosis of AMI in patients with type 2 diabetes, in addition to renal impairment. According to a study by Bokovikov et al. (2023), patients with T2DM and AMI have greater concentrations of inflammatory markers like neutrophils, leukocytes, and high-sensitivity C-

reactive protein (hsCRP). Lower clinical outcomes are correlated with these increased levels, which are suggestive of a more severe inflammatory response [5].

It has been demonstrated that, in T2DM patients with AMI, glycated haemoglobin (HbA1c) levels significantly correlate with cardiac function and prognosis. Elevated HbA1c levels were linked to lower cardiac function and an increased risk of severe adverse cardiovascular events. This emphasises the significance of appropriate blood glucose control in these individuals [6].

The prognosis of patients with acute myocardial infarction (AMI) is significantly impacted by the coexistence of diabetes mellitus and renal insufficiency, according to recent studies. Research shows that in patients with type 2 diabetes mellitus (T2DM), renal impairment is a significant risk factor for the onset and exacerbation of AMI severity. More specifically, in this patient population, a decrease in glomerular filtration rate (GFR) below 60 ml/min is linked to a higher risk of death [7].

Conclusion

The study's conclusions highlight the significant effects of diabetes mellitus and renal impairment on the prognosis of AMI patients. These illnesses raise the risk of death and other unfavourable clinical outcomes considerably, making improved therapeutic techniques necessary for the optimal management of these high-risk patients. The information emphasises how crucial it is to incorporate comprehensive care plans that take these comorbidities into account in order to increase patient survival and lower complications in AMI patients.

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