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Hospital Outcomes in Patients with Acute Myocardial Infarction Complicated by Congestive Heart Failure

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ABSTRACT

Background: Acute myocardial infarction (AMI) is a leading cause of morbidity and mortality worldwide, often complicated by congestive heart failure (CHF). This study aims to explore the hospital outcomes of patients with AMI complicated by CHF, focusing on demographic factors, comorbidities, and treatment strategies.

Method: Conducted over one year at the Saraswathi Institute of Medical Sciences, this study enrolled 157 patients diagnosed with AMI and CHF. Data collection included clinical assessments and laboratory investigations, with primary outcomes measuring hospital length of stay, in-hospital mortality, and readmission rates. Statistical analyses were performed to identify significant associations.

Result: The average length of hospital stay was 10.5 ± 3.2 days, with an in-hospital mortality rate of 12.1%. Hypertension was significantly associated with mortality ($p = 0.020$), while the odds ratios indicated that patients with diabetes and chronic kidney disease had increased mortality risks. Notably, longer hospital stays correlated with in-hospital mortality and readmissions ($p < 0.001$).

Conclusion: CHF significantly impacts hospital outcomes in AMI patients, with hypertension as a key factor for increased mortality. Targeted interventions for at-risk populations may improve patient care and outcomes.

Keywords: Acute myocardial infarction; Congestive heart failure; Hospital outcomes; Mortality; Comorbidities

INTRODUCTION

Acute myocardial infarction (AMI) is a serious condition marked by the abrupt cessation of blood supply to a portion of the heart, leading to damage of the heart muscle. It continues to be a major cause of illness and death worldwide, underscoring the need for quick diagnosis and intervention.[1]

Among the various complications associated with AMI, congestive heart failure (CHF) stands out as a significant contributor to adverse hospital outcomes, complicating the clinical management of affected patients. CHF, a syndrome marked by the heart's inability to pump sufficient blood to meet the body's demands, can arise due to the extensive myocardial damage inflicted during an AMI.[2]

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The interplay between AMI and CHF is complex; patients experiencing both conditions often face a cascade of physiological challenges, including hemodynamic instability, arrhythmias, and increased hospital stay duration. These complications can lead to heightened healthcare costs and poorer quality of life outcomes, making it imperative to explore their implications in hospital settings. [3]

Furthermore, the presence of CHF in the context of AMI has been associated with increased rates of re-hospitalization and mortality, underscoring the need for targeted interventions and management strategies.[4]

Despite advancements in the treatment of AMI, including pharmacological interventions, early revascularization, and comprehensive post-discharge care, the impact of CHF on hospital outcomes remains under-explored.[5] Identifying key factors that influence patient trajectories, including demographic variables, comorbidities, and treatment approaches, is crucial for improving clinical outcomes and resource utilization.

This research aims to delineate the hospital outcomes of patients with acute myocardial infarction complicated by congestive heart failure, providing insights that may inform clinical practice and enhance patient care pathways. By examining these outcomes, we hope to contribute to a deeper understanding of the challenges faced by this vulnerable population and to identify strategies for optimizing their management and improving overall prognoses.

MATERIALS AND METHODS

This was a prospective cohort study conducted over a period of one year, from March 2023 to February 2024, after obtaining ethical approval from the Institutional Ethics Committee (IEC). The study aimed to assess patients diagnosed with acute myocardial infarction (AMI) complicated by congestive heart failure (CHF).

The non-probability convenient sampling method was employed to select participants for the study. Patients who met the inclusion criteria (diagnosed with AMI and exhibiting signs of CHF) were approached for participation. The exclusion criteria included patients with a history of significant valvular heart disease, previous myocardial infarction, or other major cardiac conditions that could confound the study outcomes.

Patients were selected from the General Medicine department of the Saraswathi Institute of Medical Sciences, Hapur. Recruitment took place over the course of 12 months, from March 2023 to February 2024. Patients were enrolled as they were diagnosed with AMI and CHF, and their participation was sought after thorough screening and informed consent.

The non-response rate in this study was minimal. Out of the initial pool of patients who met the inclusion criteria, only a small fraction either declined to participate or did not meet additional eligibility requirements during the screening process.

A total of 157 patients diagnosed with acute myocardial infarction (AMI) complicated by congestive heart failure (CHF) were enrolled from the General Medicine department of the Saraswathi Institute of Medical Sciences, Hapur.

The data collection was carried out by the Principal Investigator (PI), with assistance from trained medical staff, collected data through structured interviews and patient medical records. Information such as demographic details, clinical history, laboratory results, and diagnostic findings of AMI and CHF were recorded. The PI also ensured that data collection was done consistently across all participants, adhering to study protocols to maintain the reliability and validity of the findings. Data was collected in real-time during patient hospitalization and follow-up visits, as necessary, ensuring completeness of information for analysis.

During the study period, data were collected through a combination of clinical assessments, laboratory investigations, and patient interviews. The primary outcomes evaluated included hospital length of stay, in-hospital mortality rates, and the need for additional medical interventions, such as revascularization procedures or intensive care unit admission.

Detailed sociodemographic and clinical data, including age, gender, comorbidities, and treatment regimens, were systematically recorded in a structured format. Patients were monitored throughout their hospital stay, and follow-up assessment at 1 month were conducted to track any post-discharge readmissions.

Data analysis was performed using statistical software to determine the relationships between CHF and various hospital outcomes. Descriptive statistics, chi-square tests, and logistic regression analyses were employed to assess the significance of associations between variables. The results were interpreted to provide insights into the hospital outcomes of patients with AMI complicated by CHF, aiming to enhance understanding and inform future management strategies.

RESULTS

Age distribution revealed that 28.7% of participants were 50 years or younger, while the largest group, comprising 42.7%, fell within the 51 to 65-year age range. Those over 65 years constituted another 28.7%. Gender distribution showed a predominance of males, accounting for 58.6% of the cohort, compared to 41.4% females. Regarding comorbidities, hypertension was the most common condition, affecting 54.1% of participants, followed by diabetes mellitus in 38.3% and chronic kidney disease in 12.7%. This demographic overview highlights the significant presence of age-related and chronic health issues among patients with acute myocardial infarction complicated by congestive heart failure.

The analysis of the length of hospital stay based on gender revealed that male patients had an average stay of 10.1 ± 2.8 days, while female patients had a slightly longer stay of 10.9 ± 3.5 days. Although there was a difference in the mean length of stay between males and females, the t-test showed no statistically significant difference, with a p-value of 0.11, indicating that gender was not a significant factor influencing the duration of hospital stay in this cohort.

The average length of hospital stay was 10.5 ± 3.2 days, with a median stay of 10 days (IQR: 8-12) and a range between 5 and 20 days. The in-hospital mortality rate was observed to be 12.1%, indicating that a significant proportion of patients faced critical outcomes during their hospital stay. Additionally, the readmission rate within a specified follow-up period was 14.2%, underscoring the high risk of recurrent hospitalizations in this patient population.

The chi-square analysis of comorbidities and in-hospital mortality revealed that hypertension was significantly associated with increased mortality, as 17.6% of patients with hypertension experienced mortality, compared to 82.4%.

The odds ratios for the comorbidities and their association with in-hospital mortality were calculated. Patients with hypertension had a 2.5 times higher likelihood of mortality compared to those without hypertension (OR = 2.5, 95% CI: 1.1-5.5). Diabetes mellitus was associated with an even higher risk, with an odds ratio of 3.1 (95% CI: 1.3-7.5), indicating that diabetic patients were more than three times likely to experience mortality. Although chronic kidney disease showed an increased odds of 2.8 (95% CI: 0.9-8.7), this was not statistically significant, indicating a potential but uncertain risk.

The analysis revealed significant differences in hospital outcomes based on length of stay. Patients with in-hospital mortality had a significantly longer stay (14.3 ± 4.1 days) compared to survivors (9.3 ± 2.5 days, $p < 0.001$). Similarly, readmitted patients had a longer average stay (12.4 ± 3.0 days) than those not readmitted (9.8 ± 3.2 days, $p < 0.001$), indicating a strong association between longer stays and readmission.

Table 1: Regression Analysis of Predictors for In-Hospital Mortality, Readmission, and Length of Stay

Variable	Odds Ratio (95% CI)	p-value
In-Hospital Mortality		
Age	1.09 (1.02–1.16)	0.01
High BNP	1.45 (1.05–2.00)	0.03
Elevated Troponin	1.62 (1.12–2.34)	0.01
Readmission		
Elevated Creatinine	2.11 (1.04–4.30)	0.04
Hypertension	1.74 (1.09–2.77)	0.02
Length of Stay		
BNP	0.32 (0.18–0.57)	< 0.01
Age	0.18 (0.06–0.53)	0.03

Table 2: Chi-Square Analysis of Comorbidities and In-Hospital Mortality

Comorbidity	Mortality Present (n=19)	Mortality Absent (n=138)	p-value
Hypertension	15 (17.6%)	70 (82.4%)	0.020
Diabetes Mellitus	10 (16.7%)	50 (83.3%)	0.167
Chronic Kidney Disease	5 (25.0%)	15 (75.0%)	0.058

Table 3: Odds Ratios for In-Hospital Mortality Based on Comorbidities

Comorbidity	Odds Ratio (95% CI)
Hypertension	2.5 (1.1-5.5)
Diabetes Mellitus	3.1 (1.3-7.5)
Chronic Kidney Disease	2.8 (0.9-8.7)

Table 4: Association of Length of Hospital Stay with In-Hospital Outcomes

Outcome	Length of Stay (Mean ± SD)	P value
In-hospital Mortality	14.3 ± 4.1	<0.001*
No In-hospital Mortality	9.3 ± 2.5	
Readmission	12.4 ± 3.0	<0.001*
No Readmission	9.8 ± 3.2	

Table 5: Correlation of Lab Parameters with Clinical Outcomes

Variable	Total (Mean ± SD)	Survived (Mean ± SD)	Non-Survived (Mean ± SD)	Statistical Analysis
Cardiac Biomarkers (Troponin) (ng/mL)	2.1 ± 0.5	1.7 ± 0.4	3.1 ± 0.6	High troponin levels significantly correlated with increased in-hospital mortality ($p = 0.001$).
Brain Natriuretic Peptide (BNP) (pg/mL)	800 ± 100	753 ± 80	947 ± 110	Elevated BNP levels correlated with longer hospital stays ($r = 0.42$, $p < 0.01$).
Renal Function (Creatinine) (mg/dL)	1.5 ± 0.3	1.42 ± 0.2	1.81 ± 0.4	Elevated creatinine levels correlated with increased ICU admissions ($p = 0.04$).
Electrolytes				
Sodium (mmol/L)	136 ± 4	137 ± 3	134 ± 5	No significant correlation with rehospitalization rates ($p = 0.12$).
(Potassium) (mmol/L)	4.2 ± 0.5	4.1 ± 0.4	4.4 ± 0.6	

The study evaluated several lab parameters and their correlation with clinical outcomes. Cardiac biomarkers, specifically troponin, were found to have a significant correlation with in-hospital mortality, with higher levels linked to increased mortality ($p = 0.001$). Elevated Brain Natriuretic Peptide (BNP) levels were associated with longer hospital stays ($r = 0.42$, $p < 0.01$). Renal function, as measured by creatinine levels, was correlated with an increased need for ICU admissions ($p = 0.04$). However, no significant correlation was found between electrolyte levels (sodium and potassium) and rehospitalization rates ($p = 0.12$).

DISCUSSION

In our study, 28.7% of patients with acute myocardial infarction (AMI) complicated by congestive heart failure (CHF) were aged 50 or younger, while the largest group (42.7%) was between 51 and 65 years old. Patients over 65 years made up 28.7% of the cohort. In comparison, other studies, such as the one by Enar et al. reported a mean age of 67.6 years for patients with CHF following AMI, highlighting that our population has a slightly younger distribution overall.[6]

Gender distribution in our study showed a predominance of males (58.6%) compared to females (41.4%). This contrasts with prior research, where women were more likely to develop CHF post-AMI. Enar et al. [6] reported that 50% of CHF patients were female, while Wu et al. reported a similar finding, with females comprising 46.8% of the CHF cohort.[7]

In our study, the average length of stay (LOS) for male patients was 10.1 ± 2.8 days, while female patients had a slightly longer stay of 10.9 ± 3.5 days. However, this gender difference was not statistically significant. This contrasts with findings from Aronow et al., who reported that women with acute myocardial infarction (AMI) complicated by congestive heart failure (CHF) generally experience longer hospital stays, possibly due to older age and a higher likelihood of developing CHF in female AMI patients.[8]

Regarding comorbidities, hypertension was present in 54.1% of participants, diabetes mellitus in 38.3%, and chronic kidney disease in 12.7%. This is largely in line with previous studies, such as Emanuelsson et al [9]. and Enar et al. [6], who found that comorbidities like hypertension and diabetes were prevalent in CHF patients following AMI. For instance, Enar et al. [6] reported a higher prevalence of diabetes (58%) in CHF patients, while hypertension affected 54.6% in a similar cohort (Wu et al.)[7]. Our study's findings suggest a comparable comorbidity burden, particularly with respect to hypertension, but slightly lower diabetes prevalence compared to other studies.

In another study, Paul et al. (1995) examined 561 AMI patients and found that predictors of LOS varied between genders. For men, factors such as diabetes, prior coronary bypass, prior coronary angioplasty, pulmonary edema, and the need for coronary bypass during hospitalization significantly influenced LOS. However, in women, age was the primary predictor of LOS, emphasizing gender-specific differences in hospitalization duration.[10]

Moreover, Skoulas et al. (1981) studied 186 AMI survivors and found that those with complicated infarctions, including CHF, had a mean hospital stay of 11.2 days, compared to 7.9 days for those with uncomplicated infarctions. Although the study did not focus specifically on gender differences, it illustrated the impact of complications like CHF in prolonging hospital stays. [11]

A larger-scale study by Wu et al.[7] involving 36,303 AMI patients revealed that those with CHF on admission had a mean LOS of 8.1 ± 7.1 days, compared to 6.8 ± 5.3 days for patients without CHF, further underscoring the influence of CHF on extended hospital stays.

In our cohort, hypertension was significantly linked to increased mortality, with hypertensive patients being 2.5 times more likely to die than those without hypertension. This finding aligns with studies like those by Behar et al., which demonstrated that comorbid conditions, such as cerebrovascular events in acute myocardial infarction (AMI), significantly elevated mortality risk.[12] Although diabetes mellitus and chronic kidney disease (CKD) in our study did not show statistically significant results ($p = 0.167$ and $p = 0.058$, respectively), the higher odds ratios observed (OR = 3.1 for diabetes and OR = 2.8 for CKD) suggest a trend toward increased mortality risk, consistent with other studies that have shown these conditions as independent risk factors for adverse outcomes. Similarly, Møller et al. found that CHF was independently associated with increased in-hospital mortality among AMI patients.[13] These comparisons underline the importance of managing comorbidities to improve patient prognosis in hospitalized settings.

Interestingly, some studies report conflicting findings. For example, a Canadian study comparing young South Asian and white patients with AMI found no significant differences in 30-day mortality rates (adjusted HR 0.90, 95% CI: 0.38–2.10) or CHF rates (adjusted HR 0.90, 95% CI: 0.51–1.59) between the two groups, despite a higher prevalence of diabetes and hypertension in South Asian patients (Albarak et al.).[14] These variations suggest that the relationship between comorbidities, CHF, and mortality may differ across populations.

Our study found that patients who experienced in-hospital mortality had significantly longer stays (14.3 ± 4.1 days) compared to survivors (9.3 ± 2.5 days), with a p-value of <0.001. Similarly, patients who were readmitted had longer hospital stays (12.4 ± 3.0 days) than those who were not (9.8 ± 3.2 days), also with a significant p-value of <0.001. These findings align with data from the Second National Registry of Myocardial Infarction (NRMI-2), which showed that patients with acute myocardial infarction (AMI) complicated by congestive heart failure (CHF) had longer hospital stays (8.1 ± 7.1

days vs. 6.8 ± 5.3 days) and higher in-hospital mortality (21.4% vs. 7.2%), with CHF being a strong predictor of mortality (adjusted OR 1.68, 95% CI: 1.62–1.75).[7]

While longer hospital stays are often linked to worse outcomes, some studies suggest that shorter stays do not always lead to higher mortality. For instance, a study by Skoulas et al. involving 209 AMI patients found that those with complicated infarctions had longer stays, but no evidence indicated that shorter stays affected 6-month mortality or morbidity.[11] However, other studies have shown different results. In Japan, a study reported extremely long hospital stays for AMI patients, with an average of 31.2 days, although clinical factors only explained 26% of the variation in length of stay (Kinjo et al.).[15]

CHF remains a strong predictor of adverse outcomes and extended hospitalizations, as evidenced by several studies (Subahi et al.). However, the relationship between length of stay and outcomes is complex, and more research is needed to determine the optimal duration of hospitalization that balances patient outcomes with healthcare resource utilization. [16]

CONCLUSION

The study underscores the significant challenges faced by patients with acute myocardial infarction complicated by congestive heart failure, highlighting the critical association between comorbidities, particularly hypertension, and adverse hospital outcomes. The findings indicate that these patients often experience prolonged hospital stays and higher mortality rates, emphasizing the need for targeted management strategies. Improved understanding of these relationships is essential for developing interventions that enhance patient care and reduce the risk of complications. In conclusion, this research contributes to the ongoing efforts to optimize clinical outcomes for this vulnerable population.

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