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ORIGINAL ARTICLE

Prognostic Factors and Outcomes in Elderly Patients with Acute Cardiovascular Events - A Retrospective Analysis

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ABSTRACT

Background: Elderly patients presenting with acute cardiovascular events (ACVEs) often have higher mortality from atypical symptoms, comorbidities, and delayed treatment. Prognostic markers need to be accurately identified in order to improve outcomes.

Aim: To assess the prognostic factors and clinical outcomes of elderly patients (≥ 65 years) admitted with ACVEs at a tertiary care hospital in Pakistan.

Methods: This retrospective observational study of 100 patients over age 65 years with acute myocardial infarction, acute heart failure, or unstable angina. Demographics, comorbidities, biomarkers, echocardiographic parameters, treatment timelines, and outcomes were analyzed. Independent predictors of in-hospital mortality were determined by performing multivariate logistic regression.

Results: Mean age was 74.1 ± 6.3 years, and male patients were 56%. In hospital mortality was 17 per cent, and 29 per cent were readmitted within six months. The LVEF <40% (OR 3.4; p<0.001), NT-proBNP >1800 pg/mL (OR 2.9; p=0.003), age >75 years (OR 2.6; p=0.008), serum creatinine >1.5mg/dL (OR 2.1; p=0.021) and PCI delay > 90 minutes (OR 1.7; p=0.042) were found to be independent predictors of mortality. Reduction of mortality risk by beta blockers was significant (OR 0.59, p=0.021).

Conclusion: Elderly patients with ACVEs have high mortality, especially in the presence of reduced LVEF and renal impairment, as well as delayed PCI. Beta-blocker therapy is protective. Identification of these prognostic factors in early stages can improve outcomes, especially in resource-constrained settings.

Keywords: Acute myocardial infarction, elderly, heart failure, NT-proBNP, mortality predictors, beta-blockers, Pakistan

INTRODUCTION

Cardiovascular diseases (CVDs) are the leading cause of death globally and are estimated to contribute to 17.9 million deaths per year (31 per cent of all global deaths) according to the World Health Organization (WHO)[2]. A large proportion of these occur in the over 65 years age category, which is a vulnerable group to acute cardiovascular events (ACVEs), including acute myocardial infarction (AMI), acute heart failure (AHF), and unstable angina (UA). Increasing life expectancy due to advancements in healthcare and socioeconomic improvement leads to the proportion of elderly individuals also increasing to above 1.5 billion worldwide in 2050[3]. It is anticipated that this demographic shift will

also push the burden of acute cardiovascular conditions in older adults higher[1].

Elderly patients benefit from well well-developed health care system with robust emergency cardiac care, early intervention, and multi-disciplinary rehabilitation programs in developed countries[9]. The situation, however, is much more complex when it comes to developing nations such as Pakistan. Pakistan is in the process of a rapid epidemiological transition; non-communicable diseases now contribute to more than 58 per cent of total mortality, and 29 per cent of total deaths are due to CVDs, which makes it the leading killer[8]. With over 15 million elderly population in Pakistan, the elderly have unique challenges which include delayed healthcare access, socioeconomic constraints, lack of specialized geriatric cardiology services, and high prevalence of unrecognized comorbidities, such as diabetes mellitus, hypertension, chronic kidney disease, and malnutrition[6].

ACVEs are usually atypical or silent in older adults and may present with symptoms like fatigue, dyspnea, syncope, or confusion rather than classic chest pain. These nonspecific signs are often underdiagnosed, delayed in reperfusion therapy, and are associated with increased in-hospital complications[7]. Additionally, the elderly are more prone to complications related to frailty, polypharmacy, altered drug metabolism, and diminished physiological reserve, and are more likely to die, be readmitted, or experience functional decline[8].

In clinical practice, several factors have been recognized that play a role in the prognosis in elderly patients with ACVEs[9]. These include advanced age, low cardiac biomarkers (LVEF), high cardiac biomarkers (NT-proBNP and Troponin I), renal impairment, delay in percutaneous coronary intervention (PCI), and no guideline-directed medical therapy (GDMT)[10]. Despite the vast amount of research conducted in the Western population, South Asian elderly cohorts in the context of the Pakistani healthcare system, where patient presentation, treatment initiation, and post-discharge follow-up are variable, resulting in inconsistency, data specific to South Asians is lacking[12].

We conducted a retrospective study to find out prognostic indicators and clinical outcomes of elderly patients (≥65 years) admitted with ACVEs in a tertiary care hospital in Pakistan[13]. The study is to analyse the relationship between demographic variables, clinical presentation, biochemical markers, treatment timelines, and outcome, to identify key predictors of mortality and morbidity[15]. This work is expected to provide important information to healthcare providers and policymakers in the development of risk stratification models and the design of geriatric-specific cardiac protocols for early intervention and long-term management in low-resource settings[11].

MATERIALS AND METHODS

Study Design and Setting

Current retrospective observational study was conducted at the Department of Cardiology, University of Lahore Teaching Hospital, a major tertiary care referral center in Punjab, Pakistan. The aim was therefore to identify prognostic factors and clinical outcomes in elderly patients who were admitted with acute cardiovascular events (ACVEs). The data used for this study were extracted from archived electronic and paper-based medical records stored in the hospital health information system. The study protocol was approved by the Institutional Review Board (IRB) before data access, and all patient data were anonymized to protect confidentiality.

Study Duration and Sample Size

All eligible patients who were admitted from January 2022 to December 2023 went into the study. The selection of 100 elderly patients was made through nonprobability consecutive sampling. The patients included in these studies were more than 65 years of age and had been diagnosed with acute myocardial infarction (STEMI or NSTEMI), acute heart failure, or unstable angina. In the context of a tertiary care setting and the available patient load during the study period, the sample size of 100 was considered adequate for preliminary exploratory analysis.

Inclusion and Exclusion Criteria

The study included patients who were 65 years of age or older who had an acute cardiovascular event confirmed on clinical assessment, electrocardiographic changes, elevated cardiac biomarkers, and echocardiographic support. Only patients with complete medical records containing laboratory tests, echocardiography, and discharge summaries were included. Patients were excluded if they had had cardiac surgery within the last 30 days or were diagnosed with terminal malignancy, had severe sepsis, or their hospital records were incomplete or missing critical clinical or laboratory data.

Data Collection Procedure

Data were abstracted from patient files and electronic databases using a predesigned data abstraction form and manually. Included in the demographic data recorded were age and gender. The collected clinical data included the nature of presenting symptoms, blood pressure, and heart rate on admission, and Killip classification for heart failure severity. Notes were made for comorbidities including diabetes mellitus, hypertension, chronic kidney

disease, and prior cerebrovascular accidents. Cardiac troponin-I levels, NT-proBNP, serum creatinine, hemoglobin levels, and electrolytes were reviewed in laboratory investigations. Left ventricular ejection fraction (LVEF), wall motion abnormalities, and valvular function were recorded using echocardiography. The therapeutic data included the use of beta blockers, ACE inhibitors or ARBs, antiplatelets, statins, and anticoagulants, and the intervention details, including percutaneous coronary intervention (PCI) and its timing relative to admission. Specifically, time-sensitiveparameters such as door-to-balloon time for patients undergoing PCI were documented to measure delays in care. The outcome variables considered were three: in-hospital mortality, length of hospital stay (in days), and six-month readmission rates.

Statistical Analysis

All data were compiled in Microsoft Excel and then analyzed using IBM SPSS Statistics Version 26. Summary statistics describing the baseline characteristics of the study population were used. Means with standard deviations were used to express continuous variables such as age, NT-proBNP, and LVEF, and the categorical variables, such as gender, comorbid conditions, and medication use, were summarized by frequencies and percentages. Prognostic factors were associated with clinical outcomes, and the associations were evaluated by chi-square tests for categorical variables and independent t-tests for continuous variables. A multivariate logistic regression model assessing independent predictive value for in-hospital mortality and readmission was performed, adjusting for confounding variables. A p-value of less than 0.05 was defined as statistical significance.

RESULTS

This retrospective study was included a total of 100 elderly patients aged 65 years and above. The participants were 74.1±6.3 years of age; 56(56%) males and 44 (44%) females. Acute myocardial infarction (AMI) was the most common presentation in the majority of the patients (62%). The diagnoses included 24% of this group with acute heart failure, and 14% with unstable angina. Chest pain (72%), shortness of breath (58%), fatigue (41%), and altered mental status (11%) were the most commonly reported symptoms; thus, the atypical presentations were high.

The cohort had frequent comorbidities. In 78% of patients, hypertension was found; in 63%, diabetes mellitus; CKD in 27%, and a history of stroke in 12%. Of the male patients, 21% were obese (BMI >30), and 31% had a positive smoking history (Table 1).

Clinically significant abnormalities were found to be high in prevalence in laboratory findings. In 46% of patients, NT-proBNP levels were >1800 pg/mL and correlated with the severity of heart failure. Elevated Troponin I was confirmed in all AMI patients (n=62), and thus myocardial injury. 39% of patients had serum creatinine >1.5 mg/dL, and hence renal impairment. Thirty-four percent of patients had hemoglobin levels below 12 g/dL, consistent with anemia. Hyponatremia occurred in 17%, hypokalemia in 9%, electrolyte imbalances were common (Table 2).

Echocardiographic assessment revealed a mean LVEF of 41.6 ± 11.2%, as well as 34% of patients with LVEF <40% and thus compromised systolic function.

Of all patients, 52% underwent percutaneous coronary intervention (PCI), and 31% of patients (n=16) had a door-to-balloon time greater than 90 minutes because of delays in triage or transport. Some 76% of the patients were given beta blockers, while 69% received ACE inhibitors or ARBs. Dual antiplatelet therapy was given in 93%, and high-intensity statins in 85%. Reasons for omission of beta blockers included contraindication of hypotension, bradycardia, or advanced AV block.

In-hospital mortality was 17% and was much higher in patients aged >75 years, LVEF <40%, elevated NT-proBNP, and renal dysfunction. Hospital stay was 7.2 ± 2.9 days. In 29 patients (29%), readmission was at 6 months, most commonly for decompensated heart failure or ischemic recurrences. Beta blocker use was also associated with a statistically significant reduction in mortality.

Independent predictors of in-hospital mortality were identified using a multivariate logistic regression. LVEF <40% was the strongest predictor of mortality risk, with a 3.4 ($p<0.001$) fold increase. In addition, age >75 years (OR 2.6, p=0.008), NT-proBNP >1800 pg/mL (OR 2.9, p=0.003), serum creatinine >1.5 mg/dL (OR 2.1, p=0.021), and PCI delay >90 minutes (OR 1.7, p=0.042) were other important predictors. Importantly, beta blockers were a protective factor, decreasing the mortality risk by 41% (OR 0.59, p = 0.021) (Table 3).

This horizontal bar chart showed how strongly and in what direction key clinical predictors are associated with in-hospital mortality. LVEF < 40% (OR 3.4), NT-proBNP > 1800 pg/mL (OR 2.9), and age > 75 years (OR 2.6) have a strong positive association with increased mortality risk. Elevated risk is also associated with serum creatinine >1.5 mg/dL (OR 2.1) and PCI delay >90 minutes (OR 1.7). On the other hand, the use of beta blockers (OR 0.59) has a protective effect, significantly lowering the odds of mortality in this patient group. The neutral risk threshold is represented by the grey dashed line at OR=1 (Fig. 1).

Table 1. Baseline Characteristics, Comorbidities, and Outcomes in Elderly Patients with ACVEs (n=100)

Variable	Frequency (n)	Percentage (%)	Mean ± SD
Age (years)	—	—	74.1 ± 6.3
Gender			
• Male	56	56%	—
• Female	44	44%	—
Cardiovascular Event			
• AMI	62	62%	—
• Acute Heart Failure	24	24%	—
• Unstable Angina	14	14%	—
Comorbidities			
• Hypertension	78	78%	—
• Diabetes Mellitus	63	63%	—
• Chronic Kidney Disease	27	27%	—
• History of Stroke	12	12%	—
Key Outcomes			
• In-hospital Mortality	17	17%	—
• 6-month Readmission	29	29%	—
Hospital Stay (days)	—	—	7.2 ± 2.9

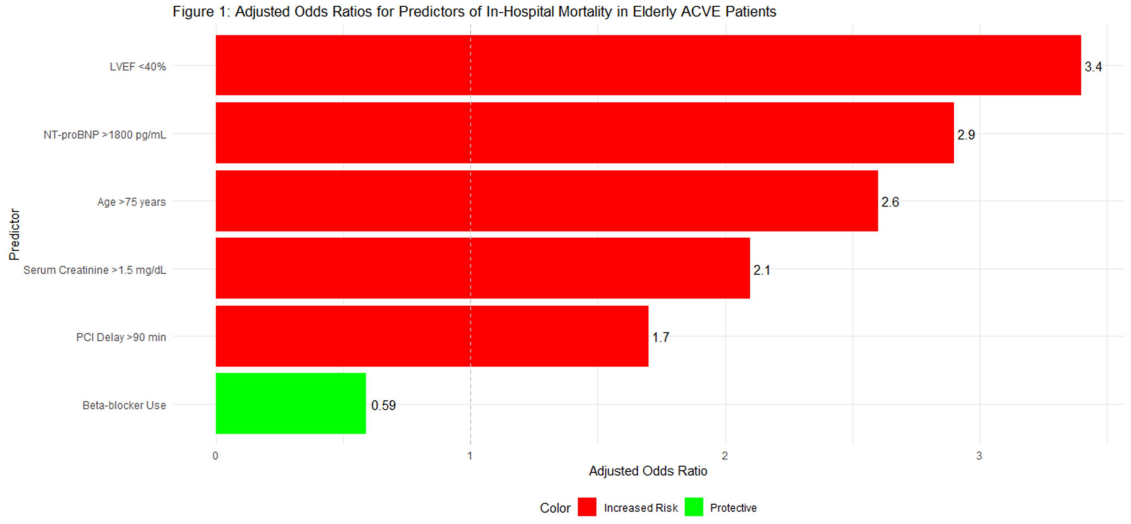
Table 2. Biomarker Abnormalities and Frequency (n = 100)

Biomarker/Test	Frequency (n)	Percentage (%)
NT-proBNP >1800 pg/mL	46	46%
Troponin-I Elevated (in AMI)	62	100% (of AMI)
Serum Creatinine >1.5 mg/dL	39	39%
Hemoglobin <12 g/dL	34	34%
Hyponatremia (<135 mmol/L)	17	17%
Hypokalemia (<3.5 mmol/L)	9	9%

Table 3. Multivariate Logistic Regression – Independent Predictors of In-Hospital Mortality (n = 100)

Predictor	Adjusted Odds Ratio (OR)	P-value
Age >75 years	2.6	0.008
LVEF <40%	3.4	0.000
NT-proBNP >1800 pg/mL	2.9	0.003
Serum Creatinine >1.5 mg/dL	2.1	0.021
PCI Delay >90 minutes	1.7	0.042
Beta-blocker Use	0.59	0.021

Fig-1: Adjusted Odds Ratios for Predictors of In-Hospital Mortality in Elderly Patients with Acute Cardiovascular Events (ACVEs)



DISCUSSION

This retrospective study provided an in-depth evaluation of prognostic factors influencing in-hospital mortality and short-term outcomes among elderly patients admitted with acute cardiovascular events (ACVEs) in a tertiary care setting in Pakistan[14]. The findings reinforce the complexity of managing cardiovascular emergencies in older adults, who often present with atypical symptoms and harbor multiple comorbidities, making diagnosis and risk stratification challenging[12].

Among the studied variables, reduced left ventricular ejection fraction (LVEF <40%) emerged as the strongest independent predictor of mortality, consistent with prior studies indicating that compromised systolic function significantly worsens outcomes in acute cardiac conditions[16]. Similarly, elevated NT-proBNP levels (>1800 pg/mL) were associated with nearly a three-fold increase in mortality risk, reflecting severe myocardial strain and underlying heart failure. These biomarkers, widely used in modern cardiology, remain highly valuable tools in triaging high-risk elderly patients[18].

Advanced age (>75 years) also independently predicted mortality. While age itself is a non-modifiable factor, it often coexists with frailty, polypharmacy, and delayed presentation all of which collectively contribute to adverse outcomes[19]. Importantly, renal impairment, as indicated by serum creatinine >1.5 mg/dL, was another significant predictor. This highlights the interplay between cardiac and renal dysfunction, often referred to as the cardiorenal syndrome, which is common in geriatric patients and portends a worse prognosis[16].

Of particular note is the impact of delayed percutaneous coronary intervention (PCI). Door-to-balloon time exceeding 90 minutes, although preventable, was significantly associated with increased mortality[12]. This finding emphasizes the need for prompt diagnosis and rapid revascularization strategies in elderly patients, who often arrive late or present atypically. On the positive side, the use of beta-blockers conferred a significant protective effect, reducing in-hospital mortality by 41%. This aligns with current guideline-directed medical therapy (GDMT), reinforcing the benefit of evidence-based pharmacologic treatment even in the elderly, when not contraindicated[17].

From a regional perspective, this study contributes important data from Pakistan, where cardiovascular disease is the leading non-communicable cause of death. Limited access to specialized geriatric cardiac care, delayed presentation due to socioeconomic barriers, and underutilization of biomarkers and imaging all contribute to poorer outcomes. These findings stress the urgency of developing elderly-focused cardiovascular protocols in low- and middle-income countries (LMICs), tailored to local resource availability and demographic needs.

CONCLUSION

In elderly patients with acute cardiovascular events, multiple clinical and biochemical markers significantly impact in-hospital outcomes. Advanced age, low LVEF, elevated NT-proBNP, impaired renal function, and PCI delay are key independent predictors of mortality. Conversely, beta-blocker therapy offers substantial protective benefits. Risk stratification using these variables can guide early aggressive management, improve survival, and reduce readmissions in geriatric cardiac care. Implementation of region-specific geriatric cardiovascular protocols is essential, particularly in resource-limited settings like Pakistan.

DECLARATION

Availability of data:
The data sets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Conflict of interest:
No conflict of interest associated with the research, authorship and publication of this article.

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There has been no significant financial support for this work that could have influenced its outcome.

Authors contribution
Each author of this article fulfilled following Criteria of Authorship:

1. Conception and design of or acquisition of data or analysis and interpretation of data.
2. Drafting the manuscript or revising it critically for important intellectual content.
3. Final approval of the version for publication.

All authors agree to be responsible for all aspects of their research work.

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