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ORIGINAL ARTICLE

Clinical Determinants of In-Hospital Mortality in a Multicenter Coronary Care Unit Cohort

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ABSTRACT

Background: Cardiovascular diseases remain a major global health concern, and coronary care units (CCUs) provide specialized care for patients with acute cardiovascular conditions.

Objective: This multicenter cohort study aimed to investigate mortality rates in Turkish CCUs and identify predictors of in-hospital mortality.

Study Design: Multicenter, observational cohort study.

Methods: Patients admitted to CCUs across Türkiye with cardiovascular diagnoses were included. Demographic, clinical, laboratory, and outcome data were collected. Regression analyses were performed to identify predictors of in-hospital mortality.

Results: A total of 3,157 patients were included, and the overall CCU mortality rate was 4.3% (n=137). The median age was 65 years (interquartile range, 56-73), and 66.1% of the patients were male. Hypertension (59.8%) and diabetes mellitus (37.5%) were the most common comorbidities. Non-survivors had significantly higher rates of heart failure and chronic kidney disease and lower ejection fractions than survivors. Age, female sex, lower mean blood pressure (BP), elevated serum creatinine, C-reactive protein, and white blood cell count were independent predictors of in-hospital mortality. Mean BP and serum creatinine were the strongest contributors to mortality prediction.

Conclusion: CCU mortality in Türkiye was relatively low. Hemodynamic impairment and renal dysfunction were the primary determinants of in-hospital mortality, highlighting the value of simple clinical parameters for early risk stratification.

Keywords: Coronary care unit, in-hospital mortality, cardiovascular outcomes, mortality predictors, multicenter study

INTRODUCTION

Cardiovascular diseases (CVDs) represent a substantial global public health challenge and remain the leading cause of mortality worldwide. Coronary care units (CCUs) were established specifically to manage CVDs in the late 1960s. Following the initial report by Killip and Kimball[1] demonstrating that the use of a CCU could reduce mortality by nearly 20%, CCUs were widely adopted. Their effectiveness has been demonstrated by an increase in survival rates from 18-20% to 40-46% over several decades of development. Initially focused on the rapid identification and treatment of cardiac arrhythmias, these units subsequently evolved into pivotal research centers dedicated to advancing the treatment of acute coronary syndromes (ACS). Over nearly six decades, the CCU has transformed into a more sophisticated intensive care unit (ICU) that provides comprehensive critical care for patients with a wide range of cardiovascular conditions.[2,3]

Mortality rates in CCUs are influenced by several factors, including patients' preexisting comorbidities, such as diabetes, hypertension, and renal disease, which increase the risk of mortality because of additional cardiovascular risk factors and potential complications. Furthermore, mortality in CCUs is a multifactorial outcome affected by patient characteristics, disease severity, treatment strategies, and the overall quality of healthcare delivery.[4,5] Therefore, evaluating patients' clinical characteristics and factors associated with mortality is essential for improving outcomes and reducing mortality rates in CCUs. Several scoring systems, including APACHE, SAPS II, and GRACE, have been developed to estimate mortality risk in CCUs.[6] However, these scoring systems may not be universally applicable to all CCU populations, and even low scores do not necessarily correlate with lower mortality rates. In addition, differences among patient populations may affect the interpretation of these scores, further complicating mortality risk assessment in CCUs.

International sharing of CCU data, including patient follow-up information, provides valuable insights into mortality outcomes. Variations in demographic characteristics, treatment approaches, and socioeconomic conditions across countries contribute to differences in mortality rates.[7,8] However, previous studies have primarily focused on patients with ACS, highlighting the need for a more comprehensive approach to data collection across diverse patient populations to improve the accuracy of mortality risk assessment in CCUs. Moreover, patients with non-ACS diagnoses, including acute heart failure (HF), arrhythmias, myopericarditis, and cardiogenic shock, constitute a

substantial proportion of the CCU population and may influence survival outcomes.

Türkiye, with a population of approximately 83 million and a well-developed healthcare system, has made substantial progress in improving CCUs. Although CVDs remain the leading cause of death, comprehensive data on mortality rates and predictors in CCUs across all cardiovascular diagnoses, including ACS, remain limited. Accordingly, the MORtality predictors in CCUs in TURKey (MORCOR-TURK) study was designed to characterize Turkish CCUs, evaluate mortality rates among patients with CVDs admitted to these units, and identify predictors of in-hospital mortality. Although the baseline characteristics and overall outcomes of the MORCOR-TURK cohort have been reported previously, the present study provides a focused and more comprehensive evaluation of the determinants of in-hospital mortality, including the relative contribution of individual predictors and their clinical implications for early risk stratification. These findings may help guide clinical decision-making, optimize treatment strategies, and ultimately improve patient outcomes in the critical coronary care setting.

METHODS

Study Design

The MORCOR-TURK study is a prospective, multicenter, observational, non-interventional study. The study was prospectively registered at ClinicalTrials.gov (Identifier: NCT05296694). It included 50 CCUs located across the seven geographical regions of Türkiye.

Study Population

All consecutive patients admitted to the CCUs at 50 centers across Türkiye between September and October 2022 were enrolled. Eligible participants were adults aged 18 years or older of either sex who presented with various cardiovascular emergencies, including ACS, acute HF, arrhythmias, myopericarditis, and cardiogenic shock, and who provided informed consent.

Data collected included demographic and clinical characteristics, hemodynamic status, medical history, laboratory findings, primary diagnoses, in-hospital events, and discharge status. Patients received standard care under the supervision of cardiologists, including medical and interventional therapies. Medications and vital signs were recorded, and adverse events, including arrhythmias, stroke, renal failure, bleeding, and mortality, were documented. No additional medical interventions were performed as part of the study.

Upon admission, routine biochemical tests, cardiac biomarkers (e.g., troponin I and creatine kinase-MB measured at 8-hour intervals), complete blood counts, and lipid profiles were assessed. In addition, all patients underwent two-dimensional M-mode echocardiography. Left ventricular dimensions and wall thickness were measured, and left ventricular ejection fraction (EF) was visually estimated.

Exclusion Criteria

Twenty-four patients who remained in the CCU for less than 4 hours were excluded from the study. In addition, patients admitted to the CCU for reasons other than cardiovascular conditions, including elective procedures such as coronary interventions, peripheral arterial interventions, and transcatheter valve interventions, as well as those who died within 30 minutes despite unsuccessful cardiopulmonary resuscitation (CPR), were excluded (Figure 1).

Center Selection

The process of selecting study centers for the MORCOR-TURK trial was conducted with careful planning. Initially, 50 centers were selected to ensure comprehensive geographic representation based on population density. These centers provided 24-hour CCU care and were distributed across the seven geographical regions of Türkiye.

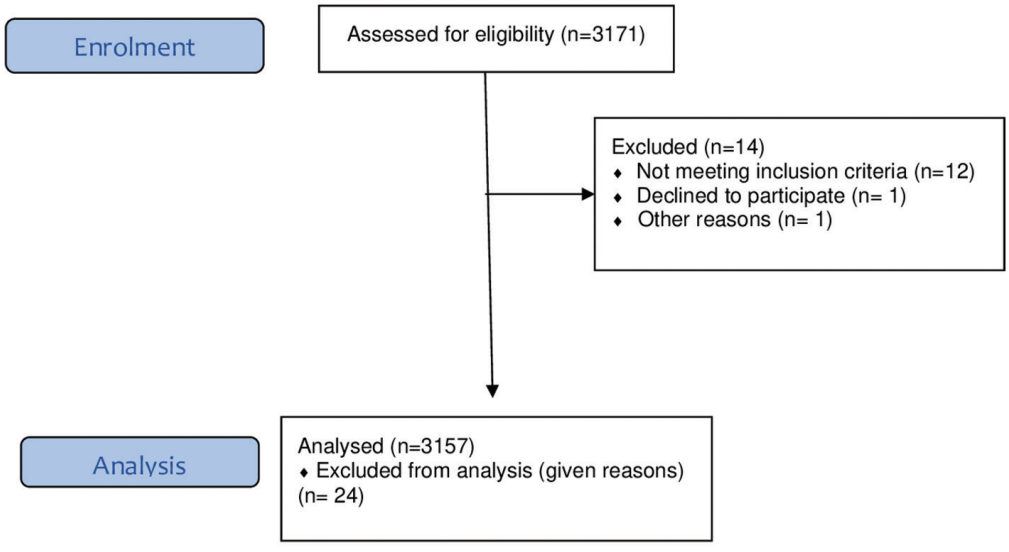

Figure 1. Flow diagram of patient inclusion

Subsequently, a stratified random sampling approach was used to ensure balanced population representation. The final selection of hospitals was intended to be representative of the national healthcare setting in Türkiye based on their geographic distribution and the characteristics of the participating CCUs.

Diagnoses

The diagnosis of ACS was established according to the guidelines of the European Society of Cardiology.[9] ST-segment elevation myocardial infarction (STEMI) was defined by the presence of at least 2 mm of ST-segment elevation in two or more contiguous leads or a new left bundle branch block on a 12-lead electrocardiogram (ECG). Non-STEMI (NSTEMI) was diagnosed in patients with symptoms of myocardial ischemia without ST-segment elevation but with elevated troponin levels. Unstable angina pectoris (USAP) was diagnosed in patients with symptoms of myocardial ischemia and normal troponin levels.

Acute HF was defined as the sudden or gradual onset of HF symptoms. Atrial fibrillation (AF) was diagnosed based on ECG findings of irregular R-R intervals and the absence of distinct P waves. Ventricular tachycardia was defined as premature ventricular complexes persisting for more than 30 seconds on ECG. Bradyarrhythmia was diagnosed when the heart rate was below 60 beats/min and accompanied by any type of atrioventricular block. Cardiogenic shock was defined as persistent hypotension [systolic blood pressure (BP) <90 mmHg or the need for vasopressor support to maintain systolic BP ≥90 mmHg] accompanied by signs of end-organ hypoperfusion, in accordance with contemporary guideline recommendations.

Myopericarditis was diagnosed based on clinical evidence of myopericardial inflammation supported by laboratory findings and imaging modalities, including cardiac magnetic resonance imaging and echocardiography, particularly in patients presenting with typical or atypical symptoms. Coronary angiography and/or percutaneous coronary intervention (PCI) were performed at the discretion of the interventional cardiologist, either immediately, urgently, or electively, to confirm or exclude the presence of coronary artery disease.

In addition, chronic kidney disease (CKD) was defined as an estimated glomerular filtration rate (eGFR) <60 mL/min/1.73 m^2 for at least 3 months or a documented history of CKD. The CHA_2DS_2-VA score was calculated for patients with AF to assess thromboembolic risk in accordance with current clinical guidelines.[9] This scoring system is freely available for clinical and research use. Hypertension was defined as a documented history of hypertension or current use of antihypertensive medication. Diabetes mellitus was defined as a documented history of diabetes mellitus, current use of antidiabetic medication, or a previous diagnosis established according to contemporary diagnostic criteria.

Mean arterial pressure was calculated from the admission systolic and diastolic BP measurements using the standard formula: diastolic BP+1/3×(systolic BP-diastolic BP).

Statistical Analysis

Because this was a prospective, nationwide, multicenter observational registry, all consecutive eligible patients admitted during the predefined 1-month study period were included. Therefore, no formal sample size calculation was performed. All statistical analyses were conducted using SPSS version 24 (IBM Corp., Armonk, NY, USA). The primary study endpoint was all-cause in-hospital mortality. Continuous variables are presented as the mean ± standard deviation or median with interquartile range (IQR), depending on the distribution assessed using the Kolmogorov-Smirnov test. Categorical variables are presented as frequencies and percentages.

Comparisons between groups were performed using Student's t-test or the Mann-Whitney U test for continuous variables and the chi-square test for categorical variables. To identify predictors of in-hospital mortality, candidate variables were selected based on their clinical relevance and statistical significance. Variables included in the univariate analysis were age, sex, comorbidities (coronary artery disease, hypertension, AF, HF, and CKD), CHA_2DS_2-VA score, admission diagnosis and cardiac rhythm, vital signs (mean BP and heart rate), and laboratory parameters, including serum creatinine, sodium, potassium, calcium, C-reactive protein (CRP), hematocrit, white blood cell (WBC) count, platelet count, and low-density lipoprotein cholesterol.

Variables with a significance level of $p<0.25$ in the unadjusted comparisons between survivors and non-survivors, together with clinically relevant variables, were considered for inclusion in the multivariable logistic regression model. To minimize the risk of multicollinearity, variables that were components of composite risk scores were not entered simultaneously with the corresponding score in the final multivariable model. Specifically, the CHA_2DS_2-VA score was not included in the final model together with its individual components. Missing data were handled using complete-case analysis. Patients with missing values for variables included in a specific analysis were excluded only from that analysis, and multiple imputation was not performed.

A backward stepwise multivariable logistic regression analysis was performed to identify the best predictive model for in-hospital mortality. The explanatory power of the model, as measured by the Nagelkerke R^2, increased substantially from 0.25 to 0.70 after the inclusion of mean BP and serum creatinine. The Akaike information criterion decreased from 180 to 150 following the inclusion of these variables, indicating improved model fit. The Wald test confirmed the significance of mean BP ($p<0.001$), and the likelihood ratio test demonstrated a significant reduction in model fit when mean BP was excluded ($p<0.001$). Receiver operating characteristic (ROC) curve analysis was used to evaluate the model's discriminatory ability. Model performance was assessed using standard discrimination metrics to evaluate its predictive accuracy for in-hospital mortality.

Ethical Considerations

Ethical approval for this study was obtained from the Afyonkarahisar Health Sciences University Clinical Research Ethics Committee for non-interventional clinical studies (date: August 5, 2022; meeting no: 2022/9; approval no: 422). The study was conducted in strict accordance with the principles of Good Clinical Practice and the Declaration of Helsinki. Written informed consent was obtained from all participants or their legally authorized representatives, ensuring the ethical integrity and transparency of the study.

RESULTS

A total of 3,157 patients were included in the study (Figure 1). The most common primary diagnosis was NSTEMI, affecting 1,187 patients (38%), followed by STEMI in 742 patients (23.5%). Other common diagnoses included USAP in 355 patients (11.2%), decompensated HF in 438 patients (14%), and arrhythmias in 272 patients (8.6%). Cardiac arrest was relatively uncommon, occurring in 19 patients (0.6%) (Figure 2). During the 1-month study period, 137 patients died, resulting in an overall in-hospital mortality rate of 4.3%. Among non-survivors, decompensated HF was the most frequent diagnosis, accounting for 39 patients (28.4%). STEMI and NSTEMI were each diagnosed in 31 non-survivors (22.6%).

Non-survivors were significantly older than survivors [median age, 73 years (IQR, 63-83) vs. 65 years (IQR, 56-73); p<0.001]. Mortality was also significantly higher among male patients (66.7% vs. 53.3%, p=0.002). Although the difference did not reach statistical significance, the prevalence of hypertension was higher among non-survivors than among survivors (66.4% vs. 58.7%, p=0.076). The prevalence of diabetes mellitus, smoking, and dyslipidemia was similar between the two groups. Likewise, the prevalence of coronary artery disease was higher among non-survivors but did not differ significantly between groups (54.0% vs. 45.4%, p=0.054). Several baseline comorbidities differed significantly between survivors and non-survivors. Patients who died were more likely to have a history of AF (24.8% vs. 14.9%, p=0.003), HF (55.5% vs. 29.9%, p<0.001), and CKD (32.8% vs. 12.9%, p<0.001). They also had a significantly lower median EF (40% vs. 53%, p<0.001) (Table 1).

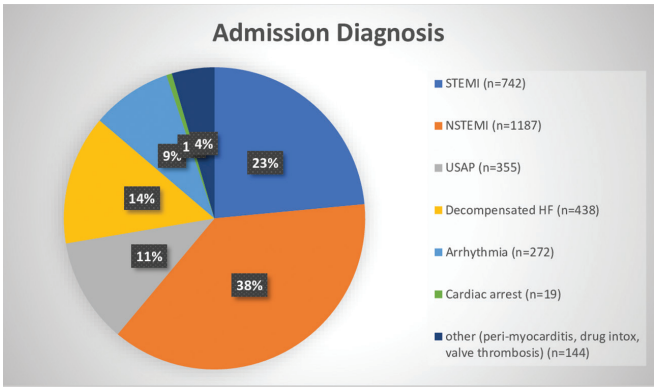

Figure 2. Distribution of admission diagnoses
STEMI: ST-segment elevation myocardial infarction, NSTEMI: Non-ST-segment elevation myocardial infarction, USAP: Unstable angina pectoris

However, the median mean BP was lower in the non-survivor group than in the survivor group [76 (IQR, 66-93) vs. 95 (IQR, 85-105) mmHg, p<0.001], whereas the median heart rate was higher [96 (IQR, 80-110) vs. 80 (IQR, 70-93) beats/min, p<0.001]. Regarding laboratory findings, non-survivors had lower oxygen saturation [94% (IQR, 86-96) vs. 96% (IQR, 93-98), p<0.001], eGFR [39 (IQR, 22.7-78) vs. 79 (IQR, 57-95) mL/min/1.73 m^2, p<0.001], and hematocrit (36.9±6.7% vs. 39.9±6.1%, p<0.001). In contrast, they had higher serum glucose [151 (IQR, 114-212) vs. 123 (IQR, 101-164), p<0.001], serum creatinine (1.6±0.9 vs. 1.3±0.4, p<0.001), potassium (4.7±0.8 vs. 4.4±0.6, p<0.001), WBC count (12.3±5.3 vs. 9.9±3.5, p<0.001), and CRP levels [23.6 (IQR, 10-120) vs. 5.7 (IQR, 1.9-16), p<0.001] (Table 2).

The multivariable analysis identified several independent predictors of in-hospital mortality. Each additional year of age was associated with a 2.4% increase in the odds of in-hospital mortality [odds ratio (OR), 1.024; 95% confidence interval (CI), 1.001-1.048; p=0.040]. Although male patients comprised the majority of the survivor group, female sex emerged as an independent predictor of in-hospital mortality after adjustment for age, comorbidities, and clinical variables (OR, 2.007; 95% CI, 1.150-3.504; p=0.014). Lower mean BP (OR, 0.938; 95% CI, 0.922-0.955; p<0.001), elevated serum creatinine (OR, 1.821; 95% CI, 1.473-2.250; p<0.001), higher CRP levels (OR, 1.007; 95% CI, 1.003-1.012; p=0.001), and higher WBC count (OR, 1.086; 95% CI, 1.022-1.154; p=0.008) were also identified as independent predictors of in-hospital mortality (Table 3).

In addition, ROC curve analysis was performed to evaluate the discriminatory ability of the prediction model. The final multivariable model demonstrated good discrimination for predicting in-hospital mortality [area under the curve (AUC)=0.842]. The optimal predicted probability cut-off was 0.092, corresponding to a sensitivity of 61.7%, a specificity of 90.2%, and a Youden index of 0.519 (Figure 3).

Table 1. Main diagnoses distribution in survivors and non-survivors

	All patients (n=3157)	Non-survivors (n=137)	Survivors (n=3020)	p values
STEMI, n (%)	742 (23.5%)	31 (22.6%)	711 (23.5%)	0.805
NSTEMI, n (%)	1187 (37.6%)	31 (22.6%)	1156 (38.3%)	<0.001
USAP, n (%)	355 (11.2%)	8 (5.8%)	347 (11.5%)	0.041
Decompensated HF, n (%)	438 (14%)	39 (28.4%)	399 (13.2%)	<0.001
Arrhythmia, n (%)	272 (8.6%)	11 (8%)	261 (8.6%)	0.802
Cardiac arrest, n (%)	19 (0.6%)	9 (6.6%)	10 (0.3%)	<0.001
Other, n (%)	144 (4.5%)	8 (5.8%)	132 (4.5%)	0.463

STEMI: ST-segment elevation myocardial infarction, NSTEMI: Non-ST-segment elevation myocardial infarction, USAP: Unstable angina pectoris, HF: Heart failure

Table 2. Baseline characteristics of the study group

	All patients (n=3157)	Non-survivors (n=137)	Survivors (n=3020)	p
Age (years), median (IQR)	65 (56-73)	73 (63-83)	65 (56-73)	<0.001
Sex (male), n (%)	2087 (66.1)	73 (53.3)	2014 (66.7)	0.002
Hypertension, n (%)	1864 (59)	91 (66.4)	1773 (58.7)	0.076
Diabetes mellitus, n (%)	1184 (37.5)	55 (40.1)	1129 (37.4)	0.528
Dyslipidaemia, n (%)	1120 (35.5)	46 (33.6)	1074 (35.6)	0.715
Smoking, n (%)	1955 (61.9)	79 (57.7)	1876 (62.1)	0.322
Family history of CAD, n (%)	1101 (34.9)	37 (27.2)	1064 (35.8)	0.043
CAD, n (%)	1446 (45.8)	74 (54)	1372 (45.4)	0.054
AF, n (%)	483 (15.3)	34 (24.8)	449 (14.9)	0.003
Heart failure, n (%)	978 (31)	76 (55.5)	902 (29.9)	<0.001
Stroke history, n (%)				0.086
No	3015 (95.5)	126 (92)	2889 (95.7)	
Ischemic stroke	125 (4)	9 (6.6)	116 (3.8)	
Haemorrhagic stroke	17 (0.5)	2 (1.5)	15 (0.5)	
Prior major bleeding, n (%)	130 (4.1)	6 (4.5)	124 (4.2)	0.823
Chronic renal disease, n (%)	434 (13.7)	45 (32.8)	389 (12.9)	<0.001
EF (%), median (IQR)	52 (40-57)	40 (30-50)	53 (44-58)	<0.001
Mean blood pressure (mmHg), median (IQR)	94.7 (84.7-105.0)	76 (66-93)	95 (85-105)	<0.001
Heart rate (bpm), median (IQR)	81 (71-94)	96 (80-110)	80 (70-93)	<0.001
Saturation (%), median (IQR)	95 (93-98)	94 (86-96)	96 (93-98)	<0.001
Glucose (mg/dL), median (IQR)	124 (102-166)	151 (114-212)	123 (101-164)	<0.001
Glomerular filtration rate (mL/min), median (IQR)	78 (54-95)	39 (22.7-78)	79 (57-95)	<0.001
Creatinine (mg/dL), mean±SD	0.9±0.4	1.6±0.9	1.3±0.4	<0.001
Sodium (mmol/L), mean±SD	137.6±4.0	137.6±3.9	137.3±5.7	0.318
Potassium (mmol/L), mean±SD	4.4±0.6	4.7±0.8	4.4±0.6	<0.001
White blood cell ($\times 10^3$/µL), mean±SD	10.0±3.7	12.3±5.3	9.9±3.5	<0.001
Haematocrit (%), mean±SD	40.0±6.0	36.9±6.7	39.9±6.1	<0.001
Platelet ($\times 10^3$/µL), mean±SD	243.3±80.5	241.1±115.0	243.4±78.6	0.742
AST (U/L), median (IQR)	27 (19-47)	29 (16-90)	27 (19-46)	0.002
ALT (U/L), median (IQR)	20 (14-32)	24 (12-73)	20 (14-32)	0.001
CRP (mg/L), median (IQR)	6 (2-17)	23.6 (10-120)	5.7 (1.9-16)	<0.001
Troponin (ng/mL), median (IQR)	191 (23-3131)	543 (36-8300)	180 (23-2977)	0.088
CHA_2DS_2VASc score, median (IQR)	3 (1-4)	4 (3-5)	3 (1-4)	<0.001

AF: Atrial fibrillation, ALT: Alanine aminotransferase, AST: Aspartate aminotransferase, CAD: Coronary artery disease, CHA_2DS_2-VASc: Congestive heart failure, hypertension, age ≥75 years (2 points), diabetes mellitus, stroke/transient ischemic attack (2 points), vascular disease, age 65-74 years, sex category (female), CRP: C-reactive protein, EF: Ejection fraction, GFR: Glomerular filtration rate, HF: Heart failure, SD: Standard deviation, IQR: Interquartile range

Table 3. Independent predictors of in-hospital mortality

Variables	Multivariable analysis	
	OR (95% CI)	p
Age (years)	1.024 (1.001-1.048)	0.040
Sex (female)	2.007 (1.150-3.504)	0.014
Mean BP	0.938 (0.922-0.955)	<0.001
Creatinine (mg/dL)	1.821 (1.473-2.250)	<0.001
CRP (mg/L)	1.007 (1.003-1.012)	0.001
WBC (×10³/µL)	1.086 (1.022-1.154)	0.008

OR: Odds ratio, CI: Confidence interval, BP: Blood pressure, CRP: C-reactive protein, WBC: White blood cell

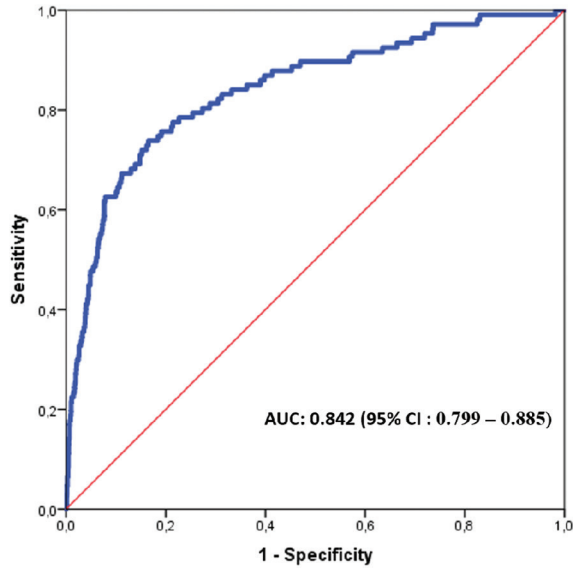

Figure 3. Receiver operating characteristic (ROC) curve of the prediction model
AUC: Area under the curve, CI: Confidence interval

DISCUSSION

In this recent real-world cohort study, we comprehensively evaluated the baseline characteristics, demographic features, clinical profiles, diagnosis distribution, and predictors of in-hospital mortality among patients admitted to CCUs in Türkiye. Although the primary findings of the MORCOR-TURK study have been reported previously, the present analysis provides a focused and in-depth evaluation of mortality predictors and their clinical implications. The overall in-hospital mortality rate was 4.3%, which is consistent with international benchmarks. The study population predominantly comprised male patients with common cardiovascular risk factors, underscoring the ongoing need for targeted preventive strategies in this population. Notably, serum creatinine and mean BP emerged as the strongest predictors of in-hospital mortality. In addition, age, female sex, WBC count, and CRP levels were independently associated with mortality risk. Collectively, these findings provide clinically relevant insights for risk stratification among hospitalized CCU patients. Although the baseline characteristics of the MORCOR-TURK cohort have been reported previously, the present study specifically focuses on in-hospital mortality and its predictors. Whereas the previous report primarily described the demographic and clinical characteristics of the cohort, the current analysis provides a dedicated evaluation of the determinants of in-hospital mortality in a nationwide CCU population. Taken together, our findings suggest that short-term mortality among patients admitted to CCUs is driven primarily by acute hemodynamic compromise and renal dysfunction, whereas demographic and inflammatory factors act as important modifiers rather than primary determinants.

Modern CCUs have achieved substantial advances in patient monitoring, interventional capabilities, and pharmacologic treatment strategies, resulting in a marked reduction in in-hospital mortality among patients with severe CVDs. Previous studies have reported in-hospital mortality rates ranging from approximately 5.6% to 15.2% in heterogeneous CCU populations.[10,11] Notably, our findings demonstrated significant differences in admission diagnoses between survivors and non-survivors, underscoring the critical importance of early recognition and aggressive management of high-risk conditions, such as acute pulmonary edema, decompensated HF, cardiac arrest, and NSTEMI. The high rate of PCI in our cohort further highlights the central role of timely and effective interventional strategies in improving short-term outcomes. Although system-level factors were not directly evaluated, differences in healthcare organization and resource availability may contribute to regional variation in CCU outcomes and should be considered when interpreting patient-level predictors of mortality.

We identified several independent predictors of in-hospital mortality, including age, female sex, mean BP, serum creatinine, CRP, and WBC count. Notably, mean BP and serum creatinine emerged as the strongest predictors, underscoring the importance of hemodynamic stability and renal function in determining patient outcomes. Renal function has been extensively investigated in previous studies, in which acute kidney injury and GFR were identified as independent predictors of adverse events across various patient populations, as well as predictors of mortality in ICUs and CCUs.[12] Mean BP also emerged as a robust predictor of mortality, together with serum creatinine, both of which are key components of established prognostic scoring systems, including APACHE II, SAPS, and MELD. We have previously demonstrated the utility of these parameters in predicting mortality among CCU patients.[6,13] Although established prognostic scoring systems remain valuable, their complexity may limit routine use in busy CCU settings. In this context, readily available and clinically actionable parameters are particularly valuable. The risk model developed in the present study demonstrated good discriminatory performance, with an AUC of 0.842, supporting its potential utility for early risk stratification in CCU patients. The identification of mean BP and serum creatinine as key predictors highlights the value of simple, routinely measured, and potentially modifiable clinical variables for guiding real-world clinical decision-making. Nevertheless, the non-randomized observational design and the exclusion of some CCUs may limit the generalizability of these findings. Future prospective studies are warranted to validate the model and determine whether its integration with established risk scoring systems could further optimize triage and risk stratification in the CCU setting.

In addition to hemodynamic and renal parameters, age, female sex, and markers of systemic inflammation were independently associated with in-hospital mortality in the present study. Advanced age likely reflects reduced physiological reserve and a greater burden of comorbidities, thereby increasing susceptibility to adverse outcomes in the acute CCU setting.[14] The association between female sex and increased mortality risk, despite the higher proportion of male non-survivors in the unadjusted analysis, suggests the influence of confounding clinical factors, such as older age at presentation, greater disease severity, or differences in the recognition and management of cardiovascular conditions. The discrepancy between the unadjusted and adjusted analyses warrants further consideration. Although male patients constituted a greater proportion of the non-survivor group, multivariable adjustment identified female sex as an independent predictor of mortality. This finding may reflect residual differences in age, comorbidity burden, clinical presentation, or disease severity between the sexes. Previous studies have also suggested that women admitted with acute cardiovascular conditions are often older, present with atypical symptoms, and may experience delays in diagnosis or treatment, all of which may adversely affect clinical outcomes. Therefore, the observed association should not be interpreted as a direct biological effect of sex but rather as a marker of complex clinical and healthcare-related factors that warrant further investigation.

Systemic inflammation may represent a common pathophysiological pathway linking these factors. In the acute cardiovascular care setting, an exaggerated inflammatory response often reflects not only the severity of the primary cardiac condition but also the cumulative effects of concomitant organ dysfunction, including HF, renal impairment, and tissue hypoperfusion.[15] Accordingly, elevated inflammatory markers may serve as integrative indicators of overall physiological stress rather than isolated laboratory abnormalities. The independent association between inflammatory burden and short-term mortality observed in our cohort supports growing evidence that inflammation plays a central modulatory role in outcomes among critically ill patients with CVD and underscores the clinical value of incorporating inflammatory markers into early risk stratification in CCU practice.

Although AF was more prevalent among non-survivors, it did not emerge as an independent predictor of in-hospital mortality in the multivariable analysis. This finding may reflect the complex and multifactorial impact of AF in the acute CCU setting, where short-term outcomes are driven primarily by hemodynamic instability, underlying ventricular dysfunction, and concomitant comorbidities. AF contributes to adverse outcomes through the loss of atrial contribution to ventricular filling, impaired cardiac output, and an increased risk of thromboembolic complications, all of which may have a greater influence on long-term prognosis than on immediate in-hospital mortality.[16] Accordingly, long-term follow-up of the MORCOR-TURK cohort may provide additional insights into the sustained impact of AF on mortality and cardiovascular outcomes.

The high prevalence of hypertension and diabetes mellitus highlights the need for targeted preventive and therapeutic strategies for these risk factors in the CCU population. Although diabetes mellitus is a well-established contributor to poor clinical outcomes, its prevalence was similar between survivors and non-survivors in our cohort. However, serum glucose levels were significantly higher among non-survivors. This discrepancy may be attributable to unrecognized dysglycemia or stress-induced hyperglycemia during acute cardiovascular events. It is also possible that the physiological stress associated with cardiovascular emergencies contributes to metabolic disturbances that increase serum glucose levels. Nevertheless, serum glucose did not emerge as an independent predictor of mortality in the present study. Because this study focused on short-term in-hospital mortality, serum glucose levels may have a greater impact on long-term cardiovascular outcomes.

Study Limitations

Despite the valuable insights provided by this nationwide study, several limitations should be acknowledged. First, although the study included a broad geographic representation of CCUs across Türkiye, not all CCU-capable centers were enrolled, which may limit the generalizability of the findings. Differences in institutional resources, the availability of advanced interventional facilities, and operator experience across centers may have influenced patient management and clinical outcomes. Second, although the study was designed as a prospective observational investigation, its non-randomized design precludes causal inference. Although standardized definitions and data collection forms were used, variations in diagnostic practices, admission criteria, and clinical decision-making across centers may have introduced heterogeneity in patient classification and management. In addition, the inclusion of a heterogeneous CCU population that reflected real-world practice beyond ACS may have influenced the relative contribution of individual predictors to short-term mortality. Furthermore, patient recruitment was limited to a 1-month period, which may not have fully captured seasonal variations in admission patterns, disease severity, or mortality rates. Third, several clinically relevant variables could not be comprehensively assessed, including detailed hemodynamic measurements, the timing and intensity of therapeutic interventions, medication dosing, and dynamic changes in laboratory values and vital signs during hospitalization. Furthermore, detailed treatment-related variables, such as the timing of PCI, vasopressor use, mechanical circulatory support, and treatment intensity, were not systematically recorded. Likewise, detailed information regarding the timing, extent, and complexity of coronary angiography, PCI, stent implantation, and surgical procedures was unavailable. Consequently, the direct effects of treatment strategies on survival could not be evaluated. Furthermore, postdischarge outcomes and long-term survival data were not available for the present analysis. Therefore, the findings are limited to in-hospital outcomes and should not be extrapolated to long-term mortality. Although long-term follow-up is planned within the MORCOR-TURK framework, those data were beyond the scope of the present study. Finally, patients who remained in the CCU for less than 4 hours and those who died within 30 minutes despite unsuccessful CPR were excluded according to the predefined study protocol. This may have resulted in a slight underestimation of the in-hospital mortality rate and should be considered a potential source of selection bias.

CONCLUSION

This nationwide study provides comprehensive insights into the predictors of in-hospital mortality among patients admitted to CCUs in Türkiye and contributes to establishing contemporary benchmarks for CCU mortality. Our findings highlight the central role of renal function and hemodynamic status in determining short-term outcomes, underscoring the clinical value of close monitoring of serum creatinine and mean BP in the acute care setting. The proposed risk model, developed using data from a nationwide Turkish CCU cohort, offers a practical framework for early risk stratification and may assist clinicians in prioritizing care and optimizing resource allocation. Although further prospective validation is warranted, these findings support the use of simple, readily available clinical parameters to inform clinical decision-making and may serve as a foundation for future collaborative efforts to improve the quality of CCU care and patient outcomes across diverse healthcare systems. From a practical perspective, these results support a CCU strategy that prioritizes early hemodynamic stabilization and close monitoring of renal function using universally available bedside parameters.

Ethics Committee Approval: Ethical approval for this study was obtained from the Afyonkarahisar Health Sciences University Clinical Research Ethics Committee for non-interventional clinical studies (date: August 5, 2022; meeting no: 2022/9; approval no: 422).

Informed Consent: Written informed consent was obtained from all participants or their legally authorized representatives, ensuring the ethical integrity and transparency of the study.

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