



EuroSCORE and Mortality–Morbidity Assessment in CABG Patients Aged ≥70 Years

70 Yaş ve Üzeri KABG Hastalarında EuroSCORE ve Mortalite–Morbidite Değerlendirmesi

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ABSTRACT

Aim: With the growing elderly population, coronary artery disease and the need for coronary artery bypass grafting (CABG) have increased substantially. Accurate preoperative risk stratification is crucial in this age group. Although EuroSCORE is widely used to predict perioperative mortality, its performance in elderly patients remains debated. This study aimed to evaluate the predictive accuracy of the EuroSCORE and to identify additional non-EuroSCORE factors associated with mortality and morbidity in patients aged ≥70 years undergoing CABG.

Material and Method: This retrospective study included 393 patients aged 70 years or older who underwent CABG in our clinic. Standard and logistic EuroSCORE values were calculated, and predicted vs. observed mortality rates were compared. Operative and postoperative outcomes were analyzed. Statistical analyses included Student's t-test, Chi-square test, Fisher's exact test, Mann–Whitney U test, ANOVA, and ROC analysis. A p-value <0.05 was considered significant.

Results: Of the patients, 58.3% were classified as high risk, with female sex, COPD, extracardiac arteriopathy, neurological sequelae, recent MI (<90 days), and reduced ejection fraction occurring more frequently in this group (p<0.05). The postoperative mortality rate was 7.63%, with mortality significantly higher in the high-risk group (10.5% vs. 3.7%; p=0.012). Predicted mortality using logistic EuroSCORE did not differ significantly from observed rates (p>0.05). ROC analysis demonstrated good discriminative ability (AUC=0.753). Non-EuroSCORE predictors associated with mortality included preoperative heart failure, prolonged cardiopulmonary bypass and cross-clamp times, and postoperative myocardial infarction. Hypertension, diabetes mellitus, cerebrovascular disease, and heart failure contributed to increased morbidity.

Conclusion: EuroSCORE provides reliable mortality prediction in elderly CABG patients; however, risk assessment in this population should not rely solely on scoring systems. Incorporating multimodal clinical parameters—such as frailty, organ dysfunction, and perioperative physiological reserve—offers a more comprehensive evaluation and may improve surgical decision-making.

Keywords: Elderly patients, coronary bypass, EuroSCORE, mortality, morbidity

ÖZ

Amaç: Yaşlı popülasyonda koroner arter hastalığının artmasıyla koroner arter baypas greftleme (CABG) cerrahisinin risk değerlendirilmesi klinik açıdan daha da önem kazanmıştır. EuroSCORE, kardiyak cerrahi sonrası mortaliteyi tahmin etmek için yaygın kullanılan bir modeldir; ancak ileri yaş grubunda tüm risk faktörlerini yeterince yansıtmadığı tartışmalıdır. Bu çalışma, 70 yaş ve üzeri CABG hastalarında EuroSCORE'un prediktif performansını ve EuroSCORE dışı faktörlerin mortalite ve morbiditeye etkilerini değerlendirmeyi amaçlamıştır.

Gereç ve Yöntem: Kliniğimizde tarihleri arasında merkezimizde CABG uygulanan 393 hastanın verileri retrospektif olarak analiz edildi. Standart ve lojistik EuroSCORE hesaplamaları yapıldı; beklenen ve gerçekleşen mortalite karşılaştırıldı. Operatif ve postoperatif klinik sonuçlar değerlendirildi. İstatistiksel analizlerde Student t testi, Ki-kare testi, Fisher testi, Mann–Whitney U testi, ANOVA ve ROC analizi kullanıldı; p<0,05 anlamlı kabul edildi.

Bulgular: Hastaların %58,3'ü yüksek risk grubunda yer aldı ve bu grupta kadın cinsiyeti, KOAH, ekstrakardiyak arteriopati, nörolojik sekel, son 90 gün içinde MI ve düşük ejeksiyon fraksiyonlu anlamlı olarak daha sık görüldü (p<0,05). Otuz günlük mortalite oranı %7,63 idi; orta risk grubunda %3,7, yüksek risk grubunda %10,5 olarak bulundu (p=0,012). Lojistik EuroSCORE ile tahmin edilen mortalite oranları gerçekleşen değerlerle uyumluydu (p>0,05). ROC analizinde AUC=0,753 olup EuroSCORE'un iyi prediktif güce sahip olduğu gösterildi. EuroSCORE dışı faktörlerden preoperatif KKY, uzamış kardiyopulmoner bypass ve kros klemp süreleri ile postoperatif miyokard infarktüsü mortaliteyle ilişkili bulundu. Morbidite açısından hipertansiyon, diyabetes mellitus, serebrovasküler olay ve konjestif kalp yetmezliği ek risk faktörleri olarak belirlendi.

Sonuç: EuroSCORE, 70 yaş ve üzeri CABG hastalarında mortalitenin öngörülmesinde güvenilir bir araçtır; ancak yaşlı popülasyonda risk çok boyutlu olup, frailty, organ fonksiyonları ve perioperatif klinik durum gibi ek faktörlerin değerlendirilmesi gereklidir. Çalışma, yaşlı hastalarda yalnızca skor temelli değil, multidisipliner ve multimodal risk analizine dayalı bir yaklaşımın cerrahi karar sürecini daha doğru yönlendireceğini göstermektedir.

Anahtar Kelimeler: Yaşlı hastalar, koroner baypas, EuroSCORE, mortalite, morbidite

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INTRODUCTION

In recent years, the expanding elderly population has been accompanied by a substantial increase in the prevalence of cardiovascular diseases (1). In patients aged 70 years and older, coronary artery disease is among the leading determinants of mortality and morbidity, and coronary artery bypass grafting (CABG) remains one of the most commonly employed therapeutic strategies in this population (2). However, age-related declines in physiological reserve, increased frailty, multimorbidity, and limited postoperative recovery capacity markedly elevate surgical risk in this population (3-5). Therefore, an objective assessment of surgical risk is critical when deciding on CABG in elderly patients (4,6).

EuroSCORE is a risk stratification system developed to predict perioperative mortality in patients undergoing cardiac surgery and is widely used in clinical practice (7). Because it incorporates numerous clinical parameters—such as female sex, left ventricular dysfunction, pulmonary disease, and peripheral arterial disease—it has been reported to provide valuable guidance in risk assessment, particularly in elderly populations (8). However, recent studies have demonstrated that EuroSCORE does not fully capture the overall risk profile in elderly patients undergoing CABG; additional factors—particularly frailty, renal dysfunction, chronic obstructive pulmonary disease (COPD), prolonged cross-clamp time, extended cardiopulmonary bypass duration, postoperative mechanical ventilation time, recent myocardial infarction, and multimorbidity—have been shown to predict mortality independently (9).

A comprehensive evaluation of the factors influencing postoperative mortality and morbidity in patients aged 70 years and older, together with an examination of the EuroSCORE's predictive performance in this population, holds considerable clinical significance (10). The present study aims to investigate the effects of both EuroSCORE-related and additional non-EuroSCORE variables on mortality and morbidity in elderly patients undergoing CABG at our center, and to elucidate the actual predictive value of EuroSCORE in this age group.

MATERIAL AND METHOD

Between August 2004 and January 2011, the data of 393 patients aged 70 years and older who underwent coronary artery bypass surgery in our clinic were retrospectively analyzed.

Preoperative evaluation: Diabetic patients were taken to surgery after achieving glycemic control in consultation with the endocrinology department. In patients diagnosed with COPD, pulmonary function tests and arterial blood gas analyses were performed, and the pulmonology team arranged necessary

treatments. Patients with severe urea/creatinine elevation or those undergoing dialysis were evaluated by nephrology. Medical therapy for hyperlipidemia was initiated upon hospital admission. Patients with a history of syncope, transient ischemic attack (TIA), or stroke were assessed by neurology. All patients routinely underwent complete blood count, electrocardiography, chest radiography, hepatitis and HIV serology, urinalysis, hemostasis parameters, liver and renal function tests, cardiac enzymes, fasting blood glucose, and HbA1c testing in diabetic individuals. Standard transthoracic echocardiography was performed in all patients.

Preoperative bilateral carotid Doppler ultrasonography was routinely conducted; carotid stenosis greater than 50% was identified in 56 patients (14.2%). Patients with stenosis exceeding 70% underwent digital subtraction angiography, and 18 of them underwent simultaneous coronary bypass surgery and carotid endarterectomy based on clinical indication.

Operative procedure: All patients underwent median sternotomy under general anesthesia. Fourteen patients (3.5%) underwent surgery under emergency conditions. Coronary artery bypass was performed under cardiopulmonary bypass (CPB) in 341 patients (86.7%), while 52 patients (13.3%) underwent beating-heart surgery. Of the off-pump procedures, 10 were performed on a beating heart under perfusion support. For LAD revascularization, the left internal thoracic artery (LITA) was used as the graft in 361 patients (91.8%), the saphenous vein in 26 patients (6.6%), and the radial artery in 6 patients (1.6%). LITA was harvested as a pedicled graft and topically treated with papaverine and nitroglycerin (perlinganit) for vasodilation. When required, the saphenous vein and radial artery were harvested as additional conduits.

During on-pump procedures, the activated clotting time was maintained above 450 seconds, whereas the target ACT for off-pump operations was >200 seconds. Heart rate was controlled intraoperatively with intravenous metoprolol during beating-heart surgery. Myocardial protection was achieved with moderate hypothermia and initial cold crystalloid cardioplegia, followed by blood cardioplegia every 20 minutes. Postoperatively, all patients were transferred to the intensive care unit, and 361 patients (91.8%) were extubated within the first 24 hours.

Off-pump surgery was defined as coronary artery bypass grafting performed without cardiopulmonary bypass, whereas on-pump surgery referred to procedures performed using cardiopulmonary bypass; the term beating-heart surgery was used synonymously with off-pump surgery.

Emergency surgery was defined as procedures requiring immediate intervention due to life-threatening conditions; urgent surgery, as procedures that could not



be delayed beyond a short period of clinical stabilization; and elective surgery, as procedures scheduled in advance without immediate risk to the patient.

Risk assessment: A total of 97 parameters were evaluated, including 68 preoperative and 29 operative variables. The study was designed and initiated before the introduction of EuroSCORE II; therefore, the original EuroSCORE model was used for perioperative risk assessment. The standard EuroSCORE was calculated as the sum of points assigned for each risk factor. Logistic EuroSCORE was calculated separately for each patient using the formula: mortality = $e^{(\beta_0 + \sum X_i \beta_i)} / [1 + e^{(\beta_0 + \sum X_i \beta_i)}]$. Risk stratification was defined as follows: low risk (≤ 2 points; no patients in this category in our study), moderate risk (3–5 points), and high risk (> 5 points) 11. Mortalite, cerrahi sonrası 30 gün içinde gerçekleşen ölüm olarak tanımlandı [11]. Mortality was defined as death occurring within 30 days after surgery.

Statistical Analysis

Mortality rates predicted by the EuroSCORE were compared with the observed mortality using the t-test. Receiver operating characteristic (ROC) analysis was performed to evaluate the model's discriminative ability for predicting mortality. Statistical analyses included ROC curve analysis, Chi-square test, Student's t-test, Fisher's exact test, ANOVA, and the Mann–Whitney U test. A p-value < 0.05 was considered the threshold for statistical significance.

RESULTS

Preoperative findings: Of the 393 patients included in the study, 253 (64.4%) were male. A total of 231 patients (58.8%) were aged 70–75 years, 118 (30.0%) were aged 75–79 years, and 44 patients (11.2%) were aged ≥ 80 years. According to the standard EuroSCORE classification, 164 patients (41.7%) were categorized as moderate risk, while 229 patients (58.3%) were classified as high risk. The proportion of women was significantly higher in the high-risk group (29.9% in the moderate-risk group vs. 39.7% in the high-risk group; $p=0.044$). Patients in the high-risk group were also older (73.16 ± 2.90 vs. 75.22 ± 4.20 years; $p<0.001$). No significant differences were observed between the groups regarding height, weight, or body surface area (BSA). Hypertension, COPD, elevated creatinine levels, and extracardiac arteriopathy were significantly more frequent in the high-risk group ($p<0.05$). Preoperative neurological sequelae were observed exclusively in the high-risk group ($p=0.023$). (Table 1) Although the prevalence of diabetes was similar between the groups, the use of oral antidiabetic agents was higher in the moderate-risk group ($p=0.024$). No significant differences were found regarding hyperlipidemia or smoking history.

Table 1. Demographic characteristics and fundamental preoperative risk factors of patients

Variables	Medium risk (n=164)	High risk (n=229)	p
Female gender, n (%)	49 (29.9%)	91 (39.7%)	0.044
Age (years), mean \pm SD	73.16 \pm 2.90	75.22 \pm 4.20	<0.001
Hypertension, n (%)	84 (51.2%)	156 (68.1%)	0.001
COPD, n (%)	30 (18.3%)	80 (34.9%)	<0.001
Creatinine ≥ 200 μ mol/L	2 (1.2%)	21 (9.2%)	0.001
Extracardiac arteriopathy	10 (6.1%)	79 (34.5%)	<0.001
Neurological sequelae	0 (0%)	8 (3.5%)	0.023
MI in the last 90 days	27 (16.5%)	87 (38.0%)	<0.001
USAP	5 (3.0%)	92 (40.2%)	<0.001
Ejection fraction (%)	56.05 \pm 9.28	47.49 \pm 12.36	<0.001
LMCA $>50\%$	14 (8.5%)	37 (16.2%)	0.027
HDL (mg/dL)	41.29 \pm 9.12	38.60 \pm 8.49	0.003
LDL (mg/dL)	103.4 \pm 33.4	105.5 \pm 33.2	0.538
Urea (mg/dL)	41 (17–74)	44 (12–203)	0.005
Troponin (ng/mL)	0.01 (0.008–180)	0.02 (0.003–159)	0.001

Abbreviations: SD;Standart deviation, COPD; Chronic obstructive pulmonary disease, MI;Miyocardial infarction, USAP;Unstable angina pectoris, LMCA; Left main coronary artery, HDL; High density lipoprotein, LDL;Low density lipoprotein

From a cardiac standpoint, myocardial infarction within the previous 90 days, the presence of unstable angina, and Class 4 angina were significantly more common in the high-risk group ($p<0.001$). Preoperative congestive heart failure, prior cardiac surgery, and previous PTCA+stent procedures were also more frequently observed in the high-risk group ($p<0.05$).

Coronary angiography and echocardiographic findings showed that left main coronary artery stenosis $>50\%$ was more prevalent in the high-risk group ($p=0.027$). Left ventricular ejection fraction was significantly lower in the high-risk group (56.05 ± 9.28 vs. 47.49 ± 12.36 ; $p<0.001$). No significant difference was detected in the number of diseased vessels.

Regarding laboratory measurements, HDL levels were lower in the high-risk group ($p=0.003$), whereas urea and troponin levels were higher ($p=0.005$ and $p=0.001$, respectively). Other biochemical parameters did not differ significantly between the groups.

In terms of preoperative medication use, nitrate therapy was more common in the high-risk group ($p=0.019$). No significant differences were observed between the groups concerning the use of β -blockers, ACE inhibitors, calcium channel blockers, ARBs, or statins.

Operative and postoperative data: A total of 14 patients (3.5%) underwent emergency surgery; the majority were in the high-risk group ($p=0.008$). In the entire cohort, 341 patients (86.8%) underwent surgery under CPB, while 52 patients (13.2%) underwent off-pump procedures. The use of CPB was more frequent in the moderate-risk group, whereas off-pump

(beating-heart) procedures were more common in the high-risk group ($p < 0.05$). The number of arterial grafts and the use of LITA were significantly higher in the moderate-risk group ($p = 0.035$ and $p = 0.017$, respectively). The number of venous grafts, the number of distal anastomoses, and the perfusion and cross-clamp times were similar between the groups (Table 2).

Table 2. Comparison of operative data.

Variables	Medium risk	High risk	p
Emergency operation	1 (0.6%)	13 (5.7%)	0.008
Surgery under CPB	150 (91.5%)	191 (83.4%)	0.035
Beating heart bypass	14 (8.5%)	38 (16.6%)	0.065
Number of arterial grafts	1.01±0.36	0.94±0.32	0.035
LITA usage	157 (95.7%)	204 (89.1%)	0.017
Number of distal anastomoses	3.36±1.08	3.18±1.04	0.105
Perfusion time (min)	73.05±54.64	69.24±40.70	0.428
Cross clamp time (min)	41.8±19.53	39.91±22.45	0.386

Abbreviations: CPB; Cardiopulmonary bypass, LITA; Left internal thoracic artery

No significant differences were observed between the groups for preoperative, postoperative, or total hospital length of stay. However, the duration of ICU stay was significantly longer in the high-risk group (46.3 ± 34.2 vs. 59.5 ± 66.3 hours; $p = 0.011$). The need for mechanical ventilation lasting more than 24 hours was comparable between the groups. Similarly, perioperative use of erythrocyte suspension, fresh frozen plasma, platelets, and whole blood did not differ significantly between the two groups.

Morbidity: Among the postoperative morbidity parameters evaluated, elevated creatinine levels, inotropic support, intra-aortic balloon pump (IABP) use, and respiratory failure were significantly more common in the high-risk group ($p < 0.05$). Postoperative creatinine elevation was observed in 48 patients (12.2%), occurring at nearly twice the rate in the high-risk group ($p = 0.012$). The need for inotropic support (72.9% vs. 60.4%; $p = 0.009$) and the use of IABP (14.4% vs. 4.9%; $p = 0.002$) were also higher among high-risk patients. Respiratory failure was significantly more frequent in the high-risk group ($p = 0.018$). Although postoperative myocardial infarction, wound infection, pneumonia, sepsis, gastrointestinal complications, bleeding requiring reoperation, low cardiac output, cerebrovascular events, TIA, pulmonary embolism, and atrial fibrillation were observed at various rates across the cohort, most of these parameters did not differ significantly between the groups. Atrial fibrillation occurred in 125 patients (31.8%) and, although more frequent in the high-risk group, the difference did not reach statistical significance ($p = 0.116$) (Table 3).

Table 3. Postoperative morbidity comparison.

Morbidity Parameter	Medium risk	High risk	p
Postoperative creatinine ≥ 200 $\mu\text{mol/L}$	12 (7.3%)	36 (15.7%)	0.012
Inotrope use	99 (60.4%)	167 (72.9%)	0.009
Postoperative MI	7 (4.3%)	18 (7.9%)	0.150
IABP requirement	8 (4.9%)	33 (14.4%)	0.002
Respiratory Failure	8 (4.9%)	27 (11.8%)	0.018
Pneumonia	7 (4.3%)	19 (8.3%)	0.113
Wound infection	12 (7.3%)	24 (10.5%)	0.284
CVE	7 (4.3%)	15 (6.6%)	0.332
Atrial fibrillation	45 (27.4%)	80 (34.9%)	0.116

Abbreviations: MI; Myocardial infarction, IABP; Intraaortic balloon pump, CVE; Cerebrovascular event

Mortality: Thirty-day postoperative mortality was identified in 30 patients (7.63%) across the entire cohort. Mortality was 3.7% (6/164) in the moderate-risk group and 10.5% (24/229) in the high-risk group, indicating a significantly higher mortality rate among high-risk patients ($p = 0.012$).

According to the logistic EuroSCORE, the expected mortality rates were calculated as 3.26% in the moderate-risk group and 8.92% in the high-risk group. In both groups, the differences between expected and observed mortality were not statistically significant ($p > 0.05$). The mean standard EuroSCORE values were 4.29 in the moderate-risk group and 7.86 in the high-risk group, with a statistically significant difference between the two ($p < 0.001$) (Table 4). In the ROC analysis, the area under the curve (AUC) was 0.753 (Figure 1), indicating good discriminatory ability of EuroSCORE for predicting mortality in this patient population.

Table 4. Relationship between EuroSCORE and actual mortality

Variable	Medium risk	High risk	p
Standard EuroSCORE	4.29 (3–5)	7.86 (6–14)	<0.001
Logistics EuroSCORE	3.26 (1.82–5.67)	8.92 (4.63–48.22)	<0.001
Actual mortality	6 (3.7%)	24 (10.5%)	0.012

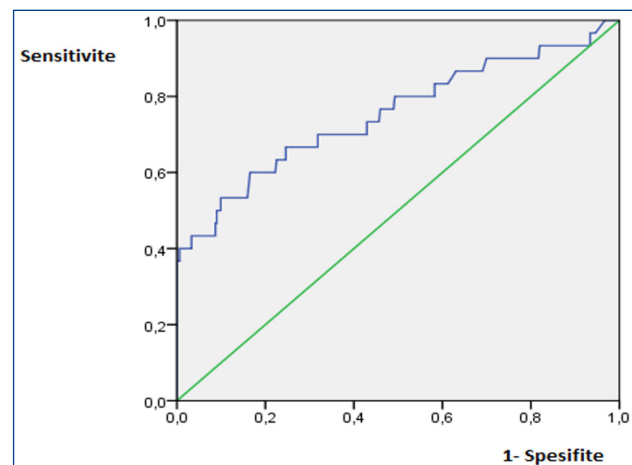


Figure 1. ROC curve demonstrating the predictive performance of EuroSCORE for postoperative mortality. (AUC:0.753)



When postoperative morbidity parameters associated with mortality were examined, low cardiac output, sepsis, elevated creatinine levels, gastrointestinal complications, IABP use, sternal dehiscence, myocardial infarction, pneumonia, pulmonary embolism, and respiratory failure were found to be strongly associated with mortality in both groups. Mortality rates were also higher among patients who were female, had COPD, extracardiac arteriopathy, preexisting neurological sequelae, preoperative renal dysfunction, an ejection fraction $<30\%$, a history of myocardial infarction within the previous 90 days, or who required emergency surgery.

DISCUSSION

In this study, the performance of EuroSCORE in predicting postoperative mortality among patients aged 70 years and older undergoing coronary artery bypass surgery was evaluated, and the expected mortality rates closely matched the observed mortality outcomes. This finding indicates that EuroSCORE remains a clinically valid and reliable tool for risk stratification in elderly patients. While EuroSCORE II has largely replaced the original EuroSCORE in contemporary practice, the use of the original EuroSCORE in the present study reflects the time frame of data collection. This approach allows a historically appropriate assessment of operative risk in elderly patients and supports the validity of the results within that clinical context.

Among the EuroSCORE parameters, female sex, advanced age (≥ 80 years), COPD, extracardiac arteriopathy, preoperative neurological sequelae, recent myocardial infarction (<90 days), and severely reduced ejection fraction ($<30\%$) were identified as significant predictors of mortality. Additional factors not included in the EuroSCORE model but found to be associated with mortality in our study included preoperative heart failure, prolonged CPB duration, and postoperative myocardial infarction. In contrast, although hypertension, preoperative stroke, and extended cross-clamp time were associated with higher mortality rates, these relationships did not reach statistical significance.

With respect to morbidity, several EuroSCORE risk parameters—including advanced age, female sex, COPD, extracardiac arteriopathy, elevated creatinine levels, reduced ejection fraction, recent myocardial infarction, and the need for emergency surgery—were found to influence clinical outcomes negatively. Among the non-EuroSCORE variables, hypertension, diabetes, preoperative stroke, congestive heart failure, and prolonged cross-clamp time were also associated with adverse postoperative results.

Overall, our study demonstrates that EuroSCORE provides adequate accuracy in predicting mortality among elderly patients undergoing CABG; however, it

also highlights that risk in this age group is multifactorial, and additional clinical parameters not included in the model must be carefully considered. Therefore, in elderly patients, the EuroSCORE should not be used in isolation but rather as part of a comprehensive clinical assessment that incorporates comorbid conditions and perioperative risk indicators when guiding surgical decision-making.

Coronary bypass surgery carries a high risk of mortality and morbidity in the elderly due to increasing comorbidities and declining physiological reserve (12). Therefore, risk stratification represents a critical component of surgical planning, particularly in patients over 70 years of age. Current literature indicates that risk assessment in elderly CABG populations is increasingly shifting toward considerations of frailty, systemic comorbidities, and preoperative organ function (13,14).

In our study, 393 patients aged 70 years and older were evaluated, and it was observed that parameters such as female sex, COPD, extracardiac arteriopathy, reduced ejection fraction, elevated creatinine levels, recent myocardial infarction, unstable angina, neurological sequelae, and the need for emergency surgery were more common in the high-risk group. The increased prevalence of this comorbidity cluster among elderly individuals is consistent with findings from previous extensive cohort analyses (2,15,16).

The observed mortality rates—3.7% in the moderate-risk group and 10.5% in the high-risk group—and their concordance with the EuroSCORE-predicted values indicate that the system remains valid in the elderly population. This finding is consistent with recent cohort studies demonstrating that EuroSCORE and EuroSCORE II retain reasonable accuracy in predicting outcomes among older patients (17,18). The AUC of 0.753 in the ROC analysis further supports the model's predictive capability. This level of performance is comparable to the AUC values reported in CABG risk-validation studies (19-21).

Although the association between female sex and mortality remains a subject of debate in the literature, several contemporary studies suggest that perioperative complications occur more frequently in women, which may contribute to higher mortality in this subgroup (22). In our study as well, the higher mortality observed among women may be attributable to increased rates of postoperative myocardial infarction, low cardiac output, and infectious complications.

COPD is one of the strongest predictors of morbidity in elderly patients undergoing CABG. Recent extensive cohort analyses have demonstrated a strong association between COPD and respiratory failure, pulmonary embolism, and prolonged mechanical ventilation (23,24). Our findings are consistent with these observations.

Extracardiac arteriopathy was identified as a determinant of both mortality and postoperative cerebrovascular events. Recent publications report that peripheral arterial disease significantly increases the risk of complications following CABG and that widespread atherosclerosis substantially elevates the likelihood of cerebrovascular events (25,26). It is well established that the incidence of cerebrovascular events is higher in patients undergoing concomitant carotid surgery during CABG; the rates observed in our study are consistent with this literature (27,28).

Left ventricular function emerged as one of the strongest determinants of mortality. The literature consistently emphasizes that reduced ejection fraction increases both early and late mortality in patients aged 70 years and older (29). In our cohort, the mortality rate of 18.5% among patients with an ejection fraction <30% further supports these findings.

Preoperative congestive heart failure and renal dysfunction were also found to be associated with mortality. Contemporary evidence similarly indicates that impaired renal function is among the most important predictors of mortality in elderly surgical patients (30).

A recent myocardial infarction (<90 days) has been identified as a major perioperative risk factor in contemporary cohort studies (31). In our study, the higher mortality and infectious complication rates observed in this subgroup are consistent with the existing literature.

Although emergency surgery is widely reported to increase mortality, some contemporary series have shown that mortality does not rise significantly in high-volume, experienced centers (32). In our study, emergency surgery did not increase mortality; it only influenced the incidence of postoperative atrial fibrillation.

Prolonged CPB duration (particularly >120 minutes) significantly increases mortality in elderly patients. The literature similarly identifies CPB and cross-clamp times as important prognostic determinants in the elderly CABG population (33). Our findings corroborate this association.

With respect to postoperative morbidity, pulmonary complications and renal dysfunction are known to play a prominent role in elderly patients (15). Consistent with this, respiratory failure, the need for inotropic support, IABP requirement, and postoperative renal impairment were all observed more frequently in the high-risk group in our study.

Limitations

This study has several limitations. First, its retrospective, single-center design may introduce selection bias and limit generalizability. Second, the data were

collected between 2004 and 2011; improvements in surgical and perioperative care over time may reduce the applicability of the findings to current practice. Third, some clinically relevant subgroups—such as octogenarians and patients with severely reduced ejection fraction—were relatively small, potentially limiting statistical power. Fourth, frailty and other geriatric-specific risk domains were not systematically assessed and therefore could not be incorporated into the analysis. Finally, long-term outcomes were not evaluated, restricting conclusions to early postoperative mortality and morbidity.

CONCLUSION

In this study, EuroSCORE-predicted mortality rates were concordant with observed outcomes in patients aged 70 years or older undergoing coronary bypass surgery, demonstrating that EuroSCORE remains a reliable risk assessment tool in this older population. Female sex, advanced age, COPD, extracardiac arteriopathy, preoperative neurological sequelae, myocardial infarction within the last 90 days, and reduced ejection fraction emerged as the principal EuroSCORE variables associated with increased mortality. Additionally, preoperative heart failure, prolonged CPB and cross-clamp durations, and postoperative myocardial infarction were identified as contributory factors to mortality.

Regarding morbidity, hypertension, diabetes, stroke, and heart failure were found to have additive effects beyond the variables included in the EuroSCORE. These findings emphasize that risk assessment in elderly patients should incorporate not only score-based calculations but also a multimodal evaluation encompassing frailty, organ function, cerebrovascular status, and pulmonary reserve. Overall, while EuroSCORE remains applicable in elderly patients, careful consideration of supplemental clinical parameters is essential for accurate perioperative risk stratification.

ETHICAL DECLARATIONS

Ethics Committee Approval: This study was derived from the author's thesis submitted in 2011 to the Department of Cardiovascular Surgery at Ankara Atatürk Training and Research Hospital. The study was designed as a single-center, retrospective analysis and conducted in accordance with the ethical principles of the Declaration of Helsinki of the World Medical Association regarding medical research involving human subjects. Due to the study's retrospective nature, ethics committee approval was not required. Patient confidentiality and data privacy were strictly maintained throughout the study.



Informed Consent: Due to the study's retrospective design, written informed consent was not obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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