ORIGINAL ARTICLE

Pre-operative predictors of mortality in ruptured abdominal aortic aneurysms: is the Harborview Medical Center mortality risk score enough?

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ABSTRACT

BACKGROUND: We aimed to evaluate the reliability of the Harborview Medical Center (HMC) mortality risk scoring system in predicting post-operative in-hospital mortality after open repair (OR) of a ruptured abdominal aortic aneurysm (rAAA) and to investigate the presence of other possible mortality risk factors.

METHODS: Patients who underwent OR for rAAA between January 01, 2004, and December 31, 2021, were retrospectively included in this single-center cohort study. The 30-day hospital mortality risk was calculated using the HMC risk scoring system. We assessed the relationship between mortality and other perioperative variables. Logistic regression analysis was performed to determine the factors affecting mortality. Receiver operating characteristic curve analysis was utilized to obtain the predictive value of the HMC mortality risk score.

RESULTS: A total of 91 patients were included in this study. A statistically significant difference existed between the patients who survived and those who died. Univariate logistic regression analysis of the pre-operative patient data revealed that the hematocrit, lactate, shock index values, admission type, loss of consciousness, and HMC risk score significantly affected post-operative mortality. However, in the multivariate logistic regression analysis, only the HMC risk score was associated with post-operative mortality ($P<0.001$). The HMC risk score could predict 30-day mortality, with an AUC of 0.912 for all patients.

CONCLUSION: Our study showed that the HMC risk score could reliably predict in-hospital mortality, but it did not reveal any other parameters that further increased the reliability of this scoring system without compromising on its straightforward and practical calculation.

Keywords: Accuracy; mortality; open repair; risk score; ruptured abdominal aortic aneurysm.

INTRODUCTION

Abdominal aortic aneurysms (AAA) frequently affect up to 5% of people over 50.[1] Several risk factors have been associated with the AAA: Male gender, smoking, hypertension, atherosclerosis, and advanced age.[2] AAA of any size can rupture. The increased aneurysmal diameter or growth rate (≥10 mm/year), female sex, smoking, and hypertension increase the risk of rupture.[3] The overall mortality rate of patients with ruptured AAA (rAAA) is approximately 80%.[4] Recently, elective repair of AAA has experienced a noteworthy reduction in in-hospital mortality rates, with rates as low as 3% being reported. The utilization of endovascular aneurysm repair (EVAR) techniques is considered as a major contributing factor to this favorable trend.[5] Nonetheless, the incidence of hospital mortality among patients who have undergone open repair (OR) for ruptured abdominal aortic aneurysm (rAAA) remains markedly high, with reported rates as high as 53%.[6] Although

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the adoption of EVAR has contributed to a reduction in hospital mortality rates to approximately 16%, the incidence of secondary interventions has shown a corresponding increase. Moreover, long-term follow-up data for such patients have revealed decreased survival rates.[5,7] Notable enhancements, including the increasing prevalence of EVAR, the rise in the number of advanced centers equipped with proficient surgeons specializing in OR, and developments in ambulance transfer facilities, have improved the clinical outcomes of patients with AAA. Despite the advances mentioned above, hospital mortality rates among patients with rAAA persist at high levels. Various scoring systems, such as the Glasgow Aneurysm Score (GAS), Vancouver Scoring System, Edinburgh Ruptured Aneurysm Score, Hardman Index (HI), Vascular Study Group of New England (VSGNE) Ruptured Aneurysm Score, Harborview Medical Center (HMC) Risk Score, and Dutch Aneurysm Score (DAS), have been devised to estimate the risk of mortality among patients with AAA. The scoring systems, as mentioned earlier, assess various pre-operative and intraoperative data (including the history of myocardial or cerebrovascular disease, renal failure, age, pH, creatinine, systolic blood pressure (SBP), cardiac arrest, hemoglobin level, loss of consciousness, and use of a suprarenal clamp, etc.) among patients with rAAA to determine the risk of mortality following EVAR or OR. Despite the availability of several scoring systems for risk estimation, health-care professionals have no consensus regarding the universally applicable risk scoring system. Furthermore, none of the existing scoring systems can accurately calculate a homogeneous and universally applicable mortality risk for all patient groups. Certain scoring systems, such as the DAS, involve a complex calculation method, while others, including the GAS, may not reliably estimate the mortality risk among patients undergoing ruptured endovascular aneurysm repair (rEVAR). Certain scoring systems, such as the GAS and HI, may not accurately calculate the mortality risk of high-risk patients. Other scoring systems (e.g., the VSGNE scoring system) additionally depend on intraoperative data and may not adequately assess the pre-operative variables that contributing to mortality risk in patients with rAAA.[8] In recent years, the HMC risk score solely using pre-operative patient data has gained popularity due to ease of calculation and reliable mortality risk estimation.[9] The HMC mortality risk score includes only four pre-operative variables: age greater than 76 years, creatinine level exceeding 2 mg/dl, pH <7.2, and SBP <70 mmHg. The presence of each parameter equals one score, and the HMC score is calculated according to the total score.

The objective of this study was to evaluate the effectiveness of the HMC risk scoring system in predicting hospital mortality following OR for patients with rAAA. Additionally, the study aimed to identify pre-operative and intraoperative risk factors that may influence post-operative mortality.

MATERIALS AND METHODS

Study Design

This study included patients diagnosed with rAAA, admitted to the emergency department of our hospital between January 01, 2004, and December 31, 2021, and underwent OR. This study included patients aged above 18 years who underwent OR. All rAAAs were located infrarenal. Many cardiovascular surgeons have operated on patients during this period. None of the patients in this study underwent rEVAR. Our study was approved by a Local Ethics Committee (No: 2022/263; Date: May 09, 2022).

The study collected data on various patient characteristics include age, gender, comorbidities such as hypertension, coronary artery disease (CAD), diabetes mellitus (DM), chronic obstructive pulmonary disease (COPD), and end-stage chronic kidney disease (ESRD), as well as information on admission type (direct or transferred), vital signs such as pulse and blood pressure, loss of consciousness and arrest status, and serum creatinine levels and pH values at admission. The 30-day hospital mortality risk was determined using the HMC risk scoring system. Furthermore, the correlation between mortality risk and various pre-operative variables such as comorbidities, admission type, shock index (SI), hematocrit and lactate values, cardiac arrest status, intraoperative variables such as blood product replacement and change in overtime (first 9 years vs. second 9 years) was analyzed. The presence of shock was identified using the SI, which was calculated by dividing the heart rate by SBP, with an SI greater than 0.9 indicative of severe shock.

Statistical Analysis

Statistical analysis was conducted using IBM® SPSS® Statistics (version 23). The normality of the data was assessed using the Kolmogorov-Smirnov test. Non-normally distributed continuous variables were reported as median (range) and analyzed using the Mann–Whitney U-test. Categorical variables, expressed as frequencies or percentages, were analyzed using the chi-square or Fisher's exact test. Univariate and multivariate logistic regression analyses were performed to identify factors affecting mortality. Receiver operating characteristic (ROC) curves were utilized to evaluate the predictive value of the HMC mortality risk score. The area under the curve (AUC) with 95% confidence intervals (CI) was reported. Statistical significance was set at $P < 0.05$ for all analyses.

RESULTS

This study included 91 patients who underwent OR for rAAA. In our hospital, elective EVAR is available; however, due to the challenges of obtaining emergency stent grafts, the OR was the preferred method routinely. Notably, around 66% of patients admitted to our hospital were referred from other medical facilities. There was no significant statistical difference in the demographic characteristics and HMC scores between patients who presented directly to the hospital and those transferred from another health-care facility (P > 0.05). However, significant differences were observed between these groups in terms of the median values of SBP, SI, and lactate (P=0.001, 0.006, and 0.02, respectively).

The patient cohort exhibited a mean age of 71.04±10.60 years. Furthermore, 36.3% of the patients were aged 76 years or older. The male patients comprised the majority at a prevalence of 80%. The study participants had comorbidities such as hypertension (73.6%), COPD (38.5%), CAD (29.7%), DM (25.3%), and ESRD (7.7%). At the time of admission, 46.2% of the patients had hypotension (SBP <70 mmHg any time pre-operatively), 28.2% had pH <7.2, and 30.8% had serum creatinine levels of >2.0 mg/dL. Pre-operative cardiac arrest was detected in 11% of the patients and loss of consciousness in 34.1%.

A statistically significant difference was observed between the pre-operative hematocrit, lactate, and SI values of patients who died and those who survived. Table 1 provides a

Table 1. Patient characteristics, perioperative variables, and 30-day mortality

	Total n (%)	Survived n (%)	Died n (%)	P-value
	91 (100.0)	44 (48.4)	47 (51.6)	
Age*	71 (47–93)	68.5 (47–84)	77 (52–93)	0.002
Gender				
Male	73 (80.2)	37 (40.7)	36 (39.6)	0.264
Female	18 (19.8)	7 (7.7)	11 (12.1)	
Comorbidities				
Hypertension	67 (73.6)	35 (38.5)	32 (35.2)	0.158
Diabetes mellitus	23 (25.3)	10 (11)	13 (14.3)	0.383
CAD	27 (29.7)	11 (12.1)	16 (17.6)	0.238
COPD	35 (38.5)	18 (19.8)	17 (18.7)	0.402
ESRD/Hemodialysis	7 (7.7)	0 (0.0)	7 (7.7)	0.008
Transferred from another hospital	60 (65.9)	23 (25.3)	37 (40.7)	0.007
Prior laparotomy	7 (7.7)	2 (2.2)	5 (5.5)	0.245
Antiplatelet administration	30 (33)	13 (14.3)	17 (18.7)	0.327
Pre-operative cardiac arrest	10 (11)	2 (2.2)	8 (8.8)	0.056
Pre-operative loss of consciousness	31 (34.1)	3 (3.3)	28 (30.8)	<0.001
The HMC score variables				
Age >76 years	33 (36.3)	8 (8.8)	25 (27.5)	<0.001
pH <7.2	26 (28.6)	2 (2.2)	24 (26.4)	<0.001
SBP <70 mmHg	42 (46.2)	5 (5.5)	37 (40.7)	<0.001
Creatinine>2.0 mg/dL	28 (30.8)	4 (4.4)	24 (26.4)	<0.001
Total HMC score*	1 (0–4)	0 (0–2)	2 (1–4)	<0.001
0 point	28 (30.8)	28 (30.8)	0 (0.0)	<0.001
1 point	20 (22.0)	13 (14.3)	7 (7.7)	
2 points	23 (25.3)	3 (3.3)	20 (22.0)	
3 points	16 (17.6)	0 (0.0)	16 (17.6)	
4 points	4 (4.4)	0 (0.0)	4 (4.4)	
Hematocrit*	25.6 (17.0–44.1)	28.0 (17.0–44.0)	24.9 (17.0–35.8)	<0.001
Laktate*	3.88 (0.76–18.0)	1.65 (0.76–10.20)	4.20 (0.84–18.00)	<0.001
Shock index*	1.05 (0.50–3.33)	0.80 (0.50–2.56)	1.52 (0.63–3.33)	<0.001
ES replacement*	8.8 (0–22)	8.5 (0–22)	9 (1–21)	0.774
FFP replacement*	5.8 (0–18)	5 (0–15)	5 (0–18)	0.204
AP replacement*	0.8 (0–4)	0 (0–4)	1 (0–4)	0.128

*Median (min-max) was used for non-parametric variables. CAD: Coronary artery disease; COPD: Chronic obstructive pulmonary disease; ESRD: End-stage renal disease; ES: Erythrocyte suspension; FFP: Fresh frozen plasma; AP: Apheresis platelet.

Table 2. Thirty-day mortality predicted by HMC mortality risk score for all patients

The HMC Score	Died	Observed	Probability of death	Lower CI	Upper CI
0 point	0	28	0.00	0.00	0.04
1 point	7	20	0.35	0.18	0.57
2 points	20	23	0.87	0.68	0.95
3 points	16	16	1.00	0.81	1.00
4 points	4	4	1.00	0.51	1.00

CI: Confidence interval.

summary of pre-hospital patient characteristics and 30-day mortality. Notably, 51.1% of all deaths occurred during the first 9-year period (2004-2013), with the remaining 48.9% occurring in the second 9-year interval (2013-2021). However, the difference in mortality rates between these two 9-year periods was statistically insignificant (P=0.15). The HMC score had a median value of 1 (0–4), with a statistically significant difference noted between those who survived (median, 0 [0–2]) and those who died (2 [1–4]). The overall 30-day mortality rate following rAAA repair was 51.6%, with 44 patients surviving beyond the 30-day mark. Notably, none of the patients who scored zero points in the HMC assessment succumbed to mortality. Patients with a score of one point and two points exhibited mortality rates of 35% and 87%, respectively, while none with a score of three or four points survived (Table 2). We observed a marked increase in mortality rates among the patients with 2 points. Out of 23 patients with this HMC score, 17 had a SBP below 70 mmHg (74%), ten exhibited creatinine levels exceeding 2.0 mg/dL (43.5%), 12 were older than 76 years (52.2%), and seven had a pH value below 7.2 (30.4%). To further dissect the contributing factors for a score of 2, we formulated six binary groups based on combinations of HMC parameters and assessed the mortality rates within these groups. The groups were delineated as follows: Group 1 (Age+Creatinine), Group 2 (Age+SBP), Group 3 (Age+pH), Group 4 (SBP + Creatinine), Group 5 (SBP+pH), and Group 6 (pH+Creatinine). The distribution of patients in these groups was five in Group 1 (21.7%), six in Group 2 (26.1%), one in Group 3 (4.3%), five in Group 4 (21.7%), and six in Group 5 (26.1%). Notably, no patients fell into Group 6. The respective mortality rates for the six groups were 60% in Group 1 (n=3), 100% in Groups 2 (n= 6), 3 (n=1), and 4 (n=5), and 83.3% in Group 5 (n=5). It is noteworthy that groups including the SBP parameter – Groups 2, 4, and 5 – exhibited particularly high mortality rates ranging from 83.3% to 100%. However, the small sample size precluded any additional statistical analysis.

Univariate logistic regression analysis revealed that Hct, lactate, SI values, admission type, loss of consciousness, and the HMC risk score significantly influenced post-operative mortality. However, multivariate logistic regression analysis revealed that solely the HMC risk score exhibited an association with post-operative mortality (OR=26.57; 95% CI: 4.59–153.64; P<0.001), as reported in Table 3. As lactate and

Table 3. Predictors of 30-day mortality

Variable	Univariate		Multivariate	
	OR (%CI)	P-value	OR (%CI)	P-value
Sex (reference: Male)	1.61 (0.564–4.629)	0.37	3.38 (0.35–32.24)	0.29
HMC score	21.6 (6.249–74.902)	<0.001	26.57 (4.59–153.64)	< 0.001
Hematocrit	0.82 (0.73–0.92)	<0.001	1.03 (0.83–1.29)	0.76
Laktate	1.8 (1.33–2.42)	<0.001	-	*
Shock index	12.22 (3.76–39.70)	<0.001	-	*
Transfer from another hospital (reference: direct)	3.37 (1.35–8.43)	0.009	4.19 (0.64–27.18)	0.13
Cardiopulmonary arrest	4.30 (0.86–21.54)	0.07	0.04 (0.001–2.17)	0.11
Loss of consciousness	20.14 (5.44–74.57)	<0.001	1.24 (0.11–13.51)	0.85
Hemodialysis	1777022350.7 (0.0–…)	0.99	150755396.8	0.99

*The model did not include lactate and shock index because they were highly correlated with other parameters (pH and SBP, components of the HMC score)

Table 4. Harborview Medical Center pre-operative ruptured abdominal aortic aneurysm mortality risk score

	OR	CI	P-value	Scoring
SBP <70 mm Hg	28.8	9.012–92.425	<0.001	1 point
pH <7.2	21.913	4.747–101.145	<0.001	1 point
Creatinine >2.0 mg/dL	10.43	3.219–33.830	<0.001	1 point
Age >76 years	5.11	1.965–13.310	<0.001	1 point

OR: Odds ratio; CI: Confidence interval; SBP: Systolic blood pressure.

SI were observed exhibited a high correlation with other parameters (pH and SBP, both components of the HMC score), they were excluded from the multivariate analysis.

The multivariate logistic regression model identified four variables that significantly predict mortality in the patient cohort: age >76 years (OR=5.11; CI: 1.965–13.310; P<0.001), creatinine level >2.0 mg/dL (OR=10.43; CI: 3.219–33.830; P<0.001), pH <7.2 (OR=21.913; CI: 4.747–101.145; P<0.001), and SBP <70 mm Hg (OR=28.8; CI: 9.012–92.425; P<0.001) (Table 4). Furthermore, the HMC score showed strong predictive ability for 30-day mortality with an AUC of 0.912 for all patients, as demonstrated in Figure 1.

DISCUSSION

Rupture is a fatal complication (80%) of AAA. OR mortality rates for rAAA have remained high (20–53%) over the past four decades.[6] We also determined that the 30-day in-hospital mortality rate was 51.6%, consistent with the previous studies.

Extensive research has been conducted to determine the reasons for the high mortality rate in rAAA. Hoornweg et al.[10] conducted a meta-analysis that revealed no significant improvement in the mortality rate (49%) associated with OR for rAAA over time. Their findings highlighted that advanced patient age contributes to the high mortality rates observed. Similarly, our analysis revealed no differences in mortality rates over the years.

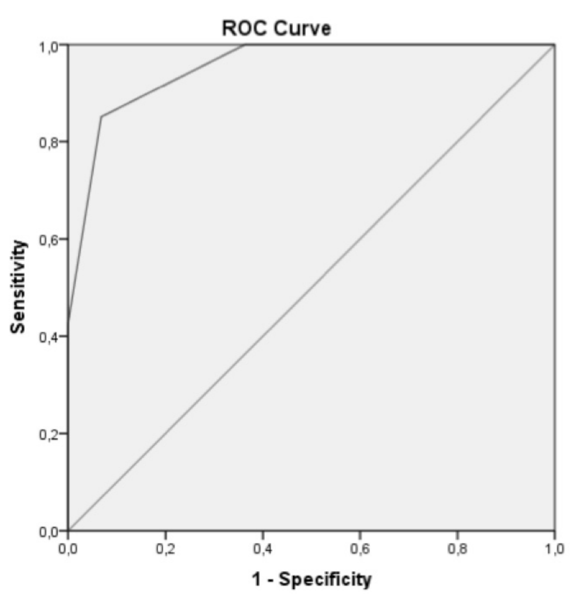

Figure 1. The area under the receiver operating characteristic curve results by HMC risk score for all patients.

According to Warner et al.,[11] centralization and regionalization of treatment play roles in the management of rAAA. They suggest that treating rAAA at tertiary or central hospitals, rather than community or 1st-level hospitals, can significantly decrease mortality rates by up to 20%. In contrast, Qiu et al.[12] demonstrated a lower mortality rate of 33% in patients who underwent surgery at the first center of admission compared to the higher rate of 68% in those who were transferred to an advanced center. Although the postoperative mortality rate was higher in patients referred to our tertiary hospital emergency department than those who directly presented to our tertiary hospital, the multivariate logistic regression analysis did not reveal any association between patient admission type and mortality.

Hans et al.[13] studied 101 patients who underwent OR for rAAA by a single surgeon over 21 years; they emphasized that more surgeon experience did not improve survival rates. Our study did not evaluate the impact of a surgeon's experience on mortality rates, as multiple surgeons participated in operations spanning an 18-year timeframe.

Efforts are ongoing to find the ideal scoring system to estimate a patient's mortality risk following rAAA repair preoperatively. Garland et al.[7] aimed to establish a practical scoring system to predict the mortality in 303 patients who underwent EVAR or OR for rAAA. They developed the HMC score to determine rAAA mortality risk pre-operatively. The HMC scoring system uses for pre-operative variables which are scored from 0 to 4. The expected mortality rates for patients with 0–4 points were 27%, 22%, 69%, 80%, and 100%, respectively. The authors emphasized that the HMC is the only scoring system that is reliable, practical, easy to calculate, and requires only pre-operative patient data to estimate the 30-day mortality following rAAA repair. In the patient cohort of Garland et al., the positive effect of rEVAR on mortality rates compared to OR is remarkable. This difference in favor of rEVAR was more obvious in patients with 1 point and 2 points (7–30%, 37–80%, respectively). However, in this study, none of the patients with 4 points performed rEVAR. Therefore, the positive effect of rEVAR on mortality rates compared to OR in the highest-risk patients (4 points) could not be evaluated. Hemingway et al.[9] found that the 30-day mortality rate was 14.6% for patients with an HMC score of zero points, 35.7% for one point, 68.4% for two points, and 100% for three and four points. In this study, the authors also emphasized that the short and medium-term results of rE-VAR approach are improved than OR in patients with suitable anatomy. Our study calculated the in-hospital 30-day mortality rates as 35%, 87%, 100%, and 100% in patients with an HMC risk score from 1 to 4, respectively. Our study found no deaths among the 28 patients with an HMC score of 0 points. The disparity observed in mortality rates between our study and that of Garland et al. may be attributed to several factors, including the limited sample size, diversity of cohorts, and the difference in the treatment modalities. Additionally, the HMC score predicted the 30-day mortality in our patient cohort, with an AUC of 0.912 for all patients. Therefore, we proved that the HMC score could successfully predict post-operative mortality using population data alone. In the study by Ciaramella et al.,[14] the AUC in the ROC analysis for HMC, VSGNE, and DAS for predicting hospital mortality following rAAA treatment with EVAR and OR was 0.74 (95% CI: 0.60–0.88), 0.73 (95% CI, 0.58–0.87), and 0.67 (95% CI, 0.51–0.83), respectively. This study demonstrated that the most current scoring systems (HMC, DAS, and VSGNE risk scores) accurately and equally predict in-hospital mortality after rAAA repair. Univariate analysis of the HMC and VSGNE scores showed linear associations with in-hospital death; high scores were associated with an increased probability of death. This finding is supported by ROC curves showing significant predictive values for all three scoring systems. The mentioned study included patients who underwent both OR and rEVAR; their sample size was approximately half that of ours. Consequently, differences in the ROC analysis outcomes for the HMC score were observed between these two studies due to these factors.

Hansen et al.[8] compared the reliability of the DAS, VSGNE, and HMC risk scoring systems in predicting 30-day mortality in patients undergoing EVAR or OR for rAAA. Although all three scoring systems were reliable, with no statistical difference in the results, they emphasized that the VSGNE score was the most accurate. However, the VSGNE score system is dependent on intraoperative variable (suprarenal clamp). Therefore, this scoring system cannot enable the surgeon, clinician, patients, and their families to decide on the treatment method based on pre-operative patient data alone. DAS is dependent only on pre-operative patient data. However, since its calculation method is more complex, it leads to a waste of time in these patients with critical condition. HMC was able to predict mortality successfully using only pre-operative patient data. The authors also emphasized that the accuracy of the HMC score was increased in patients undergoing rEVAR.

In our study, univariate logistic regression analysis of pre-operative patient data revealed that the Hct, lactate, SI values, admission type, and loss of consciousness significantly affected post-operative mortality in addition to the HMC risk score. However, in the multivariate logistic regression analysis, only the HMC risk score was associated with post-operative mortality. Lieberg et al.[5] reported that the lowest perioperative hemoglobin and highest lactate values were significant risk factors for post-operative 30-day mortality in 48 patients who underwent OR for rAAA.

Ciaramella et al.[14] found the following variables are associated with in-hospital mortality: lowest pre-operative SBP, serum creatinine levels >2.0 mg/dL, first recorded intraoperative pH, and suprarenal aortic cross-clamping. In addition, pre-operative cardiac arrest status was close to significant (P=0.051).

An evaluation of the HMC risk score sub-parameters of our patients revealed that the following affected (increased) the mortality risk: SBP <70 mmHg (OR: 28.8, CI: 9.01–92.425), pH <7.2 (OR: 21.91, CI: 4.747-101.145), creatinine level>2.0 mg/dL (OR: 10.43, CI: 3.219-33.830), age >76 years (OR: 5.11, CI: 1.965-13.310) (from the highest to lowest effect). Da Silveira et al.[15] reported that the following risk factors were associated with early post-operative mortality in patients undergoing OR for rAAA: age >60 years, pre-operative creatinine level >1.3 mg/dL, pre-operative SBP <70 mmHg, intraoperative urine output <200 mL, and volume replacement >8 liters. Da Silveira et al. had conducted the only study to date to have evaluated the effect of intraoperative urine output on post-operative mortality. We assessed the effect of blood product replacement on post-operative mortality; however, we did not find a statistically significant relationship. Recent studies using different parameters to predict post-operative mortality and/or evaluate the accuracy of the HMC score have gained prominence. In a study of 500 patients who underwent OR for rAAA by Tomic et al.,[16] the most common post-operative complications were pulmonary issues, acute renal failure, and the need for surgical revision. The 30-day mortality rate was 35.4%. A multivariate logistic regression analysis found five variables that predicted mortality: age >74 years, loss of consciousness, previous history of myocardial infarction, ventricular arrhythmia, and diastolic blood pressure <60 mmHg. They assigned 1 point to each of these five pre-operative parameters. The 30-day mortality rate was found to be 15.3% for those who received 1 point, 68.2% for those who received 3 points, and 100% for those who received 5 points. This bedside, easily calculable risk scoring system by Tomic et al., requires only pre-operative patient data; thus, it has emerged as an alternative to predicting hospital mortality after OR for rAAA. Stuntz et al.[1] analyzed the outcomes of 75.000 patients admitted for rAAA; female patients who underwent EVAR or OR had significantly higher hospital mortality rates than male patients.

They noted that despite all advancements in rAAA repair, women continue to have a higher mortality rate than men, regardless of the treatment chosen. However, sex did not affect the in-hospital mortality in our patients who underwent OR for rAAA. Barakat et al.[6] found that the median survival of women was significantly lower than men's in their study. The average age of the women in their study was 4 years older than that of men, which may account for their lower survival rate. However, there is no consensus on this in the literature. Evans et al.[17] reported no significant difference in sex between in-hospital mortality and long-term survival after OR after rAAA.

The limitations of our study were its small sample size, retrospective nature, single-center design, no patients undergoing rEVAR, and lack of long-term survival outcomes.

CONCLUSION

Our study showed that the HMC risk score could reliably predict in-hospital mortality. However, it did not reveal any other parameters that further increased the reliability of this scoring system without compromising on its straightforward and practical calculation.

Given that all patients who presented with an HMC score of 3–4 experienced 100% mortality within our patient cohort, advocating for conservative treatment to manage these patients would be a particularly bold assertion. Such a recommendation necessitates prospective, multicenter studies with significant patient participation before implementing a paradigm shift in the managing this patient population. The reliability of the HMC rAAA mortality risk score in predicting that rEVAR has improved results than OR should also be investigated in these large-scale and multicenter studies.

Ethics Committee Approval: This study was approved by the Ondokuz Mayıs University, Faculty of Medicine Ethics Committee (Date: 25.05.2022, Decision No: 2022/263).

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ORİJİNAL ÇALIŞMA - *ÖZ*

Rüptüre abdominal aort anevrizmalarında preoperatif mortalite öngörücüleri: Harborview Medical Center (HMC) mortalite risk skoru yeterli mi?

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AMAÇ: Rüptüre abdominal aort anevrizmasının (rAAA) açık onarımından sonra postoperatif hastane içi mortaliteyi öngörmede Harborview Tıp Merkezi (HMC) mortalite risk skorlama sisteminin güvenilirliğini değerlendirmeyi ve diğer olası mortalite risk faktörlerinin varlığını araştırmayı amaçladık

GEREÇ VE YÖNTEM: 01 Ocak 2004 ile 31 Aralık 2021 tarihleri arasında rAAA nedeniyle açık onarım yapılan hastalar bu tek merkezli kohort çalışmasına retrospektif olarak dahil edildi. 30 günlük hastane mortalite riski, HMC risk skorlama sistemi kullanılarak hesaplandı. Mortalite ve diğer perioperatif değişkenler arasındaki ilişki incelendi. Mortaliteyi etkileyen faktörleri belirlemek için lojistik regresyon analizi yapıldı. HMC mortalite risk skorunun prediktif değerini elde etmek için İşlem Karakteristik (Receiver Operating Characteristic) Eğrisi analizi kullanıldı.

BULGULAR: Bu çalışmaya toplam 91 hasta dahil edildi. Hayatta kalan hastalar ile ölenler arasında istatistiksel olarak anlamlı bir fark vardı. Preoperatif hasta verilerinin tek değişkenli lojistik regresyon analizi, hematokrit, laktat ve şok indeksi değerlerinin, başvuru şeklinin, bilinç kaybının ve HMC risk skorunun postoperatif mortaliteyi anlamlı olarak etkilediğini ortaya koydu. Ancak çok değişkenli lojistik regresyon analizinde sadece HMC risk skoru postoperatif mortalite ile ilişkiliydi ($p<0.001$). HMC risk skoru, tüm hastalar için 0,912 AUC değeri ile 30 günlük mortaliteyi tahmin edebilir.

SONUÇ: Çalışmamız, HMC risk skorunun hastane içi mortaliteyi güvenilir bir şekilde tahmin edebileceğini gösterdi, ancak bu skorlama sisteminin kolay ve pratik hesaplanmasından ödün vermeden güvenilirliğini daha da artıran başka parametreler ortaya koymadı.

Anahtar sözcükler: Rüptüre abdominal aort anevrizması; mortalite; risk skoru; açık onarım; doğruluk.

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