Ekvivalent: Epidemiološke karakteristike i čimbenici povezani sa smrtnošću teško opečenih bolesnika – iskustvo hrvatskog opeklinskog centra

Škunca, Agata

Professional thesis / Završni specijalistički

2024

Degree Grantor / Ustanova koja je dodijelila akademski / stručni stupanj: **University of Zagreb, School of Medicine / Sveučilište u Zagrebu, Medicinski fakultet**

Permanent link / Trajna poveznica: https://urn.nsk.hr/urn:nbn:hr:105:870951

Sveučilište u Zagrebu

Medicinski fakultet

Agata Škunca

EPIDEMIOLOŠKE KARAKTERISTIKE I ČIMBENICI POVEZANI SA SMRTNOŠĆU TEŠKO OPEČENIH BOLESNIKA – ISKUSTVO HRVATSKOG OPEKLINSKOG CENTRA

Završni specijalistički rad

Zagreb, rujan, 2024. godine

Sveučilište u Zagrebu

Medicinski fakultet

Agata Škunca

EPIDEMIOLOŠKE KARAKTERISTIKE I ČIMBENICI POVEZANI SA SMRTNOŠĆU TEŠKO OPEČENIH BOLESNIKA – ISKUSTVO HRVATSKOG OPEKLINSKOG CENTRA

Završni specijalistički rad

Zagreb, rujan, 2024. godine

Ovaj rad je ekvivalent završnog rada na specijalističkom studiju Anesteziologije, reanimatologije i intenzivne medicine u akademskoj godini 2019./2020.

Rad je objavljen u časopisu Acta clinica Croatica 2023. godine.

Škunca A, Mesić A, Magdić Turković T, Radočaj T, Potočki S. Epidemiological Characteristics and Factors Associated with Mortality in Severely Burned Patients–Croatian National Burn Center Report. Acta clinica Croatica. 2023 Apr 1;62(1):115-22.

Klinički bolnički centar Sestre milosrdnice, Zavod za anesteziologiju, reanimatologiju i intenzivnu medicinu

Mentor: dr.sc. Tomislav Radočaj, dr.med.

Student: Agata Škunca, dr.med.

Redni broj rada:

SADRŽAJ

POPIS OZNAKA I KRATICA

WHO - World Health Organization

DALYs - disability-adjusted life-years

BICU – burn intensive care unit

TBSA – total body surface area

SD – standard deviation

ROC - receiver operating characteristic

LOS – length of stay

CI – confidence interval

OR – odds ratio

IQR = interquartile range

1. INTRODUCTION

According to the World Health Organization (WHO), burns are responsible for approximately 180 000 deaths annually and thus represent a significant worldwide public health problem. In low-income and middle-income countries, burns are one of the leading causes of disability-adjusted life-years (DALYs) lost (1). Despite a significant decrease in the incidence, severity and mortality rates, especially in high-income countries, the socioeconomic burden of these injuries is still substantial due to prolonged hospitalization and extended rehabilitation followed by impaired physical and psychological quality of life (2,3).

Epidemiological studies are essential for the prevention of burn injuries and providing appropriate medical care. Burn injuries have not been researched in Croatia until now, epidemiological and clinical characteristics of burn patients are unknown; therefore, the aim of this study was to fill this research gap by providing data on severely burned adult patients in Croatia. We decided to perform this study to compare our results with the literature and gain an insight into the quality of burn care in our Center. The following epidemiological and clinical characteristics were documented: age, sex, comorbidities, hospital of primary treatment, mechanism of injury, total body surface area (TBSA) burned, presence of inhalation injury, duration of mechanical ventilation, timing of tracheotomy, length of stay (LOS) in the burn intensive care unit (BICU), LOS in the hospital, and outcome of severely burned patients with TBSA burned over 20% treated in BICU. Besides the epidemiology analysis, the goal was to determine the factors associated with mortality. We hypothesized that factors such as age, sex, comorbidity, mechanism of injury, TBSA burned, and inhalation injury were correlated with death outcome in patients with severe burns admitted and treated in BICU. These data should serve as a basis for further improvement of burn care in Croatia.

2. PATIENTS AND METHODS

This was a retrospective observational study of severely burned patients admitted to BICU in the Department of Traumatology, Sestre milosrdnice University Hospital Center from January 1, 2016 to September 1, 2022. This Department treats adult patients referred from the emergency clinic, regional hospitals and other clinical hospital centers in Croatia and neighboring countries. Data were retrieved from the clinical electronic database. Before data collection, the study was approved by the Hospital Ethics Committee (approval number 003-06/21-03/040 as of December 9, 2021). Patients eligible for this study were adults (18 years and older) with TBSA burned 20% or higher who were admitted to the BICU. Exclusion criteria were less than 20% TBSA burned, first-degree burns, pregnancy, unfinished medical treatment in BICU during the study period, and incomplete medical records.

During the study period, 193 patients were admitted to the BICU and 109 patients were included in the study. The following data were collected: age, sex, comorbidities, hospital of primary treatment, mechanism of injury (flames, scalds, electrical injury), TBSA burned, presence of inhalation injury, duration of mechanical ventilation, timing of tracheotomy, LOS in BICU, LOS in the hospital, and outcome.

Statistical analysis was performed using SAS © Ver. 9.4 (Cary, NC). Descriptive statistics were used to summarize the characteristics of the patients included. All continuous variables were expressed as mean and standard deviation (SD) and median with an interquartile difference. Categorical variables were expressed as frequencies and percentages. Age, sex, comorbidities, mechanism of injury, TBSA burned, and presence of inhalation injury were used as explanatory variables of outcome in a logistic regression model. All p values less than 0.05 were considered statistically significant.

3. RESULTS

Out of 109 patients included in the study, 80 (73.39%) were male, 29 (26.61%) were female, and the male to female ratio was 2.76:1. Their mean age was 54.50±20.21 years. The mean age of males was 51.85±20.04 years and of females 61.80±19.16 years. Thirty (30.61%) patients were healthy without documented comorbidities, 35 (35.71%) had one comorbidity, and 33 (33.67%) had 2 or more comorbidities. The presence and number of comorbidities were dependent on the available electronic database and data on 11 patients were missing. Comorbidities that were noted were hypertension, diabetes, chronic obstructive pulmonary disease, chronic alcoholism, psychiatric disorders, history of myocardial or cerebral infarction and malignancy, renal insufficiency, and epilepsy. Approximately one-third of patients (n=36, 36.36%) had a history of psychiatric disorders. Psychiatric diagnosis was defined from the electronic database as the history of F diagnosis according to the International Classification of Diseases 10 th Revision. Most patients (n=72, 66.06%) were transferred from other hospitals and 37 (33.94%) were admitted to the BICU directly from the emergency clinic. Patient characteristics are shown in Table 1.

The mean and standard deviation for TBSA burned was 42.48±18.64%. The group with 20%-39% TBSA burned included 54 (49.54%), the group with 40%-59% TBSA burned 27 (24.77%), and the group with 60% TBSA burned or more 28 (25.69%) patients. Most burns were caused by flame (n=88, 80.73%), followed by scalds (n=10, 9.17%). The most common mechanism of burn injury was unintentional injury (n=84, 77.06%), 10 (9.17%) were suicide attempts, 3 (2.7%) were assaults by another person, and 7 (6.42%) were electrical injuries. The presence of inhalation injury was detected in 46 (42.20%) patients, 31 of them were diagnosed using bronchoscopy and 15 were diagnosed based on clinical evaluation and mechanism of injury. These results are shown

in Table 2.

Length of stay in the BICU was 40.11±37.65 days and in the hospital 58.72±49.03 days. Half of the patients survived (n=55, 50.46%). The LOS/TBSA ratio of patients who survived (n=55) was 2.45±1.5. The majority of patients (n=86, 78.90%) were mechanically ventilated. Most of them (n=61, 70.93%) were intubated and mechanically ventilated upon admission. The duration of mechanical ventilation was 25 days on average (mean 24.80±25.55). Tracheotomy was performed in 34 of 86 (39.53%) mechanically ventilated patients at 21.00±24.73 days after starting mechanical ventilation. Results are shown in Table 3. Antibiotic therapy was initiated in 100 (91.74%) patients following clinical suspicion of infection at 5.27±3.81 days after injury. Regression coefficients for TBSA burned and the number of comorbidities were found to be statistically significant (p=0.0001 and p<0.0001, respectively). Considering that the odds ratio for the number of comorbidities 2+ vs. 0 was estimated at 27.66 (with a 95% confidence interval (CI) of 6.12-124.93), it may be concluded that patients with 2+ comorbidities had about 28-fold higher odds of a lethal outcome than those with no comorbidities. Finally, the estimated odds ratio for TBSA burned was 1.07 (with a 95% CI of 1.04-1.11). Thus, it may be concluded that with an increase of TBSA by 1%, the odds of a lethal outcome are expected to increase by approximately 7% (while holding the number of comorbidities at a fixed value). Odds ratio estimates are displayed in Table 4 and Figure 1. Receiver operating characteristic (ROC) curve is shown in Figure 2. Overlaid ROC curves in Figure 2 demonstrate successive improvements in model performance when particular predictors are added one at a time to the model. It could be observed that the final model is superior to all models in the previous steps in terms of true and false classification.

4. DISCUSSION

The authors conducted a single-center retrospective study during the last 6.5-year period. The study aimed to describe demographic data of burn patients in the Croatian burn center and investigate the factors affecting mortality. This group of patients is important because they exhibit a high mortality rate. The mortality of severely burned patients reported in the literature varies, ranging from 27% to 33%, and up to 54% for injuries of 40% TBSA or greater in Australia and New Zealand (4). In Europe, the reported mortality rate was between 1.4% and 18% (maximum 34%) for acute burn injury requiring specialized care during hospital admission (2).

This study included a total of 109 burn patients. The sample consisted of 80 (73.39%) male patients with a male to female ratio of 2.76:1, which corresponds to data from current studies (3,5). The mean age was 54.50±20.21 years. In comparison with other studies, the mean age of the patients was higher (5-8), which might be due to pediatric patients not being included in the study.

Most burns were caused by flames (n=88, 80.73%), which is the main cause of adult burns in a number of studies (2,4,9,10), while scalds (n=10, 9.17%) and electrical injuries (n=7, 6.42%) are the causes of a minority of burns. Flame injuries occurred mostly from gasoline ignition caused by improper handling of gasoline, uncontrolled weed burning, explosions due to malfunctioning of household appliances, inappropriate handling of inflammable substances, work-related injuries, and other less frequent causes. Most injuries in our study were accidental and could have been prevented.

Inhalation injury was detected in 46 (42.20%) patients by bronchoscopy or clinically based on clinical evaluation and mechanism of injury. Fiberoptic bronchoscopy is the standard technique for diagnosis of inhalation injury 11 but standard criteria for diagnosis and grading have not been reached (12). In our BICU, bronchoscopy is performed when the mechanism of injury indicates inhalation injury but grading of inhalation injury is usually not reported in our electronic database. Bronchoscopy is performed in mechanically ventilated patients only leaving the possibility of undiagnosed inhalation injury in patients that were not intubated upon admission. It is not performed by the same medical professional, which also leaves the possibility of subjective impression.

The mean TBSA burned in our study was 42.48±18.64%, the mortality rate was 49.54%, and the LOS/TBSA ratio of patients who survived (n=55) was 2.45±1.5. A commonly used method for estimating burn LOS is 1 day of hospitalization per TBSA burned (13,14). In our study, the mortality rate 5,7,9,15 and the LOS/TBSA ratio were high and exceeded those reported in relevant literature (3,7,14), possibly because of a high percentage of inhalation injury, advanced patient age, not including pediatric patients, and using a sample of severely burned adult patients admitted to the BICU. For example, a systematic review of burn injuries in the East Mediterranean Region reports on the ages between 18 to 25 years with TBSA burned between 10% to 48% (15), which is higher than the mean age and mean TBSA in our study group. An epidemiological report from Albania reports on the overall mortality rate of 6.98% with a mean TBSA burned 25.6±19.1% and mean age 24.9±25.5 years (7), with a note that all burns regardless of TBSA burned, involving pediatric and adult patients, were included in the calculation in both papers (7,15).

We investigated the relationship between the outcome and age, sex, comorbidities, mechanism of injury, TBSA burned, and presence of inhalation injury. The results demonstrated that patients with 2 or more comorbidities had a higher chance for a fatal outcome compared with patients with no comorbidities (OR, 27.66; 95% CI, 6.12-124.93; p<0.0001). Our results are in agreement with the German study that investigated the effect of comorbidities on mortality (16), and with previous literature reports (17,18). Besides comorbidities, our results showed that the percentage of TBSA burned increased the chances of a fatal outcome (OR 1.07; 95% CI, 1.04-1.11; p<0.0001). This result corresponds with the literature (2,5) and TBSA percentage is a well-known predictor of mortality included in the calculation of Baux and mortality prediction scores (19-23). Inhalation injury did not show statistically significant results, possibly due to it being applicable in flame burns only.

The need of mechanical ventilation has been described as a prognostic factor in several studies, but we did not include it as a predictor because the majority of patients were mechanically ventilated (24,25). Also, duration of mechanical ventilation is influenced by many factors such as the severity of injury, presence of inhalational injury, presence of comorbidities, associated injuries, and lack of standard protocols for analgosedation.

Other variables associated with higher mortality in other studies, such as age 19-23 and gender (26,27), did not show statistically significant results in our logistic regression model. The reason behind this could be data limitations caused by the size of our sample.

This study had two main limitations. First, data were collected retrospectively from an electronic database and some data were missing, making the whole data collecting process prone to error.

Furthermore, electronic records were deficient in previous years. This led to the impossibility of calculating an objective score for the assessment of comorbidities such as the Charlson Comorbidity Index. Second, this was a single-center study with a small sample size.

The treatment of patients with severe burns remains a great challenge for patients, families and medical professionals. In Croatia, patients with severe burns are initially treated in general hospitals or other departments if the injury occurred outside the Zagreb County, or they are directly transmitted to our department if the injury occurred in the Zagreb County region. The majority of patients from our study were referred from general hospitals outside the Zagreb County and from other Croatian departments, e.g., Rijeka, Split and Osijek University Hospital Centers. In addition, there were patients referred from Bosnia and Hercegovina. Looking at our results for the last 6.5 years, we would like to highlight further suggestions for improvement in the management of burn patients in Croatia. Firstly, we support early transfer to a specialized facility. The absence of a protocol for starting palliative care in the acute phase of the disease leads to overtreatment of patients; therefore, we should make an effort to establish such protocols in the future. In order to facilitate statewide epidemiological research and treatment evaluation, there is the need of establishing a national database of burn injuries, which is currently lacking in Croatia. Other points to consider in the future would be protocols for early burn care that should be implemented in general hospitals. Also, we should consider early tracheotomy when indicated since our data show late performance of tracheotomy (mean 21.00±24.73 days after starting mechanical ventilation). It is necessary to improve diagnosis and grading of inhalation injury by education and to better manage medical records.

This study provides information on demographics, burn injury characteristics, and outcomes of

severely burned adult patients in Croatia. These data combined can serve as an insight into the possible areas of improvement in patient care and a base for further research. There is the need of further studies that would include the entire population of burn patients in Croatia to draw significant epidemiological conclusions.

5. ABSTRACT

EPIDEMIOLOGICAL CHARACTERISTICS AND FACTORS ASSOCIATED WITH MORTALITY IN SEVERELY BURNED PATIENTS – CROATIAN NATIONAL BURN CENTER REPORT

The authors conducted a single-center retrospective study during the last 6.5 years. The study aimed to describe demographic data of burn patients in the Croatian Burn Center and investigate factors affecting mortality for the first time after the Center was established. The study included 109 severely burned patients with a total body surface area (TBSA) burned ≥20%, admitted to the burn intensive care unit. The relationship between the fatal outcome and age, sex, comorbidity, mechanism of injury, TBSA burned, and inhalation injury was investigated. The mean patient age was 54.50±20.21 years and the mean TBSA burned was 42.48±18.64%, with the mortality rate of 50%. The results demonstrated that patients with 2 or more comorbidities compared with those with no comorbidities had a higher chance of lethal outcome ($p<0.0001$). With an increase of TBSA by 1%, the odds of lethal outcome are expected to increase by 7% ($p<0.0001$). Other variables included in the analysis did not show statistical significance. TBSA percentage is a well-known predictor of mortality and numerous studies indicate an association between comorbidities and mortality but there are conflicting results about other demographic factors and injury characteristics.

6. SAŽETAK

Provedena je prva retrospektivna studija u tercijarnom centru u Hrvatskoj u posljednjih 6,5 godina s ciljem opisivanja demografskih podataka te čimbenika koji utječu na smrtnost teško opečenih bolesnika. U istraživanje je uključeno 109 teško opečenih bolesnika s ukupnom opečenom površinom ≥20%, hospitaliziranih u Jedinici intenzivnog liječenja. Analizirana je povezanost smrtnog ishoda i dobi, spola, supostojećih bolesti, mehanizma ozljede, postotka opečene površine i prisutnosti inhalacijske ozljede. Srednja dob bolesnika uključenih u istraživanje bila je 54,50±20,21 godina, srednja vrijednost postotka opečene površine bila je 42,48±18,64%, a smrtnost je iznosila 50%. Rezultati pokazuju veće izglede za smrtni ishod kod bolesnika s 2 ili više supostojećih bolesti u odnosu na one bez takvih bolesti ($p<0,0001$). Porastom postotka opečene površine kože za 1% izgledi za smrtni ishod rastu za 7% ($p<0,0001$). Analizom nije nađena statistički značajna razlika za ostale varijable. Postotak opečene površine je dobro poznati prediktor smrtnosti i brojne studije ukazuju na povezanost supostojećih bolesti i smrtnosti, dok su za ostale demografske čimbenike i značajke ozljede rezultati studija oprečni.

7. TABLES AND FIGURES

Table 1. Patient characteristics

	Total	Survived	Deceased
Age (years)			
Mean ± SD (%)	54.50±20.21	48.71±20.31	60.40±18.49
Median and IQR	56.84 (39-71)	45.12 (31-66)	63.65 (46-74)
Sex			
Male	80 (73.39%)	41 (74.55%)	39 (72.22%)
Female	29 (26.61%)	14 (25.45%)	15 (27.78%)
Comorbidities			
No comorbidities	30 (30.61%)	22 (42.31%)	8 (17.39%)
1 comorbidity	35 (35.71%)	22 (42.31%)	13 (28.26%)
≥2 comorbidities	33 (33.67%)	8 (15.38%)	25 (54.35%)
Psychiatric disorders			
Yes	36 (36.36%)	16 (30.77%)	20 (42.55%)
No	63 (63.64%)	36 (69.23%)	27 (57.45%)
Referral status			
Direct admission	37 (33.94%)	21 (38.18%)	16 (29.63%)
Referred	72 (66.06%)	34 (61.82%)	38 (70.37%)

SD = standard deviation; IQR = interquartile range

Table 2. Injury characteristics

	Total	Survived	Deceased
TBSA burned			
Mean ± SD (%)	42.48±18.64	35.91±12.73	49.17±21.27
Median and IQR	40.00 (30-60)	35.00 (25-40)	50.00 (30-65)
TBSA burned group			
20%-39%	54 (49.54%)	35 (63.64%)	19 (35.19%)
40%-59%	27 (24.77%)	15 (27.27%)	12 (22.22%)
≥60%	28 (25.69%)	5 (9.09%)	23 (42.59%)
Mechanism of injury			
Flames	88 (80.73%)	45 (81.82%)	43 (79.63%)
Scalds	10 (9.17%)	5 (9.09%)	5 (9.26%)
Electrical	7 (6.42%)	5 (9.09%)	2 (3.70%)
Unknown	4 (3.67%)	0	4 (7.41%)
Inhalation injury			
Yes	46 (42.20%)	20 (36.36%)	26 (48.15%)
No	63 (57.80%)	35 (63.64%)	28 (51.85%)

TBSA = total body surface area; SD = standard deviation; IQR = interquartile range

Table 3. Patient outcomes

	Total	Survived	Deceased
Duration of mechanical ventilation			
Mean ± SD (%)	24.80±25.55	20.14±19.42	28.02±28.78
Median and IQR	16.00 (8-32)	14 (8-25)	18 (8-40)
Tracheotomy			
Yes	34 (31.19%)	12 (21.82%)	22 (40.74%)
No	75 (68.81%)	43 (78.18%)	32 (59.26%)
LOS (BICU)			
Mean ± SD (%)	40.11±37.65	44.45±37.58	35.69±37.56
Median and IQR	29.00 (13-57)	31 (18-64)	22 (10-54)
LOS (hospital)			
Mean ± SD (%)	58.72±49.03	80.96±48.12	36.06±38.77
Median and IQR	52 (20-81)	67 (50-103)	22 (10-54)

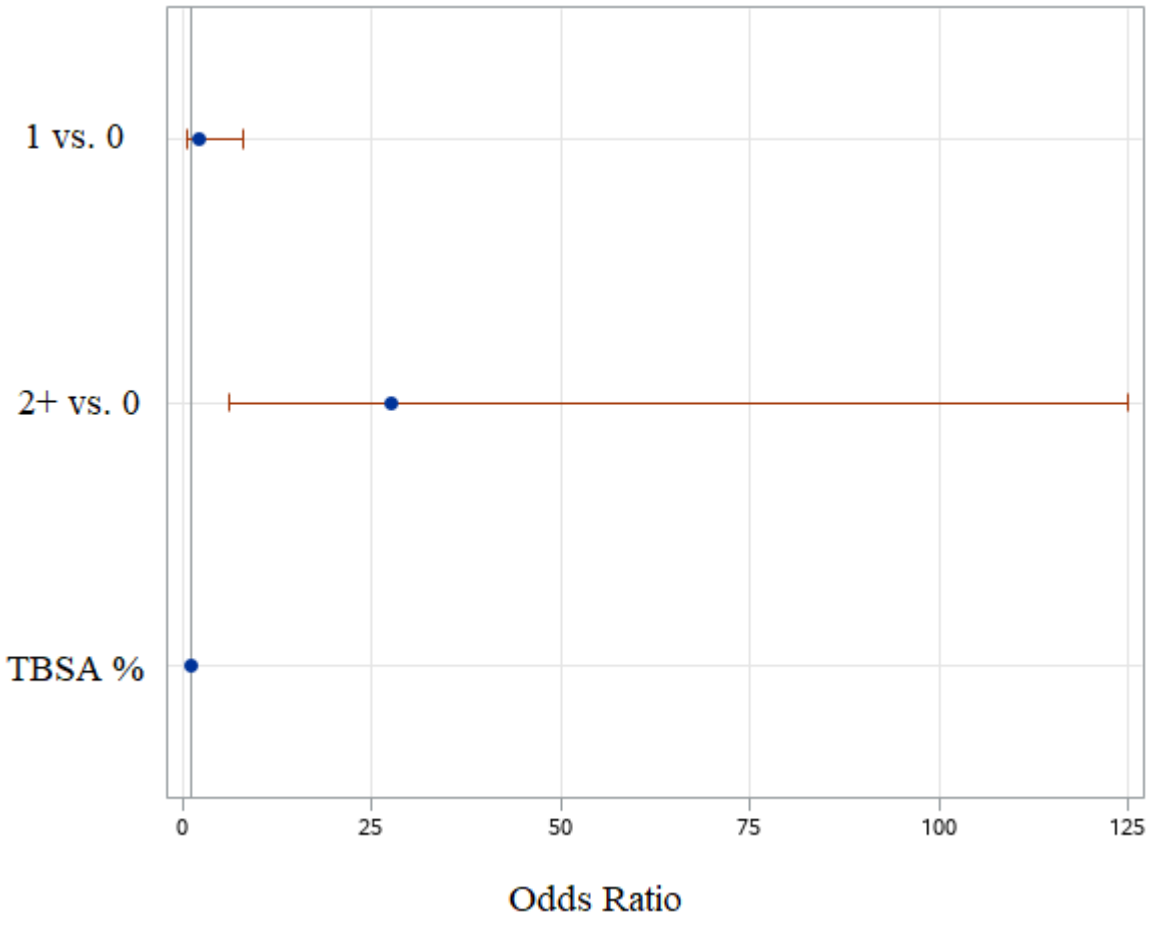
SD = standard deviation; IQR = interquartile range; LOS = length of stay; BICU = burn intensive care unit

Table 4. Variables associated with increased chance of lethal outcome

	Odds ratio	95% Wald confidence limits	
Comorbidities 1 *vs*. 0	2.241	0.624	8.046
Comorbidities 2+ *vs*. 0	27.658	6.123	124.930
TBSA burned (percent)	1.073	1.036	1.112

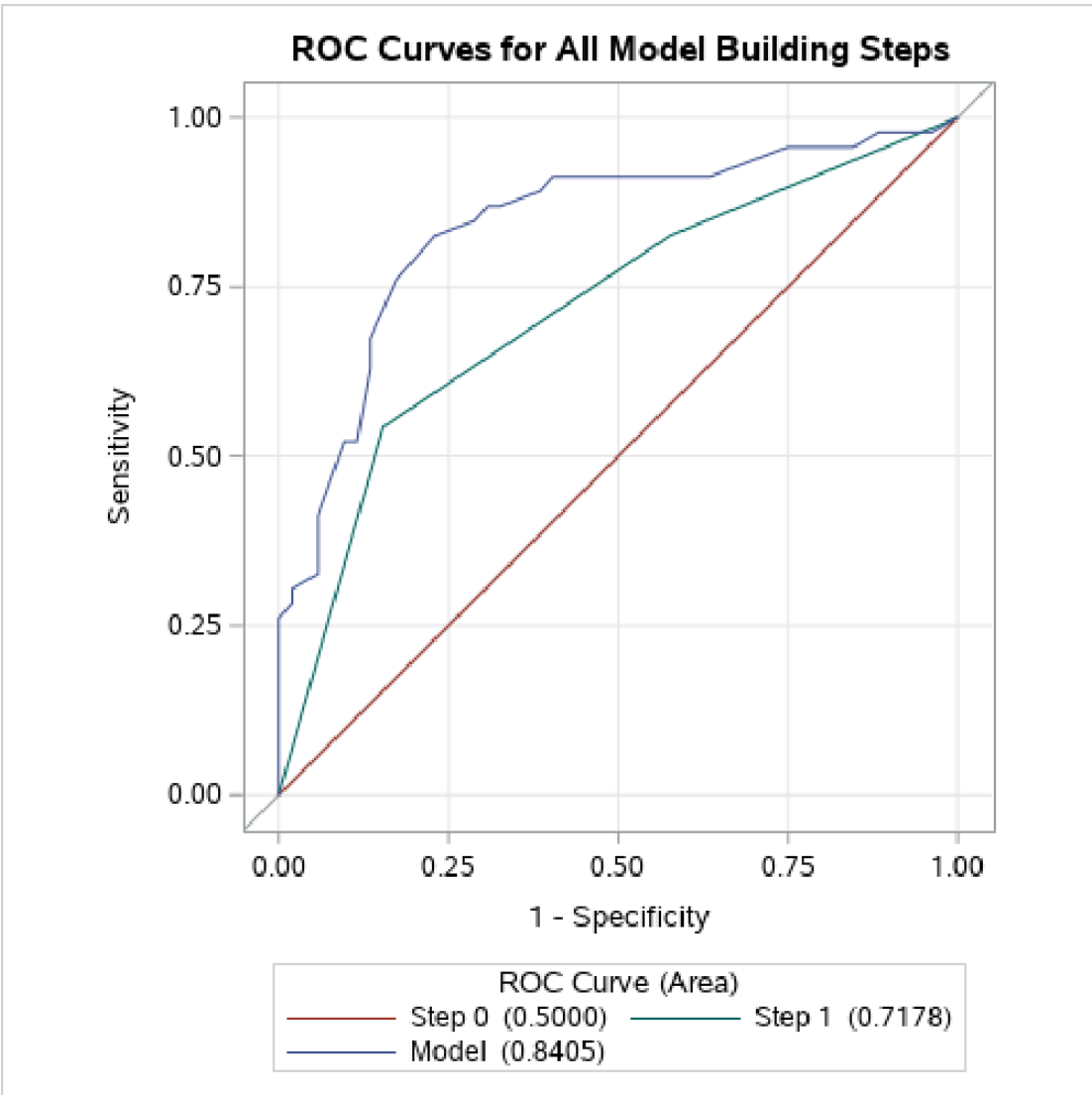
1 = patients with 1 comorbidity; 2+ = patients with 2 or more comorbidities; 0 = patients with no comorbidities; TBSA = total body surface area

Fig. 1. Odds ratio with 95% Wald confidence interval limits.



1 = patients with 1 comorbidity; 2+ = patients with 2 or more comorbidities; 0 = patients with no comorbidities; TBSA = total body surface area

Fig. 2. Overlaid receiver operating characteristic curves (ROC) for all logistic regression models built using the stepwise procedure.



Step 0 = model with intercept only; Step 1 = model with comorbidities; Model = final model with comorbidities and % total body surface area (TBSA) groups

8. REFERENCES

1. Burns [Internet]. World Health Organization. 2018 [cited 2022 Oct 8]. Available from: https://www.who.int/news-room/fact-sheets/detail/burns
2. Brusselaers N, Monstrey S, Vogelaers D, Hoste E, Blot S. Severe burn injury in Europe: a systematic review of the incidence, etiology, morbidity, and mortality. Crit Care Lond Engl. 2010;14(5):R188. DOI: 10.1186/cc9300.
3. Smolle C, Cambiaso-Daniel J, Forbes AA, Wurzer P, Hundeshagen G, Branski LK, et al. Recent trends in burn epidemiology worldwide: a systematic review. Burns. 2017 Mar;43(2):249-57. DOI: 10.1016/j.burns.2016.08.013.
4. Toppi J, Cleland H, Gabbe B. Severe burns in Australian and New Zealand adults: epidemiology and burn centre care. Burns. 2019 Sep 1;45(6):1456-61. DOI: 10.1016/j.burns.2019.04.006.
5. Li H, Yao Z, Tan J, Zhou J, Li Y, Wu J, et al. Epidemiology and outcome analysis of 6325 burn patients: a five-year retrospective study in a major burn center in Southwest China. Sci Rep. 2017 Apr 6;7(1):46066. Tan Chor Lip H, Tan JH, Thomas M, Imran FH, Azmah Tuan Mat TN. Survival analysis and mortality predictors of hospitalized severe burn victims in a Malaysian burns intensive care unit. Burns Trauma. 2019;7:3. DOI: 10.1186/s41038-018-0140-1.
6. Filaj VH, Belba MK. Epidemiological trends of severe burns, 2009-2019: a study in the service of burns in Albania. Burns J Int Soc Burn Inj. 2021 Jun;47(4):930-43. DOI: 10.1016/j.burns.2020.09.006.
7. Atwell K, Bartley C, Cairns B, Charles A. The epidemiologic characteristics and outcomes following intentional burn injury at a regional burn center. Burns. 2020 Mar

1;46(2):441-6. DOI: 10.1016/j.burns.2019.08.002.

8. Dokter J, Felix M, Krijnen P, Vloemans JFPM, Baar ME van, Tuinebreijer WE, et al. Mortality and causes of death of Dutch burn patients during the period 2006-2011. Burns J Int Soc Burn Inj. 2015 Mar;41(2):235-40. DOI: 10.1016/j.burns.2014.10.009.
9. Kobayashi K, Ikeda H, Higuchi R, Nozaki M, Yamamoto Y, Urabe M, et al. Epidemiological and outcome characteristics of major burns in Tokyo. Burns J Int Soc Burn Inj. 2005 Jan;31 Suppl 1:S3-11. DOI: 10.1016/j.burns.2004.10.007.
10. Jones SW, Williams FN, Cairns BA, Cartotto R. Inhalation injury: pathophysiology, diagnosis, and treatment. Clin Plast Surg. 2017 Jul;44(3):505-11. DOI: 10.1016/j.cps.2017.02.009.
11. Suresh M, Pruskowski KA, Rizzo JA, Gurney JM, Cancio LC. Characteristics and outcomes of patients with inhalation injury treated at a military burn center during U.S. combat operations. Burns J Int Soc Burn Inj. 2020 Mar;46(2):454-8. DOI: 10.1016/j.burns.2019.08.008.
12. Taylor SL, Sen S, Greenhalgh DG, Lawless M, Curri T, Palmieri TL. Not all patients meet the 1 day per percent burn rule: a simple method for predicting hospital length of stay in patients with burn. Burns J Int Soc Burn Inj. 2017 Mar;43(2):282-9. DOI: 10.1016/j.burns.2016.10.021.
13. Johnson LS, Shupp JW, Pavlovich AR, Pezzullo JC, Jeng JC, Jordan MH. Hospital length of stay – does 1% TBSA really equal 1 day? J Burn Care Res. 2011 Feb;32(1):13-9. DOI: 10.1097/BCR.0b013e318204b3ab.
14. Othman N, Kendrick D. Epidemiology of burn injuries in the East Mediterranean Region: a systematic review. BMC Public Health. 2010 Feb 20;10(1):83. DOI: 10.1186/1471-2458-10-83.

15. Bagheri M, Fuchs PC, Lefering R, Grigutsch D, Busche MN, Niederstätter I, et al. Effect of comorbidities on clinical outcome of patients with burn injury – an analysis of the German Burn Registry. Burns J Int Soc Burn Inj. 2021 Aug;47(5):1053-8. DOI: 10.1016/j.burns.2020.04.040.
16. Zavlin D, Chegireddy V, Boukovalas S, Nia AM, Branski LK, Friedman JD, Echo A. Multi-institutional analysis of independent predictors for burn mortality in the United States. Burns & trauma. 2018 Dec 1;6. DOI: 10.1186/s41038-018-0127-y.
17. Brandão C, Meireles R, Brito I, Ramos S, Cabral L. The role of comorbidities on outcome prediction in acute burn patients. Ann Burns Fire Disasters. 2021 Dec 31;34(4):323-33.
18. Halgas B, Bay C, Foster K. A comparison of injury scoring systems in predicting burn mortality. Ann Burns Fire Disasters. 2018 Jun 30;31(2):89-93.
19. Osler T, Glance LG, Hosmer DW. Simplified estimates of the probability of death after burn injuries: extending and updating the Baux score. J Trauma. 2010 Mar;68(3):690-7. DOI: 10.1097/TA.0b013e3181c453b3.
20. Tobiasen J, Hiebert JM, Edlich RF. The abbreviated burn severity index. Ann Emerg Med. 1982 May 1;11(5):260-2. DOI: 10.1016/s0196-0644(82)80096-6.
21. Smith DL, Cairns BA, Ramadan F, Dalston JS, Fakhry SM, Rutledge R, et al. Effect of inhalation injury, burn size, and age on mortality: a study of 1447 consecutive burn patients. J Trauma. 1994 Oct 1;37(4):655-9. DOI: 10.1097/00005373-199410000-00021.
22. Ryan CM, Schoenfeld DA, Thorpe WP, Sheridan RL, Cassem EH, Tompkins RG. Objective estimates of the probability of death from burn injuries. N Engl J Med. 1998 Feb 5;338(6):362-6. DOI: 10.1056/NEJM199802053380604.
23. Angulo M, Aramendi I, Cabrera J, Burghi G. Mortality analysis of adult burn patients in Uruguay. Rev Bras Ter Intensiva. 2020 May 8;32:43-8. DOI: 10.5935/0103-

507X.20200008.

24. Lip HTC, Idris MAMd, Imran FH, Azmah TN, Huei TJ, Thomas M. Predictors of mortality and validation of burn mortality prognostic scores in a Malaysian burns intensive care unit. BMC Emerg Med. 2019 Dec;19(1):66. DOI: 10.1186/s12873-019-0284-8.
25. O'Keefe GE, Hunt JL, Purdue GF. An evaluation of risk factors for mortality after burn trauma and the identification of gender-dependent differences in outcomes. J Am Coll Surg. 2001 Feb 1;192(2):153-60. DOI: 10.1016/s1072-7515(00)00785-7.
26. McGwin GJ, George RL, Cross JM, Reiff DA, Chaudry IH, Rue LWI. Gender differences in mortality following burn injury. Shock. 2002 Oct;18(4):311-5. DOI: 10.1097/00024382-200210000-00004.

9. ŽIVOTOPIS AUTORA

Agata Škunca, dr. med., rođena je 1990. godine u Zadru. Od 2005. Do 2009. pohađala je Gimnaziju Franje Petrića u Zadru. Medicinski fakultet Sveučilišta u Zagrebu je upisala 2009. godine, a 2015. je diplomirala. U općoj bolnici Zadar odradila je pripravnički staž 2015./2016. godine. Do ožujka 2017. godine radila je u Domu zdravlja Zadarske županije, nakon čega je započela specijalizaciju iz Anesteziologije, reanimatologije i intenzivne medicine u Kliničkom bolničkom centru Sestre milosrdnice. Od srpnja 2022. godine je zaposlena kao specijalist anesteziologije, reanimatologije i intenzivne medicine u Kliničkom bolničkom centru Sestre milosrdnice na Klinici za traumatologiju.