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Predicting mortality and safe discharge in drowning victims: A comprehensive analysis of neurological and clinical outcomes in the emergency department

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Abstract:

OBJECTIVES: This study sought to identify risk factors linked to mortality, intensive care unit admission, and poor neurological outcomes among drowning victims and to find markers for safe discharge from the emergency department (ED).

METHODS: This retrospective cross-sectional study evaluated all drowning victims presenting to both adult and pediatric EDs at a single center over an 11-year period. Variables such as arrival time at ED, age, type of water, comorbid diseases, vital signs, treatments given, and prehospital interventions were assessed.

RESULTS: The study found that early basic life support (BLS) by bystanders significantly improves survival and neurological outcomes. Respiratory rate, oxygen saturation, and Glasgow Coma Scale (GCS) were identified as independent risk factors for poor clinical outcomes. While the Szpilman clinical score is useful, it alone is not sufficient for predicting poor clinical outcomes.

CONCLUSIONS: For optimal management of drowning victims, immediate BLS is crucial. In the ED, respiratory rate, oxygen saturation, and GCS should be closely monitored. Drowning victims with a GCS of 15, normal respiratory rate, normal oxygen saturation, and Szpilman score below 3 can be safely discharged from the ED.

Keywords:

Drowning, emergency medicine, Glasgow Coma Scale, neurological outcomes, resuscitation

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Introduction

Drowning is defined as the process of experiencing respiratory impairment from submersion/immersion in liquid.[1] The victim may survive or die after this process, but regardless of the outcome, has been involved in a drowning incident.[2] In studies to date, prognostic markers in drowning victims have been evaluated in prehospital and intensive care unit (ICU) settings. In addition, survival has been used as a predictor of prognosis in drowning;

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Box-ED section

What is already known on the study topic?
- Drowning is a significant public health issue, often resulting in high mortality and morbidity rates worldwide
- Existing prognostic tools like the Szpilman score provide partial insights but lack comprehensive discharge criteria for emergency department (ED) settings.

What is the conflict on the issue? Has it importance for readers?
- There is no universally accepted protocol or criteria for safely discharging drowning victims from the ED
- Understanding the relationship between initial clinical findings and outcomes is crucial for improving patient management and resource allocation.

How is this study structured?
- This is a retrospective, cross-sectional study analyzing data from 292 drowning victims admitted to adult and pediatric EDs at a single center over 11 years.

What does this study tell us?
- Respiratory rate, oxygen saturation, and Glasgow Coma Scale (GCS) are independent risk factors for poor clinical outcomes in drowning victims
- Drowning victims with a GCS of 15, normal respiratory rate, normal oxygen saturation, and a Szpilman score below 3 can be safely discharged from the ED
- Early basic life support initiated by bystanders significantly improves survival and neurological outcomes.

however, poor neurological outcomes in surviving patients have not been included in these evaluations. Because of these reasons, there are no defined discharge criteria for drowning patients in the emergency department (ED).

Although not suitable for the standard approach in the ED, there are two commonly used scoring methods for drowning. The Orlowski score, which is one of these scores, is used to determine the prognostic criteria of pediatric cases with out-of-hospital cardiac arrest (OHCA) due to drowning. The Orlowski score predicts mortality by incorporating several factors, including age, submersion time, no resuscitation period after the rescue, patient in a coma upon presentation to the ED, and arterial blood pH.[3] However, solely knowing the mortality rate without knowing neurological outcomes is insufficient to predict the prognosis and does not provide a significant benefit to patient management. Furthermore, this scoring system has limitations in its applicability to all age groups since the original Orlowski study only included pediatric age groups.[3] The Szpilman clinical score, the other scoring, predicts the mortality rate of drowning cases with the patient's respiratory status and prehospital lung examination.[4] Unlike the Orlowski score, the Szpilman clinical score was created by incorporating data from drowning victims of all age groups. While the Szpilman score is a helpful tool in predicting mortality, it is limited in its scope due to its failure to provide information regarding neurological outcomes.

Prehospital findings, duration of submersion, and postrescue interventions can be used to predict mortality and thus determine the appropriate center for patient transfer. However, while these scores are effective in prehospital management, it is unclear how to decide on the discharge of patients after the presentation to the ED. Physical examination, laboratory testing, imaging studies, and interventions applied in the ED can be decisive in predicting the prognosis of the patient admitted to the ED.

In this study, data from drowning patients admitted to a single-center adult and pediatric ED over an 11-year period were analyzed. Our objective was to identify the risk factors associated with mortality, ICU admission, and poor neurological outcome, as well as to identify markers for safe discharge from the ED. The results of this analysis can improve the potential to enhance the management of drowning victims in the ED, thereby resulting in improved patient outcomes.

Methods

This retrospective cross-sectional study examined all drowning victims reported to the Adult and Pediatric EDs at our hospital over an 11-year span. Cases were discovered via hospital databases utilizing relevant International Classification of Diseases, Tenth Revision codes. Cases without sufficient documentation or not pertaining to drowning were excluded from the study.

This retrospective investigation examined the medical records of drowning victims. The collected data encompassed: ED arrival time, characteristics of the drowning site, comorbidities, initial vital signs including GCS score, ED interventions and oxygenation methods, diagnostic evaluations (laboratory and imaging studies), therapeutic interventions, prehospital management (intubation/cardiopulmonary resuscitation [CPR]), time to mortality, clinical outcomes, and discharge modified Rankin Scale (mRS) scores. The mRS was used to score the range from asymptomatic (0) to death (6).[5] In this study, the mRS was used to assess neurological outcomes. Good neurological outcomes (mRS 0–1) indicated no disability, moderate neurological outcomes (mRS 2–3) represented mild disability without assistance, and poor neurological outcomes (mRS 4–5) signified moderate-to-severe disability requiring assistance. mRS 6 (death) was excluded from the poor neurological outcome group. As mRS is not routinely documented in ED records, it was retrospectively derived from physician notes, nursing assessments, and discharge summaries. For discharged patients, functional status was inferred from documented neurological examinations, GCS scores, and mobility assessments. Cases with insufficient data were excluded to ensure accuracy.

The Szpilman clinical score was used to classify drowning severity.[4] Although the Szpilman clinical score was not explicitly documented in the medical records, it was retrospectively determined based on available clinical data. The score was derived from physician notes, prehospital and ED assessments, documented respiratory status, and imaging findings. Cases with insufficient data to accurately assign a Szpilman score were excluded to maintain the reliability of the analysis.

SPSS V22.0 (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY, USA: IBM Corp.) was used for data analysis. To enhance comparability across the results, missing values of covariates were imputed using the Expectation–Maximization Algorithm. The maximum percentage of missing values was 10%. Missing variables were imputed based on the entire study population ($n = 292$).

Descriptive statistics

For categorical variables, numbers and percentages are given. Numerical variables were given as median, minimum, and maximum values for age, and interquartile range for other parameters. A one-sample binomial test was used for homogeneity of categorical data, and Pearson Chi-square Fisher's exact test was used for comparison. After evaluating the variability of numerical variables with the Kolmogorov–Smirnov test, the Mann–Whitney *U*-test was used for comparisons because the data did not conform to a normal distribution.

Factors affecting the patients' outcomes (for death and survival) were evaluated by univariate regression analysis, and the results were given with an odds ratio, 95% confidence interval (CI), and *P* values. After evaluating demographic data, laboratory, physical examination, and chest radiography findings in terms of poor clinical outcome (death, discharge as mRS ≥4, or need for hospitalization from ED) with univariate regression analysis in adult patients, those with $P > 0.20$ were evaluated in multivariate regression analysis, and independent risk factors were identified. Sensitivity, specificity, negative and positive predictive values for poor clinical outcomes were determined by examining the relationship between Szpilman scores and poor clinical outcomes in these patients. The data were analyzed at a 95% confidence level, and if the $P < 0.05$, it was considered significant.

Ethical Approval: The study commenced subsequent to obtaining approval from the Non-Interventional Ethics Committee of Dokuz Eylül University Faculty of Medicine (Decision No: 2019/11-12, Date: April 24, 2019).

This manuscript was prepared in compliance with the Strengthening the Reporting of Observational Studies in Epidemiology guidelines for observational studies.

The primary objective of this study was to identify prognostic factors associated with mortality, ICU admission, and poor neurological outcomes in drowning victims. In addition, the study aimed to determine clinical parameters that could guide safe discharge decisions in the ED. To achieve these objectives, the primary endpoints included mortality, both in-hospital and at 1-year follow-up, ICU admission rates, and neurological outcomes assessed using the mRS. Secondary endpoints focused on identifying independent risk factors for poor clinical outcomes, such as vital signs, GCS, and Szpilman clinical score, as well as establishing criteria for the safe discharge of drowning victims from the ED based on these parameters.

Results

This retrospective analysis included 292 drowning cases (median age 36.0 years, range: 9 months to 89 years), comprising 204 adult and 88 pediatric patients. Peak presentations to the ED occurred throughout the summer months (July 32.2%, August 29.8%, June 15.1%) between 12:00 and 18:00 on weekdays. The primary location for drowning incidents was maritime environments (86.6%).

In this study, 56.8% of drowning patients arrived at the ED without comorbidities. Hypertension was the most prevalent preexisting condition at 19.5%, followed by diabetes mellitus and coronary artery disease at 10.6% each, epilepsy at 9.6%, and other neurological disorders at 7.9%. However, no statistically significant association was found between comorbid conditions and mortality ($P > 0.05$), so these findings were not included in further analysis.

An examination of respiratory interventions indicated that 18.5% of drowning victims necessitated intubation (8.6% prehospital, 3.4% reintubation, and 9.9% during follow-up). Among the surviving patients, respiratory support methods utilized during ED management comprised invasive mechanical ventilation (IMV) (16.4%), non-IMV (22.3%), and high-flow nasal oxygen (5.8%).

We investigated mortality and hospitalization outcomes related to drowning. The allocation of patient dispositions was as follows: 41.1% were admitted to the ICU, 14% were admitted to wards, and 40.8% were discharged from the ED. The 1-year mortality rate was 14.7%, comprising 4.1% mortality in the ED and 2.1% posthospitalization mortality directly linked to drowning. In 8.5% of cases, the causal relationship between drowning and mortality was indeterminate.

The neurological outcomes of drowning victims were evaluated using the mRS on discharge. Individuals having an mRS score of 6 (indicating death) were omitted from the poor neurological outcome cohort. The results indicated that 90.7% of patients attained good neurological outcomes, 1.4% moderate neurological outcomes, and 1.7% poor neurological outcomes, accompanied by a mortality rate of 6.2%. Among patients not necessitating basic life support (BLS), 96% experienced good neurological outcomes, whereas only 56.4% of those requiring BLS received good neurological outcomes [Figure 1].

Within the study cohort, 39 patients (13.3%) had unresponsiveness with absent or abnormal breathing.

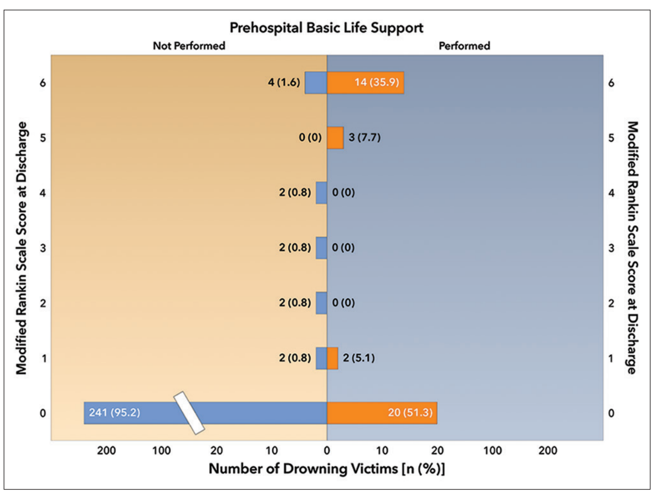

Figure 1: The association between prehospital basic life support (BLS) and modified Rankin Scale (mRS) scores at discharge in drowning victims. Neurological outcomes were measured using the mRS, with good neurological outcomes defined as mRS 0 and mRS 1, moderate neurological outcomes as mRS 2 and mRS 3, poor neurological outcomes as mRS 4 and mRS 5, and death as mRS 6. The mortality rate of drowning victims who provided prehospital BLS is higher. This can be explained by the fact that there are fewer drowning victims who require BLS in the group that did not provide it. However, while the rate of moderate neurological outcome was 1.6% in the group that did not perform prehospital BLS, it was not observed at all in the group that performed it. The rate of poor neurological outcome is similar in both groups

Bystander-initiated BLS occurred in 21 cases (53.9%), whereas emergency medical services (EMSs)-initiated BLS accounted for the remaining 46.1%. Bystander-initiated BLS resulted in markedly better outcomes, achieving 90.5% good neurological results compared to 16.7% with EMS-initiated BLS ($P < 0.05$). Furthermore, mortality rates were significantly reduced with bystander-initiated BLS (9.5%) in contrast to EMS-initiated BLS (66.7%) ($P < 0.05$) [Figure 2].

We examined the relationship between life support interventions and mortality rates in drowning incidents. Advanced cardiac life support (ACLS) was provided to 13 patients (4.5%) at the ED. Prehospital ACLS started by EMS in 11 cases and continued upon arrival at the ED. The mortality rate in this group was 90.9% ($n = 10$). Of the two patients undergoing in-hospital ACLS for cardiac arrest in the ED, one survived, resulting in a 50% mortality rate. An analysis of BLS patients among all providers indicated a 35.9% mortality rate. While this finding suggests a potential benefit of early BLS compared to delayed ACLS, the retrospective nature of the study and the complexity of drowning-related cardiac arrests make it difficult to draw definitive conclusions. However, bystander-initiated BLS before EMS arrival was associated with improved survival rates and neurological outcomes, emphasizing the importance of early intervention in the OHCA survival chain.

In this study, poor clinical outcome was operationally defined as cardiac arrest, poor neurological outcome at discharge, or ICU admission. Among 204 adult drowning victims analyzed, 107 (52.5%) experienced poor outcomes. Poor clinical outcomes were significantly more prevalent in freshwater drowning incidents ($P < 0.05$), early morning ED presentations ($P < 0.05$), and cases with diffuse infiltration on chest radiography ($P < 0.001$).

The predictive value of the Szpilman clinical score was evaluated for drowning victims' outcomes in the ED. A score ≥3 significantly correlated with poor clinical outcomes ($P < 0.001$) [Figure 3]. No mortality occurred in patients scoring <3; however, only 8.4% ($n = 9$) of patients with scoring ≥3 were discharged. A score of ≥3 exhibited a sensitivity of 66.4% (95% CI: 57.9–74.2), specificity of 89.0% (95% CI: 83.0–93.5), positive predictive value of 84.3% (95% CI: 77.1–89.5), and negative predictive value of 75.0% (95% CI: 70.2–79.3) for poor clinical outcomes. In adult patients, the results were 67.3% (95% CI: 57.6–76.1), 92.8% (95% CI: 85.7–97.1), 91.1% (95% CI: 83.3–95.5), and 72.0% (95% CI: 66.1–77.1), respectively.

This study sought to discover prognostic factors associated with poor clinical outcomes in adult drowning victims, omitting patients who arrived at the ED in

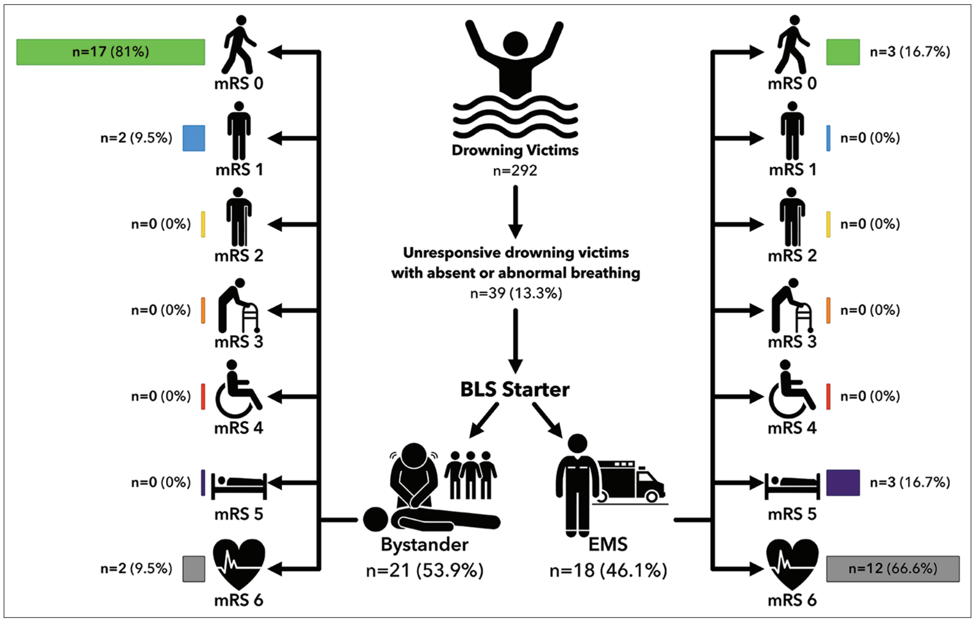

Figure 2: The relationship between first responders and neurological outcomes in drowning victims who received basic life support (BLS). Neurological outcomes were measured using the modified Rankin Scale (mRS), with good outcomes defined as mRS 0 and mRS 1, moderate outcomes as mRS 2 and mRS 3, poor outcomes as mRS 4 and mRS 5, and death as mRS 6. The Bystander-BLS starter group had a statistically significant higher rate of good neurological outcomes ($P < 0.05$), and a significantly lower mortality rate compared to the emergency medical service (EMS)-BLS starter group ($P < 0.05$). No drowning victims with moderate neurological outcomes were observed in either group. There was no statistically significant difference in the group with poor neurological outcomes. The reason for the better outcome of the Bystander-BLS Starter group is that the EMS arrived later to a drowning victim than to a bystander. Public education about BLS can help reduce mortality and improve neurological outcomes in drowning victims. mRS: Modified Rankin Scale, EMS: Emergency medical service, BLS: Basic life support

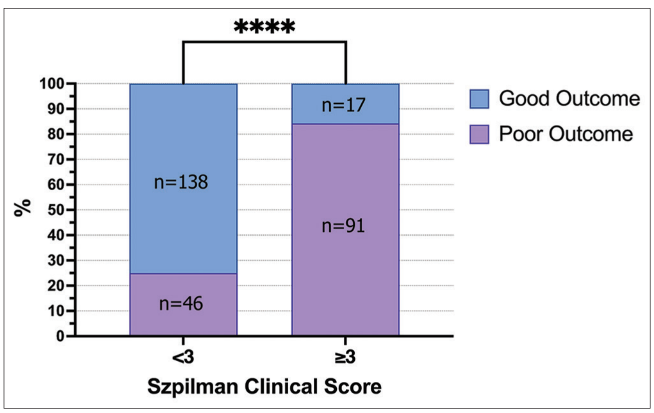

Figure 3: The efficacy of the Szpilman clinical score in predicting the outcome of drowning victims in the emergency department. The results show that a Szpilman clinical score of 3 or higher was statistically significantly associated with poor clinical outcome ($P < 0.0001$)

cardiac and respiratory arrest. Univariate analysis of vital signs, physical examination results, and laboratory parameters was succeeded by multivariate regression analysis. The latter found respiratory rate, oxygen saturation, GCS score, and chest radiograph local infiltrates as independent risk factors for poor clinical outcomes.

Discussion

The data of our study show that drowning victims are most frequently presented to our ED in the afternoons and evenings of July and August. This can be explained by factors such as the increase in population in the region due to our hospital being located in popular holiday destinations, schools being closed during the summer months, and the opening of the sea season. Similarly, drowning accidents are often observed in summer months and the frequency of incidents increases from midday to evening, as shown in literature in around the world. In a study conducted in Türkiye, the most common months for drowning incidents were found to be July, June, and August, respectively.[6] In a study conducted in South Africa, it was reported that drowning incidents occur frequently during summer months and official holidays.[7] In a study examining drowning-related deaths in children, it was found that they occurred between May and August and most of them took place between 12:00 and 20:00 on weekends.[8] These results indicate that EDs should be more prepared for drowning accidents during the summer months.

Many studies have shown an increased risk of drowning in adults and children diagnosed with epilepsy.[9,10] The global incidence of epilepsy is between 0.4% and 1%,[11] and our study observed that epilepsy patients accounted for 9.6% of drowning victims, with no deaths among drowning cases diagnosed with epilepsy. While our findings suggest that epilepsy may be a contributing factor to drowning incidents, the absence of mortality in this subgroup could be due to sample size limitations or unmeasured confounders. Further studies with larger cohorts are needed to determine the impact of epilepsy on drowning-related mortality.

El Sibai *et al*. found that drowning victims with chronic diseases had a higher likelihood of poor clinical outcomes.[12] In contrast, our study found that chronic diseases did not affect mortality. However, our study only evaluated drowning victims presented to our ED, and we do not have data on patients who did not respond to resuscitation before arriving at the hospital. Due to this limitation, we can only comment on ED outcomes regarding comorbid illnesses.

Our study has shown that 53.9% of BLS performed on drowning victims are started by bystanders. In studies conducted in different countries, the rates of BLS by bystanders in OHCA cases related to drowning incidents were reported as 42.5% in Japan,[13] 47.1% in the USA,[14] and 74% in Sweden.[15] While the results of our study indicate that the BLS rates by bystanders in Türkiye are better compared to some other countries, there are also studies showing that the BLS rates by bystanders in OHCA cases are low in Türkiye. In a study conducted in Türkiye, it was reported that BLS was performed by a bystander in only 1.7% of OHCA cases.[16] The higher rates of BLS in drowning victims may be due to the nature of drowning accidents, which may make bystanders more willing to intervene.

Since there is no correlation between the lung X-ray findings and arterial blood gas parameters in the initial evaluation of drowning victims, the use of lung X-rays for predicting prognosis is not recommended.[17,18] This investigation of chest radiograph findings in drowning victims (n = 278, excluding 14 cases without radiographs) revealed that 32.4% exhibited normal chest radiographs. Bilateral infiltrates were prominent among mortalities at 80%, in contrast to unilateral infiltrates at 20%. The total mortality rate was 5.6% in patients with bilateral infiltrates and 4.4% in those with unilateral infiltrates. Although radiographic abnormalities were associated with poor clinical outcomes and functioned as an independent risk factor in the whole cohort, they did not achieve statistical significance in forecasting outcomes for patients who did not necessitate CPR or intubation in the ED. These findings support prior research, demonstrating that chest radiographs alone are inadequate for prognostic assessment in drowning mortalities.

The Szpilman clinical scoring system, established by Szpilman in 1997, predicts the mortality of drowning victims at the accident site by evaluating vital signs and physical examinations.[3] Mott and Latimer investigated the effectiveness of the Szpilman clinical scoring system and recommended that victims with grade 1 be left at the accident site, those with grade 2 be taken to the ED, and those with grade 3 or higher be admitted to the ICU.[19] Analysis indicated no mortality among patients with Szpilman scores below 3, but only 8.4% of patients with scores of 3 or higher were discharged from the ED. Poor clinical outcomes were noted in 25% of participants with scores <3 compared to 84.3% of those with scores ≥3 ($P < 0.001$). The Szpilman score exhibited a high specificity of 89.0% but a low sensitivity of 66.4% in forecasting poor clinical outcomes. A Szpilman score ≥3, however inadequate as the only discharge criterion, is a significant clinical indicator for emergency physicians.

Previous studies evaluating prognostic indicators in drowning victims have identified initial vital signs, GCS, pupillary response, and clinical scoring systems (APACHE 2) as valuable predictors.[17,20] Our analysis revealed 100% survival among patients presenting with normal respiratory rate, oxygen saturation, GCS of 15, and clear lung X-ray. Following the exclusion of patients requiring initial CPR or intubation, we performed univariate regression analysis on demographic data, vital parameters, laboratory values, and physical examination findings [Table 1]. Multivariate regression analysis of statistically significant variables identified respiratory rate, oxygen saturation, and GCS as independent predictors of mortality [Table 2]. Our findings demonstrate that respiratory rate, oxygen saturation, and GCS serve as significant prognostic indicators for drowning victims in the ED. However, blood gas parameters and electrolyte levels were not found to be predictive of adverse outcomes in the adult population.

Limitations

This study has several limitations inherent to its retrospective nature and data collection methodology. The single-center design and exclusive focus on ED-presenting drowning cases potentially restrict result generalizability. In addition, the absence of prehospital mortality data and comprehensive neurological outcome assessments limits our understanding of drowning-associated morbidity.

Conclusions

Our study demonstrates that bystander-initiated BLS plays a crucial role in improving the survival and neurological outcomes of drowning victims. To enhance survival rates, public education on BLS is essential, particularly in regions with high drowning incidence. Based on our findings, respiratory rate, oxygen saturation, and GCS should be closely monitored in the ED, as they are independent

Table 1: Analysis of drowning victims who do not require cardiopulmonary resuscitation/intubation at emergency department

Parameters	Poor clinical outcome		OR (95% CI)	*P**
	No (*n*=97), *n* (%)	Yes (*n*=86), *n* (%)		
Age	47 (29.5–67)	63.5 (41.7–74)	1.022 (1.007–1.037)	0.004
SBP	128 (118–145)	133 (116–153)	1.007 (0.995–1.018)	0.241
DBP	80 (71–87)	79 (70–90)	1.013 (0.991–1.035)	0.243
Heart rate	88 (80–101)	103 (88–117)	1.036 (1.018–1.054)	<0.001
Respiratory rate	22 (18–24)	28 (24–32)	1.243 (1.156–1.337)	<0.001
SpO_2	95 (90–98)	80 (71–89)	0.860 (0.821–0.901)	<0.001
GCS	15	15 (13–15)	0.348 (0.207–0.583)	<0.001
pH	7.39 (7.35–7.42)	7.31 (7.25–7.37)	0.021 (0.001–0.338)	0.006
$PaCO_2$	34 (30.8–37.9)	41.1 (35.5–47.3)	1.109 (1.062–1.158)	<0.001
PaO_2	69.5 (56.9–81.1)	57.8 (48.6–74.7)	0.985 (0.973-0.997)	0.015
HCO_3	21 (18.9–23)	19.9 (17.4–22.7)	0.961 (0.888–1.041)	0.331
Lactate	2.0 (1.1–2.9)	3.2 (1.7–4.9)	1.335 (1.141–1.562)	<0.001
BE	–3.8 (–6.3-–1.4)	–5 (–7.9-–1.5)	0.960 (0.896–1.028)	0.238
Sodium	141 (139–144.6)	145 (141–147)	1.159 (1.076–1.248)	<0.001
Potassium	4.14 (3.83–4.42)	4.01 (3.76–4.37)	0.650 (0.364–1.160)	0.145
Creatinine	0.82 (0.66–1.02)	0.92 (0.77–1.06)	2.535 (0.911–7.052)	0.075
AST	38.1 (22–60.6)	35.4 (21–48.6)	0.995 (0.992–1.008)	0.433
ALT	18.1 (11–34.1)	22 (14–38.4)	1.018 (1.000–1.037)	0.047
CK-MB	2.9 (1.1–6.9)	2.7 (1.3–4.6)	0.977 (0.993–1.023)	0.323
HGB	14.1 (13–15.6)	13.9 (12.8–15.1)	0.977 (0.842–1.134)	0.763
HCT	42.5 (38.1–46.4)	42.5 (38.3–45.6)	1.000 (0.948–1.054)	>0.999

**P*<0.05 was considered statistically significant. SBP: Systolic blood pressure, DBP: Diastolic blood pressure, SpO_2: Pulse oximetry, BE: Base excess, HGB: Hemoglobin, HCT: Hematocrit, OR: Odds ratio, CI: Confidence interval, GCS: Glasgow Coma Scale, ALT: Alanine transaminase, AST: Aspartate transaminase, CK-MB: Creatine Kinase-MB

Table 2: Multiple regression analysis of drowning victims who do not require cardiopulmonary resuscitation/intubation at emergency department

Parameters	OR	95% CI	*P**
Respiratory rate	1.120	1.020–1.231	0.018
SpO_2	0.914	0.857–0.975	0.007
GCS	0.298	0.120–0.737	0.009

**P*<0.05 was considered statistically significant. SpO_2: Pulse oximetry, GCS: Glasgow Coma Scale, OR: Odds ratio, CI: Confidence interval

predictors of poor clinical outcomes. While the Szpilman clinical score provides valuable prognostic insight, it is not sufficient as a standalone tool for predicting poor outcomes. Our results suggest that drowning victims presenting with a GCS of 15, a respiratory rate within the normal range, normal oxygen saturation, and a Szpilman score below 3 can be safely discharged from the ED.

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Author contributions statement (CReDiT Statement)

S.G.K. (Süleyman Gökhan Kara): Conceptualization (lead), Methodology (lead), Data Curation (lead), Writing – Original Draft (lead), Investigation (equal).

B.B. (Başak Bayram): Project Administration (lead), Supervision (lead), Validation (equal), Writing – Review and Editing (equal).

Ş.S.H. (Şebnem Şakar Halaç): Formal Analysis (equal), Data Collection (equal), Writing – Review and Editing (equal).

O.S. (Osman Sönmez): Resources (equal), Visualization (equal), Writing – Review and Editing (supporting).

N.Ç. (Neşe Çolak): Project Administration (equal), Supervision (equal), Funding Acquisition (equal).

Conflicts of interest

None Declared.

Ethical approval

Ethical approval for this study was obtained from the Non-Interventional Ethics Committee of Dokuz Eylül University Faculty of Medicine (Decision No: 2019/11-12, Date: April 24, 2019).

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