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ORIGINAL ARTICLE

To Investigate the Relationship Between the Prognosis and Mortality of Intoxication Cases Admitted to The Emergency Department and Intoxication Severity Scoring Systems

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Abstract

Background: This study aimed to evaluate the need for intensive care unit (ICU) admission and the severity of intoxication in patients presenting to the Emergency Department (ED) using the Ankara Poisoning Criteria, PGI, Mascot, and Sequential Organ Failure Assessment (SOFA) scores.
Methods: This prospective observational study included intoxicated patients aged over 18 years who were admitted to the ED over a 1-year period. Demographic data, clinical parameters, and various intoxication scoring systems were used to assess poisoning severity and ICU admission needs. The diagnostic performance was evaluated using ROC curves, and risk factors for ICU admission were determined through univariate and multivariate logistic regression analyses.
Results: A total of 210 patients were included. Half (n=105) were admitted to the ICU, and the other half were monitored in the ED. The median age was 30 years, and 52.9% of patients were male. Significant differences in age and Glasgow Coma Scale (GCS) scores were observed between ICU-admitted and ED-discharged patients ($p<0.05$). In multivariate analysis, age, Ankara Criteria scores, and Mascot scores were identified as independent risk factors for ICU admission ($p<0.01$). The Ankara Criteria demonstrated the highest diagnostic accuracy for predicting ICU admission.
Conclusion: The Ankara Poisoning Criteria is a reliable and effective tool for assessing poisoning severity and predicting ICU admission.

Keywords: Emergency Medicine, Intensive Care Units, Poisoning, Prediction

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INTRODUCTION

Poisoning is a common clinical condition in emergency departments (EDs) and can lead to high levels of morbidity and mortality if timely and appropriate interventions are not provided [1,2]. Therefore, the effective and accurate evaluation of these patients is crucial for improving clinical outcomes. Currently, there is no universally accepted, reliable, and practical scoring system to predict the prognosis of poisoning cases or the need for ICU admission in emergency settings.

The Poisoning Severity Score (PSS), developed previously, has not gained widespread clinical use due to its complexity [3]. Various scoring systems exist for specific toxins, such as the Mascot score for methamphetamine poisoning, the PGI score for aluminum phosphide poisoning, and the NewPMS score for organophosphate poisoning [4-6]. However, these systems are inadequate for heterogeneous poisonings such as multi-drug ingestion, and comparative studies are limited.

The Ankara Poisoning Criteria, proposed in 2019, aim to assess poisoning severity and predict ICU admission in patients with multiple drug ingestion [7]. These criteria focus on clinical findings such as low Glasgow Coma Scale (GCS) score, hypotension, tachycardia or bradycardia, elevated lactate levels, and pH imbalance. However, the comparative performance of these criteria relative to other scoring systems has not been thoroughly validated.

This study aims to evaluate the effectiveness of the Ankara Poisoning Criteria compared to the PGI, Mascot, SOFA, and NewPMS scores in predicting ICU admission in patients presenting with poisoning. Additionally, the diagnostic accuracy of each scoring system was assessed via ROC analysis to identify the most effective clinical guide.

METHODS

Patients and Study Design

This prospective observational study was conducted in the emergency department of a tertiary university hospital between January 1, 2024, and December 31, 2024. All patients over the age of 18 admitted with a diagnosis of intoxication who provided informed consent were included.

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Exclusion criteria were pregnancy, concomitant trauma, unconsciousness with no available surrogate to provide consent, and the presence of serious acute comorbid conditions.

Data Collection

For all patients, demographic characteristics, vital signs, laboratory parameters (pH, lactate), Glasgow Coma Scale (GCS) scores, treatment modalities (antidote administration, activated charcoal, gastric lavage, dialysis), hospital stay duration, and ICU admission were recorded.

Scoring systems (Ankara Criteria, PGI, Mascot, SOFA, and NewPMS) were calculated at admission and at 4 and 8 hours.

Scoring Systems

The Ankara Criteria include:

- GCS <15,
- Systolic blood pressure \u226490 mmHg,
- Tachycardia (>100/min) or bradycardia (<60/min),
- pH disturbance (<7.35 or >7.45),
- Lactate >2.0 mmol/L.

Each parameter is assigned 1 point, yielding a total score ranging from 0 to 5 [7].

The PGI score includes pH, GCS, and systolic blood pressure <90 mmHg. The Mascot score evaluates methamphetamine poisoning and includes sex, age, consciousness level, oxygen requirement, shock, and tachycardia. The NewPMS score considers demographic data, vital signs, and intoxication type. The SOFA score assesses organ dysfunction [4,5,8-10].

Gold Standard and Grouping

ICU admission decisions were made based on the clinical assessments by experienced physicians and were accepted as the gold standard. Patients were divided into two groups: Those admitted to the ICU, those discharged from the ED.

Statistical Analysis

Data were analyzed using SPSS 20.0. The normality of continuous variables was assessed with the Kolmogorov\u2013Smirnov test. The Mann\u2013Whitney U test was used for non-normally distributed variables, while categorical variables were compared using the chi-square or Fisher\u2019s exact test. Time-dependent changes in scores were evaluated using Friedman\u2019s test. Univariate and multivariate logistic regression analyses were used to identify independent predictors of ICU admission. ROC analysis was used to calculate AUC, sensitivity, specificity, PPV, and NPV for each scoring system. A p-value <0.05 was considered statistically significant.

Ethics approval:

This study was approved by the Ethics Committee of University of Health Science Ankara Training and Research Hospital (E23-1306, Date: 21/06/2023).

RESULTS

Clinical Characteristics

A total of 210 patients were included in the study (Figure 1). Among them, 47.1% were female, and the median age was 30 years (IQR: 23–42). Activated charcoal (53.8%) and gastric lavage (44.8%) were the most commonly used treatment modalities. Antidotes were administered to 27.1% of patients, and dialysis was performed in 7.6%. At least one symptom was observed in 47.1% of cases, with neuropsychiatric symptoms being the most common (57.6%) (Table 1).

Comparison Between Groups

Significant differences were observed between ICU-admitted and ED-discharged patients in terms of: Age (p=0.037), Glasgow Coma Scale (GCS) scores (p=0.018), pH levels (p=0.017), Lactate levels (p<0.001). The use of activated charcoal, gastric lavage, antidotes, and dialysis also differed significantly between the two groups (p<0.05) (Table 2).

Table 1. Patient characteristics

N=210	Median (IQR 25-75)
Age (year)	30 (23-42)
Systolic Blood Pressure (mm Hg)	124 (115-145)
Diastolic Blood Pressure (mm Hg)	72 (64-82)
Pulse rate (/min)	90 (82-99)
Fever (^{0}C)	36.4 (36.2-36.7)
Saturation(%)	96 (93-98)
Respiratory rate (/min)	15 (13-16)
Blood glucose (mg/dl)	95 (87-108)
Glasgow coma score	15 (14-15)
PH	7.38 (7.34-7.40)
Lactate (mmol/ L)	2.0 (1.4-2.7)
Hospitalization time (hour)	48 (24-72)
	n (%)
Gender	
Female	99 (47.1%)
Male	111(52.9%)
Lavage	94 (44.8%)
Activated charcoal	113 (53.8%)
Antidote	57 (27.1%)
Dialysis	16 (7.6%)
Symptom	99 (47.1%)
Symptom type (n=99)	
Neuropsychiatric	57 (57.6)
CVS/RS	12 (12.1 %)
GIS	30 (30.3%)
Discharged (n=204)	
With healing	178 (87.3%)
With sequelae	6 (2.9%)
With own request	20 (9.8%)
Outcome	
Hospitalization	105 (50%)
Discharged	105 (50%)

GIS: Gastrointestinal System, CVS: Cardiovascular System, RS: Respiratory System

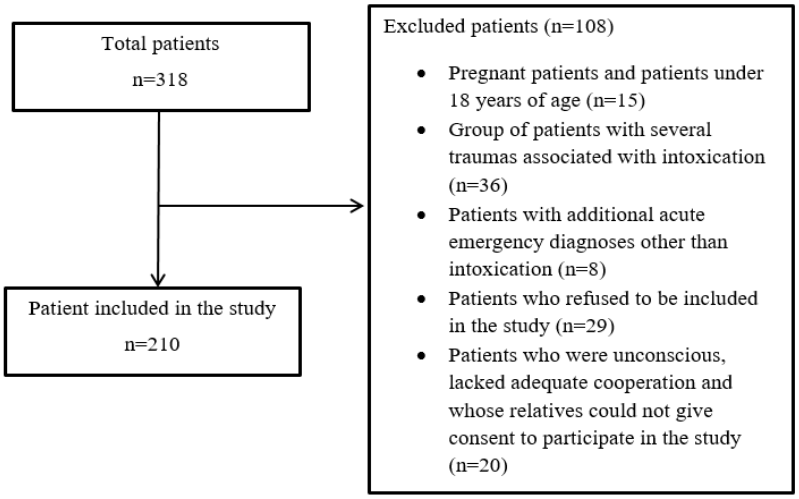

Figure 1. Patient Inclusion and Exclusion Flow Diagram for the Study Cohort

Table 2. Comparison of the characteristics of patients hospitalized in the Intensive Care Unit and patients discharged from the Emergency Department

	Hospitalized Median (IQR 25-75)	Discharged Median (IQR 25-75)	p
Age (year)	32 (25-42)	28 (22-40)	0.037 [b]
Systolic Blood Pressure (mm Hg)	124 (110-145)	124 (116-145)	0.721 [b]
Diastolic Blood Pressure (mm Hg)	72 (62-83)	72 (65-81)	0.734 [b]
Pulse rate (/min)	90 (81-103)	90 (82-98)	0.870 [b]
Fever (^{0}C)	36.4 (36.2-36.7)	36.4 (36.2-36.7)	0.845 [b]
Saturation(%)	96 (91-98)	96 (94-98)	0.209 [b]
Respiratory rate (/min)	15 (8-36)	14 (13-16)	0.098 [b]
Blood glucose (mg/dl)	96 (85-108)	94 (88-106)	0.909 [b]
Glasgow Coma Score	15 (14-15)	15 (15-15)	0.018 [b]
pH	7.30±0.19 7.36 (6.50-7.50) (7.31-7.40)	7.37±0.07 7.38 (6.90-7.54) (7.36-7.40)	0.017 [b]
Lactate (mmol/ L)	4.19±5.28 2.3 (0.6-27.0) (1.5-3.9)	2.55±3.67 1.7 (0.5-31.0) (1.3-2.4)	<0.001 [b]
	n (%)	n (%)	
Gender			
Female	52 (49.5%)	47 (44.8)	0.489 [c]
Male	53 (50.5%)	58 (55.2%)	
Lavage	58 (55.2%)	36 (34.3%)	0.004 [c]
Activated charcoal	65 (61.9%)	48 (45.7%)	0.015 [c]
Antidote	52 (49.5%)	5 (4.8%)	<0.001 [c]
Dialysis	13 (12.4%)	3 (2.9%)	0.009 [c]
Symptom	63 (60.0%)	36 (34.3%)	<0.001 [c]
Symptom type			
Neuropsychiatric	40 (63,5%)	17 (47.2%)	0.050 [c]
CVS/RS	4 (6.3%)	8 (22.2%)	
GIS	19 (30.2%)	11 (30.6%)	

b: Mann Whitney U test, c: Chi-Square Test/Fisher's Exact test. GIS: Gastrointestinal System, CVS: Cardiovascular System, RS: Respiratory System

Temporal Changes in Scores

Ankara Criteria, PGI, and SOFA scores showed significant changes at 0, 4, and 8 hours ($p<0.05$). Although NewPMS and Mascot scores also varied over time, the differences between ICU and ED groups were less pronounced (Table 3).

ROC Analysis and Diagnostic Performance

The Ankara Criteria showed the highest diagnostic accuracy for predicting ICU admission (AUC: 0.659; 95% CI: 0.585–0.732; p=0.032). PGI (AUC: 0.595) and SOFA (AUC: 0.601) scores also demonstrated statistical significance. NewPMS and Mascot scores had AUC values below 0.59, indicating limited discriminatory power (Figure 2).

Regression Analysis

In univariate analysis, age, GCS score, symptom presence, and all scoring systems (except NewPMS) were significantly associated with ICU admission. In multivariate analysis, only age, Ankara Criteria, and Mascot scores remained independent predictors of ICU admission. Each 1-point increase in the Ankara Criteria score increased the risk of ICU admission by 1.546-fold (p=0.021) (Table 4).

DISCUSSION

This study comparatively evaluated the Ankara Criteria, PGI, Mascot, SOFA, and NewPMS scoring systems in patients with multi-drug poisoning. Our findings suggest that the Ankara Criteria outperformed the other scoring systems in predicting ICU admission, demonstrating the highest AUC values and significance in multivariate analysis.

Scores such as PGI and Mascot were originally developed for specific toxins, limiting their applicability in diverse poisoning cases. For instance, the PGI score, designed for

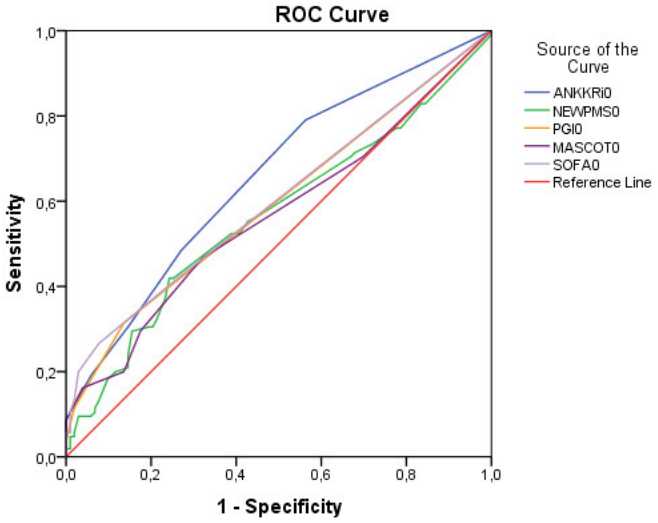

Figure 2. ROC analysis graph for Ankara Criteria, PGI, Mascot, SOFA, NewPMS

Table 3. Comparison of the scores of patients hospitalized in the Intensive Care Unit and patients discharged from the Emergency Department at 0.hour, 4.hour and 8.hour (within and between groups)

		0.hour	4.hour	8.hour	
		Median (IQR25-75)	Median (IQR25-75)	Median (IQR25-75)	p
Ankara criteria	Hospitalized	1 (1-3)	1 (0-2)	0 (0-1)	<0.001 [d]
	Discharged	1 (0-2)	0 (0-1)	0 (0-0)	<0.001 [d]
	p value	<0.001	0.008	0.007	
NewPMS	Hospitalized	31 (23-38)	30 (23-36)	29 (21-31)	0.001 [d]
	Discharged	27 (23-31)	27 (21-31)	27 (20-31)	<0.001 [d]
	p value	0.097	0.051	0.112	
PGI	Hospitalized	0 (0-1)	0 (0-0)	0 0-0)	0.026 [d]
	Discharged	0 (0-0)	0 (0-0)	0 (0-0)	0.002 [d]
	p value	0.001	<0.001	0.003	
Mascot	Hospitalized	1 (0-3)	1 (0-2)	1 (0-2)	0.026 [d]
	Discharged	1 (0-2)	1 (0-2)	1 0-1)	0.002 [d]
	p value	0.077	0.042	0.012	
SOFA	Hospitalized	0 (0-2)	0 (0-1)	0 (0-1)	<0.001 [d]
	Discharged	0 (0-1)	0 (0-0)	0 (0-0)	<0.001 [d]
	p value	0.003	0.002	0.001	

d: Friedman 2-way Anova, PGI: PGI: Ph, GCS, low systolic pressure (I), SOFA: Sequential Organ Failure Assessment, NewPMS: New Poisoning Mortality Score

Table 4. Univariate and Multivariate Logistic Regression Analysis for Risk Factors for Intensive Care Unit Hospitalization

	Univariate			Multivariate		
	OR	95 % CI	p value	Adj OR	95 % CI	p value
Age	1.025	1.003- 1.048	0.026	1.037	1.008 – 1.066	0.011
GCS	1.321	1.092- 1.597	0.004	1.323	0.887 – 1.447	0.317
Symptom presence	2.875	1.640 – 5.039	<0.001	1.819	0.936 – 3.536	0.078
Ankara Criteria	1.534	1.242 – 1.896	<0.001	1.546	1.069 – 2.237	0.021
PGI	2.399	1.408 – 4.089	0.001	1.026	0.320 – 3.292	0.965
SOFA	1.424	1.133 – 1.790	0.002	1.314	0.929 – 1.857	0.122
Mascot	1.223	0.045- 1.431	0.012	1.589	1.112 – 2.272	0.011
NewPMS	1.025	0.998 – 1.053	0.075	-	-	-

OR: Odds Ratio, CI: Confidence Interval, GCS: Glasgow Coma Score, PGI: Ph, GCS, low systolic pressure (I), SOFA: Sequential Organ Failure Assessment, NewPMS: New Poisoning Mortality Score

aluminum phosphide poisoning, is based on variables such as a pH <7.25, GCS <13, and systolic blood pressure <87 mmHg, which are strongly associated with mortality [6,13]. The Mascot score targets acute methamphetamine intoxication and includes parameters like tachycardia, hypotension, and oxygen requirement [6,10]. Although these scores share some features with the Ankara Criteria, their clinical application differs significantly.

The NewPMS score has been mainly validated in organophosphate poisoning and shows limited effectiveness in heterogeneous poisonings [6,11,12]. While some recent studies report its utility in mortality prediction, its performance in mixed poisoning remains uncertain [13,14].

A major advantage of the Ankara Criteria is its reliance on simple and readily obtainable clinical and laboratory parameters—such as GCS, hypotension, pH imbalance, and elevated lactate levels—which are well-established indicators of poisoning severity and ICU need.

These variables overlap with those used in other scoring systems but offer a more comprehensive evaluation in multi-drug intoxications [3,15].

Previous studies have identified age and GCS score as reliable prognostic markers in poisoned ICU patients [16,17], consistent with our findings.

In our cohort, the median pH was 7.38, reflecting generally stable acid–base balance, while a median lactate of 2.0 mmol/L suggests early tissue hypoxia or hypoperfusion. Elevated lactate is a recognized marker of severe poisoning and has been linked to adverse outcomes in previous studies [12,18].

One of the strengths of our study is the comparison of five different scoring systems within the same patient population, using robust statistical methods like ROC analysis. Additionally, using clinician judgment as the gold standard for ICU admission strengthens the validity of our results.

However, the study has several limitations. It was conducted at a single center with a relatively small sample size, which may limit the generalizability of the findings. Moreover, since some scoring systems were originally developed for specific toxins, their validity in heterogeneous poisonings might be limited. Future larger, multicenter studies are needed to validate the Ankara Criteria across various clinical scenarios.

CONCLUSION

This prospective study evaluated multiple scoring systems (Ankara Criteria, PGI, Mascot, SOFA, and NewPMS) in patients presenting to the Emergency Department with multi-drug poisoning. Our findings suggest that the Ankara Criteria demonstrate superior diagnostic accuracy for predicting ICU admission compared to the other systems evaluated. The use of simple and easily obtainable clinical and laboratory parameters makes the Ankara Criteria practical and widely applicable. Its identification as an independent predictor in multivariate analysis further supports its reliability. Implementing the Ankara Criteria in clinical practice may enhance early ICU triage and optimize the allocation of healthcare resources. Future multicenter studies with larger sample sizes are warranted to validate its effectiveness across diverse poisoning scenarios and to explore its association with long-term outcomes, such as mortality.

Conflict of Interest: The authors report no conflicts of interest and are responsible for the content and writing of the paper.

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REFERENCES

1. Zöhre E, Ayrık C, Bozkurt S, Köse A, Narcı H, Çevik İ, et al. Retrospective analysis of poisoning cases admitted to the emergency medicine. Arch Iran Med. 2015;18(2):117-22. (PMID: 25644801).
2. Gummin DD, Mowry JB, Beuhler MC, Spyker DA, Brooks DE, Dibert KW, et al. 2019 Annual Report of the American Association of Poison Control Centers' National Poison Data System (NPDS): 37th Annual Report. Clin Toxicol. 2020;58(12):1360–541.
3. Schwarz ES, Kopec KT, Wiegand TJ, Wax PM, Brent J. Should we be using the poisoning severity score? J Med Toxicol. 2017; 13:135-45. (doi: 10.1007/s13181-017-0609-5).

4. Lan K-C, Lin Y-F, Yu F-C, Lin C-S, Chu P. Clinical manifestations and prognostic features of acute methamphetamine intoxication. J Formos Med Assoc. 1998;97(8):528-33.
5. Pannu AK, Bhalla A, Sharma A, Sharma N. "PGI Score": A simplified three-point prognostic score for acute aluminum phosphide poisoning. Indian J Crit Care Med. 2020;24(9):790. (doi: 10.5005/jp-journals-10071-23555).
6. Han KS, Kim SJ, Lee EJ, Shin JH, Lee JS, Lee SW. Development and validation of new poisoning mortality score system for patients with acute poisoning at the emergency department. Critical Care. 2021;25:1-11. (doi: 10.1186/s13054-020-03408-1).
7. Kocaşaban DÜ, Arslan V, Günaydın YK, Okumuş M. The intensive care unit admission criteria for patients with poisoning. Eurasian Journal of Critical Care. 2019;1(2):59-64.
8. Lambden S, Laterre PF, Levy MM, Francois B. The SOFA score development, utility and challenges of accurate assessment in clinical trials. Critical Care. 2019; 23:1-9. (doi: 10.1186/s13054-019-2663-7).
9. Lam RPK, Chan CK, Tse ML, Lau EHY, Dai Z, Tsui MSH, et al. Derivation and internal validation of a clinical prediction score to predict major effect or death in acute methamphetamine toxicity. Clin Toxicol. 2023;61(3):146-52. (doi: 10.1080/15563650.2022.2164297).
10. Louriz M, Dendane T, Abidi K, Madani N, Abouqal R, Zeggwagh A. Prognostic factors of acute aluminum phosphide poisoning. Indian J Med Sci. 2009;63(6). (doi: 10.4103/0019-5359.53386).
11. Lee S, Kim SJ, Han KS, Song J, Lee SW. Comparison of the New-Poisoning Mortality Score and the Modified Early Warning Score for predicting in-hospital mortality in patients with acute poisoning. Clin Toxicol. 2024; 62(1): 1-9. (doi: 10.1080/15563650.2024.2310743).
12. Krishna Moorthy DGSR, Manju Priya S, Rajesh K, Devendra Prasad KJ. Performance of new Poisoning Mortality Score in comparison with SOFA and APACHE II scores in acute organophosphate poisoning. Journal of Emergency Medicine, Trauma & Acute Care, 2023(1), 9. (doi: /10.5339/jemtac.2023.9).
13. Yadav D, Bhattacharyya R, Banerjee D. Acute aluminum phosphide poisoning: The menace of phosphine exposure. Clin Chim Acta. 2021; 520: 34-42. (doi: 10.1016/j.cca.2021.05.026).
14. Kim SJ, Cho H, Ahn S, Kim JY, Song J, Park JH. Prognostic utility of lactate concentrations and kinetics to predict adverse events associated with acute drug overdose. Am J Emerg Med. 2021; 50: 120-5. (doi: 10.1016/j.ajem.2021.07.025)
15. Lionte C, Sorodoc V, Tuchilus C, Cimpoiesu D, Jaba E. Biomarkers, lactate, and clinical scores as outcome predictors in systemic poisons exposures. Hum Exp Toxicol. 2017;36(7):651-62. (doi:10.1177/0960327116660866).
16. Amirabadizadeh A, Nakhaee S, Jahani F, Soorgi S, Hoyte CO, Mehrpour O. Prognostic indicators in critically ill poisoned patients: development of a risk-prediction nomogram. Drug Metab Pers Ther. 2020; 35(4). (doi: 10.1515/dmpt-2020-0108).
17. Liisanantti J, Kaukoranta P, Martikainen M, Ala-Kokko T. Aspiration pneumonia following severe self-poisoning. Resuscitation. 2003;56(1):49-53. (doi: 10.1016/S0300-9572(02)00284-8).
18. Cheung R, Hoffman RS, Vlahov D, Manini AF. Prognostic utility of initial lactate in patients with acute drug overdose: a validation cohort. Ann Emerg Med. 2018;72(1):16-23. (doi: 10.1016/j.annemergmed.2018.02.022).