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REVIEW

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e-mail: oktayemergency@gmail.com
ORCID ID: orcid.org/0000-0002-1643-6007

Publisher Contact
Address: Molla Gürani Mah. Kaçamak Sk. No: 21/1 34093 İstanbul, Türkiye
Phone: +90 (530) 177 30 97
E-mail: info@galenos.com.tr/yayin@galenos.com.tr
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ORIGINAL RESEARCH

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Which Scoring System is Better in Predicting Mortality in Multiple Trauma Patients: Revised Trauma Score or Glasgow Coma Scale

Adem Az, Çiğdem Orhan

Beylikdüzü State Hospital, Clinic of Emergency Medicine, İstanbul, Türkiye

Abstract

Objective: We investigated the prognostic value of the revised trauma score (RTS) and Glasgow Coma scale (GCS) in predicting mortality in multi-trauma patients.

Materials and Methods: This retrospective study included 537 consecutive trauma patients with a shock index ≥1.0. We evaluated the demographics, clinical characteristics, and trauma scores, including GCS and RTS, in both the survivor and non-survivor groups.

Results: A total of 537 patients, comprising 58.29% males and 41.71% females, with a mean age of 44.46±22.05 years, were included. Overall mortality was 13.04%. Age and sex differed significantly between survivors and non-survivors (p=0.0001 and p=0.001). Non-survivors had significantly lower mean GCS and RTS scores (p=0.0001 for both comparisons). Receiver operating characteristic analysis identified a GCS ≤10 for predicting mortality in multi-trauma patients, with 99.89% sensitivity and 99.79% specificity. Additionally, an RTS ≤8 had 98.57% sensitivity and 99.79% specificity for determining mortality.

Conclusion: Our results indicated that lower mean GCS and RTS scores were predictors of mortality in multi-trauma patients. A GCS of ≤10 and an RTS of ≤8 exhibited exceptional sensitivity and specificity for determining mortality in multi-trauma patients.

Keywords: Trauma, trauma scores, Glasgow Coma scale, revised trauma score, mortality

Introduction

Traumatic injuries represent a significant global health concern. Each year, more than 45 million people worldwide suffer from moderate to severe disabilities due to trauma. Furthermore, trauma-related injuries claim the lives of approximately 5.8 million individuals annually [1,2]. Moreover, 50%-60% of post-traumatic deaths occur within the initial hour [3]. Despite advances in healthcare and technology, fatalities in the scene or within the first hour persist as a significant public health issue. It is estimated that one-third of trauma-related deaths can be prevented with improved trauma systems [4].

In a study conducted in Türkiye, Höke et al. [5] investigated various trauma scores, including the injury severity score (ISS), new ISS, revised trauma score (RTS), and Glasgow Coma scale (GCS), and observed that all of these scores demonstrated statistical significance in predicting mortality. In another study involving 633 trauma patients, Orhon et al. [6] found that GCS and RTS were significant indicators of mortality. Although numerous trauma scores are used to assess the severity of injuries and monitor clinical outcomes in trauma patients, the most accurate and reliable scoring system for determining morbidity and mortality remains unclear.

This study aimed to investigate the prognostic value of RTS and GCS in predicting mortality in patients with a shock index (SI) ≥1.0 who presented to the emergency department (ED) with multi-trauma.

Address for Correspondence: Adem Az, Beylikdüzü State Hospital, Clinic of Emergency Medicine, İstanbul, Türkiye
Phone: +90 530 100 71 17 **E-mail:** adem.aaz@gmail.com **ORCID-ID:** orcid.org/0000-0002-7204-6185
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Materials and Methods

Ethics Committee Approval and Patient Consent

This study was conducted in accordance with the 1989 Declaration of Helsinki and was approved by the Institutional Review Board (IRB) of University of Health Sciences Türkiye, Haseki Training and Research Hospital Clinical Research Ethics Committee (approval number: 110-2022, date: 08.06.2022). As neither the images nor the accompanying text contained potentially identifying markers or patient identifiers, the IRB did not require patient consent for the review of their medical records.

Study Design and Setting

This retrospective, observational, single-center study included 537 consecutive adult patients (≥18 years old) who were admitted to our ED with multi-trauma between April 2021 and April 2022. Our hospital is one of the high-volume EDs in İstanbul, handling approximately 1500 emergency patient admissions daily. In addition, as a trauma center, our facility provides care for over 200 trauma patients daily, ranging from mild to severe cases. Only patients with a SI ≥1.0 were included in the study to exclude mild cases. The hospital's automation systems and archives were scanned for information on all patients presenting for the evaluation and treatment of acute traumatic injuries.

We assessed patients' demographics (age and sex), vital signs on admission [systolic blood pressure (SBP), respiratory rate, and heart rate (HR)], complaints and symptoms at admission, anatomic region of injury, type of trauma (blunt or penetrating), mechanism of injury, alcohol consumption, trauma scoring systems (GCS and RTS), and clinical outcomes (discharge, hospitalization, or death). In addition, SI was calculated for each patient. SI is defined as the ratio of HR to SBP.

Multi-trauma was defined as an injury to at least two body regions. Patients who experienced blunt or penetrating injuries in the same anatomical region were classified as having penetrating injuries. This study classified multiple injuries to the same anatomical region as a singular injury to that specific anatomical region.

The patients in the study cohort were categorized into survivors and non-survivors. Demographics, clinical characteristics, and trauma scores (GCS and RTS) were compared among the groups to determine the factors associated with mortality.

Study Population and Sampling

All cases meeting the eligibility criteria were included to prevent selection bias. We enrolled 6,978 patients admitted to the ED due to traumatic injuries between April 2021 and April 2022. Patients with non-traumatic injuries or those presenting to the ED for any other reason were subsequently excluded. Additionally, 152 patients were excluded because of a lack of information. Moreover, 2,348 patients under the age of 18 years were excluded from the study. Furthermore, 1,926 patients were excluded because they had mono-trauma. Moreover, 2015 patients with a SI <1.0 were excluded because of severe injuries. The remaining 537 patients were included in the study (Figure 1).

Trauma Assessment Scores

GCS is a neurological assessment tool that measures a person's level of consciousness based on eye-opening, verbal, and motor responses, which are assigned 4, 5, and 6 points, respectively (for a total score of 15 points).

The RTS is a tool used to assess the severity of a traumatic injury. It considers three key parameters: GCS, SBP, and respiratory rate, with a total score of 12 points.

Statistical Analysis

All data analyses were conducted using SPSS statistical software (version 15.0 for Windows; SPSS Inc., Chicago, IL, USA). Categorical variables are expressed as numbers of patients (n) and percentages (%). Numerical data are expressed as mean, standard deviation, and minimum and maximum values. Intragroup analyses (survivors vs non-survivors) were conducted using the chi-square test for normally distributed data and the Mann-Whitney U-test for non-normally distributed data. Independent variables predicting mortality (age, sex, GCS and RTS) were analyzed using multivariate logistic regression analysis. The receiver operating characteristic (ROC) curve was used to determine the cut-off point for GCS and RTS. The threshold for statistical significance was defined as $p<0.05$.

Results

The demographic and clinical characteristics of the trauma patients are presented in Table 1. The study comprised a sample size of 537 patients, with 313 (58.29%) males and 224 (41.71%) females. The mean age was 44.46±22.05 years, with a range of 18-96 years. The overall mortality rate was 13.04%. In addition, 26.82% of the patients were discharged from the ED, and 61.64% were hospitalized. Overall, 73.93%

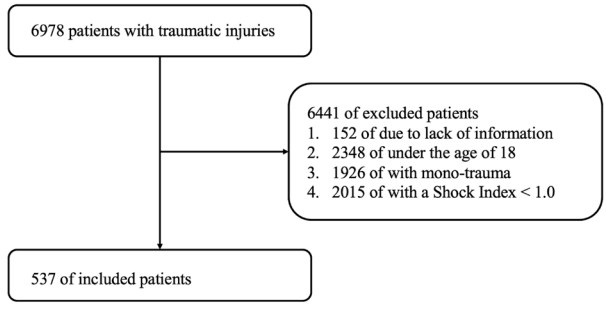

Figure 1. Flowchart

of patients presented with blunt injuries. Falls were the most commonly reported mechanism of trauma, accounting for 52.51%, followed by traffic accidents at 17.13%, and accidental injuries at 11.17%. A total of 64 individuals were transported to the ED via ambulance, while 473 arrived on foot. Analysis of anatomical regions affected by injuries revealed that the head and face were the most prevalent sites, comprising 43.58% of the cases.

A total of 142 patients were hospitalized and followed up in the orthopedics department. Additionally, 64 individuals received treatment in the neurosurgery department, 54 in the general surgery department, 30 in the cardiovascular surgery department, 22 in the thoracic surgery department, and 8 in the intensive care unit.

Table 1. Demographic and clinical characteristics of trauma patients

Characteristics			
Age in years, mean ± SD (min - max)		44.46±22.05 (18-96)	
		n	**(%)**
Sex	Female	224	(41.71)
	Male	313	(58.29)
The types of trauma	Blunt	397	(73.93)
	Penetrating	140	(26.07)
Mechanism of trauma	Fall	282	(52.51)
	Traffic accident	92	(17.13)
	Assault	60	(11.17)
	Accidental injuries	51	(9.50)
	Stab wounds	34	(6.33)
	Gunshot wounds	18	(3.35)
Place of trauma	Street/road/ highway	351	(65.36)
	Home	103	(19.18)
	Commercial/work	83	(15.46)
Alcohol consumed	No	420	(78.21)
	Yes	117	(21.79)
Forensic trauma	No	186	(34.64)
	Yes	351	(65.36)
Transport to the hospital	By foot	473	(88.08)
	Via ambulance	64	(11.92)
Anatomic region of injury	Head and face	234	(43.58)
	Lower extremities	222	(41.34)
	Upper extremities	201	(37.43)
	Abdomen	191	(35.57)
	Chest	184	(34.26)
	Spine	151	(28.12)
Outcome	Discharge	144	(26.82)
	Hospitalization	331	(61.64)
	Death	70	(13.04)

Data are given as numbers (n) and percentages (%), mean, standard deviation (SD), and minimum and maximum values

min - max: Minimum - maximum

Table 2 presents the comparative analysis of demographics, clinical characteristics, and trauma scores among patients who survived and those who did not. The age of non-survivors was found to be significantly lower than that of survivors (p=0.0001). Furthermore, the prevalence of males was significantly higher among non-survivors than among survivors (p=0.001). Penetrating traumas occurred significantly more commonly in non-survivors than in survivors (p=0.024). Moreover, statistically significant differences were observed among non-survivors and survivors in terms of the mechanisms of trauma such as falls, traffic accidents, assault, and gunshot wounds (p=0.0001, p=0.014, p=0.002, and p=0.001, respectively). Finally, non-survivor patients had significantly lower mean GCS and RTS scores than survivors (p=0.0001 for both comparisons).

Multivariate logistic regression analysis demonstrated that increased age [odds ratio (OR): 0.98, 95% confidence interval

Table 2. Comparison of demographic characteristics and trauma scores between patients who survived and those who did not

	Survivors		**Non-survivors**		**p**
Age in years, mean ± SD	46.05±22.34		33.83±16.54		0.0001
	n	**(%)**	**n**	**(%)**	**p**
Sex					
Female	208	(44.54)	16	(22.86)	0.001
Male	259	(55.46)	54	(77.14)	
Mechanism of trauma					
Fall	264	(56.53)	19	(27.14)	0.0001
Traffic accident	73	(15.63)	18	(25.71)	0.014
Accidental injuries	47	(10.06)	4	(5.71)	0.348
Assault	44	(9.42)	16	(22.86)	0.002
Stab wounds	29	(6.21)	5	(7.14)	0.972
Gunshot wounds	10	(2.14)	8	(11.43)	0.001
The types of trauma					
Blunt	353	(75.59)	44	(62.86)	0.024
Penetrating	114	(24.41)	26	(37.14)	
	Mean ± SD		**Mean ± SD**		**p**
Glasgow Coma scale	14.95±0.24		5.04±2.07		0.0001
Revised trauma score	11.94±0.27		5.61±1.83		0.0001

Data are given as numbers (n) and percentages (%), mean, and standard deviation (SD)

*Intragroup analyses (survivors vs non-survivors) were conducted using the chi-square test for normally distributed data and the Mann-Whitney U-test for non-normally distributed data, as appropriate

(CI): 0.96-1.01; p=0.001], female gender (OR: 1.96, 95% CI: 1.06-2.61; p=0.031), and decreased GCS (OR: 0.64, 95% CI: 0.18-0.98; p=0.027) and RTS scores (OR: 0.64, 95% CI: 0.22-1.97; p=0.049) were identified as significant predictors of mortality among trauma patients (Table 3).

ROC analysis identified a GCS cut-off score of ≤10 to determine mortality in multi-trauma patients, with 99.89% sensitivity and 99.79% specificity [area under the curve (AUC): 0.999, 95% CI 0.991-0.999; Table 4 and Figure 2]. In addition, ROC analysis revealed a cut-off RTS of ≤8, with 98.57% sensitivity and 99.79% specificity for determining mortality in multi-trauma patients (AUC: 0.99, 95% CI 0.990-1.000; Table 4 and Figure 2).

Discussion

Trauma is one of the leading causes of mortality. Annually, trauma leads to the mortality of nearly 6 million individuals worldwide [1]. A substantial number of fatalities occur either at the scene of the incident or within the initial 4 h following the patient's arrival at an ED [2]. Hence, the main goal of this study was to predict and determine individuals at an increased risk of mortality at an early stage. The key findings of our study are as follows. First, males and young adults exhibited a higher prevalence of trauma and trauma-related mortality. Second, falls, traffic accidents, and accidental injuries were the most commonly reported mechanisms of trauma. Third, non-survivors had lower mean GCS and RTS scores than survivors. Fourth, in determining mortality in multi-trauma patients, a GCS score of ≤10 was found to be the cut-off with 99.89% sensitivity and 99.79% specificity, and an RTS score of ≤8 was determined as the cutoff with 98.57% sensitivity and 99.79% specificity.

In studies analyzing the epidemiologic and demographic features of trauma patients, Mutasingwa and Aaro [7] and Aluisio et al. [8] consistently noted that young males were more commonly presented to the ED with traumatic injuries. Additionally, in the United States, trauma is the leading cause of mortality among individuals under the age of 44 [9]. Similarly, in our study, males and young adults exhibited a higher prevalence of trauma and trauma-related mortality.

According to our findings, the prevailing causes of trauma were falls and traffic accidents. Consistent with our study, Chokotho et al. [10] reported that falls and traffic accidents were the most common mechanisms of injury in their study involving 49,241 trauma cases. In another study conducted in Türkiye, Çırak et al. [11] found that falls and traffic accidents were the leading causes of trauma among patients. In studies conducted in low- or middle-income countries, Rouhani et al., [12], Soundarrajan et al., [13], and Zuraik and Sampalis [14] discovered that road traffic accidents were the most common trauma mechanism, followed by falls. Our findings are consistent with the main causes of trauma worldwide. However, the prevalence and trends of trauma may vary across various cultural contexts, nations, and socioeconomic circumstances. The higher incidence of traffic accidents, particularly in low- and middle-income countries, can be

Table 3. Multivariate logistic regression analysis to determine mortality

	p	OR	95% CI	
Age in years	0.001	0.98	0.96	1.01
Sex (female)	0.031	1.96	1.06	2.61
Glasgow Coma scale	0.027	0.64	0.18	0.98
Revised trauma scores	0.049	0.64	0.22	1.97

OR: Odds ratio, CI: Confidence interval

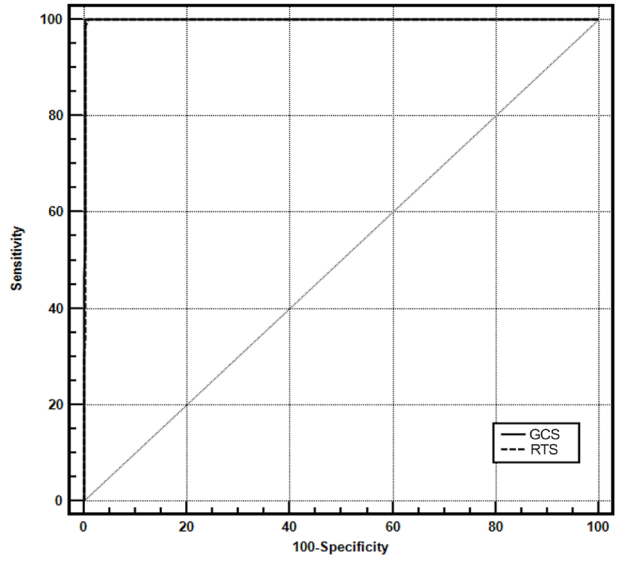

Figure 2. Specificity and sensitivity of GCS and RTS scores for determining mortality in multi-trauma patients using receiver operating characteristic curves [area under the curve (AUC): 0.999, 95% confidence interval (CI) 0.991-0.999 and AUC: 0.99, 95% CI 0.990-1.000; respectively)

GCS: Glasgow Coma scale, RTS: Revised trauma score

Table 4. Trauma scores for determining mortality in multi-trauma patients

Criterion	AUC	SE	95% CI	Sensitivity	Specificity	PPV	NPV	LR (+)
GCS ≤10	0.999	0.001	0.991-0.999	99.89	99.79	98.6	100.0	467.00
RTS ≤8	0.999	0.001	0.990-1.000	98.57	99.79	98.7	99.8	460.33

AUC: Area under the curve, SE: Standard error, CI: Confidence interval, PPV: Positive predictive value, NPV: Negative predictive value, LR (+): Likelihood ratio, , GCS: Glasgow Coma scale, RTS: Revised trauma score

attributed to inadequate adherence to safety precautions and less compliance with traffic regulations [10,14]. The research conducted within Türkiye revealed a higher prevalence of fall incidents compared with traffic accidents [11]. Moreover, based on our findings, penetrating injuries exhibited a higher fatality rate, even though most trauma incidents involved blunt injuries.

In a study involving a sample of 633 trauma patients from Türkiye, Orhon et al. [6] found that GCS and RTS were significant indicators of mortality. In another study conducted in Türkiye, Güneytepe et al. [15] investigated various trauma scores, including GCS, RTS, ISS, and trauma and injury severity score (TRISS), and observed that all these scores demonstrated statistical significance in predicting mortality. In a study of 1,410 trauma patients, Yadollahi et al. [16] also observed that TRISS, RTS, GCS, and ISS were all highly effective in determining prognosis and mortality among trauma patients. Similarly, our study revealed significant differences between survivors and non-survivors in terms of GCS and RTS.

In a study assessing post-traumatic deaths, Demetriades et al. [3] discovered that GCS <8 emerged as the most important risk factor associated with mortality among trauma patients within the first hour after admission to the hospital. Another study, involving 740 trauma patients, also recognized a GCS <8 as a reliable predictor of mortality [17]. Furthermore, Yadollahi et al. [16] identified increased age, GCS <8, RTS <7.6, and TRISS <0.9 as the most significant predictors of in-hospital mortality. Our results demonstrated that GCS could predict mortality with 99.89% sensitivity and 99.79% specificity in the scores ≤10. Moreover, patients with a GCS of ≤10 have a 467-fold increased risk of mortality than those with a GCS of >10. Similar to our findings, a study conducted in Northern Iran reported that a GCS ≤8 predicts mortality with exceptionally high accuracy, showing a sensitivity of 98.4% and specificity of 92.3% [18].

Yadollahi et al. [16] demonstrated that RTS exhibited the highest effectiveness in assessing the severity of traumatic injuries, following TRISS. Furthermore, they established a cut-off point for RTS at ≤7.69 with 95% sensitivity and 67% specificity in predicting mortality in trauma patients. In another study conducted by Yousefzadeh-Chabok et al. [19], an RTS score of ≤6 was identified as a predictor of mortality among trauma patients, exhibiting 99% sensitivity and 62% specificity. In our study, an RTS score of ≤8 was determined as a predictor of mortality with 98.57% sensitivity and 99.79% specificity. In our cohort, we exclusively included patients with SI ≥1.0. The higher specificity observed in our findings compared with other studies can be attributed to this selection criterion. Based on our findings, the combined use of RTS with SI offers valuable insights for predicting mortality and prognosis among multi-trauma patients.

In our multivariate logistic regression analysis that examined the utility of the GCS and RTS for predicting mortality in multi-trauma patients, we found that both scoring systems had a comparable OR. However, the GCS showed a slightly higher level of statistical significance and a more reliable CI, suggesting that it may be a more reliable predictor of mortality in our population.

Study Limitations

A limitation of this study is its use of a retrospective and hospital-based study design, which offers a risk of selection and misclassification biases affecting the obtained results. Second, our observations are limited to the patient population that seeks medical attention at the hospital. Consequently, it is not possible to reach conclusions about the prevalence of trauma among the general population. Finally, we lack information about the post-discharge health status and care quality of trauma patients.

Conclusion

Our results indicated that lower mean GCS and RTS scores were predictors of mortality in multi-trauma patients. Specifically, a GCS of ≤10 had a sensitivity of 99.89% and a specificity of 99.79% for determining mortality in multi-trauma patients with an SI ≥1.0. Moreover, an RTS of ≤8 exhibited an exceptional sensitivity of 98.57% and a specificity of 99.79% in identifying mortality. We recommend the use of trauma scores, such as GCS and RTS, in conjunction with SI at ED admission to accurately assess disease severity and mortality risk in trauma patients.

Ethics

Ethics Committee Approval: This study was conducted in accordance with the 1989 Declaration of Helsinki and was approved by the Institutional Review Board (IRB) of University of Health Sciences Türkiye, Haseki Training and Research Hospital Clinical Research Ethics Committee (approval number: 110-2022, date: 08.06.2022).

Informed Consent: As neither the images nor the accompanying text contained potentially identifying markers or patient identifiers, the IRB did not require patient consent for the review of their medical records.

Authorship Contributions

Concept: A.A., Ç.O., Design: A.A., Ç.O., Data Collection or Processing: A.A., Ç.O., Analysis or Interpretation: A.A., Literature Search: A.A., Ç.O., Writing: A.A., Ç.O.

Conflict of Interest: No conflicts of interest were declared by the authors.

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ORIGINAL RESEARCH

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The Effect of Infrared Vein Finder on Fear of Pain During Peripheral Venous Catheterization at the Emergency Department

Cansu Uğraş Arıaslan[1], İlknur Çalışkan[2], Yunus Emre Arık[3]

[1]Bandırma Training and Research Hospital, Clinic of Emergency, Balıkesir, Türkiye
[2]İzmir Tınaztepe University Faculty of Health Sciences, Department of Nursing, İzmir, Türkiye
[3]University of Health Sciences Türkiye, Şişli Hamidiye Etfal Training and Research Hospital, Clinic of Emergency, İstanbul, Türkiye

Abstract

Objective: Peripheral venous catheterization (PVC) is one of the most common and invasive procedures performed in the emergency department (ED). The use of technologies to improve efficiency and reduce pain is important. This study aimed to reveal the effect of an infrared vein finder (IVF) on pain and fear of pain (FOP) during PVC.

Materials and Methods: This prospective randomized study was conducted with 200 patients who underwent PVC at the ED. The patients were randomized into two groups: IVF and control groups. PVC was applied to the control group using the conventional method. In the IVF group before PVC, patients were informed about IVF devices and PVC performed using them. The fear of pain-3 questionnaire (FPQ-3) before the procedure and the numerical pain scale (NRS) after the procedure were applied for both groups. FPQ-3, NRS scores, and PVC success rates were analyzed.

Results: Two hundred patients participated in the study. The mean age was, 33.3±11.2 for IVF and 32.5±10.2 for control group. The success rate in the first attempt was 92% (n=92) in the IVF group and 97% (n=97) in the control group (p=0.121). The mean total scores were; 78.8±21.5 8 in the IVF group and 85.8 ±22.0 in the control group (p=0.025). The groups were compared in terms of severe pain, minor pain, and medical pain scores, and there was only a difference in minor pain scores (p=0.021). The mean NRS score in the IVF group was 2.56±1.25, control group was 2.94±1.58 (p=0.121). The correlations between NRS and subgroups were; "severe pain" (r=0.407, p<0.001), "minor pain" (r=0.534, p<0.001) and "medical pain" scores (r=0.390, p<0.001) in the IVF group.

Conclusion: Although the use of IVF for venous catheterization reduces the FOP in adults but does not reduce pain and severe pain fear, it only reduces the fear of minor pain and does not affect the success of the procedure.

Keywords: Pain, fear of pain, vein, catheterization, infrared vein finder

Introduction

Peripheral venous catheterization (PVC) is one of the most common procedures in the emergency department (ED), and approximately 1.2 billion intravenous (IV) cannulation procedures are performed annually worldwide [1]. PVC is an invasive procedure that involves inserting a sterile catheter through the patient's skin into the peripheral vein. The peripheral venous catheter is crucial for fluid electrolyte therapy, blood and blood product transfusion, IV drug administration and nutritional support [2]. In addition, PVC has various complications such as phlebitis, dislodgement, occlusion, and pain [3]. One of the most important factors affecting complications in peripheral vein catheterization is the experience of the healthcare provider [4]. Rapid IV catheterization is important for effective resuscitation in patients with trauma, shock, and burns admitted to the ED. Conditions such as vascular problems due to IV drug use, age (elderly, child), peripheral edema, hypothermia, and dehydration can cause obstacles in the IV catheter procedure

Address for Correspondence: Yunus Emre Arık, University of Health Sciences Türkiye, Şişli Hamidiye Etfal Training and Research Hospital, Clinic of Emergency, İstanbul, Türkiye
Phone: +90 544 580 09 10 **E-mail:** dryunusemrearik@gmail.com **ORCID-ID:** orcid.org/0000-0002-4521-9546
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[5,6]. In such patients, emergency team members may not be able to localize the vein and insert the catheter blindly. IV cannulation is a painful procedure that affects cognitive abilities by increasing pain and fear of pain (FOP), and this blind intervention may increase the number of attempts and increase the patient's pain [7,8]. Pain is a condition that negatively affects a person's physical, psychosocial, and social life. Therefore, controlling the patient's pain, increasing the patient's comfort, and minimizing the complications related to pain are important in reducing the length of stay in the ED [9]. FOP was evaluated as a condition affected by pain and can be defined as a verbal, behavioral, and physiological response to the possibility of current or potential pain [10]. In recent years, the use of technologies to improve efficiency and reduce pain in painful procedures such as PVC has become more important. In this regard, infrared vein finder (IVF) devices have been used, especially in patients in whom peripheral catheterization is difficult [11]. This study was conducted to reveal the effect of the IVF on pain and FOP in patients who underwent PVC in the ED.

Materials and Methods

Patients and Study Design

This prospective randomized observational study was conducted between June 2 and September 30, 2019 in the ED of University of Health Sciences Türkiye, İstanbul Şişli Hamidiye Etfal Training and Research Hospital, which is a tertiary hospital and has approximately 150,000 admissions to the ED annually. The study was approved by the Local Ethics Committee of University of Health Sciences Türkiye, İstanbul Şişli Hamidiye Etfal Training and Research Hospital (approval number: 2402, date: 14.05.2019). The inclusion criteria were; older than 18 years, patients with PVC indication in the ED, conscious, patients with at least one previous PVC experience, and no communication barrier. Exclusion criteria were; younger than 18 years old, infection, burn, vascular disorder, and neurological sequelae in the extremity planned for catheterization. Two groups were formed the IVF group and the control group according to simple randomization. The researchrandomizer.com website was used for randomization. Power analysis (G*Power 3.1.9.2) was used to determine the size of the sample. The α value was 0.05, the power of the study was 80%, and the effect size was between low and -medium (0.40) [12]. According to the power analysis, it was planned to include 100 patients in the IVF group and 100 patients in the control group. A total of 312 patients were evaluated for eligibility, and 112 patients were excluded because they did not meet the inclusion criteria or refused to participate in the study. A total of 200 patients participating in the study were analyzed.

Control Group

Peripheral catheterization was performed using the conventional method in patients in the control group. The following steps were applied according to the conventional method; the patient was informed about the procedure and informed consent was obtained. The fear of pain questionnaire-3 (FPQ-3) [13] and the numeric pain rating scale (NRS) [14] were explained to the patients, and the FOP 3 scale was administered. Antecubital skin antisepsis was provided. A tourniquet was applied 10-15 cm above the area where the procedure will be performed, and an appropriate peripheral venous catheter was placed. NRS was administered the patients after the procedure.

IVF Group

The following steps were performed; before intervention, the patient was informed about the procedure and informed consent was obtained. The use and function of the IVF are explained. The FPQ-3 and the NRS were explained to the patients, and the FOP 3 scale was administered. Then, routine peripheral venous catheter insertion was performed using the AccuVein AV400 IVF. NRS was administered the patients after the procedure. In both groups, PVC was administered by a nurse with 7 years of emergency room experience.

FPQ-3

The FPQ is a 30-item self-report measure of pain-related fear designed to tap fear related to severe pain (e.g. "breaking your leg"), minor pain (e.g. "getting a paper-cut on your finger"), and medical pain (e.g. "receiving an injection in your hip/buttocks"). Items are scored on a 5-point Likert scale ranging from 1 (not at all) to 5 (extreme) [13].

NRS

The NRS is one of the most preferred and easily applied scales in pain assessment. Absence of pain is scored 0 (zero), and extreme pain is scored 10 (ten). In this way, the patient is asked to express the appropriate pain score [15].

Statistical Analysis

Statistical analysis was performed using the SPSS 21 package program. Mean, standard deviation, median, minimum, and maximum values were used for descriptive statistics for continuous variables, and numbers and percentages were used for categorical variables. Compliance with normal distribution was checked using the Kolmogorov-Smirnov test. T-test (Student's t-test) was used in independent groups with normal distribution and Mann-Whitney U test was used in cases not showing normal distribution. Differences in three or more groups were used for ANOVA in the variables that provided the normality assumption and the Kruskal-Wallis test

in the variables that did not provide the normality assumption. Correlation analysis was performed while examining the relationship between continuous variables. Statistically, $p<0.05$ was considered significant.

Results

The flow chart of the study is shown in Figure 1 and the demographic characteristics of the patients participating in the study are given in the table below (Table 1).

Information about the PVC, patients' previous experience about PVC, inserted catheter sizes, discomfort with the idea of PVC, FOP during catheterization, and number of attempts are summarized in Table 2.

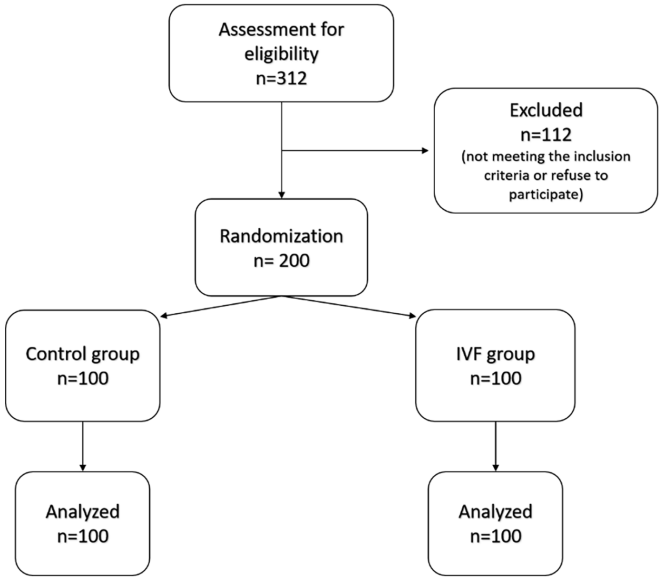

Figure 1. Flowchart of the study, IVF: Infrared vein finder

The total and subgroup FOP 3 scale scores of the patients were calculated. The mean total score of the patients were; 78.8±21.5 8 (minimum: 41.0-maximum: 148.0) in the IVF group and 85.8±22.0 (minimum: 44.0-maximum: 150.0) in the control group ($p=0.025$). The scale subgroup "minor pain" score was compared for all variables. When the groups were compared, this score was found to be different ($p=0.021$) and was higher in the control group. Although the "severe pain" score was lower in the IVF group, it was not statistically different ($p=0.088$) (Table 3).

The mean NRS score of the patients in the IVF group was 2.56±1.25 (minimum: 1.00, maximum: 6.00), and the mean score of the patients in the control group was 2.94±1.58 (minimum: 1.00, maximum: 7.00). Considering the NRS scores of the IVF and control groups, the IVF group score was lower but statistically similar to the control group ($p=0.121$) (Table 4).

The correlation between the patients' FPQ-3 scores and NRS scores were analyzed. There was a moderate positive correlation between the NRS score and the "severe pain" ($r=0.407$, $p<0.001$), "minor pain" ($r=0.534$, $p<0.001$) and "medical pain" scores ($r=0.390$, $p<0.001$) in the intervention group (Table 5).

According to the regression analysis; one-point increase in FPQ-3 total score increased NRS 0.03 points in the IVF group ($R^2=0.282$, $p<0.001$) and 0.05 points in the control group ($R^2=0.464$, $p<0.001$). Considering the subgroups of FPQ-3, it was found that a one-point increase in "severe pain" score

Table 1. Comparison of the descriptive characteristics of intervention and control group patients

		IVF group		Control group		Statistical test	
						χ^2 or t	p
Age		33.3±11.2		32.5±10.2		0.508*	0.612
		n	%	n	%		
Sex	Female	63	63.0	62	62.0	0.021	0.884
	Male	37	37.0	38	38.0		
Marital status	Married	50	50.0	52	52.0	0.080	0.777
	Single	50	50.0	48	48.0		
Comorbidities	Yes	19	19.0	30	30.0	3.271	0.071
	No	81	81.0	70	70.0		
Number of comorbidities	1	16	84.2	25	83.3	0.007	0.935
	>1	3	15.8	5	16.7		
Hospitalization history	Yes	58	58.0	62	62.0	0.333	0.564
	No	42	42.0	38	38.0		

Descriptive statistics are summarized as mean ± standard deviation, and other categorical variables as number (n) and percentage (%).

*T-test was applied, and chi-square (χ^2) test was used for other variables.

IVF: Infrared vein finder

increased NRS by 0.06 points in the IVF group (R^2=0.167, p<0.001) and 0.09 points in the control group (R^2=0.270, p<0.001). One-point increase in "minor pain" score increased NRS 0.09 in IVF group (R^2=0.297, p<0.001) and 0.11 points in control group (R^2=0.309, p<0.001). Also, one-point increase in "medical pain" score increased NRS 0.06 in IVF group (R^2=0.184, p<0.001) and 0.11 points in control group (R^2=0.388, p<0.001) (Table 6).

Discussion

Peripheral venous catheter intervention in the ED causes moderate pain and anxiety. There are several methods such as the use of local anesthetics, ultrasonography, and local ethyl chloride to reduce pain and anxiety and increase the success of the intervention [2,5,8]. Although most of the patients in our study had previous PVC experience, they were still afraid of this procedure. The demographic characteristics of the groups

Table 2. Information about peripheral venous catheterization

Parameters	IVF group		Control group		Statistical test	
	n	%	n	%	χ^2	p
Number of previous PVC experiences						
1	12	12.0	20	20.0	5.052	0.168
2	14	14.0	8	8.0		
3	5	5.0	9	9.0		
≥4	69	69.0	63	63.0		
Catheter size						
22 G-24 G	26	26.0	20	20.0	1.016	0.313
18 G-20 G	74	74.0	80	80.0		
Discomfort with the PVC idea						
Yes	48	48.0	44	44.0	0.322	0.570
No	52	52.0	56	56.0		
Fear of PVC pain						
Yes	59	59.0	52	52.0	0.992	0.319
No	41	41.0	48	48.0		
Number of PVC attempts						
1	92	92.0	97	92.0	2.405	0.121
≥1	8	8.0	3	3.0		

Variables are summarized as numbers (n) and percentages (%). Chi-square (χ^2) test was used for analysis. IVF: Infrared vein finder, G: Gauge, PVC: Peripheral venous catheterization

Table 3. FPQ-3 scores of the IVF and control groups

	IVF group		Control group		Statistical test	
	Mean ± SD	Median (min-max)	Mean ± SD	Median (min-max)	t/U	p
Severe	32.5±8.7	33.0 (14.0-50.0)	34.4±8.8	35.0 (15.0-50.0)	-1.531	0.127*
Minor	21.7±7.7	21.0 (10.0-50.0)	24.3±8.2	23.0 (11.0-50.0)	4055.5	0.021**
Medical	24.7±8.8	23.0 (10.0-48.0)	27.0±9.4	27.5 (11.0-50.0)	4302.0	0.088**
Total	78.8±21.5	75.0 (41.0-148.0)	85.8±22.0	84.5 (44.0-150.0)	-2.261	0.025*

FPQ-3: Fear of pain-3 questionnaire, IVF: Infrared vein finder, SD: Standard deviation, min-max: Minimum-maximum

*T-test, **Mann-Whitney U test

Table 4. Comparison of the NRS scores of the groups

	IVF group	Control group	Statistical test	
	Mean ± SD	Mean ± SD	Mann-Whitney U	p
NRS score	2.6±1.3	2.9±1.6	4380.5	0.121

NRS: Numeric pain rating scale, IVF: Infrared vein finder, SD: Standard deviation

Table 5. Correlation between the NRS and FPQ-3 scores

Group		Severe	Minor	Medical	Total
IVF	r	0.407	0.534	0.390	0.494
(n=100)	p	<0.001	<0.001	<0.001	<0.001
Control	r	0.497	0.518	0.586	0.645
(n=100)	p	<0.001	<0.001	<0.001	<0.001

FPQ: Fear of pain questionnaire, NRS: Numeric pain rating scale, IVF: Infrared vein finder, r: Correlation coefficient

Table 6. Effect of the FPQ-3 scale subgroups on NRS scores

Group	Severe			Minor			Medical		
	a	b	R^2	a	b	R^2	a	b	R^2
IVF	0.626	0.06	0.167	0.628	0.09	0.297	1.050	0.06	0.184
Control	-0.288	0.09	0.270	0.313	0.11	0.309	0.09	0.11	0.388

FPQ: Fear of pain questionnaire, NRS: Numeric pain rating scale, IVF: Infrared vein finder a: Constant term, b: Regression coefficient

were similar in terms of age and gender. In a randomized controlled study conducted by Aulagnier et al. [16] in which the use of IVF devices in the emergency room was investigated, the average age of the participants was higher than that in this study, and the demographic characteristics were similar in the intervention and control groups.

Considering the effect of the IVF on the number of PVC attempts, the number of vascular accesses in the first attempt in the IVF group was 92 (92%); in the control group, the success of the first attempt was 97 (97%), and there was no statistically significant difference between them (p=0.121). In the study conducted by Aulagnier et al. [16], no significant difference was found between the intervention and control groups in terms of the number of interventions. Curtis et al. [17] showed that there was no significant difference in the number of interventions between ultrasonography, IVF, and the standard approach in the pediatric population. In the study of De Graaff et al. [18] with 1,913 pediatric patients, it was found that the IVF device had no effect on the number of interventions and PVC success. On the other hand, Demir and Inal [19] and Inal and Demir [20] have shown that IVF increases the success of PVC intervention in their studies in the 3-18 and 0-3 age groups. As mentioned above, IVF devices appear to be more effective in the pediatric population than in adults.

The total FPQ-3 scores and the minor pain scores were found to be lower in the IVF group. IVF devices are not effective enough to reduce the fear of severe pain but may help reduce the fear in those with a mild FOP. Therefore, although it is seen that IVF results in a decrease in the total pain scores, it is thought that it would not be appropriate to use them to reduce the fear and anxiety of the patients, especially in those who have severe FOP. A moderate positive correlation was found between the FPQ-3 subgroups (minor, severe, medical), total pain scores, and NRS scores. There was no strong correlation between the NRS and FPQ-3 scores.

There was no statistically significant difference between the control and IVF groups' NRS scores. Aulagnier et al. [16] also showed that IVF has no effect on pain. In a study with 450 patients with hemophilia, IVF reduced pain in patients with difficult vascular access but had no effect on pain in patients without difficult vascular access [21]. On the other hand, it has been shown that the use of IVF in the pediatric population reduces pain, especially in patients younger than 3 years of age [20,22,23]. Therefore, IVF devices seem to be more effective in reducing pain in the pediatric population than in adults.

Conclusion

Although the use of IVF for venous catheterization reduces the FOP in adults, it does not reduce the fear of severe pain; it only reduces the fear of minor pain and does not affect the success of the procedure. More studies are needed in adults because most of the studies were conducted in the pediatric population.

Ethics

Ethics Committee Approval: The study was approved by the Local Ethics Committee of University of Health Sciences Türkiye, İstanbul Şişli Hamidiye Etfal Training and Research Hospital (approval number: 2402, date: 14.05.2019).

Informed Consent: Required informed consent was obtained from the study participants.

Authorship Contributions

Surgical and Medical Practices: C.U.A., Y.E.A., Consenp: C.U.A., İ.Ç., Design: C.U.A., İ.Ç., Y.E.A., Data Collection or Processing: C.U.A., İ.Ç., Y.E.A., Analysis or Interpretation: C.U.A., İ.Ç., Y.E.A., Literature Search: C.U.A., İ.Ç., Y.E.A., Writing: C.U.A., İ.Ç., Y.E.A.

Conflict of Interest: No conflicts of interest were declared by the authors.

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ORIGINAL RESEARCH

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Can the Manchester Triage Scale Better Predict Mortality and Outcomes When Combined with Different Frailty Tests in Geriatric Population?

Ozan Can Barlas, Kurtuluş Açıksarı, Görkem Alper Solakoğlu

İstanbul Medeniyet University Faculty of Medicine, Department of Emergency Medicine, İstanbul, Türkiye

Abstract

Objective: In our study, we aimed to determine the effect of identifying patients at high risk of frailty by questioning their frailty status during triage in patients aged 65 years and older on the prediction of outcomes.

Materials and Methods: Patients were classified as frail or non-frail according to their scores on frailty tests. According to the Manchester triage system, T2-T3 patients were classified as high priority and T4-T5 patients as low priority. According to the length of stay in the emergency department, patients were divided into two groups as under and over 4 h. The endpoints of the patients were hospitalization, treatments, and mortality. Patients grouped according to triage priorities and frailty risks with the program of research to integrate services for the maintenance of autonomy (PRISMA-7), identifying the seniors at risk, and FRESH tests were statistically analyzed according to separate outcomes, and the relationship between them was investigated.

Results: The study was conducted with 331 elderly patients aged between 65 and 99 years with a median age of 75 years. The PRISMA-7 test predicts admission, mortality, emergency department length of stay (EDLOS) in low priority patients ($p<0.05$), treatment and mortality are mostly affected by triage scores, but admission and EDLOS can be predicted by frailty tools.

Conclusion: The integration of frailty questioning into triage systems will prevent elderly patients presenting with atypical findings and non-specific complaints from being incorrectly classified as low triage priority.

Keywords: Triage, geriatric medicine, frailty

Introduction

The presence of non-urgent cases, comprising approximately 30% of emergency service admissions, obliges emergency care providers to differentiate between urgent and nonurgent applications, which are complex, costly, and time-consuming [1]. Triage plays an important role in rapidly assessing patients who require further evaluation and treatment. Older patients constitute 12%-24% of emergency service admissions [2]. These patients have more comorbidities than the young; they also have higher rates of hospitalization and mortality [3]. The elderly are inappropriately triaged more commonly, which leads to longer waiting times, delayed access to treatment, and more frequent adverse outcomes [4]. In recent years, the science of emergency medicine has increasingly focused on creating efficient systems to determine the priority and urgency of older patients [5]. Triage systems classify individuals according to the urgency of the care they need and optimize resource use in the emergency room. Five-step triage systems widely used around the world, such as the Manchester triage system (MTS) and the Canadian triage and acuity scale (CTAS), were originally designed to screen heterogeneously dispersed patients as a homogeneous population, regardless of age and gender. However, the validity of triage systems applied to older patients in the emergency

Address for Correspondence: Ozan Can Barlas, İstanbul Medeniyet University Faculty of Medicine, Department of Emergency Medicine, İstanbul, Türkiye
Phone: +90 507 170 40 95 **E-mail:** ozancanbarlas@hotmail.com **ORCID-ID:** orcid.org/0000-0002-7286-3329
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department (ED) has been investigated in only some studies [6-8]. Frailty is a geriatric syndrome characterized by increased susceptibility to adverse events (e.g., injury, hospitalization, and death); its assessment is based on a disability accumulation index or phenotype [9]. A scale integrated with triage systems that enables rapid screening of frailty in the ED could be useful for predicting patient outcomes. This study aimed to evaluate the effect of asking questions about frailty during triage on the prediction of outcomes [mortality, hospitalization in wards and intensive care units (ICUs), and advanced medical intervention] in patients aged 65 or older.

Materials and Methods

This study sought to examine the impact on various outcomes of the frailty status and triage level of patients aged 65 years or older who presented to the ED. The study was conducted in accordance with the principles of Good Clinical Practice and the Declaration of Helsinki and was approved by the İstanbul Medeniyet University, Göztepe Training and Research Hospital Clinical Research Ethics Committee (approval number: 2021/0364, date: 30.06.2021).

Patients and the Setting

Patients aged 65 years or older who presented to the ED of a tertiary hospital between September 1 and October 31, 2021 were included in the study after providing informed consent. Referrals from other healthcare facilities, patients who could not express themselves, and those who required immediate medical treatment were excluded. The patient's demographic information (including age and gender), chronic disease history, and multiple drug use status were recorded at the time of admission. Patients with two or more chronic diseases were considered to have multimorbidities. The frailty tools were assessed with healthcare givers or relatives of the patients where applicable. The program of research to integrate services for the maintenance of autonomy (PRISMA-7), identifying the seniors at risk (ISAR), and FRESH frailty scales were used to assess frailty [10-12].

One month after inclusion in the study, the patients' records were retrospectively reviewed, and the following outcomes were recorded: duration of ED stay, blood transfusion, hemodialysis, angiography, surgical intervention in the ED or ward, discharge, hospitalization in a service or an ICU, and in-hospital mortality. After the triage was completed, frailty tests were administered by resident physicians who were not involved in the study. A one-on-one, question-and-answer method was used. If necessary, the answers were confirmed with the patients' relatives. Because the FRESH and ISAR tests were not validated in Turkish, they were translated into Turkish by two independent translators, and a consensus was reached on the Turkish text. This was then translated back into English by two additional translators to ensure its equivalence with the original version. The Turkish version was found to be adequate and was used in the evaluation. The PRISMA-7 frailty scale has been validated for use in the Turkish language [13].

Frailty Tests

The PRISMA-7 test is a survey consisting of seven questions, with answers of "yes" or "no." The questionnaire assesses factors such as patient age and gender, presence of health problems that restrict activities or require home care, need for support while walking, and need for regular assistance. Each affirmative answer is assigned one point, and a score of three or more points signifies increased frailty [11].

The ISAR test comprises six binary questions. This study examines functional dependency, recent hospitalization, difficulties with memory and vision, and the use of multiple medications. Each affirmative answer is given a score of one point, and a score of two or more points indicates increased frailty. The ISAR tool has been validated in EDs [12].

The FRESH test comprises four binary questions that can be answered either "yes" or "no." The questions evaluate the presence of fatigue after simple physical exertion, recent episodes of weakness, recent falls or fear of falling, and the need for assistance with daily activities. Each affirmative answer is assigned one point, and a score of two or more points indicates increased frailty. The FRESH tool was developed in the ED [10].

Each frailty assessment took approximately 1 minute to complete.

Based on the results of the assessments, the patients were classified into two groups: frail and non-frail. In accordance with the MTS, the participants in the T2-T3 category were deemed to be of high priority, whereas those in the T4-T5 category were considered low priority [14]. The patients were further divided into two groups based on emergency department length of stay (EDLOS), with those who stayed for less than 4 h being placed in one group and those who stayed for more than 4 h being placed in another group. The participants were then grouped according to their hospitalization and discharge status, such as discharge to a service or an ICU. Those who underwent advanced treatment procedures, such as surgical intervention, blood transfusion, hemodialysis, and angiography, were divided into two groups, with one group consisting of those who received such procedures and the other group consisting of those who did not. Finally, the patients were classified as deceased or alive based on their survival status at the end of their hospital stay. Separate analyses were performed on participants grouped according to triage priorities and frailty risks, and the relationship between these factors and outcomes was investigated.

Statistical Analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences software (version 21, IBM Corp., Armonk, NY). Descriptive statistical methods were employed to evaluate the data, including mean, standard deviation, median, frequency, percentage, minimum, and maximum. The triage, frailty, and multimorbidity status of the patients were compared using cross-tables based on the outcomes of service/ICU hospitalization, advanced treatment, EDLOS of 4 h or more, and mortality. Pearson's chi-square test or Fisher's exact test was used to determine the differences between the groups. The ability of the frailty scales to predict ward/ICU admission, advanced treatment, EDLOS of 4 h or more, and mortality was analyzed using receiver operating characteristic (ROC) curve analysis. Sensitivity, specificity, and areas under the curve were calculated based on the threshold values. The results were considered statistically significant if the p-value was less than 0.05.

Results

The study was conducted with 331 older patients whose ages ranged between 65 and 99 years; the median age was 75. Of the 331 participants, 62.2% (n=206) were women. The distribution of patients among the age groups 65-74, 75-84, and 85 years or older were 46.83%, 30.82%, and 22.35%, respectively.

In terms of triage classification, most participants (51.4%) were classified as T3 according to the MTS, with T2, T4, and T5 representing 5.4%, 14.8%, and 28.4% of the patients, respectively. The results of the PRISMA-7 test revealed that 47.7% (n=158) of the participants were frail, whereas 52.6% (n=174) and 57.4% (n=190) were found to be frail according to the ISAR and FRESH tests, respectively.

Of all the patients, 82.8% (n=274) did not undergo any advanced treatments, whereas 7.9% (n=26) underwent surgical intervention. Other advanced treatment procedures performed included blood transfusion (3.6%), hemodialysis (5.1%), and coronary angiography (0.6%). After hospital follow-up, 73.1% (n=242) of the patients were discharged, 7% (n=89) were hospitalized, and 9.4% (n=31) died in hospital.

Chronic diseases were prevalent in 81% (n=269) of the participants, with 53.5% (n=177) having at least two chronic conditions. The most common ones were hypertension (n=217, 65.6%), diabetes mellitus (n=98, 29%), and coronary artery disease (n=79, 23.9%). Other chronic conditions included arrhythmia (n=16, 4.8%), chronic kidney failure (n=31, 9.4%), chronic obstructive pulmonary disease (n=37, 11.2%), cerebrovascular disease (n=24, 7.3%), dementia (n=15, 4.5%), endocrinopathies (n=14, 4.2%), malignancy (n=37, 11%), and cirrhosis (n=1, 0.3%).

Tables 1 and 2 present an evaluation of the MTS and frailty scales in relation to admission and discharge, treatment, and mortality. Furthermore, the results of the ROC analysis of the frailty scales are provided on the basis of the patients' hospitalization/ICU admission, treatment, and mortality status in accordance with the MTS. Table 3 shows the logistic regression analyses between patient characteristics and outcomes.

Discussion

The aim of this study was to examine the impact of determining the frailty status of older patients (aged 65 or above) during the triage process on the early identification of adverse outcomes. This aim was motivated by the recognition that the acutely evolving health issues of older adults are often obscured by atypical symptoms (e.g., altered consciousness and overall debility) and that these patients are more likely to have multiple comorbidities than younger populations, which could result in undertriage [7]. The results indicated a low sensitivity of MTS in this patient population, which led to prolonged waiting times and a higher incidence of adverse outcomes. This highlights the need for a more thorough assessment of older adults during triage to ensure timely and appropriate medical intervention [15]. In a prior investigation of the efficacy of MTS, it was discovered that its sensitivity was inadequate, particularly in the pediatric population. However, recent updates to the scale have alleviated this problem in such a population. Thus, the implementation of similar modifications for the elderly would result in improved outcomes [16]. In 2016, a frailty assessment was integrated into the CTAS following recognition of the scale's tendency toward undertriage in the older population. The frailty status of patients classified as low priority through the triage process was evaluated, and those identified as having a high risk of frailty had their triage priority elevated [17]. In our view, the selection of frailty tools for use in ED triage should prioritize attributes such as efficiency, ease of administration, and avoidance of extensive examinations. This consideration arises from the urgent and time-sensitive nature of the triage process, where swift decisions are crucial and patients must be promptly allocated to appropriate treatment areas. Consequently, the chosen tools should be designed to expedite the triage process without compromising the quality of patient assessment and care. The results of this study were consistent with previous literature that found that patients with higher triage priority had a higher rate of hospitalization, mortality, need for additional therapeutic measures, and extended EDLOS compared with those with lower triage priority [18]. The literature shows that frailty predicts hospitalization, length of hospital stay, functional decline, and adverse outcomes (e.g., mortality) [19].

Table 1. Evaluation of the Manchester triage system and frailty scales based on patients' admission/discharge, treatment, and mortality status

General assessment of the Manchester triage system and frailty scales

		Admission n (%)			Treatment n (%)			Mortality n (%)			EDLOS n (%)		
		Yes	No	p	Yes	No	p	No	Yes	p	<4 h	>4 h	p
MTS	Low	20 (9.1)	199 (90.9)	<0.001	16 (7.3)	203 (92.7)	<0.001	212 (96.8)	7 (3.2)	<0.001	188 (85.8)	31 (14.2)	<0.001
	High	43 (61.6)	69 (38.4)		41 (36.6)	71 (63.4)		87 (77.7)	25 (22.3)		37 (33)	75 (67)	
PRISMA-7	Yes	65 (41.1)	93 (58.9)	<0.001	45 (28.5)	113 (71.5)	<0.001	132 (83.5)	26 (16.5)	<0.001	83 (52.5)	75 (47.5)	<0.001
	No	24 (13.9)	149 (86.1)		12 (6.9)	161 (93.1)		167 (96.5)	6 (3.5)		142 (82.1)	31 (17.9)	
ISAR	Yes	64 (36.8)	110 (63.2)	<0.001	44 (25.3)	130 (74.7)	<0.001	147 (84.5)	27 (15.5)	<0.001	97 (55.7)	77 (44.3)	<0.001
	No	25 (15.9)	132 (84.1)		13 (8.3)	144 (91.7)		152 (96.8)	5 (3.2)		128 (81.5)	29 (18.5)	
FRESH	Yes	66 (34.7)	124 (65.3)	<0.001	46 (24.2)	144 (75.8)	<0.001	163 (85.8)	27 (14.2)	<0.001	111 (58.4)	79 (41.6)	<0.001
	No	23 (16.3)	118 (83.7)		11 (7.8)	130 (92.2)		136 (96.5)	5 (3.5)		114 (80.9)	27 (19.1)	

Low-priority (T4-T5) patients according to the Manchester triage system

		Admission n (%)			Treatment n (%)			Mortality n (%)			EDLOS n (%)		
		Yes	No	p	Yes	No	p	No	Yes	p	<4 h	>4 h	p
PRISMA-7	Yes	14 (16.7)	70 (83.3)	0.002	12 (14.3)	72 (85.7)	0.002	78 (92.9)	6 (7.1)	0.014	64 (76.2)	20 (23.8)	0.001
	No	6 (4.4)	129 (95.6)		4 (3)	131 (97)		134 (99.3)	1 (0.7)		124 (91.9)	11 (8.1)	
ISAR	Yes	14 (13.9)	87 (86.1)	0.025	10 (9.9)	91 (90.1)	0.172	97 (96)	4 (4)	0.706	79 (78.2)	22 (21.8)	0.003
	No	6 (5.1)	112 (94.9)		6 (5.1)	112 (94.9)		115 (97.5)	3 (2.5)		109 (92.4)	9 (7.6)	
FRESH	Yes	14 (12.6)	97 (87.4)	0.07	11 (9.9)	100 (90.1)	0.133	105 (94.6)	6 (5.4)	0.119	91 (82)	20 (18)	0.096
	No	6 (5.6)	102 (94.4)		5 (4.6)	103 (95.4)		107 (99.1)	1 (0.9)		97 (89.8)	11 (10.2)	

High-priority (T2-T3) patients according to the Manchester triage system

		Admission n (%)			Treatment n (%)			Mortality n (%)			EDLOS n (%)		
		Yes	No	p	Yes	No	p	No	Yes	p	<4 h	>4 h	p
PRISMA-7	Yes	51 (68.9)	23 (31.1)	0.026	33 (44.6)	41 (55.4)	0.014	54 (73)	20 (27)	0.095	19 (25.7)	55 (74.3)	0.021
	No	18 (47.4)	20 (52.6)		8 (21.1)	30 (78.9)		33 (86.8)	5 (13.2)		18 (47.4)	20 (52.6)	
ISAR	Yes	50 (68.5)	23 (31.5)	0.04	34 (46.6)	39 (53.4)	0.003	50 (68.5)	23 (31.5)	0.001	18 (24.7)	55 (75.3)	0.01
	No	19 (48.7)	20 (51.3)		7 (17.9)	32 (82.1)		37 (94.9)	2 (5.1)		19 (48.7)	20 (51.3)	
FRESH	Yes	52 (65.8)	27 (34.2)	0.156	35 (44.3)	44 (55.7)	0.009	58 (73.4)	21 (26.6)	0.094	20 (25.3)	59 (74.7)	0.007
	No	17 (51.5)	16 (48.5)		6 (18.2)	27 (81.8)		29 (87.9)	4 (12.1)		17 (51.5)	16 (48.5)	

Manchester triage score low-priority (T4-T5) patients with increased frailty risk and Manchester triage score high-priority (T2-T3) patients with no frailty risk

		Admission n (%)			Treatment n (%)			Mortality n (%)			EDLOS n (%)		
		Yes	No	p	Yes	No	p	No	Yes	p	<4 h	>4 h	p
PRISMA-7	Group 1	14 (16.7)	70 (83.3)	<0.001	12 (14.3)	72 (85.7)	0.35	78 (92.9)	6 (7.1)	0.31	64 (76.2)	20 (23.8)	0.002
	Group 2	18 (47.4)	20 (52.6)		8 (21.1)	30 (78.9)		33 (86.8)	5 (13.2)		18 (47.4)	20 (52.6)	
ISAR	Group 1	14 (13.9)	87 (86.1)	<0.001	10 (9.9)	91 (90.1)	0.247	97 (96)	4 (4)	0.67	79 (78.2)	22 (21.8)	0.001
	Group 2	19 (48.7)	20 (51.3)		7 (17.9)	32 (82.1)		37 (94.9)	2 (5.1)		19 (48.7)	20 (51.3)	
FRESH	Group 1	14 (12.6)	97 (87.4)	<0.001	11 (9.9)	100 (90.1)	0.222	105 (94.6)	6 (5.4)	0.23	91 (82)	20 (18)	<0.001
	Group 2	17 (51.5)	16 (48.5)		6 (18.2)	27 (81.8)		29 (87.9)	4 (12.1)		17 (51.5)	16 (48.5)	

MTS: Manchester triage system, EDLOS: Emergency department length of stay, PRISMA-7: The program of research to integrate services for the maintenance of autonomy, ISAR: Identifying the seniors at risk, FRESH: Short screening instrument for continuum of care for frail elderly people, Group 1: Patients who are frail according to the assessment tool and have low Manchester triage score, Group 2: Patients who have high Manchester triage score and are not frail according to the assessment tool

Table 2. Results of ROC analysis of frailty scales based on patients' hospitalization/intensive care unit admission, advanced treatment, and mortality status according to the Manchester triage scale

Results of the ROC analysis of patients with low priority according to the Manchester triage scale				
Admission	**Area under the curve**	**p**	**Sensitivity (%)**	**Specificity (%)**
PRISMA-7	0.730	0.001	70	64.8
ISAR	0.678	0.009	70	56.3
FRESH	0.678	0.009	70	51.3
Advanced treatment				
PRISMA	0.725	0.061	75	64.5
ISAR	0.646	0.069	62.5	55.2
FRESH	0.646	0.069	68.8	50.7
Mortality				
PRISMA	0.803	0.059	85.7	63.2
ISAR	0.694	0.088	57.1	54.2
FRESH	0.651	0.072	85.7	50.5
Emergency department length of stay				
PRISMA	0.666	0.052	64.5	66
ISAR	0.674	0.046	71	58
FRESH	0.622	0.054	64.5	51.6
Results of the ROC analysis of patients with high priority according to the Manchester triage scale				
Admission	**Area under the curve**	**p**	**Sensitivity (%)**	**Specificity (%)**
PRISMA	0.579	0.056	73.9	46.5
ISAR	0.552	0.058	72.5	46.5
FRESH	0.563	0.057	75.4	37.2
Advanced treatment				
PRISMA	0.603	0.054	80.5	42.3
ISAR	0.618	0.053	82.9	45.1
FRESH	0.632	0.053	85.4	38
Mortality				
PRISMA	0.641	0.059	80	37.9
ISAR	0.693	0.059	92	42.5
FRESH	0.640	0.059	84	33.3
Emergency department length of stay				
PRISMA	0.608	0.059	73.3	48.6
ISAR	0.675	0.056	73.3	51.4
FRESH	0.668	0.058	78.7	45.9

ROC: Receiver operating characteristic, PRISMA-7: The program of research to integrate services for the maintenance of autonomy, ISAR: Identifying the seniors at risk, FRESH: Short screening instrument for continuum of care for frail elderly people

However, the extent of the relationship between frailty and triage priority remains uncertain. Further research is expected to shed light on the significance of frailty evaluation during triage and to assist in the clinical decision-making process. The results of O'Caoimh et al.'s [20] study, which evaluated the effectiveness of the PRISMA-7 and ISAR frailty scales in identifying patients at high and low risk of frailty in Ireland, showed that PRISMA-7 was significantly better at making this distinction than ISAR. According to the study, with PRISMA-7, the best sensitivity and specificity values for distinguishing high-risk patients from low-risk ones were found for the recommended threshold value of three points. With ISAR, sensitivity was high for the recommended threshold value of two points, but specificity was weak. With this scale, the threshold value that provides the optimum sensitivity and specificity values is three [20]. Triage is a system that evaluates patients' medical urgency and guides them to receive prompt and suitable medical care [21]. Proper application of frailty scores and directing patients to specific treatment areas can enhance the efficiency of providing appropriate medical

Table 3. Logistic regression analysis of patient characteristics and outcomes

	Admission to the hospital				Advanced treatment				Mortality				Emergency department length of stay			
	B	S.E.	Odds ratio	p	B	S.E.	Odds ratio	p	B	S.E.	Odds ratio	p	B	S.E.	Odds ratio	p
Patient characteristics																
Sex	-0.216	0.383	0.869	0.573	-0.505	0.406	0.598	0.215	-0.042	0.040	0.950	0.292	-0.395	0.367	0.696	0.282
Diabetes mellitus	0.511	0.454	1.096	0.260	0.744	0.473	1.445	0.115	0.020	0.524	1.254	0.970	0.355	0.428	1.381	0.407
Hypertension	0.660	0.602	1.173	0.273	0.071	0.618	0.566	0.908	-0.150	0.644	1.375	0.816	0.301	0.547	1.701	0.582
Ischemic heart disease	0.459	0.453	1.307	0.312	-0.355	0.456	0.526	0.436	-0.068	0.772	1.560	0.930	-0.011	0.424	1.118	0.980
Arrhythmias	0.897	0.707	2.160	0.205	0.771	0.701	1.694	0.272	0.111	0.597	0.305	0.853	-0.645	0.700	0.579	0.357
Chronic kidney disease	1.501	0.602	4.133	0.013	1.574	0.552	3.612	0.004	-1.742	1.279	2.414	0.173	1.682	0.587	5.557	0.004
Chronic obstructive pulmonary disease	0.628	0.506	1.254	0.215	0.154	0.549	0.907	0.779	0.478	0.612	0.775	0.434	0.313	0.497	1.419	0.528
Cerebrovascular disease	0.034	0.646	0.724	0.958	0.448	0.628	1.158	0.476	-0.101	0.705	0.740	0.886	0.540	0.633	1.854	0.394
Dementia	-1.054	0.892	0.279	0.237	-1.646	1.157	0.158	0.155	-0.988	0.853	0.00	0.247	-0.557	0.768	0.590	0.468
Endocrine diseases	-0.506	0.969	0.396	0.602	0.249	0.979	1.146	0.799	-20.925	9325.993	0.000	0.998	-1.118	0.959	0.291	0.244
Malignancy	0.360	0.666	0.933	0.589	0.440	0.657	0.601	0.503	-18.122	9764.797	1.825	0.999	1.250	0.580	4.412	0.031
Frailty tool																
PRISMA-7	0.182	0.164	0.996	0.267	0.199	0.172	0.896	0.246	-21.076	40192.970	1.309	1.000	-0.167	0.147	0.700	0.257
ISAR	-0.174	0.200	0.766	0.384	-0.141	0.203	0.912	0.485	0.225	0.258	1.417	0.383	0.262	0.194	1.313	0.176
FRESH	0.283	0.203	1.540	0.163	0.384	0.218	1.315	0.079	0.381	0.261	0.741	0.145	0.171	0.186	1.737	0.357

B: Coefficient estimates, S.E.: Standard errors, PRISMA-7: The program of research to integrate services for the maintenance of autonomy, ISAR: Identifying the seniors at risk, FRESH: Short screening instrument for continuum of care for frail elderly people

services tailored to their urgent medical conditions. The outcome of whether a patient is hospitalized in the ICU or a ward can be used as a measure of successful triage. In our study, the PRISMA-7 frailty scale was found to be more successful than the ISAR and FRESH frailty scales in terms of predicting hospitalization, need for further treatment, mortality, and EDLOS.

There are several functional scales that measure frailty, but they are not widely used in clinical practice in the ED [22]. A recent study identified frailty as a strong predictor of severe adverse outcomes within the first 30 days after discharge from the emergency room. However, this study used a 44-item scale, which is not suitable for rapid screening in the ED [23].

Mowbray et al. [17] conducted a study in Canada involving 2,153 patients, which evaluated the association between frailty and triage priority status in terms of adverse outcomes, such as hospitalization, length of hospital stay, and repeat ED visits. In the study, CTAS was used for measuring triage priority, while a software program based on a frailty scale developed by Brousseau et al. [24] was used for frailty. An examination was performed to establish the correlation between frailty and hospitalization, length of stay, and repeated visits to the ED. The results indicated that only hospitalization was predictable through triage status. Moreover, the authors found that patients who were assigned a low triage priority but possessed a high risk of frailty experienced a higher rate of hospitalization and prolonged lengths of stay after discharge [17].

In the Netherlands, Blomaard et al. [25] investigated the relationship between triage urgency, as assessed by MTS, and adverse outcomes in 2,608 patients. In addition to MTS, this study used the acutely presenting older patient (APOP) geriatric rating scale. The results showed that the risk of 30-day mortality increased with higher triage urgency and higher APOP risk. Furthermore, patients with low triage urgency but high APOP risk were found to have a significantly higher mortality rate than those with low APOP risk.

In accordance with the existing literature, our study found that high triage urgency according to the MTS and high risk of frailty according to the PRISMA-7, ISAR, and FRESH frailty scales were independently associated with increased hospitalization, need for advanced treatment, mortality, and EDLOS. The results showed that patients with a high risk of frailty according to PRISMA-7, particularly those classified as low urgency according to the MTS, were more likely to experience the negative outcomes evaluated in the study. However, this association was not significant when using the FRESH frailty scale. These findings suggest that incorporating PRISMA-7 into the triage process and identifying patients at high risk of frailty could lead to more efficient allocation of resources and improved patient outcomes.

Study Limitations

Despite being a pioneering effort, our study presents several limitations concerning integrating frailty assessment into a triage system and achieving universal validity. These limitations include the single-center design of our study, limited sample size, and brief follow-up. These factors may impact the generalizability and sustainability of our findings and call for further research with larger and more diverse patient populations.

Conclusion

Our study highlights the significance of considering frailty in low-priority patients classified under MTS. The inclusion of frailty assessment in the triage process could avoid the misclassification of older patients as low priority. By taking frailty into account, the negative outcomes associated with delays in treatment can be reduced.

Ethics

Ethics Committee Approval: The study was conducted in accordance with the principles of Good Clinical Practice and the Declaration of Helsinki and was approved by the İstanbul Medeniyet University, Göztepe Training and Research Hospital Clinical Research Ethics Committee (approval number: 2021/0364, date: 30.06.2021).

Informed Consent: Required informed consent was provided.

Authorship Contributions

Surgical and Medical Practices: O.C.B., Concept: O.C.B., K.A., G.A.S., Design: O.C.B., K.A., G.A.S., Data Collection or Processing: O.C.B., Analysis or Interpretation: O.C.B., G.A.S., Literature Search: O.C.B., K.A., G.A.S., Writing: K.A., G.A.S.

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ORIGINAL RESEARCH

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Investigation of Radiological Imaging, Treatment and Package Contents of Body Packers Brought to the Emergency Department in Our Region

Orhan Delice[1], Ali Kaan Şanal[2], Enes Yıldırım[1]

[1]Erzurum City Hospital, Clinic of Emergency Medicine, Erzurum, Türkiye
[2]Erzurum City Hospital, Clinic of General Surgery, Erzurum, Türkiye

Abstract

Objective: Illegal transportation of drugs in body cavities has recently become a method used in international drug trafficking. We wanted to study the demographic characteristics and types and quantities of substances carried. In addition, we wanted to present the characteristics of a case of opioid intoxication in our region.

Materials and Methods: Between January 2020 and July 2023, we retrospectively reviewed patients who were brought to a third-level emergency department by law enforcement officers with the suspicion of carrying drugs in their bodies. The characteristics and quantity of the substances they carried were obtained from the department of narcotics.

Results: Twenty-two cases brought to our emergency department were found to have narcotics in their bodies. The cases comprised 22 people, 17 males and 5 females. The mean age was 31.4±8.7 years. The majority (68%) of substances carried were opioids. The packages were surgically removed in the person who developed opioid toxicity, whereas laxatives were used in the others. It was found that the broken package was made by simple bagging without the use of a condom.

Conclusion: In our region, all the people-carrying drugs in their bodies were young. The substance carried was mostly opioids rather than cocaine. All smugglers used wheeled transportation.

Keywords: Opioid intoxication, body packers, drug mules

Introduction

Drug use is increasing all over the world, and this brings related health problems. Thus, the death rate of drug overdose in the United States of America increased 3-fold between 1999 and 2014 [1]. Increasing consumption rates have created an increased need to access these substances. With the development of technology, drugs are detected at border crossings and airports, forcing smugglers to develop many different methods. One of these is the body packing method [2].

Although illegal substances are transported to various parts of the world by land, air, and sea, concealment through the body has become a frequently used method for transporting small amounts of substances. The most commonly used method is oral swallowing [3]. To a lesser extent, vaginal and rectal ingestions have also been reported.

People who carry drugs in their body cavities in this way are called “body packers” or “drug mules”. While body pushers carry illegal substances in their rectum or vagina, body stuffers swallow poorly packaged or unpackaged drugs for fear of being caught [4].

These people used to swallow packages wrapped in materials that had a high risk of tearing; therefore, the risk of toxicity

Address for Correspondence: Orhan Delice, Erzurum City Hospital, Clinic of Emergency Medicine, Erzurum, Türkiye
Phone: +90 530 144 79 25 **E-mail:** orhandelice@gmail.com **ORCID-ID:** orcid.org/0000-0003-1629-4245
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was higher. They now carry large quantities of substances in packages made of strong materials (condoms, latex, etc.). Despite this carriage rate, the complication rate is considered below 5% [5].

When searched in the literature, it is seen that these substances are generally cocaine and heroin [6,7]. In addition to the legal aspect of this situation, these people are also at high risk in terms of health [8]. Therefore, these people may be brought to the emergency department asymptomatically, or they may have complicated clinical presentations that may progress to mechanical intestinal obstruction or toxidrome of the transported substance. Both intestinal obstruction and acute poisoning due to body packing are called "body packers syndrome". Therefore, the management of these patients requires a multidisciplinary approach that requires the consensus of the emergency physician, radiologist, general surgeon, and toxicologist.

In this study, we aimed to present the characteristics of 22 patients who were brought to the emergency department of Erzurum City Hospital with the suspicion of carrying a drug package in their body. One patient had complicated opioid intoxication and the others were asymptomatic.

Materials and Methods

After obtaining the approval of the local ethics committee (Erzurum Faculty of Medicine Scientific Research Ethics Committee, decision number: 45, date: 16.08.2023), cases carrying or suspected of carrying drugs in their bodies brought to the emergency department of Erzurum City Hospital between January 2020 and July 2023 were retrospectively analyzed using the hospital information management system.

We retrospectively reviewed patients who were brought by law enforcement officers to a third-level emergency department between January 2020 and July 2023 with the suspicion of carrying drugs in their bodies.

Electronic medical records, imaging files, clinical, laboratory, and radiological data, consultation notes, and applied treatments of the cases were accessed from the hospital archive. Demographic characteristics (age, gender, nationality) and vital signs of all patients were recorded.

Photographs of Case 1 taken during surgery were obtained from the general surgeon. Radiological images were obtained from the hospital information management system. The number of packages carried by these people, package features, and types and quantities of substances were obtained with permission from the Erzurum Police Department Narcotics Office.

Because the data of 21 patients were obtained from patient files, an informed consent form was not used. Informed consent was obtained from the patient in Case 1.

Statistical Analysis

Statistical analysis was performed using version 21 of SPSS software with a special focus on the description of the patients. Qualitative variables were expressed as percentage (%); in addition, quantitative variables were shown as mean ± standard deviation.

Results

All cases were of Iranian nationality and arrived by land via Iran. The cases comprised 22 people, 17 males and 5 females. A case was a child who reported receiving suspicious packages rectally (body pushers). The oldest age was 56 years, and the youngest age was 17 years. The mean age was 31.4±8.7 years. Demographic data and vital signs of the patients are shown in Table 1.

The opioid group was found in 15 cases (68%), Cannabis in 3 cases (14%), Methamphetamine in 2 cases (9%), Methamphetamine and Cannabis were seen in 1 case, and Methamphetamine and opioid in 1 case. The package characteristics and contents of the cases are shown in Table 2.

Opioid intoxication was thought to occur in just one case because of the acute change in consciousness, shallow breathing, and bilateral miotic pupils. In Figure 1, packages are shown in abdominal computed tomography (CT) axial, coronal, and sagittal sections. The colon material is shown in Figure 2, and the extracted capsules are shown in Figure 3. The drug panel sent in the urine resulted as Codeine: 4194 ng/ml (<1000), Methadone: 4436 ng/mL (<300).

In the other 21 cases, abdominal X-ray imaging revealed packages; therefore, abdominal CT was not requested. As seen in Figure 4, when examined by X-ray, many ellipsoidal materials surrounded by a radiolucent ring were observed.

Patient with toxidrome was the only case in which abdominal CT was requested. The packages are shown in Figure 1 on abdominal CT in axial, sagittal, and coronal sections. Our criteria when discharging the cases were to prove that there were no remaining packs. All patients were discharged after it was proved by imaging methods that there were no remaining packages.

Discussion

Opioid poisoning is increasing worldwide, and related morbidity and mortality rates are increasing [9]. In particular, illegal drug trade is an important reason for this. Body packers present with different clinical presentations. These people usually do not go to the emergency department voluntarily. The police bring the substance carriers they detect to the emergency department for legal procedures and safe removal of the packages. In our cases, the situation was the same;

Table 1. Demographic features and vital signs of the cases

Cases	Age	Sex	Hospital stay (day)	Blood pressure (mm/Hg)	Fever (°C)	Heart rate (bpm)	SPO_2 (%)
1	23	Male	10	113/74	36.4	118	85
2	26	Male	1	118/76	36.8	87	98
3	25	Female	1	123/78	36.7	75	96
4	25	Male	6	133/74	36.9	110	99
5	25	Male	8	126/76	36.5	76	97
6	40	Male	5	137/87	36.7	98	96
7	29	Male	4	112/69	36.6	85	98
8	37	Male	3	126/85	36.4	67	95
9	17	Male	3	112/64	36.6	93	97
10	36	Male	1	118/76	36.8	87	95
11	56	Male	4	137/78	36.9	64	94
12	29	Male	2	116/76	36.8	83	98
13	25	Female	2	125/81	36.6	72	99
14	38	Female	1	134/76	36.7	83	99
15	41	Male	1	115/73	37.1	86	97
16	35	Male	1	123/76	36.9	79	98
17	27	Female	2	126/83	37.2	83	98
18	41	Male	3	135/76	36.6	69	99
19	25	Male	4	122/87	36.5	77	99
20	29	Male	4	131/76	36.5	87	99
21	27	Male	1	107/76	36.7	76	98
22	36	Female	2	127/76	36.9	94	97

SPO_2: Oxygen saturation, bpm: Beats per minute

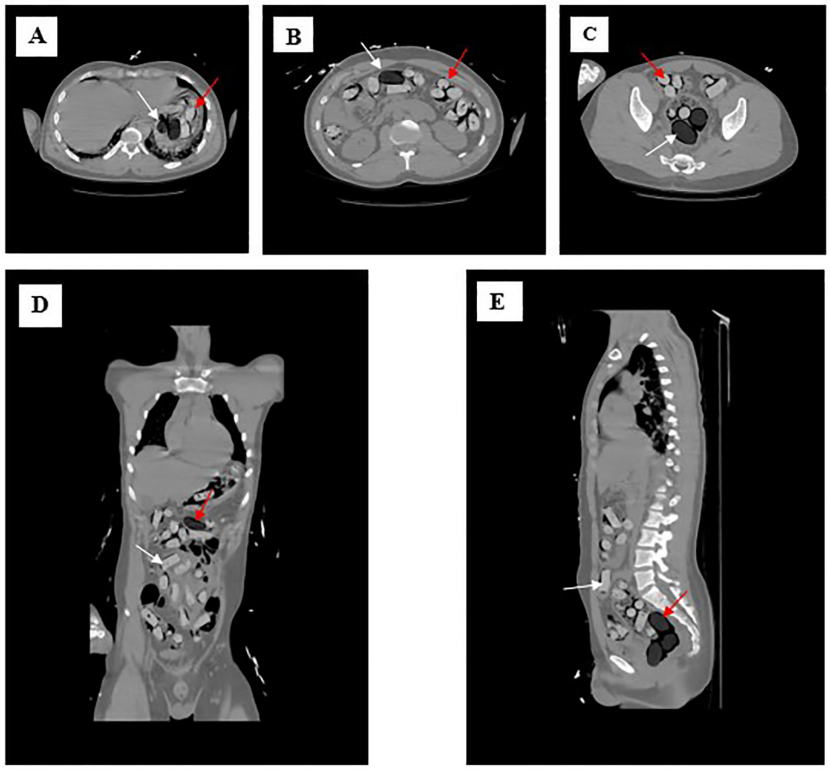

Figure 1. Abdominal computed tomography images of case 1 in axial (A, B and C), coronal (D), and sagittal (E) sections (red arrow: capsules containing heroin, white arrow: capsules containing opium poppy)

all patients, with only one exception, were brought to the emergency department by the police. It was observed that one of our cases was brought to our emergency department by emergency medical services when a change in consciousness was noticed on the bus in which he was riding as a passenger.

In retrospect, the first case of body packing was reported in Canada in 1973, presenting with mechanical bowel obstruction after swallowing a single poppy-filled condom [10]. Since then, a wide variety of transportation methods have emerged, and they are frequently seen at airports and city crossings. All of our cases were detected during road transportation.

People who carry substances in their bodies try to carry products with the highest financial value because the amount they can carry is limited [11]. For this reason, cocaine (70-90%) is most frequently transported, followed by heroin [12]. Other substances are less common because they have a lower commercial value. Contrary to the literature, in the cases coming to our hospital, mostly opioid group was found in capsules instead of cocaine. Package prefer opioids in smuggling cases between Iran and Erzurum.

Previously, drugs wrapped in simple materials such as aluminum foil appeared more radiopaque and easily broken down, resulting in systemic toxicity. Nowadays, we see that the use of latex products, especially condoms, in packaging has become widespread. This is because they are less radiopaque and provide better protection to the illicit substance, thus reducing the risk of toxicity [13]. In our cases, it was observed that the packages of the patients who developed toxicity were made with simple nylon bags. Two packages were deformed. Condoms were used in the packages of other cases. No evidence of toxicity was found in any of the samples. All of our cases in which condoms were used in packaging were visible on abdominal X-ray imaging.

Table 2. Package characteristics and contents of the cases

Cases	Type of packages	Weight of packages (g)
1	7 Heroin 104 Opium poppy	111.7 g Heroin 1061.28 g Opium poppy
2	2 Heroin 1 Opium poppy	8.07 g Opium poppy 39.74 g Heroin
3	32 Opium poppy	295.21 gr Opium poppy
4	161 Opium poppy	1120 g Opium poppy
5	195 Opium poppy	1403 g Opium poppy
6	117 Opium poppy	1908.1 g Opium poppy 209.93 g Heroin
7	46 Opium poppy	560 g Opium poppy
8	30 Opium poppy 41 Heroin	446 g Opium poppy 490 g Heroin
9	63 Opium poppy	673 g Opium poppy
10	31 Marijuana	266 g Marijuana
11	25 Methamphetamine 7 Marijuana	703 g Methamphetamine 237 g Marijuana
12	82 Opium poppy	920 g Opium poppy
13	83 Opium poppy	860 g Opium poppy
14	15 Marijuana	123 g Marijuana
15	6 Heroin 2 Methamphetamine	175 g Heroin 2 g Methamphetamine
16	11 Methamphetamine	325 g Methamphetamine
17	12 Methamphetamine	329 g Methamphetamine
18	19 Heroin	158 g Heroin
19	45 Heroin	400 g Heroin
20	62 Opium poppy 1 Heroin	838 g Opium poppy 1 g Heroin
21	43 Opium poppy	438 g Opium poppy
22	28 Marijuana	210 g Marijuana

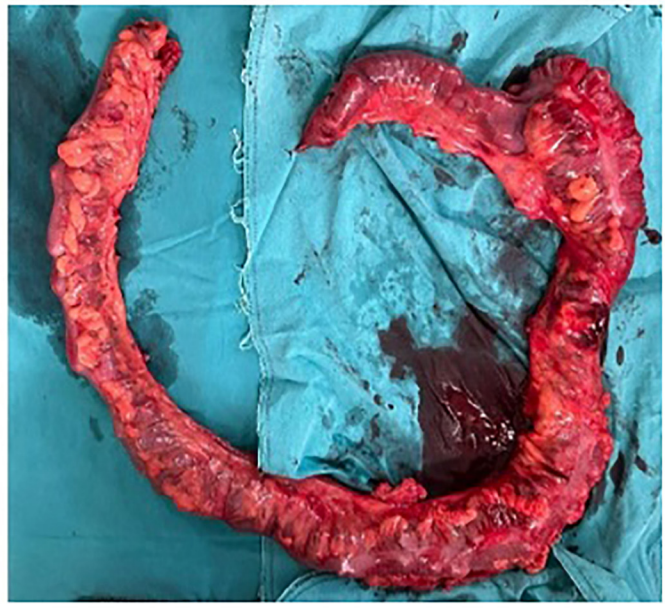

Figure 2. Large intestine tissue of Case 1

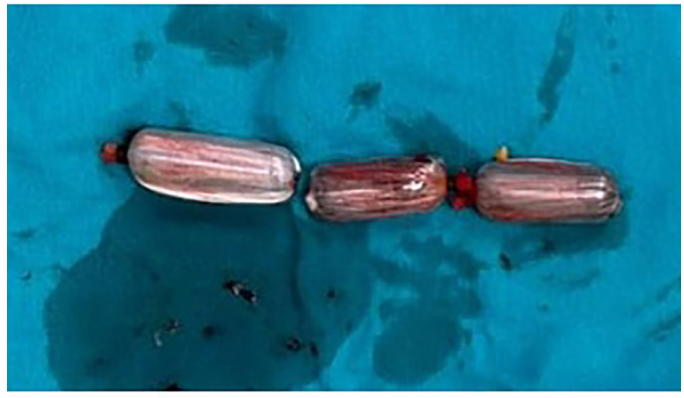

Figure 3. Capsule materials of Case 1

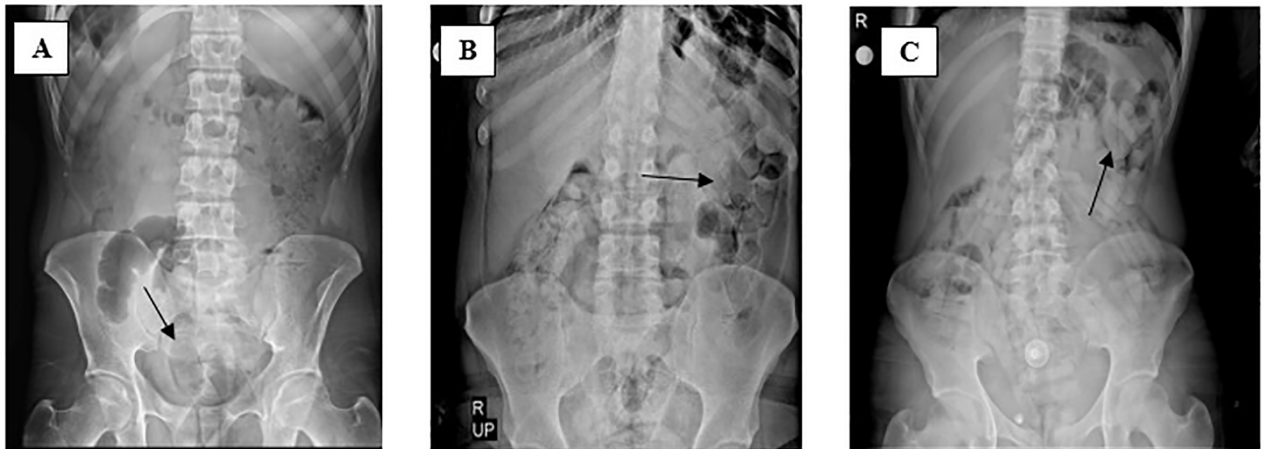

Figure 4. X-ray images of cases carrying drug packages in their bodies: Case 2 (A), Case 7 (B), and Case 9 (C) (black arrow: Shows packages)

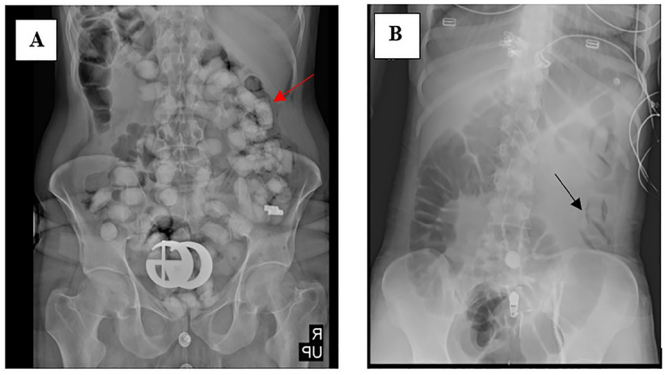

Figure 5. Shows the radiological findings. Case 10 (A) "double condom sign", Case 3 (B) "tic tac" sign

The first option for imaging this patient group in the emergency department is abdominal X-ray [14]. Uniform ellipsoid-rectangular substances are arranged along the intestine, creating the so-called "tictac" sign. Sometimes air gets trapped between the swallowed substance and the capsule, which is called the "double condom sign". The radiological findings are shown in Figure 5. In cases where abdominal X-ray is inadequate or in doubt, non-contrast CT imaging is the gold standard diagnostic method [11]. Abdominal CT and abdominal X-ray images of our cases are shown in Figure 1 and Figure 4.

Surgical treatment is extremely rare in body packer cases. The main indications for emergency surgery are intestinal obstruction and suspected bundle rupture. Packs that have remained inside the body for a long time are also candidates for surgical treatment because they are more likely to cause complications [15,16]. In case 1, two packages were ruptured and opioid intoxication developed, and the packages were surgically removed.

Study Limitations

Photographs of the packages extracted from all cases could not be obtained. Except for a package that could be viewed, the others were wrapped in condoms. In the case where the package was torn apart, it was determined that it was packaged with simple bagging.

Conclusion

People brought to the emergency department with suspected body packaging should first undergo an abdominal X-ray. In cases with suspected body packaging, if X-ray is insufficient, abdominal CT should be performed.

People who carry possible packages on their bodies should be treated early, and precautions should be taken to completely remove them from the body because of the risk of toxicity. Conscious suspects should be questioned about how the packages were made, what they were packaged with, and the contents of the packages.

Again, the physician who encounters such cases in the emergency department should know that these patients should be managed multidisciplinaryly and should not delay consultations of the relevant specialty.

It should be kept in mind that suspicious persons brought to the emergency department by law enforcement officers may be body packers, even if there are no signs of toxicity, and they should be evaluated by abdominal X-ray. In unexplained clinical presentations, as in Case 1, intoxication should also be among the preliminary diagnoses of the emergency physician.

Acknowledgments

We would like to thank Erzurum Provincial Police Department Narcotics Branch Directorate for their contributions.

Ethics

Ethics Committee Approval: The study was initiated after ethical approval was obtained from the Erzurum Faculty of Medicine Scientific Research Ethics Committee (decision number: 45, date: 16.08.2023).

Informed Consent: Because the data of 21 patients were obtained from patient files, an informed consent form was not used. Informed consent was obtained from the patient in Case 1.

Authorship Contributions

Surgical and Medical Practices: O.D., A.K.Ş., E.Y., Concept: O.D., Design: E.Y., Data Collection or Processing: E.Y., Analysis or Interpretation: O.D., Literature Search: O.D., Writing: O.D.

Conflict of Interest: No conflicts of interest were declared by the authors.

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ORIGINAL RESEARCH

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The Causes of Prolonged ED Stays for Female Patients with Acute Abdominal Pain

Emine Ayça Şahin[1], Nuri Havan[2], Cem Ayan[1], Hüseyin Yüzlü[1], Umut Özdamarlar[2], Doğaç Niyazi Özüçelik[3]

[1]*University of Health Sciences Türkiye, İstanbul Bakırköy Dr. Sadi Konuk Training and Research Hospital, Clinic of Emergency Medicine, İstanbul, Türkiye*
[2]*Ataşehir Florance Nightingale Hospital, Clinic of Radiology, İstanbul, Türkiye*
[3]*İstanbul University-Cerrahpaşa, Faculty of Health Sciences, Department of Social Services, İstanbul, Türkiye*

Abstract

Objective: Female emergency department (ED) patients with abdominal pain require consultation and investigation for accurate diagnosis, thus prolonging their stay.

Materials and Methods: This study employed a retrospective design and focused on female patients who sought medical attention at an ED between April and September 2015. The study included patients who were referred to general surgery and/or obstetrics and gynecology clinics for consultation. Other variables included the length of stay (LOS), duration of consultations, recommendations provided in the consultation notes, and laboratory and imaging results.

Results: The data of 1,146 patients were analyzed over a 6-month period. Upon analysis of their hospitalization and discharge status, it was concluded that there was no statistically significant disparity in terms of LOS in the ED (p=0.611). Patients who underwent computed tomography scans, had negative beta human chorionic gonadotropin results, or sought general surgeon consultation had longer stays in the ED.

Conclusion: The sequential administration of examinations and consultations prolonged the ED stays of female abdominal pain patients. Thus, a standardized protocol for female abdominal pain patients is widely believed to be necessary.

Keywords: Emergency department, length of stay, abdominal pain, female patient, consultation, overcrowding

Introduction

Abdominal pain constitutes approximately 5 to 8% of the total number of visits to emergency departments (EDs) [1,2]. It is considered to be among the top three prevailing factors contributing to the prolonged stay in the ED [3]. The primary reasons for individuals seeking medical attention at EDs due to abdominal pain were nonspecific abdominal pain (NSAP), gastrointestinal disorders, acute appendicitis, acute diverticulitis, and bowel obstruction. The prevailing diagnosis among patients experiencing abdominal pain is typically a mild ailment, with only a minority (approximately 20-25%) requiring hospitalization [1]. Diagnosing abdominal pain in female patients presents greater challenges than in male patients, primarily due to the presence of additional pelvic organs [1]. Utilization of history, physical examination, and laboratory testing can contribute to the process of diagnosis [4]. However, it is crucial to employ imaging techniques, such as ultrasonography and computed tomography (CT) scans, to thoroughly investigate abdominal discomfort [5,6]. Conversely, it should be noted that the administration of any diagnostic tests necessitates a certain amount of time, thereby increasing the duration of a patient's stay within the ED. Numerous

Address for Correspondence: Emine Ayça Şahin, University of Health Sciences Türkiye, İstanbul Bakırköy Dr. Sadi Konuk Training and Research Hospital, Clinic of Emergency Medicine, İstanbul, Türkiye
Phone: +90 546 415 66 61 **E-mail:** aycadr916@gmail.com **ORCID-ID:** orcid.org/0000-0001-5071-3496
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studies have demonstrated that the inclusion of laboratory and radiological examinations, along with consultations, is associated with an increase in the length of stay (LOS) in the ED [7].

Between 20% and 40% of patients who seek medical attention in the ED require consultation. Of these consultations, approximately 5% are directed toward the general surgery (GS) clinic [7,8]. As per the established guidelines, consultations within the ED are recommended to have a duration of 30-45 min [8]. Prolonged consultation response times have been found to be associated with an increase in ED LOS and ED overcrowding [8,9]. There is a lack of existing research on obstetric and gynecological consultations, although female patients make up 57% of all visits [4,10]. There is a scarcity of research examining the impact of consultations on the LOS in the ED, specifically among female patients experiencing abdominal pain.

The main objective of this study was to examine the factors that influence the LOS in the ED for female patients seeking medical attention for abdominal pain.

Materials and Methods

The present study was conducted retrospectively at the ED of a tertiary hospital following approval from the University of Health Sciences Türkiye, İstanbul Bakırköy Dr. Sadi Konuk Training and Research Hospital Clinical Research Ethics Committee (approval number: 2016/03/32, date: 11.04.2016). The hospital in question offers medical services to an estimated range of 200,000 to 220,000 emergency visits annually. Data of female patients who sought medical attention at the ED during the period from April 01, 2015 to September 30, 2015, specifically for addressing complaints related to abdominal pain, were collected.

Study Protocol

The inclusion criteria for female patients were as follows: presenting to the ED with complaints of abdominal pain and subsequently being referred to the GS and/or obstetrics and gynecology (OB-GYN) clinics. The criteria for exclusion were established as follows: individuals who were not consulted at either of the two clinics, individuals under the age of 18, individuals with trauma, and individuals exhibiting signs of upper or lower. Informed consent was not obtained from patients due to the retrospective nature of the study.

The occurrence of gastrointestinal bleeding and the act of leaving the hospital without undergoing formal discharge procedures before departure (Figure 1).

The age and abdominal examination data of the participants were analyzed. The results include white blood cell count, alanine aminotransferase (ALT), aspartate aminotransferase (AST) levels, amylase-lipase values, and beta-human chorionic hormone (B-hcg) values.

The findings of abdominal ultrasound (USG), as well as the results obtained from the administration of intravenous (IV) and oral contrast during computed abdominal tomography, along with the outcomes of consultations and the respective response durations, warrant further consideration for reconsultation. Outcomes and response durations, ED LOS, ultimate diagnosis, hospital admission, and discharge status were examined. The duration of patients' stay in the ED was determined by measuring the time interval between their initial entry into the examination room and their subsequent hospitalization or discharge. Consultation times were determined by measuring the duration between the initiation of a consultation request through the hospital automation system and the provision of a formal response. Based on the consultations, the patients were divided into three distinct groups, denoted as group 1. Individuals who were referred to both the GS and OB-GYN clinics for consultation are hereafter referred to as group 2. The participants were divided into three groups: group 1, consisting of individuals referred solely to the OB-GYN clinic; group 2, consisting of individuals referred to both the OB-GYN clinic and another specialty clinic; and group 3, consisting of individuals referred to a different specialty clinic.

A total of 49,933 female patients, accounting for 49% of the total, sought medical attention. A total of 4,176 patients who presented with abdominal pain were included in the study. A total of 2,498 patients were excluded because of certain criteria. The individuals in question were not provided with a referral to either the GS department or the OB-GYN department. Similarly, 532 individuals who were below the age of 18 years, exhibited a prior record of trauma, presented gastrointestinal bleeding indications, and/or were not formally

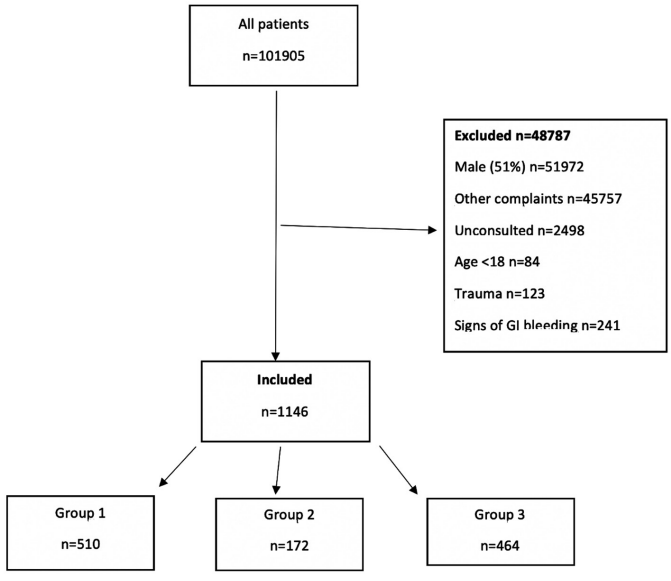

Figure 1. Flow diagram of the study

GI: Gastrointestinal

discharged from the hospital were excluded. The dataset of 1,146 individuals was stored in a database file created using Microsoft® Excel 2007. Figure 1 illustrates the flow.

Statistical Analysis

In statistical analysis, numerical variables are commonly represented by various descriptive measures, including the mean, standard deviation, median, minimum, and maximum. Quantitative variables are represented in the form of numerical values and proportions. The distributions of the data were determined using the Shapiro-Wilks test and the Kolmogorov-Smirnov test. The Mann-Whitney U or Kruskal-Wallis tests were employed to analyze the disparity between the variables. This study examines the use of independent groups in analyzing numerical variables. Similarly, the chi-square test was used to assess the disparity among the groups in nominal variables. The Spearman and Pearson correlation coefficients are both widely used statistical measures for assessing the strength and direction of the relationship between two variables. Correlation analysis was employed to examine the relationship between the variables. Statistical analysis was conducted using SPSS® for Windows (version 22.0). The level of significance was rejected at a significance level of $p<0.05$.

Results

The study comprised a cohort of 1,146 female patients. The median age of the population was 40. Table 1 presents the distribution of the groups with respect to age, laboratory results, and imaging findings. The study results and the LOS in the ED were examined. A notable disparity was observed among the three groups concerning the LOS in the ED. In our research, the statistical analysis yielded a p value of less than 0.001. Group 1, indicating a notable difference in the duration of their stay. Statistical analysis revealed significant differences among the various groups ($p<0.001$). According to the findings of the current study, 459 of 974 patients in groups 1 and 3 underwent CT scans. An assessment of the decisions made regarding CT scan requests indicated that 299 patients (65.1%) were recommended to undergo IV and oral contrast CT scans after their initial GS consultation, whereas 34 patients (7.4%) were not. After their second gastrointestinal surgery consultation, 6 patients (1.3%) experienced complications. Similarly, 6 patients (1.3%) experienced complications after their third gastrointestinal surgery consultation. A total of 339 patients, accounting for 34.8% of the sample, were referred for abdominal CT scan on the basis of their medical condition. Regarding the consultation results on GS. Out of the total sample size of 172 patients in group 2, only 8 individuals (4.6%) underwent CT scans. It is important to note that the subject matter at hand holds significant importance and warrants careful consideration. The scanning procedure required an average time of 2-3 hours for completion after its request in our ED.

In group 1, 422 patients, accounting for 82.7% of the sample, were referred for multiple consultations with a general surgeon. In addition, 110 patients, representing 21.5% of the sample,

Table 1. Distribution of the groups according to age, laboratory, imaging and length of stay

	Group 1 Median (min-max)	Group 2 Median (min-max)	Group 3 Median (min-max)	Total Median (min-max)	p
Age	33 (18-85)	30 (18-55)	57 (18-115)	40 (18-115)	p<0.001
WBC	11.95 (2-39)	9.6 (4-21)	10.8 (2-70)	11 (2-70)	p<0.001
LOS in the ED (min)	634 (117-2220)	252.2 (64-1640)	510 (41-2460)	540 (41-2460)	p<0.001
	n (%)	n (%)	n (%)	n (%)	
B-hcg positive	31 (6.1)	32 (18.6)	8 (1.7)	71 (6.2)	
Standard abdominal X-ray	52 (10.1)	29 (16.8)	95 (20.4)	166 (14.4)	
Pathological findings in standard abdominal X-ray	7 (13.4)	0	51 (53.6)	61 (36.7)	
Abdominal USG	465 (91.1)	58 (33.7)	357 (76.9)	880 (76.7)	
Pathological findings in abdominal USG	276 (59.3)	27 (46.5)	285 (79.8)	588 (66.8)	
Gynecological USG	497 (97.4)	167 (97.1)	0	664 (57.9)	
Pathological findings in gynecological USG	246 (49.4)	100 (59.8)	0	346 (52.1)	
IV/oral contrast CT	303 (59.4)	8 (4.6)	148 (31.8)	459 (40.0)	
Pathological findings in IV/oral contrast CT	176 (58.8)	6 (75)	111 (75)	293 (63.8)	

B-hcg: Beta human chorionic gonadotropin, CT: Computed abdominal tomography, IV: Intravenous, min: Minute, USG: Ultrasonography, WBC: White blood cell, LOS: Length of stay, ED: Emergency department, min-max: Minimum-maximum

were referred for multiple consultations with an obstetrician-gynecologist. In addition, 11 patients (6.4%) from group 2 sought multiple consultations with obstetrician-gynecologists, whereas 272 patients (58.6%) from group 3 sought multiple consultations with general surgeons. The study showed that patients who had multiple consultation requests had a significantly longer LOS in the ED than those who were referred for only one consultation ($p<0.05$).

The value is less than 0.001. According to the consultation notes from GS, 150 patients, accounting for 29.4% of the total, were referred for an OB-GYN consultation by the same clinic. Similarly, the consultation notes from the OB-GYN appointments. A total of 85 individuals, accounting for 16.6% of the sample, were referred for consultation with a general surgeon.

Considering the relationship between the quantity of consultations and the LOS in the ED, it is important to examine the number of initial, subsequent, and tertiary consultations with GS as well as the frequency of initial consultations.

A notable correlation was observed between consultations with obstetrician-gynecologists and the LOS in the ED.

The correlation coefficient between consultation and LOS in the ED was found to be $r=0.374$, indicating a significant positive relationship ($p<0.001$). Table 2 presents its distribution.

This study examines the relationship between consultation times by different groups and their correlation with the LOS in the ED.

Upon examination of the final diagnoses of the patients, 214 (18.7%) were diagnosed with NSAP and 158 (13.8%) with acute appendicitis.

Out of the total cases of acute abdomen, 5 individuals (0.4%) presented with peptic ulcer perforation, 23 individuals (2%) had incarcerated hernia, 52 individuals (4.5%) experienced ileus, and 258 individuals (22.5%) were diagnosed with liver-biliary and pancreatic disorders.

Of the total sample size, 54 individuals (4.7%) experienced gastrointestinal disorders such as gastritis, inflammatory bowel diseases, and colitis. Additionally, 25 individuals (2.2%) were affected by gallstones, acute cholecystitis, cholangitis, hydropic sac, or pancreatitis.

Among the total number of tumors observed, 170 cases (14.8%) were identified as having gynecological pathologies. These pathologies included ovarian cysts, mittelschmerz, dysmenorrhea, myoma, polycystic ovarian syndrome, endometrioma, and pelvic conditions.

Of the total sample size, 37 cases (3.2%) were classified as gynecological emergencies, specifically involving ovarian cyst rupture, which can lead to inflammatory disease. Of the total cases examined, 78 instances (6.8%) were identified as having urinary conditions, such as ovarian torsion, tubo-ovarian abscess, and ruptured ectopic pregnancy.

Among the observed pathologies, the majority consisted of systemic pathologies such as cystitis and renal colic, accounting for 89% of the cases. The remaining 11 cases (1%) were classified as other pathologies. A retrospective analysis was conducted on the medical records of patients who were admitted and subsequently monitored for acute abdomen. Among the cohort, 31 patients underwent diagnostic procedures. During the laparoscopy procedure conducted by GS, 20 patients were diagnosed with acute appendicitis, 2 patients were diagnosed with pelvic inflammatory disease, and 4 patients were diagnosed with ovarian cyst rupture. A total of five patients did not.

The remaining 30 patients were promptly discharged following medical follow-up. The relationship between the LOS in the ED and the final diagnosis is depicted in Table 3.

Table 2. Distribution of consultation times by groups and correlation with the duration of LOS in the ED

	Group 1			Group 2			Group 3		
	Consultation time	LOS in the ED		Consultation time	LOS in the ED		Consultation time	LOS in the ED	
	Median (min-max)	r*	p	Median (min-max)	r*	p	Median (min-max)	r*	p
First general surgery consultation response time (min)	100 (20-746) (n=510)	0.156	0.000				104 (20-664) (n=464)	0.213	0.000
2nd general surgery consultation response time (min)	101 (10-728) (n=332)	0.374	0.000				110 (10-720) (n=239)	0.210	0.001
3rd general surgery consultation response time (min)	116 (10-450) (n=90)	0.295	0.006				96.5 (15-390) (n=33)	0.287	0.081
First obstetrics and gynecology consultation response time (min)	32 (20-450) (n=510)	0.129	0.003	30 (20-300) (n=172)	0.257	0.001			
2nd obstetrics and gynecology consultation response time (min)	30.5 (20-360) (n=110)	0.106	0.272	45 (20-450) (n=11)	0.891	0.000			

*Spearman correlation coefficient, min: Minute, ED: Emergency department, LOS: Length of stay, min-max: Minimum-maximum

Table 3. Relationship between the last diagnosis among the groups and LOS in the ED

Last diagnosis	LOS in the ED (min)			
	Group 1	Group 2	Group 3	p
NSAP (mean ± SD)	714.8±329.1	267.08±132.29	575.3±308.01	p<0.001
Acute appendicitis (mean ± SD)	596.1±280		501.2±321.8	p=0.189
Acute abdomen (mean ± SD)	755.04±378.8		641.6±342.5	p=0.317
Perforated ulcer	720		369.5±213.8	p=0.157
Incarcerated hernia	185		393±336.6	p=0.291
Ileus (mean ± SD)	732±378.1		592.7±390	p=0.313
Hepatobiliary pathologies (mean ± SD)	380±226.2		586.5±348.8	p=0.366
Diseases of the GIT (mean ± SD)	760±277.5	895±1053	626.5±391	p=0.86
Mass/malignancy (mean ± SD)	917.8±518.4	395.6±318	728.6±357	p=0.162
Gynecological pathologies (mean ± SD)	798.7±362.6	315±193.2		p<0.001
Gynecological emergencies (mean ± SD)	734.2±274.8	433.2±268.3		p=0.03
Urinary system pathologies (mean ± SD)	673.3±313.1	296.4±139.6	781.4±418.8	p<0.001

ED: Emergency department, GIT: Gastrointestinal tract, LOS: Length of stay, min: Minute, NSAP: Non-specific abdominal pain, SD: Standard deviation

Upon analysis of the hospitalization and discharge data, it was determined that out of the total 1,146 patients, 632 individuals (55.1%) were discharged, 47 patients (4.1%) were admitted to the OB-GYN clinic, and 38 patients (3.3%) underwent surgical procedures at the same clinic. Similarly, 449 patients, accounting for 39.2% of the patient population, were admitted to the GS clinic. Among these individuals, 360 patients, constituting 31.4% of the total, underwent surgical procedures performed at the GS clinic. Thirteen patients, accounting for 1.1% of the total, were admitted to alternative healthcare facilities.

The study found that 48.3% of patients (n=217) were admitted to the hospital during their initial consultation at the GS clinic, whereas 41.4% of patients (n=186) were admitted during their subsequent consultation. A total of 15 hospitalizations, accounting for 31.9% of cases, were determined by the OB-GYN clinic.

Of the total sample size, 47 individuals (42.6%) reached a decision regarding their first OB-GYN consultation, whereas the remaining 27 individuals (57.4%) arrived at a decision following their second consultation.

Upon analyzing the hospitalization and discharge status of patients during their follow-up, it was observed that there was no statistically significant distinction between inpatients and discharged patients in relation to the LOS in the ED (p=0.611). Nevertheless, the LOS in the ED for patients.

The incidence of patients who underwent a CT scan was significantly higher than that of the remaining patient population (p<0.001). The B-hcg values of the patients indicated that pregnant individuals had a considerably shorter LOS in the ED than those who were not pregnant (p<0.001). There was no statistically significant evidence. There was no statistically significant relationship between the elevation of AST, ALT, amylase, and lipase levels and the LOS in the ED (p>0.05).

Table 4. Analysis of LOS in the ED according to hospitalization status, pregnancy status, and radiological images

n	LOS in the ED min (mean ± SD)	p
Not hospitalized (632)	608.9±367.7	p=0.611
Hospitalized (514)	586.2±329.9	
B-hcg positive (72)	474.5±338.1	p<0.001
B-hcg negative (666)	609.3±348.9	
Pathological findings in USG (588)	625.4±361.4	p=0.075
No pathological findings in USG (292)	649.1±332.9	
No pathological finding in abdominal CT (166)	748.07±333.9	p=0.173
Pathological findings in abdominal CT (293)	793.1±356.3	
Had no abdominal CT (687)	479.7±298.9	p<0.001
Had abdominal CT (459)	776.8±348.7	

B-hcg: Beta human chorionic gonadotropin, CT: Computed tomography, ED: Emergency department, LOS: Length of stay, min: Minute, USG: Ultrasonography, SD: Standard deviation

Table 4 presents a comprehensive examination of ED LOS in relation to hospitalization status, pregnancy status, and radiological imaging outcomes of patients.

The LOS of patients in the ED was categorized into two distinct groups: (1) those with an LOS of less than 4 h and (2) those with an LOS exceeding 4 h. A total of 143 patients, constituting 12.5% of the sample, received follow-up care in the ED.

Among the sample of 1003 patients, constituting 87.5% of the total, the duration of follow-up exceeded 4 h within a time

frame of less than 4 h (Table 5). Furthermore, there was no statistically significant disparity observed in the patients' condition regarding their eligibility for surgery and discharge by the general surgeon, as well as their LOS in the ED for a duration shorter or longer than 4 h (p=0.813). In a similar vein, there was no statistically significant disparity observed between the patients' condition in terms of being operated on and discharged by OB-GYN and their LOS in the ED for durations shorter or longer than 4 h (p=0.654).

Discussion

Our research revealed that the consultation process and the clinics that were consulted had a significant impact. The condition had an impact on the LOS in the ED. Furthermore, the implementation of diagnostic interventions resulted in an extended LOS in the ED.

In the study group, the execution of all consultation procedures was facilitated through the utilization of notification emails generated by the information system implemented by our hospital. Patients who are referred to the GS clinic for consultation must wait in the ED until a consulting physician arrives to assess their condition. Nevertheless, this principle does not hold true in the context of OB-GYN consultations. Utilization of the hospital information system remains consistent. However, consultations with obstetrician-gynecologists require patients to physically visit the doctor's office for appointments.

The purpose of seeking a gynecological consultation is to undergo a transvaginal examination and transvaginal USG. Hence, the duration of the consultation is comparatively shorter than that of GS consultations. In addition, most OB-GYN consultations are typically concluded during the initial appointment. Because of these aforementioned factors, the LOS in the ED for patients who received consultations exclusively for OB-GYN purposes exhibited a statistically significant reduction.

Table 5. Relationship between the last diagnosis and LOS in the ED

	<4 hours n (%)	>4 hours n (%)
NSAP	29 (13.6)	185 (86.4)
Acute appendicitis	13 (8.2)	145 (91.8)
Acute abdomen	5 (8.2)	56 (91.8)
Perforated ulcer	2 (40)	3 (60)
Incarcerated hernia	10 (43.5)	13 (56.5)
Ileus	7 (13.5)	45 (86.5)
Hepatobiliary pathologies	24 (9.3)	234 (90.7)
Diseases of the GIT	2 (3.7)	52 (96.3)
Mass/malignancy	1 (4)	24 (96)
Gynecological pathologies	32 (18.8)	138 (81.2)
Gynecological emergencies	4 (10.8)	33 (89.2)
Urinary system pathologies	13 (9.1)	65 (83.3)
Total	143 (12.5)	1003 (87.5)

ED: Emergency department, GIT: Gastrointestinal tract, LOS: Length of stay, NSAP: Nonspecific abdominal pain

In their study, Dadeh and Phunyanantakorn [11] investigated the LOS of patients who sought medical attention at the ED. Because of reported instances of chest and abdominal discomfort, it was observed that out of the 304 patients experiencing abdominal pain, 28 individuals (9.2%) were directed to seek consultation at the GS clinic. These patients were subsequently allocated a certain amount of time for their consultation.

A mean duration of 352.3 minutes was observed in the ED, as reported previously [11]. In addition, it was observed that the consultation resulted in a 50% increase in the patients' LOS. Furthermore, requests for USG and CT scans resulted in an extended stay in the ED.

This study demonstrates that the GS clinic decided to administer IV and oral contrast abdominal CT scans to 449 patients. This process necessitated further consultation and analysis of the imaging findings.

Consequently, this leads to the patient requiring multiple consultations. In the current investigation, a statistically significant disparity was observed among individuals who underwent abdominal surgery. In their review study, Gans et al. [4] suggested that it is advisable to conduct OB-GYN consultations for female patients experiencing acute abdominal pain when the etiology of the pain is uncertain.

This phenomenon cannot be explained by alternative explanations. Considering these circumstances, it is imperative to promptly seek an obstetrician-gynecologist consultation in the event of an urgent gynecological pathology.

Nevertheless, in the absence of emergency gynecological pathology, it is advisable to assess the patient in the outpatient clinic [4]. In this study, upon evaluating the initial group, it was observed.

Consultation with an obstetrician-gynecologist was requested for 270 patients, which accounted for 53% of the total.

The etiology of abdominal pain was elucidated in contexts distinct from the study conducted by Gans et al. [4]. Additionally, 31 cases (6%) were attributed to alternative causes.

The existence of pathological conditions necessitated the use of both clinics. In contrast, the final diagnosis of 682 patients who sought consultation with an obstetrician-gynecologist revealed that 77 individuals (11.3%) had a specific condition.

Of the total number of patients, a portion were diagnosed with a gynecological emergency, whereas a smaller percentage required outpatient follow-up for gynecological pathology. The remaining patients did not exhibit any gynecological symptoms or conditions.

The field of study focuses on the nature, causes, and effects of diseases. It can be argued that the decisions made during consultations can impact the number of consultations conducted. Furthermore, the GS and OB-GYN clinics have expressed the need for additional consultations between them. The inclusion of these additional consultation requests can augment the LOS in the ED.

In line with our investigation, a previous study concluded that the involvement of multiple specialists and the use of CT scans were associated with a prolonged LOS in the ED. Consequently, it is imperative for all medical practitioners, including emergency physicians, to exercise caution when making requests for emergency consultations. However, within the context of the given situation, it can be observed that based on the current study, it is inconclusive whether patients who were not experiencing a gynecological emergency derived any benefits from seeking consultation. Nevertheless, this particular circumstance resulted in an extended LOS in the ED. In their research, van der Veen et al. [7] discovered an extended LOS in the ED lasting four hours or more. Consistent with our research, their study revealed that 48% of the individuals seeking medical attention in the ED were female. A total of 5% of individuals were directed to the GS clinic for consultation. Furthermore, it was discovered that 80% of the aforementioned patients had an ED stay of less than 4 h, while 19% of them were directed for consultation. According to a study, 53% of the patients who experienced a LOS exceeding 4 h were consulted [7]. In the conducted study, it was observed that 87.5% of the patients had a duration of stay exceeding 4 h. In addition, all patients included in the study sought consultation from either one or both of the clinics. The duration of our consultation process exceeds that of van der Veen et al.'s [7] Furthermore, our ED caters to a significantly larger number of patients, approximately ten times more, than the clinic studied by van der Veen et al. [7]. This scenario can induce an extended LOS in the ED.

Moreover, the findings of this study indicated that there was no statistically significant disparity in the LOS between patients who were clinically hospitalized and those who were not, as well as between individuals with or without pathological findings on abdominal CT and USG. In their study, Hwabejire et al. [12] found no significant correlation between hospital LOS and other factors. The severity of the disease, as observed in our study, is comparable.

Study Limitations

This study is subject to certain limitations. The waiting time in the ED waiting room could not be obtained. The study did not include patients with pathologies relevant to both clinical settings and those who required intraoperative consultations. This study did not investigate the LOS in the ED for female patients who were not consulted and presented with abdominal pain complaints. While our study did not specifically examine the hourly analysis of consultation requests, it can serve as a research for future research exploring the potential impact of the number of consultations made at various times of the day and days of the week on ED LOS (ED LOS).

Conclusion

The LOS in the ED for female patients with abdominal pain was extended because of the number of consultation counts and imaging studies. Emergency physicians should try to increase accuracy in their practice. Hence, the establishment of a standardized protocol is necessary for consultations with female patients experiencing abdominal pain and in need of medical consultations.

Ethics

Ethics Committee Approval: The present study was conducted retrospectively at the ED of a tertiary hospital following approval from the University of Health Sciences Türkiye, İstanbul Bakırköy Dr. Sadi Konuk Training and Research Hospital Clinical Research Ethics Committee (approval number: 2016/03/32, date: 11.04.2016).

Informed Consent: Informed consent was not obtained from patients due to the retrospective nature of the study.

Authorship Contributions

Concept: E.A.Ş., C.A., H.Y., D.N.Ö., Design: E.A.Ş., N.H., D.N.Ö., Data Collection or Processing: C.A., H.Y., U.Ö., Analysis or Interpretation: E.A.Ş., N.H., U.Ö., Literature Search: N.H., H.Y., U.Ö., D.N.Ö., Writing: E.A.Ş., C.A., D.N.Ö.

Conflict of Interest: No conflicts of interest were declared by the authors.

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ORIGINAL RESEARCH

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Examination of Anxiety Levels Among First-line Healthcare Professionals in the February 2023 Türkiye Kahramanmaraş Earthquake

Kaan Yusufoğlu[1], İlker Akbaş[2], Sinem Doğruyol[1], İbrahim Altundağ[3], Metin Öner[4], Burcu Genç Yavuz[1]

[1]University of Health Sciences Türkiye, Haydarpaşa Numune Training and Research Hospital, Clinic of Emergency Medicine, İstanbul, Türkiye
[2]Kahramanmaraş Sütçü İmam University Faculty of Medicine, Department of Emergency Medicine, Kahramanmaraş, Türkiye
[3]University of Health Sciences Türkiye, Başakşehir Çam and Sakura City Hospital, Clinic of Emergency Medicine, İstanbul, Türkiye
[4]Dörtyol State Hospital, Clinic of Emergency Medicine, Hatay, Türkiye

Abstract

Objective: Two earthquakes of 7.7 and 7.6 magnitudes on the Richter scale occurred in Kahramanmaraş on February 6, 2023, resulting in 50,000 deaths and significant devastation. Our aim was to assess the anxiety levels of emergency healthcare professionals (HPs) providing medical services in earthquake-stricken areas following the Kahramanmaraş earthquake.

Materials and Methods: This study included survivor and volunteer HPs. Only 89 of 159 HPs completed the questionnaire, resulting in a response rate of 57.1%.

Results: The mean Beck anxiety inventory (BAI) score for survivor HPs was 29.53±13.25, and for volunteer HPs was 7.62±11.12. The average BAI score for all HPs working in the earthquake zone was 19. The difference between these scores was statistically significant (95% confidence interval: 16.77-27.05, p=0.000).

Conclusion: Our study indicates that HPs providing first-line health services in earthquake-stricken areas exhibit high anxiety scores. The BAI scores of survivor HPs were higher than those of volunteer HPs. As the duration of work in earthquake-stricken areas increased, anxiety levels increased accordingly.

Keywords: Anxiety, Beck anxiety inventory, earthquake, score

Introduction

Earthquakes are sudden-onset disasters that occur rapidly and unpredictably, leading to human, material, economic, and environmental losses. Two earthquakes of 7.7 and 7.6 magnitudes on the Richter scale that occurred in Kahramanmaraş on February 6, 2023, have resulted in significant devastation in our country. According to data from the World Health Organization, approximately 20 million people have been affected by the earthquake in both Türkiye and Syria. The same report indicates that the death toll in Türkiye is estimated to be around 50,000 [1].

Earthquakes and other natural disasters impact individuals not only physically but also intensely on a psychological level. Anxiety, fear, anger, and depression are the fundamental psychological pathologies caused by earthquakes. During the post-earthquake period, symptoms of post-traumatic stress disorder and anxiety increase and do not alleviate for an extended period [2]. In the immediate aftermath of the earthquake, there is a significant demand for numerous healthcare professionals (HPs) who will be involved in both rescuing the injured and participating in subsequent intervention and patient care processes within the disaster-stricken area. In the Kahramanmaraş earthquake, both earthquake survivors and HPs quickly responded to duty from the moment of the earthquake's onset. Additionally, volunteer HPs from across the country were mobilized and transferred to the earthquake-affected areas. HPs work in disaster-stricken

Address for Correspondence: Kaan Yusufoğlu, University of Health Sciences Türkiye, Haydarpaşa Numune Training and Research Hospital, Clinic of Emergency Medicine, İstanbul, Türkiye
Phone: +90 532 492 32 49 **E-mail:** dr.kaanyusufoglu@gmail.com **ORCID-ID:** orcid.org/0000-0002-9248-7527
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areas under life-threatening conditions and endure long and strenuous hours of duty. In addition, losing their own relatives or the disaster victims they are serving is one of the primary psychological challenges faced by HPs working in earthquake-affected areas [3]. These factors increase HP susceptibility to post-earthquake psychological pathologies.

This study aimed to assess the anxiety levels of emergency HPs providing medical services in the earthquake-stricken area following the Kahramanmaraş earthquake. The Beck anxiety inventory (BAI) has been used to assess anxiety levels. In our study, we also aimed to examine characteristics specific to HPs that could influence anxiety levels.

Materials and Methods

Procedure and Sample

This study is designed as a cross-sectional study and includes emergency HPs who have been actively serving in the earthquake-stricken area since February 6, 2023, as well as those who have been dispatched to the region from other cities. The target population was reached through official online communication groups involving HPs, and an electronic questionnaire was administered to them. The duration of the study was set at 4 months and concluded upon the completion of the government's deployment of healthcare personnel to the earthquake-stricken area. Questionnaires were distributed to 156 HPs, but only 89 completed the survey, resulting in a response rate of 57.1%. Online consent was obtained from HPs who agreed to participate in this study. The BAI was used to measure the anxiety levels of healthcare workers who were asked whether they agreed to participate in this scale. Informed voluntary consent forms were obtained from healthcare workers who agreed to participate in the study. Participation in the study was facilitated through the online email communication groups of hospitals.

Research Ethics

Our study was initiated with the ethical committee approval of University of Health Sciences Türkiye, Haydarpaşa Numune Training and Research Hospital under Ethical Committee (decision number: HNEAH-KAEK 2023/63, date 03.04.2023).

Questionnaire

Demograhpic Information

The initial section of the questionnaire included questions related to HPs demographic data, such as age, gender, marital status, work experience, and duration of front-line work in the earthquake zone. Participants were evaluated in two groups: survivor HPs residing in the earthquake zone and volunteer HPs who went to the region to provide healthcare services. For survivor HPs, inquiries were made about their level of earthquake impact, including questions about physical injuries, loss of loved ones, and displacement from their residences.

BAI

The BAI is a self-reported anxiety scale consisting of 21 questions [4]. The BAI scale is a 4-point Likert-type scale, ranging from "0= not at all" to "3= severe, I could barely stand it," and the total score range is defined as 0-63. In our study, anxiety levels were categorized based on BAI scores as follows: <8 points indicate normal anxiety, 8-15 points represent low-level anxiety, 16-25 points indicate moderate-level anxiety, and 26-63 points represent severe-level anxiety [5]. The BAI has a high internal consistency (Cronbach's α=0.92).

Statistical Analysis

During the statistical analysis, the Statistical Package for the Social Sciences (version 23.0, USA) and Medcalc software (version 19.2.6, Medcalc Software, Belgium) programs were used. The normal distribution of continuous variables was assessed using the Shapiro-Wilk test. Percentages and frequencies were calculated for categorical variables, whereas mean (± standard deviation) values were determined for continuous variables. Student's t-test was employed for comparing BAI scores in binary comparisons. For categorical variables, the chi-square test was used. The Pearson correlation test was applied to analyze correlations among normally distributed data. The confidence interval (CI) was set at 95%, and a p-value less than 0.05 was considered statistically significant.

Results

The data of the 89 HPs who completed the questionnaire were examined. Of the participants, 47 (52.8%) were male and 42 (47.2%) were female. The mean age was 32.16±5.84, with an age range of 24-50 years. Regarding marital status, 59 participants (66.35%) were married, 27 (30.3%) were single, and 3 (3.4%) were divorced. When participants were classified based on work experience, it was observed that 36 individuals (40.4%) had been working for 1-5 years, 27 individuals (30.3%) for 6-10 years, 19 individuals (21.3%) for 11-15 years, and 7 individuals (7.9%) for 16-20 years. Among the participants, 47 individuals (52.8%) were identified as survivors of HP. Demographic information of the two groups of HP operating within the earthquake-affected region is presented in Table 1.

The average BAI score for all included HP was 19.19±16.44. The mean BAI score for females was 23.31±18.70, while for males it was 15.51±13.28, and the difference was statistically significant (95% CI: 1.02-14.57, p=0.025). The mean BAI score for survivor HP was 29.53±13.25, and for volunteer HP was 7.62±11.12. The difference between scores was 21.91±2.61, and this difference was statistically significant (95% CI: 16.77-27.05, p=0.000). When anxiety levels were examined on the basis of BAI scores, it was determined that 35 participants

Table 1. Demographic information pertaining to two groups of healthcare professionals operating within the earthquake-affected region

	Healthcare professionals			
	Total n=89 (%)	**Survivors n=47 (%)**	**Volunteers n=42 (%)**	**p values**
Age (years) (mean ± SD)	32.16±5.84	31.02±4.88	33.43±6.59	0.056
Sex				
- Male	47 (52.8)	24 (51.1)	23 (54.8)	0.727
- Female	42 (47.2)	23 (48.9)	19 (45.2)	
Marital status				
- Married	59 (66.35)	27 (57.4)	32 (76.2)	0.175
- Single	27 (30.3)	18 (38.3)	9 (21.4)	
- Divorced	3 (3.4)	2 (4.3)	1 (2.4)	
Work experience (healthcare-years)				
- 1 to 5	36 (40.4)	19 (40.4)	17 (40.5)	0.091
- 6 to 10	27 (30.3)	18 (38.3)	9 (21.4)	
- 11 to 15	19 (21.3)	9 (19.1)	10 (23.8)	
- 16 to 20	7 (7.9)	1 (2.1)	6 (14.3)	
Duration of work (earthquake zone-days)	15.20±9.85	21.11±10.13	8.60±2.87	0.000
BAI score (mean ± SD)	19.19±16.44	29.53±13.25	7.62±11.12	0.000

BAI: Beck anxiety inventory, SD: Standard deviation

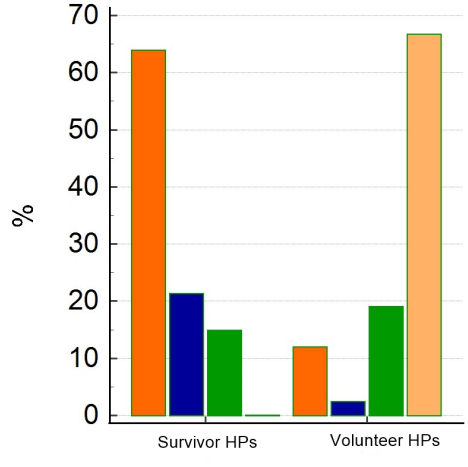
The chi-square test was performed for categorical variables. The mean BAI scores of survivors and volunteers were compared using Student's t-test.

(39.3%) had severe anxiety. In the volunteer HP group, this frequency was 11.9%, whereas in the survivor HP group, it was 63.8%. This difference between the two groups was statistically significant (p=0.000). The frequency distribution of BAI levels among HP, categorized as survivors and volunteers, is presented in Figure 1.

The average duration of active work of all participants in the earthquake zone was 15.20±9.85 days. This period was 21.11±10.13 days in the survivor HP group, whereas it was calculated as 8.60±2.87 days in the volunteer HP group. The mean difference between the two groups was statistically significant (95% CI: 9.42-15.60, p=0.000). There was a positive linear association between the duration of work in the earthquake zone and BAI scores (correlation coefficient r=0.78; p<0.0001). Scatter plot depicting the correlation analysis between BAI and the duration of work (days) are presented in Figure 2.

Among the survivor HPs, it was determined that 5 individuals (10.6%) had suffered physical injuries due to the earthquake, 11 individuals (23.4%) had lost relatives, and 13 individuals (27.7%) had lost their homes. Moderate to severe levels of anxiety were identified in all BAI scores of survivor HPs who had experienced physical injury, lost relatives, or lost their homes.

The relationship between the participants' work experience as HPs and BAI scores was examined. The average BAI score for



	Survivor HPs (n=42)	Volunteer HPs (n=47)	
Level of Anxiety			
Normal (<8 points)	0 (0%)	28 (66.7%)	
Mild (8–15 points)	7 (14.9%)	8 (19.0%)	p=0.000
Moderate (16–25 points)	10 (21.3%)	1 (2.4%)	
Severe (26–63 points)	30 (63.8%)	5 (%11.9)	

Figure 1. Graphic illustrating the frequency distribution of healthcare professionals according to their Beck anxiety inventory levels, categorized as survivor HPs and volunteer HPs

HPs: Healthcare professionals

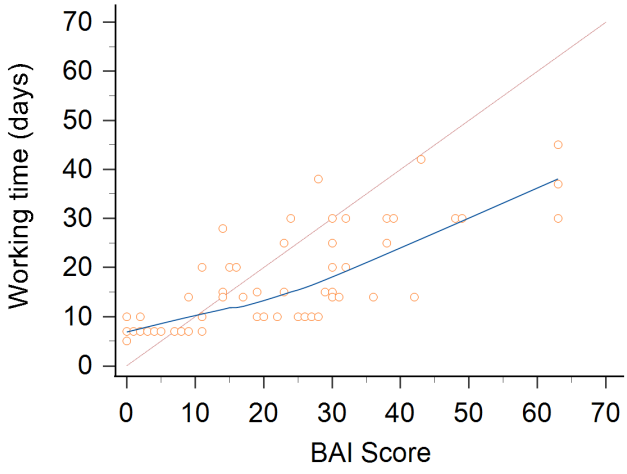


Figure 2. Scatter plot depicting the correlation analysis between BAI and the duration of work (days)

BAI: Beck anxiety inventory

HPs with work experience of over 10 years was calculated as 12.88±14.22, while the average BAI score for HPs with 10 years or less of work experience was 21.79±16.69. The difference between these two groups was statistically significant (95% CI: 1.90-15.91, p=0.019).

Discussion

Providing healthcare services in earthquake-stricken areas is a highly challenging task, both physically and mentally. The primary aim of our study was to examine the anxiety levels of survivor HPs (continued their duties after experiencing a disaster in the earthquake zone) and volunteer HPs. Because of our study, we found significantly higher BAI scores among survivors of HPs, which corresponded to moderate to severe levels of anxiety. We observed a correlation between BAI scores and the duration of work in the earthquake zone among HPs, and we also identified that anxiety levels were higher in survivors than in volunteers. Among all participants, we concluded that HPs with longer total work experience had lower anxiety levels.

Earthquakes are disasters that, in addition to causing destruction and loss of life, have a negative impact on the remaining life processes of survivors. A significant majority of survivors lose their secure living spaces, and some have to confront the loss of their relatives [6]. The combination of factors like these and many others increases the frequency of mental health problems among survivors. This situation has been confirmed in the literature through existing studies [7,8]. Thapa et al. [9] reported that the prevalence of anxiety remained high even during the first year after the Nepal earthquake. In a study conducted by Muntingh et al. [10], which examined the effectiveness of BAI scores in assessing anxiety levels in patients with multiple anxiety disorders, the average BAI score was reported to be 18.5. In our study, the average BAI score for all HPs working in the earthquake zone was 19. This indicates that the BAI scores of HPs working in the earthquake zone are at a level that can be defined as anxiety disorders. In addition, we observed that the BAI score was significantly higher in survivor HPs than in volunteer HPs. Among survivor HPs, we also found that the BAI scores of all survivor HPs who had experienced physical trauma, lost relatives, or lost their homes indicated moderate to severe levels of anxiety.

The study conducted by Kang et al. [11] found that there was an increased frequency of post-traumatic stress disorder among healthcare workers who began their duties in the area from the very first day of the disaster. In various studies examining the psychological symptoms of HP in the literature, no relationship has been found between the duration of work in earthquake-stricken areas and the psychological symptoms [12,13]. In our study, we found that the BAI scores of HPs increased in correlation with the duration of work in the earthquake-stricken area. As the time spent in the area increased, HPs had to cope with various stress factors such as the fear of being caught in aftershocks and experiencing physical trauma, fatigue caused by working long hours without adequate rest, and the sadness stemming from the loss of earthquake survivors they were trying to assist.

Perrin et al. [14] indicated in their study that specialized professionals such as police officers and emergency healthcare workers experienced with disasters had lower levels of post-traumatic stress disorder in the post-disaster period. Ma et al. [12] indicated in their study that HPs who were involved in the Taiwan earthquake and had more work experience (duration in their profession) had a lower frequency of post-traumatic stress disorder. Consistent with the literature, our study demonstrated that emergency HPs with over 10 years of work experience had significantly lower anxiety levels than those with less work experience. This finding suggests that the increased experience gained by emergency medical workers over years in their profession has made them psychologically resilient during the post-disaster period.

Study Limitations

The most significant limitation of our study is the reliance on scoring based on individuals' questionnaire responses to assess anxiety levels. HPs included in our study were not clinically evaluated by a psychiatrist. Additionally, the inability to appoint volunteer HPs to the earthquake-stricken areas simultaneously resulted in each participant completing the survey at different time periods after the earthquake. This prevented the study from being conducted at a standardized time after the earthquake and for all participants simultaneously.

Conclusion

The most significant outcome of our study was that HPs providing first-line health services in earthquake-stricken areas exhibited high anxiety scores. In particular, the BAI scores of survivor HPs were even higher than those of volunteer HPs. Additionally, as the duration of work in earthquake-stricken areas increased, anxiety levels correlated and increased accordingly. The results of our study indicate that despite being accustomed to working in challenging conditions and under stress, HPs may struggle to cope with stress during major disaster situations like earthquakes and exhibit anxiety symptoms. We believe that it is essential to provide psychological support for HPs who continue to work in disaster-stricken areas to prevent long-term, persistent mental disorders that could develop and become chronic.

Ethics

Ethics Committee Approval: Ethics committee approval of the study was obtained from the University of Health Sciences Türkiye, Haydarpaşa Numune Training and Research Hospital Clinical Research Ethics Committee (decision number: HNEAH-KAEK 2023/63, date 03.04.2023).

Informed Consent: Informed consent was obtained from all the participants.

Authorship Contributions

Concept: İ.A., M.Ö., Design: K.Y., İ.A., S.D., B.G.Y., Data Collection or Processing: K.Y., İ.A., S.D., İ.A., Analysis or Interpretation: K.Y., İ.A., S.D., İ.A., M.Ö., Literature Search: K.Y., İ.A., S.D., B.G.Y., Writing: K.Y., S.D., İ.A., M.Ö., B.G.Y.

Conflict of Interest: No conflicts of interest were declared by the authors.

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ORIGINAL RESEARCH

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Comparison of Direct Laryngoscopy and Video Laryngoscopy Success After Standardized Manikin Training in Medical Students

Hande Asan[1], Erdem Çevik[1], Nagihan Şen[2], Hatice Kübra Erdoğan[2], Zeynep Kerküklü[2], Sena Nur Ateş[2], Meryem Evli[2], Samood Badwan[2]

[1]*University of Health Sciences Türkiye, Sultan 2. Abdul Hamid Khan Training and Research Hospital, Clinic of Emergency, İstanbul, Türkiye*
[2]*University of Health Sciences Türkiye, Hamidiye Faculty of Medicine, Medical Student, İstanbul, Türkiye*

Abstract

Objective: Endotracheal intubation is essential for emergency airway management, assisting ventilation and oxygenation by allowing airway patency. As an alternative to direct laryngoscopy (DL), the use of video laryngoscopy (VL) is now advocated by many operators, especially to manage the difficult airway (DA). This study aimed to compare DL and Scoper® VL in normal and DAs.

Materials and Methods: We conducted a crossover trial comparing DL and VL in difficult and normal airway (NA). Twenty volunteer medical students from the University of Health Sciences Türkiye Hamidiye Faculty of Medicine who had not received intubation training before enrolled. After the training sessions, the volunteers performed at four different independent stations (DL on normal and DA scenarios, VL on normal and DA scenarios) in a completely randomized manner on the next day. The primary outcome was the first-pass success rate, with secondary outcomes of time to intubation, number of intubation attempts, user satisfaction, and procedural difficulty by visual analog scale.

Results: Twenty volunteers were included in the study. When the first-pass success rate was examined, the highest success rates were found with VL. No statistically significant difference was detected in terms of time to intubation, user satisfaction with the intervention, or procedural difficulty. No other statistically significant differences were found between the four scenarios in other pairwise comparisons ($p<0.05$).

Conclusion: Although the first-pass success rates were better with VL, it was not superior to DL. Further studies should be planned involving Scoper® in conjunction with other video laryngoscopes to evaluate efficacy.

Keywords: Video laryngoscopy, direct laryngoscopy, difficult airway, Scoper®, intubation, manikin

Introduction

Endotracheal intubation (ETI) is essential for emergency airway management, assisting ventilation and oxygenation by allowing airway patency. Direct laryngoscopy (DL) allows us to perform this procedure by visualizing the glottis and vocal cords. Video laryngoscopy (VL) includes an integrated high-resolution camera and video monitor to facilitate glottic visualization and ET tube placement [1]. The use of VL, especially to manage difficult airway (DA), is now advocated by many operators [2]. A DA is defined as a clinical situation in which there is expected or unexpected difficulty or failure by a physician trained in anesthetic care [3]. Vomit, secretions, or blood may obstruct the view of the glottis. Cervical spine immobilization and distorted airway anatomy due to swelling or trauma can make it challenging to obtain a direct view of the glottis. Insufficient mouth opening, enlargement of the tongue, and obesity also lead to DA [4]. Meta-analyses of randomized controlled trials comparing VL and DL in patients with DA have reported better laryngeal visualization, a higher frequency of successful intubation, and a higher first-attempt successful intubation [5,6]. In studies using scoring systems to evaluate intubation difficulty, the use of VL has been shown to be easier than DL, reducing difficult views and intubation difficulty [7,8].

Address for Correspondence: Hande Asan, University of Health Sciences Türkiye, Sultan 2. Abdul Hamid Khan Training and Research Hospital, Clinic of Emergency, İstanbul, Türkiye
Phone: +90 535 383 11 36 **E-mail:** dr.handebeygirci@gmail.com **ORCID-ID:** orcid.org/0000-0002-6742-302X
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The theoretical advantages of VL make it attractive for the management of patients requiring emergency orotracheal intubation. However, despite improved glottic visualisation with VL, this may not translate into a higher success rate for successful intubation on the first attempt or decreasing time to intubation, as tracheal intubation under indirect vision may be more difficult [7,9-12]. It has been reported that video laryngoscopes increase the success rate of intubation in novice practitioners without prior experience in airway management [13].

In the literature search, there was no published article on Scoper® VL. This study aimed to compare DL and VL in difficult and normal airway (NA). The primary outcome was the first-pass success rate, with secondary outcomes of time to intubation, user satisfaction, and procedural difficulty level.

Materials and Methods

The study was approved by the University of Health Sciences Türkiye Hamidiye Scientific Research Ethics Committee (decision number: 2/17, date: 14.01.2022).

Study Design and Setting

We conducted a crossover trial comparing DL and VL in normal and DA scenarios. Following written informed consent, 20 volunteer medical students from the University of Health Sciences Türkiye Hamidiye Faculty of Medicine who had not received intubation training before enrollment. Before the start of the study, all participants were given a 2-hour theoretical training session followed by practical training where they could practice on a manikin with the devices. Each participant had at least 10 successful intubation attempts per laryngoscope during the practice session. The volunteers performed at four different independent stations (DL on normal and DA scenarios, VL on normal and DA scenarios) in a completely randomized manner on the next day. We recorded parameters such as time to intubation and number of intubation attempts. In addition, we assessed user satisfaction and procedural difficulty using the visual analog scale (VAS). The scale, a line 0-100 mm, the word "least satisfied/easy" was described on the left side of the line, and "most satisfied/difficult" on the right side. The intubation time was calculated as the time from the volunteer holding the laryngoscope blade visualize the tube passing through the vocal cords. If the patient failed within 30 seconds, they were instructed to withdraw the tube and start again, and if the airway could not be established within 2 min, it was recorded as a failed airway. Each attempt was recorded as the number of attempts.

The manikin used in the practice session and trial was the same (Resusci Anne, Leardal®, Stavenger, Norway). By attaching a cervical collar (Perfit ACE; Ambu Inc, Linthicum, MD) to the manikin, a DA was created. DL was performed using a standard Macintosh blade 4. VL was performed using a Scoper® (Technomedicare Medical Company, Ankara, Türkiye) with blade 4. The tracheal tube size was a 7.0 mm (internal diameter) (Figure 1).

Statistical Analysis

All statistical analyses were conducted using IBM SPSS Statistics 26.0 (IBM Corp, Armonk, NY). We determined the sample size to detect a reduction in time-to-intubation by comparing the DL with VL of 10 seconds, a standard deviation of 15, type 1 error =0.05, power 80%. This gave a sample size of 17, which was rounded to 20 participants. We used the Shapiro-Wilk test to determine the normal distribution of data. The results are reported as mean ± standard deviation for normally distributed continuous variables. Median and interquartile range were used for non-normally distributed variables, and frequency and percentage were used for categorical variables. Between-group comparisons for continuous data with abnormal distributions were tested using the Wilcoxon test. A p-value of <0.05 was set as statistically significant.

Results

Twenty medical students were included in this study. Nine of the volunteers were female, whereas 11 were male. The mean age of the participants was 20.95±1.024. No statistically significant difference was detected in terms of time to intubation between DL and VL in normal and DA scenarios. Furthermore, no statistically significant difference was found for time to intubation in DL normal and DAs, and the same was the case in VL ($p>0.05$) (Table 1).

The first-pass success rate was determined to be 85% for DL in the NA, 95% for DL in the DA, 100% for VL in the NA, and 95% for VL in the DA. Although the highest success rates were found with VL, no statistically significant difference was found (Table 1).

Figure 1. Video laryngoscopy in the normal airway

When user satisfaction with the intervention was evaluated, no statistically significant difference was detected among the groups in terms of VAS scores. Similarly, no statistically significant difference was revealed when the procedural difficulty VAS scores were analyzed (Table 1). No other statistically significant differences were found between the four scenarios in other pairwise comparisons ($p<0.05$).

Discussion

In this study, we designed four different scenarios for tracheal intubation and compared the performances of DL and VL. Contrary to our hypothesis, we did not observe superiority of VL over DL in terms of time to intubation. We believe that despite providing visual comfort, VL requires more practice to ensure ease of use. We suggest a higher learning curve when passing the endotracheal tube using VL rather than DL. Similar findings have been found in a previous study with novice medical students, in which the intubation time was parallel for both laryngoscopes [13]. In a meta-analysis evaluating 3,050 intubations, there was no difference between the use of DL and VL in terms of time to intubation [9].

Although there was no statistically significant difference, we observed that the first-pass success rate increased with VL. In a study simulated DA with manual in-line stabilization were found to be similar in the first-pass success rate and the number of ETI attempts between the VL and DL groups [8]. However, in a trial comparing first-pass success in ETI among novice emergency physicians during cardiopulmonary resuscitation, which can indirectly cause DA, they achieved a higher success rate in VL than DL (91.8% vs. 55.9%) [14].

User satisfaction was similar between the groups in our study, but we encountered contradictory data on this subject in the literature. Pieters et al. [15] reported that devices with Macintosh-type blade laryngoscopes scored the highest in user satisfaction. In contrast, Rendeki et al. [16] stated that operator satisfaction was significantly better with VL.

The evaluation of procedural difficulty revealed no statistically significant difference between VL in the NA and VL in the DA. In a study evaluating intubation difficulty using VAS score in DA, it was reported as 20 for VL, whereas it was 10 for DL [8]. A recent meta-analysis performed by Lewis et al. [7], which used the intubation difficulty score, stated that VL was easier to use when compared with DL.

Study Limitations

First, we used the cervical collar as our difficult intubation setting; however, there are many other difficult situations, such as trauma or obesity. Second, the study was conducted in a simulated scenario.

Conclusion

The first-pass success rate was examined, and the highest success rates were found with VL in normal and DAs. Further studies should be planned involving Scoper® in conjunction with other video laryngoscopes to evaluate efficacy.

Table 1. Comparison of data between direct laryngoscopy and video laryngoscopy using

	Group	n	Median	IQR	25th	75th	p
Time to intubation	1	20	11.77	4.97	9.50	14.46	0.236
	2	20	11.32	4.13	9.36	13.50	
	3	20	13.97	6.34	10.66	17.00	
	4	20	13.61	7.22	10.45	17.67	
Procedural difficulty	1	20	13.50	23.50	7.00	30.50	0.297
	2	20	28.50	24.50	17.75	42.25	
	3	20	21.00	14.50	16.00	30.50	
	4	20	29.50	29.25	14.50	43.75	
User satisfaction	1	20	97.50	9.50	90.50	100.00	0.412
	2	20	97.00	19.00	81.00	100.00	
	3	20	98.50	8.50	91.50	100.00	
	4	20	93.00	19.75	79.50	99.25	
Number of intubation attempts	1	20	1.00	0.00	1.00	1.00	0.531
	2	20	1.00	0.00	1.00	1.00	
	3	20	1.00	0.00	1.00	1.00	
	4	20	1.00	0.00	1.00	1.00	

1: Direct laryngoscopy in the normal airway, 2: Direct laryngoscopy in the difficult airway, 3: Video laryngoscopy in the normal airway, 4: Video laryngoscopy in the difficult airway

IQR: Interquartile range

Ethics

Ethics Committee Approval: The study was approved by the University of Health Sciences Türkiye Hamidiye Scientific Research Ethics Committee (decision number: 2/17, date: 14.01.2022).

Informed Consent: Informed written consent was obtained from all participants.

Authorship Contributions

Surgical and Medical Practices: H.A., N.Ş., Z.K., S.N.A., S.B., Concept: E.Ç., H.K.E., Design: E.Ç., M.E., Data Collection or Processing: H.A., N.Ş., Z.K., S.N.A., S.B., Analysis or Interpretation: E.Ç., M.E., Literature Search: H.A., H.K.E., Writing: H.A., E.Ç.

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ORIGINAL RESEARCH

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Evaluation of Patients Presenting to the Emergency Department of a Tertiary Care Hospital in İstanbul After the Kahramanmaraş Earthquakes and Organisation of Emergency Health Services During the Disasters

Burcu Bayramoğlu[1], Perihan Şimşek[2], İsmail Kaftancı[1], İsmail Tayfur[1]

[1]*University of Health Sciences Türkiye, Sancaktepe Şehit Prof. Dr. İlhan Varank Training and Research Hospital, Clinic of Emergency Medicine, İstanbul, Türkiye*
[2]*Trabzon University School of Applied Sciences, Department of Emergency Aid and Disaster Management, Trabzon, Türkiye*

Abstract

Objective: Because of the two earthquakes that occurred in Kahramanmaraş in Türkiye on February 6th, 2023, 50,783 people lost their lives and 115,353 people were injured. In this study, cases presenting to our center, which is approximately 1000 km away from the earthquake zone, were examined.

Materials and Methods: In our study, the data of earthquake-affected patients aged 18 and over who presented to our hospital between 06.02.2023 and 06.03.2023 were retrospectively evaluated and statistically analysed.

Results: Of the 521 patients, 288 were women, and the mean age was 49.91 years. It was observed that cases presenting to the hospital because of trauma presented to the hospital at an earlier stage. The three most common reasons for presentation to the emergency department for non-traumatic reasons were upper and lower respiratory tract infections (34.4%), myalgia (12%), and anxiety (5.6%).

Conclusion: Although trauma-related patient presentations are predominant after disasters, it should not be forgotten that internal and psychiatric diseases may be among the reasons for presentation to the hospital. Distance from the earthquake zone affects the reasons for admission and severity of injuries.

Keywords: Earthquake, disaster, disaster management, emergency medicine, disaster medicine

Introduction

Türkiye is a country where natural disasters such as earthquakes, landslides, floods, and avalanches frequently occur. According to data published in 2023 by the INFORM index for risk management, which aims to determine the risks of humanitarian crises and disasters and to rank countries according to disaster risks, Türkiye is in the high-risk group in terms of disasters with an index score of 5.0. When evaluated specifically for earthquakes, it has a value of 9.7/10 [1]. Türkiye is a country suffering the most damage due to earthquakes. Between 1900 and 2023, 20 earthquakes with a magnitude of over 7 M_w occurred in Türkiye. Considering the major damage and loss of life, the biggest earthquakes were the 2023 Kahramanmaraş, 1939 Erzincan, and 1999 Gölcük earthquakes, respectively [2].

On February 6th, 2023, two earthquakes occurred in Kahramanmaraş at 04:17, at a depth of 8.6 km and with a magnitude of 7.7 M_w, and at 13:24, at a depth of 7 km and with a magnitude of 7.6 M_w. Eleven provinces were affected by these earthquakes, which have been called the disaster of the century in Türkiye. The earthquakes, which were felt in neighboring countries other than Türkiye, also caused destruction in Syria.

Address for Correspondence: Burcu Bayramoğlu, University of Health Sciences Türkiye, Sancaktepe Şehit Prof. Dr. İlhan Varank Training and Research Hospital, Clinic of Emergency Medicine, İstanbul, Türkiye
Phone: +90 536 471 09 78 **E-mail:** drburcubayramoglu@gmail.com **ORCID-ID:** orcid.org/0000-0001-7653-6969
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Because of the earthquakes, 50,783 people lost their lives and 115,353 people were injured in Türkiye [3]. Following the earthquake, the personnel and equipment of the National Medical Rescue Team (UMKE) Unit were sent to the affected areas. To provide the necessary health care, 1253 ambulances, 14 air ambulances, and 245 UMKE vehicles were sent to the region, while 12,749 UMKE and 112 health personnel were assigned to work in the region. In addition to these health personnel, 26,353 doctors and other healthcare staff were assigned. In addition to the hospitals that could provide care, 35 field hospitals were set up, and 51,581 injured patients were transferred [2].

Patients who exceeded the service delivery capacity of the hospitals in the region presented to public and private health institutions in different provinces of Türkiye for treatment, both through the Ministry of Health and their own means. In this study, the characteristics and clinical conditions of patients presenting to our center, which is approximately 1000 km away from the earthquake zone, were examined.

Materials and Methods

Study Design

In our study, the data of earthquake-affected patients aged 18 and over who presented to our hospital between 06.02.2023 and 06.03.2023 were retrospectively analysed. In addition to demographic data such as age and gender of patients, data were recorded and statistical analysis of the data was performed for complaint on presentation, conditions that may cause the disease in question, diagnosis of hospitalised patients regarding the indication for hospitalisation and other additional diagnoses, the need for surgery and the procedures performed, the number of days of hospitalisation, the hospitalisation clinic, the need for intubation and in-hospital mortality.

Permission for this study was obtained from the Ethics Committee of University of Health Sciences Türkiye, Sancaktepe Şehit Prof. Dr. İlhan Varank Training and Research Hospital (approval number: E-46059653-050.99-213716745, date: 18.04.2023). Because of our study was a retrospective study, patient consent was not obtained.

Statistical Analysis

The Statistical Package for the Social Sciences (SPSS) for Windows 26.0 (IBM Corporation, Chicago, Illinois) was used for data analysis. Statistical significance level was set at 0.05, and 95% confidence interval was used. Descriptive statistics of the cases were obtained. Pearson's chi-square test was used to analyze categorical variables that did not comply with normal distribution. The relationship between hospital admission days was analyzed using One-Way ANOVA.

Results

Between 06.02.2023 and 06.03.2023, which was the first one-month period when the data of earthquake-affected patients were examined, 521 earthquake victims, of whom 288 (55%) were women, presented to the emergency department of our hospital. The age of the patients ranged from 18 to 92 years, with a mean age of 49.91 years. It was found that 149 (29%) of the patients presented due to trauma and that 34 (7%) patients had been pulled out of the rubble. Hospital presentation times ranged from days 2 to 29, with 38.2% of patients presenting on days 7-13, and 22.8% presenting on days 0-6. Thirty-two (6%) patients presenting to the hospital were hospitalized. Apart from these patients, 8 patients left the hospital even though hospitalization was recommended by signing a medical treatment refusal form.

Eighty-three (56%) of the 149 patients who presented due to trauma were women. The age of the patients who presented because of trauma ranged from 18 to 85 years, with a mean age of 47.89 years. When these patients were evaluated according to presentation times, it was observed that 40% of patients presented to the emergency department on days 0-6, 48% on days 7-13, 0.9% on days 14-20, 0.3% on days 21-27, and 0.1% on days 28-30. Among the patients presenting to the emergency department due to trauma, 132 (89%) were discharged. When patients were evaluated according to trauma mechanisms, it was seen that 82 (55%) patients presented to the emergency department due to falls or sprains occurring while escaping during the earthquake, 47 (32%) patients due to being struck by objects or getting trapped between objects, 7 (4.7%) patients due to cuts or foreign bodies, 5 (3.5%) patients due to falling during the post-earthquake period, 4 (2.4%) patients due to multisystem trauma caused by being under debris, and 4 (2.4%) patients due to burns. When the patients were evaluated according to trauma sites, it was observed that 70 (27%) patients presented to the emergency department due to isolated lower extremity injuries, 28 (19%) patients due to isolated upper extremity injuries, 22 (15%) patients due to multiple trauma, 12 (8%) patients due to spinal trauma, 12 (8%) patients due to head and facial trauma, 4 (3%) patients due to thoracic trauma, and 1 (0.7%) patient due to abdominal trauma. Following the necessary examinations and tests, it was determined that 108 (72%) of the patients had soft tissue trauma, 31 (21%) had bone fractures, 3 (2%) had a foreign body under the skin, 4 (3%) had burns, 1 (0.7%) had crush syndrome, 1 (0.7%) had auricular hematoma, and 1 (0.7%) had compartment syndrome.

Nine of the 17 (37%) patients who were hospitalized with injuries secondary to trauma were females, with a mean age of 45.29 years. The mean number of days of hospitalization was 7.59 days. Among these patients, 41% presented to the hospital on days 0-6, 37% presented on days 7-13, and 6% presented on days 14-20. When these patients were evaluated

according to hospitalization diagnoses, it was observed that 13 (76%) patients were hospitalized due to bone fracture, 1 (6%) patient due to soft tissue infection, 1 (6%) patient due to crush syndrome, 1 (6%) patient due to burns, and 1 (6%) patient due to compartment syndrome. Ten (58%) patients were operated on. Except for the need for perioperative intubation, patients were not intubated, and no mortality was observed in hospitalized patients. When the hospitalization clinics were evaluated, 11 (65%) patients were admitted to the orthopedics and traumatology clinic, 2 (12%) patients to the internal medicine clinic, 1 (6%) patient to the cardiology clinic, 1 (6%) patient to the burns unit, 1 (6%) patient to the otolaryngology clinic, and 1 (6%) patient to the neurosurgery clinic.

Of the 372 patients presenting to the emergency department for non-traumatic reasons, 205 (55%) were women. The age of the patients ranged from 18 to 92 years, with a mean age of 50.72. It was observed that 16% of patients presented to the emergency department on days 0-6, 35% on days 7-13, 28% on days 14-20, 18% on days 21-27, and 3% on days 28-30. Fifteen (4%) of these patients were hospitalized. Patients' complaints were related to the respiratory system in 141 (38%) patients, the musculoskeletal system in 55 (15%) patients, the gastrointestinal system in 37 (10%) patients, ear, nose, and throat problems in 21 (6%) patients, psychiatric diseases in 21 (7%) patients, the cardiovascular system in 17 (5%) patients, the genitourinary system in 15 (5%) patients, the central nervous system in 12 (3%) patients, the endocrine system in 8 (2%) patients, the hematopoietic system in 4 (1%) patients, and gynecology and obstetrics in 3 (0.8%) patients. Twenty-seven (7%) complaints were associated with other systems. When the patients' diagnoses were evaluated, the three most common reasons for presentation were upper and lower respiratory tract infections (34%), myalgia (12%), and anxiety (6%). Ten (3%) patients who were discharged had no active complaints and presented to the emergency department for the supply of routinely used drugs. Apart from these patients, three (1%) patients presented to the hospital because they could not use the drugs they routinely used.

Nine (60%) of the 15 patients who presented to the emergency department for non-traumatic reasons and were hospitalized were women. The age of these patients ranged from 21 to 92 years, with a mean age of 67.33. It was observed that 20% of the patients presented to the emergency department on days 0-6, 27% on days 7-13, 33% on days 14-20, and 20% on days 21-27. The length of hospital stay of the patients ranged from 2 to 17 days, with an average stay of 6.7 days. When the indications for hospitalization of the patients were evaluated, it was seen that five patients were hospitalized because of pneumonia. The other patients with indications for hospitalization had anemia, acute renal failure, need for routine dialysis, deep vein thrombosis, hypocalcemia, postoperative follow-up after gastrectomy, stroke, lymphoma pain, elective finger amputation, and uremic encephalopathy. The patient with hypocalcemia was using calcium supplements after thyroid surgery but could not obtain the medication after the earthquake. Some patients were hospitalized with multiple diagnoses. In one patient who was hospitalized, gastrointestinal bleeding, anemia, warfarin overdose, lumbar fracture, and acute renal failure were detected. In another patient who was found to have a bone fracture, the acute renal failure was observed along with this diagnosis. In the patient with acute coronary syndrome, it was observed that hyperkalemia accompanied this diagnosis. When the hospitalized patients were evaluated according to their clinics, it was seen that 6 (40%) patients were admitted to the internal medicine clinic and 5 (33%) patients to the chest diseases clinic, while the other patients were admitted to the general surgery, cardiovascular surgery, neurology, orthopedics, and traumatology clinics. The need for intubation or in-hospital mortality was not observed in the patients.

When the patients presenting to the hospital were evaluated according to their gender, the number of female patients was higher among all earthquake victims and among those who presented to the hospital for non-traumatic reasons, and this difference was statistically significant (p=0.016, p=0.049, respectively). There was no significant gender difference in trauma patients or hospitalized earthquake victims (p=0.164, p=0.480, respectively) (Table 1).

When evaluated in terms of whether the earthquake victim patients presented to the emergency department due to trauma or for non-traumatic reasons, and when evaluated in total, the highest number of presentations was seen on days 7-13. It was observed that the number of patient presentations on days 0-6 and days 14-20 was similar, whereas the number of patient presentations decreased from the 21st day (p<0.001). When the number of patients presenting to the emergency

Table 1. Relationship between gender and patients presenting to the hospital

Variable	Female (n, %)	Male (n, %)	Total (n, %)	p
Earthquake victim patients	288 (55)	233 (45)	521 (100)	0.016*
Trauma (+)	83 (56)	66 (44)	149 (100)	0.164
Trauma (-)	205 (55)	167 (45)	373 (100)	0.049*
Hospitalized patients	18 (55)	14 (45)	32 (100)	0.480

*p: Pearson chi-square

department because of trauma was evaluated according to the time of presentation, there was a statistically significant difference between the presentation days ($p<0.001$). It was observed that 70 patients presented on days 7-13, while 58 patients presented on days 0-6. Comparing the percentage of patients presenting due to trauma, the rate of presentation on days 0-6 was relatively higher. There was a significant decrease in the number of presentations from the 14th day (Table 2).

When the patients were evaluated according to the trauma site, a statistically significant difference was found between the injured body regions ($p<0.001$). The lower extremity was the region most exposed to trauma, whereas the upper extremity was the second most exposed region (Table 3).

When the patients were evaluated according to trauma mechanisms, there was a statistically significant difference between the injury mechanisms ($p<0.001$). It was observed that patients were most frequently injured in falls while escaping from the earthquake. The second most common injury mechanism was being struck by objects or getting trapped between objects (Table 4).

The 11 patients who were admitted to the orthopedic clinic were operated on. During the operations, open reduction internal fixation (ORIF) was performed in 2 patients, fasciotomy in 1 patient, amputation in 1 patient, minimally invasive plating in 3 patients, K-wire fixation in 2 patients, external fixator removal in 1 patient, and debridement in 1 patient.

Other than patients who received their first diagnosis in our hospital or whose first intervention was performed in the earthquake zone, it was observed that three patients were operated on in the earthquake region because of fractures, and that although the indication for hospitalization continued, the patients were referred to our center after stabilization to increase the bed capacity in the earthquake region.

Discussion

It has been found in numerous studies that more than half of earthquake-related injuries are related to the musculoskeletal system and that most of these injuries cause fractures [4]. Apart from traumas, patients with acute exacerbations of respiratory system diseases, cardiovascular system diseases, and other chronic diseases may also present to hospitals for emergency health care after an earthquake [5]. Although patients mostly present to the emergency department in the first hours and days after an earthquake due to trauma, patients may present to hospitals from the first hours of an earthquake to its later stages with various symptoms due to acute attacks and exacerbations of chronic diseases, limited access to routine medications and treatments for internal diseases, cases of newly emerging diseases, post-traumatic stress disorders, or for existing psychiatric problems, the impact of the disaster environment, and limited access to psychological support or treatments for the control of psychiatric conditions. When the presentations to the hospital were evaluated in terms of traumas, there were patients who had been under the rubble and had multiple injuries or who had been exposed to various traumas while leaving the buildings after the earthquake. Moreover, various physical traumas could be seen in patients because of the living conditions following the earthquake.

Table 2. Relationship between days of presentation to the hospital and reasons for presentation

	Day of presentation to the hospital					
Variable	**0-6 (n, %)**	**7-13 (n, %)**	**14-20 (n, %)**	**21-27 (n, %)**	**28-30 (n, %)**	**p**
Trauma (+)	58 (49)	70 (35)	13 (11)	5 (7)	2 (14)	
Trauma (-)	61 (51)	129 (65)	104 (89)	66 (93)	12 (86)	<0.001*
Total	119 (100)	199 (100)	117 (100)	71 (100)	14 (100)	

*p: One-Way ANOVA test

Table 3. Comparison of trauma patients according to the regions where trauma occurred

Trauma site	n (%)	p
Isolated lower extremity	70 (47)	
Isolated upper extremity	28 (19)	
Multiple trauma	22 (15)	
Head and face	12 (8)	<0.001*
Spine	12 (8)	
Thorax	4 (2.3)	
Abdomen	1 (0.7)	
Total	149 (100)	

*p: Pearson chi-square

Table 4. Relationship between trauma mechanisms in trauma patients

Trauma mechanism	n (%)	p
Falling while escaping from earthquake	82 (55)	
Being struck by objects or getting trapped between objects	47 (32)	
Cuts and foreign bodies	7 (4.7)	
Falls occurring after earthquake	5 (3.5)	<0.001*
Injuries due to being under debris	4 (2.4)	
Burns	4 (2.4)	
Total	149 (100)	

*p: Pearson chi-square

In a study conducted by Del Papa et al. [6] after the earthquake that occurred in Italy in 2009, the most common traumatic injury was fractures with a rate of 46.8%. It was found that 38.75% of the fractures were associated with the lower extremities. In a study conducted by Moitinho de Almeida et al. [5] after the earthquake that occurred in Nepal in 2015, the data of 501 patients were analyzed and it was found that 89% of the injuries were related to the lower extremities, while 66% of the injuries were caused by fractures. In the study, it was determined that the highest number of admissions to the hospital was on the 5th day. Approximately 69% of the patients were operated on, and most of the operations were performed by orthopedics and traumatology. In a study conducted by Kanchan et al. [7], in which the same earthquake was analyzed, the data of 238 patients who needed surgery after the earthquake were examined, and it was found that 185 patients were operated on by orthopedics, 26 patients by neurosurgery, 9 patients by general surgery, 17 patients by plastic surgery and 1 patient by oral and maxillofacial surgery. Among the surgical procedures performed by orthopedics, ORIF was found to be the most common procedure. Another study of the 2015 Nepal earthquake was conducted by Giri et al. [8], in which the 21-day period after the first earthquake was examined. During this period, another earthquake occurred 17 days after the first one, and the data analyzed included the first 5 days after this earthquake. In the patient data analyzed, it was seen that 2,003 patients presented to the emergency department and that 70% of these patients presented to the emergency department with earthquake-related complaints. It was observed that the number of patients admitted to the emergency department was approximately five times higher than that in the period before the earthquake. Most of the patients admitted to the hospital because of the earthquake were hospitalized, and these patients stayed in the hospital longer than cases with non-earthquake-related diagnoses and hospitalizations. Fractures were detected in 58% of the 1083 cases. Of the 345 surgical procedures performed, 98% were orthopedic procedures, and internal fixations with open and closed reduction were the most common procedures. In a study conducted by Xu et al. [9], in which three earthquakes occurring in China were investigated and compared with each other, the data of 1,390 patients were examined. It was found that most of the patients were admitted to the hospital within the first 2 weeks. While gender was unrelated to hospital admission, when the age distribution was examined, it was found that most of the patients were younger than 60 years. It was found that orthopedic interventions were predominant in surgical procedures and ORIF was the most common surgical procedure. In a study by Shi et al. [10] investigating the earthquake that occurred in China in 2017, the data of 48 patients were analyzed, and it was found that 30 patients were operated on and that 93.3% of the operations were performed by orthopedics and traumatology. In a study conducted by Nieh et al. [11] after the earthquake that occurred in Taiwan in 2018, it was found that 89.4% of the patients presented to the emergency department due to trauma. Fractures were detected in 9.4% of the patients, and 67.1% of traumas affected the lower or upper extremities.

In a study conducted after the Kahramanmaraş earthquake in a hospital close to the earthquake zone by Yarkaç et al. [12], it was found that 2,043 hospital applications were made in the first 15 days after the earthquake and more than half of these applications were trauma-related. In an article about the same earthquake conducted by Görmeli Kurt et al. [13] observed that 1,577 patients were admitted to the emergency department within a 22-day period, and among the patients with trauma, the number of patients with isolated extremity injuries was higher than those with other traumas.

In our study, it was observed that patients with trauma presented to the hospital earlier than those without trauma. When the anatomical localization of the traumas was evaluated, it was observed that 47% of the patients presented to the emergency department with isolated lower extremity trauma, which is consistent with the literature. When the reasons for admission of cases who presented with symptoms unrelated to trauma and were hospitalized were examined, factors such as the weather and living conditions in the disaster area, the continuation/disruption of routine treatments for those with chronic diseases, and the discharge of patients who were hospitalized in disaster-affected hospitals to ensure patient drainage played a role.

In hospital presentation after earthquakes, the reason for presentation and the day of presentation vary according to the distance of the hospital from the epicenter of the earthquake. This situation also affects issues such as patient population, reasons for presentation, severity of injuries, and operations performed. Although the number of patients and the severity of traumas decrease as the distance from the epicenter of the earthquake decreases, the rate and severity of admissions to hospitals far from the earthquake area may increase depending on the magnitude of the earthquake.

The distance of our hospital from the disaster area has led to different results from those of the above-mentioned studies, which were conducted in hospitals in disaster areas:

1) Unlike the literature, the first presentation to our hospital by an earthquake victim was on the second day after the earthquake.

2) In the first days of the disaster, trauma-related presentations to healthcare institutions were mostly made in the disaster area. The reason why the rate of presentation to the emergency department for non-traumatic reasons was higher in our study

than in other studies may be related to the fact that our study covered the first month after the earthquake, the distance of our hospital from the disaster area, and the settlement of earthquake victims in provinces far from the disaster area.

3) In our study, 72% of patients admitted with trauma had soft tissue trauma and 20% had bone fractures. The reason why the percentage of cases with fractures is lower than that in other studies in the literature may be that patients with fractures were treated in the earthquake area or in centers close to the earthquake area.

4) When the operations performed on the patients were examined, it was seen that, unlike the literature, most of the operations performed in our hospital were elective orthopedic surgeries. This difference in our study is related to the distance of our center from the earthquake area and the fact that operations indicated to be performed by other branches were cases that could not be delayed.

While examining the patients included in the study, one of the important issues that caught our attention was the population of patients who presented to the emergency department for reasons related to the earthquake despite not being earthquake victims themselves. It was observed that this population consisted of patients who requested tetanus prophylaxis before going to the earthquake area and those who presented to our emergency department after returning from the earthquake area for reasons such as myalgia, respiratory tract infection, anxiety, and trauma. Another important finding was that patients who were not earthquake victims but whose relatives were affected by the earthquake or who experienced anxiety due to the news in the press presented to the emergency department. The data from these cases were not included in our study because they did not meet the requirements for inclusion in the study.

In large-scale disasters that affect many settlements and where the number of earthquake victims is very high, such as the recent earthquakes occurring in Türkiye, health care services need to be organize quickly. In the management of this disaster, the injured and other patients in need of treatment were transferred to other hospitals in the country, especially to hospitals in nearby provinces, because some hospitals in the disaster area that could have provided service were damaged and because the number of patients who needed treatment exceeded the service capacity of the hospitals that could still provide service. Apart from these patients who were transferred, there were also patients who left the earthquake area and presented to health care institutions in other provinces to receive health care by their own means, and patients who left the earthquake area and settled in other regions temporarily or permanently and presented to health care institutions to receive health care. Despite the distance between our center and the disaster area, it was one of the centers where patient presentations were made. This situation once again emphasizes the magnitude of the disaster that occurred.

Generally speaking, during the organization of health care services in disaster management, patients in need of health care are first taken to the closest institutions that can deliver the most active health care for their first intervention, or they present as outpatients by their own means and are transferred to other centres, if necessary, after the first response. In the management of these patients, certain points stand out [14]:

1) Effective and correct triage is performed from the first hours of the disaster.

2) After triage, the patients who need emergency treatment are determined and their treatment is started. If emergency treatment is not required, appropriate triage is performed and higher-priority patients are treated.

3) After the first intervention for patients who need emergency treatment, if further examination and treatment are required, it is determined whether the center has the capacity to provide this treatment.

4) If the center to which the patient presents for examination and treatment does not have the capacity to provide the appropriate treatment for the patient, the patient is referred to an appropriate center, and land, air and sea ambulances are organized to be used for this purpose.

5) In order to reduce the overcrowding that occurs in centers to which patients can be transferred, other patients who are not earthquake victims and who do not need emergency treatment are discharged, and patients who still need treatment but are stabilized and can be transferred to other centers are transferred to appropriate centers, where the appropriate number of hospital beds is provided.

6) The necessary plans are made for health institutions in the disaster area and for centers located outside the disaster area that accept large numbers of patients from the disaster area to use resources such as the workforce, bed capacity, and materials for emergency patients by not accepting elective patients.

For these and similar disasters to be experienced without disrupting the health care services mentioned in the above-mentioned items, by prioritizing the patient's benefit and by taking care to use the resources at hand efficiently, national disaster management plans should be created and updated at regular intervals, and all institutions and individuals providing health care services should have full knowledge of these plans.

Study Limitations

The biggest limitation of our study is that it was conducted retrospectively. Additionally, the distance from our center to the earthquake zone affected the size of the study population.

Conclusion

Following an earthquake, the reason for presenting to the hospital and the day of presentation vary according to the distance of the hospital from the epicenter of the earthquake. This situation also affects issues such as the population of patients who are admitted, the reasons for admission, the severity of injuries, and the operations performed. Although patient presentations due to trauma are predominant after disasters, patients presenting with internal complaints should not be ignored. Conditions such as anxiety and post-traumatic stress disorder can not only affect earthquake victims and people whose relatives are in the earthquake area but can also be seen in other people who follow disaster-related broadcasts and publications. This population can be described as "the hidden part of the iceberg" in terms of exposure to disasters. This is an important public health problem that needs to be resolved.

Disaster preparedness and the provision of health care at the time of a disaster is an important issue that concerns the entire country and its resources. Each of the health care institutions located in the disaster area and at different distances from the disaster area should undertake a task suitable for their location and capacity.

Ethics

Ethics Committee Approval: Permission for this study was obtained from the Ethics Committee of University of Health Sciences Türkiye, Sancaktepe Şehit Prof. Dr. İlhan Varank Training and Research Hospital (approval number: E-46059653-050.99-213716745, date: 18.04.2023).

Informed Consent: Because of our study was a retrospective study, patient consent was not obtained.

Authorship Contributions

Concept: B.B., İ.T., Design: B.B., İ.K., İ.T., Data Collection or Processing: B.B., İ.K., İ.T., Analysis or Interpretation: P.Ş., İ.T., Literature Search: B.B., P.Ş., İ.K., İ.T., Writing: B.B., P.Ş., İ.T.

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REVIEW

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Pulmonary Embolism Treatment: Current Developments and Approaches

Evren Dal[1], Suna Eraybar[1], Mehtap Bulut[1], Akkan Avcı[2]

[1]University of Health Sciences Türkiye, Bursa City Hospital, Clinic of Emergency Medicine, Bursa, Türkiye
[2]University of Health Sciences Türkiye, Adana City Training and Research Hospital, Clinic of Emergency Medicine, Adana, Türkiye

Abstract

Pulmonary embolism (PE) remains an important preventable condition with high mortality and morbidity, recurrence, and sometimes difficult diagnosis. Current treatments have evolved considerably and changed remarkably recently. PE is a condition requiring critical care, and rapid advances in this field have led to significant evolution in treatment strategies. The broad spectrum and severity of PE require individualization and optimization of treatment approaches. In addition to algorithms guiding the diagnostic process of patients, the use of risk classifications guiding the recognition of critically ill patients and the decision of treatment modalities has an important place in emergency department practice. This review addresses the latest developments for treating PE based on the current findings of epidemiological studies. Considering the characteristics of patient populations, clinical conditions, and comorbidities, a range of treatment options from anticoagulation therapies to catheter-based interventions, thrombolytic therapies, and alternative approaches will be examined. Changes in current guidelines affecting treatment decisions and the role of a multidisciplinary approach will also be emphasized. This review aims to synthesize the current knowledge in the field of PE treatment and will allow us to collectively interpret the most effective and safe treatment strategies for this critical condition.

Keywords: Pulmonary embolism, angioagulant therapy, systemic thrombolysis, catheter-related embolectomy

Introduction

Pulmonary embolism (PE) is a critical vascular condition affecting the pulmonary arterial system resulting from an embolism caused by venous thrombosis. Emboli resulting from the unfavorable course of deep vein thrombosis cause occlusions in the pulmonary arteries, leading to a serious condition that restricts lung perfusion. Clinical symptoms can vary over a wide spectrum and can cause potentially life-threatening complications that require timely diagnosis and intervention.

This review aims to provide a deeper understanding of PE cases and examine treatment strategies. Considering recent medical advances, available treatment options, and current literature will be reviewed, thus providing a basis for understanding the role of this important vascular event in the medical field.

When cases with suspected PE in the emergency department are analyzed, PE is the final diagnosis in approximately 35% of cases with advanced imaging and investigations, and the prevailing mortality rate of 10% shows the complexity related to PE management. In recent years, increasingly effective treatment modalities, the use of advanced diagnostic tools, and increased adherence to guidelines have led to favorable developments in PE prognosis [1,2]. However, the use of diagnostic tests has increased nowadays because of the involvement of small branches or the diagnosis of PE without clinical significance. Although this has increased the incidence of PE cases, the same efficacy has not been demonstrated in terms of mortality and treatment complications.

This situation is a paradox in clinical practice. Diagnostic difficulties may lead to unnecessary treatment, whereas missed cases of PE may lead to potentially fatal outcomes. These challenges highlight the need for an important balancing act that influences clinical practice and guides treatment strategies.

Address for Correspondence: Evren Dal, University of Health Sciences Türkiye, Bursa City Hospital, Clinic of Emergency Medicine, Bursa, Türkiye
Phone: +90 532 667 33 04 **E-mail:** evrendal2000@yahoo.com **ORCID-ID:** orcid.org/0009-0003-7755-3703
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In PE diagnosis, the interpretation of symptoms and association with PE and clinical suspicion play an important role, and the algorithm followed by the clinical combination of risk factors may lead to a diagnosis [3]. Modified Genova and Wells scoring systems are the most commonly used systems in clinical decision-making and risk determination [4,5]. While scoring systems allow the determination of the risk of PE in the patient, they may also guide the planning of the diagnostic stages. In these scoring systems, the PE expectancy in the low, medium, and high-probability groups is 10%, 30%, and 65%, respectively [6,7].

In patients with new-onset chest pain or shortness of breath presenting to the emergency department, considering PE without risk analysis increases the risk of misuse of excessive laboratory tests and imaging modalities in the differential diagnosis. PE exclusion criteria have been developed with a sensitivity of 97% for excluding the diagnosis, especially in patients with a low probability of PE. In the PROPER study, the correct and effective use of exclusion criteria in patient evaluation may reduce the use of computed tomography pulmonary angiography and may also reduce unnecessary follow-up periods when the waiting time of patients for laboratory and imaging results is considered [8,9].

In the diagnostic process, it is important to question provoking factors such as the patient's history of previous operations, trauma, bed rest and immobilization, pregnancy status, or use of hormone replacement therapy. These factors play a critical role in assessing the risk of possible thrombosis. However, there are cases of thrombosis occurring without any known provocative factor, which is an important factor in determining the course of treatment. Clinical evaluation of patients, history taking, and determination of risk factors help to accurately classify both provoked PE states and thrombosis developing without provocation and to develop a treatment plan [10].

Clinical symptoms are usually nonspecific, and the most common complaint is chest pain. Chest pain manifests as sudden onset pleuritic-type pain, particularly in distal pulmonary artery (PA) emboli, whereas it causes pressure and pain in the chest in the presence of large areas of centrally located thrombus [11]. In this case, in addition to PE, life-threatening causes of chest pain, especially acute coronary syndromes and acute aortic pathologies, should be considered.

Dyspnoea is a common symptom following chest pain in patients with PE. In particular, in individuals with previous cardiopulmonary disease, a sudden increase in dyspnoea and impaired oxygenation should suggest PE. Arterial blood gas examination is not always diagnostic, and normal values may be encountered in 40% of cases. However, hypoxia and hypocapnia and consequent respiratory alkalosis are the most common blood gas symptoms resulting from ventilation-perfusion imbalance. Although chest radiography is far from diagnostic, it should be used to rule out other causes. Obtaining indirect findings may support the diagnosis [12,13].

Electrocardiographic (ECG) findings may also be helpful in the diagnosis of PE. The most common finding is sinus tachycardia. T wave changes between V1 and V4 may be seen as a reflection of right ventricular (RV) enlargement on ECG because of RV involvement. The S1Q3T3 pattern is unlikely to be seen and is not diagnostic alone. These findings are important guidelines in the ECG evaluation of PE and provide important clues for emergency management [14].

Hypotension and shock are important symptoms that indicate a high risk of the development of PE. However, most PE cases are in the intermediate- and low-risk groups. Clinical parameters such as low systolic blood pressure, tachycardia, tachypnea, and syncope adversely affect the short-term prognosis of PE.

Detection of myocardial damage because of RV involvement or acute pressure overload, particularly in patients in the medium-low risk class, is critical for determining a rapid and accurate prognosis. These clinical parameters play a vital role in determining treatment strategies [15-17].

In conclusion, in patients diagnosed with PE, an accurate assessment of both the basic findings indicating high-risk conditions and the prognosis in intermediate-low-risk groups is vital in establishing an effective and personalized treatment plan.

Treatment in the Acute Phase

Respiratory Support and Haemodynamic Stabilization

Hypoxaemia is an important sign of severe PE and is usually caused by a mismatch between ventilation and perfusion. Supplemental oxygen administration is necessary for patients with PE and arterial oxygen saturation <90%, which is considered a fundamental strategy in the management of acute respiratory failure due to hypoxaemia [18].

Hypoxaemia that develops because of ventilation and perfusion incompatibility may lead to severe respiratory failure that may become resistant to conventional oxygen support. Alternatively, high-flow oxygen or non-invasive mechanical ventilation techniques should be considered to be correct hypoxaemia [18-20]. Invasive mechanical ventilation may decrease venous return due to the positive intrathoracic pressure it creates. It may further deepen the existing hypotension with RV failure that develops especially in unstable patients due to severe PE. Therefore, this situation should be considered in the presence of an indication for invasive mechanical ventilation, and undesirable haemodynamic effects should be reduced with low tidal volume (6 mL/kg) and end-inspiratory plateau pressure (below 30 mmHg) [18,21].

Pharmacological Treatment for New-onset RV Failure

The most common cause of mortality observed in PE is impaired pump function and decreased volume due to RV involvement. Initiation of appropriate fluid therapy in these patients requires careful monitoring. Although delay in fluid replacement does not contribute to treatment, excessive fluid administration may deepen the dysfunction of the RV. Giving fluid replacement in a controlled manner according to the patient's current volume load and deciding the volume and rate of fluid replacement under the guidance of central venous pressure measurement or inferior vena cava imaging with ultrasonography represent a more accurate and effective approach [22,23].

Vasopressors, such as norepinephrine, increase myocardial perfusion and contractility without affecting peripheral vascular resistance and should be used especially in shock states. In patients with a low ejection fraction and normal blood pressure, dobutamine may be preferred. Vasodilators, such as inhaled nitric oxide has been reported to improve ventilation and perfusion by providing selective pulmonary vasodilatation and to be beneficial; however, extensive additional studies are needed [24].

Advanced Life Support

In the presence of pulseless electrical activity in cardiac arrest developing with non-shockable rhythm, acute PE should be considered as a cause of arrest. Advanced cardiac life support steps should be applied in cases of cardiac arrest due to PE. Thrombolytic treatment should be kept in mind, and resuscitation procedures should be continued for 60-90 minutes if a thrombolytic drug is administered [25,26].

Maintenance of cardiopulmonary resuscitation and circulation with mostly venoarterial extracorporeal membrane oxygenation (VA-ECMO) may be beneficial in high-risk PE patients, and successful case series have been reported in patients with circulatory collapse or cardiac arrest [27].

Initial Anticoagulation

Patients with high and moderate suspicion of PE should receive anticoagulant therapy while the diagnostic testing process is being performed. The anticoagulant agent of choice is often subcutaneous low molecular weight heparin (LMWH), fondaparinux, or intravenous unfractionated heparin (UFH) [28,29]. The decision should be based on the clinical condition of the patient and drug interactions. LMWH and fondaparinux may be preferred over UFH for initial treatment because they have a lower risk of major bleeding and heparin-induced thrombocytopenia.

Non-vitamin K antagonist oral anticoagulants (NOACs) are now the agents of choice for treating most patients with PE, both in the acute phase (with or without a short initial period of parenteral heparin or fondaparinux) and in the longer term. Regardless of whether parenteral heparin is used in the first few hours or days after acute PE, the 2019 guidelines now recommend that a NOAC is preferred over a vitamin K antagonist when the decision is made to start oral anticoagulation [30,31].

Reperfusion Therapies

Systemic Thrombolysis

The clinical probability of suspected acute high-risk PE is usually high, and the differential diagnosis includes other life-threatening conditions such as cardiac tamponade, acute coronary syndrome, aortic dissection, acute valvular dysfunction, and hypovolemia. If acute PE causes hemodynamic decompensation, immediate bedside transthoracic echocardiography will detect acute RV dysfunction. In a highly unstable patient, echocardiographic evidence of RV dysfunction is sufficient to initiate immediate reperfusion without further testing. In intubated patients, transesophageal echocardiography can provide direct visualization of thrombi in the PA and its main branches, particularly in patients with RV dysfunction.

The 2019 guidelines recommend the establishment of a multidisciplinary team for the acute phase management of high-risk and (in selected cases) intermediate-risk PE, depending on the available resources and expertise in each hospital [8]. Primary reperfusion therapy includes systemic thrombolytic therapy to prevent circulatory shock. Surgical pulmonary embolectomy (SPE) or percutaneous catheter-directed therapy are alternative reperfusion options in patients with contraindications for thrombolysis, if expertise in either of these methods and appropriate resources are available [31,32].

In addition, the PE thrombolysis study examined the efficacy of thrombolytic therapy in normotensive intermediate-risk cases of PE. This study found a significantly better response with thrombolytic agents than with anticoagulants in hemodynamic instability, but a high risk of serious major bleeding and intracranial hemorrhage after thrombolytic therapy in these patients. Therefore, thrombolytic therapy in these patients should be carefully evaluated and possible complications should be considered [33].

Tissue plasminogen activator (rtPA), streptokinase, and urokinase are commonly used as thrombolytic agents. The most commonly preferred thrombolytic agent is rtPA, which is widely used because of its short half-life and ease of administration compared with other agents. rtPA is usually administered as an infusion of 100 mg/2 h for treating PE. Recent studies on half the classical dose of rtPA (50 mg/2 h infusion and 10 mg bolus + 40 mg/2 h infusion) have shown that although the same therapeutic effect is achieved, a lower rate of complications is observed [34,35].

Catheter-mediated Embolectomy

Mechanical reperfusion is achieved by PA catheterization via the femoral route. This includes mechanical fragmentation with different types of catheters, thrombus aspiration, or, more commonly, mechanical or ultrasound-assisted fragmentation with a pharmacomechanical approach and low-dose thrombolysis [36].

Surgical Embolectomy

Surgical embolectomy in acute PE is usually performed with aortic cross-clamping and cardioplegic cardiopulmonary bypass without cardiac arrest and incision of the pulmonary arteries with removal or resorption of fresh clots. Recent reports have shown favorable surgical outcomes in high-risk PE patients with or without cardiac arrest and in selected cases of PE [37]. Pulmonary embolectomy is recommended for individuals with submassive or massive PE under specific conditions. These include cases where there are contraindications to thrombolysis, unsuccessful outcomes following thrombolysis or catheter-assisted embolectomy, or instances where the patient is in a state of shock with a high likelihood of succumbing to the condition before the effects of thrombolysis can manifest, especially within a few hours. This surgical intervention is suitable when there is access to the necessary surgical expertise and resources [38].

Using thrombolysis and catheter thromboembolectomy can swiftly restore hemodynamic stability. However, these treatments carry the potential risk of causing distal fragment embolization and hemorrhage.

In cases involving high-risk situations and cardiogenic shock, SPE is a viable option. This is particularly applicable to patients with massive PE who are unsuitable candidates for fibrinolysis or exhibit instability even after its administration. In addition, individuals with submassive PE, in whom thrombolysis is either contraindicated or proves ineffective, and those with right heart thrombi situated close to or straddling a patent foramen ovale are also considered suitable candidates for surgical intervention [39].

Upon deciding to proceed with pulmonary embolectomy, it is imperative to swiftly move the patient to the operating room. In situations involving massive pulmonary embolism, it is advisable to establish VA-ECMO support before transitioning to the operating room. This precautionary measure mitigates the challenges associated with sudden and potentially disorderly induction of anesthesia and initiation of cardiopulmonary bypass. For severely ill patients with PE, VA-ECMO can be employed to provide life-saving support. In fact, VA-ECMO is frequently employed as a crucial intervention before opting for surgical embolectomy [40,41].

VA-ECMO stands out as a rapid and reliable mechanical circulatory support device that effectively reduces RV volume overload. Its application is also endorsed as a viable treatment for PE patients experiencing refractory circulatory collapse or cardiac arrest. Notably, the reported overall survival rate for patients undergoing VA-ECMO for severe PE ranges from 38% to 67%. Current guidelines advocate VA-ECMO as a transitional support mechanism leading to definitive reperfusion therapy [40,42].

The Class IIb recommendation for VA-ECMO is derived from various case series because there is a dearth of case-control or cohort studies directly comparing VA-ECMO with alternative treatments. Despite the absence of robust evidence, the use of VA-ECMO has seen a rise over time and has demonstrated improved outcomes in high-risk PE, as indicated by national studies [43,44].

Treatment Strategies

Emergency Treatment of High-risk PE

In high-risk PE patients, the initial treatment is acute reperfusion therapy, and in most cases, systemic thrombolysis is the preferred treatment protocol. In patients with contraindications to thrombolysis, alternative reperfusion strategies such as SPE or catheter embolectomy-guided therapy may be considered, depending on the experience of the clinic and hospital conditions. However, for these methods to be applied, expertise in the relevant field and appropriate resources should be available. After hemodynamic stabilization and reperfusion therapy, oral or parenteral anticoagulant therapy should be initiated. In particular, NOACs apixaban or rivaroxaban may be preferred [10].

Emergency Treatment of Intermediate-risk PE

For most acute PE cases without hemodynamic compromise, parenteral or oral anticoagulation (without reperfusion techniques) is adequate. In normotensive patients, at least one PE-related indicator or comorbidity should be treated with hospitalization. In this group, in the presence of evidence of RV dysfunction on echocardiography or pulmonary angiography or a positive troponin test result, patients should be monitored during the first hours and days and followed for hemodynamic decompensation.

Management of Low-risk PE: Triage for Early Discharge and Home Treatment

In low-risk PE cases, discharge from the emergency department and outpatient anticoagulant therapy may be considered after evaluation of certain criteria. Outpatient follow-up may be considered if the risk of mortality and morbidity is found to be low in the PE risk assessment and if the patient is in the low-

risk group in terms of existing complications. In addition, the patient should not have comorbid conditions and additional provoking factors that may worsen PE, and the patient should have social support to follow anticoagulation therapy on an outpatient basis.

Considering the commonly used exclusion criteria, in studies interpreting the use and efficacy of Hestia pulmonary embolism severity index (PESI) or simplified PESI, it was found that the rate of recurrent venous thromboembolism cases within 3 months was 2.3% and the mortality rate was 0.6% in patients discharged within 1 day and followed up as outpatients. Therefore, it may be considered to use one of these criteria in clinical triage based on personal experience and preference [45-47]. The treatment strategies determined by risk classification in PE are summarized in Figure 1 [10].

In conclusion, PE is an important pathology that should be considered in the differential diagnosis of patients presenting with chest pain and shortness of breath in the emergency department. The use of appropriate risk classifications at the time of patient evaluation and the execution of diagnostic algorithms accompanied by scoring allows the critical patient to be recognized.

In the diagnosis of PE obtained because of the necessary imaging and laboratory tests, making severity estimates and deciding on the need for hospitalization play a key role in effective treatment and management. Reperfusion therapies that should be applied in unstable patients should be planned within the existing experience and facilities and, where possible, should be performed in emergency departments simultaneously with diagnostic processes. Providing an appropriate treatment approach in emergency departments may increase survival.

The prognosis of PE heavily relies on the presence or absence of circulatory collapse and advanced cardiac conditions like cardiac arrest requiring external massage. A comprehensive approach involving swift noninvasive diagnostics, accurate risk assessment, and immediate access to surgical intervention is pivotal for achieving optimal outcomes. Numerous studies have underscored a higher in-hospital mortality rate for patients with preoperative cardiac arrest. Therefore, SPE should

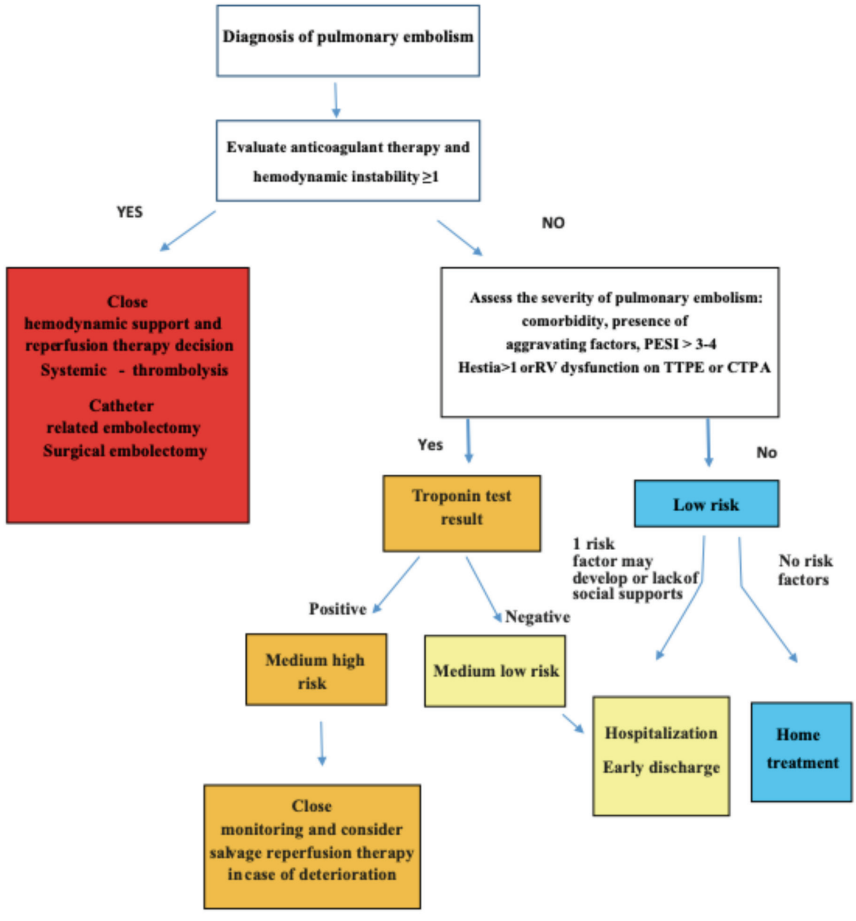

Figure 1. Algorithm including treatment decision stages after the diagnosis of pulmonary embolism

PESI: Pulmonary embolism severity index, RV: Right ventricular, TTPE: Transthoracic echocardiography, CTPA: Computed tomography pulmonary angiography

be considered for patients before progressing to advanced hemodynamic instability and reaching cardiogenic shock.

The growing accessibility of VA-ECMO and concerted efforts to standardize the intricate surgical procedure have significantly enhanced the post-operative outcomes of SPE. This underscores the value of surgery as a viable option for treating PE accompanied by severe RV dysfunction or hemodynamic instability. In the future, there is a pressing need for the reeducation of medical and surgical trainees, ensuring they are well-versed and updated on the role of SPE in acute PE treatment, especially in centers equipped with surgical expertise for performing SPE.

Ethics

Authorship Contributions

Surgical and Medical Practices: M.B., Concept: E.D., A.A., Design: S.E., A.A., Data Collection or Processing: E.D., Analysis or Interpretation: E.D., Literature Search: S.E., Writing: E.D., S.E.

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