EPAT
Emergency Physicians Association of Turkey

EAJEM

Eurasian Journal of Emergency Medicine

Citation abbreviation: Eurasian J Emerg Med

ISSN 2149-5807 • EISSN 2149-6048

Volume: 23
Issue: 2

www.eajem.com

June
2024

galenos yayınevi

Official Journal of Emergency Physicians Association of Turkey

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Printing at: Son Sürat Daktilo Dijital Baskı San. Tic. Ltd. Şti.
Gayrettepe Mah. Yıldızposta Cad. Evren Sitesi A Blok No: 32 D: 1-3 34349 Beşiktaş, İstanbul, Turkey **Phone:** +90 (212) 288 45 75
Printing Date: June 2024 **ISSN:** 2149-5807 **E-ISSN:** 2149-6048
International scientific journal published quarterly.

EAJEM
Eurasian Journal of Emergency Medicine
Citation abbreviation: Eurasian J Emerg Med

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Citation abbreviation: Eurasian J Emerg Med

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Eurasian Journal of Emergency Medicine
Citation abbreviation: Eurasian J Emerg Med

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EAJEM
Eurasian Journal of Emergency Medicine
Citation abbreviation: Eurasian J Emerg Med

Contents

EURASIAN JOURNAL OF EMERGENCY MEDICINE
Editorial
DOI: 10.4274/eajem.galenos.2024.98360
Eurasian J Emerg Med. 2024;23(2): 81-3

Accidental Hydrogen Peroxide Ingestion: Consequences and Their Management

Neeraj Kumar

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Keywords: Hydrogen peroxide, poisoning, ingestion, HBOT

Hydrogen peroxide (H_2O_2) is a clear, colorless, odorless liquid that usually exists in solutions with concentrations ranging from 3% to 90%. It is relatively unstable and will rapidly decompose, through an exothermic reaction into water and oxygen in the presence of alkali, metals, and the enzyme catalase, which is usually found in mucous membranes, liver, kidney, red blood cells, and bone marrow (1). They can cause corrosive damage, oxygen gas formation, and lipid peroxidation. After coming in close contact with the stomach wall, it releases oxygen, which then diffuses inside the blood vessel, which further leads to gas-induced hypervascularity, especially in the portal system, gastric wall, cerebral vessels, and pulmonary vessels, because of the high concentration of oxygen, which exceeds the maximum solubility of blood. Often, intravascular foaming can affect right ventricular output. One swallow, approximately 30 mL, of 35% H_2O_2 can produce 3400-mL oxygen gas (2). There may be some therapeutic value of hyperbaric oxygen therapy (HBOT) for treating vascular gas embolism and mitigation of concentrated H_2O_2 ingestion toxicity.

Zengin et al. (3) reported hepatic portal venous gas in a 20-year-old male after ingesting 30 mL of 30% H_2O_2, and the case was conservatively managed and discharged on 4th day. No HBOT was used. However, various studies showing the mortality benefit of HBOT after H_2O_2 ingestion are shown in Table 1.

Youssef et al. (4) reported that the differential diagnosis of portal vein gas following H_2O_2 ingestion is pneumobilia and pneumoperitoneum, on X-rays both present with sword lucency in the right paraspinal region (Saber sign) and cupola sign, respectively. On computed tomography, pneumobilia has branch air densities with more central distribution, and pneumoperitoneum has free air densities in peritoneal cavities.

Chung and Jeong (5) reported oxygen embolism (sudden drop of $P_{ET}CO_2$ from 35 mmHg to 22 mmHg) in a 39-year-old male caused by accidental subcutaneous injection of 3% of 50 mL H_2O_2 following right acetabulum fracture surgery.

Vander Heide and Seamon (6) reported the case of an 82-year-old woman who accidentally ingested food-grade peroxide and developed severe neurological sequelae and seizures.

Pak et al. (7) reported a case of a 52-year-old male who accidentally ingested approximately 100 mL of 35% H_2O_2, resulting in the sudden onset of gastrointestinal and neurological symptoms.

Current recommendations for HBOT in cerebral air gas embolisms involve the use of Navy Dove, which takes patients to a depth of 3 atmospheres absolute (ATA) for 60 min followed by 120 min at 2 ATA with several air breaks interspersed throughout, taking a total of 285 min to complete (8). As per Boyles' law, the volume of gas emboli is decreased, which increases the solubility of gas into the tissues and plasma, leading to rapid resolution of vascular occlusion.

Hatten et al. (9) conducted a retrospective analysis over a period of 10 years from the National Poison Data System and concluded that high-concentration (>10%) peroxide ingestion occurred in 294 cases, of which 41 cases developed embolic events and 20 cases either died or presented with sustained disability. Death occurred in 5 of 294 symptomatic patients with evidence of

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Cite this article as: Kumar N. Accidental Hydrogen Peroxide Ingestion: Consequences and Their Management. Eurasian J Emerg Med. 2024;23(2): 81-3.

Received: 06.06.2024
Accepted: 07.06.2024

possible embolic events on follow-up at the poison center (Table 2).

Conclusion

H_2O_2 is very unstable and easily decomposes to form oxygen and release heat. The severity of H_2O_2 ingestion will depend on the concentration used, exposure route, and contact time. The two concentrations mainly used for H_2O_2 are 3% and >10% for medical disinfection and industrial use, respectively. A concentration of >30% is corrosive to the skin, mucosa, and other local tissues. Shock, coma, convulsions, and pulmonary and cerebral edema may occur within 24-72 hours after exposure to highly concentrated hydrogen peroxide. Early use of Hyperbaric oxygen therapy may serve as an effective mode of treatment for improving clinical conditions.

Table 1. H_2O_2 ingestions without mortality on being treated with (HBOT)

First author	Years	Number of cases	Age and sex	Volume ingested (mL) concentration (%)	Symptoms	Length of hospital stay
Mullins and Beltran (2)	1998	01	35 years/female	30 mL, 35%	Foaming, emesis, confusion, ataxia, dysarthria, hemiparesis	1
Vander Heide and Seamon (6)	2003	01	82 years/female	89 mL, 35%	Confusion, ataxia, diplopia, foaming, hematemesis	3
Ciechanowicz et al. (11)	2007	01	54 years/male	100 mL, 90%	Chest pain, abdominal pain, hematemesis, hemiparesis, obtunded	8
Rider et al. (10)	2008	01	48 years/male	5-10 mL, 33%	Vomiting, hematemesis, headache, confusion, hemiparesis	4
French et al. (12)	2010	11	Mean age 50 years M: F: 6:5	230 mL, 12-35%	Oral burns, emesis, abdominal pain, chest pain, hematemesis, sore throat, seizure, nausea	Mean 1.57 days
Papafragkou et al. (13)	2012	01	32 years/female	Volume ingested unknown, 35%	Abdominal pain, nausea, emesis, portal emboli	3
Manning et al. (14)	2014	01	23 years/female	30 mL, 35%	Tachycardia, epigastric pain and vomiting	4

Table 2. Ingestion of H_2O_2 associated with mortality

Cases	Age and sex	Volume ingested (mL) concentration (%)	Symptoms	Cause of death
01	35 years/female	180 mL, unknown	Emesis, AMS, tachycardia, decerebrate posturing, seizure, ventricular tachycardia, and herniation	Seizure at home and incapacitated for 1 h before presentation. Intubated on arrival. X-ray/CT without extraluminal gas. EGD with gastritis. Cerebral herniated in ICU.
02	82 years/female	30 mL, 35%	Emesis, possible aspiration, altered mental status, tachycardia	Airway protected for decreased LOC/emesis. But succumbed inside the ICU due cerebral herniation.
03	69 years/male	<45 mL, 20-40%	Elevated troponin level and altered mental status	Intubated for decreased LOC. Refusal for HBOT by relatives. Suspected basilar insult. Care withdrawn.
04	55 years/male	960 mL, 35%	Emesis, respiratory distress, altered mental status, tachycardia	Patient have multiple infarcts in pons, brainstem, cerebellum, and cerebral cortex with hemorrhagic transformation with midline shift died due features of raised ICP in ICU.
05	73 years/male	15 mL, 35%	Altered mental status, tachycardia and vomiting	Intubated for decreased LOC and emesis, but succumbed inside the ICU.

ICU: Intensive care unit, EGD: Esophagogastroduodenoscopy, LOC: Level of consciousness, ICP: Intracranial pressure, HBOT: Hyperbaric oxygen therapy, CT: Computed tomography

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EURASIAN JOURNAL OF EMERGENCY MEDICINE
Systematic Review and Meta-analysis
DOI: 10.4274/eajem.galenos.2024.56688
Eurasian J Emerg Med. 2024;23(2): 84-94

Endotracheal Intubation Versus Supraglottic Airway for Airway Management in Adults with Out-of-hospital Cardiac Arrest: A Systematic Review and Meta-analysis

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Abstract

Aim: The goal of this meta-analysis is to evaluate and compare the effectiveness of endotracheal intubation (ETI) and supraglottic airway (SGA) devices in airway management during out-of-hospital cardiac arrest events.

Materials and Methods: Study was designed as a systematic review and meta-analysis and was conducted according to the 2020 PRISMA guidelines. Relevant studies published up to January 2024 were searched systematically using the following databases: PubMed, EMBASE, Scopus, Web of Science, and Cochrane Library. Pooled effect sizes were calculated using a random-effects model and reported as the odds ratios and 95% confidence intervals.

Results: Out of 4218 records initially identified, 25 eligible studies were selected for inclusion in a meta-analysis. Survival to hospital admission was 26.8% for ETI and 14.5% for SGA ($p<0.001$). Survival rates among patients treated with ETI vs. SGA varied and amounted to: 25.5% vs. 17.6% for 24-h survival rate ($p<0.001$); 13.4% vs. 15.1% ($p=0.002$); and 8.6% vs. 6.0% for survival to hospital discharge/30-d survival ($p=0.09$). Survival with favorable neurological outcomes occurs in 5.3% in ETI group, compared to 3.8% in SGA group ($p=0.35$).

Conclusion: Our analysis reveals the nuanced and context-dependent nature of airway management in prehospital emergency care. The high heterogeneity across studies suggests that factors such as provider experience, patient characteristics, and the specific emergency context significantly influence outcomes.

Keywords: Endotracheal intubation, supraglottic airway device, airway management, out-of-hospital cardiac arrest, survival rate

Introduction

Airway management is a cornerstone of resuscitation in out-of-hospital cardiac arrest (OHCA), a critical medical emergency with low survival rates globally (1,2). The primary goal during resuscitation is to ensure adequate oxygenation and ventilation to support the heart and brain until spontaneous circulation can be restored (3,4). Over the years, the strategies for airway management in OHCA have evolved from basic methods like mouth-to-mouth respiration to advanced techniques involving endotracheal intubation (ETI) and supraglottic airway (SGA) devices. These advancements reflect the ongoing efforts to improve patient outcomes by optimizing the airway management approach during the critical minutes following cardiac arrest.

ETI has long been considered the gold standard for securing the airway in emergency medicine, given its ability to provide a secure airway, protect against aspiration, and enable controlled ventilation (5,6). ETI, however, requires significant skill and experience to perform successfully, especially in the challenging

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Received: 13.02.2024
Accepted: 01.04.2024

Cite this article as: Dabkowski M, Wieczorek P, Cander B, Kacprzyk D, Pruc M, Szarpak L. Endotracheal Intubation Versus Supraglottic Airway for Airway Management in Adults with Out-of-hospital Cardiac Arrest: A Systematic Review and Meta-analysis. Eurasian J Emerg Med. 2024;23(2): 84-94.

conditions encountered during OHCA. Studies, including those by Bartos et al. (7) have explored the impact of ETI in OHCA, with a focus on the procedure's success rates, its influence on survival outcomes, and potential complications arising from its use in the ETI setting.

On the other hand, SGA devices have emerged as a viable alternative to ETI for airway management in OHCA. SGAs are designed to be easier to insert and require less skill and training than ETI. They have gained popularity due to their simplicity and the potential for rapid deployment, which is crucial in time-sensitive scenarios like OHCA. The literature, including studies by Becker et al. (8), Benger et al. (9), and others, has examined the efficacy of SGAs compared to ETI, assessing metrics such as insertion success rates, ventilation quality, and the impact on patient outcomes including survival to hospital discharge (SHD) and neurological status.

The debate between the use of ETI and SGA devices in OHCA management centers around several key issues. These include the skill level required for effective implementation, the impact on patient outcomes, and the operational challenges faced by emergency medical services in different regions. Factors such as the availability of skilled personnel, training programs, and the specific circumstances of each cardiac arrest case (e.g., etiology of arrest, patient anatomy, presence of bystanders) play critical roles in determining the most appropriate airway management strategy.

The evolution of airway management strategies reflects a broader trend in emergency medicine towards evidence-based practice. Randomized controlled trials and observational studies have provided valuable insights into the relative benefits and drawbacks of ETI and SGA devices. For instance, research has shown that while ETI may offer superior airway protection, the technical challenges and potential for procedural complications can adversely affect outcomes. Conversely, the ease of use associated with SGA devices might lead to faster airway control but could be associated with increased rates of improper placement and inadequate ventilation in some cases.

The goal of this meta-analysis is to evaluate and compare the effectiveness of ETI and SGA devices in airway management during OHCA events. This work aims to integrate available data from studies comparing these two methods with respect to key outcome indicators, such as survival to hospital admission (SHA), SHD, and the neurological status of patients who survived the cardiac arrest.

Materials and Methods

This study was conducted according to Preferred Reporting Items for Systematic Reviews and Meta-analyses guidelines (10) and the Cochrane Handbook for Systematic Review of Interventions (11). The review protocol was registered with the International Prospective Register of Systematic Reviews (PROSPERO-CRD42024500150). This study did not require ethical approval and informed consent as it was a systematic review and meta-analysis of previously published studies.

Search Strategy

We did a systematic review and network meta-analysis. We searched the PubMed, EMBASE, Scopus, Web of Science, and Cochrane Library databases from the date of their inception to January 31, 2024, with restriction to English language.

We used the search terms compilation "endotracheal intubation" OR "intubation" OR "direct laryngoscope" OR "direct intubation" OR "Macintosh laryngoscope" OR "laryngoscope" OR "MAC" AND "supraglottic airway device" OR "SGA" OR "i-gel" OR "IGEL" OR "laryngeal mask airway" OR "laryngeal tube" OR "LMA-Classic" OR "LMA-Proseal" OR "LMA" OR "SoftSeal" OR "air-Q" OR "cobra perilaryngeal airway" OR "self-pressurised air-Q" OR "Ambu Aura-I" OR "Ambu AuraGain" OR "Ambu AuraOnce" AND "heart arrest" OR "cardiac arrest" OR "out-of-hospital cardiac arrest" OR "OHCA" OR "OOHCA" OR "OH-CA" OR "prehospital cardiac arrest" OR "sudden cardiac death". We also checked the reference lists of included studies.

Study Selection

Two researchers (M.D. and M.P.) independently screened titles and abstracts of the identified papers in order to select relevant and not-relevant papers. Each citation was reviewed with full-text retrieval of any citation considered potentially relevant. All studies meeting the following PICOS criteria were included in our analysis: adult (aged 18 years or older) patients with OHCA (P); airway management with ETI (I); airway management with SGA devices (C); return of spontaneous circulation (ROSC), SHA with sustained ROSC; SHD, with good neurological outcome defined as a score 1 or 2 according to Cerebral Performance Categories (CPC) Scale (O); randomized controlled trial as well as non-randomized trials (S). We excluded trials focusing on pediatric population or conducted among simulation or animal model, systematic reviews, reviews, commentaries/editorials, letter to editors, and literature reviews, as well as studies not addressing our review question.

Data Extraction and Data Retrieval

After identifying those studies meeting inclusion criteria, two members (M.D. and D.K.) of our team should have independently reviewed and assessed each of the included studies. Any disagreement on both study selection and data extraction was planned to be solved by discussion with a further author (L.S.) or by contacting the corresponding author.

The following information was collected: first author, year of the study, country, study design, type of SGA device, total number of patients per group, sex and age. Furthermore, we collected: witnessed arrest and bystander cardiopulmonary resuscitation, ROSC, SHA with sustained ROSC; SHD with good neurological outcome defined as a CPC 1-2. If data were missing, a request was sent by e-mail to the corresponding author of the study. If no response was received after our initial request, a second request was sent seven days later.

Quality Assessment and Certainty of Evidence Assessment

Two researchers (M.D. and M.P.) independently evaluated the quality of included RCTs by using the risk of bias (RoB) 2 Tool (12) and for non-RCT by using ROBINS-I Tool (13). Disagreements were resolved by discussion with a third researcher (B.C.).

RoB 2 Tool assesses study quality and RoB by exploring five domains (bias arising from the randomization process, bias due to deviations from intended interventions, bias due to missing outcome data, bias in the measurement of the outcome, bias in the selection of the reported result) and each domain is judged on a three-grade scale (low RoB, high RoB or some concerns).

In contrast, in the case of the ROBINS-I tool, the following domains were assessed: bias due to confounding; bias due to the selection of participants; bias in the classification of intervention; bias due to deviations from the intended interventions; bias due to missing data; bias in the measurement of outcomes; bias in the selection of the reported result.

An overall RoB among both tools was expressed based on the above domains on a three-grade scale (low RoB, high RoB or some concerns).

Both the single domains and the overall judgement are based on the criteria reported in the RoB 2 Tool (14).

Statistical Analysis

Statistical analyses utilized Review Manager software (v5.4, by the Nordic Cochrane Centre of the Cochrane Collaboration) and Stata software (v18, from StataCorp in College Station, TX, USA) for computations. We conducted all statistical comparisons as two-tailed, setting the threshold for significance at $p<0.05$. The analysis employed (OR) with 95% confidence intervals (CIs) for binary outcomes, and mean differences with 95% CIs for continuous outcomes. When studies reported continuous outcomes using medians and ranges, we derived means and standard deviations using Hozo et al.'s (15) method. A random-effects model underpinned all analyses, with heterogeneity quantified by I^2 statistics, categorizing it as low (<25%), moderate (25-50%), or high (>50%). To detect publication bias, we applied Egger's test and constructed funnel plots, specifically examining asymmetry in analyses involving more than ten studies. Finally, in sensitivity analyses, leave-one-out analysis was performed.

Results

Study Selection

Our literature search identified a total of 4218 studies; the process of study selection is summarized in Figure 1. We excluded 1171 duplicates and 3022 citations after title and abstract screening. We identified 25 trials (with 160,071 participants) to include in this meta-analysis (7-9,16-37). Baseline characteristics of the included studies were provided

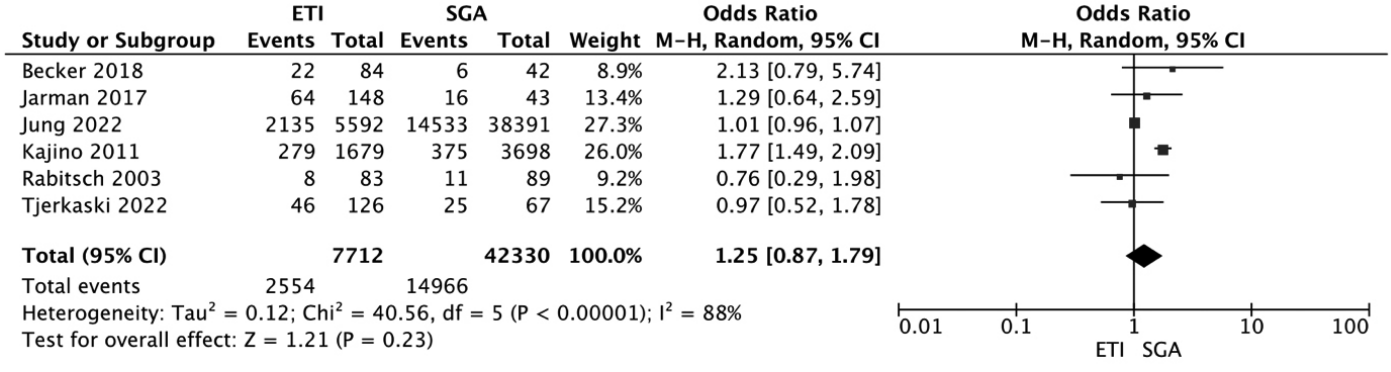

Figure 1. PRISMA flow chart

ETI: Endotracheal intubation, SGA: Supraglottic airway device, CI: Confidence interval, PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-analyses

Table 1. Baseline characteristics of included trials

Study	Country	Study design	Study groups	No.	Age	Sex, male, n (%)	Witnessed arrest, n (%)	Bystander CPR, n (%)	Shockable rhythm, n (%)
Bartos et al. (7), 2023	USA	RS	ETI	179	57.3±12.4	144 (80.5)	138 (77.1)	132 (73.7)	NS
			SGA	204	57.2±11.4	167 (81.9)	157 (77.0)	135 (66.2)	NS
Becker et al. (8), 2018	USA	RS	ETI	84	68.5±3.4	56 (66.7)	NS	4 (4.8%)	NS
			SGA	42	62.4±4.4	25 (59.5%)	NS	8 (19.0%)	NS
Behrens et al. (16), 2020	Germany	RS	ETI	2776	70.4±14.6	1862 (67.1)	1236 (44.5)	940 (33.9)	624 (22.5)
			SGA	2776	70.9±14.2	1862 (67.1)	1236 (44.5)	940 (33.9)	624 (22.5)
Benger et al. (9), 2018	England	RCT	ETI	4410	73.3±3.5	2791 (63.3)	2788 (63.2)	2774 (63.9)	1023 (23.3)
			SGA	4886	72.3±3.5	3132 (64.1)	3100 (63.4)	3149 (64.4)	1133 (23.2)
Bernhard et al. (17), 2018	Germany	RS	ETI	17.884	68.2±16.9	11.397 (63.7)	8303 (46.4)	5581 (31.2)	4421 (24.7)
			SGA	4463	67.9±15.5	2914 (65.3)	1914 (42.9)	1530 (34.3)	952 (21.3)
Chiang et al. (18), 2018	Taiwan	RS	ETI	1541	77.0±3.3	961 (62.4)	504 (32.7)	463 (30.1)	144 (9.3)
			SGA	3099	76.3±3.8	1968 (63.5)	1051 (33.9)	936 (30.2)	355 (11.5)
Christ et al. (19), 2016	Germany	RS	ETI	164	70.5±13	106 (64.6)	119 (72.6)	75 (45.7)	60 (36.6)
			SGA	62	67.6±13.7	32 (51.6)	42 (67.7)	29 (46.8)	19 (30.6)
Deakin et al. (20), 2021	England	RCT	ETI	78	60.9±26.5	50 (64.1)	56 (71.8)	16 (20.5)	17 (21.8)
			SGA	67	61.6±23.0	43 (64.2)	44 (65.7)	15 (22.4)	15 (22.4)
Jarman et al. (21), 2017	USA	PS	ETI	148	60.8±3.5	95 (64.2)	77 (52.0)	75 (50.7)	37 (25.0)
			SGA	43	58.8±6.3	27 (63.8)	22 (51.2)	22 (51.2)	16 (37.2)
Jung et al. (22), 2022	Korea	RS	ETI	5592	NS	3606 (64.5)	2910 (52.0)	1372 (24.5)	1064 (19.0)
			SGA	38.391	NS	24.784 (64.6)	19.903 (51.8)	9124 (23.8)	7351 (19.1)
Kajino et al. (23), 2011	Japan	PS	ETI	1679	73.8±14.6	1021 (60.8)	NS	686 (40.9)	278 (16.6)
			SGA	3698	71.9±15.2	2291 (62.0)	NS	1472 (39.8)	622 (16.9)
Kim et al. (24), 2019	Korea	RS	ETI	121	73.0±3	71 (58.7)	70 (57.9)	62 (51.2)	21 (17.4)
			SGA	965	68.5±3.7	673 (69.7)	536 (55.5)	524 (54.3)	207 (21.5)
Lee et al. (25), 2022	Taiwan	RCT	ETI	517	72.1±16.4	330 (63.8)	219 (42.4)	374 (72.3)	95 (18.4)
			SGA	419	74.7±38.1	239 (57.0)	200 (47.7)	290 (69.2)	52 (12.4)
Lesnick et al. (26), 2021	USA	RCT	ETI	1224	62.3±6.9	738 (60.3)	578 (47.2)	579 (47.3)	214 (17.5)
			SGA	1418	64.2±4.1	881 (62.1)	621 (43.8)	659 (46.5)	248 (17.5)
Lin et al. (27), 2014	Taiwan	RS	ETI	44	72.3±6.9	32 (72.7)	19 (43.2)	16 (36.4)	NS
			SGA	1384	73.5±4.0	909 (65.7)	607 (43.9)	322 (23.3)	NS
Lupton et al. (28), 2019	USA	RS	ETI	1299	64.0±23.0	780 (60.0)	604 (46.5)	613 (48.6)	214 (16.5)
			SGA	1353	64.0±23.0	846 (62.5)	604 (44.6)	629 (48.8)	253 (18.7)
Nakayama et al. (29), 2023	Japan	PS	ETI	413	77.3±3.2	245 (59.2)	291 (70.5)	188 (45.5)	38 (9.2)
			SGA	1114	75.5±3.0	667 (59.9)	704 (63.2)	523 (46.9)	207 (18.6)
Okubo et al. (30), 2022	USA	RCT	ETI	776	64.5±3.8	467 (60.2)	290 (37.4)	439 (56.6)	132 (17.0)
			SGA	923	64.3±3.8	584 (63.3)	332 (36.0)	486 (52.7)	180 (19.5)
Rabitsch et al. (31), 2003	Austria	RCT	ETI	83	54.7±20.4	64 (77.1)	NS	8 (9.6)	74 (89.2)
			SGA	89	60.7±16.2	67 (75.3)	NS	11 (12.4)	78 (87.6)
Ryan et al. (32), 2021	US	RS	ETI	767	27±47.5	526 (68.6)	184 (24.0)	348 (45.4)	67 (8.7)
			SGA	458	41±36.5	331 (72.3)	127 (27.7)	158 (34.5%)	45 (9.8)
Shin et al. (33), 2012	Korea	RS	ETI	250	61.7±17.0	160 (64.0)	83 (33.2)	10 (4.0)	32 (12.8)
			SGA	391	61.0±16.9	270 (69.1)	136 (34.8)	16 (4.1)	32 (8.2%)

Table 1. Continued

Study	Country	Study design	Study groups	No.	Age	Sex, male, n (%)	Witnessed arrest, n (%)	Bystander CPR, n (%)	Shockable rhythm, n (%)
Sulzgruber et al. (34), 2018	Austria	PS	ETI	793	67.5±3.7	515 (64.9)	493 (62.2)	315 (39.7)	243 (30.6)
			SGA	404	68.3±3.2	267 (66.1)	230 (56.9)	197 (48.8)	94 (23.3)
Tanabe et al. (35), 2013	Japan	RS	ETI	16.054	73.8±15.3	9397 (58.5)	7126 (44.4)	6722 (41.9)	1201 (7.5)
			SGA	34.125	72.1±15.9	20.657 (60.5)	13.413 (39.3)	12.930 (37.9)	2943 (9.8)
Tjerkaski et al. (36), 2022	Multicountry	Post hoc sub-analysis of RCT	ETI	126	64.8±10.7	98 (77.8)	NS	78 (61.9)	42 (33.3)
			SGA	67	65.5±12.2	49 (73.1)	NS	40 (59.7)	22 (32.8)
Wang et al. (37), 2018	USA	RCT	ETI	1499	64.3±3.8	901 (60.1)	708 (47.2)	709 (55.4)	270 (18.0)
			SGA	1505	64.3±3.8	928 (61.7)	691 (45.9)	698 (55.5)	301 (20.0)

ETI: Endotracheal tube intubation, NS: Not specified, PS: Prospective study, RCT: Randomized controlled trial, RS: Retrospective study, SGA: Supraglottic airway device, CPR: Cardiopulmonary resuscitation

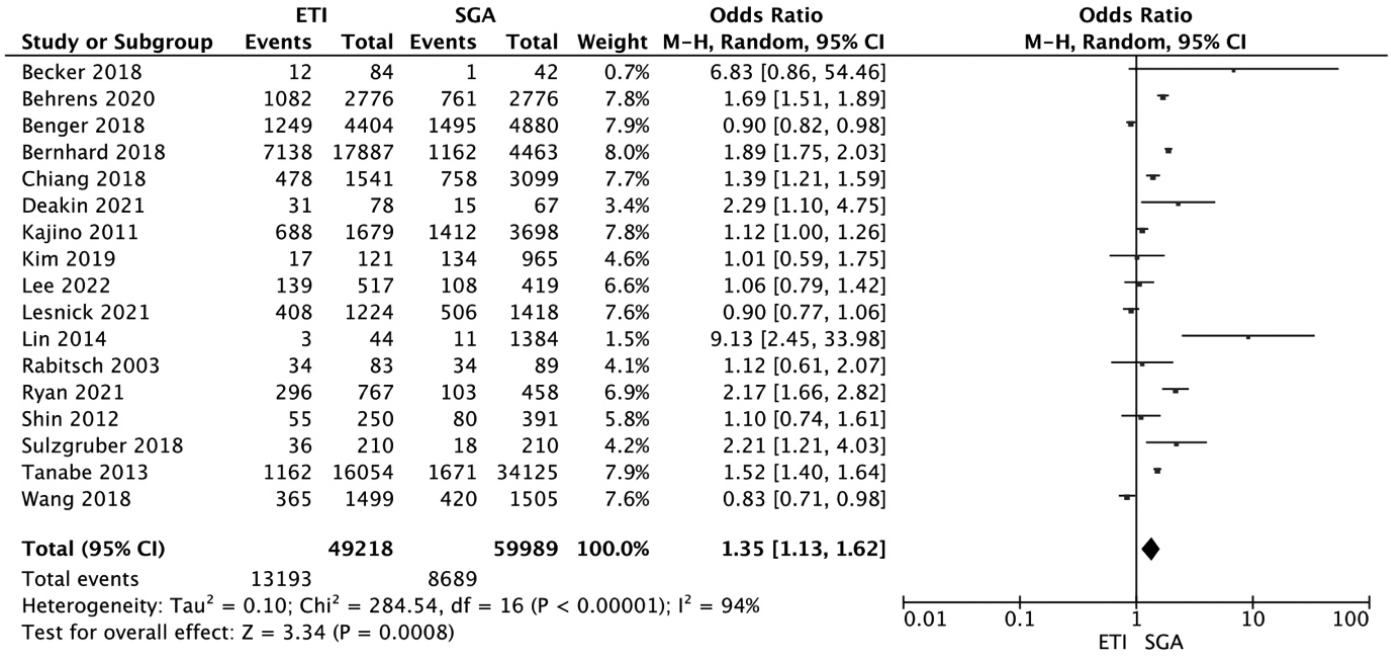

Figure 2. Forest plot of prehospital return of spontaneous circulation among ETI and SGA groups. The center of each square represents the odds ratios for individual trials, and the corresponding horizontal line stands for a 95% confidence interval. The diamonds represent pooled results

ETI: Endotracheal intubation, SGA: Supraglottic airway device, CI: Confidence interval

in Table 1. Of the included articles, eight were conducted in the US, three each in Germany, Taiwan, Korea and Japan, two in England, and two in Austria. In addition, one study was an international survey covering Belgium, the Czech Republic and Sweden. Both prospective and retrospective studies had low RoB (Supplementary Figures 1-4).

Summary of Studies

Our analysis included data from 160,071 out-of-hospital cardiac arrest cases. Among them, 57,921 airways were protected with ETI, while in 102,150 cases with SGA. Patient characteristics are shown in Table 2. In the analysis of airway management outcomes, the odds of being male were marginally lower in the ETI group (62.2%) compared to the SGA group (63.1%), with an odds ratio of 0.94 (95% CI, 0.92 to 0.97, p<0.001) and low study heterogeneity (I^2=23%). Age did not significantly differ between ETI and SGA groups, with specifics on mean and standard deviation not provided. Witnessed arrests occurred in 47.5% of ETI cases versus 46.6% for SGA, with an OR of 1.04 (95% CI, 0.97 to 1.11, p=0.23) and moderate heterogeneity (I^2=75%).

Bystander CPR was provided in 39.2% of ETI cases against 33.5% in SGA, with an OR of 1.12 (95% CI, 0.98 to 1.27, p=0.09) and high heterogeneity (I^2=94%). These findings suggest that demographic factors and prehospital interventions like witnessed arrest and bystander CPR show no significant differences between the ETI and SGA groups, despite varying levels of heterogeneity across studies.

Meta-analysis Outcomes

Prehospital ROSC was assessed in 6 studies involving 7,712 participants for ETI and 42,330 for SGA (Figure 2). The event rate was 33.1% for ETI compared to 35.4% for SGA. The odds ratio (OR) was 1.25, with a 95% CI of 0.87 to 1.79, indicating no significant difference between the groups (p=0.23). Heterogeneity across trials was high (I^2=88%).

SHA was evaluated in 17 studies with 49,218 participants for ETI and 59,989 for SGA, revealing an event rate of 26.8% for ETI and 14.5% for SGA (Figure 3). The OR was 1.37 (95% CI, 1.32 to 1.42), with a p value of less than 0.001, suggesting a significant difference favoring ETI. However, heterogeneity remained high (I^2=94%).

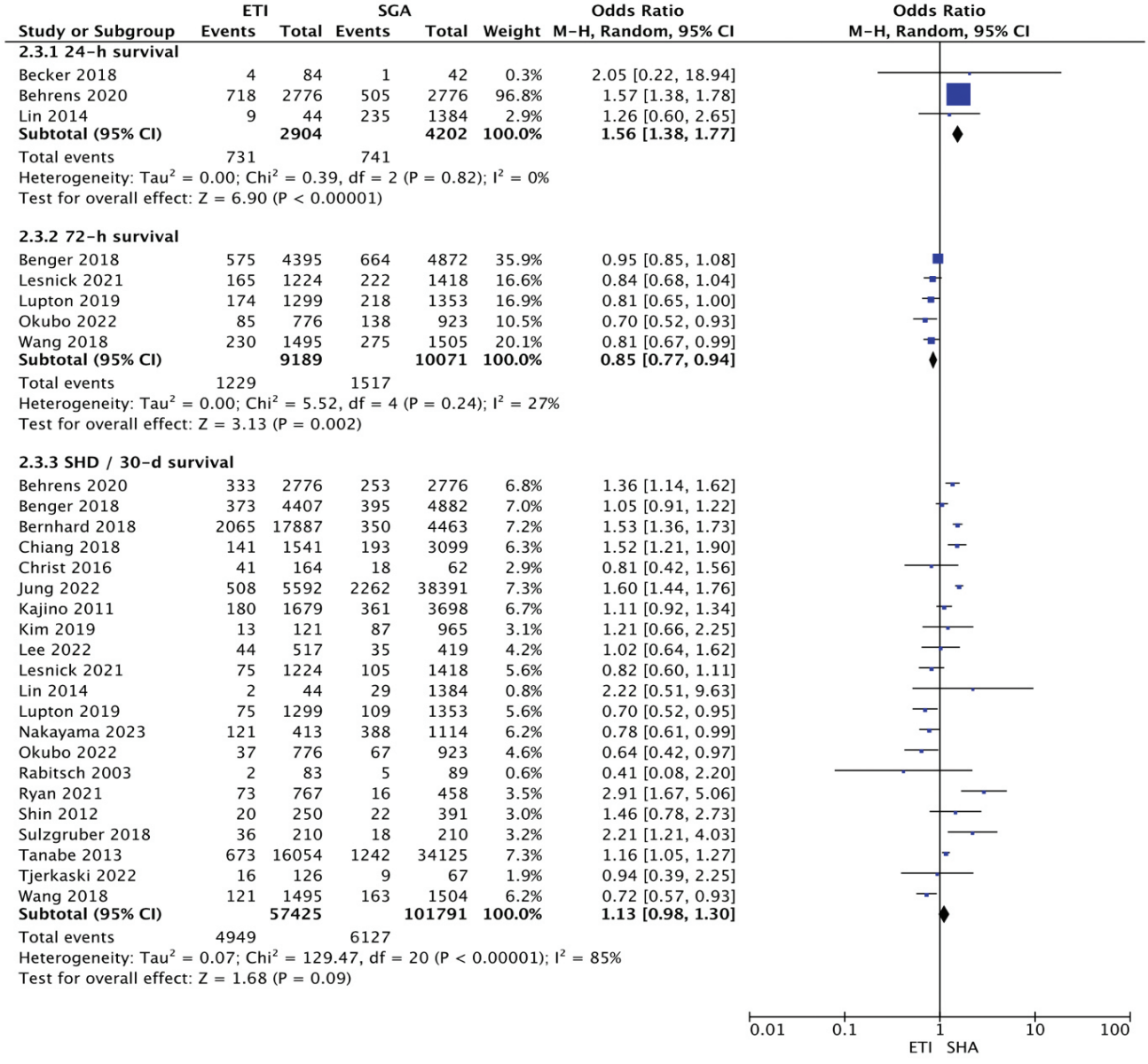

Figure 3. Forest plot of survival to hospital admission among ETI and SGA groups. The center of each square represents the odds ratios for individual trials, and the corresponding horizontal line stands for a 95% confidence interval. The diamonds represent pooled results

ETI: Endotracheal intubation, SGA: Supraglottic airway device, CI: Confidence interval, SHD: Survival to hospital discharge

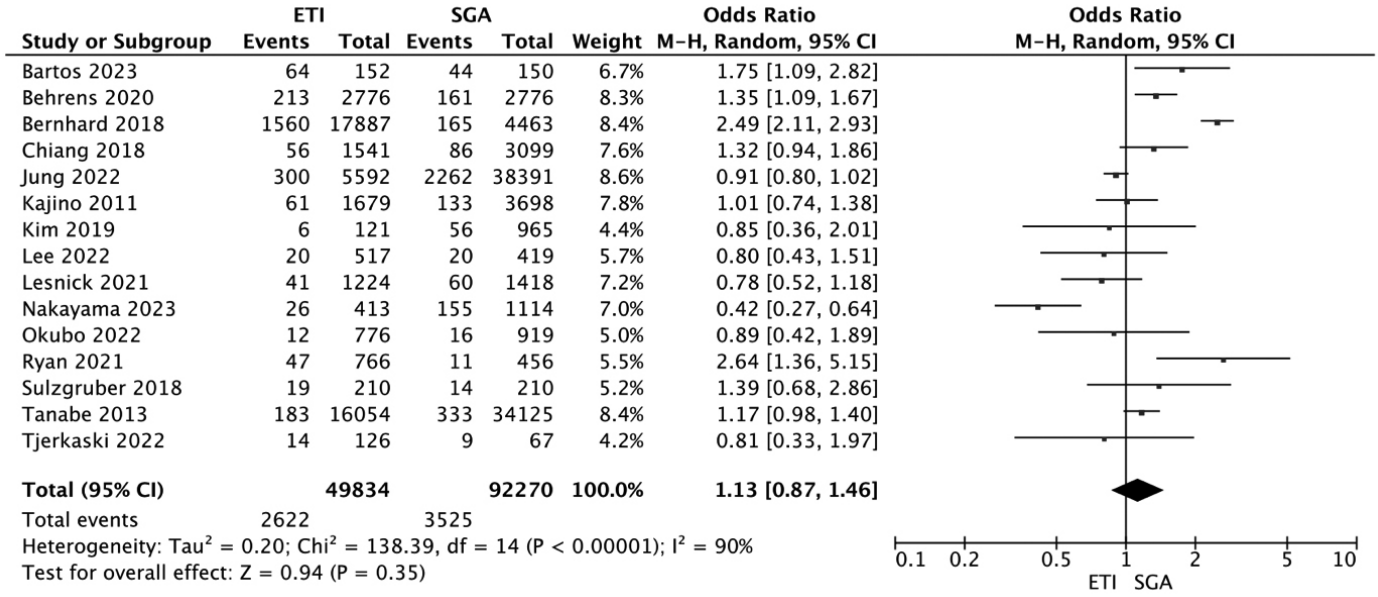

Figure 4. Forest plot of survival periods (a) 24-h survival rate; (b) 72-h survival rate; survival to hospital discharge/30-d survival rate among ETI and SGA groups. The center of each square represents the odds ratios for individual trials, and the corresponding horizontal line stands for a 95% confidence interval. The diamonds represent pooled results

ETI: Endotracheal intubation, SGA: Supraglottic airway device, CI: Confidence interval

Table 2. Baseline of patient characteristics among included trials

Outcome	No. of studies	Event/participants or mean ± SD		Events		Heterogeneity between trials		p value for differences across groups
		ETI	SGA	OR or MD	95% CI	p value	I^2 statistics	
Sex, male	25	36.019/57.921 (62.2%)	64.492/102.150 (63.1%)	0.94	0.92 to 0.97	0.15	23%	<0.001
Age, years	23	70.03±16.91	71.05±15.24	0.58	-0.02 to 1.18	<0.001	97%	0.06
Witnessed arrest	21	26.426/55.678 (47.5%)	45.559/97.849 (46.6%)	1.04	0.97 to 1.11	<0.001	75%	0.23
Bystander CPR	24	22.397/57.132 (39.2%)	33.945/101.284 (33.5%)	1.12	0.98 to 1.27	<0.001	94%	0.09

CI: Confidence interval, CPR: Cardiopulmonary resuscitation, ETI: Endotracheal intubation, MD: Mean difference, OR: Odds ratio, SGA: Supraglottic airway device, SD: Standard deviation

24-hour survival rate among patients treated with ETI and SGA varied and amounted to 25.2% and 17.6% respectively (OR=1.56; 95% CI: 1.38 to 1.77; p<0.001; Figure 4).

For the 72-hour survival rate, 5 studies with 9,189 participants for ETI and 10,071 for SGA showed an event rate of 13.4% for ETI and 15.1% for SGA. The OR was 0.85 (95% CI, 0.77 to 0.94), with moderate heterogeneity (I^2=27%) and a p value of 0.002, favoring SGA.

SHD/30-day survival rate was reported in 21 studies including 57,425 participants for ETI and 101,791 for SGA. The event rate was 8.6% for ETI and 6.0% for SGA, with an OR of 1.13 (95% CI, 0.98 to 1.30). Despite high heterogeneity (I^2=85%), the difference was not statistically significant (p=0.09).

SHD with CPC 1-2 was assessed in 15 studies with 49,834 participants for ETI and 92,270 for SGA. The event rate was 5.3% for ETI compared to 3.8% for SGA. The OR was 1.13 (95% CI, 0.87 to 1.46), and the p value was 0.35, indicating no significant difference, with very high heterogeneity (I^2=90%).

Discussion

This meta-analysis compares the efficacy of ETI versus SGA devices in the prehospital setting, focusing on various survival outcomes. Our findings present mixed results, highlighting the complexity of choosing the optimal airway management technique in emergency situations.

In our analysis for prehospital ROSC, the difference between ETI and SGA was not statistically significant. While a slightly higher event rate was observed for SGA, the OR did not indicate significant differences between the groups. The high degree of heterogeneity (I^2=88%) may reflect variations in study protocols, patient populations, or techniques used for both procedures. Regarding SHA the significant difference favoring ETI suggests that under certain clinical conditions, intubation may provide better outcomes. Nevertheless, the extremely high heterogeneity (I^2=94%) underscores the need for cautious interpretation of these results. The SHD/30-day survival rate did not show a statistically significant difference between ETI and SGA, despite high heterogeneity (I^2=85%). This finding suggests that the immediate benefits of airway management techniques may not translate into long-term survival advantages, highlighting the importance of comprehensive post-resuscitation care. Furthermore, when assessing SHD with CPC of 1-2, no significant difference was observed, indicating that the choice of airway management technique may not significantly impact neurological outcomes, although very high heterogeneity (I^2=90%) was noted. The importance of securing airway patency in prehospital emergency care cannot be overstated, as it is a critical determinant of successful resuscitation outcomes. Both ETI and SGA devices play pivotal roles in ensuring airway management, yet they offer distinct advantages that cater to different emergency scenarios. Isolating the airway through either ETI or SGA is crucial for preventing aspiration, a common and potentially fatal complication during cardiac arrest and other emergencies. Furthermore, these airway management techniques facilitate the delivery of high-quality, uninterrupted chest compressions by allowing for asynchronous resuscitation. This approach, wherein ventilation and chest compressions are not temporally linked, can maximize cerebral and coronary perfusion by eliminating pauses in chest compressions, which are known to negatively impact survival and neurological outcomes.

The ability to provide asynchronous resuscitation underscores the strategic importance of choosing the appropriate airway management device in the prehospital setting. ETI, with its direct access to the trachea, offers a definitive airway that is most beneficial in scenarios requiring long-term ventilation, protection against aspiration, and in situations where advanced airway management skills are readily available.

ETI is recognized as a technically demanding procedure that requires a high level of skill and practice to achieve proficiency. The learning curve for ETI is steep, indicating that a significant number of attempts are needed to reach a level of competency where the success rate stabilizes. Studies suggest that to achieve a high success rate in ETI, practitioners often need to perform a substantial number of intubations under supervision. The complexity of the procedure, variability in patient anatomy, and the emergent nature of situations requiring ETI contribute to this challenging learning curve. As such, continuous training and regular practice are imperative for maintaining proficiency, particularly for providers in the prehospital setting where conditions can be unpredictable and resources limited. In contrast, the learning curve for SGA devices is generally less steep compared to ETI. SGAs are designed for ease of use, allowing for rapid and reliable airway management with minimal interruption to resuscitation efforts. The simpler insertion technique and lower skill threshold needed for effective use make SGAs an attractive option in emergency settings, especially for providers who may not perform airway management procedures frequently. However, while SGAs can be easier to learn and implement, understanding the nuances of proper placement, seal, and potential complications is essential for optimizing patient outcomes.

Study Limitations

This meta-analysis also has several limitations. The included studies showed substantial heterogeneity, which might be attributed to differences in research protocols, patient groups, or procedures. Second, significant imprecision and inconsistency lowered trust in evidence for a range of outcomes. Furthermore, there are questions regarding protocol adherence, since not all patients may get the course of care to which they were allocated. This might be explained by resuscitation time bias, which occurs when patients who fail tracheal intubation get an SGA and are predicted to have a poorer result.

Conclusion

Our analysis reveals the nuanced and context-dependent nature of airway management in prehospital emergency care. The high heterogeneity across studies suggests that factors such as provider experience, patient characteristics, and the specific emergency context significantly influence outcomes. Future research should aim to identify these moderating factors and evaluate the cost-effectiveness of ETI and SGA in various prehospital settings. Additionally, training protocols and guidelines may need to be adapted to reflect the complex decision-making process in choosing the most appropriate airway management technique.

Ethics

Ethics Committee Approval and Informed Consent: This study did not require ethical approval and informed consent as it was a systematic review and meta-analysis of previously published studies.

Authorship Contributions

Surgical and Medical Practices: M.D., Concept: M.D., Design: M.D., Data Collection or Processing: M.D., P.W., M.P., L.S., Analysis or Interpretation: M.D., Literature Search: M.D., P.W., M.P., L.S., Writing: M.D., P.W., B.C., D.K., M.P., L.S.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

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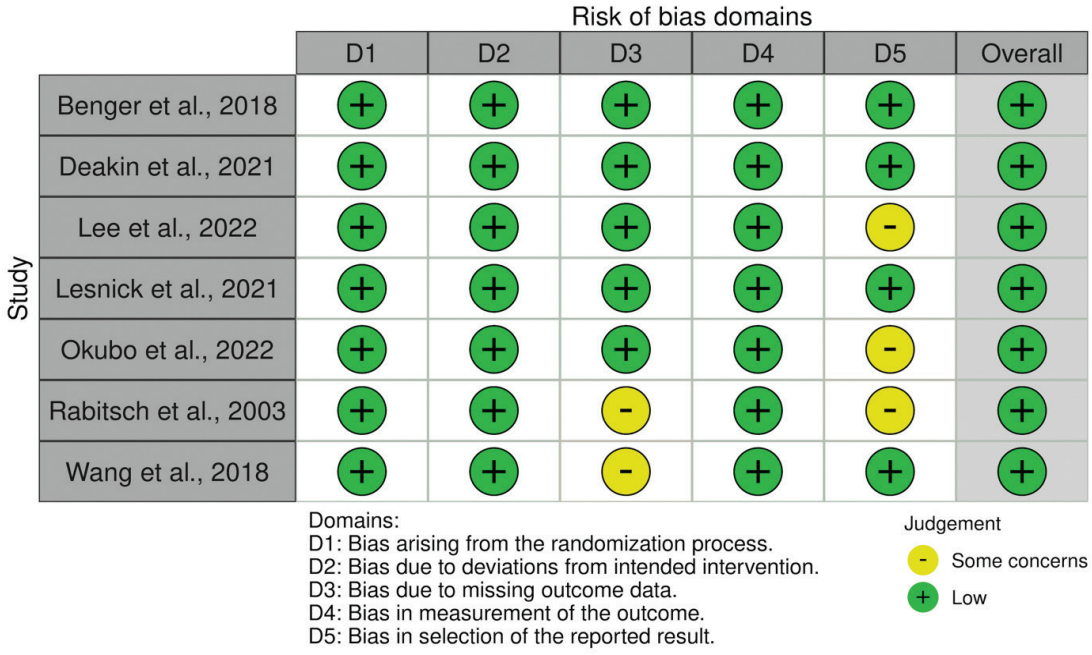
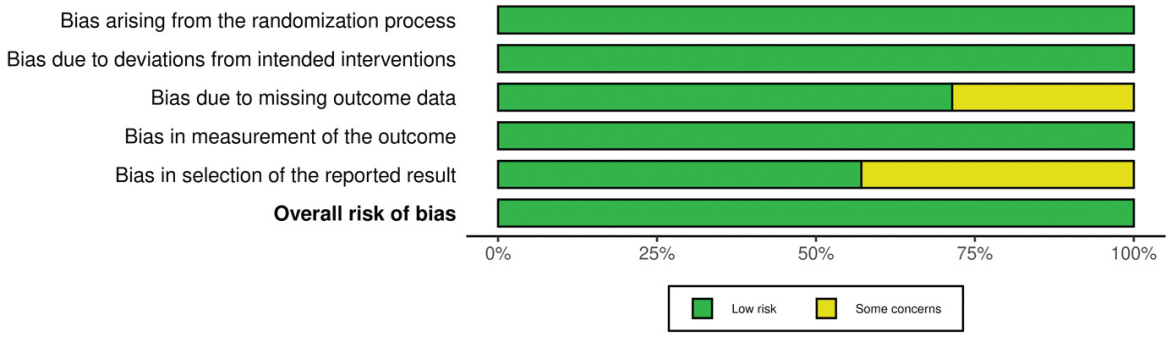
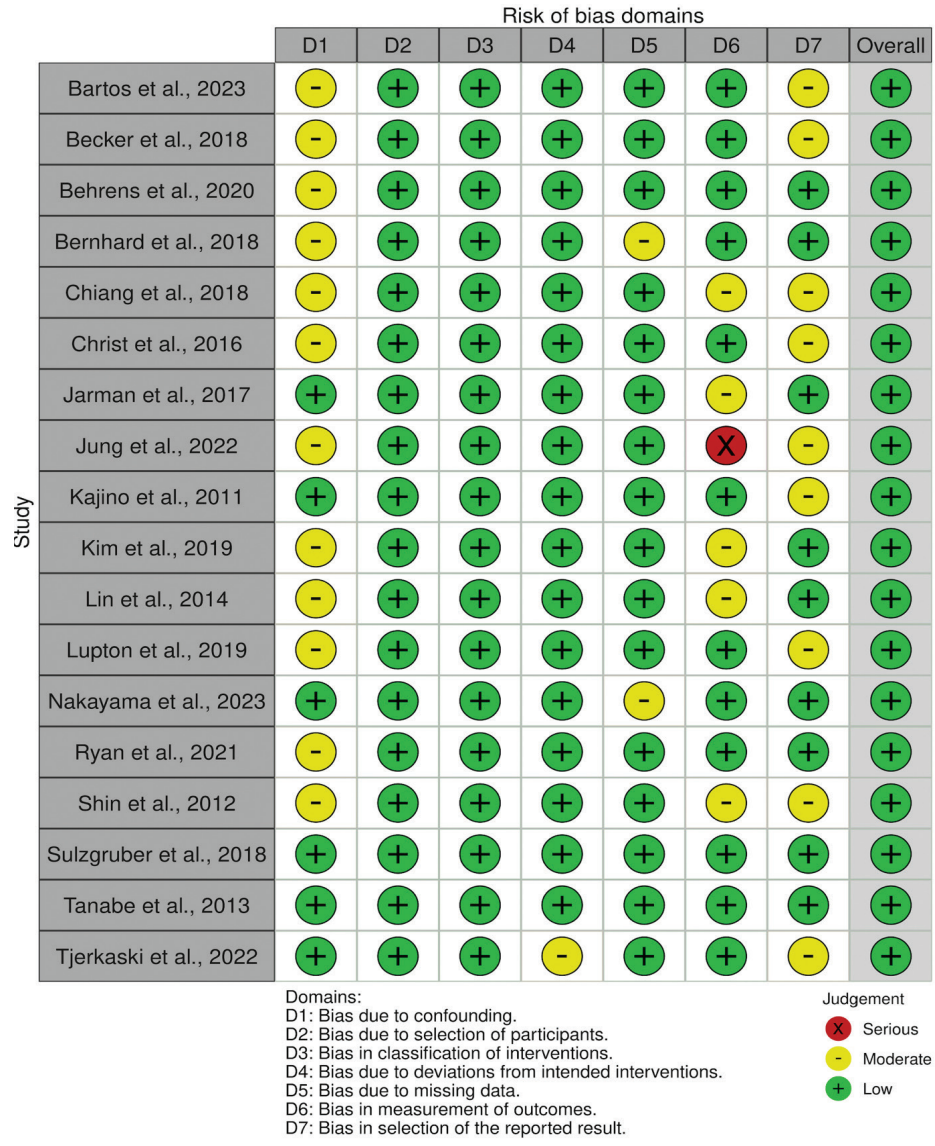


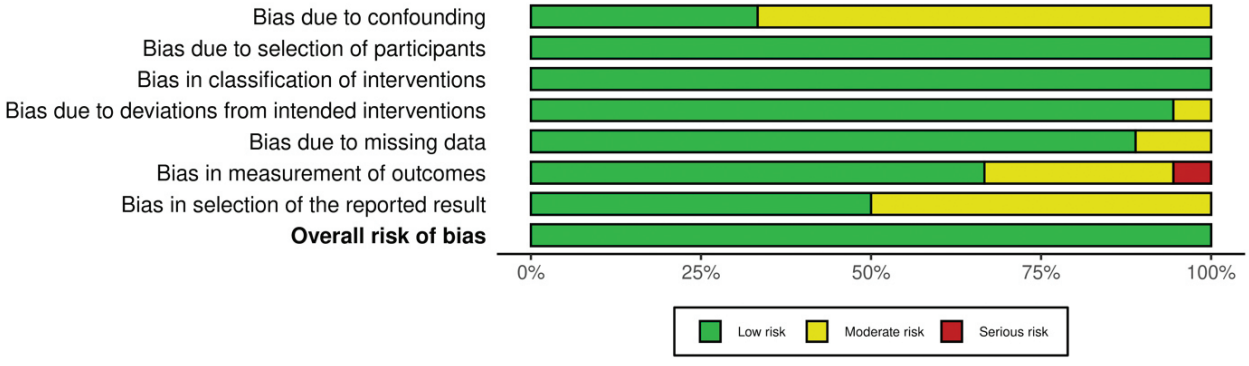
Supplementary Figure 1. A summary table of review authors' judgements for each risk of bias item for randomized study



Supplementary Figure 2. A plot of the distribution of review authors' judgements across randomized studies for each risk of bias item



Supplementary Figure 3. A summary table of review authors' judgements for each risk of bias item for non-randomized trials



Supplementary Figure 4. A plot of the distribution of review authors' judgements across non-randomized studies for each risk of bias item

EURASIAN JOURNAL OF EMERGENCY MEDICINE
Original Article
DOI: 10.4274/eajem.galenos.2024.21548
Eurasian J Emerg Med. 2024;23(2): 95-104

The Impact of Shift Work on the Lifestyle and Well-being of Emergency Physicians: A Comprehensive Examination of Eating Habits and Health Behaviors

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Abstract

Aim: Shift work causes unhealthy changes in sleep patterns, physical activity, and eating habits. We evaluated emergency physicians' eating habits and health behaviors and how shift work affects them.

Materials and Methods: A survey questionnaire consisting of 40 questions was administered to Turkish emergency physicians at the international emergency medicine (EM) congresses held in 2018 by Turkey's two major EM societies.

Results: A total of 278 emergency physicians were divided into the non-shift group (n=55) and the shift group (n=223). Most experienced depression (73.4%) and some reported sleep problems (45%) and irritability (34.2%). No shift effect was detected on most eating habits, body mass index, regular exercise, and self-perceived health status. The shift group statistically had fewer positive considerations about hospital food and was more likely to order or eat from different alternatives.

Conclusion: Emergency physicians in our study suffered from sleep problems, mood disorders, unhealthy dietary routines, and limited physical activity, which did not particularly differ by shift work. The generalizability of the findings is limited.

Keywords: Circadian rhythms, shift work, emergency physician, emergency department, eating behavior, snack consumption, lifestyle

Introduction

Human physiological functions are regulated according to the timing of the day and night, as in many plants and animals. These behavioral day-night cycles, called circadian rhythm (diurnality), occur at the level of hormones, metabolism, and molecules. With the advent of industrialization and technology and the lifestyle changes associated with them, circadian rhythm disorders (i.e., biological rhythm desynchronization) have emerged. The acute form of these disorders is referred to as the "jet lag" phenomenon, whereas the chronic form is usually observed in shift workers who are exposed to different working hours that are incompatible with the circadian rhythm. Shift work increased significantly with the industrial revolution and has become widespread enough to affect approximately 25-30% of the workforce (1,2).

The macroeffects of shift work are predominantly seen in sleep patterns, physical activity, and eating habits. Shift work-related nutritional disorders are important risk factors for shift workers' general health and well-being (3-5). Although the associated mechanisms are not fully understood, evidence shows that shift work increases the risk of obesity, diabetes, gastrointestinal diseases, cardiovascular diseases, metabolic syndrome, and even vulnerability to DNA damage (6-9).

Because the healthcare system frequently represents uninterrupted patient care, shift work in medicine is as common

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Received: 08.06.2023
Accepted: 13.03.2024

Cite this article as: Vural S, Coşkun F. The Impact of Shift Work on the Lifestyle and Well-being of Emergency Physicians: A Comprehensive Examination of Eating Habits and Health Behaviors. Eurasian J Emerg Med. 2024;23(2): 95-104.

as in the industry. Health organizations have their own shift systems, which can differ among institutions and departments. It can have many patterns according to pattern recurrence (e.g., rotating or fixed) and work duration. The most common is a three-shift system (3x8 h) composed in morning, evening, and night shifts. Emergency departments (EDs) are the most prominent unit of healthcare where shift work occurs. The literature contains many reports on shift work effects. However, most of the populations in those papers are industrial workers, health care workers, or nurses (3-5,7-9). Studies conducted on physicians, on the other hand, are relatively limited (10-13). Accordingly, the present study aimed to explore the eating habits and health behaviors of emergency physicians (EPs) and to determine whether the eating habits and health behaviors differ between shift and non-shift-working EPs.

Materials and Methods

Study Design

This cross-sectional study was approved by the Yozgat Bozok University Institutional Ethical Committee (decision number: 2017-KAEK-189_ 2018.09.128_03, date: 12.09.2018). A survey questionnaire in Turkish consisting of 40 questions and body measurements was used to determine the lifestyle and eating habits of the study population (Supplementary 1). The survey included four main parts: (1) Demographic data, (2) General health and exercise status, (3) Food and food access in the workplace, and (4) Eating habits and lifestyle.

Study Participants

The survey was conducted on volunteer physicians among Turkish participants of international emergency medicine (EM) congresses held by Turkey's two major EM societies. These congresses were the 5th International Emergency Medicine and Family Medicine Congress in Cyprus and the 6th Eurasian Congress of Emergency Medicine in Turkey in 2018. Surveys were distributed to willing physicians during breaks between sessions. Participants were asked to complete the survey. The inclusion criteria were working in an ED as a physician, actively shift working for shift working participants, and having quit shift work for more than five years for non-shift working participants. The participants who did not complete the entire survey were excluded from the study. A total of 320 participants completed the survey. Data from 42 participants were excluded because of incomplete responses. Analyses were conducted on 278 records.

Measurements

Measurements of height and body weight were used to calculate body mass index (BMI). The BMI thresholds of underweight, healthy, overweight, and obese were ≤18.5, 18.5-24.9, 25-29.9, and ≥30-39.9 kg/m^2, respectively. In addition, the measurement of waist circumference was recorded. The threshold for abnormal waist circumference was set as >94 cm for men and >80 cm for women.

The measurements were completed according to the statements of the physicians who had these measurements taken within the last 3 months. If participants had not undergone these measurements in the last 3 months, the values observed by rater 1 (SV) were recorded using the same scale and tape equipment.

Statistical Analysis

Continuous variables were expressed as median (interquartile range) and categorical variables as numbers (n) and percentages (%). Statistically significant differences between groups were calculated using the Mann-Whitney U test. The chi-square test was used to evaluate the differences between groups for categorical variables. All data were analyzed using SPSS statistics version 25.0 (SPSS Inc., IBM Corp., Chicago, IL, USA). A p value <0.05 was considered statistically significant.

Results

Demographic Data

Among the 278 participants whose data were analyzed, 265 (95.3%) had a degree in EM, whereas 13 (4.7%) were general practitioners. The demographic distribution of the study group and the subgroups were shown in Table 1. The median age was 34 (13) years, and the male/female ratio was 2.5. According to the working schedule, the study population was divided into the non-shift group (n=55, 19.8%) and the shift group (n=223, 80.2%). The shift group was younger than the non-shift group (p=0.001). No difference was found in terms of gender distribution among the subgroups (p=0.148). The non-shift group had a median of 6 (3) years of shift work history before a non-shift schedule during their professional life.

Body Mass Index, Waist Circumference, and Weight Changes

The median BMI of participants was 25.5 (5) kg/m^2, which did not differ for the subgroups (p=0.1) (Table 1). The prevalence of being overweight and obese were 43.5 vs. 14.7%, and the prevalence of having an abnormal waist circumference was 35.3%. The non-shift group had a higher waist circumference than the shift group [90 (26) vs. 82 (24) cm, p=0.025]. Approximately half of the participants (n=133, 47.8%) reported gaining weight [7 (5) kg] after starting ED work. Only 26 physicians (19.5%) claimed that their weight gain was intentional.

Mood Alterations, Lifestyle Changes, and Health Status

While most of the physicians experienced depression (73.4%) after they began to work in the ED, some reported sleep problems (45%)

and irritability (34.2%) (Figure 1). Only 30.9% of the participants claimed that they had no lifestyle changes or mood alterations. However, no difference was found between the shift and non-shift groups regarding sleep problems, depression, or irritability (p=0.492, 0.055, and 0.569).

The rates of tobacco and alcohol use were 46.8% and 43.2%, respectively. The shift group had a higher smoking rate but a similar alcohol drinking rate compared with the non-shift group (p=0.024 and 0.095, respectively).

The exercise was a routine activity for only 20.9% (n=58) of the participants. In contrast, 28.8% (n=80) reported no routine exercise in their life. Shift work did not differentiate EPs in terms of exercise (p=0.61)

The self-perceived health status of the physicians had a median of 7 (3) within a 10-point scale and did not differ across the shift groups (p=0.516).

Perceptions and Attitudes Toward the Food Provided by Hospital Catering Services

The survey included some questions regarding the perceptions and attitudes toward the food provided by the hospital catering service (HCS) and the accessibility of alternative food in the hospital environment (Figure 2). The general perceptions about hospital meals were mainly not positive, especially in the shift group. The shift group physicians were less likely to believe that HCS served healthy, nutritious, and tasty food or used high-quality ingredients with hygienic conditions than the non-shift group (p=0.001, 0.001, 0.001, and 0.001, respectively). Moreover, EPs in the shift group reported that the timing of meals was not consistent with the work schedule more than in the non-shift group (p=0.001). Some participants preferred to order in or eat outside for main courses (21.6%) and snacks (27.3%). These tendencies were more common in the shift group than in the non-shift group (p=0.001 and 0.001).

Table 1. The demographic distribution of the study group and the subgroups

	Non-shift group (n=55)	Shift group (n=223)	The total (n=278)	p value
Sex (n, %) - Male - Female	 43 (78.2) 12 (21.8)	 156 (70) 67 (30)	 199 (71.6) 79 (28.4)	0.148
Age [median (IQR)]	46 (39.3-49.8)	32 (28-37)	34 (29-42)	**0.001**
BMI [median (IQR)] - Underweight (≤18.5) (n, %) - Normal range (18.5-24.9) - Overweight (25.0-29.9) - Obese (≥30)	27.8 (23.5-29.8) 0 20 (18) 24 (19.8) 11 (26.8)	25.4 (23.5-28.4) 5 (100) 91 (82) 97 (80.2) 30 (73.2)	25.5 (23.5-28.4) 5 (1.8) 111 (39.9) 121 (43.5) 41 (14.7)	0.1
Waist circumference	90 (77-104.3)	81 (72-96)	84 (73.5-98)	**0.025**
Number of night shifts	-	8±3		
Living condition (n, %) - With someone - Alone	 42 (76.4) 13 (23.6)	 157 (70.4) 66 (29.6)	 199 (71.6) 79 (28.4)	0.241
Workplace - University faculty - Teaching hospital - State hospital - Others	 34 (31.5) 2 (2) 3 (7) 16 (59.3)	 74 (68.5) 98 (98) 40 (93) 11 (40.7)	 108 (38.8) 100 (36) 43 (15.5) 27 (9.7)	
Working position - Academician - Non-academic	 31 (56.4) 24 (43.6)	 24 (10.8) 199 (89.2)	 55 (19.8) 223 (80.2)	**0.001**
Total working in ED (year) - Less than 1 - 1-5 - 5-10 - More than 10	 0 (0) 5 (9.1) 17 (30.9) 33 (60)	 17 (7.6) 86 (38.6) 83 (37.2) 37 (16.6)	 17 (6.1) 91 (32.7) 100 (36) 70 (25.2)	

ED: Emergency departments, BMI: Body mass index, IQR: Interquartile range

Snack Consumption and Missing/Skipping Meals

Sixty-two EPs (22.4%) stated that they did not consume any snacks at work. Among the respondents who consumed snacks, the most popular snacks were high calorie foods (e.g., chips, biscuits, chocolate, cracker, or dessert - 38.6%) and fast food (17.3%). In contrast, only 21.7% reported consuming salad, fruit, or fiber-containing foods. Regarding the snacks they consumed at home, most participants preferred salad, fruit, or fiber-containing foods at home (62.6%). The shift and non-shift groups did not differ regarding snack consumption at work and home (p=0.61 and 0.081, respectively).

Missing or skipping meals was common in the workplace (40.3%) but not during the daily routine outside work (15.5%). The shift group had a statistically higher rate of missing or skipping meals than the non-shift group (p=0.006). The main reasons for missing or skipping meals in the workplace were the ED workflow (n=245), disliking hospital food (n=215), and the intention to lose weight (n=57).

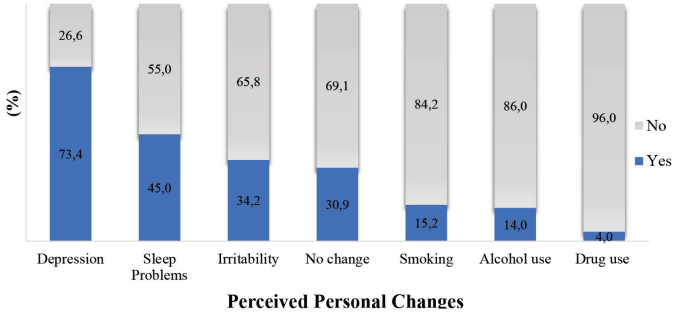

Figure 1. The stacked bar chart of the perceived personal lifestyle changes of the physicians after starting to work in the emergency departments

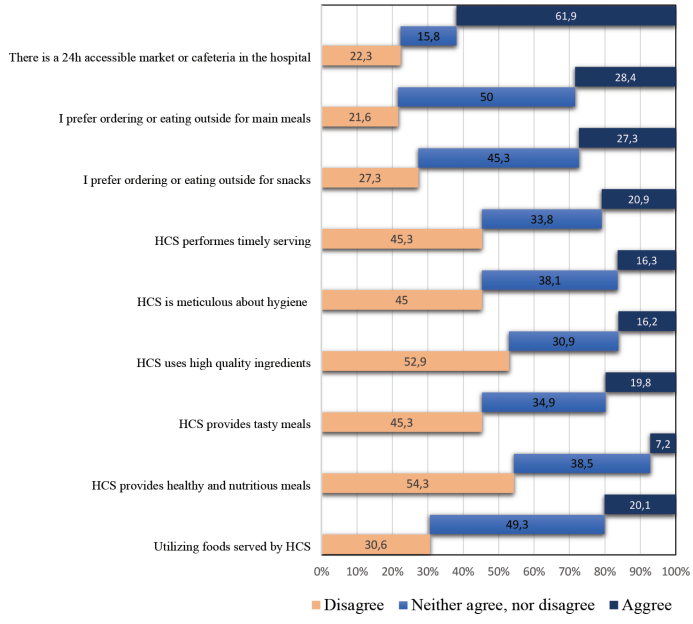

Figure 2. The stacked bar chart of the perceptions, attitudes towards the food provided by hospital catering service, and accessibility of alternative food in the hospital environment in the emergency departments

HCS: Hospital catering service

Discussion

Our findings indicated that EPs had a high BMI and an overweight range. In addition, the smoking rate was very high, and routine exercise was not a common lifestyle choice for EPs. Healthy snacking was mainly achievable at home compared with the workplace. Moreover, BMI did not differ by shift work status as well as self-perceived health status, mood alterations, physical activity, consumption of food provided by HCS, or snack consumption. However, the shift group had more negative perceptions about the food supplied by HCS and was more likely to skip or miss meals at work.

EDs are the most chaotic and stressful hospital units that must provide acute, qualified, and unbiased health care. To provide this service uninterruptedly, healthcare workers in EDs generally work in shifts. There is no national or international age cut-off for eliminating overnight shifts for EPs, but we believe that shift work is not effectively sustainable throughout the entire working life. Strategies for keeping experienced and academic EPs in acute patient care are mandatory with a more feasible working schedule. Our demographic data represented some insights into the EP profile. First, most of our sample consisted of shift-working non-academic physicians working in EDs for less than 10 years. On the other hand, the non-shift group had a more balanced distribution across academics and non-academic physicians with a higher age median (46 vs. 33 years old) and with more ED working experience, more than 10 years, probably due to including more academics.

The adverse health effects of shift work have been reported from many aspects, such as body composition, chronic diseases, sleep quality, psychological disorders, well-being, physical activity, and eating habits (1-11). As for the physicians' weight, to begin with, the literature has some contradictory findings. An animal study showed that shift work, imitated by a rotating light cycle, promoted weight gain and hepatic lipid accumulation (14). BMI ≥30 kg/m^2 for obesity was reported to have a positive relationship between obesity and shift work by a recent meta-analysis (5). Similarly, a cross-sectional survey reported that the duration of shift work was positively associated with the prevalence of overweight/obesity in nurses (15). However, they found no association between current shift work and BMI. Similar to this finding, we did not find a difference in BMI between shift- and non-shift-working physicians. Studies comparing health professionals' weight to general populations generally report

that obesity and overweight status are similar to the general population. For example, Horton Dias and Dawson (16) reported that the overweighted shift working nurse ratio was similar to that of the general American population. A Medscape lifestyle report on EPs showed that 42% were overweight to obese, with an obesity prevalence of ~7% (17). Our findings showed a similar overweight ratio, but only obesity was much more common in our population. Compared with the 2019 national BMI data in the Turkish population, physicians in our study tended to be overweight (18). However, obesity was less common among physicians compared with the national distribution.

Physicians are expected to have favorable or healthy lifestyle habits because of their medical education and role models for patients. One study showed that non-smoking physicians who exercised at least one day a week were more likely to recommend lifestyle interventions described by the National Hypertension Guidelines (12). It may suggest that the healthier the physician, the more rational and health-oriented the patient lifestyle counseling will be. However, the smoking rates reported in Bahrain, Japan, and the United States ranged from 5.7% to 16.2%, which were much lower than those in our study population (19-21). A recent meta-analysis reported that the smoking prevalence among physicians was around 21%, which was still lower than our results (22). Unfortunately, the smoking rate among Turkish EPs was higher than that in the general population of Turkey (23). The other parameters regarding health behaviors also have contradictory results. For example, the literature showed higher alcohol consumption rates among physicians than in our sample, which may be related to religious tendencies (19,21).

Regular exercise is undoubtedly an essential step for a healthy life. In the United States, 57-77% of EPs exercise routinely and rate their health 93%, which were far higher than our findings (17). In addition to the physical aspect, Rosa et al. (24) emphasized psychological consequences, such as anxiety, stress, and depression, apart from physiological consequences in their systematic review. Another recent report reported that shift work was associated with considerable impacts on sleep, depressed mood and anxiety, substance use, impairments in cognition, lower quality of life, and even suicidal ideation (25). We found that most EPs experienced depression, sleep disorders, or irritability after working in EDs, regardless of shift work. While depression is seen in 5% of the adult population in Europe and 9% in Turkey, it may be an alarming finding that this rate was 73.4% in EPs (26).

In our study, we also comprehensively evaluated the eating habits of EPs. Evidence suggests that individuals working shifts are more prone to a sedentary lifestyle and to gain excess weight due to unbalanced food and nutrient intake (27). Chen et al. (28) found that shift work in health care workers was associated with increased calorie intake with higher fat and higher carbohydrate diets and sleep deprivation. Another similar study emphasized that shiftwork rostering, missed scheduled work breaks, and high work demands influenced the food patterns of all nurses and may have impacted fatigue as well as food intake, selection, and relative hydration (29). A study monitoring 24-h food intake during a shift and the preceding daytime found that emergency healthcare workers working during night shifts have a lower amount and quality of nutrient intake (30). Hospital food policy should support and strengthen the eating habits of the staff, but our findings showed that hospital food was not considered either desirable or nutritious. Negative perceptions about hospital food were more prominent in the shift group. The shift group had more skipping or missing meals and stated that they preferred to reach alternative food sources compared with the non-shift group. Nevertheless, multidisciplinary strategies are required to promote healthier behaviors among physicians. According to the current evidence, not all consequences of shift work should be perceived as inevitable (31-33). However, these efforts should include shift-specific measures.

Study Limitations

Our study has some limitations. First, although we set specific inclusion criteria for the non-shift group, very few physicians working in the ED work with regular daytime shifts and have a history of working in shifts. This can be considered a confounding factor, but a perfect matching control group for shift working EPs is challenging. In addition, the previous history of shift work can be suggested as one of the possible reasons why shift work does not affect many eating habits and lifestyles in this study. Second, self-reported behaviors and perceptions can be inconsistent. Lastly, the sample size may be relatively small to represent the EP community in the country.

Conclusion

Our cohort was more likely to be overweight and have an unhealthy lifestyle regarding regular exercise, self-perceived health status, and smoking. No shift effect was detected on most eating habits and BMI, regular exercise, and self-perceived health status, which can be attributed to previous shift work history. Conversely, hospital foods were not perceived as healthy, nutritious, tasty, or hygienic by EPs, which were more prominent in the shift group. This single-center study limits the generalizability of the findings. Further multicenter and international studies are required.

Ethics

Ethical Committee Approval: This cross-sectional study was approved by the Yozgat Bozok University Institutional Ethical

Committee (decision number: 2017-KAEK-189_ 2018.09.128_03, date: 12.09.2018).

Informed Consent: Survey questionnaire study.

Authorship Contributions

Surgical and Medical Practices: S.V., F.C., Concept: S.V., F.C., Design: S.V., F.C., Data Collection or Processing: S.V., F.C., Analysis or Interpretation: S.V., F.C., Literature Search: S.V., F.C., Writing: S.V., F.C.

Conflict of Interest: The authors declare that they have no conflict of interest.

Financial Disclosure: There are no financial conflicts of interest to disclose.

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Supplementary 1. Study survey

A. Demographic Data

This section is necessary to associate and analyze the opinions obtained in the research with the characteristics of the participants who contribute to the research, such as age, institution, gender, etc. The information you provide will only be used within the scope of this research.

1. Your age is_____

2. Your gender

[ ] Male [ ] Female

3. In the house I live in is_____

[ ] I live alone

[ ] I have parent/spouse/child/friend/partner

4. Currently Please tick the institution you work for.

[ ] State University [ ] training and research Hospital

[ ] Private Hospital [ ] State Hospital [ ] Private University Hospital

[ ] Other is_____

5. What is your roster position?

[ ] Assistant [ ] Expert

The university is: [ ] Dr. Lecturer Member [ ] Associate Professor [ ] Professor

EAH is: [ ] Clinic Chief [ ] Education Officer

6. What is your working system?

[ ] Day only [ ] Night only [ ] With shifts (day-night)

[ ] Day + watch [ ] 24-hour watches

7. Your Shift Hours…

[ ] 6-8 hours [ ] 12 hours [ ] 16 hours

[ ] 24 hours [ ] Other _____ Hours

8. Number of night shifts per month? is_____ night/month

9. How long have you been working in the emergency department?

[ ] Less than 1 year [ ] 1 – 5 years [ ] 6-10 years [ ] More than 10 years

10. Fill in your body measurement values. If you don't know, get help from the pollsters.

	Value
Weight	…… kg
Heigth	……cm
Waist Circumference	……cm
BMI (to be calculated later)	

B. General Health Status

11. Please tick the disease or diseases you have been diagnosed with.

In this section, you are expected to answer questions about your general health condition. The information you provide will only be used within the scope of this research.

[ ] Diabetes mellitus [ ] Hypertension [ ] Hyperlipidemia

[ ] Kidney disease [ ] Liver Disease [ ] Peptic ulcer

[ ] Anorexia [ ] Bulimia [ ] Depression

[ ] Gastritis, ulcer [ ] Anxiety [ ] Other is_____

12. Write down the medication(s) you use regularly.

_____

13. Since I started practicing medicine in the emergency department…

[ ] I lost weight …….kg [ ] voluntarily [ ] involuntarily

[ ] I gained weight …….kg [ ] voluntarily [ ] involuntarily

[ ] I am the same weight

14. Have you been diagnosed with a new disease since you started working as an Emergency Department physician?

_____

15. How long after you started practicing Emergency Department medicine did you receive this diagnosis?

_____

16. Have there been any changes in the dosages of medication you use since you started working as an Emergency Department physician?

[ ] It did not happen [ ] The dose was increased [ ] There was a dose reduction

17. (**For women**) What were your menstrual cycles like before you started ED?

[ ] It was orderly [ ] It was irregular

18. (**For women**) How did the pattern of your menstrual cycles change after you started ED?

[ ] It has become regular [ ] It has become irregular [ ] It continues as it was before

19. What changes have occurred in your life since you started working in the Emergency Department?

[ ] I have insomnia problems [ ] I started using alcohol

[ ] I became a very angry person [ ] I started using substances

[ ] I feel depressed [ ] None, life goes on as it is.

[ ] I started smoking [ ] Other: is_____

20. How healthy do you feel overall?

(1=very unhealthy, 10=very healthy)

1 ……..…...……5……10

[ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]

C. Food Services Provided in Your Hospital

In this section, we will ask you to share with us your opinions about the food services provided in your hospital, as a factor that affects your diet and eating habits, especially at your workplace. Rate, from 1 to 3, how much you agree with the following sentences and/or how often you say them.

1= Strongly Disagree / Never

2= Neither Agree nor Disagree / Occasionally

3= Strongly Agree / Always / Often

If you think about the food services at the hospital you work in	**1**	**2**	**3**
21. I always benefit from the food services provided in the hospital.			
22. I find the food served at the hospital healthy and nutritious.			
23. I think the food served in the hospital is not to my taste.			
24. I think the ingredients used in the meals served at the hospital are not good.			
25. I think that not enough attention is paid to the presentation and hygiene of the meals served in the hospital.			
26. For main meals, I order or eat food from outside instead of hospital meals.			
27. For snacks, I order or eat food from outside instead of hospital meals.			
28. The hospital where I work has a canteen that is open 24 hours a day and is accessible to me.			
29. Food services are provided in accordance with my working schedule.			

30. Tick the meals provided in your hospital.

[ ] Breakfast [ ] Lunch [ ] Dinner [ ] Snack

D. Nutrition and Lifestyle

In this section, we will generally ask questions about your eating habits and lifestyle both at your workplace and outside of it.

31. How many meals a day do you eat on working days?

_____

32. How many meals a day do you eat on days when you are not working?

_____

33. Do you skip meals on days you are not at work?

[ ] Often [ ] Sometimes [ ] Never

34. Do you skip meals while working?

[ ] Often [ ] Sometimes [ ] Never

35. Number the three most important factors that cause you to skip meals while working, 1-3, in order of importance.

[__] I can't get a hot meal due to work flow

[__] I forget

[__] I do not like the food served in the hospital

[__] I'm trying to lose weight

[__] I have no appetite

[__] Other_____

36. What kind of food do you often consume for snacks at your workplace?

[ ] I do not eat snacks [ ] Fast-food type snacks

[ ] Junk food (biscuits, chocolate, chips, etc.) [ ] Fruit, salad, etc.

[ ] Fibrous foods, Nuts, dried fruits, etc. snacks

37. What kind of food do you often consume for snacks when you are at home?

[ ] I do not eat snacks [ ] Fast-food type snacks

[ ] Junk food (biscuits, chocolate, chips, etc.) [ ] Fruit, salad, etc.

[ ] Fibrous foods, Nuts, dried fruits, etc. snacks

38. Answer the relevant fields.

	Yes	**No**	**I quit (for at least a year)**
Cigarette	At home: grain/per day Here: grains/per day		
Alcohol	Glass /per week		
Drugs	Substance used:		
Support preparation (vitamin, mineral, etc.)	Substance used:		
Legal stimulant or attention-enhancing substance (coffee, modafilin, modiodal, etc.) for your seizures.	Substance used:		
Substances that help you sleep (anxiolytics, antihistamines, sleeping pills, etc.)	Substance used:		

39. Do you exercise regularly?

[ ] Often [ ] Sometimes [ ] Never

40. What do you think are the three most important reasons why you cannot exercise regularly?

[__] Due to lack of time [__] I don't like it

[__] I forget [__] I have no energy due to seizures

[__] There is no area where I can do sports [__] Other _____

Thanks for your time.

EURASIAN JOURNAL OF EMERGENCY MEDICINE
Original Article
DOI: 10.4274/eajem.galenos.2024.90277
Eurasian J Emerg Med. 2024;23(2): 105-11

Knowledge of Adult Life Support Among Nurses at a Tertiary Hospital in Somalia

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Abstract

Aim: This study aimed to assess the knowledge level of nurses in clinics at the Somalia Mogadishu Turkey Recep Tayyip Erdoğan Training and Research Hospital concerning basic life support (BLS) and advanced life support (ALS).

Materials and Methods: A questionnaire comprising 10 questions related to demographic data and 24 objective questions assessing knowledge about BLS and ALS was administered to 104 nurses working in the hospital's clinics. The questionnaire responses were analyzed, and the results were compared across different clinics.

Results: Among the 104 participants, 48 were male and 56 were female nurses. The age distribution analysis revealed that 58 participants were aged between 26 and 30 years or older. Most (n=30) nurses were stationed in the intensive care unit. Participants with over 4 years of professional experience constituted the largest group. Female nurses demonstrated higher accuracy in survey responses than their male counterparts. The emergency medicine department yielded the highest number of correct answers based on the services provided. Significant correlations were identified between years of professional experience and correct answers to ALS questions. A noteworthy difference surfaced between the ability to effectively implement adult life support and accurate responses to the BLS survey questions.

Conclusion: Periodic informative training on adult life support should be provided to all nurses. In particular, nurses working in critical departments should be afforded opportunities to familiarize themselves with new guidelines through periodic reviews. This approach will substantially enhance knowledge levels and service quality in the application of adult life support.

Keywords: Advanced life support, basic life support, cardiopulmonary resuscitation

Introduction

Timely and efficient cardiopulmonary resuscitation (CPR) performed by healthcare professionals plays a pivotal role in the survival of individuals experiencing cardiopulmonary arrest. Despite the low overall survival rates in such situations, the prompt application of effective CPR and defibrillation significantly enhances the likelihood of survival. Basic life support (BLS) is a critical link in the survival chain and constitutes a fundamental aspect of healthcare professional training.

In the United States (US), BLS training has been recommended for all healthcare professionals since 1966, particularly those involved in resuscitation efforts. Conversely, in developing nations like Nepal, BLS is optional in training programs. However, promoting BLS knowledge within communities is crucial for saving lives and enhancing the overall quality of life. Recent BLS guidelines address shortcomings and errors in prehospital and in-hospital CPR, motivating healthcare professionals to enhance their skills (1).

BLS is vital until the patient receives appropriate medical care. Nurses and emergency medical technicians are the primary providers of BLS. Advanced life support (ALS) involves advanced techniques such as intravenous (IV) fluids, medication administration, intubation, and efforts to restore airway patency, breathing, and circulation.

ALS is typically practiced by nurses and physicians, and while the techniques used for ALS and BLS overlap, the associated

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Cite this article as: Yakar Ş, Akan AŞ, Baykan N, Mohamed HH. Knowledge of Adult Life Support Among Nurses at a Tertiary Hospital in Somalia. Eurasian J Emerg Med. 2024;23(2): 105-11.

Received: 25.12.2023
Accepted: 20.03.2024

concepts may vary across countries. The diversity in ALS and BLS concepts, coupled with variations in prehospital care due to political, geographical, cultural, and economic factors, has led to controversies in research outcomes (2).

Despite the constant emphasis on the importance of BLS, post-training studies reveal challenges in acquiring related skills. Feedback from training sessions indicates that only 1.7% of rescue breaths and 3.5% of chest compression are correctly performed. Understanding ventilation training proves challenging, and a decline in the comprehension of BLS concepts, CPR, and ventilation occurs as early as 2 weeks post-training, reaching pre-training levels within 1-2 years (3).

In the realm of ALS, guidelines were initially established in 1974 by the American Heart Association (AHA) to enhance post-cardiac arrest survival rates and improve the knowledge and skills of healthcare practitioners. Subsequent revisions, aligned with decisions from the 2010 International Liaison Committee, Consensus on Science and Treatment Recommendations (CoSTR), are recognized as the gold standard for managing cardiac arrest and other life-threatening emergencies. The CoSTR emphasizes education's role in enhancing resuscitation quality and post-cardiac arrest care. Globally, substantial financial resources are allocated to provide standardized ALS training courses, with resuscitation committees recommending the renewal of ALS training every two years (3).

Accordingly, in this study, we assessed the knowledge level of nurses in clinics at the Somalia Mogadishu Turkey Recep Tayyip Erdoğan Training and Research Hospital concerning BLS and ALS.

Materials and Methods

In this study, we engaged 104 actively practicing nurses in the Somalia Mogadishu Turkey Recep Tayyip Erdoğan Training and Research Hospital. Participants were given a questionnaire that included 24 objective questions assessing knowledge levels regarding BLS and ALS. Demographic data were also collected. Notably, administrative nurses were excluded from the study. Ethical approval for our research was obtained from the Ethics Committee of Somalia Mogadishu Turkey Recep Tayyip Erdoğan Training and Research Hospital (ethics committee decision number: 2022/472, date: 07.02.2022).

Statistical Analysis

The obtained questionnaire data were compiled, with the results expressed as median values along with the corresponding minimum and maximum values. The Shapiro-Wilk test was employed to evaluate the data distribution.

Analysis of variance between independent groups was performed using either the unpaired t-test or the Mann-Whitney U test. Group differences were further explored by applying one-way ANOVA or the Kruskal-Wallis tests.

Statistical significance was set at $p<0.05$. All statistical calculations were performed using SPSS statistical software (SPSS for Windows version 21.0; SPSS Inc., Chicago, IL).

Results

The results of our observational study analyzing the responses from 104 nurses regarding BLS and ALS based on the 2021 guidelines of the European Resuscitation Council (ERC) provided valuable insights into their knowledge and experiences.

Nurses aged between 20 and 25 years constituted 25% (n=26), whereas those aged between 26 and 30 years constituted 55.8% (n=58) of the study population. In addition, those aged 31 years and over constituted 19.2% (n=20) of the entire group.

The study involved 46.2% (n=48) male nurses and 53.8% (n=56) female nurses. The distribution of nurses across different departments was as follows: emergency medicine 12.5% (n=13), intensive care unit (ICU) 28.8% (n=30), surgery 10.6% (n=11), internal medicine 17.3% (n=18), operating room 14.4% (n=15), delivery room 6.7% (n=7), and dialysis 9.6% (n=10).

Nurses with less than 1 year of employment constituted 9.6% (n=10), those with more than 1 year and less than 2 years 20.5% (n=21), those with more than 2 years and less than 3 years 22.1% (n=23), those with more than 3 years and less than 4 years 9.6% (n=10), and those with 4 or more years of employment constituted 38.5% (n=40) of the entire study population.

While 17.3% (n=18) had never received adult life support training, 37.5% (n=39) received training at the faculty, 14.4% (n=15) received training within 1 year, 7.7% (n=8) received training more than 1 year and less than 2 years ago, 9.6% (n=10) received training more than 2 years and less than 3 years ago, and 13.5% (n=14) received training more than 3 years ago.

Our analysis also revealed that 27.9% (n=29) of the participants never read a guideline on adult life support, 24% (n=25) read the ERC 2021 guideline, 28.5% (n=30) read the AHA 2020 guideline, and 19.2% (n=20) read a guideline published before 2020.

The analysis regarding the performance of adult life support revealed that 8.7% (n=9) did not perform at all, 32.7% (n=34) performed it every weekday, 34.6% (n=36) performed it once a week, 21.2% (n=22) once a month, and 2.9% (n=3) once a year. The answers given to the three critical questions included in the questionnaire are displayed in Table 1. The demographic data

of the participants are shown in Table 2. Analysis of the answers given in the BLS and ALS questionnaires revealed no significant impact of age on the rates of correct answers. However, gender-related differences were significant (p=0.03), with female nurses showing higher accuracy in the BLS questionnaire than male nurses. The department of the nurse did not have a significant effect on the responses to the BLS-related questions.

In ALS-related questions, emergency medicine nurses were significantly more successful than internal medicine (p=0.01), delivery room (p=0.004), and dialysis nurses (p=0.006). On the other hand, ICU nurses gave a significantly higher rate of correct answers than internal medicine (p=0.005), delivery room (p=0.003), and dialysis nurses (p=0.008). Surgery nurses were significantly more successful than the delivery room (p=0.01) and dialysis nurses (p=0.02) in answering ALS-related questions. There was a significant difference (p=0.03) between the internal medicine and operating room nurses in this regard. Similarly, there was a significant difference between the operating and delivery room nurses (p=0.03).

While no significant difference was found in the distribution of years of working life for BLS-related questions, a significant difference was found (p=0.04) for ALS-related questions. The frequency of receiving adult life support training or reading the guidelines did not create a significant difference in answering BLS and ALS questions. The frequency of performing adult life support also did not significantly impact the correct answer rates in the BLS and ALS questions. The yes and no answers to the question "Do you think that all nurses should have knowledge and skills about adult life support?" did not significantly differ in answering the BLS and ALS questions. However, a significant difference (p=0.03) was observed between the yes and no answers to "If necessary, can you effectively implement adult life support?" and answering BLS questions. In contrast, no significant difference was found for the ALS questions. The answer to the question "Do you think repeating ALS training would be beneficial for nurses?" did not relate to answering BLS and ALS questions (Supplementary 1).

Discussion

CPR, involving chest compression and artificial ventilation, is a critical medical intervention to sustain blood flow to vital organs, particularly the brain. Trained healthcare professionals performing CPR contribute to a reduction in in-hospital cardiac deaths. In hospital settings, nurses often play a crucial role as first responders to identify patients experiencing cardiopulmonary arrest and initiate intervention.

Our study, an observational, cross-sectional, single-center survey, aimed to assess nurses' knowledge of adult life support. The

Table 1. Answers to three critical questions included in the questionnaire

Question	Yes	No
Do you think that all nurses should have knowledge and skills about adult life support?	59.6% (n=62)	40.4% (n=42)
If necessary, can you effectively implement adult life support?	77.9% (n=81)	22.1% (n=23)
Do you think repeating adult life support training would be beneficial for nurses?	94.2% (n=98)	5.8% (n=6)

Table 2. Results of the survey based on demographic patient data

	BLS	p value	ALS	p value
Age				
20-25	8 (3-11)	0.11	8 (5-11)	0.128
25-30	8 (5-11)		7 (3-10)	
>30	6.5 (4-10)		7 (3-11)	
Gender				
Male	7 (4-11)	**0.03**	8 (3-11)	0.364
Female	8 (3-11)		7 (3-10)	
Unit				
Emergency medicine	7 (6-11)	0.65	8 (6-10)[1,2,3]	**0.003**
ICU	8 (4-11)		8 (5-11)[4,5,6]	
Surgery	8 (4-11)		7 (6-9)[7,8]	
Internal medicine	6.5 (5-9)		6.5 (3-10)[9]	
Operating room	7 (3-11)		8 (6-11)[10]	
Delivery room	8 (6-8)		6 (3-8)	
Dialysis	7.5 (6-9)		6.5 (4-8)	
Duty period				
<1 year	7.5 (3-10)	0.278	8 (5-9)	**0.04**
1-2 years	8 (5-11)		8 (3-10)	
2-3 years	8 (4-11)		7 (6-10)	
3-4 years	7.5 (6-9)		8 (4-10)	
>4 years	7 (4-11)		7 (3-11)	
Most recent ALS training				
Never	6.5 (4-8)	0.52	7 (3-9)	0.36
At the faculty of nursing	8 (3-10)		8 (4-11)	
Before <1 year	7 (5-11)		8 (6-10)	
Before 1-2 years	8 (5-10)		8.5 (3-10)	
Before 2-3 years	7.5 (5-11)		8 (4-11)	
Before>3 years	7 (4-9)		7 (5-10)	
Most recent ALS guidelines				
Never	7 (4-9)	0.08	7 (3-9)	0.08
ERC 2021	8 (5-11)		8 (4-10)	
AHA 2020	8 (3-11)		7 (3-10)	
Published before 2020	8 (5-11)		8 (5-11)	

Table 2. Continued

	BLS	p value	ALS	p value
Frequency of ALS performance				
Never	7 (5-8)	0.5	7 (4-9)	0.18
Daily	7 (5-11)		8 (4-11)	
Often (every week)	8 (3-11)		8 (3-10)	
Not often (once a month)	8 (4-11)		7 (3-10)	
Once a year	8 (7-8)		8 (8-11)	

BLS: Basic life support, ALS: Advanced life support, ERC: European Resuscitation Council, AHA: American Heart Association, ICU: Intensive care unit
[1]The rate of correct answers to questions about ALS in the emergency medicine department was found to be significantly higher than that in the internal service (p=0.01).
[2]The rate of correct answers to questions about ALS in the emergency medicine department was found to be significantly higher than in delivery room (p=0.004).
[3]The correct answer rate to questions about ALS in the emergency medicine department was found to be significantly higher than in dialysis (p=0.006).
[4]The rate of correct answers to questions about ALS in the ICU was found to be significantly higher than that in the internal service (p=0.005).
[5]The rate of correct answers to questions about ALS in the ICU was found to be significantly higher than in delivery room (p=0.003).
[6]The correct answer rate to questions about ALS in the ICU was found to be significantly higher than in dialysis (p=0.008).
[7]The correct answer rate to questions about ALS in surgical service was found to be significantly higher than in delivery room (p=0.01).
[8]The correct answer rate of surgical service to questions about ALS was found to be significantly higher than dialysis (p=0.02).
[9]The rate of correct answers to questions about ALS in the internal service was found to be significantly lower than in the operating room (p=0.03).
[10]The correct answer rate to questions about ALS in the operating room was found to be significantly higher than in the obstetrics and delivery room (p=0.03).

mean age and gender ratio of the nurses in our study is consistent with the existing literature.

Unlike some studies, our findings indicated that female nurses provided more accurate answers to survey questions measuring knowledge about adult life support than male nurses (4).

A multicenter study evaluating CPR knowledge among healthcare workers found higher knowledge levels among cardiology, ICU, and emergency medicine department workers compared with other clinics.

In another study, it was observed that nurses working in places with cardiac risk patients were more successful in answering BLS and ALS questions than those working in other places.

Similarly, in our study, the emergency medicine department and ICU demonstrated higher success in answering survey questions than other units.

Additionally, our study revealed a positive correlation between the number of correct answers about ALS and nurses' years of experience, which is consistent with findings from previous studies (5-7).

Adult life support practices have been in place for over 50 years, and ongoing training remains crucial. Some studies suggest a decline in nurses' knowledge and skills six months after initial adult life support training, highlighting the need for recurrent training and certification (4). However, contrary to the existing literature, our study did not find a significant correlation between the frequency of training and correct responses to questionnaire questions (8).

Another study emphasizes that adult life support training is forgotten after a certain period of time; therefore, it is important to repeat the training at certain intervals (9). Another study suggested that nurses should receive frequent training on the subject (10). While most studies argue that there is a decrease in adult life support knowledge and skills over time, two different studies say that knowledge and skills are not forgotten during the working period, as in our study (11,12).

Contrary to findings emphasizing the importance of the guidelines reading for self-improvement in adult life support knowledge, our study did not reveal a significant impact (13). They found that nurses in a particular branch were quite insecure when applying BLS effectively (14). Nonetheless, our study identified a high confidence level among nurses in adult life support practices. Overall, our findings contribute to the understanding of nurses' knowledge and practices related to adult life support, emphasizing the potential impact of experience and training frequency on performance.

Study Limitations

The study has notable limitations, primarily stemming from the fact that the participating nurses served temporarily in our hospital, having been assigned voluntarily from different hospitals. Consequently, information regarding the participants' educational backgrounds and experiences was unavailable, introducing a potential source of variability. Our study was a small-volume, single-center study. Enhanced reliability and a more accurate reflection of adult life support knowledge levels could be achieved with a more extensive and diverse sample, ideally involving participants from multiple centers. Further epidemiological studies are warranted to provide comprehensive insights into the subject.

Conclusion

Our study indicates a high level of self-confidence among nurses regarding adult life support. When we scanned the literature regarding our study, we found that knowledge and skills regarding adult life support generally decrease when it is not repeated for 2 years or longer. Although we could not find any significant results regarding the repetition of training in our

study, our recommendation is; In terms of practice, it is obvious that adult life support training should be repeated at certain intervals and that it is important to read the current guideline on the subject.

Regular training for all hospital nurses, particularly those caring for critically ill patients, conducted by dedicated adult life support trainers could reduce in-hospital deaths and enhance the overall quality of adult life support practice. Implementing periodic questionnaires to measure knowledge levels within the hospital, addressing knowledge gaps, finding solutions, and implementing best practices are deemed essential contributions to the healthcare system.

Ethics

Ethics Committee Approval: Ethical approval for our research was secured from the Ethics Committee of Somalia Mogadishu Turkey Recep Tayyip Erdoğan Training and Research Hospital (ethics committee decision no: 2022/472, date: 07.02.2022).

Informed Consent: Survey questionnaire study.

Authorship Contributions

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

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

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Supplementary 1. Survey form

Hello and welcome to this survey exploring the knowledge and practice of adult life support (ALS). The survey contains questions about your demographic features in part-1(1-10) and your current knowledge of basic and advanced ALS in part-2 (11-34).

It is planned to prepare an article with the data to be obtained from the questionnaires.

Please read each question carefully and click the appropriate box (tick one box only per question).

Demographics features

1. Age ☐ 20-25 ☐ 25-30 ☐ 30-35 ☐ >35

2. Gender ☐ Male ☐ Female

3. Which unit are you working in?

☐ Emergency Department ☐ Intensive Care Unit (ICU)

☐ Internal service (service-3) ☐ Surgical service (service-1)

☐ Operating room

4. How long have you been working in this unit?

☐ <1 year ☐ 1-2 years ☐ 2-3 years ☐ 3-4 years ☐ >4 years

5. When did you attend training on Adult Life Support (ALS)?

☐ At Faculty of Nursing ☐ Before <1 year

☐ Before 1-3 years ☐ Before 2-3 years

☐ Before >3 years ☐ Never attend

6. What is the current guide you have read about ALS?

☐ European Resuscitation Council Guidelines 2021

☐ 2020 American Heart Association Guidelines

☐ ALS guidelines published before 2020

☐ Never read

7. How often do you perform ALS in your unit or hospital?

☐ Daily ☐ Often (Every week)

☐ Not often (once a month) ☐ Once a year ☐ Never

8. Do you think that all nurses should have knowledge and skills about ALS?

☐ Yes ☐ No

9. If necessary, can you effectively implement ALS?

☐ Yes ☐ No

10. Do you think repeating ALS training would be beneficial for nurses?

☐ Yes ☐ No

Basic life support	**True**	**False**
11. Ensure you, the victim, and any bystanders are safe.		
12. Open the airway; in trauma patients, you can use the head-tilt chin-lift aneura.		
13. Look, listen, and feel for breathing for no more than 5 s.		
14. If alone with an adult patient, activate the Emergency Medical Services (EMS) first and then start cardiopulmonary resuscitation (CPR).		
15. If alone with an adult patient, leave the victim to receive an automated external defibrillator (AED) if available.		
16. Compress to a depth of at least 5 cm but not more than 6 cm.		
17. Compress the chest at a rate of 120-130 min.		
18. Alternate between providing 30 compression and 2 rescue breaths.		
19. The AED will advise a shock for all cardiac arrest patients.		
20. If no shock is advised by AED or if no AED is available, continue CPR.		
21. Don't interrupt resuscitation until the victim is definitely waking up, moving, opening eyes, and breathing normally.		
22. If the patient is unresponsive and breaths abnormally, place in the recovery position.		
Advanced life support		
23. If the patient is unresponsive with absent or abnormal breathing, start CPR 30:2 and attach a defibrillator.		
24. Use a basic or advanced airway technique. Rescuers with high success should use tracheal intubation.		
25. Give low-flow oxygen during CPR.		
26. Immediately resume chest compression at non-shockable regions.		
27. Use adrenalin early for non-shockable cardiac arrest.		
28. During CPR, give 1 mg IV adrenalin every 5-10 min.		
29. Pulseless ventricular tachycardia (pVT) and pulseless electrical activity (PEA) are shockable rhythms.		
30. For biphasic waveforms, deliver the first shock with an energy of at least 150 J.		
31. Assess rhythm after giving shock, then start CPR.		
32. Assess rhythm after giving shock, then start CPR.		
33. Consider intraosseous (IO) access if attempts at IV access are unsuccessful or IV access is not feasible		
34. Stop CPR if the patient has not recovered after 15 min of resuscitation.		

EURASIAN JOURNAL OF EMERGENCY MEDICINE
Original Article
DOI: 10.4274/eajem.galenos.2024.65707
Eurasian J Emerg Med. 2024;23(2): 112-8

Analysis of the Accuracy and Quality of Information in YouTube Videos on Shoulder Dislocations and Reduction

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Abstract

Aim: Shoulder instability is common in emergency departments. Various social media platforms provide health-related information, including YouTube. This study aimed to confirm the validity and quality of information in YouTube videos on shoulder dislocations/reduction using validated tools.

Materials and Methods: A search was conducted on https: //www.youtube.com/ on February 1, 2023, using keywords "shoulder dislocations" and "shoulder reductions." Videos uploaded in the previous year were listed, and information on video features, sources, and target audiences was recorded. Quality, reliability, and accuracy were independently evaluated by emergency medicine specialists using the Journal of American Medical Association (JAMA) score, DISCERN score, and Global Quality Score (GQS). Correlation analysis was performed between the video features, GQS, JAMA, and DISCERN scores.

Results: A total of 103 videos were included, with a combined length of 37,298 s and 519,685 views. Academic institution-associated videos constituted 6.8%, whereas videos for physicians accounted for 55.3%. DISCERN scores for videos targeting physicians were higher than those for patients, but no significant differences were observed in GQS and JAMA scores (p=0.007, p=0.440, and p=0.455, respectively).

Conclusions: YouTube, although frequently used for information, does not provide highly reliable information on shoulder dislocations/reductions.

Keywords: Emergency medicine, shoulder dislocations, shoulder reduction, social media, YouTube

Introduction

Shoulder instability is common in emergency departments the emergency department and orthopedic clinic (1,2). The incidence of shoulder dislocation in the general population in North America and Europe varies from 12.3 to 26.2 per 100,000 people per year (3). With the expansion of smartphones and internet use, it is a fact that, regardless of the method applied in the emergency department, patients search for information on procedures online. Baker et al. (4) determined in their 2010 study that 30% of patients in the elective spine polyclinic group used the internet to search for information about their illnesses. Except for elective situations, in emergencies, including acute appendicitis and cholecystitis, regardless of the period between diagnosis and treatment, patients probably use the internet to find more information about their diseases (5). The increasing use of web resources to access medical information because of due to increased access to the Internet also supports this situation (6). Many social media platforms on the Internet present information on health. One such platform is undoubtedly YouTube, which embodies several free videos and is one of the main video-sharing sites (http://www.youtube.com). On YouTube, a free-access access platform, users can make comments on uploaded videos, like or dislike them, and express their opinions (7). Videos uploaded on YouTube do not go through any editorial processes and might not include information on many content owners or their origin.

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Cite this article as: Yılmaz Başer H, Kemancı A, Ulutürk M, Yılmaz A. Analysis of the Accuracy and Quality of Information in YouTube Videos on Shoulder Dislocations and Reduction. Eurasian J Emerg Med. 2024;23(2): 112-8.

Received: 29.12.2023
Accepted: 26.03.2024

Users do not have information on the validity or reliability of sources and might be exposed to misleading advertisements (8).

The educational aspect of YouTube videos for some emergency and orthopedic diseases and their treatment has been evaluated in many studies. Another point that is as important as easy access to information is to reach the right information. The aim of our study is to determine the quality of videos related to shoulder dislocations/reduction on YouTube.

Materials and Methods

Study Design and Data Collection

On February 1, 2023, a search was conducted on https://www.youtube.com/ using shoulder dislocations and shoulder reductions keywords and listed videos uploaded in the last year. Videos unrelated to shoulder dislocations, in languages other than English, and those that have commercial/advertorial purposes are left outside the study.

All videos included in the evaluation are publicly accessible on the social media website (YouTube.com), and there are no human or animal participants in the study. Therefore, although ethical board approval is not necessary, the study protocol was approved by the Bandırma Onyedi Eylül University Faculty of Medicine Clinical Research Ethics Committee (decision number: 2022/4-6, date: 21.07.2022). Additional, all patients included in this study indirectly provided written informed consent for the publication of the videos included in this study, as they uploaded them to social media platforms and/or gave permission for their upload.

Video Parameters, Quality, and Reliability Analysis

Videos were categorized based on video length (seconds), the number of views, time since upload on YouTube (days), the rate of video views, video comment counts, and video likes counts, in addition to the video source, target audience, language format, and video content. Video source was categorized into 2 groups: university/academic institution/societies or personal. The video's target audience was categorized into 2 groups: physicians or patients. The video content category was categorized into 3 groups: only theoretical, practical only theoretical, only practical, or theoretical + practical. The rate of video likes wasn't calculated because YouTube removed the public dislike count from all videos in November 2021. So Video Power Index wasn't calculated like the rate of video likes. The Journal of American Medical Association (JAMA) score developed by Silberg et al. (9) and the Global Quality Score (GQS) developed by Singh et al. (10) were used to determine the accuracy and reliability of the medical information in the videos evaluated in the scoring. JAMA score is a scoring system that measures the quality of online information using four different criteria: authorship, citation, explanation, and validity (9). The GQS is a likert scale that analyzes the usefulness of the webcast for patients, scoring the quality of the video from 0 to 5 on the based on educational value (10). These two scoring systems provide a non-specific evaluation of health-related websites. To measure the reliability and quality of information of patients and information providers in health-related videos, the DISCERN questionnaire consisting of 15 questions (where each question can receive 1-5 points) developed by Charnock et al. (11) was applied.

Statistical Analysis

During the statistical analysis of the study results, the Statistical Package for the Social Sciences version 22.0 software (SPSS Inc., Chicago, IL, USA) was used. Median, minimum, maximum, number, and percentage were used as descriptive methods. Shapiro-Wilk test was conducted to evaluate the normalcy of distribution. The chi-square test was used for comparison to categorical data. Kruskal-Wallis test was used in the comparison of averages, and the Mann-Whitney U test was used in the determination of the group that causes the difference. Pearson and Spearman rho correlation analysis were used in evaluation of correlation among parameters. The level of significance was accepted as $p<0.05$.

Results

Between February 1, 2022, and February 1, 2023, shoulder dislocations and, shoulder reduction search words were used, and videos uploaded on YouTube were included in the study. As presented on the flowchart of video choice and study design in Figure 1, a total of 124 videos were listed on the relevant dates. Five videos were left outside the study for being in a language other than English, and 16 videos were for being commercial/advertorial in purpose. After the exclusions, the remaining 103 videos were included in the study (Figure 1). The rate of commercial/advertorial videos on shoulder dislocation/reduction in this study was 12.9 observed to be 12.9%.

The total video length of the videos included in the study was 37,298 seconds (621.63 minutes), the median video length was 273 seconds (minimum: 21, maximum: 3389), and the median number of views was 227 (minimum: 1, maximum: 710.93). The number of days since upload on YouTube was a median 261 (minimum: 41, maximum: 365). The number of median likes was observed as 7 (minimum: 0, maximum: 2,300). The total video comment counts were median of 1 (minimum: 0, maximum: 250). The target audience of most of the videos was 55.3% (n=57) physicians. When the sources of the videos were evaluated, only

6.8% (n=7) videos were uploaded from university/academic institution/societies. In terms of the assessment conducted to measure the quality of the videos, the median DISCERN score was calculated as 30 (minimum: 15, maximum: 50), the GQS as 2 (minimum: 1, maximum: 5), and JAMA score as 1 (minimum: 0, maximum: 4). Classification of the videos and their descriptive statistics are presented in Table 1.

Regarding the assessment of the videos in terms of their assessment scores and video parameters in the target audience, source, content, and language format classifications; videos toward physicians were found to be significantly longer compared to videos toward patients (p=0.011). It was determined that the DISCERN scores of videos directed towards physicians were higher compared to videos towards patients but there was no difference in terms of GQS and, and JAMA scores (p=0.007, p=0.440, and p=0.455 respectively). It was observed that videos with university/academic institution/societies as video sources were longer compared to videos with personal origins (median 585 sec. vs 252.5 sec. respectively), while their DISCERN scores (median score 42 vs 29.3 respectively) and GQS (median 4 vs 2 respectively) scores were higher (p=0.03, p=0.003, and p=0.006 respectively). Regarding videos content, videos with theoretical + practical information were observed to be longer and they had higher DISCERN, GQS, and JAMA scores (p=0.015, p=<0.001, p=<0.001, and p=0.021 respectively). Regarding language format, English audio videos were observed to have higher GQS (median score 2 vs 1) and DISCERN (median score 30 vs 25) scores compared to English subtitled videos (p=0.028, p=0.041 respectively). Analysis conducted regarding scores of videos in the target audience, video source, video content, and language format classifications and video parameters is presented in Table 2.

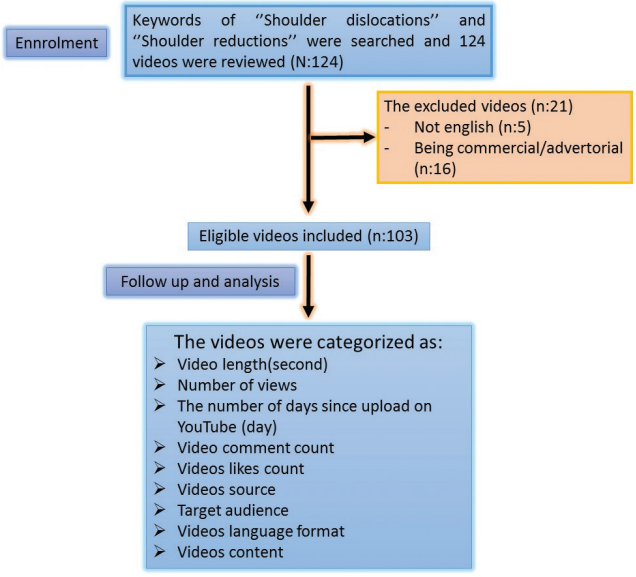

Figure 1. Flowchart of the video selection and study design

The correlation analysis conducted between video parameters and DISCERN, score, GQS, and JAMA scores is presented in Table 3. The only parameter with a significant relationship with DISCERN score, GQS, and JAMA scores was videos length (rho: 0.582, p<0.001, rho: 0.509, p<0.001 and rho: 0.301, p=0.002 respectively). While there was a strong correlation between the

Table 1. Classification and descriptive statistics of videos

Video length (second) [median, (min.-max.)]		273 (21-3389)
The number of days since upload on YouTube (day) [median, (min.-max.)]		261 (41-365)
Number of views [median, (min.-max.)]		227 (1-71093)
Videos likes count [median, (min.-max.)]		7 (0-2300)
Videos comment count [median, (min.-max.)]		1 (0-250)
Videos source	University/academic institution/societies (n; %)	7 (6.8)
	Personal (n; %)	96 (93.2)
Videos content	Only theoretical information (n; %)	53 (51.5)
	Only practical information (n; %)	21 (20.4)
	Theoretical + practical information (n; %)	29 (28.2)
Language format	English audio (n; %)	92 (89.3)
	English subtitles (n; %)	11 (10.7)
Target audience	Physicians (n; %)	57 (55.3)
	Patients (n; %)	46 (44.7)
DISCERN score [median, (min.-max.)]		30 (15-50)
GQS [median, (min.-max.)]		2 (1-5)
JAMA score [median, (min.-max.)]		1 (0-4)

GQS: Global Quality Score, JAMA: Journal of American Medical Association, min.-max.: Minimum-maximum

Table 2. Analysis of videos in terms of evaluator scores and video parameters in target audience, video source, video content and language format classification

	Target audience		p value	Videos source		p value	Videos content			p value	Language format		p value
	Physicians	Patients		university/ academic institution/ societies	Personal		Only theoretical information	Only practical information	Theoretical + practical information		English audio	English subtitles	
Video length (second) [median, (min.-max.)]	351 (21-1527)	201 (44-3389)	0.011	585 (176-1517)	252.5 (21-3389)	0.03	297 (21-3389)	127 (38-787)	351 (71-1517)	0.015	300 (26-3389)	207 (21-960)	0.057
The number of days since upload on YouTube (day) [median, (min.-max.)]	261 (52-375)	261.5 (41-361)	0.405	299 (80-375)	258.5 (41-374)	0.428	261 (49-374)	271 (52-361)	204 (41-375)	0.814	255.5 (41-375)	365 (82-363)	0.650
Number of views [median, (min.-max.)]	273 (2-71093)	195 (1-71017)	0.278	229 (2-62104)	226.5 (1-71093)	0.995	316 (1-71017)	137 (12-3862)	229 (2-71093)	0.429	228 (1-71093)	219 (42-3862)	0.765
Videos comment count [median, (min.-max.)]	1 (0-250)	1 (0-250)	0.789	0 (0-5)	1 (0-250)	0.302	1 (0-250)	1 (0-10)	1 (0-250)	0.521	1 (0-250)	1 (0-4)	0.758
DISCERN score [median, (min.-max.)]	30 (15-50)	27 (15-46)	0.007	42 (30-50)	29.5 (15-46)	0.001	27 (15-45)	27 (15-35)	34 (24-50)	<0.001	30 (15-50)	25 (17-50)	0.041
GQS [median, (min.-max.)]	2 (1-4)	2 (1-5)	0.440	4 (2-4)	2 (1-5)	0.006	2 (1-4)	2 (1-4)	3 (1-5)	<0.001	2 (1-5)	1 (1-4)	0.028
JAMA score [median, (min.-max.)]	1 (0-4)	1 (0-4)	0.455	1 (0-3)	1 (0-4)	0.631	1 (0-4)	0 (0-2)	1 (0-4)	0.021	1 (0-4)	0 (0-2)	0.051

GQS: Global Quality Score, JAMA: Journal of American Medical Association, min.-max.: Minimum-maximum

Table 3. Correlation analysis between video parameters and DISCERN score, GQS and JAMA scores

			DISCERN score	GQS	JAMA score	Videos length	Number of views	The number of days since upload on YouTube	Video comment count	Video source	Video content	Language format	Target audience
Spearman's rho	DISCERN score	Correlation coefficient	-	0.784	0.181	0.582	0.305	0.103	0.111	-0.329	0.362	-0.202	-0.266
		Sig. (2-tailed)	-	<0.001	0.064	<0.001	0.002	0.301	0.265	0.001	<0.001	0.040	0.007
	GQS	Correlation coefficient	0.784	-	0.012	0.509	0.228	0.228	0.118	-0.270	0.277	-0.217	-0.077
		Sig. (2-tailed)	<0.001	-	0.904	<0.001	0.020	0.021	0.235	0.006	0.005	0.027	0.442
	JAMA score	Correlation coefficient	0.181	0.012	-	0.301	0.130	-0.474	0.138	-0.048	-0.126	-0.193	0.074
		Sig. (2-tailed)	0.064	0.904	-	0.002	0.192	<0.001	0.163	0.633	0.206	0.051	0.458

GQS: Global Quality Score, JAMA: Journal of American Medical Association

DISCERN score and GQS, no statistically significant correlation was detected between the DISCERN score and the JAMA score, the number of days since upload on YouTube, and video comment counts (p=0.064, p=0.301, and p=0.265 respectively).

Discussion

In this study, where we examined shoulder dislocation/reductions on YouTube, which is the most frequently used platform and where people refer to social media even provision of emergency departments, the quality and information content of shoulder dislocation/reduction videos are poor compared to all scoring systems.

YouTube is a popular video-sharing platform for being free, easy to access, has a large user database, and allows viewers to communicate with the uploaders. Patients and healthcare professionals increasingly and more frequently use the internet and video-sharing sites such as YouTube to learn about their health problems (12,13). YouTube has been a reference for receive information about medical illnesses and train patients, but it might have false information (5). Therefore, it is important to know the quality of the content on these platforms because, as resources such as YouTube are researched by physicians and patients and can play a role in patients' decision-making processes (14). Patients refer to social media even in cases of medical emergency (5). Since shoulder dislocations/reductions have not been evaluated before, the results of our study will be a guiding in this field.

The length of the total viewing time of the videos included in the research and the fact that the total number of views is 519,685, the total time after uploading to YouTube is 23,103 days, and the total number of comments is 1,125 show that shoulder dislocation/reduction videos attract attention. In our study, it was noted that the DISCERN, GQS, and JAMA scores were all high only in theoretical + practical information videos. DISCERN scores, which were developed to measure the reliability and quality of information of patients and information providers in health-related videos, were also found to be high in videos originating from universities/academic institutions/societies and those targeting physicians. This situation was observed in line with similar studies in the literature (15-18). We believe that the most significant findings of this study are the statistically significant difference between DISCERN scores and video content and the moderate correlation of 0.58 between DISCERN scores and video length. Similarly, there is a low level of correlation between the number of video views and DISCERN scores. These low and medium correlations do not mean that the videos are of high quality. In the literature, some studies have concluded that videos with high-quality content are more popular, while some

studies have concluded that videos with low-quality content are more popular (19-21). In addition, studies supporting that there is no significant relationship between the number of views of videos and video quality scores also support this situation (13,22,23).

Study Limitations

This study has some limitations and need to be addressed. First, its evaluation of videos in a certain period, such as the last year, may limit generalization. Second, the fact that this study only represents the YouTube platform may limit generalization to all social media. The strengths of this study are that all validated forms of the scales were ultimately compatible with each other and this study was the first systematic review of information on YouTube videos about shoulder dislocations/reduction that use validated tools to assess the quality of the information to the knowledge of authors. Third, although making discrimination between publications of high and low quality with aid of DISCERN is possible, expressing positive or negative opinions about this scoring developed for the purpose of making decisions about patient information or treatment options may not be very meaningful for visual broadcasts such as YouTube videos.

Conclusion

Although YouTube is the most frequently preferred platform to search and convey information, it does not provide very reliable information on shoulder dislocations/reductions. Online and understandable videos prepared by professional institutions are required.

Ethics

Ethics Committee Approval: Bandırma Onyedi Eylül University Faculty of Medicine Clinical Research Ethics Committee (decision number: 2022/4-6, date: 21.07.2022).

Informed Consent: All patients included in this study indirectly provided written informed consent for the publication of the videos included in this study, as they uploaded them to social media platforms and/or gave permission for their upload.

Authorship Contributions

Surgical and Medical Practices: H.Y.B., Concept: H.Y.B., A.Y., Design: H.Y.B., A.Y., Data Collection or Processing: H.Y.B., A.K., M.U., A.Y., Analysis or Interpretation: H.Y.B., A.K., M.U., A.Y., Literature Search: H.Y.B., A.K., M.U., A.Y., Writing: H.Y.B., A.K., M.U., A.Y.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

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EURASIAN JOURNAL OF EMERGENCY MEDICINE
Original Article
DOI: 10.4274/eajem.galenos.2024.49260
Eurasian J Emerg Med. 2024;23(2): 119-24

Analysis of Patient Presentations to the Emergency Department Due to Anxiety Associated with the Lunar Cycle and Seasonality

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Abstract

Aim: To analyze the distribution of patients who presented to the emergency department (ED) because of anxiety according to the lunar cycle and seasons.

Materials and Methods: Patients who presented to the ED because of anxiety over 1 year were identified. Patients' age and sex, date and time of emergency presentation, presence of psychiatric history, and clinical outcomes were obtained by screening patients' epicrises. Using the date and time information, the lunar cycle during which each presentation occurred was determined using a website. The recorded characteristics of the patients were then analyzed according to the lunar cycle and seasonality.

Results: The study included a total of 1,179 patients, of whom 58.6% were women. The mean age was 39.1±15.2 years. Most patients (69.9%) were aged 18-44 years. It was found that 58.6% (n=691) of all patients were female, 25.4% (n=300) presented to the ED during the last quarter phase of the lunar cycle, and 36.7% (n=433) during the summer season. It was determined that patients diagnosed with psychiatric diseases visited the hospital at a higher rate during the winter, and the hospitalization rate was higher in the winter season ($p<0.05$). The hospitalized patients were mostly young, male patients diagnosed with psychiatric diseases ($p<0.05$).

Conclusion: The results showed that the number of ED presentations due to anxiety was the highest in the last quarter of the lunar cycle, during the summer season, and among women. Patients with a history of psychiatric diseases and young male patients were hospitalized more frequently during the winter.

Keywords: Anxiety, lunar cycle, seasonality

Introduction

Anxiety is a psychiatric disorder that is mostly associated with fear, nervousness, anxiety, and panic but can also affect the cardiovascular, respiratory, gastrointestinal, and nervous systems, either individually or in combination (1). Although anxiety disorders (e.g., generalized anxiety disorder, panic disorder/agoraphobia, and social anxiety disorder) vary according to age, sex, and race, they constitute the most common mental disorders according to US data (1,2). It has been reported that 19% of the population in the USA experiences an anxiety attack at least once during six months (1).

Psychiatric complaints constitute a significant portion of emergency department (ED) presentations. Because of the frequent co-occurrence of anxiety with new and rapid-onset symptoms, patients tend to first refer to emergency services. Anxiety accounts for 20% of patient visits to the ED with psychiatric complaints and 1.1% of all ED presentations (3). If patients who receive their initial interventions here are not accurately diagnosed, appropriately treated, or properly referred, repeated presentations to the ED occur, which leads to an increase in the burden on the health system and the cost of mental health services (1).

Today, even in developed countries, there is a prevailing belief that diseases are associated with the zodiac signs and certain phases of the moon. Therefore, the possible relationship between the lunar cycle and many diseases has been the subject of research

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Cite this article as: Kara E, Turgut K, Gülaçtı U, Aydın İ, Yavuz E. Analysis of Patient Presentations to the Emergency Department Due to Anxiety Associated with the Lunar Cycle and Seasonality. Eurasian J Emerg Med. 2024;23(2): 119-24.

Received: 17.02.2024
Accepted: 22.04.2024

(4). The potential effects of celestial bodies on human existence have been a topic of investigation since the advent of lunar cycle exploration (5). It is believed that the lunar cycle changes the behavior, emotions, and health of individuals through its effects on sleep and human physiology (5,6). Similarly, there is a widespread belief among healthcare professionals and a considerable portion of society that seasonality and the lunar cycle are linked to psychological symptoms. Studies conducted on this subject have shown that while seasonal changes affect psychological symptoms, the lunar cycle significantly affects mental health (7).

The full moon affects human behavior. Many studies have been conducted to investigate the relationship between the full moon and violence, suicides, murders, and ED presentations due to psychiatric disorders. Although the majority of these investigations failed to establish a statistically significant correlation between the lunar cycle and psychiatric ED visits or suicides, a few studies did identify a relationship between crimes committed and the full moon (6,8). Similarly, studies have shown that bipolar disorders and the lunar cycle are related (9).

Despite the availability of many publications exploring the relationship between the lunar cycle and various diseases, to the best of our knowledge, there is a scarcity of research investigating the relationship between anxiety and the lunar cycle. Therefore, in our study, we aimed to analyze the distribution of adult patients who presented to the ED and were diagnosed with anxiety according to the lunar cycle and seasonality and to compare the data obtained with those of the existing literature.

Materials and Methods

This study was conducted in the ED of a tertiary hospital. The hospital where the study was conducted is the only official healthcare institution in the province and serves approximately 25-30,000 patients monthly. The study was initiated after receiving approval from the Adıyaman University Training and Research hospital non-invasive clinical research ethics committee (ethical decision number: 2021/10-12, date: 14.12.2021).

In this study, patients who presented to the ED between November 1 and October 30, 2021 and were diagnosed with anxiety were retrospectively examined. These patients were identified using the International Classification of Diseases codes F41 (anxiety disorders), F41.0 (panic disorder), and F41.1 (generalized anxiety disorder) from the hospital registry system. For the identified patients, age and sex, and the date and time of presentation to the ED, were recorded. In addition, the patients' epicrises and drug histories were examined, and any diagnosed psychiatric diagnosis and outcome after presentation to the ED (hospitalization or discharge) were recorded. The seasons were defined as follows: summer, June 1-August 31; autumn, September 1-November 30; winter, December 1-February 28; and spring, March 1-May 31. The lunar cycle was classified as the new moon, the first quarter moon, the full moon, and the last quarter moon. Using the date and time when the patients were registered in the ED, it was determined during which phase of the moon each patient presented to the ED. For this purpose, a website (www.timeanddate.com) was used (10). Using this information, changes in the characteristics of the patients were examined according to the lunar cycle, seasonality, and outcomes.

Pediatric patients (<18 years), pregnant women, individuals experiencing grief reactions due to the death of a relative, those with any pathologies other than psychiatric diagnoses (heart attack, stroke, etc.), and those with recurrent presentations were excluded from the study (Figure 1).

Statistical Analysis

The SPSS program version 22 was used in this study. The suitability of continuous data for normal distribution was determined using the Kolmogorov-Smirnov test. The data that conformed to the normal distribution were analyzed using Student's t-test, and those that did not comply with the normal distribution were analyzed using the Mann-Whitney U test. The chi-square test was used to compare qualitative data. Numerical data that complied with the normal distribution were expressed as mean ± standard deviation, and those without a normal distribution were shown as median (minimum-maximum) values. Categorical variables are expressed as numbers and percentages. p values of <0.05 were considered statistically significant.

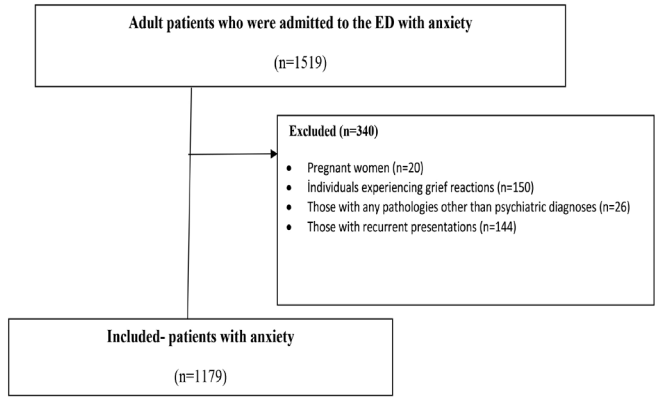

Figure 1. Patient flow chart
ED: Emergency department

Results

During the 1-year study period, 293,500 patients visited the ED. The number of patients diagnosed with anxiety was 1,519. Of these patients, 340 were excluded from the study because they did not meet the eligibility criteria; therefore, the study was conducted with the remaining 1,179 patients. The mean age of these patients was 39.1±15.2 years, and 69 percent of patients were aged 18-44 years. It was observed that 58.6% (n=691) of all patients were female, 25.4% (n=300) presented to the ED during the last quarter phase of the lunar cycle and 36.7% (n=433) during the summer season, 91.9% (n=1084) were discharged from the ED, and 54% (n=637) had a previous psychiatric diagnosis.

Most patients were discharged from the ED (91.9%), with the highest discharge rate being observed during the first quarter moon (93.9%) and among female patients (60.3%). Examinations of age, gender, season of presentation, presence of psychiatric diagnosis, and patient outcomes indicated no significant change according to the different phases of the month (p>0.05) (Table 1).

Upon analyzing patient presentations according to seasons, we determined that the highest number of presentations occurred during summer (36.7%), whereas patients with psychiatric diagnoses had a higher rate of winter presentations (p<0.001). The hospitalization rate was also higher among those visiting the ED during winter (p=0.008) (Table 2).

It was determined that the hospitalized patients were mostly between the ages of 18 and 44 years (p=0.003). In addition, male gender and the presence of a psychiatric diagnosis were determined to be factors that were highly prevalent among the hospitalized patients (p<0.001) (Table 3).

Table 1. Demographic and clinical characteristics of the patients presenting to the emergency department with anxiety

Variables		Total (n=1.179)	New moon (n=292, 24.8%)	First quarter moon (n=293, 24.9%)	Full moon (n=294, 24.9%)	Last quarter moon (n=300, 25.4%)	p value
Age (years)	18-44	799 (69%)	205 (71.9%)	197 (69.1%)	199 (68.4%)	198 (66.7%)	0.19
	45-65	280 (24.2%)	69 (24.2%)	62 (21.8%)	69 (23.7%)	80 (26.9%)	
	>65	79 (6.8%)	11 (3.9%)	26 (9.1%)	23 (7.9%)	19 (6.4%)	
Gender	Female	691 (58.6%)	183 (62.7%)	157 (53.6%)	175 (59.5%)	176 (58.7%)	0.162
	Male	488 (41.4%)	109 (37.3%)	136 (46.4%)	119 (40.5%)	124 (41.3%)	
Season	Winter	206 (17.5%)	55 (18.8%)	44 (15%)	54 (18.4%)	53 (17.7%)	0.357
	Spring	289 (24.5%)	73 (25%)	71 (24.2%)	73 (24.8%)	72 (24%)	
	Summer	433 (36.7%)	108 (37%)	106 (36.2%)	118 (40.1%)	101 (33.7%)	
	Autumn	251 (21.3%)	56 (19.2%)	72 (24.6%)	49 (16.7%)	74 (24.7%)	
Diagnosed	Yes	637 (54%)	154 (52.7%)	165 (56.3%)	170 (57.8%)	148 (49.3%)	0.159
	No	542 (46%)	138 (47.3%)	128 (43.7%)	124 (42.2%)	152 (50.7%)	
Outcome	Hospitalized	95 (8.1%)	30 (10.3%)	18 (6.1%)	27 (9.2%)	20 (6.7%)	0.197
	Discharged	1084 (91.9%)	262 (89.7%)	275 (93.9%)	267 (90.8%)	280 (93.3%)	

Table 2. Seasonal distribution of the patients

Variables		Winter (n=206 17.5%)	Summer (n=433, 36.7%)	Spring (n=289, 24.5%)	Autumn (n=251, 21.3%)	p value
Age (years)	18-44	146 (72.3%)	293 (68.9%)	189 (65.6%)	171 (70.4%)	0.532
	45-65	43 (21.3%)	108 (25.4%)	73 (25.3%)	56 (23%)	
	>65	13 (6.4%)	24 (5.6%)	26 (9%)	16 (6.6%)	
Gender	Female	107 (51.9%)	263 (60.7%)	162 (56.1%)	159 (63.3%)	0.053
	Male	99 (48.1%)	170 (39.3%)	127 (43.9%)	92 (36.7%)	
Diagnosed	Yes	133 (64.6%)	204 (47.1%)	167 (57.8%)	133 (53%)	<0.001
	No	73 (35.4%)	229 (52.9%)	122 (42.2%)	118 (47%)	
Outcome	Hospitalized	24 (11.7%)	20 (4.6%)	27 (9.3%)	24 (9.6%)	0.008
	Discharged	182 (88.3%)	413 (95.4%)	262 (90.7%)	227 (90.4%)	

Table 3. Distribution of the patients by outcome				
Variables		**Hospitalized (n=95)**	**Discharged (n=1.084)**	**p value**
Age (years)	18-44	78 (82.1%)	721 (67.8%)	0.003
	45-65	17 (17.9%)	263 (24.7%)	
	>65	0 (0%)	79 (7.4%)	
Gender	Female	37 (38.9%)	654 (60.3%)	<0.001
	Male	58 (61.1%)	430 (39.7%)	
Diagnosed	Yes	80 (84.2%)	657 (51.4%)	<0.001
	No	15 (15.8%)	527 (48.6%)	

Discussion

Anxiety is the most common psychiatric disorder in the general population. Patients with anxiety frequently present to the emergency services. In a study by Dark et al. (2017) (11), 0.93% of ED presentations were reported to be made because of anxiety. The majority of patients presenting to the ED in that study were young patients with psychiatric disorders, and the number of women was higher than that of men. In our study, it was observed that approximately 0.4% of ED presentations were due to anxiety. Similar to the literature, young female patients had a higher rate of anxiety-related ED visits.

Climatic factors such as sunlight, temperature, and humidity have an impact on human health, emotions, and behavior (12). Therefore, seasonal changes affect human psychology. Despite the presence of several studies in this area, the relationship between anxiety and seasons remains unclear. According to a previous study, the severity of anxiety symptoms was lowest in autumn and spring and highest in winter and summer (13). In another study examining the relationship between patient presentations to the psychiatry outpatient clinic due to anxiety and seasonality, Saucedo-Uribe et al. (14) reported an increase in anxiety related presentations during autumn and summer, although they did not detect a significant difference in the frequency of anxiety according to the season. In the same study, it was also determined that the number of women with anxiety presentations was higher than that of men, and psychiatric hospitalizations increased with increasing air temperatures. In the current study, the highest number of ED visits occurred in the summer season, whereas patients with psychiatric diagnoses tended to present to this department more often in the winter season. Unlike the above-mentioned studies, we observed that the hospitalization rate was higher in the winter. A lack of daylight triggers depression. Accordingly, it has been observed that suicide cases increase during the winter. In a study by Meyer-Rochow et al. (6), who examined the relationship between suicide cases and lunar phases and seasons, the number of men who committed suicide was found to be higher than that of women. While no relationship was found between suicide events and lunar phases and seasons in male patients, there was an increase in suicide attempts among young women (<44 years of age) during the winter and full moon phases. It is thought that the lunar cycle is associated with the severity of psychiatric findings and frequency of ED visits. In a study evaluating patients presenting to the ED with a psychiatric attack during the full moon phase, the number of men was found to be higher than that of women, but no significant relationship was observed between the lunar cycle and psychiatric ED presentations (8).

In a study examining changes in parasuicides (suicide attempts) according to the lunar cycle and seasonality, the number of women attempting suicide was found to be higher than that of men. Suicide attempts were observed at a higher rate among women at younger ages and during the summer, whereas men had a higher suicide attempt rate at older ages and during the winter. Although the frequency of parasuicide decreased during periods when the temperature increased and increased during rainy periods, no statistically significant difference was found according to seasonality. The majority of presentations resulted in hospitalization, regardless of sex. Considering these results, the authors could not establish a relationship between suicide attempts and the lunar cycle (15).

In another study investigating the effects of seasonality and the lunar cycle on psychological symptoms (panic attack, anxiety disorder, and suicidal ideation) in patients presenting to the ED with chest pain, it was reported that depression and anxiety symptoms were more common in spring and summer, whereas no seasonal effects were found on mood disorders and suicidal ideation. Apart from the low probability of panic disorder in the last quarter phase of the moon, there was no other significant effect of the lunar cycle on the mental health of patients (7).

Studies on the effect of the lunar cycle on psychiatric diseases have yielded diverse results. Wang et al. (16), evaluated the effect of the lunar cycle on schizophrenia and hospital presentations

and found that the presentations of patients with schizophrenia increased during the first quarter and full moon phases and decreased during the new moon phase. The authors determined that the lunar cycle affected the mental health of patients with schizophrenia and that patients' clinical conditions were better during the new moon phase. Although it is believed that the moon affects people's mental health, a study conducted by Gupta et al. (17) showed that the hospitalization or discharge status of psychiatric patients did not differ according to the lunar cycle. In another study evaluating patients with different psychiatric diagnoses, it was observed that the lunar cycle did not have a statistically significant effect on psychiatric presentations, hospitalization, or discharge. It has been reported that all patients with psychotic, mood, or anxiety disorders were hospitalized at a rate independent of the lunar cycle (18). In another study investigating the relationship between the frequency of psychiatric clinic presentations of patients with mental disorders and the phases of the moon, no significant difference was detected (19).

In the current study, most of the patients who presented to the ED due to anxiety were young female patients aged 18-44 years. Although the majority of presentations occurred in the summer and the last quarter phase of the lunar cycle, the rate of hospitalization was higher in the winter months, and the majority of hospitalized patients were men with a psychiatric diagnosis. No significant relationship was found between anxiety-related presentations and the lunar cycle or seasonality. Furthermore, there were no significant differences between the different phases of the moon and the rates of psychiatric presentations, hospitalization, and discharge.

Study Limitations

This study has several limitations. These include a single-center and retrospective design and a focus on anxiety patients identified through the hospital registry system. A study that examines the association of different anxiety disorders (e.g. generalized anxiety disorder, panic disorder/agoraphobia, and social anxiety disorder) with menstruation and seasonality separately may provide more comprehensive results.

Conclusion

The results showed that most presentations to the ED due to anxiety occurred in the last quarter phase of the lunar cycle and during the summer season. Individuals diagnosed with psychiatric diseases were more likely to visit the ED during winter, and the highest number of hospitalizations was observed during this season. Finally, the majority of hospitalized patients were young, male individuals with a psychiatric diagnosis.

Ethics

Ethics Committee Approval: The study was approved by the Adıyaman University Training and Research Hospital Non-invasive Clinical Research Ethics Committee (ethical decision number: 2021/10-12, date: 14.12.2021).

Informed Consent: Retrospective study.

Authorship Contributions

Surgical and Medical Practices: E.K., K.T., U.G., İ.A., E.Y., Concept: E.K., K.T., U.G., İ.A., E.Y., Design: E.K., K.T., U.G., İ.A., E.Y., Data Collection or Processing: E.K., E.Y., Analysis or Interpretation: K.T., U.G., Writing: E.K., K.T.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support

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EURASIAN JOURNAL OF EMERGENCY MEDICINE
Original Article
DOI: 10.4274/eajem.galenos.2024.46667
Eurasian J Emerg Med. 2024;23(2): 125-31

Evaluation of Physician Opinions Against Patient Complaints and Administrative and Judicial Instigations

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Abstract

Aim: In recent years, physicians practicing in Turkey have started to face various legal processes such as patient complaints, medical malpractise,administrative disciplinary proceedings, criminal cases, and compensation lawsuits more frequently. This study aimed to evaluate the experiences and opinions of physicians on the subject.

Materials and Methods: The study was conducted in the form of a questionnaire, and the questions directed to the participants were created through the application called Google Forms and were requested to be filled in electronically.

Results: The age range of 30-35 years (32.6%) and 1-5 years of professional experience (34.4%) had the highest participation rate. Among the physicians who participated in the survey, 80.2% stated that they had complained at least once, 81.5% stated that they had testified at least once in judicial institutions, and 46.8% stated that they had attended a hearing in court. Of the physicians, 21.8% received administrative penalties and 7.9% received judicial penalties. According to the results of our study, general practitioners and emergency medicine specialists were the most frequently complained about physicians who were prosecuted in judicial courts for assault,insult, and assault.

Conclusion: Efforts should be made to reduce the forensic concerns of physicians, and a common perspective on the issue should be developed by creating platforms where medical and legal sciences come together.

Keywords: Medical malpractise, physician error, patient complaints, defensive medicine

Introduction

Healthcare workers work with great responsibility toward themselves, their patients, and their colleagues. If employees do not fulfill their responsibilities adequately, defects in duty may occur. Physicians have the greatest responsibility in the functioning of health services. Therefore, the definition of negligence or malpractise is mainly evaluated within the framework of the physician's responsibilities and is explained by the physician's errors in diagnosis, treatment, and practice (1). Any medical intervention that does not comply with the standards of the specialist physician and that does not show the necessary care according to the data in medical science is considered as a treatment error (2). Failure to intervene with the patient on time, incomplete testing, confusion of patients, wrong choice of treatment method, wrong drug administration, failure to recognize complications, wrong surgical technique, failure to urgently refer the patient to another hospital, failure to comply with infection and hygiene rules, forgetting a foreign substance in the patient's body, performing medical intervention without examining records and tests, and failure to request consultation on time are some of the treatment errors (1,2).

Medical science has continued with the transfer of the theoretically determined practices into practice since the beginning of history. However, today, legal principles and principles have started to take more place in this process than they should (3). Legal principles and the practices of medical science sometimes come into conflict during the diagnosis and treatment of the patient. While the sole purpose of medical science since its inception has been to restore the patient to health, in recent years, due

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Received: 30.11.2023
Accepted: 30.04.2024

Cite this article as: Alpaslan M, Baykan N, Salt Ö, Bol O, Altuntaş M. Evaluation of Physician Opinions Against Patient Complaints and Administrative and Judicial Instigations. Eurasian J Emerg Med. 2024;23(2): 125-31.

to legal principles and sanctions, science has started to function differently from its purpose. Legal processes arising from medical malpractise have recently begun to increase. Therefore, the area of malpractise in the field of health law has begun to expand (4). With the constant agenda of legal factors, changes in practices have begun to occur in the field of medical science. It has been predicted that health care workers' working uneasy due to legal reasons also affects their professional performance. The practice of defensive medicine has begun to emerge due to the legal anxiety of physicians while fulfilling their professional responsibilities. Defensive medicine can be defined as physicians distancing themselves from the patient with as few procedures as possible to defend themselves in case of complaints and lawsuits (5,6).

In this study, we aimed to analyze the judicial processes that physicians have experienced during their professional life and their thoughts about working under the threat of litigation due to malpractise, which has been frequently brought to the agenda in recent years.

Materials and Methods

The study was initiated after the approval of Nevşehir Hacı Bektaş Veli University Rectorate Non-interventional Clinical Research Publication Ethics Committee (decision number: 2023/06, date: 15.09.2023). The questions directed to the participants were created using the application called Google Forms and were requested to be filled electronically. Participants were selected from different provinces and institutions, and the study evaluation form together with the informed consent form was directed to them via e-mail and/or the WhatsApp mobile application. Physicians were contacted and informed about the study in advance. The form was not sent to physicians who did not wish to participate in the study. The number of participants was based on G power analysis, and it was predicted that there should be at least 250 participants in the study. The survey questions were directed at physicians working in different branches, provinces, and institutions. A period of 15 days was provided after the survey questions were directed. Those with 1 year of professional experience were excluded from the study. Data that were found to be incomplete in the questionnaire form were excluded from the study. The study was conducted after obtaining the consent of the participants who agreed to participate in the study.

Participants were asked about their age, gender, marital status, professional experience, physician status, field of practice, branch distribution, and professional insurance status. Participants were asked questions about their views on being complained about, testifying and attending court, being tried, administrative and/or judicial penalties, and professional judicial concerns. If the answer in the options was more than one, it was indicated by number. Within the scope of the study, 293 people answered the survey questions, and the study was completed with the participation of 288 people due to missing data in five participants.

Statistical Analysis

Statistical Package for Social Sciences for Windows 21.0 (SPSS 21.0) was used to analyze the data. Descriptive statistics (frequency, percentage distribution) and the chi-square test were used to compare categorical variables between the two groups. The results are given as mean±standard deviation or frequency (percentage) and $p<0.05$ was considered statistically significant at 95% confidence interval.

Results

Among the physicians who participated in the study, 50.7% were women. The highest participation rate was in the 31-35 age range (32.6%) and the lowest in the 56-60 age range (0.7%) (Figure 1). In total, 67.7% of the respondents were married. Regarding their professional experience, the highest number of participants (34.4%) was between 1 and 5 years (Figure 2). 21.5% of the participants were general practitioners. The most common area of work for these physicians was emergency departments (24.7%)

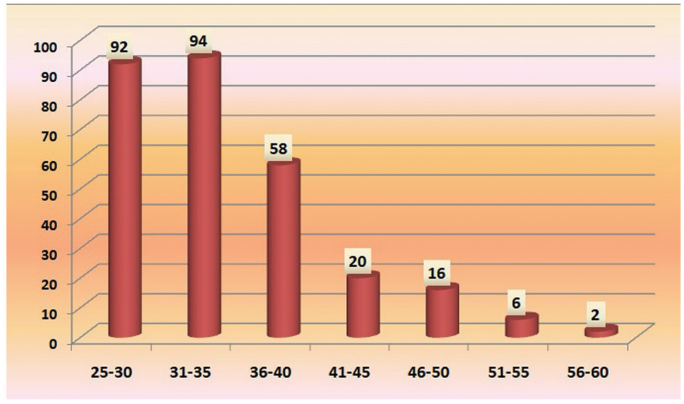

Figure 1. Age distribution of physicians participating in the survey

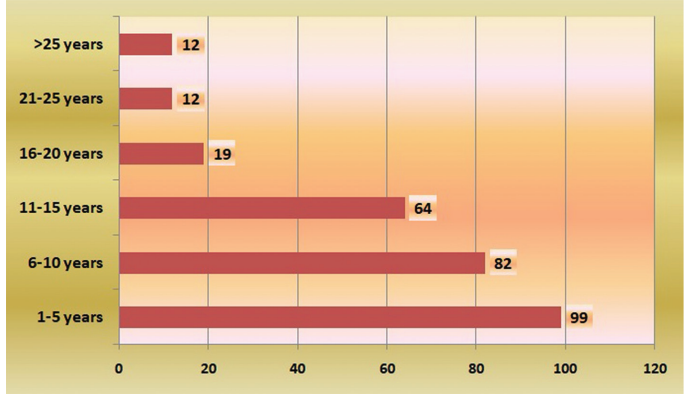

Figure 2. Distribution of years of professional experience

(Table 1). The percentage of specialist physicians participating in the study was 39.9%. Emergency medicine (66.9%) was the most participating specialty (Table 1).

The most common answer to the question "Have you been complained to patient rights or judicial units by patients or their relatives?" was 1-5 times. The most common answer to the question "How many times have you testified at units such as patient rights, disciplinary unit, police center, and prosecutor's office during your professional life (complaint, giving code white, insult, judicial investigation, etc.)" was 1-5 times. The most common answer to the question "During your professional life, have you participated in court hearings in judicial courts as a witness, defendant, or witness?" was 1-5 times. Table 2 shows the number of answers given to the questions in detail. In response to the question "Have you been subjected to administrative investigations during your professional life and have you received administrative penalties according to Article 125 of Civil Servants Law No. 657?", 40 of the physicians answered that they received warnings, 14 reprimands, 5 dismissals, 2 suspensions of progression, and 2 dismissals from the civil service. In response to the question "Please specify the number of times during your professional life that you have been prosecuted in judicial courts due to your profession and your actions for the reasons listed in the options", 36 physicians stated that they were prosecuted for insult, assault and assault, 19 for causing death by negligence, 4 for intentional injury and causing death, 17 for misconduct in office and 4 for disclosing the confidentiality of personal data. In response to the question "Have you been sentenced to any of the penalties given in the options due to your profession and the actions you have taken during your professional life?", 6 of the physicians stated that they were sentenced to imprisonment, 7 to judicial fine, 8 to pecuniary and/or non-pecuniary compensation, and 2 to suspension from duty.

Table 1. Status of physicians, working areas and branch distribution of specialists

Physician status	**Number (n)**	**Ratio (%)**
Specialist	115	39.9
Assistant	85	29.5
Practitioner	62	21.5
Academician	26	9.1
Distribution of general practitioners by field of practice*	**Number (n)**	**Ratio (%)**
Emergency service	28	45.1
Family medicine	17	27.4
112 Command control and ambulance	6	9.6
Community health and public health center	3	4.8
Other (intensive care. dialysis. home care services. etc.)	8	13.1
Distribution of specialists by branch	**Number (n)**	**Ratio (%)**
Emergency medicine	77	66.9
Internal medicine	19	16
Gynecology and obstetrics	14	11.7
Chest diseases	11	0.9
Pediatrics	9	0.7
Family medicine	7	0.6
General surgery	6	0.4
Orthopedics and traumatology	6	0.4
Anesthesiology and reanimation	6	0.4
Brain and nerve surgery	4	0.3
Neurology	4	0.3
Radiology	4	0.3
Dermatology	4	0.3
Psychiatry	3	0.2
Child psychiatry	3	0.2
Infectious diseases	2	0.1
Ear nose and throat diseases	2	0.1
Eye diseases	2	0.1
Thoracic surgery	2	0.1
Radiation oncology	1	0.01
Urology	1	0.01
Forensic medicine	1	0.01
Biochemistry	1	0.01

*It was evaluated as the longest working area.

Figure 3 shows the distribution of the reasons for the trial and/or the sentences received by the physicians. Questions regarding the opinions of physicians about forensic concepts are given in Table 3. According to these results, the most

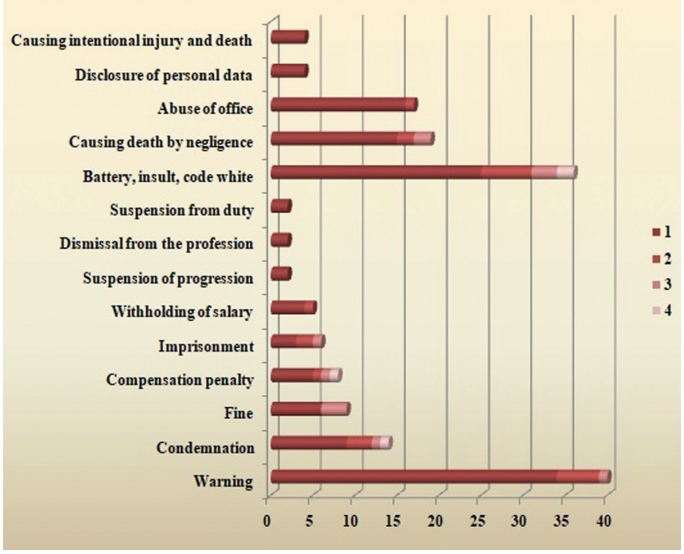

Figure 3. Distribution of reasons for prosecution and or sentences received by physicians

common responses to all questions asked to physicians were strongly agree. In total, 70.2% of the participants stated that malpractise concerns were effective in their choice of specialty. The percentage of physicians who have insurance against medical malpractise lawsuits was 92.5%. Finally, the question "Considering your medical school education period and your professional experiences, would you like to choose the profession of medicine again?" was asked to the physicians, and the most common answer was no (72%). There was no significant result when the rate of physician complaints was evaluated according to gender (p=0.109, chi-square: 9.003). When the rates of complaints were compared according to professional experience, significant results were found (p<0.001, chi-square: 58.895). Among the physicians who participated in our study, those with 6-10 years of professional experience were the most frequently complained about (23.6%). According to this result, the rate of complaint decreased as the professional experience increased. There was no significant difference between the rates of complaints and physician status (p=0.005, chi-square: 32.986). According to the physician status, the most complained physician group was specialists (37.8%). Table 4 shows the distribution of the number of complaints made by patients or their relatives to patient rights or judicial units according to the branches, and there was no significant difference (p=0.964, chi-square: 89.217). According to the results, emergency medicine specialists were the most frequently complained about. When the physicians who were prosecuted in judicial courts for reasons such as assault, insult, and being assaulted were examined, it was seen that emergency medicine specialists were the most common physicians. Physicians prosecuted for causing death by negligence were general practitioners, emergency medicine specialists, anesthesiology and reanimation specialists, and internal medicine specialists, according to the number of cases. The physicians sentenced to imprisonment were emergency medicine specialists and pulmonologists.

Discussion

Health is one of the most important factors in human life. People want to solve their health-related problems by applying to health institutions. The accessibility, quality, and adequacy of health institutions have an important place in people's health-related services. As people's accessibility to health institutions increases, their expectations also increase. With the continuous fulfillment of expectations, new requests emerge. As a result, if the desired quality of service cannot be obtained from health institutions, patient complaints begin to increase. Studies show that patient complaints are mostly directed against physicians. In fact, in a recent study, 37.4% of patient complaints were made against physicians (7). According to a study conducted by Acar et al. (8) in 2015, it was observed that the most frequently complained personnel group in the emergency department was on-call physicians (44%). In another study, it was observed that the complaints by patients and their relatives were mostly about outpatient services (67.4%) and the least about intensive care services (1.1%) (9). In our study, 231 (80.2%) of the physicians stated that they complained to the judicial units by patients and/

Table 2. Complaints, testimony and court attendance of physicians

Questions	No (n/%)	1-5 (n/%)	6-10 (n /%)	11-15 (n/%)	16-20 (n/%)
Have you been complained to patient rights or judicial units by the patient or his/her relatives (specify the number)	57 (19.8)	**174 (60.4)**	33 (11.5)	14 (4.8)	10 (3.5)
How many times during your professional life have you testified in units such as patient rights, disciplinary unit, police center and prosecutor's office (complaint, giving code white, insult, judicial investigation, etc.)?	53 (18.4)	**195 (67.7)**	29 (10)	7 (2.4)	4 (1.5)
During your professional life, have you participated in court hearings in judicial courts for reasons such as witness, defendant or witness (specify the number)?	150 (53)	**125 (43.4)**	6 (2)	3 (1)	1 (0.6)

Table 3. Physicians' views on forensic concerns as a profession

Questions	Strongly disagree (n/%)	Disagree (n/%)	Undecided (n/%)	Agree (n/%)	Strongly agree (n/%)
What do you think about physicians' desire to avoid patient approach, treatment and invasive procedures due to forensic concerns?	5 (1.8)	3 (1)	12 (4.2)	96 (33.3)	**172 (59.7)**
What do you think about the complaints, administrative and judicial investigations encountered during the practice of medicine affecting the morale and motivation of physicians and preventing them from practicing their profession efficiently?	4 (1.3)	1 (0.4)	1 (0.4)	45 (15.6)	**237 (82.3)**
Do you think that forensic concerns are effective in the recent indecision about the preference of medical faculties?	4 (1.3)	4 (1.3)	14 (4.9)	81 (28)	**185 (64.5)**

Table 4. Distribution of the number of complaints made by patients or relatives to patient rights or judicial units according to branches

Branch distribution	Number of complaints				
	NO	1-5	6-10	11-15	16-20
Emergency medicine	10	45	11	6	5
Internal medicine	2	14	2	1	0
Gynecology and obstetrics	2	8	2	1	1
Chest diseases	1	7	2	1	0
Pediatrics	1	5	2	1	0
Anesthesiology and reanimation	0	5	1	0	0
General surgery	0	4	2	0	0
Orthopedics and traumatology	1	3	1	1	1
Family medicine	3	3	1	0	0
Neurology	0	4	0	0	0
Brain and nerve surgery	1	1	2	0	0
Dermatology	1	2	0	0	1
Thoracic surgery	0	2	0	0	0
Eye diseases	0	1	0	1	0
Radiology	2	1	0	1	0
Psychiatry	2	1	0	0	0
Radiation oncology	0	1	0	0	0
Urology	0	1	0	0	0
Ear nose and throat diseases	1	1	0	0	0
Child psychiatry	1	1	0	0	0
Forensic medicine	0	1	0	0	0
p=0.964, chi-square: 89.217					

or their relatives. In a study conducted by Aynac in 2008, it was reported that 12.3% of physicians had one or more lawsuits filed against them for medical malpractise (10). Similarly, in another study, 10.1% of physicians reported that they had been sued for malpractise (11). In our study, 15.2% of physicians reported that one or more lawsuits were filed against them.

In a study conducted in Ankara province between 2011 and 2013 to analyze administrative and judicial investigations for malpractise of healthcare workers, it was observed that 57.9% of the healthcare workers who were investigated were male and most frequently (38.4%) in the 30-40 age group. When the distribution of personnel was analyzed, it was reported that most investigations were conducted against physicians (80.5%) (1). In our study, most physicians who participated in the survey and complained about were in the 31-35 age group.

Physicians accused of medical malpractise may face various legal processes, such as criminal lawsuits and compensation lawsuits, in addition to disciplinary proceedings and administrative investigations conducted by the institution to which they are affiliated. Although legal regulations have been made for the practice of the medical profession today, there are no special regulations and provisions regarding the legal responsibilities of physicians in the Turkish Criminal and Civil Law Legislation (12).

According to the results of the study titled "Analysis of malpractise files submitted to the court of cassation between 2015 and 2020 in terms of health management", 50.8% of malpractise lawsuits were filed against healthcare professionals in private hospitals and 38.7% were filed against public hospital employees. In addition, 95% of the files were filed by patients and 83.1% were compensation lawsuits. The most common reason for filing a lawsuit for compensation (55.3%) was failure to receive treatment, whereas the most common reason for filing a lawsuit for criminal cases (66.7%) was death. It was observed that 77.6% of the analyzed case files were related to surgical branches. When the distribution of malpractise lawsuits on the basis of branches was examined, it was reported that the most common branches were gynecology and obstetrics (17%), emergency service (10.5%), and general surgery (9.7%) (13). In our study, according to the answers given by the physicians regarding the trial, administrative, and/or judicial penalties, 7.9% of the physicians participating in the study received at least one penalty, 6 physicians were sentenced to imprisonment, 7 physicians were sentenced to judicial fine, 8 physicians were sentenced to material and moral compensation, and 2 physicians were sentenced to suspension from duty. According to the results of our study, emergency medicine specialists were the most frequently complained about physicians who were prosecuted in judicial courts for reasons such as assault, insult, and being assaulted. According to the number of cases, the physicians prosecuted for causing death by negligence were general practitioners, emergency medicine specialists, anesthesiology and reanimation specialists, and internal medicine specialists. The physicians sentenced to imprisonment were emergency medicine specialists and pulmonologists. In the study conducted by Özesen et al. (14) in Çukurova University Faculty of Medicine, Department of Forensic Medicine, it was observed that general practitioners were the most common physicians to be sued (15.9%) and on the other hand, malpractise claims for surgical sciences were the most common with a rate of 61.36%. According to the results of the same study, the most frequently complained branches were gynecology, obstetrics, and general surgery. In the medical malpractise files reflected in the judicial decisions between 1973 and 2013 in Turkey, lawsuits were filed most frequently against the branches of gynecology and obstetrics (26.7%), general surgery (9.8%), anesthesiology and reanimation (7.1%), and orthopedics (6.2%) (15). In another study, unlike our study, infectious diseases, dermatology, physical therapy and rehabilitation, family medicine, and emergency medicine were reported as specialties that were not sued at all

(10). In the same study, the most frequently sued specialties were gynecology and obstetrics (36.5%), orthopedics and traumatology (38.4%), and psychiatry (38.4%). In summary, defensive medicine is the physician's unnecessary use of medical practices for diagnosis and treatment and avoidance of practices with a high risk of resulting in malpractise litigation by acting overprotective or timid in order not to face criminal or civil lawsuits, not to pay compensation, and not to increase insurance policy premiums (10). In recent years, healthcare professionals practicing the medical profession have started to work in a restless and anxious manner. The reason for this is shown to be the allegations arising from medical malpractise of physicians rather than the pressures arising from social and legal regulations. This situation has started to be detected in the United States of America since the 1970s and later in other countries and has been a factor in the development of defensive medicine (16). To the question "What do you think about the desire of physicians to avoid patient approach. treatment and invasive procedures due to forensic concerns?" which we asked to the physicians participating in our study, 172 participants answered as "strongly agree" and 96 participants answered as "agree". According to this result, 93% of the physicians in our study accepted that defensive medicine is practiced. In the conclusion and summary section of his specialty thesis on the subject, Tümer stated that lawsuits created frustration in surgeons against their profession and caused hesitation in their approach to patients (17). In our study, 237 participants "strongly agreed" and 45 participants "agreed" to the question "What do you think about the complaints and administrative and judicial investigations encountered during the practice of the art of medicine affecting the morale and motivation of physicians and preventing them from practicing their profession efficiently?" According to this result, 97.9% of the physicians in our study believe that the fear of being complained about and sued has a negative effect on the practice of the profession. In a study, 84.6% of the physicians answered "absolutely yes" and "yes" to the question "would a medical malpractise lawsuit against you reduce your medical performance" (10). In Banaz and Yalçın Balçık (11), 93.7% of physicians stated that malpractise lawsuits would affect medical performance. Physician professional liability insurance is "the process of insuring the compensation to be paid due to malpractise, negligence, or lack of care that occurs during professional practice and causes damage to the person receiving service" (18). Physician professional liability insurance has become compulsory in Turkey as of July 30, 2010, and its full name is "Compulsory Financial Liability Insurance for Medical Malpractise". This product, provided by insurance companies, provides assurance against the compensation requested in lawsuits filed against physicians for damages caused by physicians for any reason during their professional activities (19). In our study, 92.5% of physicians declared that they had professional liability insurance. Of the 21 physicians without insurance, 11 (52.3%) were general practitioners. In a study conducted in 2008, 73.3% of physicians stated that they did not have any insurance (10). We believe that this result was different because the study was conducted before 2010. We support the need for insurance against malpractise and compensation lawsuits, which have been increasing in recent years.

According to the responses we received from physicians in our study, we predict that the likelihood of not choosing medical faculties due to forensic concerns will increase by 92.3%. As a matter of fact, as a result of the survey, 72% of our physicians stated that they would not choose medical school and the profession of medicine if they were offered the right to choose again. In addition, 73% of general practitioners stated that they would not choose their profession again, and in terms of branches, emergency medicine, internal medicine, gynecology and obstetrics, and pediatrics specialists, respectively, stated that they would not choose their profession again. In medical science, each branch is valuable in its own field, but surgical branches require more knowledge, attention, and endurance. Students who can be much more successful in these fields and can work with fewer errors in medical faculties move away from these branches because of the anxiety caused by medical malpractise and may lead to an increase in error rates with the unintentional selection of surgical branches (20). As a matter of fact, when the results of the 2020 Medical Specialization Examination placement results are examined in our country, branches with low malpractise risk such as radiology, dermatology, physical therapy and rehabilitation, and sports medicine, were preferred more by physicians, while emergency medicine, pediatric surgery, general surgery, thoracic surgery, gynecology and obstetrics, and cardiovascular surgery departments were preferred less (21).

Study Limitations

This study only limited generalizability; therefore, studies with much larger participants was needed.

Conclusion

As a result, allegations of medical malpractise are increasing day by day, and the rate of complaints against healthcare professionals by patients or their relatives is increasing. This situation delays the diagnosis and treatment of the patient and creates a separate burden on the health system. Research should be conducted on why medical malpractise occurs, the lines of the distinction between complication and malpractise should be clarified, and a common perspective on the subject should be developed by creating health law with platforms where

medical and legal sciences are together. Specialty associations should educate physicians on this issue and work toward the development of measures that can be taken against malpractise practices. Guidelines should be prepared by the Ministry of Health to control and eliminate the factors that cause medical malpractise and healthcare professionals should be supported with up-to-date training (22,23).

Ethics

Ethics Committee Approval: The study was initiated after the approval of Nevşehir Hacı Bektaş Veli University Rectorate Non-interventional Clinical Research Publication Ethics Committee (decision number: 2023/06, date: 15.09.2023).

Informed Consent: The study was conducted after obtaining the consent of the participants who agreed to participate in the study.

Authorship Contributions

Surgical and Medical Practices: M.A., N.B., Concept: Ö.B., Design: Ö.B., Data Collection or Processing: M.A., N.B., Analysis or Interpretation: M.A., N.B., Literature Search: O.B., M.A., Writing: M.A., N.B., Ö.B., O.B., M.A.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

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EURASIAN JOURNAL OF EMERGENCY MEDICINE
Original Article
DOI: 10.4274/eajem.galenos.2024.48243
Eurasian J Emerg Med. 2024;23(2): 132-8

Inter-level and Seasonal Variation in Reasons for Inappropriate Emergency Department Use: A Three Centers Study

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Abstract

Aim: Inappropriate emergency department (ED) use represents an important problem for health systems across the world. This study was designed to determine the reasons for inappropriate ED visits at different ED care levels during different seasons.

Materials and Methods: The study was conducted in three hospitals with different ED care levels in two periods (March and July). Physicians determined the appropriateness of ED visits. Data were collected through face-to-face interviews using a researcher-made questionnaire.

Results: The inappropriate ED visit rate was 75.6%. The most frequent reasons for inappropriate ED visits according to different ED care levels were as follows: Level 1, easy access (61.2%); Level 2, no other units providing health services outside of working hours (43.0%); and Level 3, perceived need for serum/injection treatment (58.2%). Inappropriate ED visits due to these reasons occurred more frequently in July than in March, with significant differences observed across the various levels of ED ($p<0.005$). Of the inappropriate users, 36.3% reported that receiving treatment and care from the ED made them feel valued.

Conclusion: Easy access was the most common reason for inappropriate ED visits in both study periods. In addition, ED visits make some patients feel valued, which may lead to inappropriate use.

Keywords: Emergency department, emergency department visit, inappropriate use, primary care

Introduction

Inappropriate use of emergency departments (ED) is generally defined as the use of EDs for health problems that do not require emergency intervention and can be safely treated in another unit of a healthcare institution. While inappropriate use has been a significant problem for EDs for more than 50 years, standard criteria for assessing eligibility for ED visits have yet to be developed. Criteria used by researchers vary, which leads to differences in the study results (1). A systematic review by Uscher-Pines et al. (2) found that the prevalence of inappropriate ED visits worldwide ranged from 8% to 62%.

Inappropriate use of EDs leads to delays in providing treatment, longer waiting times, difficulties in identifying patients, and increased health expenses (3). Increased workload, the inability to

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Cite this article as: İmamoğlu M, Şahin A.S, Şimşek P, Gönenç Çekiç Ö, Vuran H.S, Yadigaroğlu M, Çiçek M, Burma E, Tatlı Ö, Gürsoy A, Topbaş M, Gündüz A. Inter-level and Seasonal Variation in Reasons for Inappropriate ED Use: A Three Centers Study. Eurasian J Emerg Med. 2024;23(2): 132-8.

Received: 25.09.2023
Accepted: 09.05.2024

use emergency resources for emergency patients, and a negative psychological effect on health professionals are other problems arising from inappropriate ED use (4,5). In addition, patients who use EDs instead of primary healthcare services to monitor chronic diseases cannot receive the health education necessary to keep their chronic conditions under control, leading to recurrent exacerbations of symptoms and an increase in health expenses (6).

Globally, EDs are categorized into levels based on the services they offer. Factors affecting the tendency to visit EDs for non-emergency health problems and how they differ across various levels of EDs are unclear. However, various studies have identified several factors influencing the inappropriate use of EDs. These include the perceived need for immediate care for emergent health issues; the belief that specialized diagnostic and treatment methods are necessary; recommendations to use EDs made by healthcare professionals or the patients' relatives; the convenience of easy access; challenges in accessing primary healthcare services; the desire to avoid lengthy waits for care; the absence of health insurance; and the lack of alternative healthcare service options (1,7-10).

A review of the relevant literature indicates that, unlike the current study, previous research exploring the reasons for inappropriate ED use typically focused on a single level and one ED only.

This study investigated the reasons for inappropriate ED visits and analyze how these vary with seasonal changes and across different ED levels.

Materials and Methods

Study Design and Setting

This descriptive study was conducted at three different levels of EDs located in a province in the Black Sea Region of Turkey. The data collection periods were March 16-22, 2018, and July 22-28, 2018. In Turkey. EDs are stratified into three distinct levels based on specific criteria:

Level 1: General practitioners manage the front line, with on-call specialist overseeing processes. Patients whose conditions have stabilized but remain critical are referred to higher-level EDs for further treatment.

Level 2: General practitioners and emergency medicine specialists provide care, with oversight from at least one internal medicine specialist and one surgical specialist.

Level 3: Care is primarily provided by specialists in emergency medicine. In addition, comprehensive round-the-clock healthcare services are maintained by specialist physicians in internal medicine, surgery, and women's and children's health.

The Level 1 ED where the study was conducted is located in a district state hospital with 14 beds, averaging 350 visits per day. The Level 2 ED, situated in a state hospital in the city center, has 25 beds and accommodates approximately 500 daily patients. The Level 3 ED is part of a university hospital with 38 beds and handles approximately 300 visits daily.

Selection of Participants

The study inclusion criteria included patients aged 18 years or older whose ED visits were considered inappropriate and who voluntarily participated in the study. Exclusion criteria encompassed any physical or mental conditions that could impede understanding of the study details, providing consent, or participating in the interview, as well as being under the influence of substances like alcohol or drugs that could impair cognitive functions.

Inappropriate Use of EDs

Criteria for inappropriate ED visits include: patients with Level 5 or Level 4 on the emergency severity index (ESI); those who, according to a physician's assessment, can wait at least 24 h for medical care and treatment; and patients not referred by another health service unit. In addition, visits are considered inappropriate if the patient's main complaint could be managed in outpatient clinics or by family physicians and if no surgical procedures are necessary, such as wound suturing. In Turkey because there are no alternative healthcare departments for procedures requiring suturing, casting, or splinting besides hospital EDs, visits for these services are not deemed inappropriate.

Data Collection Tools

The data were collected using a 30 question, four-part questionnaire designed to identify the reasons for inappropriate use of EDs. This questionnaire was designed on the basis of a review of existing literature and the clinical experiences of the researchers (1,11). The first section gathers sociodemographic information. The second section asked about the reasons for choosing to visit an ED. The third section collected opinions on EDs and the fourth assessed patients' perceptions of medical emergencies. Before launching the study, the clarity and appropriateness of the questionnaire were validated by five emergency physicians and five ED nurses. Additionally, a pilot study with 20 patients was conducted to test the questionnaire and make necessary adjustments. These pilot study participants were excluded from the main study sample.

Data Collection

ESI, a five-level ED triage algorithm developed in the USA in 1999, was used to assess the appropriateness of ED visits in terms of emergency need. This system categorizes patients on the basis of their primary complaints and resource needs. Before data collection, physicians working in the EDs where the study was conducted were trained on ESI and the criteria for inappropriate ED use. The trained physicians then determined the eligibility of the patients for the study. The questionnaire was administered face-to-face after the eligible patients had received treatment and care. This ensured that the responses accurately reflected the participants' experiences and perceptions.

Statistical Analysis

Data were analyzed using Statistical Package for the Social Sciences 21.0. Descriptive data are given in numbers and percentages. Qualitative data were evaluated using the chi-square test. The statistical significance level was set as <0.05.

Results

During the study period, a total of 13,221 ED visits were evaluated, of which 75.6% (n=10,001) were deemed inappropriate. Of those identified as inappropriate users, 54.3% consented to participate in the study. The participants' average age was 40.2 years (Standard deviation=16.4), ranging from 18 to 91 years, and 54.0% were female (Table 1).

In March and July, most inappropriate users across all three ED levels were women ($p<0.05$). In the Level 1 and Level 2 EDs, the most inappropriate users-63.7% and 42.9%, respectively-had received primary education or less. Conversely, in Level 3 ED, 44.6% of inappropriate users were university graduates or held higher academic degrees ($p<0.005$). Additionally, the proportion of married patients and those aged over 40 years in Level 1 ED were significantly higher at 77.7% and 59.0%, respectively, compared with the other levels ($p<0.005$). Furthermore, Level 2 ED had a higher percentage (34.8%) of inappropriate users with chronic diseases compared with the other levels ($p<0.005$).

The primary reasons for inappropriate usage varied significantly across the ED levels, as shown in Table 2. For Level 1, the most common reason was easy access to ED (806 cases, 61.2%); for Level 2, the predominant reason was that ED are the only health services available after working hours (1,207 cases, 43.0%); and for Level 3, the leading cause was patients' belief that their health condition necessitated intravenous serum or intramuscular injection treatments (761 cases, 58.2%). With the exception of seeking shelter, these differences in the reasons for inappropriate visits across ED levels were statistically significant ($p<0.05$).

In analyzing the seasonal variations in reasons for inappropriate ED visits, the most frequent justification in both March (47.5%) and July (52.5%) was the accessibility of ED locations. The second most common reason in March (39.3%) involved patients'

Table 1. Sociodemographic characteristics of participants with ED level

	Level 1		Level 2		Level 3		X^2
	n	%	n	%	n	%	p value
Age (n=5.430)							
<40	539	41.0	1.541	54.9	927	70.9	238.866 0.000
>40	777	59.0	1.266	45.1	380	29.1	
Sex (n=5.430)							
Female	699	53.1	1.562	55.6	670	51.3	7.420 0.024
Male	617	46.9	1.245	44.4	637	48.7	
Education status (n=4.908)							
Primary school and lower	678	63.7	1.138	42.9	354	29.7	388.717 0.000
High school	240	22.6	856	32.3	307	25.7	
University graduate or higher	146	13.7	657	24.8	532	44.6	
Chronic disease (n=5.430)							
Yes	417	31.7	978	34.8	263	20.1	92.175 0.000
No	899	68.3	1829	65.2	1044	79.9	
Marital status (n=4.570)							
Married	892	77.7	1535	68.9	627	52.5	176.788
Single	256	22.3	692	31.1	568	47.5	0.000

ED: Emergency department

Table 2. Reasons for choosing EDs (n=5.430) *

Reasons	Level 1 n (%)			Level 2 n (%)			Level 3 n (%)			Total n (%)
	March	July	p value	March	July	p value	March	July	p value	
ED** is easy to access	330 (63.6)	476 (59.7)	0.160	328 (33.2)	855 (47.0)	0.000	363 (56.5)	390 (58.6)	0.441	2742 (50.5)
Only EDs provide health services after working hours	138 (26.6)	428 (53.7)	0.000	346 (35.0)	861 (47.4)	0.000	138 (21.5)	251 (37.7)	0.000	2162 (39.8)
My health problem requires serum/injection treatment	159 (30.6)	281 (35.3)	0.082	44 (4.4)	659 (36.2)	0.000	641 (99.8)	120 (18.0)	0.000	1904 (35.1)
Emergency intervention is needed	205 (39.5)	333 (41.8)	0.410	265 (26.8)	516 (28.4)	0.370	221 (34.4)	246 (37.0)	0.333	1786 (32.9)
Diagnosis/treatment is done quickly	113 (21.8)	368 (46.2)	0.000	161 (16.3)	455 (25.0)	0.000	219 (34.1)	205 (30.8)	0.205	1521 (28.0)
I do not need to wait for the examination	121 (23.3)	369 (46.30)	0.000	127 (12.8)	466 (25.6)	0.000	64 (10.0)	154 (23.2)	0.000	1301 (24.0)
Results of tests are provided more quickly	106 (20.4)	343 (43.0)	0.000	103 (10.4)	390 (21.5)	0.000	133 (20.7)	114 (17.1)	0.099	1189 (21.9)
I trust EDs more than any other unit	42 (8.1)	97 (12.2)	0.019	62 (6.3)	163 (9.0)	0.012	94 (14.6)	81 (12.2)	0.191	539 (9.9)
My health problems require special diagnostic methods	25 (4.8)	154 (19.3)	0.000	12 (1.2)	52 (2.9)	0.005	47 (7.3)	58 (8.7)	0.352	348 (6.4)
Health professionals working in EDs are more experienced	42 (8.1)	84 (10.5)	0.140	37 (3.7)	89 (4.9)	0.158	64 (10.0)	9 (1.4)	0.000	325 (6.0)
The department was recommended by others	65 (12.5)	52 (6.5)	0.000	41 (4.1)	31 (1.7)	0.000	19 (3.0)	21 (3.2)	0.835	229 (4.2)
It is more economical to receive healthcare in EDs	35 (6.7)	83 (10.4)	0.023	2 (0.2)	4 (0.2)	0.922	5 (0.8)	0 (0.0)	0.023	129 (2.4)
To be referred to a different health institution	7 (1.3)	40 (5.0)	0.000	0 (0.0)	13 (0.7)	0.008	14 (2.2)	6 (0.9)	0.060	80 (1.5)
I am impressed by my immediate relatives' use of ED	19 (3.7)	32 (4.0)	0.745	3 (0.3)	18 (1.0)	0.044	0 (0.0)	6 (0.9)	0.016	78 (1.4)
Obtaining a doctor's note for sick leave takes less time	5 (1.0)	19 (2.4)	0.060	5 (0.5)	11 (0.6)	0.738	2 (0.3)	2 (0.3)	0.972	44 (0.8)
Scenes featuring EDs in TV series impacted my choice of EDs	0 (0.0)	6 (0.8)	0.480	1 (0.1)	21 (1.2)	0.002	0 (0.0)	0 (0.0)	-	28 (0.5)
Because I do not have health insurance	3 (0.6)	13 (1.6)	0.088	1 (0.1)	7 (0.4)	0.178	0 (0.0)	1 (0.2)	0.326	25 (0.5)
To receive narcotics	2 (0.4)	4 (0.5)	0.759	0 (0.0)	2 (0.1)	0.297	0 (0.0)	0 (0.0)	-	8 (0.1)
To find shelter	0 (0.0)	2 (0.3)	0.253	0 (0.0)	2 (0.1)	0.297	0 (0.0)	0 (0.0)	-	4 (0.1)

*n number was increased because multiple options were checked, **ED: Emergency department

beliefs that their health issues required intravenous serum or intramuscular injection treatments, whereas in July (47.0%), the predominant reason was that EDs were the only available health services after working hours. The third most cited reason for visits during both March (32.1%) and July (33.4%) was the perceived need for urgent intervention.

Among the participants, 36.3% reported that receiving treatment and care from EDs made them feel valued (Table 3). Participants with primary and high school education reported a higher sense of feeling valued when admitted to the ED (38%) than those with undergraduate and higher education (31.8%), with a statistically significant difference ($p<0.0005$). Additionally, 15.7% of participants noted that visiting the ED drew the attention of their relatives. This perception was more common among those over 40 years of age (17.6%), married (17.1%), and patients without undergraduate education (16.0%) ($p<0.05$) (Table 3). No significant correlations were observed between other descriptive characteristics and opinions ($p>0.05$).

The study also assessed participants' perceptions of the purpose of emergency services. Among inappropriate users, 68.1% believed that EDs were intended for "health problems that require immediate intervention", while 26.0% thought EDs serve "all kinds of health problems, regardless of urgency". Additionally, 2.6% of the participants (n=143) indicated that ED offer services for a general examination from head to toe.

Among the participants, 57.8% described their health issues as "urgent" and 14.7% as an "emergency", while 27.5% labeled them as "non-urgent". Significant differences were observed in the participants' perceptions of urgency across study periods and levels of EDs ($p<0.05$) (Table 4). Additionally, the perception of health problems as urgent or emergency was more prevalent among females (74.2%) than among males (68.2%)

(p<0.0005), among those with a chronic disease (73.9%) than among those without (70.4%) (p=0.029), and among individuals without undergraduate education (73.6%) than among those with a graduate degree (68.6%) (p<0.0005).

The average waiting time expected by inappropriate users to be examined and receive care in the ED was 27.4±34.0 min (min. 0 min, max. 360 min). Among the participants, 60.8% reported that they were willing to wait for a maximum of one hour.

Discussion

Main Findings

In our study, the incidence of inappropriate use was 75.6%. The distribution of these inappropriate visits varied according to season and ED level, as detailed in the study by Gunduz et al. (12), and the reasons for such usage were further explored in our study. The study identified significant differences between the ED levels regarding the reasons for inappropriate use. The most prevalent reason for inappropriate use at Level 1 ED was "easy access"; at Level 2, it was "the absence of other health services providers after working hours"; and at Level 3, the predominant reason was "patients' belief that their health issue required intravenous serum/ intramuscular injection treatment". Seasonal analysis revealed that "easy access" remained the most common reason for inappropriate use across both study periods.

Table 3. Opinions of inappropriate users about the social benefits of choosing EDs (n=5.430)*

Benefits	n	%
Makes me feel valuable	1970	36.3
Helps me gain the attention of my relatives	854	15.7
Makes it easier for me to express my problems	331	6.1
Helps me get the attention of the ED team	320	5.9
Allows me to enter a different social environment	199	3.7
Allows me to establish social communication	209	3.8

*The n number was increased because multiple options were checked.
ED: Emergency department

Furthermore, approximately one-third of the participants reported feeling valued upon admission to the ED, while roughly one-fourth of the inappropriate users believed that EDs should address all types of health problems, regardless of their urgency.

In the Level 3 ED, most inappropriate visits were primarily for serum or injection therapy. In a related study by Tatli et al. (13) conducted at the same center, it was found that 82.3% of ED visits, including patients and their relatives, sought serum/ injection treatment; however, the study did not address the appropriateness of these visits. Similarly, Gentile et al. (14) reported that 37.6% of inappropriate ED visits were for obtaining medication. Amiel et al. (9) noted that this motive accounted for 69% of the visits. These findings align with the results of the current study.

The primary reason for inappropriate use at Level 2 ED was the absence of alternative health service providers after working hours, a factor also identified in other studies conducted in Turkey (7,15). The Level 1 ED, where the study was conducted, is situated in a rural area characterized by widespread agricultural activities. In contrast, the Level 3 ED is located within a university hospital and primarily serves a student population. Given its location in the city center, Level 2 ED primarily serves a population of working individuals. Therefore, it is likely that the proportion of individuals required to work during traditional working hours is higher in the community served by the Level 2 ED than in those served by Level 1 and Level 3 EDs. This demographic feature of the served community may explain the observed differences in ED usage patterns across the levels.

Various countries have implemented policies to extend primary healthcare services beyond traditional hours to reduce inappropriate ED visits resulting from the unavailability of these services outside regular working hours. Buckley et al. (17) showed that this method reduced visits with low urgency by 7.04%, and Daniel (16) reported that it reduced non-urgent visits by 0.03%.

Table 4. Participant opinions on perceived urgency levels of health issues according to different periods and levels of ED

	Level 1 n (%)		Level 2 n (%)		Level 3 n (%)		Total
	March (n=518)	July (n=785)	March (n=977)	July (n=1791)	March (n=641)	July (n=639)	n=5.351
Emergency	34 (6.6)	126 (16.1)	162 (16.6)	240 (13.4)	133 (20.7)	93 (14.6)	788 (14.7)
Urgent	368 (71.0)	422 (53.8)	469 (48.0)	1132 (63.2)	331 (51.6)	369 (57.7)	3091 (57.8)
Non-urgent	116 (22.4)	237 (30.2)	346 (35.4)	419 (23.4)	177 (27.6)	177 (27.7)	1472 (27.5)
p value	<0.0005		<0.0005		0.01		

Bonferroni correction was applied for pairwise comparisons (p=0.016). Statistical differences in perceived urgency between March and July were as follows: in Level 1, all binary comparisons; Level 2, "emergency and urgent" and "non-urgent and urgent"; in Level 3, urgent and emergency.
ED: Emergency department

However, Nagree et al. (18) found that this method did not affect the rate of non-urgent visits. In Turkey, some centers offer outpatient services outside regular working hours during certain periods. However, no research has demonstrated the impact of this practice on ED visits in Turkey.

Easy access was identified as the most common reason for inappropriate use at Level 1 ED. This trend is associated with the ED's central location in an area characterized by rough terrain. Additionally, when analyzing the reasons for inappropriate use by season, it was found that easy access remained the most common reason in both study periods, March and July. Another study conducted in Turkey found that 12.8% of inappropriate ED visits were attributed to the facility's proximity to patients (15). In contrast, a study by Amiel et al. (9) in England reported a much higher rate of 46% for similar reasons. Meanwhile, an additional study in the UK identified a considerably lower rate of 6.5% for visits influenced by the ED's vicinity (10). In Belgium, the rate of inappropriate ED visits attributed to the proximity of the facilities was 21.3%, whereas in Malaysia, it was slightly higher at 27% (19, 20). Therefore, when assessing inappropriate visits related to the closeness of EDs, it is crucial to compare the distances between EDs and alternative healthcare units.

Approximately one-quarter of the participants visited the ED because diagnostic and treatment procedures were performed quickly (28%), and there was no need to wait in line for examination (24%). In an international study covering 34 countries, while the rate of ED visits due to short waiting times was below 5% in most countries, it was determined to be 20% in Turkey (21). These results indicate that the rate of inappropriate visits due to short waiting times in Turkey is higher than the global average.

Conditions affecting ED visits are explained by the conceptual model developed by Andersen and Newman. According to the model, the main factors affecting ED visits are demographic characteristics, the health system, and factors related to the health problem (22). In our study, apart from the factors mentioned in the model, it was determined that receiving treatment and care from the ED affected ED visits by leading to individual perceptions such as feeling valuable (36.3%) and gaining the attention of relatives (15.7%).

It was determined that 57.8% of the participants evaluated their health problem as "urgent" and 14.7% as "emergency". Similar to our study, Ahmed et al. (23) found that 54% of inappropriate users defined their health problem as "emergency" and 37% of the participants perceived as "urgent". In the study by Nelson (8), none of the inappropriate users defined their health problem as "emergency", but 48% defined it as "urgent".

Our study determined that approximately one-third of the participants (32.9%) visited the ED because they believed that urgent intervention was necessary for their complaint. The rate of inappropriate visits due to perceived urgency was 14.5% in another study conducted in Turkey (7). This rate was 85% in the study by Selasawati et al. (20) and was similar to our findings at 33.2% in the study by Detollenaere et al. (19). Variations in these research results may be associated with differences in the public's level of knowledge about emergency health issues.

Study Limitations

Some participants left the interview before completing the form, resulting in incomplete demographic data for certain patients.

Conclusion

Inappropriate attendance constitutes a significant portion of ED usage. The predominant reasons for such misuse varied by level: "easier access" at Level 1, "lack of other healthcare services outside normal working hours" at Level 2, and "perceived need for serum/injection treatment" at Level 3. Additionally, patients often prefer EDs for non-emergency health issues because the care received makes them feel valued. Seasonal analysis also revealed that "easy access" was consistently the most common reason for inappropriate use across both study periods. The insights from this study elucidate the motivations driving individuals to use EDs for non-emergency situations and could inform strategies aimed at reducing inappropriate ED use.

Ethics

Ethical Committee Approval: Karadeniz Technical University Scientific Research Ethics Committee Hospital (ethics committee decision number: 24237859-562, date: 12.10.2016).

Informed Consent: Consent form was filled out by all participants.

Authorship Contributions

Surgical and Medical Practices - Concept: A.Y., M.T., A.G., Design: A.Y., M.T., A.G., Data Collection or Processing: M.İ., A.S.Ş., P.Ş., Ö.G.Ç., H.S.V., M.Y., M.Ç., E.B., Analysis or Interpretation: P.Ş., Ö.T., Literature Search: P.Ş., M.Y., M.Ç., Writing: M.İ., A.S.Ş., P.Ş., Ö.T.

Conflict of Interest: The authors declare no conflict of interests.

Financial Disclosure: This study was conducted with the support of the Scientific and Technical Research Council of Turkey (TÜBİTAK) within the 3001-Starting R&D Projects Support Program under project number: 216S972. We would like to thank TÜBİTAK for its support.

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EURASIAN JOURNAL OF EMERGENCY MEDICINE
Original Article
DOI: 10.4274/eajem.galenos.2024.94809
Eurasian J Emerg Med. 2024;23(2): 139-42

Why Does Non-traumatic Musculoskeletal Pain Apply to the Emergency Department? Cross-sectional Study from a Fourth-level University Hospital

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Abstract

Aim: Overcrowding in emergency departments (ED) is one of the most important problems in healthcare systems around the world. musculoskeletal pain (MSP) is one of the most common non-emergencies and non-traumatic reasons for admission to emergency services. This study aimed to determine the proportion of non-traumatic MSP admissions to the ED of a university hospital in Istanbul.

Materials and Methods: Hospital records of emergency admissions were retrospectively reviewed according to International Classification of Diseases codes between January 01 and December 31, 2021. Patients aged 18 years who applied to the non-traumatic ED were included. The patients were separated according to gender, age groups, and diagnostic codes.

Results: The total number of patients admitted to the ED was 265.081. While 71.158 of these applications were for general pain, 5.940 (2%) patients applied for non-traumatic, non-specific MSP. Among these 5.940 patients, 3.058 (51.48%) were male and 2.882 (48.52%) were female.

Conclusion: Because of its high prevalence and social impact, MSP should be considered when planning policies for optimizing health resources in emergencies. Implementation of training programs to cope with these problems or the development of MSP emergency care units open to the use of emergency physicians may be a precautionary measure.

Keywords: Overcrowding, low back pain, inappropriate use, emergency, non-traumatic reasons, emergency admissions

Introduction

One of the most important problems in healthcare systems around the world is overcrowding in emergency departments (ED) (1). Due to the limited resources in the ED, there is a need to prioritize patients who come to receive emergency medical care. The patient's treatment is prioritized by evaluating the urgency of the current situation with the presenting complaint and preliminary diagnosis (2).

Acute musculoskeletal pain (MSP) has a wide variety of causes, from simple problems such as contusions, sprains, strains, and chronic low-intensity MSP to emergencies such as fractures or dislocations or severe traumas that are life- or limb-threatening (3). Although MSP is the leading cause of adult disability worldwide and is associated with reduced quality of life, persistent morbidity, and reduced working capacity (4) most of these conditions are short-term, self-limiting, or manageable with simple analgesia and/or physical therapy (5). MSP is one of the most common non-emergency reasons for admission to ED's (6) and most MSP admissions are non-traumatic (7). In general, non-traumatic MSP has been identified as a significant economic burden and care requirement for any health system (8). In particular, chronic and non-traumatic MSP represents more than 25% of all emergency room visits that emergency teams must evaluate and treat every day (4,5).

As MSP is the most common complaint in patients admitted to the ED, it is of obvious interest to researchers investigating inappropriate use of the ED and ED overcrowding (1,3). Despite

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Cite this article as: İncealtın O, Erhan B, Özaydın V, Yumuşakhuylu Y. Why Does Non-traumatic Musculoskeletal Pain Apply to the Emergency Department? Cross-sectional Study from a Fourth-level University Hospital. Eurasian J Emerg Med. 2024;23(2): 139-42.

Received: 14.08.2023
Accepted: 09.05.2024

this, the proportion of non-traumatic MSP admissions in EDs has been scarcely studied. This study aimed to determine the proportion of non-traumatic MSP admissions to the ED of a university hospital in Istanbul, which is a megacity.

Materials and Methods

Prof. Dr. Süleyman Yalçın City Hospital is a fourth-line university-based hospital serving a geographic region with a population of approximately 17 billion people. On average, our hospital receives approximately 1,750,000 patient visits per year. Our hospital's ED accepts approximately 2000 patients per day. Patients are first evaluated in the triage zone and consulted with the relevant department if necessary.

The study was conducted as a single-centered and retrospective. We retrospectively reviewed hospital records of emergency admissions according to International Classification of Diseases (ICD) codes between January 01 and December 31, 2021. Patients aged 18 years and older with ICD codes of low back pain (LBP), neck pain, and joint pain (knee-shoulder-hip, etc.) who applied to the non-traumatic ED were included. The patients were separated according to gender, age groups, and diagnostic codes.

This retrospective observational study was conducted in accordance with the amended Declaration of Helsinki and approved by the Ethics Committee of the İstanbul Medeniyet University, Prof. Dr. Süleyman Yalçın City Hospital (decision number: 2013-KAEK-64, date: 09.02.2022).

Statistical Analysis

Following the stratification of presenting patients into categories based on gender and age groups, a data analysis was performed to determine the association between the nature of presenting complaints and the demographic variables of gender and age.

Results

The total number of patients admitted to the non-traumatic ED between January 01 and December 31, 2021, was 265.081. While 71.158 of these applications were for general pain such as visceral pain or headache, 5.940 (2%) patients applied for non-traumatic, non-specific MSP with ICD codes of LBP, neck pain, and joint pain (knee-shoulder-hip, etc.). A summary of emergency service applications between the specified dates is shown in Table 1.

Among these 5.940 patients, 3.058 (51.48%) were male and 2.882 (48.52%) were female. Table 2 shows MSP diagnoses by gender.

We grouped MSP diagnoses according to age. The results are shown in Table 3.

Table 1. Ratio of patients diagnosed with MSP among all patients admitted to the ED [number (n)-percent (%)]

Pain	Total patient admissions (n)	Other diagnosis (n)	Other general pain (n)	MSP (n)	Ratio of MSP to total admission %
Total	265.081	187.983	71.158	5.940	2%

MSP: Musculoskeletal pain, ED: Emergency department

Table 2. MSP diagnoses by gender

Diagnosis	Men n (%)	Women n (%)	Total n
LBP	2.182 (71.35%)	1.968 (68.29%)	4.150
Neck pain	168 (5.49%)	187 (6.49%)	355
Joint pain	708 (23.15%)	727 (25.23%)	1.435
Total	3.058 (51.48%)	2.882 (48.52%)	5.940

LBP: Low back pain, MSP: Musculoskeletal pain

Table 3. MSP diagnoses according to age

Age (years)	18-39 n (%)	40-64 n (%)	65 and older n (%)	Total n
LBP	1.760 (67.77%)	2.036 (73.69%)	354 (61.03%)	4.150
Neck pain	209 (8.05%)	136 (4.92%)	10 (1.72%)	355
Joint pain	628 (24.18%)	591 (21.39%)	216 (37.24%)	1.435
Total	2.597 (43.72%)	2.763 (46.52%)	580 (9.76%)	5.940

LBP: Low back pain, MSP: Musculoskeletal pain

Discussion

The causes of ED overcrowding are multifactorial and include factors related to patients, hospitals, and the healthcare system (1). MSP complaints are a common reason for patients to visit the ED for prompt evaluation and treatment (9). Although non-traumatic MSP has been identified as an important reason for consultation in primary care, its impact on primary care and emergency services is an understudied issue (10). To the best of our knowledge, this is the largest study describing the burden of non-traumatic MSP in the ED setting and the only study investigating common non-traumatic MSPs such as LBP, cervical pain, and other joint pains. We scanned the details of non-traumatic MSP applications in the ED of our hospital from the hospital registry system. Our findings show that non-traumatic MSP is a relatively common reason for ED admissions.

Compared with other chronic diseases, patients with MSP complaints have a higher rate of referral to healthcare professionals (11) and represent a significant portion of the ED burden. It is appropriate for patients with acute or serious conditions to be admitted to the ED, but for patients with non-acute and non-serious conditions, it is more appropriate to seek service from a primary health care institution. However, it is observed that patients present to the ED significantly because of non-urgent low-risk MSP, and especially in our country, these patients are more likely to come to the ED for evaluation at a time convenient for them.

In our study, we found that the rate of non-urgent, non-traumatic MSP admissions to our hospital's ED was 2% of the total admissions in the last year, which corresponds to 5940 visits. These figures are slightly lower than expected on the basis of previously reported results (7,12). Pasta et al. (13) reported that chronic and non-traumatic MSP, which is a worldwide cause of adult disability, accounted for more than 25% of all ED admissions. Although the number of patients admitted is high, we were surprised that the rate of MSP was quite low compared with world data. This difference can be explained by differences in patient selection; while we searched the data, we excluded traumatic conditions, emergencies such as septic arthritis, and possible complications of known rheumatic diseases. It may also be appropriate to suggest that this difference is due to the ongoing effects of the pandemic.

Edwards et al. (14) stated that LBP, which is the most common cause of MSP, constitutes 4.39% of all ED admissions and is one of the most common complaints in admissions to emergency services worldwide. Another study showed that LBP accounted for 2.3% of all emergency admissions (15). In our study, LBP constituted 69.86% of all MSP and 1.56% of all ED admissions. Our finding was similar to the results of Baker et al. (4), who reported that 1.3% of all ED presentations were for LBP.

Other causes of MSP in EDs have been scarcely studied; for example, little is known about neck pain, which is the fourth leading cause of morbidity in the world and has a poor prognosis compared with LBP (16,17). Last year, 355 patients with neck pain visited our ED. This constituted 0.14% of all emergency admissions and 5.97% of all emergency MSP admissions.

The only study separating MSP subgroups reported the most common pains presenting to the ED as low back, neck, and chest (55%), shoulder (9%), wrists and hands (9%), and knee pain (9%) (12). In our study, the most common MSP was LBP (1.56%), followed by joint pain (0.54%) involving the shoulder, knee, and hip joints, and neck pain (0.14%).Studies have shown that there is an increasing worldwide referral for ED because of the ease of obtaining emergency medical care for non-emergent medical conditions (18). Among the wide spectrum of patients faced by emergency physicians, non-traumatic MSP, especially low back and neck pain, occupies a large place. This results in ED overcrowding, increased waiting times, reduced quality of care, and increased probability of adverse events. In addition to the overcrowding of the emergency room, the high care burden, significant health expenditures, and social cost of incapacity for work should also be taken into account (19).

Study Limitations

The fact that the study was retrospectively conducted from hospital records can be considered a limitation. There is also the possibility that ICDs are not written fully and adequately in hospital emergency situations, but we think that this is not significant enough to affect our statistical results. A limitation of our study was the inability to obtain patients' occupations as demographic data. This is because the nature of the patients' employment and their working hours could impede their ability to visit the outpatient clinic.

Conclusion

To conclude, one of the principal contributors to congestion in ED is non-urgent patients' improper utilization of emergency services. Although non-traumatic MSP is not an emergency or a risky situation, it continues to constitute a significant part of ED admissions. Because of both its high prevalence and social impact, non-traumatic MSP should be considered when planning policies for optimizing health resources in emergencies. Implementation of training programs to cope with these problems or the development of MSP emergency care units open to the use of emergency physicians may be a precautionary measure. Another recommendation for an appropriate solution

is that public service announcements could be utilized to inform individuals about the advisability of visiting family medicine rather than ED for conditions that generally do not require X-ray imaging. The scarcity of publications in the literature indicates the need for an in-depth study of this subject.

Ethics

Ethics Committee Approval: This retrospective observational study was conducted in accordance with the amended Declaration of Helsinki and approved by the Ethics Committee of the İstanbul Medeniyet University, Prof. Dr. Süleyman Yalçın City Hospital (decision number: 2013-KAEK-64, date: 09.02.2022).

Informed Consent: Retrospective study.

Authorship Contributions

Surgical and Medical Practices: O. İ., B. E., V. Ö., Y.Y., Concept: O. İ., B. E., V. Ö., Y.Y., Design: O. İ., B. E., Y. Y., V. Ö., Data Collection or Processing: O. İ., B. E., V.Ö., Analysis or Interpretation: O. İ., B. E., V. Ö., Literature Search: O. İ., B. E., V. Ö., Y.Y., Writing: O. İ., B. E., V. Ö., Y.Y.

Conflict of Interest: Authors declare no conflict of interests.

Financial Disclosure: The authors declared that this study received no financial support.

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EURASIAN JOURNAL OF EMERGENCY MEDICINE
Original Article
DOI: 10.4274/eajem.galenos.2024.23281
Eurasian J Emerg Med. 2024;23(2): 143-8

Relationship Between Diabetes and Acalculose Cholestitis in the Elderly

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Abstract

Aim: The clinical picture of acute stoneless cholecystitis can be seen in a wide range from mild lesions to the size that threatens the patient's life. In this study, we aimed to contribute to the literature by investigating the relationship between patients with acute stone-free cholecystitis and diabetes mellitus (DM).

Materials and Methods: Patients were analyzed for age, sex, and blood tests. Descriptive statistics for numerical variables are presented as mean, standard deviation, min-max values. Non-parametric test procedures were performed on non-normally distributed data. In this context, dependent and independent sample t-test and Mann-Whitney U test were used to determine the relationships between the parameters. Spearman's correlation analysis was used, and chi-square analysis was performed to evaluate the relationship between categorical data.

Results: The parameters measured by complete blood count and biochemistry were as follows: neutrophil: 56.72±23.17, C-reactive protein (CRP): 38.31±7.70, aspartate aminotransferase (AST): 78.86±25.80, alanine aminotransferase (ALT): 73.59±159.90, gamma glutamyl transferase (GGT): 142.99±236.08, urea: 37.14±24.41, creatinine: 0.90±0.50, glucose: 115.42±53.70, white blood cell: 8.49±6.66, percentage of neutrophils: 63.80±14.10, platelet: 245.63±84.62. There was a positive correlation between CRP and AST, CRP and ALT, CRP and GGT, and ALT and GGT in DM+ patients.

Conclusion: It can be said that advanced age and the presence of DM increase the risk of stoneless cholecystitis, and blood parameters are used to show the presence of infection. In addition, deterioration in liver function tests increases more in patients with DM.

Keywords: Acalculous cholecystitis, blood tests, chronic diseases, diabetes mellitus, inflammation

Introduction

Acute cholecystitis is an inflammatory disease of the gallbladder. When patients with abdominal pain complaints are evaluated, it is seen that 3-10% of them have acute cholecystitis (1,2). Acute cholecystitis usually occurs because of obstruction of the cystic duct by gallstones. However, approximately 5% of patients do not have gallstones, and this is called acalculous cholecystitis (3,4). The clinical picture of acute cholecystitis can be seen in a wide range from mild lesions to the size that threatens the patient's life. The reason for this can be the degree of inflammation, presence of comorbid disease, and advanced age (5,6). Diabetes

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Cite this article as: Dolanbay T, Şahin L, Gül HF, Aras M, Atalay E, Geçgel Aras G, Anuk T, Evran M, Akbaş İ, Canbaz H. Relationship Between Diabetes and Acalculose Cholestitis in the Elderly. Eurasian J Emerg Med. 2024;23(2): 143-8.

Received: 17.01.2024
Accepted: 30.05.2024

mellitus (DM) is a chronic disease that affects 150 million people worldwide and is still ongoing, manifested by impaired function of beta cells in the pancreas and development of resistance to the effects of insulin in the organs. increases rapidly (7,8). In DM examined in two subgroups, type 1 DM mostly occurs due to insulin deficiency, whereas type 2 DM is mostly associated with insulin resistance in tissues (9-11). In this study, we aimed to reveal whether there is a relationship between DM and acute stone-free cholecystitis and to contribute to the literature by investigating the relationship between patients with acute stone-free cholecystitis and DM and examining its correlation.

Materials and Methods

This retrospective study was cross-sectional and observational. Demographic data and computed tomography of patients with and without DM who were diagnosed with acute stone-free cholecystitis and who applied to the Emergency Department and Internal Medicine Clinic of Kafkas University Health Research and Application Hospital between 01.10.2016 and 01.10.2019 were included. Ethical approval for our study was obtained from the Ethics Committee of Kafkas University, numbered 80576354-050-99/223 on 10.10.2019. Hemogram, biochemistry, such as C-reactive protein (CRP), creatinine, urea, aspartate aminotransferase (AST), alanine aminotransferase (ALT), gamma glutamyl transferase (GGT), liver function test (LFT), kidney function test, and blood glucose of the patients were analyzed. Patients under the age of 18 years were not included in our study.

Statistical Analysis

Age, sex, blood tests, and data were analyzed using the SPSS 20.0 (IBM, USA) program. Descriptive statistics for numerical variables are presented as mean, standard deviation, median, min-max values. In this context, the relations between parameters are presented. Mann-Whitney U test, which is a non-parametric alternative to the independent sample t-test, was used to determine Spearman correlation analysis in correlation analysis. Chi-square analysis was used to evaluate the relationship between categorical data. Results were evaluated at a 95% confidence level and $p<0.05$ was accepted as statistically significant. Because our study was retrospective, the voluntary consent form was waived and patient data were kept confidential.

Results

Descriptive Statistics

Of the patients, 53.67% were female (n=59) and 46.33% were male (n=51). The mean age of the patients in the study was found to be 69.96±4.128 years. The blood parameters of the patients were evaluated using the ABX Pentra DX 120 (Horiba, HORIBA ABX SAS, Japan) in our hospital according to sex and reference ranges. All diabetic patients participating in the study were diagnosed with type-2 DM. The parameters measured by complete blood count and biochemistry were determined to be as follows: neutrophil: 56.72±23.17, CRP: 38.31±7.70, AST: 78.86±25.80, ALT: 73.59±159.90, GGT: 142.99±236.08, urea: 37.14±24.41, creatinine: 0.90±0.50, glucose: 115.42±53.70, white blood cell (WBC): 8.49±6.66, neutrophil percentage: 63.80±14.10, hemoglobin: 13.80±4.60, hematocrit: 41.5±5.25,

Table 1. Parameters measured by age, complete blood count and biochemistry parameters

n=110	Mean	Deviation	Minimum	Maximum	Median
Age, years	69.96	4.13	65.00	89.00	71.55
Neutrophil, $x10^3$	56.72	23.17	0.29	60.00	54.02
CRP, mg/dL	38.31	7.70	1.10	38.90	34.95
AST, U/L	78.86	25.80	9.00	2592.00	77.03
ALT, U/L	73.59	159.90	2.00	1366.00	71.23
GGT, U/L	142.99	236.08	6.00	1044.00	82.32
Urea, mg/dL	37.14	24.41	11.00	187.00	36.54
Creatinine, mg/dL	0.90	0.50	0.60	3.80	0.70
Glucose, mg/dL	115.42	53.70	45.00	482.00	118.40
WBC, $x10^3$	8.49	6.66	4.00	28.00	9.02
Hb, g/L	13.80	4.60	6.70	17.40	13.70
Hct, %	41.50	5.25	19.50	51.90	41.60
Neutrophil percentage	63.80	14.10	48.50	89.00	60.06
Plt, fL	245.63	84.62	210.00	639.00	252.00

CRP: C-reactive protein, AST: Aspartate aminotransferase, ALT: Alanine aminotransferase, GGT: Gamma glutamyl transferase, WBC: White blood cell, Hb: Hemoglobin, Htc: Hematocrit, Plt: Platelet count

platelet count: 245.63±84.62 (Table 1).

Acute stone-free cholecystitis was diagnosed together with DM at a rate of 31.81% in our study. When the patients' age, neutrophil, CRP, AST, ALT, GGT, urea, creatinine, glucose, WBC count, neutrophil percentage, hemoglobin, hematocrit, and platelet values were analyzed according to the presence of DM, age, CRP, AST, ALT, and glucose were determined to be statistically

Table 2. Clinical characteristics and laboratory findings of patients according to the presence of DM

	DM status	**n**	**p value**
Age, years	DM (+)	75	0.043*
	DM (-)	35	
	n	110	
Neutrophil, x10^3	DM (+)	75	0.372*
	DM (-)	35	
	n	110	
CRP, mg/dL	DM (+)	75	0.002**
	DM (-)	35	
	n	110	
AST, U/L	DM (+)	75	0.064**
	DM (-)	35	
	n	110	
ALT, U/L	DM (+)	75	0.049**
	DM (-)	35	
	n	110	
GGT,U/L	DM (+)	54	0.004*
	DM (-)		
	n	27	
	Total	81	
Urea, mg/dL	DM (+)	75	0.485*
	DM (-)	35	
	n	110	
Creatinine, mg/dL	DM (+)	75	0.810*
	DM (-)	35	
	n	110	
Glucose, mg/dL	DM (+)	75	0.001*
	DM (-)	35	
	n	110	
WBC, x10^3	DM (+)	75	0.264*
	DM (-)	35	
	n	110	
Neutrophil, %	DM (+)	75	0.311*
	DM (-)	35	
	n	110	
Hb, g/L	DM (+)	75	0.499*
	DM(-)	35	
	n	110	
Hct, %	DM (+)	75	0.893*
	DM (-)	35	
	n	110	
Plt, fL	DM (+)	75	0.793**
	DM (-)	35	
	n	110	

*The Mann-Whitney U, **the independent sample t-test. CRP: C-reactive protein, AST: Aspartate aminotransferase, ALT: Alanine aminotransferase, GGT: Gamma glutamyl transferase, WBC: White blood cell, Hb: Hemoglobin, Htc: Hematocrit, Plt: Platelet count, DM: Diabetes mellitus

Table 3. The relationship of blood paremeters of patients with diabetes and non-diabetes

			AST	ALT	GGT
DM- patients	CRP, mg/dL	Correlation coefficient	0.282*	0.205	0.604**
		Sig. (2-tailed)	**0.023**	0.098	**0.001**
	AST, U/L	Correlation coefficient		0.804**	0.654**
		Sig. (2-tailed)		**0.001**	**0.001**
	ALT, U/L	Correlation coefficient			0.586**
		Sig. (2-tailed)			**0.001**
DM+ patients	CRP, mg/dL	Correlation coefficient	0.533**	0.405*	0.437*
		Sig. (2-tailed)	**0.001**	**0.016**	**0.023**
	AST, U/L	Correlation coefficient		0.894**	0.673**
		Sig. (2-tailed)		**0.001**	**0.001**
	ALT, U/L	Correlation coefficient			0.654**
		Sig. (2-tailed)			**0.001**

*Spearman's correlation analysis, p<0.05, **p<0.001
CRP: C-reactive protein, AST: Aspartate aminotransferase, ALT: Alanine aminotransferase, GGT: Gamma glutamyl transferase, DM: Diabetes mellitus

significant (Table 2).

The difference between gender and the presence of DM was not statistically significant (p=0.361).

While there was a moderate positive correlation between CRP and AST levels in DM+ patients, there was a low positive correlation between CRP and AST levels in DM patients. Although there was a moderate positive correlation between CRP and ALT in DM+ patients, no correlation was found in DM patients. While there was a moderate positive correlation between CRP and GGT in DM+ patients, a high positive correlation was observed in DM patients. Although there was a high positive correlation between ALT and GGT in DM+ patients there was a moderate positive correlation in DM patients (Table 3).

When the hospital stay times of the patients between the diabetic and non-diabetic groups were compared, the hospital stay time in the diabetic acute stone-free group was statistically longer. (p=0.002). Again, a strong positive correlation was detected between blood sugar and hospital stay duration.

Discussion

Gallbladder inflammation may be acute, chronic, or acute-on-chronic. The mechanism of inflammation has not been understood well and is likely to be multifactorial; infection, chemical and mechanical irritation, and cystic duct obstruction contribute to this. The most common cause of acute cholecystitis is acute inflammation of the cystic duct caused by obstruction by a stone. The gallbladder mucosa, which is stretched because of obstruction, is damaged, and the first step of inflammation begins. Hydrolysis of lipids (lecithin) and reabsorption of bile salts play a role in the initiation of inflammation. Bacteria can be produced in 80% of acutely inflamed gall bladders. However, there are no bacteria in many cases, which makes it impossible to detect microbial invasion as a primary cause. Therefore, it is thought that supersaturation in bile-forming elements, such as the presence of excess bile salts or acids, causes an imbalance or chemical inflammation and thus secondarily facilitates bacterial invasion. Bacterial invasion can initiate the disease in cholecystitis that develops during the course of only one systemic bacterial infection. Indeed, most of these patients do not have gallstones (12). Apart from this, acute cholecystitis has emerged as an important acute pathology in elderly patients. In this study, we believe that the presence of additional chronic diseases in elderly patients increases metabolism compared with anabolism (13).

Biliary system contamination is thought to occur by three mechanisms:

- Microorganisms in the duodenum can reach the bile ducts via the ascending path.

- The bile can also be infected by portal venous bacteremia and lymphatic route.

- In the primary intestinal disease phase (such as typhoid and cholera), there may be biliary infection with arterial and portal venous bacteremia, particularly acute cholecystitis (14). The excess bile amount is the most important reason that the microorganism cannot hold here because the bile flows continuously from a narrow lumen (15).

Stone-free cholecystitis is more common in immunosuppressed

patients. Frequent gangrene and necrosis in acalculous cholecystitis suggest that ischemia is a factor (14). Although the symptoms are the same as those of acute stone cholecystitis, this situation can be masked. Pain can be masked by the use of analgesics and unconsciousness (16). Distension and a decrease in bowel sounds were observed in 25% of cases. Although 85-96% of the patients have an increase in white blood cells and 50% have an increased value of alkaline phosphatase, these tests are not helpful in diagnosis.

Recent evidence indicates that bacterial infections are common in diabetic individuals (17). Infection is more common in diabetic individuals than in healthy individuals (18). The reason for this is vascular and neuropathic complications related to the structure and dysfunction in organs that develop due to hyperglycemia (19). Hypotension and low blood flow are present in sepsis, trauma, and burns (20). We are of the conviction that this situation negatively affects the prognosis of the patients and explains their long-term stay in the hospital.

The gall bladders of diabetic individuals are often enlarged, which decreases motility and a significant impairment of gallbladder emptying (21).

Blood circulation in diabetes is insufficient. The lack of oxygen source in the gallbladder creates a suitable environment for the growth of bacteria, which is an important cause of emphysematous cholecystitis (22). We believe that our study is consistent with this mechanism and that acute stone-free cholecystitis is more common in the presence of DM.

Although infection is not the primary cause of acute cholecystitis, it develops in 50% of patients. The susceptibility of diabetic individuals to infection due to a weakened immune system increases the risk of cholecystitis (23). In our study, when the LFT of diabetic patients (AST, ALT, GGT) were evaluated by the correlation test compared with those with acalculous cholecystitis without diabetes, higher significant correlation data were found.

In a meta-analysis performed by Aune and Vatten (11), it was revealed that there was an increase in gallbladder diseases in patients with DM, and this situation was associated with insulin resistance and obesity. In another study, when patients with emphysematous cholecystitis were examined, it was found that 55% had DM (15). In our study, the association of DM with acute stone-free cholecystitis was determined at a rate of 31.81%. This rate is lower compared to the literature, and we believe that this is due to the eating habits in our region and low obesity rates.

Many clinical conditions that can cause or accompany the disease have been described. The theories suggested in the pathogenesis of acute stone-free cholecystitis can be categorized into three groups: biliary stasis, sepsis, and ischemia. Biliary stasis occurs when the gallbladder cannot contract. After stasis, the concentration of bile increases significantly, and a viscous substance known as bile sludge is formed. This viscous material prepares the ground for edema, venous and lymphatic obstruction, ischemia, and necrosis as a cause of functional obstruction in the gallbladder. Simultaneously, it plays a role in the invasion of bacteria into the gallbladder wall by increasing bacterial colonization. The high frequency of necrosis and gangrene in the gallbladder in acute stone-free cholecystitis suggests that ischemia also plays a role in the pathogenesis. A new distribution occurs in the mucosal blood flow in the kidney, stomach, gall bladder, and lungs due to hypotension or shock (15). Anoxia that occurs because of the new distribution disrupts the barrier function of the mucosa, which causes acute inflammation because of mucosal ulceration and secondary bacterial invasion. The lower incidence of gall bladder pathologies compared with other organ failures occurring in shock has been attributed to the less affected gallbladder microcirculation in hypotension or shock (24,25).

Although the WBC count may be normal in elderly, diabetic, and immunosuppressed patients, it usually increases (4). The WBC count is usually between 12.000 and 15.000/mm^3. The high WBC count supports the presence of complications such as gangrene and perforation. CRP, the serum level of which increases in inflammatory conditions and is reported to increase in correlation with disease severity, is used as a laboratory parameter in diagnosis (4-6).

In another study, Beliaev and Booth (26) determined that the average AST level was 29, the average ALT level was 33, the average ALP level was 88, the average GGT level was 65, and the average amylase level was. In our study, the liver AST, ALT, and GGT values were also increased in accordance with the findings in the literature.

While there was a moderate positive correlation between CRP and AST levels in DM+ patients, a low positive correlation was found between CRP and AST levels in DM patients. We believe that the reason for this is that infection parameters tend to increase in patients with DM (23). CRP is a positive acute phase reactant and is expected to increase in infective cases.

In our study, we found a high positive correlation between ALT and GGT levels in DM+ patients. In addition to the fact that GGT is more specific for biliary tract pathologies, in the study conducted by Elwood (21), they stated that the presence of DM increased the susceptibility to gallbladder pathologies. It is obvious that the precision of bile disorders is increased in diabetic patients

and that biochemical markers such as GGT and ALT are serious prognostic indicators in DM+.

Study Limitations

This study has some important limitations. First, a small sample size. These limits are second, this study has affected the generalizability of the findings. Data obtained only from the Department of Emergency Medicine Kafkas University Application and Research Hospitals. Hospital. The data obtained from these hospitals may not fully reflect all patients.

Conclusion

Therefore, we can say that the presence of DM increases the risk of acalculous cholecystitis and the blood parameters used to show infection. Furthermore, impairment in LFTs increases more in patients with DM.

Ethics

Ethics Committee Approval: Ethical approval for our research was secured from the Ethics Committee of Kafkas University Faculty of Medicine Ethics Committee (ethics committee decision no: 80576354-050-99/223, date: 10.10.2019).

Informed Consent: Retrospective study.

Authorship Contributions

Surgical and Medical Practices: T.D., L,Ş., HF.G., M.A., E.A., G.G.A., T.A., M.E., İ.A., H.C., Concept: T.D., HF.G., Design: T.D., HF.G., Data Collection or Processing: T.D., M.A., M.E., Analysis or Interpretation: T.D., L,Ş., HF.G., M.A., E.A., G.G.A., T.A., M.E., İ.A., H.C., Literature Search: T.D., L,Ş., HF.G., M.A., E.A., G.G.A., T.A., M.E., İ.A., H.C., Writing: T.D., L,Ş., HF.G., M.A., E.A., G.G.A., T.A., M.E., İ.A., H.C.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

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EURASIAN JOURNAL OF EMERGENCY MEDICINE
Case Report
DOI: 10.4274/eajem.galenos.2024.99076
Eurasian J Emerg Med. 2024;23(2): 149-51

Clinical Case Report of Hydrogen Peroxide Poisoning is Treated by Hyperbaric Oxygen Therapy

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Abstract

Hydrogen peroxide is a commonly used oxidizing agent with many different uses such as: as a multi-purpose disinfectant, non-chlorine bleach, hair dye, chlorine neutralizer in water, as a cleaning agent. bleaching in paper production, making wound cleaning agents, sterilizing ophthalmic instruments, etc. Owing to its applications in many fields, ingestion of hydrogen peroxide is not a rare case of poisoning. A 30-year-old female patient presented to our poison control center because of epigastric pain after drinking industrial hydrogen peroxide. Physical examination revealed that the patient was conscious, had no signs of infection, was hemodynamically stable, and had abdominal tenderness in many epigastric areas. Computed tomography results showed air in the biliary tract in the liver, air in the stomach wall, and poor drug enhancement in the stomach wall. Faced with the risk of gastric wall necrosis and gas embolism, the patient was prescribed hyperbaric oxygen therapy (HBO). After 3 days of hyperbaric oxygen treatment, the patient's clinical condition improved significantly. This article aims to discuss the mechanism of injury in hydrogen peroxide poisoning and hyperbaric oxygen therapy HBO in concentrated hydrogen peroxide poisoning.

Keywords: Hydrogen peroxide poisoning, hyperbaric oxygen, therapy

Introduction

Hydrogen peroxide, or hydrogen peroxide (often called hydrogen peroxide, with the chemical formula H_2O_2), is a liquid oxidant with viscous and strong oxidizing properties (1). This compound can be absorbed into the body through the digestive tract, respiratory tract, and skin. Of these, absorption through the gastrointestinal tract accounts for most recorded poisoning cases. There are three main mechanisms that cause hydrogen peroxide poisoning: corrosive damage, oxygen gas formation and lipid peroxidation (2). Depending on the concentration of the oral solution, it will cause different clinical conditions. In this report, we present the case of a patient with hydrogen peroxide poisoning at the 18th hour with signs of severe stomach damage and many air bubbles in the stomach wall.

Case Report

A 30-year-old female patient was admitted to the hospital because she consumed hydrogen peroxide.

History: No previous chronic or mental illness detected.

Development: According to family members, during the days near the hospital, the patient was scammed for money online but did not tell anyone. At approximately 5:00 a.m. on January 11, 2024, the patient drank about 100 mL of industrial hydrogen peroxide with a concentration of 50% and vomited an unknown amount after drinking. The patient then used a knife to cut herself on her right wrist and elbow. At 6 a.m. on January 11, 2024, family members discovered the patient unconscious in the bathroom, with wounds on her wrist and elbow bleeding profusely. The patient was taken to Ninh Binh Provincial General Hospital for stitches to stop the bleeding.

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Cite this article as: Duc ND, Shinh NP, Anh LNH. Clinical Case Report of Hydrogen Peroxide Poisoning is Treated by Hyperbaric Oxygen Therapy. Eurasian J Emerg Med. 2024;23(2): 149-51.

Received: 21.02.2024
Accepted: 18.03.2024

Eurasian J Emerg Med.
2024;23(2): 149-51

Computed tomography (CT) scan of the abdomen shows: air in the biliary tract in the liver, air in the stomach wall, and poor drug enhancement of the stomach wall.

Diagnosis: Hydrogen peroxide poisoning followed by complications of organ perforation; the right wrist wound was stitched to stop the bleeding. Transferred to the Poison Control Center at 0:00 on January 12, 2024, in the following condition: awake, pink skin and mucous membranes, pulse 65 beats/min, blood pressure 110/70 mmHg, no difficulty breathing, no sore throat, soft abdomen, no bloating, no upper abdominal pain, taste and bowel movements were normal, and the right forearm was bandaged. Blood formula, blood chemistry, and blood coagulation tests showed no abnormalities, blood gasses showed no acid-base disorders.

Abdominal MSCT (January 12 in 2024, 10 a.m.): Image of wall thickening and poor enhancement in the pyloric antral area with air in the stomach wall; no abnormalities of the visceral vascular system were observed (Figure 1).

Thoracic MSCT (January 12 in 2024, 10 a.m.): consolidation and partial collapse of the upper and lower lobes of the lungs on both sides. Little pleural fluid on both sides.

The patient was treated: Fluid infusion, fasting, intravenous nutrition, intravenous esomeprazone 40 mg 2 times/day, and hyperbaric oxygen breathing on the same day.

At 8:00 p.m. on January 12, 2024, after the first hyperbaric oxygen therapy (HBO) breath, the patient underwent CT scan and showed normal drug enhancement in the stomach wall as well as a large decrease in the amount of air in the wall (Figure 2); therefore, the patient continued the prescription. Breathe HBO on January 13 and 14 in 2024.

After 3 days of breathing HBO, the clinical condition improved, the patient had less abdominal pain, no difficulty breathing, and no signs of embolism.

Discussion

Hydrogen peroxide is a clear, colorless, odorless liquid that usually exists in solutions with concentrations ranging from 3 to 90% (3). This is a relatively unstable substance. It is easily decomposed into water and oxygen gas and generates heat in the presence of alkalis, metals, and catalase. Normally, it reacts as an oxidizer, but many reactions in which it reacts as a reducing agent release oxygen as a byproduct. In addition, it also generates inorganic and organic peroxides very quickly.

There are three main poisoning mechanisms of hydrogen peroxide: corrosive damage, oxygen gas formation, and lipid peroxidation.

Swallowing 3% hydrogen peroxide usually causes only mild gastritis. However, direct contact or ingestion of concentrated solution (over 35%) can cause skin corrosion and mucosal blistering, ulceration, or gastrointestinal perforation. Corrosion can also occur in the respiratory tract if inhaled and can lead to airway spasm requiring intubation and mechanical ventilation (4).

Ingestion of concentrated hydrogen peroxide can produce significant amounts of oxygen gas. With 30 mL of 35% solution, 3.5 L of oxygen gas can be produced. Hydrogen peroxide can be absorbed directly in the stomach wall and then released into the blood. When this amount of oxygen exceeds the maximum solubility of the blood, the risk of gas-induced hypervascularity increases, especially in the portal venous system, gastric wall, and cerebral and pulmonary vessels. Intravascular foaming can decrease the right ventricular output.

Figure 1. CT scan showing air in the stomach wall
CT: Computed tomography

Figure 2. CT scan after the first HBO breath
CT: Computed tomography, HBO: Hyperbaric oxygen therapy

Hydrogen peroxide can be directly toxic to cells through oxidation lipids.

In our clinical case, many air bubbles appeared in the stomach wall.

As well as reduced enhancement of the gastric wall, indicating that the risk of gastric wall necrosis is very high. Faced with this situation, the early removal of air bubbles is the top priority. Hyperbaric oxygen therapy has been applied to help increase the solubility of oxygen in the blood. Therefore, it helps us quickly solve the problem of air bubbles and gastric perfusion. In the patient above, immediately after the first breath, the amount of air decreased significantly. The clinical condition improved rapidly after 3 days of treatment.

Conclusion

Hydrogen peroxide poisoning causes different clinical conditions, depending on many factors such as route of exposure, concentration, and amount of contact. In some cases, the formation of many air bubbles increases the risk of embolism or tissue necrosis due to compression. HBO is considered a treatment to help improve the above condition and provide us with more opportunities to save patients' lives.

Ethics

Informed Consent: Consent form was filled out by all participants.

Authorship Contributions

Surgical and Medical Practices- Concept - Design - Data Collection or Processing - Analysis or Interpretation - Literature Search - Writing: N.D.D., N.P.S., L.N.H.A.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

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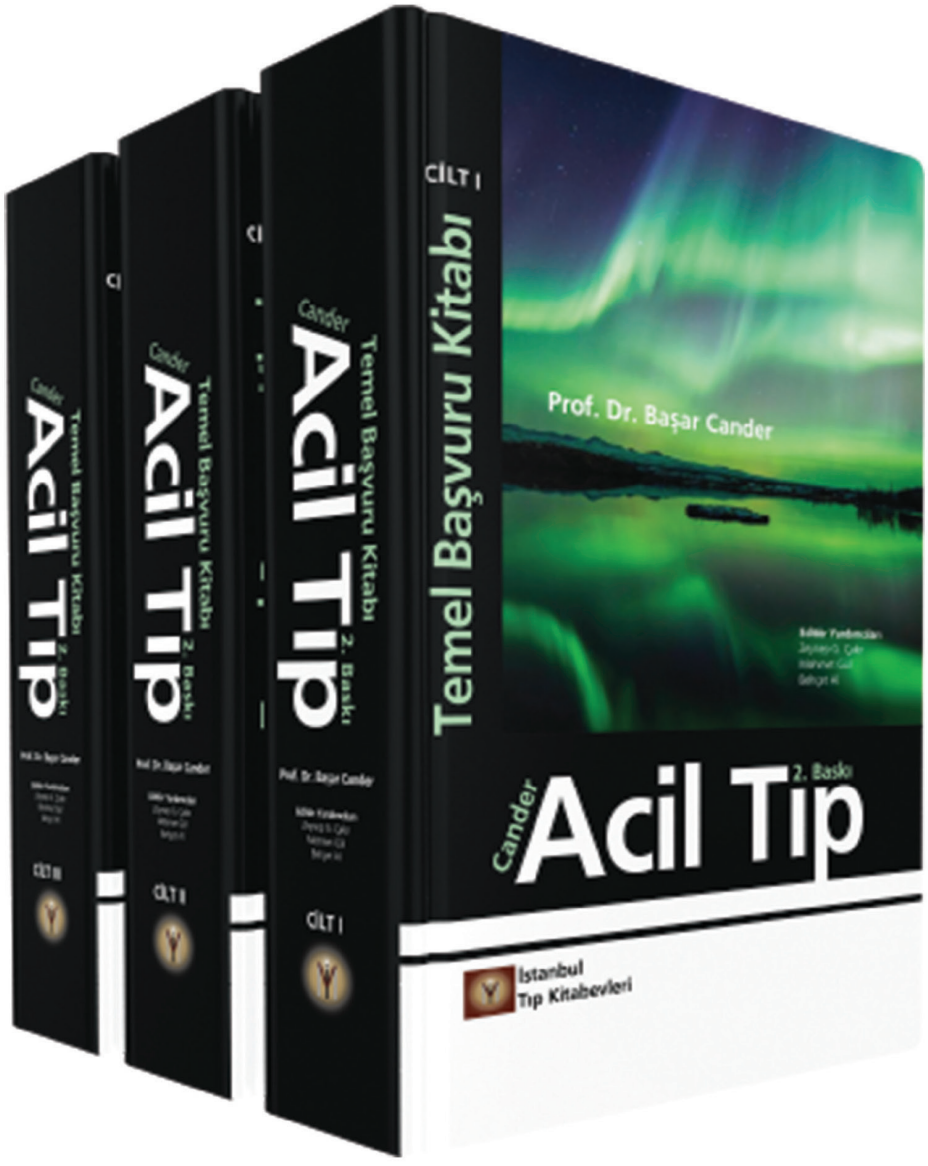

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