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Manuscript Types

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Tables should be included in the main document, presented after the reference list and they should be numbered consecutively in the order they are referred to within the main text. A descriptive title must be placed above the tables. Abbreviations used in the tables should be defined below the tables by footnotes (even if they are defined within the main text). Tables should be created using the "insert table" command of the word processing software and they should be arranged clearly to provide an easy reading. Data presented in the tables should not be a repetition of the data presented within the main text but should be supporting the main text.

Table 1. Limitations for each manuscript type.

Type of manuscript	Word limit	Abstract word limit	Reference limit	Table limit	Figure limit
Original Article	5000 (Structured)	200	50	6	7 or total of 15 images
Review Article	5000	200	50	6	10 or total of 20 images
Case Report	1500	200	10	No tables	10 or total of 20 images
Letter to the Editor	500	N/A	5	No tables	No media
Scientific letter	900	N/A	10	No tables	2 or total of 4 images
Clinical Imaging/ Visual Diagnosis	400	N/A	5	No tables	3 or total of 6 images
History	900	N/A	10	No tables	3 or total of 6 images
Publication ethics	900	N/A	10	No tables	No media

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Figures, graphics and photographs should be submitted as separate files (in TIFF or JPEG format) through the submission system. The files should not be embedded in a Word document or the main document. When there are figure subunits, the subunits should not be merged to form a single image. Each subunit should be submitted separately through the submission system. Images should not be labelled (a, b, c, etc.) to indicate figure subunits. Thick and thin arrows, arrowheads, stars, asterisks and similar marks can be used on the images to support figure legends. Like the rest of

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All acronyms and abbreviations used in the manuscript should be defined at first use, both in the abstract and the main text. The abbreviation should be provided in parenthesis following the definition.

When a drug, product, hardware, or software mentioned within the main text product information, including the name of the product, producer of the product, city of the company and the country of the company should be provided in parenthesis in the following format: "Discovery St PET/CT scanner (General Electric, Milwaukee, WI, USA)"

All references, tables and figures should be referred to within the main text and they should be numbered consecutively in the order they are referred to within the main text.

Limitations, drawbacks and shortcomings of original articles should be mentioned in the "Discussion" section before the conclusion paragraph.

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Book Section: Sherry S. Detection of thrombi. In: Strauss HE, Pitt B, James AE, editors. Cardiovascular Medicine. St Louis: Mosby; 1974.p.273-85.

Books with Single Author: Cohn PF. Silent myocardial ischemia and infarction. 3rd ed. New York: Marcel Dekker; 1993.

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Scientific or Technical Report: Smith P. Golladay K. Payment for durable medical equipment billed during skilled nursing facility stays. Final report. Dallas (TX) Dept. of Health and Human Services (US). Office of Evaluation and Inspections: 1994 Oct. Report No: HHSIGOE 169200860.

Thesis: Kaplan SI. Post-hospital home health care: the elderly access and utilization (dissertation). St. Louis (MO): Washington Univ. 1995.

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Manuscripts published in electronic format: Morse SS. Factors in the emergence of infectious diseases. Emerg Infect Dis (serial online) 1995 Jan-Mar (cited 1996 June 5): 1(1): (24 screens). Available from: URL:http:/ www.cdc.gov/ncidodlElD/cid.htm.

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Review

Original Articles

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Review
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Acute Management of Spinal Cord Injury in Out-of-hospital and Emergency Department Settings

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Abstract

Spinal cord injury (SCI) is a devastating neurological disorder that is estimated to affect approximately 1000 patients each year in the Republic of Turkey. With this review, we aim to update the recent evidence related to the acute management of patients with SCI in out-of-hospital and emergency department settings.

We performed a literature review of publications in the English language and indexed in PubMed, ScienceDirect and Scopus using the following search terms: "spinal cord injury" and "acute management", "spinal cord injury" and "immobilisation", "spinal cord injury" and "transfer", "spinal cord injury" and "transport", "spinal cord injury" and "airway management", "spinal cord injury" and "haemodynamic management", "spinal cord injury" and "steroid". We also reviewed the recent international guidelines.

This review reports the immobilisation of patients with SCI and management strategies relevant to their transfer, airway management in cervical SCI, haemodynamic management and methylprednisolone use.

The patient's spinal alignment should be maintained with appropriate techniques for sufficient immobilisation to ease safe extrication and transport. Patients with acute SCI should be promptly and carefully transported from the place of injury to the nearest specialist SCI facility.

Keywords: Spinal cord injury, haemodynamic management, airway, immobilisation

Introduction

Injuries contributed to the 6% of total deaths in Turkey (Table 1). Mostly young people affected by the injury related deaths (Figure 1). According to the data from the Turkish Statistical Institute, over one million traffic accidents occurred during the year 2014. 168,512 of the accidents resulted in fatality or injury. Seventy-five point one percent occurred in the populated areas, during the month of August at day hours. As a result of these accidents, 3,524 people died and 285,059 injured (Table 2). Among the people died in the accidents, 42.7% of them were drivers, 40.3% were travelers and 17% were people on foot. Concerning the sexual orientation breakdown of individuals died 76.8% of them were men and 23.2% were women; while for the general population harmed 70.2% of them were men and 29.8% were women (1).

There is no recent Turkish epidemiological study published in spinal cord injury (SCI) topic. According to a nation-wide retrospective study published by Karacan et al. (1) in 2000, 5,081 traumatic SCI cases were reported in 1992 (2). The estimated annual incidence of traumatic SCI was found 12.7 per million people. Male to female proportion was 2.5:1 and the normal age at harm was 35.5±15.1 (35.4±14.8 for guys and 35.9±16.0 for females). The most widely recognized reason for harm was engine vehicle mischances (48.8%) trailed by falls (36.5%), cut injuries (3.3%), shot wounds (1.9%) and wounds from jumping (1.2%). One hundred and eighty-seven patients (32.18%) were tetraplegic and 394 patients (67.8%) were paraplegic. The most well-known level of damage was C5 among tetraplegics and T12 among paraplegics. The most common related injury was head trauma took after by extremity fractures.

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Table 1. Percent distribution of injuries in Turkey		
	2010% of deaths n=24,857 total deaths	2013% of deaths n=24,703 total deaths
Road injuries	2.2	2.19
Self-harm	1.13	0.94
Falls	0.63	0.74
Mechanical forces	0.68	0.56
Violence	0.72	0.52
Drowning	0.25	0.25
Other unintentional	0.27	0.22
Foreign body	0.2	0.19
Poisoning	0.12	0.11
Fire, heat	0.11	0.1
Other transport	0.1	0.1
Animal contact	0.036	0.03
Institute for Health Metrics and Evaluation (IHME). GBD Compare. Seattle, WA: IHME, University of Washington, 2015		

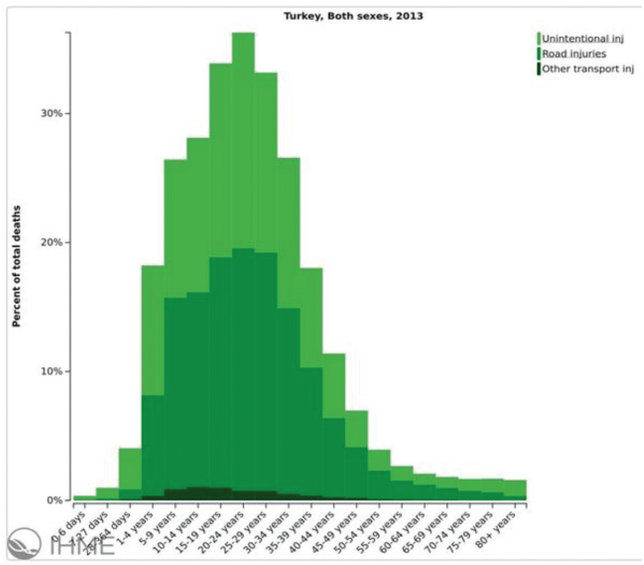

Figure 1. Age distribution of injuries in Turkey, Institute for Health Metrics and Evaluation (IHME). GBD Compare. Seattle, WA: IHME, University of Washington, 2015. Available from http://vizhub.healthdata.org/gbd-compare. [Accessed (21/05/2016)]

Acute phase of SCI management is critical for the minimization of the secondary injury, which directly affects the outcome quality and survival of the patient. Initial trauma results in an irreversible neuronal damage (Primary injury) and is only modifiable by prevention. Secondary injury starts within minutes and involves complex cascade of events including inflammation, oedema, ischemia, and excitotoxicity leading to further ischemia and progressive neurological deterioration in the following days. Carefully coordinated management strategies aim to limit/reverse this progression. Treatment and damage control starts

Table 2. Road Traffic Accident Statistics				
Year	Total accidents (n)	Accidents resulting death or injury (n)	Persons killed (n)	Persons injured (n)
2010	1,106,201	116,804	4,045	211,496
2011	1,228,928	131,845	3,835	238,074
2012	1,296,634	153,552	3,750	268,079
2013	1,207,354	161,306	3,685	274,829
2014	1,199,010	168,512	3,524	285,059
T.C. Basbakanlik Turkiye Istatistik Kurumu, Neactibey Caddesi No 114 06100 – Ankara. www.tuik.gov.tr				

at the seen and critical during the first 24 hours. Early clinical assessments, accurate spinal immobilisation, prompt transfer of injured patient to a SCI unit, and respiratory and haemodynamic support are recommended for the acute management of spinal cord injured patients (3).

It is important to recognize that 20-60% of SCI will also have a concurrent traumatic brain injury. Thoracic spine injuries may be accompanied by a major vascular injury pneumothorax, myocardial and/or pulmonary contusion. Lumbar spine fractures may be associated with bowel and solid organ injury (4-7).

1. Transfer of Spinal Cord Injured Patient

SCI occurs in up to 2-5% of all major trauma cases and at least 14% of these cases have the potential to have an unstable spine. Emergency first responders therefore should exercise high index of suspicion for SCI in the major trauma settings. In a study performed to evaluate pre-hospital management of spinal cord injuries in New South Wales between 2004 and 2008, found that the median time from the scene to a SCI unit was 12 hours, with 60% of patients needed multiple transfers. The odds of reaching a SCI unit in 24 hours were 1.71 times greater for patients injured in a major city (95% CI: 1.00-2.90) than in the other areas. SCI patients with multiple traumas had more delays to reach a SCI unit (59%) than the isolated SCI patients (40%). Patients who reached a SCI unit after 24 hours were at 2.5 times greater risk to develop a secondary complication (95% CI: 1.51-4.17) (8).

The trauma patient triage scheme of the American College of Surgeons Committee on Trauma has 4-step evaluation process, first the assessment of vital signs and Glasgow Coma scale score, second the evaluation for critical injury patterns, third the assessment of high- energy impact mechanism, and, fourth, the assessment of special patient characteristics, like age, pregnancy, anticoagulation treatment, burns, and end-stage renal disease (9).

In a review of the cases with SCI after the 2005 Pakistan earthquake, reported that the lack of SCI evacuation protocols caused permanent neurological deficits in some patients because of missed stabilisation of spinal column. On the other hand, air

transport of patients and on time transfers of the patients from the disaster zone to tertiary care hospitals had provided low mortality rates (10).

However, Oteir et al. (11) found that there is a lack of high-level evidence on the effect of pre-hospital cervical immobilisation on consequences in their systematic review of the literature to determine the efficacy of cervical immobilisation in patients with suspected cervical SCI. In their systematic review, which the eight studies included, cervical collar application in penetrating trauma was associated with increased mortality in two of the studies. In blunt trauma, one study indicated that stabilization might worsen the neurological consequences. In another study, investigators found that there are some adverse effects of pre-hospital immobilization, including increased aspiration risk, airway problems, delay in transfer, and patient discomfort (12).

In a recent systematic review of 47 studies about spinal immobilization in pre-hospital and emergency care settings from 1966 to 2015, authors found that there were 15 studies supportive of spinal immobilization, 13 studies neutral for spinal immobilization and also 19 studies opposing spinal immobilization. They said that; decisions to use spinal immobilisation should be based upon careful assessment of the risk-benefit ratio (13).

Burton et al. (14) found that, emergency medicine service providers were able to triage prehospital trauma patients with a four-step clinical assessment protocol and to accurately identify the patients likely to benefit from immobilization. Data from a statewide hospital registry included all patients treated for spine fracture during the 12-month period with 207,545 encounters, including 31,885 transports to an emergency department for acute trauma-related illness. The protocol sensitivity for immobilization of any acute spine fracture was found 87.0% (14). In a recent study conducted a retrospective analysis of penetrating trauma patients in the National Trauma Data Bank of United States, 45,284 penetrating trauma patients were concentrated; 4.3% of whom experienced spine immobilisation.

In a recent study, a retrospective analysis of penetrating trauma patients was performed in the National Trauma Data Bank of United States, 45,284 penetrating trauma patients were concentrated; 4.3% of whom experienced spine immobilization. General mortality was 8.1%. Unadjusted mortality was twice as high in spine-immobilized patients (14.7% vs 7.2%, $p<0.001$). The chances proportion of death for spine-immobilised patients was 2.06 (95% CI: 1.35-3.13) contrasted and non-immobilised patients. Prehospital spine immobilisation is related with higher mortality in penetrating trauma (15).

Various devices and methods were used for immobilization of the cervical spine in SCI patients. Before the immobilisation, spinal posture should be evaluated to prevent secondary injuries. The neutral spinal posture was defined as "the normal anatomic position of the head and torso that one assumes when standing and looking ahead" by Schriger (16). This posture corresponds to 12 degrees of cervical spinal extension on a lateral radiograph. Podolsky et al. (17) found that hard collars had better outcomes than soft collar.

The American College of Surgeons suggests the utilization of a hard backboard, an inflexible cervical neckline, horizontal bolster gadgets, and tape or straps to secure the patient's head, the neckline, and the parallel bolster gadgets to the backboard. Pronged and wrong utilisation of unbending backboard can bring about patient dismalness and ought to be stayed away from. Backboard ought to be expelled when a complete assessment is refined as well as conclusive administration is started. Spinal immobilisation of injury patients with entering wounds is not prescribed.

It is estimated that up to quarter of SCI occur following the initial trauma during the acute phase. Expeditious and careful transport of patients with acute SCI is recommended from the site of injury by the most appropriate mode of transportation available to the nearest capable definitive care medical facility. Whenever it's possible, patients should be transported to specialised acute spinal cord injury treatment centre.

2. Airway Management in Cervical Spine Injury

Inappropriate and/or insufficient airway management is a leading cause of preventable death following injury (18,19). In trauma endotracheal intubation frequently needs to be accomplished before the presence or location of an injury can be confirmed. As a result, cervical spine injury should be presumed in all trauma patients requiring intubation prior to complete physical and radiographic evaluation. If the level of injury is at or above C5, tracheal intubation and ventilation are often required (20).

Since the mid-eighties, manual in-line adjustment (MILS) is prescribed to help aviation route administration in patients with suspected SCI (21). The point of MILS is to keep any flexion; expansion or pivot of the cervical spine amid laryngoscopy is performed. In any case, use of MILS appeared to exacerbate the laryngoscopic see, draw out the intubation time or make disappointment secure the aviation route (22). One must adjust the advantages of MILS against the hazard for hypoxic harm if intubation and sufficient ventilation can't be refined. In this way, MILS might be changed or ceased if its utilisation hinders tracheal intubation.

Direct laryngoscopy is more straightforward than fiberoptic or video assisted laryngoscopy and, in this way, favoured in pressing circumstances. It was established to be more sheltered, powerful, and quicker in ordinary aviation routes and in any event proportional in troublesome aviation routes. In immobilised patients, particularly for dire intubations, coordinate laryngoscopy with the utilisation of a gum flexible bougie is a phenomenal decision to rapidly and dependably secure the aviation route while limiting the compel to the cervical spine (23).

Alternative methods may include flexible scope intubation (FSI) and nasotracheal intubation; both have restricted application in the acute trauma management. Because of the nasotracheal intubation is contraindicated with particular craniofacial injuries, and may causes further trauma and bleeding in the upper airway (24). FSI provide little spinal motion, however, it is hard to perform for inexperienced providers, results in slower intubation compared to orotracheal intubation, and also is hindered by secretions and bleeding, needs continuous patient cooperation (25).

The blind-intubating laryngeal mask airway has been used successfully in trauma settings and uninjured but immobilised patients with rigid cervical collars (26,27). But this approach showed to cause low intubation success rate in inexperience staff (24). Video assisted laryngoscopes and other imaging approaches allow a better laryngeal view than traditional methods in immobilised SCI patients (28) Table 3 provides the pros and cons of commonly used airway management devices.

Muscle trismus or clenched jaw may cause failure in pre-hospital intubation (29,30). But these situations can be eliminated with the appropriate use of fast acting neuromuscular blocking agents (31). Regarding the choice of muscle relaxant, succinylcholine remains the gold standard for rapid sequence intubation in the early stages of SCI management. If these techniques fail to intubate the trachea of SCI patients, surgical methods like cricothyrotomy should be tried (32).

Each airway manoeuvre has its inherent weaknesses and advantages. There is no conclusive evidence that an optimal airway management strategy in patients with cervical instability affects outcome. The most suitable choice will often depend on the practitioner's experience with a particular technique and the specifics of the clinical situation (33).

In the post-traumatic period, progressive neck swelling due to oedema and pre-vertebral haematoma expansion may further compromise the airway, even in the absence of positive examination findings in the early phase of the injury. Intubation should minimise cervical movement to prevent further neurological deterioration in a potential or actual SCI. Manual inline stabilization, gum elastic bougie and attention to detail required. Cricoid pressure (CP) ought to be connected amid acceptance and kept up through intubation until tube arrangement is confirmed; it might be connected through the front opening in cervical neckline before the neckline is briefly expelled. Both MILS and CP ought to be adjusted or expelled on the off chance that they hinder sufficient intubation or ventilation (34).

Table 3. Airway management options for the patient with potential cervical spine injury

Airway Management Device	Pros	Cons
Awake fiberoptic intubation	Excellent for cooperative patients Allows for documentation of neurologic exam before and after intubation	Relatively expensive Longer time to perform Not appropriate for uncooperative patients, excess blood or secretions in the airway, and inexperienced provider
Video assisted laryngoscopy	Often excellent laryngeal visualization Less for laryngoscopic view required Less mouth opening required	Not always available Blood or secretions may obscure camera view Relatively new technology with lack of evidence in studies in this area
Direct laryngoscopy	Most studied technique Usually available, even in remote locations Allows rapid ability to secure airway	High percentage of grade III and grade IV views May require adjunctive equipment
Laryngeal mask airway	Essential tool in the difficult airway algorithm	May not be appropriate for routine intubation in SCI

Adopted from; Austin N, Krishnamoorthy V, Dagal A. Airway management in cervical spine injury. International journal of critical illness and injury science. 2014;4:50-6
SCI: Spinal card injury

3. Haemodynamic Management of Spinal Cord Injury

7-10% of the SCI patients develop neurogenic circulatory shock and demonstrate hypotension with or without bradycardia (35,36). Besides to this condition, hypotension may be caused by trauma itself and may be difficult to differentiate in acute trauma (37). Kong et al. (38) found that 18.4% of the cervical SCI patients had 80 mmHg or below mean arterial pressure levels. Other possible major cardiovascular complications in the acute stage following SCI were heart rate abnormalities and venous thromboembolism. These heart rate abnormalities may lead

to sinus bradycardia, repolarization changes, atrioventricular block, supraventricular tachycardia, ventricular tachycardia, and primary cardiac arrest (39,40).

Vale et al. (41) applied resuscitation standards of volume development and circulatory strain upkeep to 77 patients who had intense neurological deficiencies taking after SCI happening from C-1 through T-12 with an end goal to keep up spinal line blood stream and avert optional harm. They performed surgical strategies for decompression and adjustment, and combination in chose cases. Sixty-four of the patients have been taken after no less than 12 months post-harm by methods for point by point neurological appraisals and useful assessments. After the 12-month follow-up period, 92% of patients exhibited clinical change subsequent to managing inadequate cervical spinal line wounds contrasted with their underlying neurological status. Ninety-two percent recaptured the capacity to walk and 88% recovered bladder work.

Levi et al. (42) studied the acute phase of SCI. Management protocol included invasive haemodynamic monitoring and cardiovascular support with dopamine and/or dobutamine, titrated to maintain a haemodynamic profile with adequate cardiac output and a mean arterial pressure of >90 mmHg.

Stevens et al. (43) reported that the neurogenic circulatory shock should be treated with fluid resuscitation until intravascular volume is restored and, afterwards, use of vasopressors (eg. dopamine, norepinephrine, and phenylephrine) should be considered. Zäch et al. (44) given an account of a planned medical administration worldview in the treatment of 117 back to back intense SCI patients in the Swiss Paraplegic Centre of Basel, Switzerland in 1976. The creators reasoned that early exchange and "prompt medicinal particular treatment of the spinal damage" with consideration regarding upkeep of adequate circulatory strain seemed to enhance neurological recuperation. Another systematic review of intensive cardiopulmonary management following acute SCI, stated that there is weak evidence supporting the maintenance of MAP higher than 85 mm Hg for a period extending up to one week following acute SCI (45).

4. Steroids in Spinal Cord Injury

Bracken et al. (46) first reported the effectiveness of methylprednisolone treatment in SCI patients. After this study the use of intravenous high-dose methylprednisolone became a standard approach in acute management SCI patients (47). On the other hand, two other studies reported that high-dose methylprednisolone can be associated increased complication rates (48,49).

The role of the steroids in treatment of SCI patients is debatable. The possible mechanisms for proposed benefits include the inhibition of lipid peroxidation and inflammatory cytokines, modulation of the inflammatory/immune cells, improved vascular perfusion and prevention of calcium influx and accumulation (50).

The current use of methylprednisolone therapy based upon three prospective randomised multi-centre trials named National Acute Spinal Cord Injury Studies (NASCIS) I, II and III (46,51-53).

In NASCIS I, 330 patients treated first 48 hours of SCI, in one group with methylprednisolone with dose of 100 mg bolus, then 25 mg every 6 hours for 10 days, in other group with methylprednisolone with dose of 1,000 mg bolus, then 250 mg every 6 hours for 10 days. No significant difference in neurologic recovery between the two groups with different dose regiments at six-month follow-up period was detected (51).

In NASCIS II, 487 patients treated first 12 hours of SCI, in the first group with methylprednisolone with dose of 30 mg bolus, then 5.4 mg/kg/hour x 23 hours, in the second group with naloxone with dose of 5.4 mg/kg bolus, then 4.0 mg/kg/hourx 23 hours. The third group was placebo group. In patients treated with methylprednisolone within 8 hours of SCI, significant motor and sensory improvement was observed at 6 months and 12 months after both complete and incomplete injury groups (46,52,53).

NASCIS III was performed with 499 patients treated within first 8 hours of SCI, in the first group with methylprednisolone with dose of 30 mg bolus, then 5.4 mg/kg/hour×23 hours, in the second group with methylprednisolone with dose of 30 mg bolus, then 5.4 mg/kg/hour×47 hours, in the third group with tirilazad mesylate with dose of 2.5 mg/kg every 6 hours for 48 hours. It was found that there was no significant difference in neurologic recovery between the three groups at 6 or 12 months follow-up period. If the treatment was started 3 to 8 hours after SCI, 48-hour methylprednisolone group had significantly better improvement than 24-hour methylprednisolone group at 6 months and 12 months follow-up period but had more severe sepsis and severe pneumonia (53-55).

In a case report of a 37-year-old woman with whiplash injury after a motor vehicle collision, who had treated with intravenous high-dose methylprednisolone with a bolus dose of 30 mg/kg over 15 min followed by maintenance infusion of 5.4 mg/kg per hour for 23 hours, the patient became unresponsive; electrocardiography showed ventricular fibrillation, necessitating prompt cardiac defibrillation and renal failure after the infusion. The evaluation of the patient showed that, the patient had diffused large B-cell lymphoma and methylprednisolone induced acute tumour

lysis syndrome causing ventricular fibrillation and renal failure. The authors said that, the physicians be aware of this clinical entity, and the importance of monitoring patients very close when prescribing corticosteroids, even in those with only mild anaemia (56).

In a cohort study, all patients with cervical cord injury were treated with methylprednisolone sodium succinate within 8 hours of their injuries (MPSS group) versus no treatment group (non-MPSS) and both groups followed up for two years. Early spinal decompression and stabilization was performed as early as possible after injury in both groups. The authors found that there was no evidence to support that high-dose methylprednisolone administration facilitates neurologic improvement in patients with SCI. They said that, methylprednisolone ought to be utilised under constrained conditions due to the high occurrence of pulmonary complications (57).

Summary

Spinal immobilisation can diminish improvement of the cervical spine and can decrease the probability of helper neurological injuries in patients with problematic cervical spinal breaks after harm. Immobilisation of the entire spinal section is crucial in these patients until a spinal string harm (or various injuries) is disallowed or until fitting treatment is begun. Regardless, not all damage patients must be treated with spinal immobilisation in the midst of prehospital restoration and transport. Various patients do not have spinal injuries and along these lines don't require such mediation.

There is an absence of authoritative proof to suggest a uniform gadget for spinal immobilisation and system. It gives the idea that a mix of an inflexible cervical neckline with steady pieces on an unbending backboard with straps and tape to immobilise the whole body is powerful at accomplishing protected, successful spinal immobilisation for transport. Spinal immobilisation gadgets ought to be utilised to accomplish the objectives of spinal strength for safe removal and transport. Spinal immobilization of injury patients with entering wounds is not prescribed.

Tolerant with an intense cervical spinal damage ought to be quickly and precisely transported from the site of harm to the closest office with SCI unit. The method of transportation picked ought to be founded on the clinical conditions, separation, and geology to be voyage and ought to be the quickest means accessible. Cervical SCI patients have a high occurrence of aviation route trade off and pneumonic brokenness; along these lines, respiratory bolster measures ought to be accessible amid transport.

In spite of beginning stable heart and pneumonic capacity it is normal to watch hypotension, hypoxemia, aspiratory brokenness, and cardiovascular insecurity in patients with intense cervical SCI. Patients with the most extreme neurological wounds seem to have the most serious danger of these life-undermining occasions. Administration in an ICU or other checked setting seems to favourably affect neurological result after intense cervical SCI. Keeping up MAP between 85-90 mm Hg for the initial seven days taking after intense SCI to enhance spinal string perfusion is the present proposal of the American Association of Neurological Surgeons and Congress of Neurological Surgeons (58).

Conclusion

Both noteworthy methodological mistakes and conflicting neurological results in the reviews distributed to date with respect to the gainful impacts of methylprednisolone can as effectively be devoted to irregular shot as to any genuine restorative impact. Abnormal state of proof exists with respect to the hurtful symptoms of methylprednisolone organization in the setting of intense SCI including wound contamination, pneumonia, hyperglycaemia requiring insulin organization, GI discharge and demise. Methylprednisolone ought not be routinely utilized as a part of the treatment of patients with intense SCI (59).

Ethics

Peer-review: Externally peer-reviewed.

Authorship Contributions

Concept: A.D., Design: A.D., Data Collection or Processing: B.K., Analysis or Interpretation: B.K., Literature Search: B.K., Writing: B.K., A.D., S.K., A.O.K.

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Thoracic Fluid Content Measurement: Diagnostic Value of Suspected Pulmonary Oedema in Acute Decompensate Heart Failure

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Abstract

Aim: One of the non-invasive methods of monitoring changes in cardiovascular haemodynamics is the measurement of transthoracic impedance (TTI). The most important features of this method are that it does not require catheterisation, it carries no risk of complications and it is both cost-effective and easily applicable.

The aim of this study was to determine the diagnostic value of thoracic fluid content (TFC), which is one the parameters obtained from TTI measurement in patients who present to the emergency department (ED) with dyspnoea and are suspected of pulmonary oedema (PO) due to acute decompensate heart failure (ADHF).

Materials and Methods: This single-centre, prospective, cohort clinical study was conducted on patients aged >18 years who presented to the tertiary care university ED with acute dyspnoea and were suspected of PO due to ADHF. The primary outcome measure was to determine the diagnostic value of TFC measurement in patients who presented to the ED with dyspnoea and were suspected of PO due to ADHF.

Results: A total of 113 patients were included in the study. The Brain Natriuretic Peptide value was accepted as the gold standard in the diagnosis of PO due to ADHF. The sensitivity/specificity of PO associated with ADHF was 64.3/31.4%, 14.3/88.4% and 60.5/83.7% for TFC, Cardiac index (CI) and Stroke index, respectively. Among these, only TFC was statistically significant in the diagnosis of PO ($p<0.001$).

Conclusion: TFC measured by TTI in patients suspected of PO due to ADHF could be a better alternative for exclusion tests.

Keywords: Thoracic fluid content, transthoracic impedance, pulmonary oedema, emergency, stroke index, cardiac index

Introduction

Acute decompensated heart failure (ADHF) constitutes a significant amount of patients admitted to the emergency department (ED) with complaints of dyspnoea (1). Pulmonary oedema (PO) is one of the major causes of dyspnoea at the time of admission among these patients. Besides patient history and physical examination, other laboratory and imaging methods are included in the diagnosis of PO. In patients suspected of ADHF, Brain Natriuretic Peptide (BNP) and transthoracic echocardiography (TTE) are used most frequently as useful diagnostic bedside tests (2). The major disadvantage of BNP testing is that it cannot be obtained immediately. Lower and upper limit values should be used to obtain accurate sensitivity and specificity. Values below the lower limit provide excellent sensitivity and can be useful in excluding heart failure. Values above the upper limit present high specificity but the clinical presentation and examination findings of the patient should be taken into account in the diagnosis of heart failure (3). TTE is non-invasive and possible to be performed at the bedside, but it is an application-dependent diagnostic method. In addition, patients must be in a supine position for accurate evaluation. One of the non-invasive methods to monitor changes in cardiovascular haemodynamics is the measurement of transthoracic impedance cardiography (ICG). The most important features of this method is that it does not require catheterization, no risk of complications as well as being cost-effective and easily applicable (4,5) ICG is a safe, non-invasive, and cheap (disposable tools used in the procedure cost about 7-8 euros or 8-9 US

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dollars (6). This ICG might be advantageous over BNP testing in patients admitted to the emergency department presenting with dyspnoea as its results can be obtained sooner ICG uses the difference between the electrical resistances of different tissues in the human body. For example, adipose tissue, bones, lungs and muscles are poor conductors of electricity while blood is a good conductor, and the blood flow and circulation result in a difference in chest impedance. Haemodynamic parameters are calculated from the impedance difference obtained after the measurement.

The inverse of the basal thoracic impedance relative to impact can give the amount of intrathoracic fluid. One of these parameters is the "amount of thoracic fluid" ICG is recorded by placing the electrodes in the longitudinal and lower thorax. Between the electrodes, a constant current of 400 μA and a frequency of 40 kHz is applied to the body and voltage is generated. Internal electrodes detect thoracic voltage changes. These voltage changes are used to calculate the impedance change. The detected static impedance indicates thoracic fluid volume, while the dynamic impedance is affected by aortic blood volume and velocity. Impedance is calculated according to Ohm's law. According to Ohm's Law; the current (I) of the electrical circuit is equal to the voltage drop (E) between the two ends of the circuit divided by the impedance (Z). From this impedance, hemodynamic parameters are calculated using mathematical methods. I=E/Z. Thoracic impedance is the electrical resistance of the thorax against high frequency low density current. This impedance is indirectly dependent on the thoracic fluid content. Recorded impedance difference is used for the measurement of hemodynamic parameters. ICG measurements can be obtained by a nurse or a technician in a few minutes without any necessary blood test (7). The following parameters can be calculated: Cardiac index (CI), cardiac output (impedance cardiography CO), total peripheral vascular resistance, pulse volume and TFC. The presence of PO is also supported by TFC obtained via ICG. When the literature was reviewed, there were not found many studies showing the diagnostic value of ICG in the diagnosis of ADHF in patients admitted to the ED with dyspnoea.

The aim of this study was to determine the diagnostic value of the parameters obtained from ICG (especially TFC) in patients presented to the ED with dyspnoea, who were suspected of PO due to ADHF.

Materials and Methods

Patient Selection

This study was designed as a clinical prospective cohort study. Sample size was not calculated before the study. The patient population consisted of patients who presented to the ED of the tertiary university hospital with complaints of dyspnoea between 01.11.2017-10.02.2018. This study was approved by Akdeniz University Scientific Research Projects Coordination Unit (project number: TTU-2017-26434). Informed Consent was obtained from all of the patients. The study was in accordance with The Declaration of Helsinki. Patients admitted to the ED with dyspnoea, who were ≥18 years old and pre-diagnosed with ADHF after clinical evaluation by an emergency physician. A total of 126 patients with complaints of dyspnoea were admitted during the period of the study. One hundred and thirteen patients were included in the study. The diagnosis of PO due to ADHF was verified according to the universally accepted techniques (2). We did not use TTE for diagnosis of ADHF. ADHF in this study were defined by using conventional techniques (an interview included age, dyspnoea and anamnesis; objective examination consisted of height, weight, respiration rate, pulmonary auscultation, oedemas, blood pressure, and heart rate, chest X-ray and BNP) and ICG. According to these sign and symptoms, non-cardiogenic and cardiogenic PO was defined. The following diagnostic values were used for the diagnosis of PO due to ADHF: BNP >500 pq/mL, TFC>34.2 1/kOhm, CI>2.6 L/min/m^2, Stroke index (SI) >31.8 mL/m^2. Each reference values are universal for the diagnosis of PE due to ADHF. The patients were categorized as four groups according to each parameter of ICG measurements. Group 1 as defined PE due to ADHF using by BNP, group 2 as defined PE due to ADHF using by TFC group 3 as defined PE due to ADHF using by CI and group 4 as defined PE due to ADHF using by SI. BNP value was accepted as the gold standard in the diagnosis of PE due to ADHF. To show the diagnostic efficacy of ICG parameters, the other groups were compared based on the diagnosis of PE due to ADHF using BNP value. According to the accepted guidelines for ICG examination patients were excluded from the study if they had any of excluding criteria: excessive physical activity during registration (n=1), severe pleural effusion (n=2), known of severe aortic or mitral valve failure (n=2), excessive low weight <25 kg (n=1), excessive high weight >220 kg (n=1), short length <120 cm (n=1), heart rate >250 beat/minute (n=1), asthma (n=1), Chronic obstructive pulmonary disease (n=1), pneumonia (n=1), pneumothorax (n=1). These conditions cause to the effect of the poor quality of the ICG signal and the errors in the calculated parameters. Patients flow chart are shown in Figure 1.

Study Protocol

In this study, we used a (Task Force Monitor) transthoracic ICG monitor with 8 electrodes produced by the Austria company "CNSystems, Medizintechnik GmbH" The ICG measurement device was installed in the monitored ED. Emergency physicians received detailed training on how to monitor patients, where to

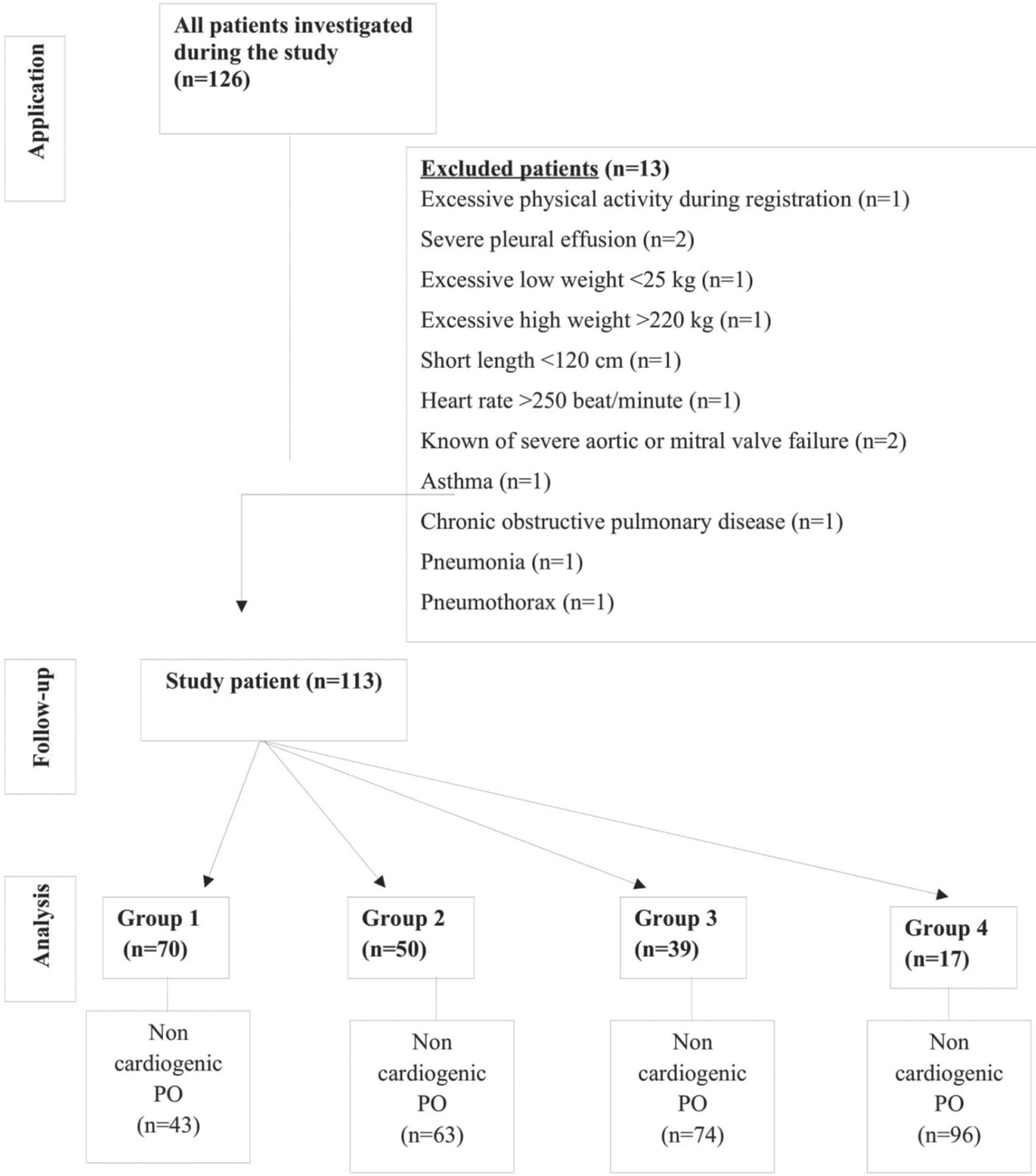

Figure 1. Patient flow chart

place the electrodes and how to record them. ICG was performed after a 10-min rest, the patient being in the lying position, with the vertex of the head elevated by 30°. The monitor measured and recorded continuous cardiovascular parameters for one minute after recording the gender, age, height and weight. The sensors measure the baseline impedance of the thorax. Impedance changes with each beat of the heart due to changes in the volume and velocity in the aorta. This produces a change in the electrical resistance (impedance) of the thorax to electrical alternating current. The changes in impedance can be used to measure or calculate hemodynamic parameters. In Figures 2 and 3, the electrodes used in the study are shown on the patient. The values of hemodynamic parameters such as TFC, CO, CI, heart rate and SI were obtained by ICG and recorded in the patient follow-up form. The main parameters of ICG are presented in Table 1.

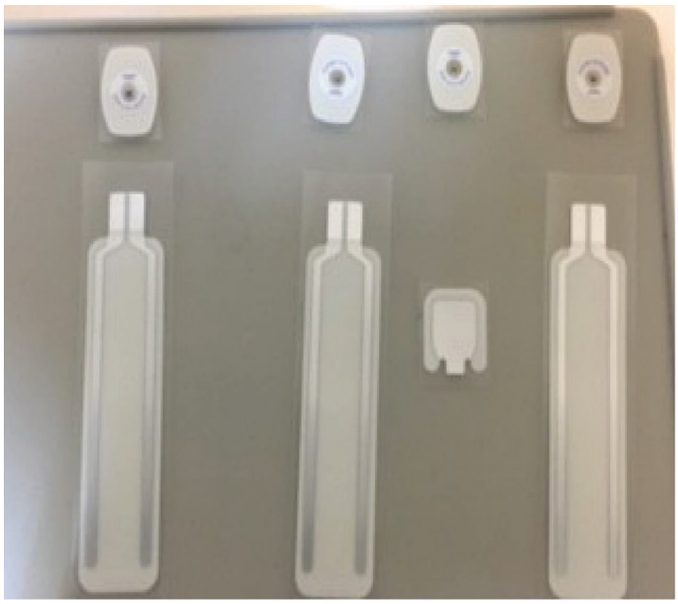

Figure 2. Electrodes used in the study (four electrodes on the upper that monitorization for patient, at lower one of them for static grounding and other three electrodes for impedance measure)

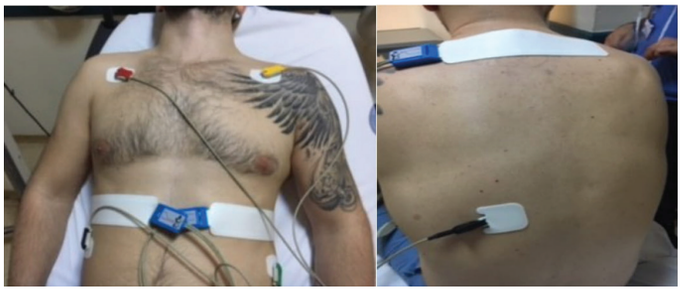

Figure 3. Electrodes were placed bilaterally at the base of the neck and on the thorax at the xiphoid level in the midaxillary line on the patient: the patient being in the lying position, with the vertex of the head elevated by 30°

Table 1. The main parameters of impedance cardiography

ICG parameters	Normal value	+ Standardised values used to diagnosis of ADHF, mean ± SD
TFC	Male: 30-50 1/kOhm	32.5 (31.0-37.7)
	Female:21-37 1/kOhm	
SI	30-65 mL/m^2	26.2 (24.7-27.0)
CI	2.5-4.7 l/min/m^2	2.4 (2.3-2.5)

ICG: Impedance cardiography, ADHF: Acute decompensated heart failure, TFC: Thoracic Fluid Content, SI: Stroke index, CI: Cardiac index, SD: Standard deviation

Standardised values used to diagnosis of ADHF: TFC>34.2 1/kOhm, CI> 2.6 L/min/m^2, SI >31.$^{8\,m}$L/m^2

Data Collection

A data collection form was created to collect sociodemographic characteristics, clinical and laboratory findings, radiological results of the patients. Two trained, licensed emergency physicians independently reviewed all medical notes, including ED visit forms, hospital admission notes, and hospital discharge notes. The primary diagnosis of PO due to ADHF was identified by the emergency physician based on the results of conventional techniques and ICG parameters. To eliminate the possibility of bias, the reviewing physicians were blinded to results of BNP, ICG parameters.

Statistical Analysis

The statistical analysis of data was performed using SPSS 18.0 (SPSS, Inc., Chicago, IL) software. Percentage and number values were given for the variables grouped in the descriptive analyses while the mean values and 95% confidence interval (CI) were given for the other variables. The Shapiro-Wilks test was used for normal distribution prior to the comparison of the mean values. The Mann-Whitney U test was used to compare the averages in the non-normal distributed groups, and t-test was used to compare the averages of normally distributed variables in the dependent groups. Chi-square test was used for categorical variables. The Receiving operator curve (ROC) analysis was performed in the statistically significant group and the area under curve (AUC) was calculated to determine the predictive values. For all variables, $p<0.05$ was considered statistically significant.

Results

Out of a total of 126 patients who presented with dyspnoea, 113 patients were included in the study after the application of the exclusion criteria (Figure 1). The demographic status of patients is presented in Table 2. In our study, 74 (65.5%) of the patients were male and 39 (34.5%) were female. The mean age was 72.0 (70.0-75.0% 95% CI), and the mean Body Mass index (BMI) was found 27 (27.2-29.4 95% CI) kg/m^2. The primary follow-up parameter of this study was to determine the diagnostic value of TFC value, which is one of the ICG parameters, for the diagnosis of PO due to ADHF. As a result of the tests carried out for the diagnosis of heart failure, the mean of the variables for TFC, SI, CI and BNP were determined as 32.5 1/kOhm [31.0-37.7% 95% confidence interval (CI), 26.2 mL/m^2 (24.7-27.0), 2,4 L/min/m^2 (2.3-2.5 95% CI), and 655.0 pg/dL (556.1-814.4 95% CI), respectively. There was found a statistically significant difference when the mean values of BNP and TFC were compared (Figure 4) ($p<0.001$). PE due to ADHF was detected in 61.9% of the patients according to BNP value, 44.2% according to TFC, 34.8% according to CI and 15% according to SI. In addition, one of the patients presented with MI as a major cardiac adverse event (MI, cerebrovascular accident, arrhythmia, peripheral embolism), which occurred in the period of one-week follow-up. Other characteristics along with the findings of physical examination and chest X-ray are shown in Table 2.

Based on BNP, the diagnostic sensitivity of PE associated with ADHF was 64.3%, 31.4%, and 14.3% for TFC, CI, SI, respectively. Among these, only TFC was statistically significant (p<0.001) (Table 3). ROC analysis was performed to distinguish the PE due to ADHF which was based on BNP by using the standardized values for TFC, SI and CI. TFC had the highest AUC value (0.76, p<0.001). The AUC was determined as 0.49-0.46 for SI and CI, respectively. These findings indicate that only TFC is able to make a distinctive diagnosis for PE due to ADHF based on BNP (Table 4). ROC curves for TFC, SI and CI and PE diagnosis due to ADHF based on BNP are shown in Figure 5. In our study, the optimal cut-off value of TFC for the diagnosis of PE due to ADHF was found 32.70. According to this cut-off value, the sensitivity was calculated as 70.0% and the specificity was 86.0% (Table 4). We examined the correlation between BMI and gender and TFC. The comparison of the mean gender and BMI based on TFC revealed a statistically significant difference between the groups (Table 5).

The ROC analysis was used to evaluate the subgroups by BMI and gender separately for TFC based on the diagnosis of PO due to ADHF using BNP value. In normal weight, obese and morbid obese patients the values were determined as follows: the AUC

Table 2. Demographic status of patients	
Variable total (n=113)	
Female/Male, n (%)	39 (34.5)/74 (65.5)
Age, mean ± SD	72 (70.0-75.0)
BMI, kg/m², mean ± SD	27.7 (27.2-29.4)
BMI, n (%)	
Normal	35 (31.0)
Overweight	39 (34.5)
Obese	33 (29.2)
Morbid obese	6 (5.3)
Pulmonary auscultation, n (%)	
Normal	16 (14.2)
Crackle on the bilateral basal	50 (44.2)
Crackle on the mid zone	24 (21.2)
Crackle on the apex	1 (0.9)
Other	22 (19.5)
The sign of chest X-ray, n (%)	
Pulmonary oedema	39 (34.5)
Inpatient from ED	49 (43.4)
Discharge from ED	62 (54.9)
MACE for during seven days	1 (0.9)

BMI: Body mass index, SD: Standard deviation, ED: Emergency department, MACE: Major cardiac events, n: Number

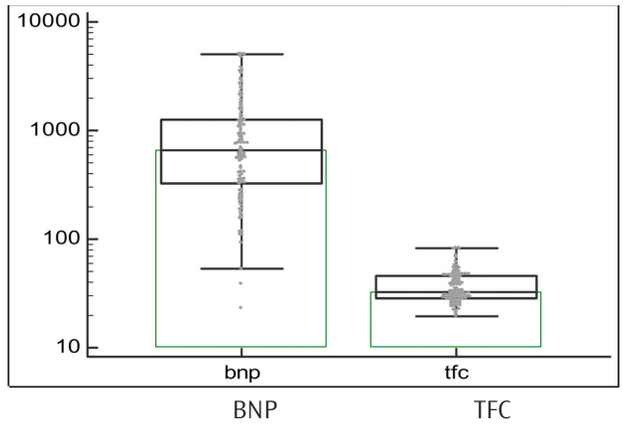

Figure 4. Comparison between the median values of BNP and TFC

BNP: Brain natriuretic peptide, TFC: Thoracic fluid content

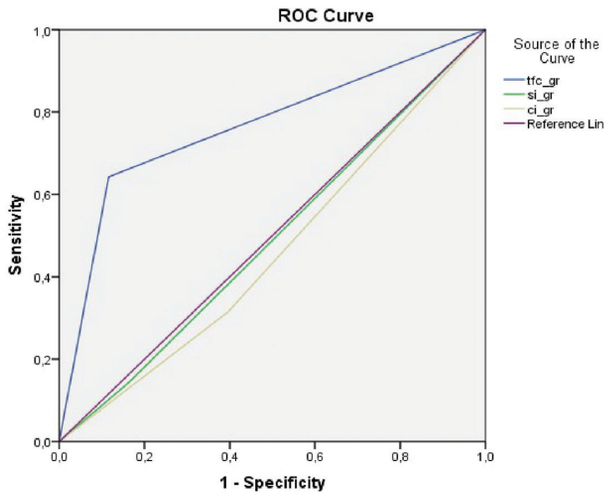

Figure 5 a. The TFC has a higher AUC [0.76 (0.674-0.853), p<0.001] than SI and CI respectively AUC [0.49 (0.380-0.600)]

#Standardized values used to TFC, SI and CI

TFC: Thoracic fluid content, AUC: Area under curve, SI: Stroke index, CI: Cardiac index

Table 3. Comparison of PO due to ADHF between the BNP and TFC, SI, CI					
Variable total (n=113)	**n (%)**	**PO due to ADHF using by BNP (group 1), n (%)**	**Sensitivity**	**Specificity**	**#p**
PO due to ADHF using by TFC (group 2)	50 (44.2)	45 (64.3)	64.3	88.4	<0.001
PO due to ADHF using by CI (group 3)	39 (34.5)	22 (31.4)	31.4	60.5	0.379
PO due to ADHF using by SI (group 4)	17 (15)	10 (14.3)	14.3	83.7	0.774

PO: Pulmonary oedema, ADHF: Acute decompensated heart, BNP: Brain natriuretic peptide, SI: Stroke index, CI: Cardiac index, TFC: Thoracic Fluid content, n: Number

Standardised values used to diagnosis of ADHF: BNP >500 pg/dL, TFC >34.2 1/kOhm, CI >2.6 L/min/m², SI >31.8 mL/m², failure #chi-square test was done

(0.85, 0.83), optimal cut-off values (36.45, 31.77) and sensitivity-specificity (77-89, 71-85), respectively. The ROC analysis was used to evaluate the subgroups by gender separately for TFC based on the diagnosis of PE due to ADHF using BNP value. In male and female patients, the values were determined as follows: the AUC (0.84, 0.81), optimal cut-off points (32.7, 31.8), sensitivity-specificity (65-95, 78-79) based on these values, respectively. (Figure 6)

Discussion

In this study, we investigated the diagnostic value of TFC, which is one of ICG parameters, in patients presented to the ED with dyspnoea and suspected of PO due to ADHF. BNP was determined as the gold standard for the diagnosis of PO due to ADHF. In addition to the high diagnostic value of TFC, it was concluded that it could also replace other exclusion tests. Besides, ICG has been proven to be a valid and accurate method in some cardiovascular diseases and emergency medical conditions, and could be substituted for other invasive diagnostic methods by virtue of its non-invasive nature (8). The literature reveals that physical examination alone is not enough for the diagnosis of PO due to ADHF (9,10). Additional diagnostic methods are needed. In cardiac failure, the routine evaluation where a catheter is passed into the chambers of the heart carries a risk of serious complications. This can be facilitated by the application of ICG. Consistent with the literature, we also found 64.3% sensitivity and 88.4% specificity for TFC ≥34.2 1/kOhm when BNP value was determined as the gold standard for the diagnosis of PO due to ADHF. Malfatto et al. included 29 patients of a 72±4 year age group with NHYA class of 3.5±0.9 (New York Heart Association) and an ejection fraction of 28±6%. They obtained the value of TFC by ICG, and measured pulmonary capillary wedge pressure

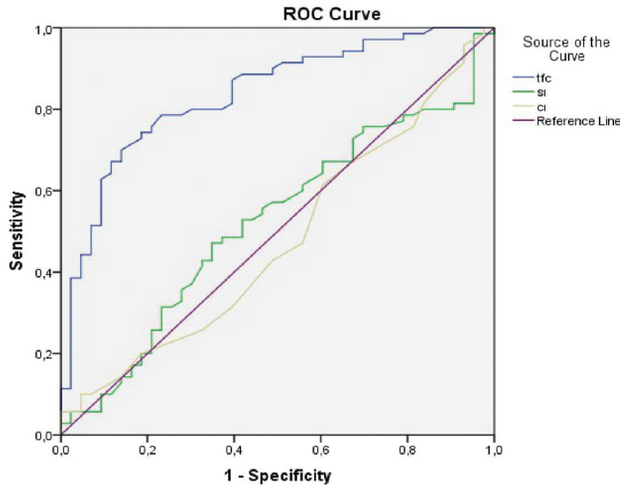

Figure 5 b. >32.70 1/kOhm value used to TFC and AUC [0.83 (0.762-0.912), p<0.001] was found

TFC: Thoracic fluid content, AUC: Area under curve

Table 4. ROC curve analysis of each parameters for PO due to ADHF using by BNP

	Sensitivity	Specificity	AUROC	p
TFC, %	64.3	88.4	0.76 (0.674-0.853)	**<0.001**
*TFC, %	70	86	0.83(0.762-0.912)	**<0.001**
SI, %	14.3	83.7	0.49 (0.380-0.600)	**0.859**
CI, %	31.4	60.5	0.46 (0.349-0.570)	0.471

AUROC: Area under the receiver operating characteristic curve, PO: Pulmonary oedema, ADHF: Acute decompensated heart failure, ROC: Receiver operating Characteristic curve

Standardised values used to diagnosis of ADHF: BNP >500 pq/mL, TFC >34,2 1/kOhm, CI >2.6 L/dk/m^2, SI >31.8 mL/m^2

*Cut off for TFC >3.70 1/kOhm in the study

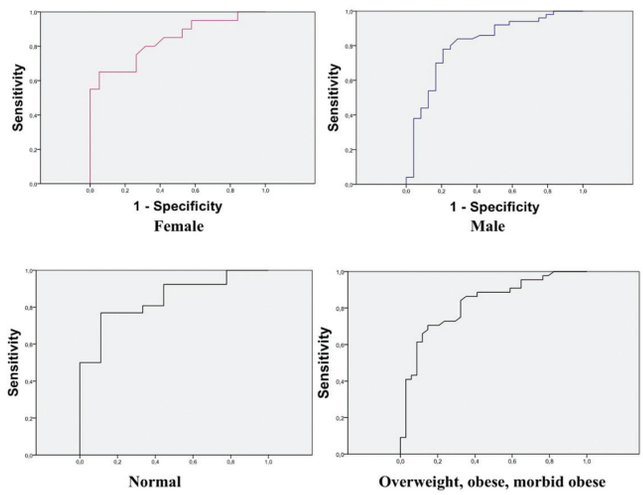

Figure 6. Receiver operation characteristic curve for PO due to ADHF using by TFC (Groups was estimated separately according to BMI and genders)

PO: Pulmonary oedema, ADHF: Acute decompensated heart failure, TFC: Thoracic fluid content, BMI: Body mass index

Table 5. Comparison between the BMI and gender according to TFC

	n	Mean rank	Sum of rank	U	Z	#p
Gender						
Female	39	48.36	1886	1106	-2.035	0.042
Male	74	61.55	4555			
BMI						
Normal	35	70.83	2479	881	-3.006	0.003
Overweight, obese, morbid obese	78	50.79	3962			

BMI: Body mass index, TFC: Thoracic Fluid content, U: u test statistic, Z: z test statistic

#Mann-Whitney U test was used

(PCWP) using cardiac catheterization. The value of TFC ≥35 1/kOhm obtained by ICG had high specificity (97%) and sensitivity (86%) in patients with PCWP ≥15 mmHg using cardiac catheterization. The reproducible and non-invasive nature of ICG and the fact that the accuracy of TFC was also proved in our study indicate that ICG can be successfully used in the diagnosis and follow-up of the treatment. It is thought that ICG can substitute for BNP testing in patients who were presented with dyspnoea and suspected of PO due to ADHF as it has a similar diagnostic value. Because ICG measurement also has advantages over BNP. In many studies positive results have been obtained between BNP and ICG in patients with ADHF. A study on 331 patients showed that BNP and STR (the marker of contractly) on ICG were good prognostic factors when evaluating heart failure flare-up (11,12). Another study involving 524 patients showed that ICG, STR, and BNP could be indicators of early heart failure flare-up, and the relative risk of heart failure flare up increased by 12.5 times ($p<0.001$) at BNP >100 pg/mL and STR >0.45 (11). In the presence of PO, ICG can be used in the distinctive diagnosis of dyspnoea in the ED (13,14). A study including 120 heart failure patients showed that TFC >35 1/kOmega measured by ICG together with BNP >350 pg/mL had 95% sensitivity and 96% specificity when diagnosing diastolic heart failure (15). Although BNP monitoring can be performed at the bedside, a laboratory is also required. Time is crucial for these patients requiring urgent treatment. A study reveals that it takes more than one hour from the beginning of BNP testing until the physician obtains the results and proceed with the assessment for diagnosis and treatment accordingly (16). ICG can be performed in less time and replicated if necessary. In our study, the optimal cut-off value for the diagnosis of PO due to ADHF was found 32.70. Replication of the statistical methods based on this cut-off value revealed 70.0% sensitivity and 86.0% specificity. We used the value of 34.20 as a standardized cut-off point for some findings in our study, which was previously found as an optimal cut-off value in a study (17). It could be concluded that the cut-off value for TFC could be standardized and used in the diagnosis of PO due to ADHF as these values were similar to each other. The mean age of the study was 72.0 years. In other studies, the mean age was over 65 years, which is similar to our study showed that TFC might vary based on anthropometric measurements (height, weight) and gender (17-19). Similarly, we found a statistically significant difference between the groups for both variables when we compared the mean values of TFC based on gender and BMI in our study. The optimal cut-off values of TFC varied according to gender and BMI when evaluated by ROC analysis. This suggests that TFC may have a higher diagnostic value when different cut-off values are accepted for TFC according to gender and BMI. However, more extensive studies are required in this regard.

Study Limitations

There were several limitations in our study. Firstly, it was a single-centred study. Secondly, the study sample was small. We didn't use TTE for diagnosis of ADHF therefore BNP value was accepted as the gold standard in the diagnosis of PO due to ADHF. Patients with arrhythmias were included in the study. This condition may have affected our results. We did not follow up non-cardiogenic PE and the outcomes of hospitalised patients. Other study limitations could be the adaptation period to the ICG device by emergency physician as there had not been any similar study or application in the ED prior to our study, and the difficulty faced by symptomatic patients to lie in the supine position. This study will be a step forward in prospective studies with larger patient populations.

Conclusion

Patients with PO due to ADHF are referred to the ED in an agitated and severe condition. Therefore, our study has revealed the importance of the use of ICG device in the ED as it is fast, non-invasive and can be performed at the bedside. In conclusion, this study showed that TFC obtained by ICG device has a high diagnostic value for PO and it can also be used as an exclusion method.

Ethics

Ethics Committee Approval: This study was supported by Akdeniz University Scientific Research Projects Coordination Unit (project number: TTU-2017-26434).

Informed Consent: Informed consent was obtained from all of the patients.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Concept: A.A., A.F.B., S.S., Design: A.A., A.F.B., Data Collection or Processing: A.A., A.F.B., Analysis or Interpretation: M.K., A.F.B., Literature Search: A.A., M.K., A.F.B., S.S., Writing: A.A., M.K.

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

Financial Disclosure: There are no financial supports.

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The Value of Cardiotrophin-1 in the Diagnosis, Severity, and Prognosis of Pulmonary Embolism

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Abstract

Aim: Pulmonary embolism (PE) is a life-threatening condition that requires early diagnosis and treatment. There is still a need for precise and non-invasive biomarkers that can be used to diagnose PE. This study aimed to determine the diagnostic value of Cardiotrophin-1 (CT-1) in patients with acute PE and ascertain the relationship between serum CT-1 level and disease prognosis and severity.

Materials and Methods: In this prospective study, the serum CT-1 levels of 165 patients with suspected acute PE were measured. The patients were divided into two groups, PE (+) and PE (−), based on their computed tomography angiography results. Their serum CT-1 levels were compared.

Results: The CT-1 levels of the PE (+) group (median=4.18 pg/mL, range=3.57-9.55 pg/mL) was non-significantly (p=0.08) different from those of the PE (−) group (median=4.38 pg/mL, range=3.57-51.64 pg/mL). Based on the severity of the condition, there were significant differences (p=0.001) in the CT-1 levels of the patients in the intermediate-low risk group (median=4.19 pg/mL, range=3.62-5.32 pg/mL), intermediate-high risk group (median=4.06 pg/mL, range=3.57-9.31 pg/mL) and high risk group (median=5.01 pg/mL, range=3.89-9.55 pg/mL). Based on the clinical course, the CT-1 levels of the patients in the good clinical course group (median=4.15 pg/mL, range=3.57-9.31 pg/ml) were significantly different (p=0.004) from those in the poor clinical course group (median=4.53 pg/mL, range=3.66-9.55 pg/mL).

Conclusion: CT-1 level was not observed to be a precise biomarker for the diagnosis of acute PE. However, our study demonstrated that the serum CT-1 levels can be used as a biomarker for ascertaining the severity and prognosis of patients with PE.

Keywords: Pulmonary embolism, diagnosis, severity, prognosis, Cardiotrophin-1

Introduction

Pulmonary embolism (PE) is a common and potentially life-threatening clinical condition that may cause obstruction of the pulmonary vascular bed and concomitant right heart failure (1,2). Early diagnosis and treatment can be life-saving. Currently, there are still various difficulties in the diagnosis of PE in emergency departments due to nonspecific symptoms and signs. D-dimer is a marker with high negative and low positive predictive value that can be used non-invasively in the diagnosis of PE. Definitive diagnosis is made by expensive techniques such as pulmonary scintigraphy and spiral computed tomography (CT) or invasive methods such as pulmonary angiography (3). However, these invasive and expensive methods may not always be available.

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There is still a need for easy and non-invasive alternative biomarkers that can be used to diagnose PE and determine its severity and prognosis. Several guidelines recommend modified Well's Score (mWS) for assessing PE risk levels for patients without clinically shock findings. According to mWS, D-Dimer, CT anjiography (CTA) and bedside echocardiography are the choices of diagnostic tools. There are advantages and disadvantages of both CTA and echocardiography. The latter is non-invasive and can be performed at the bedside, while its major disadvantages are that it is user-dependent and is not as sensitive and specific as CTA (3).

PE may follow an asymptomatic course, or may also result in severe right ventricular failure, hypotension, shock, and arrest. It is known that there is a strong relationship between the severity of PE and prognosis. The use of thrombolytic therapy in haemodynamically stable patients with PE causing RVD is still controversial. Studies in which thrombolytic therapy administered to the patients with moderate-risk PE, defined as patients with RVD findings and with high biochemical parameters such as Troponin (Tn) or B-type Natriuretic Peptide (BNP), proBNP, heart type fatty acid-binding protein (H-FABP) despite not being hypotensive, have shown that such treatment has positive effects on preventing the development of haemodynamic decompensation (4). Biochemical parameters therefore also play a role, in addition to echocardiography and CT, in determining the severity and prognosis of PE (1). There are prognostic models such as the PE Severity index (PESI) or simplified PESI (sPESI), established using the clinical features of the patients at presentation (5,6). These models are used to determine the risk of early mortality in patients with confirmed diagnosis of acute PE by evaluating imaging results together with other clinical findings (1). In addition, they can also assist clinicians in the decision whether to admit patients with acute PE or observe them on an outpatient basis (7).

CT-1, a novel biochemical marker, is a 21.5 kDa protein from the interleukin-6 family, containing 201 amino acids and found in human heart, lung, and skeletal muscle. This cytokine performs transmembrane signaling through the glycoprotein 130 receptor. It has been shown to exhibit a powerful protective and hypertrophic effect on cardiac myocytes (8,9). CT-1 has also been shown to be of prognostic and diagnostic value in several cardiovascular diseases, such as hypertension, congestive heart failure, acute myocardial infarction, and valvular heart disease (10). It is probable that CT-1 levels may play a role in the diagnosis of PE and also it may be useful to determine the prognosis and the severity.

Materials and Methods

Approval for this prospective, randomized clinical study was granted by the Karadeniz Technical University Scientific Researches Ethical Committee (no: 2016/7). The study was performed in the Karadeniz Technical University School of Medicine Department of Emergency Medicine, a tertiary centre serving approximately 100,000 patients a year.

Selection of Participants

In the one-year period following receipt of ethical committee approval, patients aged over 18, consenting to take part and presenting to the emergency department with suspected acute PE and undergoing CTA were included in the study. Patients with kidney failure or advanced liver failure at time of presentation, pregnant women, and patients with deficient records were excluded.

Study Design and Setting

The diagnostic algorithm specified in the 2014 European Society of Cardiology (ESC) guidelines on the diagnosis and management of PE was used to evaluate the patients presenting to the emergency department on suspicion of acute PE. Consistent with that algorithm, patients undergoing spiral CTA (Siemens Somatom Sensation, Germany) and identified as having PE were included in the PE (+), and those without PE were enrolled in the PE (-) group. The diagnostic value of CT-1 was then investigated. In addition, patients diagnosed with acute PE were classified as low risk, intermediate-low risk, intermediate-high risk, and high risk based on early mortality classification as described in the 2014 ESC guidelines on the diagnosis and management of PE. Analysis of CT-1 and other biochemical parameters was then performed among these groups. Finally, all patients in the PE (+) group was followed-up for 90 days and prognostic analysis was performed according to defined clinical endpoints: intensive care requirements, intubation and mechanical ventilation requirements, vasopressor requirements, cardiopulmonary resuscitation and mortality. Patients developing one of these clinical endpoints were classified as the poor clinical course group, while those not developing any of the clinical endpoints were classified as the good clinical course group, and the prognostic value of CT-1 measured at time of presentation in acute PE patients was investigated. Informed consent was obtained from all patients included in the study.

Biochemical Measurements

Blood specimens were placed into gel separator blood tubes and allowed to clot for 20 min at room temperature. The tubes were then centrifuged at 1800xg for 10 min. Following centrifugation, the serum was carefully transferred to small, closed tubes and stored at -80 ºC until the day of study.

Serum specimen CT-1 levels were measured using an enzyme-linked immunosorbent assay (ELISA) kit (BioVendor, Cat

No: RD192026200CS, Brno, Czech Republic) in line with the manufacturer's instructions. The results were expressed as pg/mL. The intra-assay repeatability of this method was 4.4% (CV%).

Statistical Analysis

Statistical analysis was performed on SPSS 23.0 (IBM SPSS, Armonk, NY, USA) and MedCalc 12.3 (MedCalc Software, Mariakerke, Belgium) statistical software. Compatibility with normal distribution was assessed using the Shapiro-Wilk test. The Mann-Whitney U test was applied to compare the PE (+) and PE (-) groups. p values <0.05 were regarded as statistically significant. To determine the accuracy and respective best cut-off values of CT-1 for predicting APE, the receiver operating characteristic (ROC) curves and their corresponding areas under the curve were used. A p value of <0.05 was considered statistically significant.

Outcomes

The primary aim of this study was to investigate the value of CT-1 in the diagnosis of PE. Our secondary aim was to determine the value of CT-1 in determining the severity of PE using CT and echocardiography findings and Tn levels. We also investigated whether CT-1 is of any value in showing prognosis in PE patients.

Results

During the study period 221 patients presenting with suspected acute PE to emergency department were evaluated. Twenty-seven patients were excluded for not meeting the inclusion criteria. CTA was not performed on seven patients due to findings of right ventricular dysfunction (RVD) at echocardiography, and these were also excluded. Another four patients were excluded since CTA could not be performed due to instability. CTA was also not performed on 18 patients in the low risk group based on clinical probability analysis and with negative D-dimer results. Information about the patients included in and excluded from the study is shown in Figure 1. CTA was finally performed on 165 patients, 67 were in acute PE group, and 98 in the non-acute PE group. A comparison of the two groups' basic clinical and demographic characteristics is shown in Table 1. No statistically significant difference was determined between the two groups' demographic and clinical characteristics (p>0.05 for all).

Since the primary aim of this study was to determine the diagnostic value of CT-1 in PE, acute PE and non-PE groups were compared in terms of CT-1 and other biochemical parameters. Median CT-1 values were 4.38 pg/mL (3.57-51.64) in the non-PE group and 4.18 pg/mL (3.57-9.55) in the acute PE group. These results revealed no statistically significant difference between the two groups in terms of CT-1 values at time of presentation (p=0.08). Comparisons of other biochemical markers between the two groups revealed significant differences in terms of TnT-hs, D-dimer, WBC and pCO2 levels (p=0.004, p=<0.0001, p=0.022, and p=0.002, respectively). Biochemical parameters between the acute PE and non-PE groups are shown in Table 2. ROC curve analysis was performed for CT-1 in patients diagnosed with APE and the area under the curve was found to be 0.581 (p=0.071; 95% CI 54,6 to 74,4 Figure 2). The best cut-off values for CT-1 when predicting APE in patients with clinically suspected APE presenting at the ED were 4.2 pg/mL (sensitivity 54.5%; specificity 64.9%).

The secondary aim of this study was to determine the value of CT-1 in determining the severity of PE in patients diagnosed with the condition. For that purpose, we compared CT-1 and other biochemical parameters between the intermediate-low, intermediate-high and high-risk groups previously established. Since there were no patients in the low-risk group, this could not be included in the analysis. Median CT-1 values were 4.19 pg/mL (3.62-5.32) in the intermediate-low risk group, 4.06 pg/mL (3.57-9.31) in the intermediate-high risk group, and 5.01 pg/mL (266.5-1435.1) in the high-risk group. Analysis revealed significant differences in terms of CT-1 values among the three

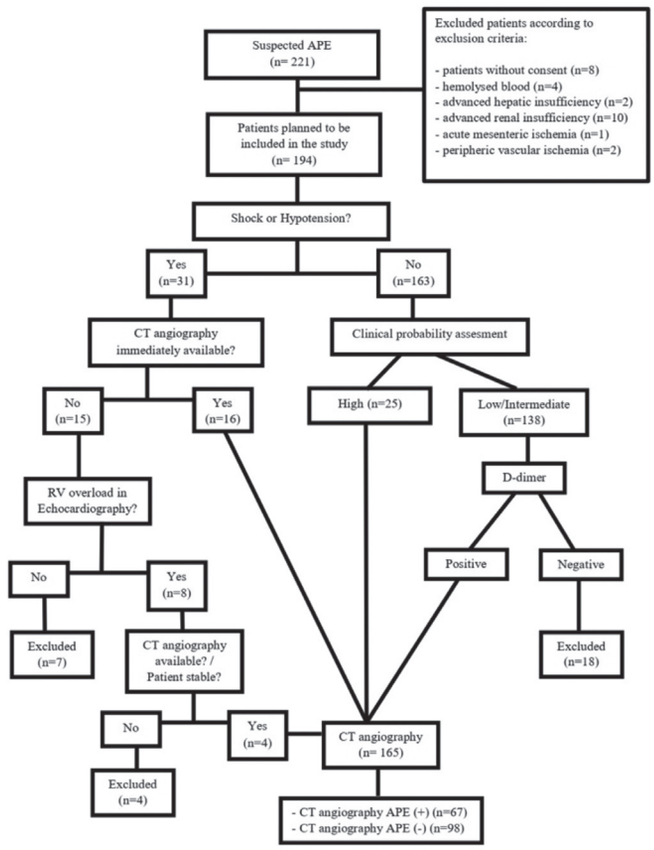

Figure 1. Study flow chart

CT: Computed tomography, APE: Acute pulmonary embolism, n: Number

Table 1. Demographic and clinical characteristics of patients

	APE Negative, n (%)	APE Positive, n (%)	p
Age, med (min-max)	72.5 (18-96)	78 (38-95)	0.69
Gender			
Female	55 (33.3%)	43 (27.3%)	0.194
Male	45 (26.1%)	22 (13.3%)	
Symptom			
Dyspnea	82 (49.7%)	55 (33.3%)	0.834
Chest pain	24 (14.5%)	17 (10.3%)	1.0
Hemoptysis	4 (2.4%)	3 (1.8%)	1.0
Syncope	16 (9.7%)	16 (9.7%)	0.237
DVT symptoms	3 (1.8%)	6 (3.6%)	0.161
Other symptoms	27 (16.4)	23 (13.9%)	0.391
Vitals			
SBP mmHg, mean ± SD	118.57±23.9	117.08±24.4	0.649
DBP mmHg, med (min-max)	71.5 (40-140)	72 (40-120)	0.831
Pulse/min, mean ± SD	101.94±23.3	98.65±21.9	0.320
Respiratory rate/min, med (min-max)	22 (10-45)	24 (10-42)	0.257
Body temperature °C, med (min-max)	36.7 (35.9-39.5)	36.8 (36-39.2)	0.697
ECG findings			
S1Q3T3	4 (2.4%)	4 (2.4%)	0.716
Sinus tachicardia	28 (17.0%)	24 (14.5%)	0.394
Atrial fibrillation	24 (14.5%)	16 (9.7%)	1.0
Negative T waves	13 (7.9%)	17 (10.3%)	0.64
RBBB	0 (0.0%)	3 (1.8%)	0.65
X-ray findings			
Pleural effusion	20 (12.1%)	9 (5.5%)	0.301
Atelectasia	23 (13.9%)	13 (7.9%)	0.57
Diaphragm elevation	2 (1.2%)	5 (3.0%)	0.121
Hampton hump	1 (0.6%)	0 (0.0%)	1.0
Pulmonary artery dilatation	9 (5.5%)	4 (2.4%)	0.453
VTE risk factors			
Previous PE	6 (3.6%)	10 (6.1%)	0.105
Previous DVT	4 (2.4%)	4 (2.4%)	0.716
Varicose veins	3 (1.8%)	4 (2.4%)	0.443
Chronic venous insufficiency	1 (0.6%)	0 (0.0%)	1.0
Previous stroke	14 (8.5%)	11 (6.7%)	0.826
Pregnancy	0 (0.0%)	0 (0.0%)	1.0
Malignancy	29 (17.6%)	25 (15.2%)	0.315
Obesity	12 (7.3%)	13 (7.9%)	0.269
Smoking history	12 (7.3%)	11 (6.7%)	0.496
Immobilisation	38 (23.0%)	35 (21.2%)	0.111
Surgery in 4 weeks	6 (3.6%)	7 (4.2%)	0.362
Trauma in 4 weeks	4 (2.4%)	5 (3.0%)	0.488
Coagulopathy	1 (0.6%)	1 (0.6%)	0.406
Oral contraceptive use	0 (0.0%)	0 (0.0%)	1.0
Postpartum period	0 (0.0%)	1 (0.6%)	0.406

APE: Acute pulmonary embolism; DVT: Deep vein thrombosis; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; RBBB: Right bundle branch block, VTE: Venous thromboembolism; PE: Pulmonary embolism, SD: Standard deviation, med: Median, n: Number, ECG: Electrocal diogram

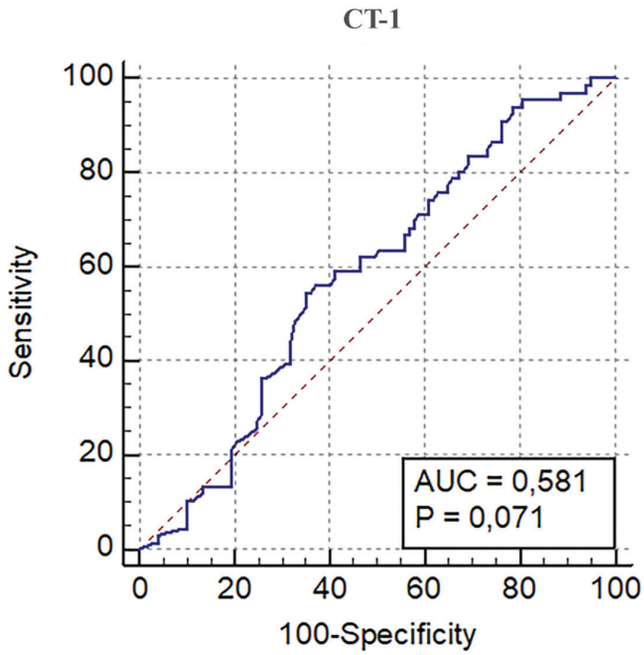

Figure 2. Roc curve analysis

AUC: Area under the curve, CT-1: Cardiotrophin-1

groups (p=0.001). Bonferroni correction was used in two-way comparisons between groups and showed a significant difference between the high-risk group and the intermediate-low and intermediate-high risk groups (Bonferroni test p=0.002 and p=0.001, respectively). CT-1 level in these three groups are shown in Figure 3.

Comparisons among these three groups in terms of other biochemical parameters revealed statistically significant differences in Tn-T and proBNP values (p=0.044, and p=0.016, respectively), but none in terms of the other biochemical

parameters. Comparisons using Bonferroni correction revealed a significant difference in pro-BNP between the intermediate-low risk group and the intermediate-high risk group (p=0.005). A comparison of biochemical parameters among the three groups constituted to determine the severity of PE is shown in Table 3.

For the third aim of this study, to evaluate the prognostic value of CT-1 in patients with PE, comparison of biochemical values in the good and poor clinical course groups that established according to previously mentioned was performed. Median CT-1 values were 4.15 pg/mL (3.57-9.31) in the good clinical course group and 4.53 pg/mL (3.66-9.55) in the poor clinical course group and a statistically significant difference was found between the two groups (p=0.004). CT-1 values between the groups evaluated in terms of prognosis are shown in Figure 4. The analysis of other biochemical parameters between two groups showed a significant difference only in terms of Tn-T (p=0.008). The

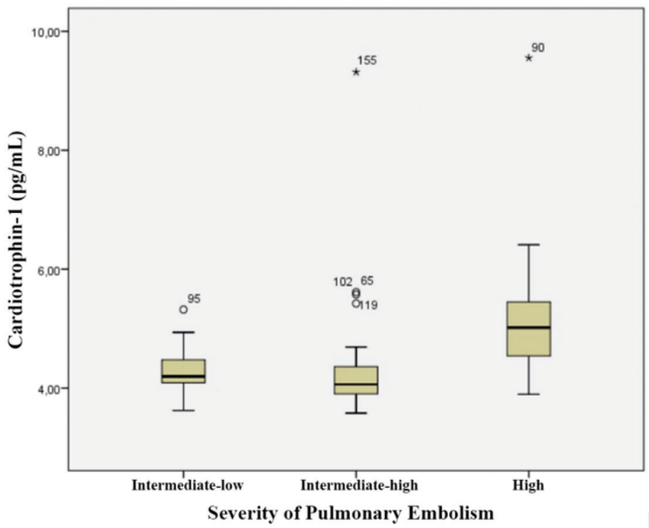

Figure 3. Distribution of Cardiotrophin-1 levels in the PE severity groups
PE: Pulmonary embolism

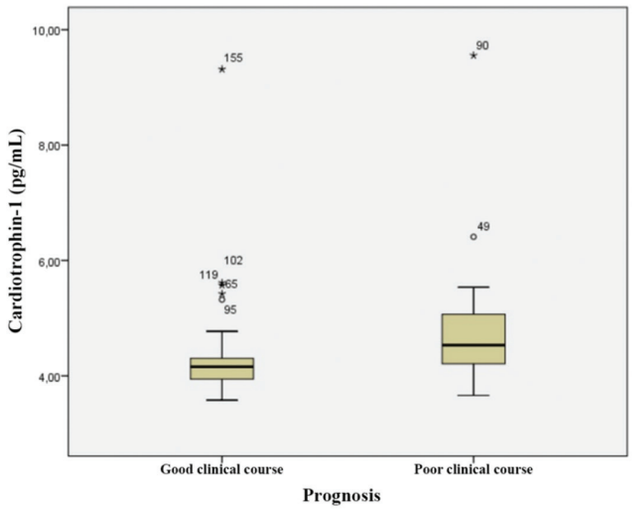

Figure 4. Comparison of biochemical parameters among the acute PE clinical course groups
PE: Pulmonary embolism

Table 2. Comparison of biochemical parameters between PE and non-PE groups

Marker	PE negative (n=98) (59.4%)	PE positive (n=67) (40.6%)	p
CT-1 (pg/mL), med (min-max)	4.38 (3.57-51.64)	4.18 (3.57-9.55)	0.080
TnT-hs (ng/L), med (min-max)	27.14 (3.18-6676.0)	38.64 (3.0-315.8)	0.004
CK-MB (ng/L), med (min-max)	1.905 (0.3-38.62)	2.29 (0.32-13.69)	0.302
Ph, med (min-max)	7.45 (6.82-7.67)	7.45 (7.05-7.57)	0.414
pCO_2 (mmHg), med (min-max)	34.85 (17.0-74.3)	31.3 (15.2-61.0)	0.002
pO_2 (mmHg), med (min-max)	71.3 (38.9-177.0)	71.3 (44.5-166.0)	0.758
sO_2 (%), med (min-max)	93.45 (56.3-99.0)	92.8 (72.9-99.3)	0.459
Glucose (mg/dL), med (min-max)	131 (78-393)	129 (90-498)	0.897
BUN (mg/dL), med (min-max)	21.5 (6.0-87.0)	23.0 (6.0-92.0)	0.386
Creatinine (mg/dL), med (min-max)	0.9 (0.23-2.39)	0.9 (0.43-1.74)	0.470
ALT (U/L), med (min-max)	19.5 (3.0-396.0)	15.0 (3.0-199.0)	0.128
AST (U/L), med (min-max)	30.0 (9.0-285.0)	25.0 (10.0-531.0)	0.124
D-dimer (µg/mL), med (min-max)	2.71 (0.57-40.0)	7.54 (1.11-42.92)	<0.0001
CRP (mg/dL), med (min-max)	4.97 (0.13-37.28)	7.0 (0.2-36.29)	0.448
WBC (/µL), med (min-max)	7860 (180-168000)	10630 (1120-38340)	0.022

PE: Pulmonary embolism, CT-1: Cardiotrophin-1, TnT-hs: High sensitive cardiac troponin T, CK-MB: Creatine kinase myocardial band, BUN: Blood urea nitrogen, ALT: Alanine aminotransferase, AST: Aspartate aminotransferase, CRP: C reactive protein, WBC: White blood cell, SD: Standard deviation, med: Median, min: Minimum, max: Maximum, n: Number

comparison of biochemical markers between the two groups is shown in Table 3.

Discussion

Acute PE is a common acute cardiovascular disease. However, diagnosis of patients presenting with acute PE can be difficult (11). Since mortality decreases significantly in cases that are treated early, rapid diagnosis is particularly important in this clinical condition with high mortality and morbidity.

Several biochemical markers and parameters have been investigated in the diagnosis of PE but to the best of our knowledge, this is the first study to evaluate the prognostic value of Cardiotrophin-1 (CT-1) in the diagnosis of PE. In this study, we also evaluated the relationship between the serum CT-1 levels with the prognosis and the risk levels of the disease.

CT-1 is a survival promoting cytokine detected in cardiomyocytes and cardiac fibroblasts in response to mechanical, humoral, metabolic and hypoxic stress. In acute stress conditions, CT-1 increases cell survival, whereas in increased stress states, the chronic effect of CT-1 is cardiomyocyte hypertrophy and consequently left ventricular failure (12). CT-1 is also released from vascular endothelial cells and produces direct vascular effects in the form of atherogenesis, vascular dysfunction, arterial stiffness and increased blood pressure (13,14). Overall, CT-1 is an effective profibrotic agent for the heart and vessels (12,14). In a review Calabrò et al. (15) evaluated the role of CT-1 in cardiovascular diseases and said that, plasma CT-1 levels are higher in patients with hypertension (with left ventricular hypertrophy), significant mitral regurgitation (with left ventricular function), aortic stenosis, unstable angina, acute myocardial infarction, and heart failure than healthy subjects.

Although it may be a biochemical marker that can be used as a diagnostic tool in cardiovascular diseases, because of the low specifity and the sensitivity rates, we concluded that CT-1 alone will not be useful in the diagnosis of acute PE. And we found that among other biochemical parameters, TnT-hs and D-dimer levels were higher in the PE group, consistent with the literature. It is well known that elevated plasma troponin levels are associated with worse prognosis in PE (1). But the use of plasma troponin levels alone in the diagnosis of PE is not appropriate because plasma troponin levels are elevated in many different cardiovascular diseases and may cause errors in diagnosis. Also, D-Dimer has a high negative and low positive predictive value, and it is used in the primary evaluation of the PE in suspected patients.

The use of cardiac troponin levels to assess the severity of PE is recommended by the 2019 ESC guideline. In addition to this, increased Heart-type fatty acid-binding protein (H-FABP), BNP, N-terminal (NT) proBNP and lactate levels were reported to be associated with poor prognosis in PE (1). Hellenkamp et al. (16) investigated the effect of copeptin on the prognosis of PE and found that patients with high levels of copeptin had more adverse outcomes. It was said that copeptin levels could improve risk stratification in normotensive patients if it was integrated in the risk assessment algorithm in the 2014 ESC algorithm. In our study we found that CT-1 levels were higher in the high-risk group compared to intermediate-high risk and intermediate-low risk groups. According to these findings we can say that CT-1 levels can be used to identify high risk PE patients. We also found that CT-1 levels are higher in the previously defined poor clinical course group and higher CT-1 levels are associated with poor prognosis.

Table 3. Comparison of biochemical parameters between the PE Severity groups and the acute pe clinical course groups

Marker	PE severity groups				Acute PE clinical course groups		
	Intermediate-low risk (n=23) (%34.3)	Intermediate-high risk (n=32) (%47.8)	High risk (n=12) (%17.9)	p	Good clinical course (n=44) (%65.7)	Poor clinical course (n=23) (%34.3)	p
CT-1 (pg/mL), med (min-max)	4.19 (3.62-5.32)	4.06 (3.57-9.31)	5.01 (3.89-9.55)	0.001	4.15 (3.57-9.31)	4.53 (3.66-9.55)	0.004
D-dimer (µg/mL), med (min-max)	7.54 (1.11-30.0)	9.54 (1.25-39.41)	5.72 (1.59-42.93)	0.821	8.22 (1.11-30.0)	7.49 (1.59-42.93)	0.235
TnT-hs (ng/L), med (min-max)	34.16 (3.00-197.00)	37.46 (15.39-226.50)	65.22 (14.80-315.80)	0.044	35.0 (3.0-208.20)	67.0 (12.92-315.80)	0.008
Nt-proBNP (pg/mL), med (min-max)	789.0 (71.0-12172.0)	2686.5 (80.0-18691.0)	3861.0 (178.0-17647.0)	0.016	1833.50 (71.0-18691.0)	1849.20 (147.0-17647.0)	0.607

PE: Pulmonary embolism, CT-1: Cardiotrophin-1, TnT-hs: High sensitive cardiac troponin T, Nt-proBNP: N terminal prohormone of B-type natriuretic peptide, min: Minimum, max: Maximum, med: Median, n: Number

Study Limitations

When our study was conducted, since the 2019 ESC guideline has not yet been published and the valid guideline for PE was the 2014 ESC guideline, we used the 2014 ESC guideline to determine the patient inclusion criteria and PE severity classification and algorithm.

The major limitation of this study is that the time of onset of PE was unclear, and that since time of presentation to hospital differed for all patients, serum collection times could not be standardized for all individuals.

Another important limitation of this study is that blood was collected from patients presenting with suspected PE only at time of presentation, rather than periodically, and no analysis of time-dependent changes in CT-1 levels was possible.

Conclusion

The results of this study do not support the use of CT-1 as a diagnostic marker in acute PE patients. However, they do suggest that serum CT-1 may be useful in determining clinical severity and prognosis in patients with acute PE.

Ethics

Ethics Committee Approval: Approval for this prospective, randomized clinical study was granted by the local clinical research ethical committee (no: 2016/7).

Informed Consent: Informed consent was obtained from the patients.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: S.P., O.A., M.İ., Concept: S.P., O.A., M.İ., A.M., M.Ş., Ö.T., Design: S.P., O.A., M.İ., A.M., M.Ş., Ö.T., Data Collection or Processing: S.P., O.A., M.Ç., M.Y., Analysis or Interpretation: M.Ç., M.Y., S.D., A.M., Ö.T., Literature Search: S.P., O.A., M.İ., Writing: S.P., O.A., M.İ.

Conflict of Interest: The authors declare that they have no significant competing financial, professional or personal interests that might have influenced the performance or presentation of the work described in this manuscript.

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Driver Behaviors of 112 Emergency Medical Services Personnel

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Abstract

Aim: The purpose of this study is to determine the driver behaviors of emergency health personnel driving ambulances.

Materials and Methods: This descriptive study included ambulance drivers at the İzmir 112 Emergency Medical Services Department. We prepared a questionnaire consisting of 21 items as the data collection tool in this study. Moreover, we used this questionnaire to evaluate personal information and driver behaviors. Furthermore, a researcher in our study conducted face-to-face interviews to obtain data at the ambulance stations.

Results: Altogether, 90.9% of the participants were self-confident in driving ambulances. Moreover, 88.8% of the participants followed traffic rules and 74.1% followed speed limits. In total, 55.2% of the participants previously had traffic accidents, and this ratio was lower in personnel taking 24-hour shifts.

Conclusion: We found that ambulance drivers are self-confident and follow speed limits as well as traffic rules. We also determined that approximately half of the participants previously had a traffic accident.

Keywords: Ambulance, operators, ambulance driving, behaviors

Introduction

The function of 112 Emergency Medical Services (EMS) is to provide emergency health services to patients and injured as well as delivering these persons to the hospital. For this reason, emergency ambulance operation constitutes an important part of delivering EMS to patients. In Turkey, drivers, Emergency Medical Technicians (EMT) and paramedics assume the duty of ambulance drivers as part of 112 EMS (1). Ambulance drivers assume great responsibilities to protect the lives and property of patients, other ambulance personnel, and other drivers and pedestrians in traffic. The smallest mistake while driving in traffic can pose a great risk for the life of everyone in the ambulance (2). However, driving the ambulance is not the only task of the personnel who assumes this duty. In addition, these personnel also take part in the emergency care of patients and injured when they arrive at the scene (1).

Ambulance driving is dangerous and has certain identified risks (3,4). One of these risks is ambulance accidents. High speed and aggressive driving style are the main risk factors for serious traffic accidents (5). Motor-vehicle death rate for emergency medical personnel is 4 times higher than other occupational groups (6). For this reason, health personnel driving ambulances work under tremendous stress. It is important to determine the driver behavior of emergency medical personnel driving ambulances under stress. This study was carried out to determine the driver behavior of emergency medical personnel driving ambulances.

Materials and Methods

This descriptive study was conducted on medical personnel (drivers, EMTs, and paramedics) assigned for duty as ambulance drivers at the İzmir 112 EMS Department.

Based on similar studies in the literature, a questionnaire consisting of 21 items was created as a data collection tool. This form was used to evaluate personal information as well as driver behavior.

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Data was obtained by the researcher through face-to-face interviews conducted at 112 ambulance stations in January-February 2020. Sample selection was not performed and the entire population was reached. Those who refused to participate in the study and those who were not present at 112 ambulance stations at the time of the study were excluded. Participants were informed about the study and volunteers were included in the study. Written consent was obtained from all volunteering participants. Study data were obtained by reaching a total of 143 people [62 (43.4%) drivers, 43 (30.1%) EMTs and 38 (26.6%) paramedics] in İzmir 112 EMS Department.

This study was approved by Dokuz Eylül University, Non-interventional Research Ethics Committee with date: 06.03.2019, protocol number: 4514-GOA and decision number: 2019/05-37. The study was conducted in accordance with the working principles of the Helsinki Declaration.

Statistical Analysis

Data was evaluated with the "SPSS for Windows 18.0" package program. Descriptive statistics and "chi-square test" were used to evaluate data.

Results

71.3% (n=102) of the participants were male. Mean age was 32.9±7.95 years and the mean employment time was 8.4±6.10 years. Ambulance driving behaviors of paramedics, EMTs, and drivers are given in Table 1. Based on participant responses, it was found that 90.9% (n=130) of the participants were self-confident in ambulance driving, 88.8% (n=127) followed traffic rules and 74.1% (n=106) followed speed limits, and 71.8% (n=102) stated that traffic density affected driver behavior. Participants were evaluated for previous traffic accidents and 55.2% of the participants (n=79) stated that they had a traffic accident with an ambulance. 86.1% (n=68) of the traffic accidents involved material damage and it was found that none of these accidents involved death.

Table 2 shows the comparison of driver behaviors between participants who previously had a traffic accident with an ambulance and participants who did not. There was no statistically significant difference in previous traffic accidents between the participants who stated that they followed traffic rules and speed limits while using an ambulance and those who did not (p>0.05). On the other hand, the rate of having a traffic accident was lower in personnel working 24-hour shifts (p=0.039).

When asked "Does driving an ambulance affect emergency care provided to the patient?", 27.2% (n=39) of the participants

Table 1. Driver behaviors of participants according to profession

	Paramedic		EMT		Driver		Total	
	n	%*	n	%*	n	%*	n	%**
Are you willing to take driver shifts?								
Yes	17	18.3	24	25.8	52	55.9	93	65.1
No	9	47.3	6	31.5	4	21.1	19	13.2
Undecided	12	38.7	13	41.9	6	19.4	31	21.7
Self-confidence in driving								
Yes	28	21.6	40	30.7	62	47.7	130	90.9
No	10	76.9	3	23.1	0	0	13	9.1
Do you follow speed limits when driving?								
Yes	31	29.2	31	29.2	44	41.6	106	74.1
No	7	18.9	12	32.5	18	48.6	37	25.9
Does patient condition (emergency status) affect ambulance speed?								
Yes	32	28.6	33	29.4	47	41.9	112	78.3
No	6	19.4	10	32.2	15	48.4	31	21.7
Does using siren affect ambulance speed?								
Yes	22	25.0	32	36.4	34	38.6	88	61.5
No	16	29.1	11	20.0	28	50.9	55	38.5
Does patient behavior or behavior of patient relatives affect ambulance speed?								
Yes	17	30.9	19	34.5	19	34.5	55	38.5
No	21	23.9	24	27.3	43	48.9	88	61.5
Do you follow traffic rules in general?								
Yes	35	27.6	40	31.5	52	40.9	127	88.8
No	3	18.8	3	18.8	10	62.5	16	11.2
Have you ever had a traffic accident with an ambulance?								
Yes	12	15.1	24	30.3	43	54.4	79	55.2
No	26	40.6	19	29.7	19	29.7	64	44.8
Severity of previous traffic accident(s)								
Material damage	10	14.7	19	27.9	39	57.3	68	86.1
Injury	2	18.2	5	45.5	4	36.4	11	13.9
Does driving increase your stress levels?								
Yes	23	33.3	29	42.0	17	24.6	69	48.2
No	15	20.3	14	18.9	45	60.8	74	51.8
Do weather conditions affect your driving?								
Yes	31	31.0	32	32.0	37	37.0	100	69.9
No	7	16.3	11	25.6	25	58.1	43	30.1
Does traffic density affect your driving?								
Yes	32	31.4	32	31.4	38	37.3	102	71.8
No	16	15.0	11	27.5	23	57.5	40	28.2
Does driving at day or night affect your driving?								
Yes	22	38.6	15	26.3	20	35.1	57	39.8
No	16	18.6	28	32.6	42	48.8	86	60.2
Do 24-hour shifts affect your driving?								
Yes	22	31.9	25	36.2	22	31.9	69	48.2
No	16	21.6	18	24.3	40	54.1	74	51.8

n: Number, EMT: Emergency Medical Technician
*Row percentage, **Column percentage

responded "Yes". These participants were asked to elaborate how driving an ambulance affected emergency care provided to the patient, and answers are given in Table 3. Majority of the participants responded "It affects care in terms of time. I cannot intervene while parking the ambulance."

Table 2. Comparison of driver behavior between participants who previously had traffic accidents and those who did not

	Previous traffic accidents							
	Yes		No		Total			
	n	%*	n	%*	n	%**	$\chi 2$	p
Willingness to take driver shifts								
Yes	54	58.0	39	42.0	93	83.0	0.00	0.989
No	11	57.9	8	42.1	19	17.0		
Self-confidence in driving								
Yes	75	57.7	55	42.3	130	90.9	3.46	0.062
No	4	30.7	9	69.3	13	9.1		
Following speed limits while driving								
Yes	56	52.8	50	47.2	106	74.1	0.97	0.325
No	23	62.2	14	37.8	37	25.9		
Following traffic rules in general								
Yes	71	55.9	56	44.1	127	88.8	0.20	0.654
No	8	50.0	8	50.0	16	11.2		
Driving increasing stress levels								
Yes	37	53.6	32	46.4	69	48.2	0.14	0.706
No	42	56.8	32	43.2	74	51.8		
Weather conditions affecting driving								
Yes	51	51.0	49	49.0	100	69.9	2.42	0.119
No	28	65.1	15	34.9	43	30.1		
Traffic density affecting driving								
Yes	52	51.0	50	49.0	102	71.8	3.18	0.074
No	27	67.5	13	32.5	40	28.2		
24-hour shifts affecting driving								
Yes	32	46.3	37	53.7	69	48.2	4.24	0.039
No	47	63.5	27	36.5	74	51.8		

n: Number, *Row percentage, **Column percentage

Table 3. Reasons why ambulance driving affects emergency care given to the patient

	Total (n=39)	
	n	%*
It affects care in terms of time. I cannot intervene while parking the ambulance	24	61.5
I have difficulty intervening the patient because the public thinks that I am the driver	12	30.7
I cannot provide care to the patient because of the stress caused by driving the ambulance	11	28.2
I cannot provide care to the patient because of the fatigue caused by driving the ambulance	2	5.1

n: Number, *Row percentage

Discussion

The present study is important as it is one of the first studies evaluating driver behavior of emergency medical personnel driving ambulances. In the present study, the participants reported that they were self-confident in ambulance driving and followed traffic rules and speed limits. There are five training modules that must be completed by personnel working at the 112 EMS Department. One of these training modules is "Ambulance Driving Techniques Training". All personnel assuming duty in 112 ambulances are required to complete these trainings in the first three years (7). The high level of self-confidence in ambulance driving and compliance with speed limits and traffic rules may be related to the module training taken by the personnel. In Turkey, highway traffic law gives certain rights and priorities to emergency vehicles such as ambulances and firefighters, but these vehicles are not allowed to travel at a higher speed or violate traffic rules (8). Traffic accidents with ambulances are one of the most serious occupational health risks faced by emergency medical personnel (5,6). It was found that 55.2% of the drivers included in the study had a traffic accident. Türkdemir and Aysun (9) investigated ambulance accidents in Turkey between 1960 and 2002, and found that 614 ambulance accidents occurred, 477 of which involved only material damage, three people died and 367 people were injured in the accidents involving ambulances. In another study, Ekşi et al. (10) stated that ambulance accidents increased by 42.5% in Turkey over a 5-year period, and found that 69.4% of emergency medical personnel were involved in a traffic accident. According to the New York State Department of Motor Vehicles statistics, two people are injured every day and 400 ambulance accidents happen annually. In addition, it is reported that 75% of these accidents are preventable (11). In a study on ambulance accidents involving death, Kahn et al. (12) showed that 16% of traffic accidents involving death occurred due to violations of traffic rules. In a USA Homeland Security report on the use of ambulances, it was stated that the causes of ambulance accident were related to reasons such as unnecessary acceleration, insufficient driver training, and driver fatigue/burnout due to long working time (13). The data obtained in the present study is generally consistent with other studies.

No statistical relationship was found between being involved in a previous traffic accident and driver behavior. Interestingly, the rate of having a traffic accident was lower in medical personnel working 24-hour shifts. In their study on ambulance accidents, Ekşi et al. (10) showed that there was no significant difference in gender, age, experience and professional title

between ambulance personnel who were involved in traffic accidents and those who were not. Kahn et al. (12) reported that high-risk drivers caused more accidents involving death and previously had traffic accidents. In another study, Patterson et al. (13) found that ambulance personnel working in 24-hour shifts slept poorly and were exposed to injuries 2.3 times more compared to other personnel. In the same study, it was found that personnel working in 24-hour shifts were more fatigued. In a report prepared by Boone et al. (14), it was emphasized that long working hours and overtime should be avoided to prevent sleep disturbances. Hersman and Whitcomb (15) showed that injury, making mistakes, and poor performance were associated with fatigue. Although the present study is generally consistent with other studies, one of the intriguing findings is that previous accidents were less common among personnel working in 24-hour shifts. In Turkey, medical personnel working in 112 EMS works in 24-hour shifts (one full day) and rests for 96 hours (four days). Ambulance operators are happy to work in this way, and they show resistance against change.

27.2% of the participants stated that ambulance driving affects providing emergency care to the patient. Most common reason stated by the participants was that it took time for the driver to deal with the ambulance, and sufficient care could not be provided to the patient. To the best of our knowledge, there are no studies on this subject.

This study was carried out only in İzmir 112 EMS Department; therefore, the results cannot be generalized. In addition, cross-sectional design of the study poses another limitation in explaining the cause and effect relationships.

Conclusion

In this study, which was conducted to determine the driver behavior of emergency medical personnel driving ambulances, it was found that ambulance drivers are self-confident in driving, follow speed limits and traffic rules, and traffic density affects the driver. Furthermore, the rate of having a traffic accident is lower in personnel working 24-hour shifts.

Ethical Considerations

Ethics Committee Approval: This study was approved by Dokuz Eylül University, Non-interventional Research Ethics Committee with date: 06.03.2019, protocol number: 4514-GOA and decision number: 2019/05-37. The study was conducted in accordance with the working principles of the Helsinki Declaration.

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

Peer-review: Externally peer-reviewed.

Author Contributions

Surgical and Medical Practices: S.Y., T.G., A.P., Concept: S.Y., T.G., Design: S.Y., A.P., Data Collection or Processing: S.Y., Analysis or Interpretation: S.Y., T.G., Literature Search: S.Y., T.G., A.P., Writing: S.Y.

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Evaluation of Inferior Vena Cava/Abdominal Aorta Diameter Index in Pulmonary Embolism

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Abstract

Aim: Among cardiovascular diseases, pulmonary embolism (PE) is a serious emergency with high mortality. Right ventricular dysfunction due to an excessive increase in pulmonary artery pressure is considered a major cause of death in vigorous PE. We aimed to assess the predictive value of computed tomographic pulmonary angiography (CTPA)-based morphometric measurements of right heart function in the diagnosis of PE.

Materials and Methods: This is a retrospective, case-controlled study. A total of 198 cases were included in the study during the study phase. CTPA results of 102 patients with PE were recorded, and the patients were grouped according to clot localisation. The diameters of the inferior vena cava (IVCA), aorta, pulmonary artery and right and left ventricles were assessed.

Results: IVCA area/aortic area significantly predicted embolism in the main pulmonary artery [area under the curve (AUC)=0.957, p<0.001]. The optimal cut-off value was 1.22 with 88% sensitivity and 90% specificity. IVCA diameter/aortic diameter significantly predicted embolism in the main pulmonary artery (AUC=0.955, p<0.001). The optimal cut-off value was 1.1 with 89% sensitivity and 88% specificity.

Conclusion: Our study illustrated a remarkable association between the existence and dispersion of PE and morphometric changes in IVCA and aortic ratio parameters measured using CTPA.

Keywords: Pulmonary embolism, inferior vena cava diameter, aortic diameter

Introduction

Pulmonary embolism (PE) is a comparatively widespread emergency among cardiovascular diseases (1). Although PE is a difficult disease to diagnose, rapid diagnosis and appropriate treatment can reduce PE-associated morbidity and mortality (2). Computed tomographic (CT) pulmonary angiography (CTPA) is a diagnostic procedure for suspected cases of PE. CTPA is a method that is non-invasive and has very high sensitivity and specificity (3). Furthermore the presentation of intraluminal clot, CTPA also allows estimation of right ventricular (RV) function in acute PE (4,5).The main cause of death in PE patients is right ventricular dysfunction (RVD) due to excessive increases in pulmonary artery pressure. The sudden rise in lung vascular resistance leads to RV dilation which changes the contractile properties of the RV myocardium via the Frank-Starling mechanism. RV pressures increase and the patient may present with syncope or hemodynamic deterioration which may result in shock and circulatory arrest due to acute RV insufficiency. Right atrial pressure is a simple and objective index of ventricular function. Inferior vena cava (IVC) diameter is one of the methods used to predict the right atrium pressure (6,7). Therefore, the IVC may

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also expand due to increased RV and RA pressures in PE patients. Ordinarily, IVC and descending aortic diameters are similar at the same levels (8). The decrease in left ventricular stroke volume is one of the hemodynamic consequences of PE. The decrease in left ventricular stroke volume will have effects on aortic pressure and size (9,10).

The objectives of this study were to appraise the IVC and aortic dimensions in clinically suspected PE patients, to determine if there is correlation between morphometric measurements of other right ventricular function parameters that can be detected with thoracic CT and to identify the predictive value of these measurements according to clot distribution in PE patients.

Materials and Methods

This retrospective study was conducted in the departments of emergency medicine between 1/1/2016 and 1/9/2017. This study complied with the declaration of Helsinki and was approved by the local ethics committee (İnönü University) (approval no: 2018/2-21, date: 16.01.2018). CTPA studies and patient files of 129 patients diagnosed with PE radiologically in the emergency department within 21 months were reviewed. Previous clinical features and diagnostic imaging data for each patient were abstracted from electronic patient records. A total of 27 out of 129 patients diagnosed with PE were excluded from the study according to exclusion criteria. CTPA examination was not technically sufficient in 10 of these 27 patients. Five had chronic heart failure, six had cor pulmonale, two had chronic pulmonary thromboembolism, one had malignancy and three had ascending aorta dilatation. Thus, a total of 102 patients formed the PE group. A total of 96 patients with age and gender matching who had no PE or additional pathology in CTPA also formed the control group (Figure 1). The patients included in the study were hemodynamically stable and did not require any vasopressor agent to maintain blood pressures above 100 mmHg. The patients included in the study were hemodynamically stable and did not require any vasopressor agent to maintain blood pressure above 100 mmHg.

CT scans were evaluated by two radiologists with at least 10 years of experience in thoracic and vascular imaging. PE in the main, right and left pulmonary arteries was defined as group 1. (n=54). PE in the lobar and interlobar arteries was defined as group 2 (n=18). PE in the segmental and subsegmental branches was defined as group 3 (n=30). A 128-slice CT scanner (Philips Healthcare, Best, the Netherlands) was used and all patient data were examined on a PACS (picture archiving and communication system) in this study. The cross-sectional areas of the IVC and descending aorta were defined at the plane of the esophageal hiatus. The maximum IVC and aortic diameters were measured on the same slice (Figure 2). The widest wall-to-wall diameters of the right ventricle (RV) and left ventricle (LV) obtained from axial images were also measured. The main pulmonary artery (MPA) wall-to-wall diameter was acquired on axial images at the level of its bifurcation. The right pulmonary artery (RPA) and the left pulmonary artery (LPA) diameters were measured at the largest section after the MPA bifurcation.

Inclusion Criteria: patients older than 18 years with acute PE proven by CTPA.

Exclusion Criteria: definitive diagnosis of cor pulmonale, pulmonary hypertension, pregnancy, malignancy, chronic PE, chronic heart failure, acute coronary syndrome, tricuspid or pulmonary valve pathology, aortopathy or aortic dilation.

Statistical Analysis

Statistical analysis performed using the SPSS program, version 22.0. The distribution of the variables were evaluated by Kolmogorov-Smirnov and Shapiro-Wilk tests. We used chi-square and t-tests as appropriate to test for baseline characteristics

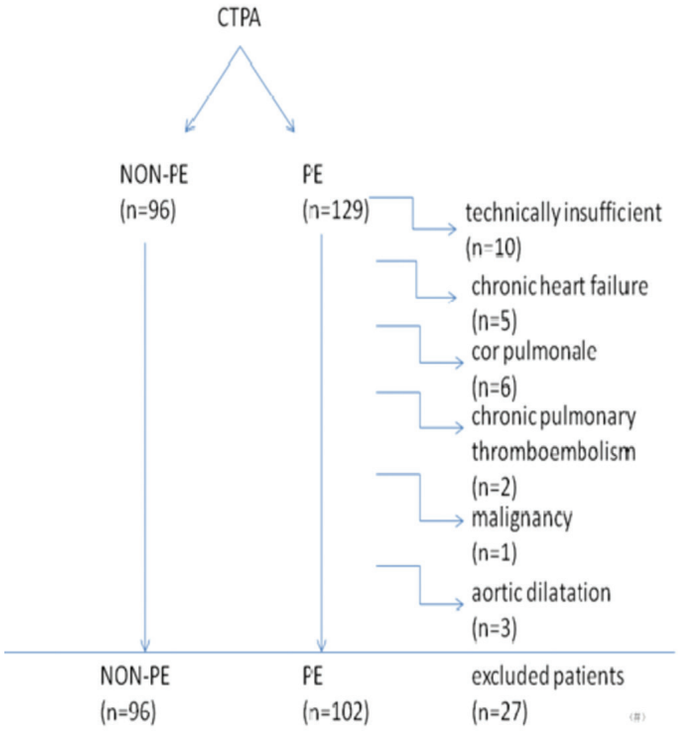

Figure 1. Flowchart shows patient selection

CTPA: Computed tomography pulmonary angiography, PE: Pulmonary Embolism, n: Number

between the control and study groups. One-way ANOVA test was used to compare multiple groups with normally distributed data. The homogeneity of the variances was evaluated by the Levene test and then post hoc Tukey test was applied. Variables not distributed normally were compared using the Kruskal-Wallis test. ROC analysis was applied to determine the extent to which the tests predicted main pulmonary artery embolization.

Results

Of the 198 patients included in the study, 96 were in the control group and did not have a PE. The remaining 102 patients were diagnosed with PE. The mean age was 61.3±16.1 years in the control group and 62.6±17.5 years in the study group (p>0.05). Demographic data of the patients are shown in Table 1. In the

Table 1. Baseline characteristics and CTPA findings of control and study population

	Control	Pulmonary embolism	p
Gender*			
Male	42 (43.8)	48 (47.1)	0.640
Female	54 (56.3)	54 (53)	
Age*	61.3±16.1	62.6±17.5	0.594
Diabetes Mellitus*	15 (15.6)	20 (19.6)	0.463
Hypertension*	43 (44.8)	49 (48)	0.647
Dyslipidemia*	21 (21.9)	27 (26.5)	0.451
Ischemic heart disease*	21 (21.9)	26 (25.5)	0.550
IVCD (mm)	23 (15-29)	24 (17-32)	<0.001
AD (mm)	23 (16-28)	21 (15-29)	<0.001
IVCD/AD	0.96 (0.8-1.15)	1.14 (0.83-1.61)	<0.001
IVCA/AA	0.92 (0.64-1.32)	1.3 (0.68-2.59)	<0.001
MPAD (mm)	26 (16-40)	29.5 (22-53)	<0.001
RPAD (mm)	19 (13-29)	22 (14-36)	<0.001
LPAD (mm)	18 (13-28)	21 (15-36)	<0.001
RVD (mm)	37 (26-52)	43 (26-67)	<0.001
LVD (mm)	45.5 (27-60)	38 (23-58)	<0.001
RVD/LVD	0.85 (0.52-1.41)	1.13 (0.71-2.20)	<0.001

IVCD: Inferior vena cava diameter, AD: Aorta diameter, IVCA: Inferior vena cava area, AA: Aortic area, MPAD: Mean pulmonary artery diameter, RPAD: Right pulmonary artery diameter, LPAD: Left pulmonary artery diameter, RVD: Right ventricle diameter, LVD: Left ventricle diameter, CTPA: Computed tomography pulmonary angiogram ekleyelim

Unless otherwise indicated, data are medians, with interquartile ranges in parentheses

*Data are given as percentages in parentheses with the number of patients

Table 2. CTPA findings according to clot distribution of pulmonary embolism

	Control	Group 1	Group 2	Group 3	p
IVCD (mm)	22.5±3.2	25.3±2.9*	23.3±2.6	22.9±3.2**	<0.001
AD (mm)	23 (16-28)	20 (15-25)*	22.5 (17-25)	23 (19-29)**	<0.001
IVCD/AD	0.96 (0.8-1.15)	1.22 (1.04-1.61)*	1.09 (0.92-1.29)*,**	1.04 (0.83-1.14)**	<0.001
IVCA/AA	0.92 (0.64-1.32)	1.48 (1.09-2.59)*	1.18 (0.84-1.67)*,**	1.08 (0.68-1.31)**	<0.001
MPAD (mm)	26 (16-40)	31 (22-53)*	30 (23-36)	29 (22-43)	<0.001
RPAD (mm)	19 (13-29)	23 (14-32)*	21.5 (15-33)	21.5 (14-36)	<0.001
LPAD (mm)	18 (13-28)	22 (16-27)*	21 (16-26)	20 (15-36)**	<0.001
RVD (mm)	37 (26-52)	45.5 (34-58)*	41 (32-56)	40.5 (26-67)**	<0.001
LVD (mm)	44.7±6.7	36.4±6.4*	39.8±6.7*	41.1±8.4**	<0.001
RVD/LVD	0.85 (0.52-1.41)	1.26 (0.78-2.20)*	1.05 (0.73-1.83)*	0.99 (0.71-1.80)*,**	<0.001

IVCD: Inferior vena cava diameter, AD: Aorta diameter, IVCA: Inferior vena cava area, AA:Aortic area, MPAD: Main pulmonary artery diameter, RPAD: Right pulmonary artery diameter, LPAD: Left pulmonary artery diameter, RVD: Right ventricle diameter, LVD: Left ventricle diameter, CTPA: Computed tomography pulmonary angiogram

*p<0.05 for groups compared with the control group, ** p<0.05 for groups compared with the group 1

study group, 54 patients had embolism in the main pulmonary artery, 18 patients had lobar and interlobar PE and 30 patients had segmental or subsegmental emboli.

The IVC diameter (IVCD)/Aortic diameter (AD) ratio was 1.14 (0.83-1.61) and 0.96 (0.8-1.15) in the study and control groups, respectively. The IVC area (IVCA)/Aortic Area (AA) ratio was 1.3 (0.68-2.59) and 0.92 (0.64-1.32) in the study and control groups, respectively (Table 1). When the IVCD/AD ratio and IVCA/AA ratio were examined according to clot distribution, the highest rates were observed in group 1 [1.04 (0.83-1.14), 1.08 (0.68-1.31) respectively]. IVCD/AD and IVCA/ AA ratios were significantly higher in patients with central PE (p<0.001) (Table 2). IVCD was measured as 24 (17-32) mm and 23 (15-29) mm in the study and control groups, respectively. AD was 21 (15-29) mm and 23 (16-28) mm in the study and control groups, respectively (Table 1).

MPA diameter (MPAD) was 29.5 (22-53) mm and 26 (16-40) mm in the study and control groups, respectively. RPA diameter (RPAD) was found to be 22 (14-36) mm and 19 (13-29) mm in the study and control groups, respectively. LPA diameter (LPAD) was found to be 21 (15-36) mm and 18 (13-28) mm in the study and control groups, respectively (Table 1). When MPAD, RPAD and LPAD were examined according to clot distribution, the highest values were observed in group 1 [31 (22-53), 23 (14-32), 22 (16-27) respectively]. MPAD, RPAD and LPAD were significantly higher in patients with central PE (p<0.001) (Table 2).

RV diameter was found to be 29.5 (22-53) mm and 26 (16-40) mm in the study and control groups, respectively. LV diameter was found to be 38 (23-58) mm and 45.5 (27-60) mm in the study and control groups, respectively (Table 1). When RV diameter measurement values were examined according to clot distribution, the highest values were observed in group 1 [45.5 (34-58)]. When LV diameter measurement values were examined according to clot distribution, the lowest values were observed in group 1 [36.4±6.4]. While RV diameter was found to be significantly higher in patients with central PE, LV diameter was significantly lower (p<0.001, p<0.001 respectively) (Table 2). RV diameter/LV diameter (RV/LV ratio) was found to be 1.14 (0.83-1.61) and 0.96 (0.8-1.15) in the study and control groups, respectively [1.13 (0.71-2.20), 0.85 (0.52-1.41) respectively] (Table 1). RV/LV ratio was significantly higher in patients with central PE (p<0.001) (Table 2).

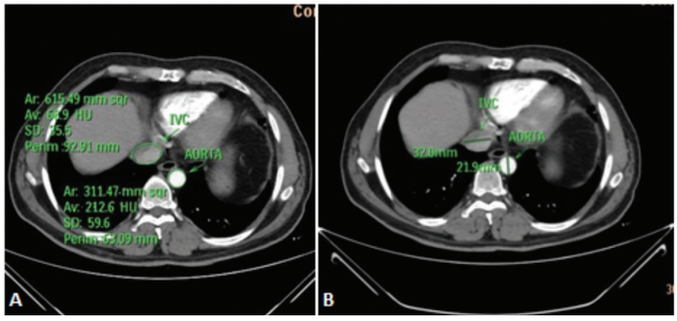

Figure 2. (A): The cross-sectional areas of the suprahepatic IVC and descending aorta were measured on a uniaxial image at the level of the esophageal hiatus. **(B)**: The maximum IVC and aortic diameters were measured on the same slice.

IVC: Inferior vena cava

Roc Analysis

IVCA/AA significantly predicted embolism in the main pulmonary artery (AUC=0.957, p< 0.001). The optimal cut-off value was calculated to be 1.22 with 88% sensitivity and 90% specificity (Figure 3).

IVCD/AD significantly predicted embolism in the main pulmonary artery (AUC=0.955, p< 0.001). The optimal cut-off value was calculated as 1.1 with 89% sensitivity and 88% specificity (Figure 3).

RVD/LVD significantly predicted embolism in the main pulmonary artery (AUC=0.874, p<0.001). The optimal cut-off value was calculated to be 1.1 with 79% sensitivity and 79% specificity (Figure 3).

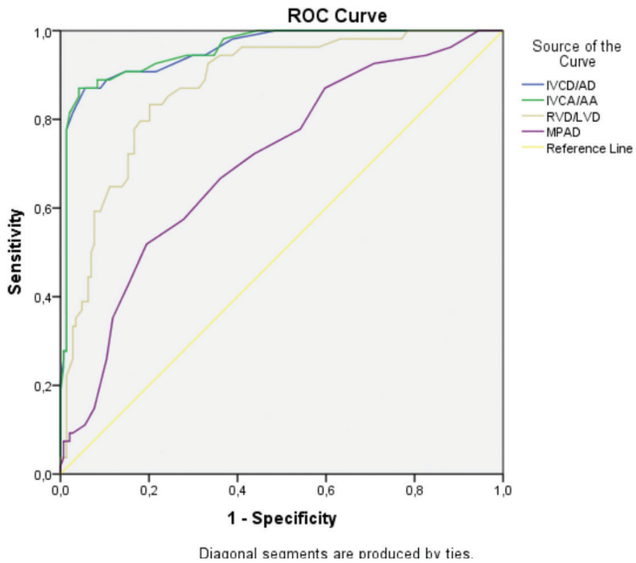

Figure 3. ROC analysis: The predicted value of IVCD/AD, IVCD/AA, RVD/LVD and MPAD in specifying the main pulmonary artery embolism. (IVCD/AD: AUC=0.955, p<0.001, IVCA/AA: AUC=0.957, p<0.001, RVD/LVD: AUC=0.874, p<0.001, MPAD: AUC=0.705, p<0.001)

ROC: Receiver operating characteristic, IVCD/AD: Inferior vena cava diameter/aortic diameter, IVCA/AA: Inferior vena cava diameter/aortic diameter, RVD/LVD: Right ventricle diameter/left ventricle diameter, MPAD: Main pulmonary artery diameter, AUC: Area under curve

MPAD significantly predicted embolism in the main pulmonary artery (AUC=0.705, p<0.001). The optimal cut-off value was calculated as 28.5 with 67% sensitivity and 64% specificity (Figure 3).

Discussion

Acute PE is an important emergency with high morbidity and mortality among cardiovascular diseases despite many medical developments. The clinician should always be alert to the clinically suspected PE because early diagnosis and urgent treatment can reduce PE related morbidity and mortality (11).

In this study, we investigated the relationship between pulmonary artery clot distribution and IVC/aortic ratio parameters in patients with PE. These include the IVC/AD ratio and the ratio of IVC to aortic cross-sectional area (IVCA/AA). In our study, the highest values of these parameters were seen in the main pulmonary artery group. The lobar group was in the second rank and the segmental or subsegmental group was observed to be in the third rank. A statistically significant difference was found when groups 1 and 2 were compared with the control group in terms of IVCA/AA and IVCD/AD ratios. In addition, there was a statistically remarkable discrepancy among groups 2 and 3 and group 1 in terms of IVCA/AA and IVC/AD ratios. These results emphasize that the values of these parameters will increase if the PE is localized more centrally. Among the evaluated parameters, there was a higher sensitivity and specificity in IVCA/AA and IVCD/AD. IVCA/AA ratio cut-off of 1.22 (AUC=0.957) and an IVCD/AD ratio cut-off of 1.1 (AUC=0.955) were calculated for detection of main pulmonary artery embolism. These findings suggest that these parameters have a high correlation with the pulmonary artery occlusion grade.

The main consequences of pulmonary thromboembolism are hemodynamic (10). Left ventricular stroke volume is reduced as a result of the shift of the interventricular septum to the left, impaired left ventricular filling pressures and the diastolic left ventricular dysfunction. Sympathetic activation and systemic vasoconstriction develop as a compensatory mechanism (10,12). Possibly all these events may lead to a modest decrease in aortic size. In fact, a decrease in the aortic diameter was observed in the first group. Once the clot flows to the pulmonary artery, RV and RA pressures increase; this is transmitted to the IVC and results in IVC dilatation (9,13). In this research, a statistically prominent change was detected in the first group compared to the control group in terms of aorta diameter (AD) and inferior vena cava diameter (IVCD). Breathing maneuvers are important in IVC measurements. Normally, in the inspiratory phase of the respiratory cycle, venous return increases towards the right heart due to negative intrapleural pressure. This leads to an increase in IVC diameter. An expanded IVC with a lack of collapse by >50% in the inspiratory phase suggests elevated RA pressure. The thoracic CT is performed at the end of the inspiratory phase and therefore better represents the measurements (6,14).

PE increases pulmonary vascular resistance and may lead to RVD. International ECHO multicenter studies have shown that in PE patients, RVD is a major determinant of short-term mortality (15,16). Follow-up of right ventricular functions plays an important role in the treatment of PE. ESC recommends transthoracic echocardiogram (TTE) in hemodynamically unstable patients for the diagnosis of PE (17). In addition, TTE can be used in risk classification for evaluation of right ventricular functions in the differentiation of submassive and low-risk PE in hemodynamically stable patients (17,18). Previous studies have also demonstrated the ability of PCTA findings to identify RVD in PE (19,20). The RVD/LVD ratio is one of the markers of RVD measured by CTPA (21,22). In our study, we found the sensitivity and specificity of the IVC/aortic ratio parameters in detecting the main PE were higher than the sensitivity and specificity of the RVD/LVD ratio. Additionally, we demonstrated that the IVCD/AD and IVCA/AA ratio increased when PE was located more centrally. The central localization of the clot in the pulmonary artery is directly proportional to the load on the right ventricle (10,21). Therefore, an increase in IVCD/AD and IVCA/AA ratio may be indicative of RVD. In this context, we believe that these parameters are useful and easily accessible markers that can be detected by CTPA in determining RVD in patients with PE.

Earlier studies have suggested that an RVD/LVD ratio >1.0 was an independent risk factor for RVD (22,23). It can be considered as a reliable indicator in the evaluation of 30-day mortality in patients with acute PE (24). In our study, an RVD/LVD ratio cut-off of 1.1 was calculated for the diagnosis of main pulmonary artery embolism. We found the highest values of RVD/LVD ratio in group 1. There was no remarkable statistical difference among groups 1 and 2 from the standpoint of RVD/LVD ratio, but there was a statistically remarkable difference among group 1 and group 3. Furthermore, there was a statistically remarkable difference in both group 1 and group 2 compared to the control group in terms of RVD/LVD ratios. This obtained data propose that an increase in RVD/LVD ratio can be expected in more centrally located PE cases.

MPAD was higher in group 1 patients. When MPAD, RPAD and LPAD were analysed according to clot distribution in PE patients, significant statistical change was detected between group 1 and the control group. In a previous study, the MPAD threshold value for patients with cardiopulmonary disease was calculated to be 28.6 mm with a mean pulmonary artery pressure of >18 mm Hg (25). In another study, the MPAD threshold value for patients with

parenchymal lung disease was calculated to be >29.0 mm with a sensitivity of 84% and a specificity of 89% in predicting a mean pulmonary artery pressure of >20 mm Hg (26). In our study, the MPAD cut-off of 28.5 mm was calculated for the diagnosis of main pulmonary artery embolism. The MPAD significantly predicted embolism in the main pulmonary artery.

Study Limitations

Our study had some limitations. First of all, our study was retrospectively reviewed. Data on follow-up and outcome of patients could not be included in the study. In our study, a consistent gold standard method of RVD was not determined. Thus, similar to previous studies, we assumed that patients with central embolism had a higher incidence of RVD than patients with peripheral embolism and those without PE (2). In the literature, there are many studies indicating the importance of echocardiography in the evaluation of right ventricular functions and mortality risk classification in PE patients (27,28). In our study, echocardiographic data could not be used to evaluate right ventricular functions. However, future studies should compare echocardiographic data with IVC/aortic ratio parameters in PE patients.

Conclusion

The results of the study imply that the IVC/aortic ratio parameters predict more centrally located PEs that will cause right heart tension. We believe that IVC/aortic ratio parameters reflecting hemodynamic changes in response to the severity of pulmonary artery occlusion in PE patients may contribute to a more comprehensive risk classification in these patients. Prognostic values of these parameters should be determined prospectively in future studies. Furthermore, the measurement of the MPAD and RVD/LVD ratio using CTPA is a valuable adjunct for the prediction of RVD and the evaluation of the severity of acute PE.

Ethics

Ethics Committee Approval: This study complied with the declaration of Helsinki and was approved by the local ethics committee (İnönü University) (approval no: 2018/2-21, date: 16.01.2018).

Informed Consent: Retrospective study.

Peer-review: Internally and externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: E.G., A.S., G.Y., Concept: E.G., Design: E.G., İ.Ç., Data Collection or Processing: E.G., B.D., İ.Ç., G.Y., Analysis or Interpretation: E.G., B.D., A.S., İ.Ç., G.Y., H.K., L.A., Ş.T.S., Literature Search: E.G., B.D., A.S., İ.Ç., H.K., L.A., Ş.T.S., Writing: E.G.

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

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Retrospective Analyses of Frequent Emergency Department Users

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Abstract

Aim: Emergency department (ED) demand and overcrowding is increasing worldwide, and a significant portion of this overcrowding is caused by "frequent users". The aim of the study is to define the characteristics of this group of patients who contribute towards a disproportionate number of ED visits.

Materials and Methods: All ED visits during a 1-year period between 01 January 2018 and 31 December 2018 were retrospectively investigated using the electronic registration system of the hospital. Patients who visited the ED ≥4 times in this period were considered as "frequent users". Social history, disease and care-related factors of frequent users were investigated.

Results: A total of 335,457 ED visits made in a calendar year (2018) were investigated. Frequents users comprised 6.8% of all ED patient population and 22.9% of all ED visits. Female gender proportion was greater among frequent users, and frequent users were younger than occasional users. Yellow/red triage code ratio was higher and the median length of hospital stay was significantly longer in the frequent users group. The proportion of uninsured patients was two times higher in the frequent users group, and half of these patients were immigrants or refugees.

Conclusion: Frequent users place a significant burden on the increasing patient volume in EDs. Welfare status was an important indicator for being a frequent user. However, frequent users are a very heterogeneous patient group and more research is needed to better understand the factors leading to frequent ED use and to develop effective strategies to meet patients' complex health care needs.

Keywords: Frequent users, occasional users, emergency department

Introduction

Increased emergency department (ED) demand and overcrowding of ED's is a global healthcare system problem (1,2). Data demonstrated that ED use grew by 36% in a decade in the United States (3). For Turkey, the situation is more dramatic that the annual number of ED visits is greater than the whole population (4). A significant portion of this overcrowding was created by "frequent users", a group of patients who contribute toward a disproportionate number of ED visits (5). Recognition of this group of patients is very important in terms of health policies and emergency literature, because frequent users make up nearly one fourth of all ED visits and so use a large number of medical resources (6).

Definition of frequent users varies in different studies; however four or more ED visits annually is accepted as an effective cut-off value to identify this group of patients (6,7). Those are a very heterogeneous group with medical insurance, multiple chronic diseases, chemical dependence, and mental health issues (8). While representing 4-8% of ED patients, frequent users, account for 21-28% of all ED visits (9). Studies also demonstrated that approximately 20-40% of frequent users in one year remain frequent users in the following year (9). Those numbers prove us frequent users are what a huge burden for emergency departments.

For the perception of health professionals, frequent users most of the time present with non-urgent and undue complaints, so their care is considered to be a waste of time and an inappropriate use of ED resources (10). At the policymaker's point of view frequent users are causing a significant health burden and reducing the number of them as a means of decreasing healthcare costs (11). On the other hand, some studies demonstrated that frequent

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users have poorer health compared to occasional users with the high prevalence of chronic diseases that lead to increased ED use, and high rates of hospitalization and mortality (10). Therefore, defining the characteristics of this group is a necessity to allow clearly directed policy design for decreasing ED burden caused by the frequent use and also meet the true medical needs of the frequent users. So, the aim of this study is to define the characteristics of frequent users in order to provide efficient and cost-effective suggestions for solving this healthcare system problem.

Materials and Methods

This study was conducted in University of Health Sciences Turkey, Keçiören Training and Research Hospital training and research hospital in capital with around 335000 annual number of ED visits after approval of the local ethics committee. All ED visits during 1-year period between 01.01.2018 and 31.12.2018 were investigated retrospectively by using electronic registration system of the hospital. Patients attended to ED ≥4 times between these periods were accepted as "frequent user" and included into the study. Number four is determined according to previous studies (6). As a subgroup, patient attended ≥12 times in a year were called as "super users". Because the emergency department admittance numbers are very high in our country, we added a new definition to describe the patient attended ≥24 times in a year and called them as "hyper users". Patient with less than 4 attendance in a year defined as "non-frequent users" and patient admitted to ED for wound dressing and prescript drug injection were excluded.

Social-history related factors (age, gender, and ethnicity), disease related factors (diagnosis, severity of illness as triage code, average length of stay at ED) and care related factors (insurance status, cost) were investigated. Diagnostic codes of patient were categorized in ten groups according to systems as: nonspecific/pain related complaints (nonspecific pain, fatigue, and myalgia), respiratory complaints (upper respiratory tract infections, lower respiratory tract infections, asthma, chronic obstructive pulmonary disease), gastrointestinal complaints (abdominal pain, gastroenteritis, nausea, vomiting etc.), psychiatric complaints (suicide, anxiety), neurological complaints (headache, vertigo, stroke, epilepsy etc.), cardiac complaints (chest pain, heart failure, palpitation etc.), trauma (stab wounds, burn, bone fractures, soft tissue injuries etc.), obstetric and gynecologic complaints, urinary complaints [(renal colic, urinary tract infections, renal failure) and others.

Statistical Analysis

The statistical analysis was performed using the IBM SPSS Statistics for Windows Version 22.0 (IBM Corp. Armonk, NY: USA. Released 2013). After assessing normal distribution using the Kolmogorov-Smirnov test, all variables were described in terms of median and interquartile range (IQR) (25-75%) and categorical variables defined as number and frequencies. Mann-Whitney U test and chi-square test were used to determine the difference between the groups. A p value <0.05 was considered statistically significant.

Results

A total of 335457 ED visits were made in a calendar year of 2018 and when the visits for wound dressing and injection were removed the real ED admittance number was 282586 from a total of 172120 different patient. Total visit number of frequent users was 64651 and total number was 11667 patients (visit ED ≥4 times in a year). That means 6.8% of ED patient population makes the 22.9% of all ED visits.

Subgroups of frequent users were analysed and 385 of those frequent users were super user (visit ED ≥12 times in a year) and 45 of those super users were hyper user (visit ED ≥24 times in a year). Highest visit number of one patient was 169 in the flow chart (Figure 1).

Among those, 64651 admittance, 40930 (63.3%) were female and median age of frequent users was 35 (IQR 26-49). Those variables were significantly different from the non-frequent visit group. Female admittance was higher and median age was younger at the frequent visit group (p<0.001 for both situations). Ninety-eight percent (n=63241) of the frequent visits were done by Turkish citizens and only 1410 visits were done by foreigners most of whom were from Iraq (n=1196) (Table 1).

Triage codes of frequent visit were investigated; 78.6% had green triage code and there were only 19 visits with red triage code.

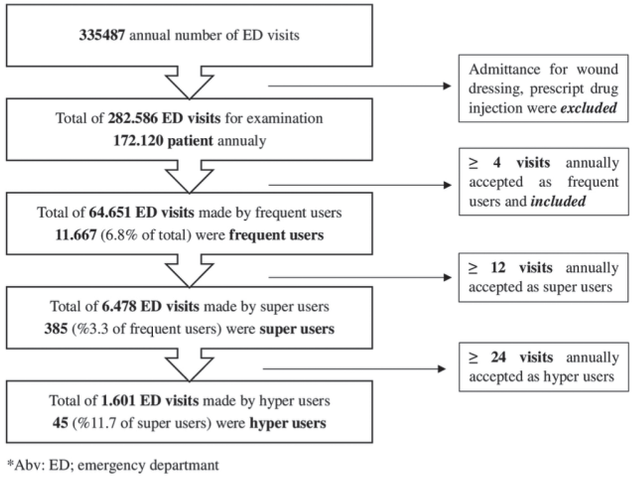

Figure 1. Flow chart

Green zone admittance was lower than non-frequent users group in frequent users group (p<0.001). Nonspecific pain related complaints, respiratory complaints and gastrointestinal complaints were most common diagnosis in both groups (Table 2). Median length of stay at ED was 4 hour (h) 32 minute (m) (IQR: 2h 10m - 8h 2m) at frequent visits group and that was significantly longer than the non-frequent visit group (p=0.014).

Insurance status of frequent visits were investigated and among 64651 admittance, 11333 (17.6%) of them were uninsured. In the uninsured group 5739 had green card, 5594 were immigrants and refugees. Uninsured patient number was significantly higher at frequent visits group (p<0.001) Total cost (cost of consumables, drug cost, protocol cost) of the frequent admittances to the hospital according to registered data of the hospital was 2,633,985 Turkish Liras (TL). Average cost of one patient was 23.17 (IQR: 19.57-47.14) TL and it was significantly lower than non-frequent visit group (p=0.006). All results were summarised at Table 1.

Table 1. Characteristics of frequent admittance

Characteristics	Frequent visits (n=64651)	Non-frequent visits (n=217935)	p
Gender			
Male	23721 (36.7%)	94335 (43.3%)	**<0.001**
Female	40930 (63.3%)	123600 (56.7%)	
Age	35 (IQR: 26-49)	38 (IQR: 28-53)	**<0.001**
Ethnicity			
Turkish citizens	63241 (97.8%)	212768 (97.6%)	**0.006**
Foreigners	1410 (2.2%)	5158 (2.4%)	
Triage codes			
Green code	50796 (78.6%)	174425 (80%)	**<0.001**
Yellow/red code	13855 (21.4%)	43505 (20%)	
Length of stay at ED	4h 32m (IQR: 2h 10m - 8h 2m)	4h 29m (IQR: 2h 9m - 7h 56m)	**0.014**
Insurance status			
Insured	53318 (82.5%)	200972 (92.2%)	**<0.001**
Uninsured			
Green card	5739 (8.9%)	16720 (7.7%)	
Immigrants/refugees	5594 (8.7%)	243 (0.1%)	
Total cost	2,633,985	12,272,567	**0.006**
Average cost of one patient	23.17 (IQR: 19.57-47.14)	23.18 (IQR: 19.57-50)	

IQR: Inter-quartile range, ED: Emergency department, h: hour, m: minute, ₹: Turkish liras

Variables given as number and frequencies or median and IQR

Discussion

This study demonstrated that likewise with the rest of the world, frequent users make a large portion within the ED patient volume and they create a huge burden in terms of healthcare costs also in Turkey. Frequent user representing 6.8% of ED patients, and account for 22.9% of all ED visits according to this study. This data was similar with the literature (7-9). Yellow/red triage code ratio was higher in frequent user group and also median length of hospital stay was significantly longer. Another important issue was insurance status that uninsured patient was two times higher at the study group and half of this patient was immigrant or refugees.

Demand for emergency care was increasing all over the world and as hospital EDs have experienced a dramatic increase in patient volume, interest has focused on the groups of individuals who contribute a disproportionate number of visits (1,4,8, and 9). This study demonstrated that number of frequent users at ED was increased more than three times in the last 5 years when compared the study of Solakoglu et al. (4). Therefore, in order to avoid overcrowding at EDs it is necessary to recognize the frequent users, who have an important share in the consumption of health resources.

There were lots of studies about characteristics of frequent users, however this was a very heterogeneous group and the results of the studies were inconsistent. About gender and health issues, patients in the geriatric age group were considered more likely to be frequent users because of their increased risk of comorbidities

Table 2. Categorized diagnostic codes of patients according to systematic complaints

Complaints	Frequent visits (n=64651)	Control group (n=217935)	p
Nonspecific/pain related complaints	16550 (25.6%)	52373 (24%)	**<0.001**
Respiratory complaints	14800 (22.9%)	50867 (23.4%)	
Gastrointestinal complaints	12064 (18.7%)	40856 (18.7%)	
Neurological complaints	5066 (7.8%)	14857 (6.8%)	
Psychiatric complaints	296 (0.5%)	1000 (0.5%)	
Cardiac complaints	2264 (3.5%)	7829 (3.6%)	
Trauma	4737 (7.3%)	23050 (10.6%)	
Obstetric gynaecologic complaints	1783 (2.8%)	3529 (1.6%)	
Urinary complaints	3152 (4.9%)	8506 (3.9%)	
Others	3939 (6.1%)	15068 (6.9%)	

n: number

(5,6). On the other hand, some studies stated the frequent users were significantly younger than the non-frequent users (12). In general, it can be mentioned that age and gender were not significant predictors of frequent ED use (12). Nevertheless, our study showed that ratio of female was higher at frequent users group, and frequent users were younger than the non-frequent users.

There is a concern that frequent users ED use might be inappropriate and they were more likely to present with primary care complaints (1). This might be due to the misunderstanding of the medical necessity. According to a study 61% of patients stated that feeling like their health problem was emergent as to visit ED that day (6); however studies demonstrated there was a difference between frequent users' perceptions of their medical complaint and actual triaged severity; the majority of the frequent users presented to the ED with complaints that would not be considered a medical emergency (3). On the other hand, there were also studies reporting frequent ED users tend to be sicker than occasional users and experience higher mortality, hospital admissions and outpatient visits (11,13). About medical issues it was demonstrated that frequent users were more likely to have chronic diseases, mental illnesses or substance abuse (12). Our study showed the most common complaints of frequent users were pain related, respiratory or gastrointestinal; but unfortunately, this was a retrospective study and the accuracy of the registered diagnostic codes were questionable. On the other hand, frequent users' attendance with yellow triage code was higher and median length of stay was longer than occasional users. These results might be interpreted as the frequent users have higher acuity complaints.

Anyone can make free use of the emergency services in Turkey, therefore the group mentioned in the study as uninsured was in fact dependent on government welfare. This situation was considered as a risk of frequent ED use in some studies (1,14). Similarly, depending on government welfare, immigrant and refugees may use ED free of charge. There were also other reasons that lead immigrants to ED such as language barriers and lack of accessing to primary care providers (15-17). Those reasons explain the high proportion of immigrant and refugees (8.7%) in frequent users in our study.

A number of interventions aimed at reducing the number of ED visits by frequent users have been evaluated in the literature; some of them were case management, individualized care plan and information sharing (18). Case management, which is a comprehensive, interdisciplinary approach taken to assess, plan, personalize, and guide an individual's health services to promote improved patient and health system outcomes, seems effective to reduce ED usage of frequent users and improve both clinical and social outcomes among them (19-21). Individualised care plans were similar to case management but less comprehensive that, they employ interdisciplinary strategies and coordinated access to primary care resources (18). Although lack of access to primary care resources seems to be a risk for being frequent ED user, some studies demonstrated that frequent use of the ED might not be related to lack of a listed primary care provider, and that even frequent ED users were also frequent primary care visitors (22,23). Despite comparable primary care access, frequent users were most likely to report unmet primary care needs and further research was necessary to understand and meet the needs of these individuals (23). Lastly, the term "information sharing" was used to describe approaches related to the sharing of patient information amongst health care providers; however, it did not make any sense to decrease the frequent visits (18).

Study Limitations

The main limitation of this study was being single-centred and the information about frequent visits to other emergency departments could not be obtained, so the actual number of frequent users might be greater than the calculated one. Second, this was a retrospective study and we had no information about the clinical presentations during the ED visits. Data based on the electronic registration system so accuracy of the diagnostic codes were questionable. This made it impossible for us to find out whether chronic diseases affect frequent ED use. Third, some socio-economic data were not available, and such data could be vital for describing the characteristics of ED users.

Conclusion

The use of emergency services is increasing, and frequent users place a significant burden on this patient volume. It is important to understand the characteristics of this patient group in order to provide efficient suggestions for solving this healthcare problem. In our study, female gender proportion was greater among frequent ED users and frequent users were younger than occasional users. There was also significant difference about welfare status that immigrant and refugees population in frequent users was eighty times higher than the occasional users. However frequent users are a very heterogeneous group and it is impossible to define all the characteristics of them in one study. Therefore, more research is needed in order to better understand factors leading to frequent ED use and to develop effective strategies to better meet their complex health care needs.

Ethics

Ethics Committee Approval: This study was approved by University of Health Sciences Turkey, Keçiören Training and Research Hospital Chief Surgeon Office, Clinical Research Ethics Committee (decision no: 2012-KAEK-15/1951, date: 28.08.2019).

Informed Consent: Retrospective study.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Concept: G.Ç.I., T.Ş., Design: G.Ç.I., T.Ş., Data Collection or Processing: G.Ç.I., M.T., Analysis or Interpretation: G.Ç.I., M.T., Literature Search: G.Ç.I., M.T., T.Ş., Y.Ç., Writing: G.Ç.I.

Conflict of Interest: There is no conflict of interest for this paper.

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Health Literacy in The Emergency Department: A Cross-sectional Descriptive Study

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Abstract

Aim: In this study, we aimed to determine the health literacy level of the patients admitted to the emergency department with green triage code and discuss this in the light of current literature.

Materials and Methods: This cross-sectional descriptive-analytical study was performed on 285 subjects attending a tertiary hospital emergency department with green triage codes through convenience sampling method in 2019. Turkey Health Literacy scale-32 was used to collect data.

Results: One hundred two participants aged 18-83 years were included in the study. Health literacy indexes of the participants ranged between 11.67 and 48.44 and the mean value was calculated as 30.9 (poor). The Health Literacy index of 59 (57.9%) participants was considered to be poor.

Conclusion: In our study, health literacy levels of patients who applied to emergency department with green triage code were found to be poor. More attention to health promotion programs and health education is needed.

Keywords: Emergency department, health literacy, health knowledge, patient education

Introduction

Health literacy, evaluates the skills of reading of health information and tables, using instruments related to personal and family health, calculation of drug timing and dosage, participating in research studies, and commenting on health and environmental policies. Health literacy levels vary according to language, culture, cultural and social environment, education system and education level and the relationship of the society in which they live with health (1).

Health literacy is an important concept for health promotion, disease prevention and early recognition and policy development in this area. Low health literacy level is associated with less access to preventive health services and the use of emergency services for health care (2). Low health literacy results in non-use of preventive health services, inability to understand one's health and to follow health instructions. However, increasing health costs are inevitable (3).

Emergency services are an entry point for access to the health system of patients with acute illnesses and in need of emergency medical treatment (4). Attempting to eliminate the health problems that can be treated in primary health care institutions in the emergency department is an additional burden on emergency services (4,5). Although it is not the only reason for non-emergency patients to use the emergency service, socioeconomic reasons are also effective (4,5).

In this study, we aimed to determine the health literacy level of the patients admitted to the emergency department with green triage code and discuss this in the light of current literature. Our secondary aim was to reveal the relationship between health literacy and demographic data of patients who applied to emergency department with green triage code.

Materials and Methods

The ethical committee approval of our study was obtained from

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the Ethical Committee of Clinic Researches of İstanbul Ümraniye Training and Research Hospital (approval number: 2018/153).

Study Population and Data Collection

In this study, health literacy levels of patients who were admitted to a tertiary hospital emergency department with green triage codes and agree to participate in the study were evaluated. Those who agreed to participate in the study and who had a green triage code were included in the study. Workers in health-related professions were excluded from the study.

To ensure random sampling, each twentieth patients following the first randomly selected patient were offered to participate in a study. Sampling was performed every day of the week and every hour of the day in order to increase the representation of the working group.

The patients were given preliminary information about the study and offered to participate in the study. Those who agreed to participate in the study were given an informed consent form and were asked to sign it. The interview with the research participants was conducted by an educated research assistant who read the questionnaire questions and answer options in the emergency room waiting room.

Health literacy levels and demographic characteristics of the participants such as age, gender, marital status, occupation, income and educational status were evaluated. Participants were grouped according to their educational status as primary and non-educated, secondary, high school, university and above; according to their professions as housewives, students, retirees, artisans, workers, freelancers, farmers and others; according to their financial status as income less than expense, income equivalent and income more than expense.

Participants' health literacy levels were determined using the Turkey Health Literacy scale-32. Health related professionals were not included in the study. In the evaluation of the scale; The indexes are standardized to be between 0 and 50 as in the HLS-EU study (1). For this purpose [index=(mean-1) x (50/3)] formula is used.

Statistical Analysis

Categorical data were expressed as number and percentage, and numerical data were expressed as median, minimum and maximum. Shapiro-Wilk test was used to evaluate the distribution pattern of numerical data. SPSS 21.0 (IBM Corp., Armonk, NY, USA) software was used for statistical analysis. Mann-Whitney U test was used to compare age and literacy index with gender and marital status, and Kruskal-Wallis test was used to compare education level, occupational group and income status. In Kruskal-Wallis test, the results of the paired comparison analyzes were evaluated in order to determine which groups were statistically significant. Spearman correlation was used to compare age and Health Literacy index.

Results

One hundred twenty-nine patients agreed to participate in the study. Twenty-seven participants were excluded from the study because of working in health-related occupations. One hundred two participants were included in the study. The ages of the participants ranged from 18 to 83 years with a median of 36 years. Descriptive statistical data regarding the categorical data of the subjects included in the study are summarized in Table 1.

Health literacy indexes of the participants ranged between 11.67 and 48.44 and the mean value was calculated as 30.9 (poor). The Health Literacy index of 59 (57.9%) participants was poor (below 33).

Table 1. The categorical data of the subjects included in the study

n=102	n	%
Gender		
Male	47	46.1
Female	55	53.9
Marital status		
Married	54	52.9
Single	48	47.1
Educational status		
Primary and non-educated	27	26.5
Secondary school	18	17.6
High school	40	39.2
University and above	4	16.7
Professions		
Housewives	24	23.5
Students	20	19.6
Retirees	5	4.9
Artisans	22	21.6
Workers	7	6.9
Freelancers	6	5.9
Farmers	6	5.9
Others	12	11.8
Financial status		
Income less than expense	22	21.6
Income equivalent	63	61.8
Income more than expense	17	16.7

n: Number

Data on the comparison of Health Literacy index and categorical data are shown in Table 2.

There was a statistically significant, negative and weak correlation between Health Literacy index and age. (Spearman correlation test, r=-0.254, p=0.01). The scatter graph of the correlation analysis is shown in graph 1.

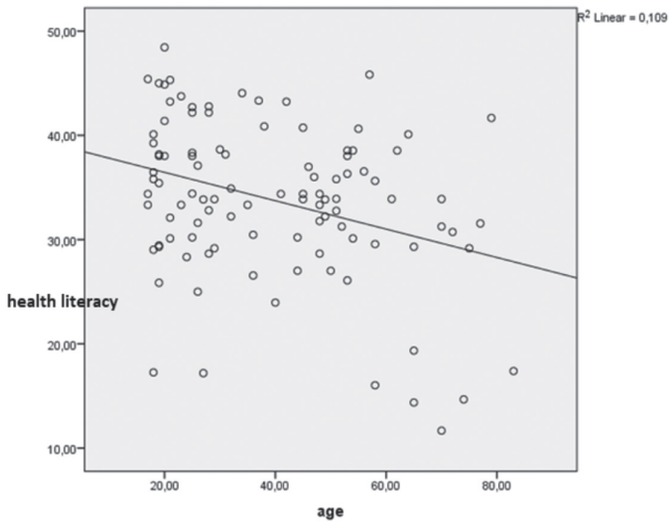
When the relationship between Health Literacy index and education levels was investigated, a statistically significant difference was found between the secondary and high school graduates in the paired comparison (p=0.017). The difference between the other groups was not statistically significant. Adjusted p values were 0.178 between secondary school and university, but it was 1 in all other binary comparisons.

Discussion

The concept of health literacy includes some skills necessary for the maintenance of health. In addition to the ability to find, understand, and interpret health-related information, it includes skills such as measuring blood glucose and using drugs regularly (6). About 80 million adults in the US have poor health literacy.

Table 2. The comparison of health literacy index and categorical data

n=102	Median (minimum-maximum)	p
Gender		
Male	30.87 (14.37-45.83)	0.92*
Female	31.38 (14.37-45.83)	
Marital status		
Married	30.59 (11.67-45.83)	0.133*
Single	33.13 (14.67-48.44)	
Educational status		
Primary and non-educated	30.33 (11.67-44.87)	0.031**
Secondary school	27.88 (14.37-36.54)	
High school	33.13 (17.26-48.44)	
University and above	35.02 (28.33-38.17)	
Professions		
Housewives	30.61 (11.67-44.87)	0.037**
Students	29.22 (17.19-42.19)	
Retirees	23.09 (14.37-40.1)	
Artisans	34.24 (17.26-48.44)	
Workers	35.54 (29.17-45.83)	
Freelancers	33.17 (30.21-43.23)	
Farmers	29.29 (31.25-40.86)	
Others	34.64 (28.33-43.23)	
Financial status		
Income less than expense	30.89 (17.39-45.4)	0.898**
Income equivalent	31.38 (11.67-48.44)	
Income more than expense	30.89 (19.35-45)	



Graph 1. The scatter graph obtained from the analysis of the correlation between the Literacy index and age distribution

Low health literacy is a global problem. Health policy regulators develop policies to identify and address this problem. For this reason, in the United States, Health Literacy: A Prescription to End Confusion were presented by The Institute of Medicine in 2004; The 2010 reports of the National Action Plan to Improve Health Literacy were presented by the Department of Health and Human Services in 2010 (7,8).

Turkey Health Literacy Survey was conducted by Sağlık ve Sosyal Hizmet Çalışanları Sendikası in 2014. In this study, has revealed that one third of the adult population of Turkey in poor or problematic health literacy category (9). In our study, this rate was found as 57.9%. We think that this rate caused by the fact that the health literacy levels of the patients admitted to the emergency department green area of our study population were lower than the normal population (10). In their study, Schumacher et al. (11) showed that it was related to health literacy in the emergency department and inability to access primary health care services.

Turkey Reliability and Validity of the Health Literacy scale was made by the Ministry of Health in order to develop a scale for Turkish society and to reveal the validity of health literacy scales in 2016. In our study, Turkey Health Literacy Scale-32 was used, the results of this research, which set forth the validity of the Turkish society.

Effective health care is associated with proper understanding of health information, regular health checks, and appropriate treatment (11,12). In their study, Derose et al. (13) found that

women with inadequate health literacy were less satisfied than emergency doctors than women with higher health literacy skills. There is a strong relationship between patient satisfaction and compliance in physicians. Therefore, we think that if the level of health literacy increases, patient satisfaction and patient compliance with medical advice will increase.

Study Limitations

In our study, we could not determine whether the severity of the disease changed according to the level of health literacy because the patients with the yellow and red triage who needed intervention due to health problems (e.g. hemodynamic instability, respiratory failure) or with high risk status evaluated by the nurse(changing mental state, severe pain or distress), were not included. Secondly, our study is a single-center study. Multicenter studies are needed.

Conclusion

As a conclusion; In our study, health literacy levels of patients who applied to emergency department with green triage code were found to be poor. This indicates the need for more attention to health promotion programs and health education.

Ethics

Ethics Committee Approval: The ethical committee approval of our study was obtained from the Ethical Committee of Clinic Researches of İstanbul Ümraniye Training and Research Hospital (approval number: 2018/153).

Informed Consent: Informed consent was obtained.

Peer-review: Internally and externally peer-reviewed.

Authorship Contributions

Concept: S.Ö., H.Ş.A., Design: S.Ö., H.Ş.A., Data Collection or Processing: S.Ö., H.Ş.A, A.A., K.K., Analysis or Interpretation: S.Ö., H.Ş.A, A.A., K.K., Literature Search: S.Ö., A.A., K.K., Writing: S.Ö., A.A.

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Evaluation of the Relationship Between C-reactive Protein, Lactate, Procalcitonin and Albumin Levels and Procalcitonin/Albumin Ratio with SOFA and APACHE-II Scores in Emergency ICU Patients

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Abstract

Aim: This study aimed to investigate the efficacy of C-reactive protein (CRP), lactate, procalcitonin and albumin levels and procalcitonin/albumin ratio used as indicators of infection on mortality in critical patients admitted to the intensive care unit and their relationships with APACHE-II and SOFA scores.

Materials and Methods: This study was conducted using patients' hospital records and patient file scans. Demographic characteristics; procalcitonin, CRP, albumin and lactate levels and APACHE-II and SOFA scores were recorded. Spearman's rank correlation was used to assess non-parametric data. ROC curve analysis was performed to determine the threshold values of blood parameters. Results: A total of 61 patients were enrolled in the present study [35 males (57.4%) and 26 females (42.6%); average age, 69.0 years]. A positive, weakly significant association was detected between APACHE-II score and procalcitonin levels. When the APACHE-II score and lactate level and procalcitonin/albumin ratio were evaluated,

Results: APACHE-II score was positively significant and weakly correlated with lactate and the procalcitonin/albumin ratio. A moderate negative correlation was found between albumin level and the APACHE-II score. The SOFA score was positively associated with both procalcitonin and lactate levels. SOFA score was positively significant and weakly correlated with the procalcitonin/albumin ratio.

Conclusion: Procalcitonin, lactate and albumin levels and the procalcitonin/albumin ratio can be considered prognostic markers according to the cut-off points in terms of mortality in critically ill patients. In addition, these blood parameters were found to be useful in clinical follow-up as they are related to the APACHE-II and SOFA scoring systems used in intensive care units.

Keywords: Critical patient, SOFA, APACHE-II, procalcitonin, procalcitonin/albumin ratio, lactate, CRP

Introduction

Critical patient is a term expressing the patients with higher rates of morbidity and mortality rates who need developed monitoring and treatment due to one or multiple organ or system failure (1,2). Monitoring of critical care patients; intensive care units equipped with advanced technology, vital indicators are monitored and patient follow-up and treatment are provided 24 hours a day. In 1999, "Society of Critical Care Medicine" prepared admission, triage and discharge guidelines for intensive care. Intensive care admission decision; priority is divided into three according to diagnostic and objective parameter models (3).

Different scoring systems were developed for early detection and treatment planning of these patients because of higher morbidity and mortality rates. Acute Physiology And Chronic Health Evaluation II (APACHE-II) and the sequential organ failure assessment score (SOFA) are two of the aforesaid scoring systems. APACHE-II and SOFA are complementary scores. APACHE-II score, which was previously evaluated during resuscitation in emergency department, has been shown to be strongly associated with mortality (4). The SOFA score is a scoring system that effectively demonstrates treatment efficacy and course of disease (5).

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In the studies conducted, it was reported that laboratory parameters correlated with scoring systems (6,7). C-reactive protein (CRP), procalcitonin and lactate are laboratory parameters which significantly increase in infection or inflammation. Some proteins called acute phase reactants are synthesized from the liver during infection, trauma, inflammatory events and some malignant diseases. These acute phase reactants prevent progression of the tissue damage, activate repair mechanism and try to isolate or injure the organism which causes infection (8). CRP is one of the acute phase reactants. It exists at very small quantities in serum of the healthy individuals without any change during the day (9). Serum level of the protein starts to elevate after 3 to 6 hours following onset of the inflammation, and it reaches to the highest level after 36 to 60 hours (9). Procalcitonin is a precursor of calcitonin which is secreted by C cells of the thyroid gland (10). Serum level of procalcitonin is very low under normal conditions: calcitonin increases as a response to hypercalcemia whereas procalcitonin is not affected (10). Although calcitonin secretion from some organs such as liver, pancreas and lungs is known, the mechanism is not clarified yet (11). Blood level of lactate which is one of the common indicators for evaluation of liquid and hemodynamic resuscitation is found associated with mortality (12). Albumin is a naturally occurring plasma protein (13). Albumin is a negative acute phase protein. In the presence of any inflammation in the body, albumin decreases with the triggering of cytokines such as TNFoc, interleukin-1 and interleukin-6 (14). A change is detected in the levels of inflammatory indicators in serum such as CRP, lactat, albumin and procalcitonin which are widely used to show the mortality during the inflammatory process induced in critical patients. Roles of CRP, procalcitonin and lactate parameters on patient management may be explained by reflection of the severity of the inflammatory process appeared in critical patients. The purpose of this study was to investigate the efficacy of procalcitonin, CRP, lactate, albumin and procalcitonin/albumin parameters used as an indicator of infection on mortality in critical patients admitted to the Intensive Care Unit and their relationship with APACHE-II, SOFA scores.

Materials and Methods

This study was conducted retrospectively in Intensive Care Unit in Emergency Medicine Clinic of Kanuni Sultan Suleyman Training and Research Hospital of Istanbul Health Sciences University between 28.11.2018-28.03.2019. It was approved by the Ethics Committee of the Institution with the protocol number 2019/07/175. The study was carried out from hospital records of patients and scans of patient files. Patients in the emergency intensive care unit are accepted according to the objective parameter model according to the intensive care guideline (3). The study was performed from the hospital records of the patients and the screening of the patient files.

Procalcitonin, CRP, lactate, albumin blood parameters and APACHE-II and SOFA scores were recorded at admission to the first intensive care unit. A total of 61 patients were included in the study. Age, gender, hospitalisation diagnoses and clinical results of the patients were recorded from the patient files. Gloskow Coma scale of the patients were recorded and divided into five groups. APACHE-II Score, scoring <10 group 1, scoring 11-20 group 2, scoring 21-30 group 3, and scoring >31 group 4 were divided into four groups. SOFA score was divided into three groups. Patients under 18 years of age, patients with cancer of etiology, patients with primary blood cell malignancy such as leukemia and lymphoma, and patients with bone marrow metastasis were excluded from the study.

Statistical Analysis

All variables were tested for normal distribution, Kolmogorov Smirnov test and parametric test criteria. The data obtained from our study were evaluated with SPSS 22.0 program. Spearman's rank correlation was used for non-parametric data. For correlation between scoring and parameters, simple correlation index was used for parameters with weak correlation. Blood parameters of procalcitonin, lactate, crp, albumin and procalcitonin / albumin levels were determined by ROC curve analysis to determine the threshold value in predicting mortality. Significance was evaluated at $p<0.05$.

Scores Used:

APACHE-II score: Developed in 1985 by Knaus et al. (15) APACHE-II, the simplified version of the APACHE scoring system, is the sum of three basic scores: age, chronic health status, and one Glasgow Coma score. The APACHE-II score, which uses the worst values in the first 24 hours, is used to calculate a mortality expectancy by assessing 34 separate hospitalisations. The highest APACHE-II score the patient could receive was 71.

SOFA score: The SOFA score is mainly used to facilitate identification of patients at risk for mortality in sepsis. It is evaluated by giving a score of 1 to 4 out of 6 parameters evaluating respiratory, cardiovascular, central nervous system, renal, coagulation and liver.

Results

Sixty-one patients were enrolled into the present study. The participants included 35 males (57.4%) and 26 females (42.6%) with an age average of 69.0 (min:19 max: 91). Eighty-eight point five percent (n=54) of the patients had additional disease. The most common conditions reported in the patient history were

hypertension by 41% (n=25), Diabetes mellitus by 31.1% (n=19), COPD by 29.5% (n=18) and respectively. The most common diagnoses for admission to intensive care unit were pneumonia by 54.7% (n=28), hypoxic respiratory failure 26.2% (n=16), acute renal failure by 19.7% (n=12) and sepsis by 14.8% (n=9) (Table 1). Mean hospitalisation period in the intensive care unit was 6.7 days. Evaluation of patient outcomes revealed referral to another centre by emergency ambulance by 32.8% (n=20), transfer to the clinic by 14.8% (n=9), discharge with a healthy condition by 27.9% (n=17) and exitus by 24.6% (n=15). When the patients were evaluated according to GCS, the GCS 15 was 42.6% (n=26). The GCS was 26.2% (n=16), which was 13-14, and the GCS 10-12 was 18% (n=11). When evaluated according to APACHE-II score, <10 below 4.9% (n=3), between 11-20 and 42.6% (n=26), scores between 21-30 and 31.1% (n=19), >31 and 21.3% (n=13). When the patients were evaluated according to SOFA score; Those with a score of 0 were 1.6% (n=1), those with a score of 1-4 were 63.9% (n=39), and those with >5 points were 34.4% (n=21). A correlation analysis was performed to detect whether a significant correlation exists between CRP, procalcitonin, albumin, lactate and procalcitonin/albumin among laboratory parameters and APACHE-II and SOFA (Table 2,3). A positive and weakly significant association was detected between APACHE-II and procalcitonin (r=0.254 and p=0.048) (Table 2). When the APACHE-II score and lactate and procalcitonin/albumin ratio were evaluated; APACHE-II was positively significant and had a weak correlation with lactate and procalcitonin/albumin ratio (r=0.316 and p=0.013, r=0.288 and p=0.025) (Table 2,3).

A simple correlation index was used between the groups of APACHE-II and SOFA scores and procalcitonin, lactate, procalcitonin/albumin, which are blood parameters. Procalcitonin averages of the groups according to APACHE-II score groups were 100, 112.5, 137.5 and 157 respectively. Procalcitonin/albumin averages of the groups according to APACHE-II score groups were 100, 119.2, 148.4 and 172.9, respectively. The correlation index of the lactate average of the groups according to APACHE-II score groups was 100, 167, 184.5 and 233 respectively (Figure 1). Procalcitonin averages of the groups according to SOFA score groups were 100, 118.5 and 160.2 respectively. Procalcitonin/albumin averages of the groups according to SOFA score groups were 100, 118.9 and 168.3, respectively. The correlation index of the lactate average of the groups according to SOFA score groups was 100, 129.7 and 178.5 respectively (Figure 2).

A moderate negative correlation was found between albumin and APACHE-II score (r=-0.469 and p=0.000) (Table 2). The SOFA score was positively associated with procalcitonin (r=0.331 and p=0.009) (Table 2). The SOFA score was positively associated lactate (r=0.353 and p=0.005) (Table 3). SOFA was positively significant and weakly correlated with Procalcitonin/albumin ratio (r=0.362 and p=0.004). SOFA was negatively correlated with albumin (r=-0.458 and p=0.000). (Table 2). There was no positive or negative correlation with CRP blood parameter APACHE-II and SOFA score (p=0.452, p=0.640) (Table 3). In our study, we divided into two groups as survivors according to 28-day mortality. Threshold values of blood parameters were determined by roc analysis in terms of mortality. procalcitonin 37.7 ng/mL AUC: 0.616 (0.447- 0.785), Albumin 2.06 g/dL AUC: 0.829 (0.717- 0.941), procalcitonin/albumin 18.5 AUC: 0.645 (0.479- 0.811), Lactate cut of value 1.5 mEq/L AUC: 0.693 (0.525- 0.861), CRP 39 mg/L AUC: 0.648 (0.483-0.812) (Figure 3). procalcitonin, CRP, lactate, procalcitonin/albumin in terms of mortality in the evaluation of the area under the curve >0.5 is considered to be significant.

Discussion

Prolongation of the life period and improved healthcare services caused a trend of increase in critical patients recently. Critical patients who develop one or multiple organ failure have cardiac, respiratory or neurological diseases and need supplementary treatments such as intubation, mechanical ventilation and positive inotropic agents (16). Sensitive and specific scoring systems and laboratory tests are required to guide monitoring of treatment response in critical patients. In this study, blood parameters with acute phase reactants were evaluated in terms of determining mortality, and these parameters were compared in terms of clinical progress and correlation in relation to prognostic scores including APACHE-II and SOFA.

The relationship between low serum albumin levels and severe disease and poor prognosis has been shown for many years in different patient groups with many studies (17). In a study, they reported that the mortality rate was 24% in hospitalized patients with serum albumin concentration lower than 3.4 mg/dL and 62% in patients with lower than 2 mg/dL (18). As a result of our study, albumin has similar results with other studies; SOFA and APACHE-II scores were negatively correlated with moderate level. Albumin value was an important factor in mortality. Some recent studies detected increased lactate concentration with higher mortality in different patient groups (19). Yılmaz et al. (20) conducted a retrospective study on trauma patients and detected a significant association between higher lactate level and mortality.

A previous studies on sepsıs emphasized that the value of lactate was important in terms of mortality (21,22). In the present study, the association between lactate level and SOFA scoring was moderately significant and it was shown as an important factor on mortality. In addition, the lactate cut-off point was found to be 1.5 mEq/L according to Roc analysis and it was found to

Demographic characteristics - independent variables (IVs)	Name of characteristics	Label	Number	Percent (%)	Mean	SD	Scale
Gender	Female (0)	FEML	26	42.6	**0.57**	**0.499**	**0-1**
	Male (1)	MALE	35	57.4			
	Total	-	61	100			
Age	**Total**	AGE	61	100	65.77	18.51	19-91
Additional disease	Diabetes Melitus (1)	DM	19	31.1	-	-	-
	Hipertansiyon (2)	HT	25	41.0	-	-	-
	Cerebrovasculer disease (3)	CVD	8	13.1	-	-	-
	Coronary artery disease (4)	CAD	15	24.6	-	-	-
	Chronic kidney disease (5)	CKD	9	14.8	-	-	-
	Alzheimer (6)	ALZH	3	4.9	-	-	-
	Cancer (7)	CA	11	18.0	-	-	-
	Chronic obstructive pulmonary disease (8)	COPD	18	29.5	-	-	-
	Other (9)	Other	16	26.2	-	-	-
	Total	-	-	-	-	0.321	1-9
Diagnosis of hospitalisation	Pneumonia (1)	PNM	28	45.9	-	-	-
	Sepsis (2)	SPS	9	14.8	-	-	-
	Hypoxic respiratory failure (3)	HSY	16	26.2	-	-	-
	Akut kidney disease (4)	ABY	12	19.7	-	-	-
	Peritonit (5)	PRT	2	3.3	-	-	-
	Electrolyte disturbance (6)	EB	6	9.8	-	-	-
	Diabetic ketoacidosis (7)	DKA	3	4.9	-	-	-
	Cerebrovascüler disease (8)	SVO	3	4.9	-	-	-
	Gastrointetinal hospitalisation (9)	GISH	6	9.8	-	-	-
	Trauma (10)	TRV	4	6.6	-	-	-
	Pulmonary embolism (11)	PE	3	4.9	-	-	-
	Subaracnoid K (12)	SAK	1	1.6	-	-	-
	Other (13)	OTHER	8	13.1	-	-	-
	Total	-	61	100	-	-	1-13
Glaskow Coma score	15 (1)	GCS1	26	42.6	-	-	-
	13-14 (2)	GCS2	16	26.2	-	-	-
	12-10 (3)	GCS3	11	18.0	-		
	9-6(4)	GCS4	6	9.8	-	-	-
	<6 (5)	GCS5	2	3.3	-	-	-
	Total	-	**61**	**100**	**2.04**	**1.14**	**1-5**
Intensive care duration	1-3(1)	-	21	34.4	**-**	**-**	**-**
	4-7 (2)	-	22	36.1	**-**	**-**	**-**
	8-14(3)	-	13	21.3	**-**	**-**	**-**
	>14(4)	-	5	8.2	**-**	**-**	**-**
	Total	-	61	100	2.03	0.94	1-4
Clinical navigation	Exitus (1)	-	15	24.6	**-**	**-**	**-**
	Healthy discharged (2)	-	17	27.9	**-**	**-**	**-**
	Transfer to the service (3)	-	9	14.8	**-**	**-**	**-**
	Intensive care referral (4)	-	20	32.8	**-**	**-**	**-**
	Total	-	61	100	-	1.190	1-4

SD: Standard deviation, GCS: Glasgow Cama Scale

Table 2. Correlation between CRP, procalcitonin, albumin, lactate and procalcitonin/albumin among laboratory parameters and APACHE-II and SOFA

Correlations			Procalcitonin	Albumin	Procalcitonin/ albumin
Spearman's rho	**SOFA**	Cor. Coef.	0.331	-0.465	0.362
		Sig.	0.009	0.000	0.004
		N	61	61	61
	APACHE II	Cor. Coef.	0.254	-0.469	0.288
		Sig.	0.048	0.000	0.025
		N	61	61	61

APACHE II: Acute Physiology And Chronic Health Evaluation II, SOFA: The sequential organ failure assessment score, Cor: Correlation, Coef: Coefficient, Sig: Significant, CRP: C-reactive protein, N: Number

Table 3. correlation between CRP, procalcitonin, albumin, lactate and procalcitonin/albumin among laboratory parameters and APACHE-II and SOFA

Correlations			Lactat	CRP
Spearman's rho	**SOFA**	Cor. Coef.	0.353	0.098
		Sig.	0.005	0.640
		N	61	61
	APACHE II	Cor. Coef.	0.316	0.061
		Sig.	0.013	0.452
		N	61	61

APACHE II: Acute Physiology And Chronic Health Evaluation II, SOFA: The sequential organ failure assessment score, Cor: Correlation, Coef: Coefficient, Sig: Significant, CRP: C-reactive protein, N: Number

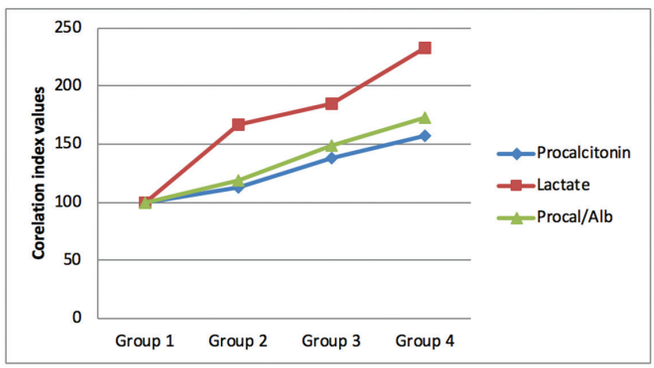

Figure 1. Correlation values of blood parameters according to APACHE II score groups

APACHE II: Acute Physiology And Chronic Health Evaluation II, Alb: Albumin

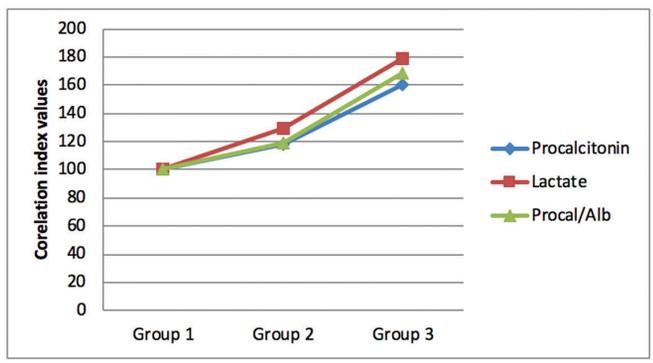

Figure 2. Correlation values of blood parameters according to SOFA score groups

SOFA: The sequential organ failure assessment score, Alb: Albumin

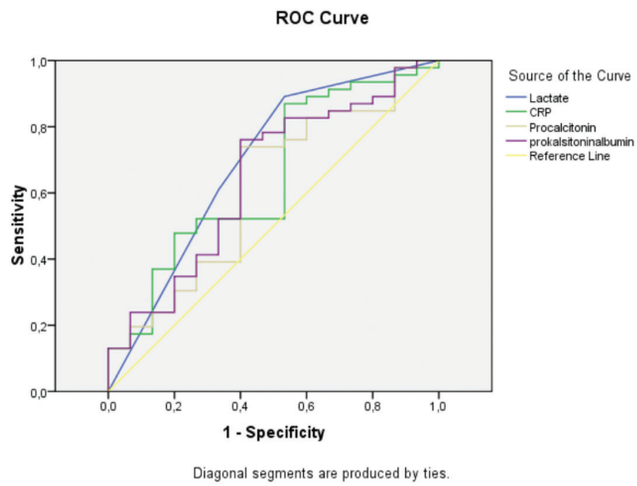

Figure 3. Mortality of blood parameters according to ROC analysis (Procalcitonin 37.7 ng/mL AUC:0.616 (0.447-0.785), Albumin 2.06 g/dLAUC: 0.829 (0.717-0.941), procalcitonin/albumin 18.5, AUC: 0.645 (0.479-0.811), lactate cut off value 1.5 mEq/mL AUC: 0.693 (0.525- 0.861), CRP: 39 mg/L AUC: 0.648 (0.483-0.812)

ROC: Receiver operating characteristic, AUC: Area under curve, CRP: C-reactive protein

be an important factor on mortality. There is not any positive or negative linearity between CRP levels and both APACHE-II and SOFA scores. A recent study did not show any effect of CRP acute phase reactant on mortality in trauma patients followed in intensive care unit (20). Although CRP did not correlate with SOFA and APACHE-II, CRP cut-off value >39 mg/dL was found to be significant in terms of mortality. Recent studies addressed that procalcitonin increase above 2 ng/mL in clinical conditions such as severe infection, sepsis and multiple organ failure

syndrome, and it is an important indicator for early diagnosis (23,24). Procalcitonin is a specific and sensitive marker for severe bacterial infections which may show developing inflammatory response earlier (25,26). Similar results were obtained in the present study. It was considered that procalcitonin presents a positive correlation with APACHE-II and SOFA scores; and it is a useful laboratory parameter for monitoring and treatment. High procalcitonin levels are associated with the severity of the infection and have been shown to be used in the follow-up of patients with severe infections, sepsis, and multiple organ failure syndrome (25). In a study, procalcitonin and albumin were important markers of infection in elderly individuals (27). In our study, procalcitonin and procalcitonin/albumin ratio were found to have a low positive correlation with prognostic scores and were found to be helpful parameters during the clinical course.

In the ROC analysis, the AUC value of the blood parameters is above 0.5 and the AUC value of the albumin is high. This shows us the importance of the albumin cut-off value in terms of mortality below 2.06 g/dL. In the study of Yap et al. (28), Similar results were obtained with our study and it was emphasised that albumin may be associated with mortality.

Study Limitations

This study was performed in the intensive care unit and the patient population was limited.

Conclusion

Considering the importance of critical patients on mortality since admission to the emergency department, procalcitonin, lactate albumin and procalcitonin/albumin were thought to be prognostic markers according to the cut-off points. In addition, they were found to be beneficial in clinical follow-up as they correlated with the scores of APACHE-II and SOFA scoring systems used in intensive care units.

Ethics

Ethics Committee Approval: Ethical approval for this study was obtained from the Ethics Committee of Kanuni Sultan Süleyman Training and Research Hospital with the protocol numbered 2019/07/175.

Informed Consent: Retrospective study.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: D.A., R.G., Concept: B.C., R.Y., T.Ö.D., Design: D.A., B.C., R.G., Data Collection or Processing: D.A., B.B., H.K., T.Ö.D., R.G., Analysis or Interpretation: B.C., R.Y., R.G., Literature Search: D.A., B.B., Writing: D.A., T.Ö.D.

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Evaluation of the Prevalence of Incidental HBV, HCV and HIV Infection Among Patients Presenting to the Emergency Department: A Prospective Cross-sectional Study

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Abstract

Aim: In this study, we randomized the patients without known hepatitis-B, hepatitis C and HIV infection who presented to the emergency department (ED). We measured the serum levels of HBsAg, Anti-HCV and Anti-HIV antibodies besides biochemical tests regarding the diagnostic process of the main complaint resulting in presentation to the ED. In this way, we aimed to determine the prevalence of occult chronic viral diseases among patients presenting to the ED and the risk of ED employees was evaluated.

Materials and Methods: The study included 800 patients who had presented to the ED for any reason over two month and who had no history of infectious viral disease.

Results: Four hundred and thirthy-four (54.2%) of the patients were male, 366 (45.8%) were female, and the mean age was 32.7 (±16.9) years. The rate of presence of a person with an infectious viral disease at the patient's home was 1%, 0.5% and 0.0% for HBV, HCV, and HIV, respectively. The overall history of HBV vaccination was 15.5% in our study sample. HBsAg, anti-HCV and HIV-positivity were 2%, 0.8% and 0.0%, respectively.

Conclusion: The prevalence of HBV- and HCV-positivity in patients admitted to the ED who did not have any known chronic viral disease was consistent with the general population prevalence. No significant change in the prevalence of HCV compared to previous years can be explained by the absence of a protective vaccine. The absence of HIV-positivity can be explained by the low rate of HIV-positivity in our country.

Keywords: Emergency medicine, HBV, HCV, HIV, chronic viral diseases

INTRODUCTION

According to the World Health Organization (WHO) data in 2017, it is estimated that more than 2 billion people are infected with the Hepatitis B Virus (HBV) around the world and 257 million people have chronic HBV infection. Most of the 887,000 deaths resulting from hepatitis B infection in 2015 were due to complications such as cirrhosis and hepatocellular carcinoma (HCC) (1).

HBV infection is usually acquired in adulthood. Transmission through sexual contact and parenteral drug use with shared needles in adolescents and young adulthood has been identified as the most important transmission route. However, perinatal

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or early childhood infections also pose a great risk for the development of HBV infection (2). Many epidemiological and molecular studies have shown that chronic HBV infection is the main risk factor for the development of HCC. Chronic HBV infection is seen in approximately 5% of infections seen in adults, whereas, this rate accounts for 90% in neonatal infections. Although HBV generally does not cause direct cytopathic effects in hepatocytes, it is thought to induce hepatic damage (fibrosis, cirrhosis, and HCC) as a result of persistent immune reaction and inflammation in the liver (3). The European Center for Disease Prevention and Control has reported the prevalence of HBV infection among the general population in Turkey as 2-8% by September 2010 (4).

Hepatitis C Virus (HCV) spreads predominantly through blood and blood contamination, such as drug injection. Furthermore, HCV outbreaks have been linked to non-sterile medical practices, unprotected blood transfusions and sexual transmission (5-9). Around two hundred million people (3% of the whole population) are infected with HCV worldwide. Approximately three to four million new cases are seen each year, and more than 350,000 people die each year due to diseases caused by HCV infection. There is very little data about the genetic properties and regional distribution of HCV infection in Turkey (7).

According to the 2018 data of the United Nations AIDS Unit, it is reported that approximately 36.9 million people are infected with Human Immunodeficiency Virus (HIV) worldwide and 53.1% (19.6 million) of them live in sub-Saharan Africa. As of 2017, the number of people receiving antiretroviral treatment reached 19 million and the mortality rate decreased by 34%. According to the 2016 data in our country, a total of 14695 HIV infected/AIDS cases were reported (10,11).

Previous studies have shown that the rate of contact of emergency service providers with the blood, blood products and body fluids of patients admitted to the emergency department is rather high. Similarly, the incidence of occupational exposure to blood or other body fluids is higher among Emergency Department (ED) workers than in the general public officials (12-16). This situation increases the risk of transmission of HBV, HCV and HIV infection among health care providers in ED. In this study, we aimed to conduct a risk analysis for ED health workers due to the patients who presented to the ED without a history of HBV, HCV or HIV infection.

Materials and Methods

The study was approved by the Gaziantep University Faculty of Medicine Ethics Committee for Clinical Studies (approval date: 12.09.2018, decision no: 2018/211) and carried out in the Department of Emergency Medicine at Şahinbey Research and Practice Hospital. The study was conducted following the Declaration of Helsinki and an informed consent form was signed by each participant before blood samples were drawn. Health care is provided to approximately 180,000-210,000 patients annually in the afore-mentioned ED. A total of 44,720 patients had presented to our ED during the two months of the study.

A total of 800 patients who had presented to the Adult ED with any complaint between 01.10.2018 and 01.12.2018 and who fulfilled the study criteria were randomly recruited. To provide randomization in the study, the resident on duty included the first patient who presented at his/her shift every hour and who fulfilled the study criteria and gave written consent.

Pre-prepared forms for the study included the patients' age, gender, medical history, history of regular drug use, surgical interventions (including curettage and superficial abscess drainage), alcohol or drug/stimulant use, blood replacement history, presence of individuals with infectious viral diseases (HBV, HCV, HIV) in their domestic environment, and the HBV vaccination history was recorded.

The exclusion criteria; patients with a history of HBV, HCV or HIV infection, those younger than 16 years, and those who refused to participate voluntarily were excluded from the study.

The inclusion criteria and workflow; Patients older than 16 years of age presenting to our ED for any reason at any time of the day and who did not know whether or not they were infected with HBV, HCV or HIV were included in the study. In addition to the laboratory samples examined in the diagnostic process of patients who fulfilled the study criteria, 3 ccs of extra blood samples were collected for the measurement of serum HBsAg, anti-HCV and anti-HIV antibody levels and sent to the Microbiology Laboratory of Şahinbey Research and Practice Hospital. The blood samples were transferred to the BD Vacutainer® SSTTM II Advance (REF 367955) biochemistry tubes containing gel and taken to the laboratory within 5 minutes. The samples were recorded in the medical automation system and centrifuged in the laboratory at 4000 rpm for 5 minutes. The serum on top of the precipitate was removed and examined using the Abbott® kits on the Architect 2000 SR® (ELISA) device. Blood samples that were not examined immediately were separated by centrifugation and stored at -20 oC for a maximum of 2 days and then examined in the same way. The device used for analysis works according to the Macro ELIZA principle.

The number of samples was calculated by considering the study with the highest rate (8%) in our country and WHO data averages (3%) (3). We use the internationally recognized formula in the calculation as follows:

$$N1=\left\{z_1-\alpha/2\pm\sqrt{p^{-}*q*(1+\frac{1}{k})}+z_1-\beta\times\sqrt{p_1*q_1+(p_2+q_2)}\right\}^2/\Delta^2$$

(17)

Based on the assumption that the study was in the 85% confidence interval when the values were used in this formulation,

$$N_1=\left\{1,96*\sqrt{0,055\times0,945*(1-\frac{1}{1})}+1,04*\sqrt{0,08*0,92+\left(\frac{0,93\cdot0,97}{1}\right)}\right\}^2/0.05^2$$

$N1 = 372$, $N_2 = k \times N_1 = 372$, Total n=744 number of participants (sample size) was calculated. Thus, we recruited a total of 800 subjects.

Statistical Analysis

The data of the patients were recorded at a computer file and analyzed with the SPSS 23.0 program. A chi-square test was used to analyze the relationship between two categorical variables; the t-test was used to compare the dependent variables. A p value of less than 0.05 was considered statistically significant.

Results

Of the 44,720 patients presenting to our emergency department during the two-month study period, 21,500 (48.08%) were male and 23,320 (51.92%) were female and the mean age was 34.74±16.80 years. Of the 800 patients who were recruited in the study, 434 (54.2%) were male, 366 (45.2%) were female and the mean age was 37.7±16.8 years. 58.4% of the patients were within the 16-35 age category (Table 1).

Among eight hundred patients, incidental HBV-positivity and HCV-positivity were 16 (2%) and six (0.8%), respectively. None of the patients had HBV and HCV coexistence. No incidental HIV-positive patients were determined. HBV-positivity was dominant in females and HCV-positivity in males (Table 2).

Of the patients included in the study, 23.3% (186) reported having a chronic disease. Among these 186 patients, HBV-positivity was determined in six (3.2%) and HCV-positivity in one (0.5%). There was no statistically significant relationship between the presence of chronic disease and HBV-positivity (p=0.173) or HCV-positivity (p=0.702) (Table 3).

Of 175 patients (21.9%) who reported chronic drug use, six (3.4%) had HBV-positivity and one (0.6%) had HCV-positivity. The relationship between chronic drug use and HBV-positivity (p=0.127) or HCV-positivity (p=0.757) was not statistically significant (Table 3).

One hundred and thirthy patients (16.3%) stated that they had undergone a surgical operation previously. HBV was positive in three (2.3%) and HCV was positive in one (0.8%) of them. There was no statistically significant relationship between a previous surgical operation history and HBV-positivity (p=0.784) or HCV-positivity (p=0.978) (Table 3).

None of the patients reported chronic alcohol or stimulant/drug use. However, 8% (n=64) of the participants defined themselves as "social drinkers". HBV-positivity (p=0.794) was found in one (1.6%) and HCV-positivity (p=0.022) in two (3.1%) of 64 patients who stated that they were social drinkers (Table 3).

Forty-five (5.6%) patients reported that they had previously undergone blood transfusion for any reason. HBV-positivity was found in one (2.2%) (p=0.913) and HCV-positivity was found in two (4.4%) (p=0.003) of these 45 patients (Table 3).

When we questioned the presence of an individual with the infectious viral disease in his/her domestic environment, eight (1%) subjects reported that there was an HBV-positive person at home. One of these eight (12.5%) was HBV-positive (p=0.160). Four (0.5%) subjects reported that there was an HCV-positive person at home. HCV was positive in one of these four (25%) (p=0.001) (Table 3). None of the participants reported that there was an HIV-positive person at home.

A total of 124 subjects (15.5%) declared that they had been vaccinated against HBV. Sixty-one (7.6%) of them were male and 63 (7.9%) were female. There were no patients among those undergoing HBV vaccination, who had a concomitant HBV infection.

Table 1. Age Groups and gender distribution of patients

Age category, (year)	Male	Female	Total, n (%)
16-25	109	110	219 (27.5%)
26-35	142	106	248 (30.9%)
36-45	73	58	131 (16.4%)
46-55	35	32	67 (8.3%)
56-65	27	21	48 (6.0%)
+66	48	39	87 (10.9%)
Total	434 (54.2%)	366 (45.8%)	800 (100%)

Table 2. Presence of HBV and HCV infection and gender distribution of patients

		Male	Female	Total
HBV	**Positive (+)**	**7**	**9**	**16**
	Negative (-)	427	357	784
	Total	434	366	800
HCV	**Positive (+)**	**4**	**2**	**6**
	Negative (-)	430	364	794
	Total	434	366	800

Table 3. The Relationship between HBV/HCV positivity and patient characteristics					
	Total patients	**HBV +**	**p value**	**HCV +**	**p value**
Presence of chronic illness	186	6	0.173	1	0.702
Regular drug intake	175	6	0.127	1	0.757
Past surgery history	130	3	0.784	1	0.978
Alcohol intake	64	1	0.794	2	0.022*
Blood transfusion history	45	1	0.913	2	0.003*
Presence of a virally infected person in the domestic environment	64	1	0.160	2	0.001*

HBV: Hepatitis B Virus, HCV: Hepatitis C Virus, *Significant at p<0.05 level (p values were obtained by chi-spuare test)

Discussion

It is reasonable to say that studies conducted in emergency services in our country can be considered as an indicator of the general prevalence of the population in epidemiological studies due to the high number of participants.

HBV infection shows significant racial/ethnic and geographic differences regarding viral exposure and immunity. In the United States, the overall prevalence of chronic HBV infection in the general population is 0.34%, which is more common among Asians and the black population (17). The European continent is a low endemic region for HBV infection. The overall prevalence of HBV is about 0.9% in EU countries. The number of cases with chronic HBV infection is estimated to be approximately 4.7 million in Europe (18). Chronic HBV infection is thought to be highly endemic in the overall African continent. In Asia, both high and low-risk countries have been reported regarding HBV infection. The rate of the population with chronic HBV infection has been reported to be 2-4% in Japan, 5-18% in China, 15-20% in Taiwan, and 2-7% in Iran (19-22). The prevalence of chronic HBV infection was found as 4-5% in Turkey in 2007 and it was reported to be 4.57% in a meta-analysis published in 2011 (23-24). Similarly, HBV-positivity was calculated as 4% in another study population by Tozun et al. (25). In our study, the incidental HBV-positivity prevalence was calculated as 2% (16 patients). When the results of our study were compared with previous studies in our country, a lower prevalence rate was found. We believe that the success of routine HBV vaccination, which was launched in 1998 in Turkey, has a great contribution to this decline. Similarly, in Taiwan (26), China (27) and Poland (28), the incidence of HBsAg-positivity has been shown to decrease after initiation of routine nationwide HBV vaccination program. We believe that the inclusion of the HBV vaccine in the routine vaccination programs is an important factor in decreasing the prevalence of HBV worldwide.

Studies reporting the prevalence of HCV have demonstrated significant geographical and regional differences in the epidemiology of HCV infection in Europe. In general, the prevalence of HCV is between 0.1-1% in northern Europe, 0.2-1.2% in Central Europe and 2.5-3.5% in southern Europe (29). Among the continents, the estimated prevalence is lowest in Northern Europe where the prevalence of HCV was reported to be lower than 1%; its prevalence is high in countries in North Asia and Africa. The lowest HCV prevalence was reported in the UK and the Scandinavian countries (less than 1%); the highest prevalence was reported from Egypt (15-20%) (30,31). In our country, the epidemiological data for HCV are mostly obtained from local studies, and anti-HCV positivity has been reported between 0.1-1.5% in community-based studies (23,32,33). The best estimate of the prevalence of HCV in our country is approximately 1% (33). In our study, the rate of anti-HCV-positive patients was 0.8%. Our results are consistent with other studies conducted in our country.

The HIV prevalence in Turkey was found to be 0.019% in 2016 (10). However, there were no HIV-positive patients determined in our study. Due to the extremely low incidence and the relatively small sample size of our study, the absence of HIV-positive patients was considered to be normal in our results.

Of the 45 patients (5.6%) who declared that they had received blood transfusion for any reason in our study, one (2.2%) had HBV-positivity (p=0.913) and two (4.4%) had HCV-positivity (p=0.003). Blood transfusion is an important route of viral transmission in developing countries. In developed countries, transmission through blood transfusions has decreased considerably. For example, the risk of HCV transmission is estimated to be approximately 0.52 per million donations in the US, 0.70 in Canada, and between 0.1 and 2.33 in different European countries (33-35). According to our results, HCV transmission among patients receiving blood transfusion is quite high compared to the rates in developed countries. However, in our study, it is not possible to attribute the cause of transmission to blood transfusion alone in these patients. In our study, two (33%) of six HCV positive patients were over 50 years of age. In the literature, some studies show the relationship between HCV positivity and the patient's age. However, we did not reach such

a conclusion in our study. In a study conducted by Niu et al. (34) on 2685 patients in China, the distribution of patients was examined by age and the rate of those older than 50 years was found to be 59.33%. In our country, some studies are examining the age-specific prevalence of HCV showing that the prevalence of HCV increases with age, especially after the age of 50 years (25,30). The results of our study were not consistent with the afore-mentioned studies in the literature in terms of age and HCV-positivity. In our study, the number of patients with HCV was only six, which did not allow the comparison of the HCV prevalence under and above 50 years of age.

In our study, the relationship between the presence of an HCV-positive person at home and HCV-positivity was statistically significant. Some studies in the literature have reported similar results. Anti-HCV-positivity was determined in 20.5% of people living with an HCV-positive person at home in a study evaluating domestic HCV transmission in Pakistan, while another study in Egypt reported 18% anti-HCV-positivity (36-38). In our study, four (0.5%) subjects declared to live with an HCV-positive individual at home. HCV-positivity was determined in one (25%) of these four people. Our result was statistically significant [(p=0.001) (Table 3)] and supports previous studies. In particular, educating people living with HBV, HCV and HIV-positive individuals at their homes regarding the transmission routes of the disease would be effective in reducing the transmission rates.

Study Limitations

As the sociocultural structure of our society is taken into consideration, it is highly likely to provide incomplete or misleading information on alcohol and drug/substance use, since only the patients' declaration was based in our study. For the same reason, although suspicious sexual intercourse is an important route of transmission, which can explain unknown reasons, the fact that it could not be questioned has created a significant limitation in our study. Since there were no HIV-positive patients in our study, no detailed analysis could be performed.

Conclusion

Emergency departments are units to which a large number of and all kinds of patients present and the necessary interventions are required without waiting for the results of biochemical analyses. Emergency Medicine Specialists and other ED employees are at high risk of exposure to blood-borne pathogens in these intensive settings. Although the incidence of HBV/HCV/HIV infection appears to be low in our study, health workers should comply fully with personal protection methods due to the high risk of transmission.

In our study, the rate of those who declared the presence of HBV vaccination was found to be 15.5% among 800 patients. Increasing the vaccination rates and performing them properly will decrease the prevalence of HBV infection to lower rates in our country.

The lack of a significant decrease in the prevalence of HCV in our country over the years reveals the importance of vaccination development studies. The lack of an effective vaccine yet can be seen as one of the main reasons why the desired success in combating the disease has not been achieved. However, it is possible to decrease the rate of transmission by increasing social awareness.

We believe that the publication of a large number of news and visual materials in the media regarding HIV infection results in a high level of awareness of the disease in our country. The registration and follow-up of the digital medical file system by the Ministry of Health is quite successful for HIV infection and AIDS. Although the number of patients is low in our country, it is very important for public health that the fight against HIV is not interrupted.

Ethics

Ethics Committee Approval: Ethics committee approval was taken from Gaziantep University Faculty of Medicine Ethics Committee for Clinical Studies (approval date: 12.09.2018, decision no: 2018/211).

Informed Consent: Informed consent forms were signed by each participant before blood samples were drawn.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Concept: B.A., Y.Z., Design: B.A., M.M.O., Data Collection or Processing: C.K., H.G., M.M.O., M.S. Analysis or Interpretation: B.A., Y.Z., Literature Search: M.M.O., M.S., Writing: M.M.O., M.S., M.B.

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Assessment of Suicidal Cases Among Emergency Department Applicants Kütahya Evliya Çelebi Training and Research Hospital Experience

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Abstract

Aim: Our work is aim at sharing our experiences in suicide cases which constitute a significant part of the psychiatric emergency cases. We hope to draw attention to the factors involved in suicide attempts. This is intended to contribute to taking precautions and prevent suicide attempts by determining the possible risk factors.

Materials and Methods: This study was conducted by retrospectively reviewing records of 292 cases filed at Dumlupınar University, Kütahya Training Research Hospital Emergency Service as suicide attempts between January 01 and December 31, 2016, in which the "Suicide Attempt Registration Form" was completed.

Results: Suicide attempts were found to occur more frequently in females within the ages of 15-24 years, particularly in cases with family problems, psychiatric diseases, and problems with the opposite sex.

Conclusion: In this study, we evaluated demographic and risk factors of suicide attempts in our hospital. Local government, non-governmental organizations, and health service providers need to cooperate in developing policies which seeks to prevent suicidal behavior. In addition, because psychiatric diseases has an important place in the etiology of suicide attempts, it is important that these patients are followed up closely and that symptoms indicative of suicide are treated and an absolute psychiatric evaluation and follow-up be done before discharge of the emergency patients.

Keywords: Suicide, attempts, risk factors, emergency department, demography

Introduction

Suicide attempts are acts undertaken to end an individual's life voluntarily but do not result in death, whereas if death is the outcome, it is called suicide. Suicide and suicide attempts are serious causes of morbidity and mortality, particularly in psychiatric emergencies (1). According to the World Health Organization, approximately one million people die every year worldwide because of suicide (2). According to the statistics of the Turkish Statistical Institute, this number was 3,212 in our country in 2015, an increase by 1.3%, from the 3,169 deaths in 2014. It means that four people die from suicide out of every one hundred thousand people (3).

Suicide attempts have an important place in the fields of psychiatry and crime intervention because of their urgency and life-threatening aspects. The first conscious intervention that should be performed is for this reason of great importance in terms of lifting life-threatening situations. In view of this situation, there is a need for systematic information about suicide attempts, particularly in terms of public health. It is crucial to determine the risk groups and their characteristics when deciding on which policies should be established for response and intervention (4,5).

We aimed to evaluate socio-demographic and clinical characteristics of patients who used our emergency service because if a suicide attempt. We think that our work is important in determining the risk factors in our region because ours is the only tertiary hospital in the city center.

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Materials and Methods

This study was conducted by examining retrospective records of 292 patients who applied to the Emergency Department of Dumlupınar University Kütahya Evliya Çelebi Training and Research Hospital because of a suicide attempt between January 01 and December 31, 2016, and filled in a "suicide attempt registration form." In this form, information including gender, age, marital status, educational status, profession, suicide method, reason for suicide, history of previous suicide attempts, and whether or not they had been treated psychiatrically in the last 6 months is recorded. The study was approved by the Dumlupınar University Faculty of Medicine Ethics Committee and was conducted in accordance with the principles of the Declaration of Helsinki (protocol no: 2017/02-7).

Statistical Analysis

The data were analyzed in SPSS (Social Sciences Statistical Package) version 20. Results are presented as mean and standard deviation for quantitative variables and as percentages for qualitative variables.

Results

Socio-demographic characteristics of these cases are provided in Table 1. Of the cases, 73.28% were female and 26.72% were male. When suicide attempts were examined according to the age group, most suicide attempts were in the age range of 15-24 years, with 55.13% cases. With respect to the marital status, 165 were single and 114 were married and 13 were other marital status. In cases that were married, this highest rate was found in the age group of 24-35 years. Among women who attempted suicide, 55.14% (n=118) were single. When the educational status was evaluated, the group that most frequently attempted suicide was found to be primary school graduates (41.43%; n=121). It was determined that 23.97% (n=70) of the cases did not work and 28.20% (n=82) of the cases were students. The gender distribution was 62.86% (n=44) women and 37.14% (n=26) male. Approximately 49.53% (n=106) of all women who were in non-working women group and housewives attempting to commit suicide. It was found that among males 46.75% (n=36) had a job.

The analysis of the methods applied and the reasons for suicide cases are given in Table 2. According to this, most suicide attempts in both genders were performed by poisoning with drugs (96.23%, n=281). The most common causes of suicide were family problems in 40.07% (n=117), mental illness in 19.52% (n=57) and mental illness in 11.30% (n=33). When the reasons according to gender were evaluated, this situation did not change in women, while in men the third reason was found to be work-

Table 1. Groups of sociodemographic characteristics

		Number, n	Percentage, %
Gender	Female	214	73.28
	Male	78	26.72
Age groups	15-24	161	55.13
	25-34	71	24.33
	35-49	43	14.72
	50 and over	17	5.82
Marital status	Married	114	30.05
	Single	165	56.50
	Other (widowed. divorced. separated living)	13	4.45
Educational status	Primary school	121	41.43
	High school	98	33.56
	University	55	18.83
	Illiterate	11	3.76
	Unknown	7	2.39
Work status	Working	70	23.97
	Non-working	70	23.97
	Student	82	28.20
	Housewife	63	21.70
	Unknown	6	2.06

Table 2. The analysis of the methods applied and reasons for suicid

		Number, n	Percentage, %
Suicidal attempt	Drugs	281	96.23
	Cutter drill injury	5	1.70
	Hang	3	1.05
	High jump	2	0.68
	Firearm injury	1	0.34
Causes of suicide	Family problems	117	40.07
	Mental illness	57	19.52
	Opposite sex problems	33	11.30
	School and test concerns	22	7.54
	Business and economic reasons	20	6.85
	Contact problems	18	6.17
	Loneliness	18	6.17
	Developmental problems	5	1.70
	Substance dependence	2	0.68
Previously attempted suicide	Yes	56	19.18
	No	236	80.82
History of psychiatric illness	Yes	54	18.50
	No	238	81.50

related. A total of 56% (n=56) had previously attempted suicide and 18.50% (n=54) of the patients were found to have no history of psychiatric illness before making the attempt. When we look at all suicide attempts, particularly drug poisoning, there is no peak for a particular time period. However, it was found that attempts occurred most commonly between 4.00 p.m. and 12.00 a.m. in both gender (Figure 1).

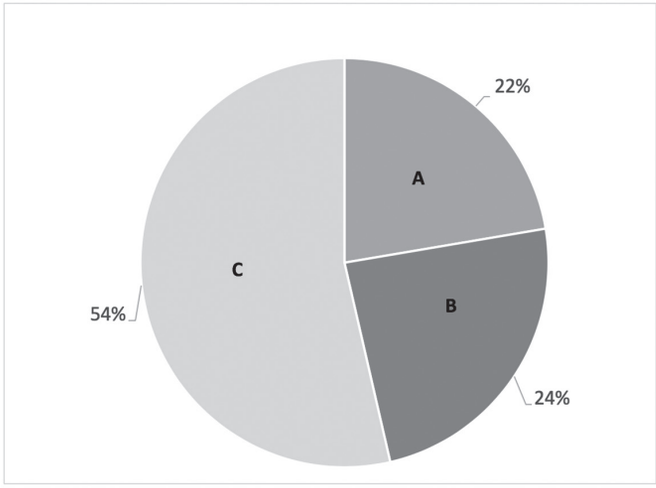

Figure 1. Time period of suicide attempts A: 00.00-07.59, B: 08.00-15.59, C: 16.00-23.59

Discussion

In studies examining suicide attempts, it has been pointed out that women attempt suicide at a higher rate than men (6,7). In our sample, the female to male ratio was found to be 2.74, which is in accordance with the literature. This may be related to the fact that women are influenced by events to a greater extent than men, and that the situation in society is also related to the compulsive nature of the women in the community and the negative conditions that women make over traditional practices.

The age group in which suicide was attempted most frequently in our study was found to be 15-24 years, as was found in similar studies in which the age group distribution was examined (8,9). Physical and mental changes due to adolescence as well as the desire to live independently and problems related to school and test anxiety may be seen as a frequent occurrence in this age group. Several studies have shown that suicide attempts are more prevalent among married couples (10,11).

Similarly, in our study, suicide attempts were more common than successful suicides. The age group in which suicide attempts occurred most frequently was be determined to be the student age group. Because the level of education increases, suicidal tendency decrease. Factors such as harmony, communication, and self-expression can be held responsible for this situation. When the work situation is taken into consideration, the risk groups are students, housewives, and individuals who do not work at all. This situation was found to be consistent with that observed in similar studies (12,13). When we look at the sociodemographic characteristics of our study, we believe that the sociocultural and socioeconomic development of the region is a parameter to be considered. In a separate analysis, we evaluated cases according to the method used for the attempt. According to this, the most frequent suicide method was the intake of drugs and toxic substances. In studies conducted in this aspect both in Turkey and in other countries, it is stated that most of the suicide attempts are by chemical substance intake. The most frequently identified substances were found to be prescription drugs found at home (14-16).

In this case, we think that measures taken by the competent authorities against this phenomenon will be effective in reducing suicide attempts and will contribute to the country's economy. Psychiatric illnesses have been found to be closely related to issues such as adverse family conditions and socioeconomic and sociocultural factors (17-19). The most common cause of suicide in our study was family problems. In our country, domestic problems and incompatibility are considered to be among the most frequent causes of suicide in most studies (20-22). In such cases, it is suggested that individuals who have attempted suicide should be interviewed with their families, and risk-bearing individuals should be identified and counselled within family communication settings. In other studies, on this issue, intervention has been counterproductive as a factor, actually increasing the risk of suicide (23). In our study, recurrent intervention was observed to have taken place in a proportion of children (19.18%). Care should be taken that this may pose a risk of suicide or death in individuals prone to attempt suicide. Studies have also revealed that people with a history of psychiatric treatment constitute a high-risk group in terms of new suicide attempts (23). Our work partially supports this observation. Therefore, psychiatric consultation should be made available both during the intervention and follow-up of cases with a history of psychiatric illness that attempt suicide and use emergency services.

Another parameter that should be discussed here is the increased frequency of suicide cases between 4.00 p.m. and 12.00 a.m. Studies in this field are generally consistent (20,21). If you look at this situation, this is the time zone when family members stay together. As the most common reason for suicide is related to family problems, attempts are expected to be concentrated in this period.

Conclusion

We evaluated some features that might be a risk factor for suicide attempts. However, eliminating these factors is not enough to prevent suicide attempts. With the help of the resulting data, preventive strategies should be developed and implemented, such as developing screening programs for risk groups, providing psychosocial support, preventing stigmatization in the community, and raising awareness (increasing social awareness).

Ethics

Ethics Committee Approval: The study was approved by the Dumlupınar University Faculty of Medicine Ethics Committee and was conducted in accordance with the principles of the Declaration of Helsinki (protocol no: 2017/02-7).

Informed Consent: Retrospective study.

Peer-review: Internally peer-reviewed.

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Retrospective Evaluation of Return Visits to the Paediatric Emergency Department

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Abstract

Aim: This study aimed to establish regional data using the results obtained via determination of clinical and demographic characteristics of patients who revisited the paediatric emergency department of a university hospital within 5 days.

Materials and Methods: Patients who revisited the paediatric emergency department within the first 5 days were included. Patient age and sex, complaints at admission, admission sessions and timeframes and whether the patients were admitted during or outside of working hours were recorded.

Results: The emergency department was revisited by 654 (1.32%) patients. When patient distribution by age group was examined, 415 patients were found to be aged <5 years. When patient distribution based on working hours was examined, 302 patients were found to be admitted outside of working hours and on holidays, whereas 291 patients were usually admitted during the evenings.

Conclusion: Clinicians informing parents at the first visit of the details about their child's disease, the disease course and when to revisit the hospital after discharge may be an effective way to not only prevent unnecessary return visits but also alleviate the anxiety of parents and reduce medical errors and negative patient outcomes.

Keywords: Return visit, emergency department, children

Introduction

Determination of need for treatment and follow-up of the patient is one of the fundamental duties of the emergency department (ED) (1). Return visits (RV) of the patients whose treatments are organized in an inpatient or outpatient setting in ED and who are then discharged reflect natural history of the current disease or the quality of the care received at the initial visit (2). During holiday periods during which outpatient clinics are not provided, RV to ED is inevitable when a disease is progressed or a parent is anxious. In addition, reason of some of RVs may be due to systemic problems such as diagnostic errors, lack of an appropriate treatment at initial visit, insufficient education at discharge or limited access to a primary care provider (3).

RV rate has been used as a quality improvement measure for ED care and accepted as an indicator of health care quality or access to health care services (4). Researchers have been reported that more number of studies are needed in order to better understand frequent visits to ED, help identification populations at risk and develop interventions to reduce recurrent visits to ED (5). RVs have been accepted as high-risk cases with a potential of medical error and used as a quality improvement tool to identify preventable medical errors, and etiologies and tendencies of preventable RVs have been studied for modification of medical practices and improvement of quality (6). Studies conducted in United States have reported RV ratios of 2.5% to 3.5% among all ED visits (7, 8). There are no large studies on this issue conducted with a childhood group. Thus, in our study, formation of our regional data with the results obtained through determination of clinical and demographical characteristics of the patients who revisited the pediatric EDof a university hospital within five days is aimed.

Materials and Methods

After an ethics committee approval was obtained, the records on the automatic control system and the hospitalization files of the

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patients under age of 18 who admitted to Necmettin Erbakan University Meram Medical Faculty Paediatric ED between January 2017 and January 2018 were examined (approval number: 2018/1166). Of the patients who were discharged after being followed-up in ED observation unit or issuance of a prescription; those who revisit to the pediatric ED within first five days were included in the study. Patients who did not visit again or who did visit after >5 days were excluded from the study (Figure 1: Flow Chart). Patients' age, gender, admission complaints, admission seasons, admission timeframe (morning, afternoon, evening, night), whether they admitted within or out of working hours, whether he/she followed the recommendations made at discharge and after how many days they admitted were recorded. Our study complies with World Medical Association Declaration of Helsinki "Ethical Principles for Medical Research Involving Human Subjects" principles.

Statistical Analysis

Statistical analysis of the study was performed by using the Statistical Package for the Social Sciences for Windows ver. 20.0 package program. Continuous variables were expressed as "mean ± standard deviation". Categorical variables expressed as numerically was given as (%). Descriptive statistics were used for distribution of the data and frequency analysis and chi-square tests were used for comparison of independent two groups for frequency data. Level of significance was considered to be <0.05 in all statistical analyses.

Results

It was determined that, of 49334 patients who admitted to Necmettin Erbakan University Meram Medical Faculty Paediatric ED between January 2017 and January 2018; 654 (1.32%) revisited ED within first five days after they were discharged from the ED with their work-ups, examination and prescription procedures completed. Of these patients; 303 (46.3%) were female and 351 (53.7%) were male, and their mean age was 5.84±4.71 years. When distribution of the patients by age groups was examined, it was observed that 415 (63.5%) were under five years of age, 115 (17.6%) were 5-10 years old, 54 (8.3%) were 11-15 years old and 70 were over 15 years old. When complaints at RV were examined, it was determined that the patients revisited most commonly with a complaint of fever in 237 patients (36.2%) and that it was followed by diarrhea (n=98, 15%) and poor feeding (n=95, 14.5%) (Figure 2). When the patients were examined by their diagnoses; it was observed that upper respiratory tract infections were most commonly diagnosed with being in 235 (36.1%) patients and that it was followed by acute gastroenteritis (n=180, 27.5%) and exanthematous diseases (n=56, 8.6%) (Figure 3).

When distribution RV of the patients by seasons was examined it was determined that 223 (34.1%) of the patients admitted most commonly during fall and followed by 27.7% in summer, 20.3% in spring and 17.9% in winter. When examined by timeframe, it was observed that 291 (44.5%) patients were admitted most commonly at evening time. When distribution of RV by working hours was examined, it was determined that 302 (61.%) patients

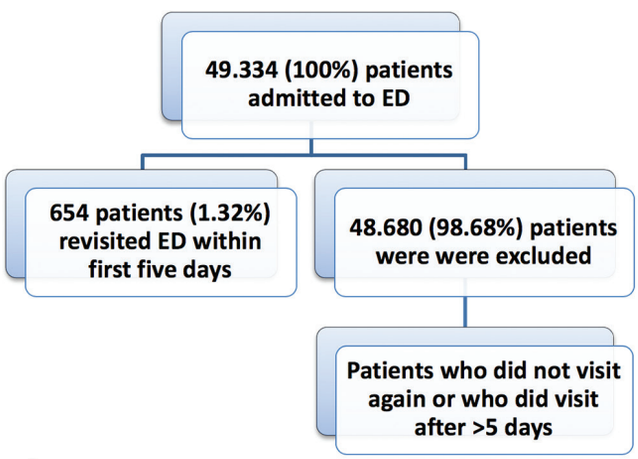

Figure 1. Flow chart
ED: Emergency department

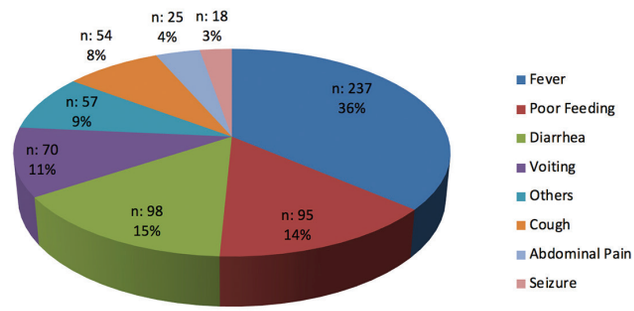

Figure 2. Distribution of the patients by revisit complaints
n: Number

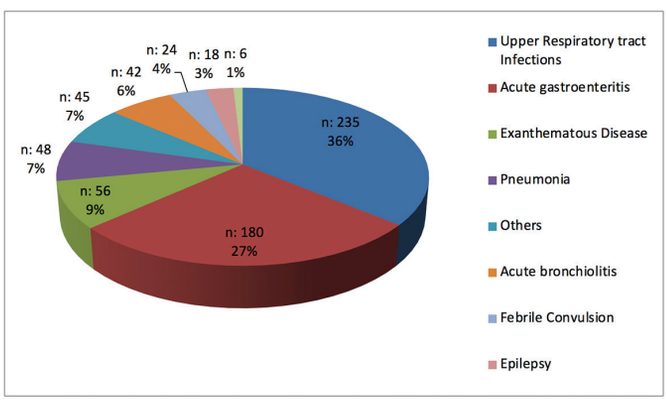

Figure 3. Distribution of the patients by diagnosis
n: Number

admitted out of working hours and during holidays. Figure 4 demonstrates that distribution of the patients by time to RV. Of the patients; 528 (80.7%) were determined not to follow the recommendations made at discharge or not to use the prescribed medications regularly.

It was determined that, of 654 patients revisited the paediatric ED; 504 (77.1%) were discharged just after examination, 140 (21.4%) were treated in inpatient setting, two (0.3%) were referred, one (0.2%) died, two (0.3%) took "French leave" and five (0.8%) left the hospital through signing a manuscript for refusal of treatment.

When the patients were compared by gender and age groups, it was determined that, of 115 (17.6%) patients in 5-10 years of age group; 76 (66.1%) were statistically significantly male (p=0.001). When distribution of the diagnoses established and admission complaints by gender was examined, 16 (88.9%) of 18 (2.8%) diagnosed with epilepsy and 16 (88.9%) of 18 (2.8%) patients admitted with a complaint of having a seizure were determined to be statistically significantly male (p=0.03, p=0.01). When the age groups and admission timeframes were compared, 140 (70.7%) of 198 (30.3%) patients admitted in the afternoon were determined to be statistically significantly under five years of age (p=0,001) (Table 1). When the age groups and admission seasons were compared, 122 (67.4%) of 181 (27.7%) of the patients admitted during summer season were determined to be statistically significantly within the age group under five years of age (p=0,01) (Table 1). When the distribution of revisits by working hours and the age groups were compared, 178 (70.6%) of 252 (38.5%) patients admitted within working hours were determined to be statistically significantly within the age group under five years of age (p=0.01) (Table 1). Distribution of diagnoses of the patients by working hours is provided in Table 2, distribution of the diagnoses by time to revisit is provided in Table 3.

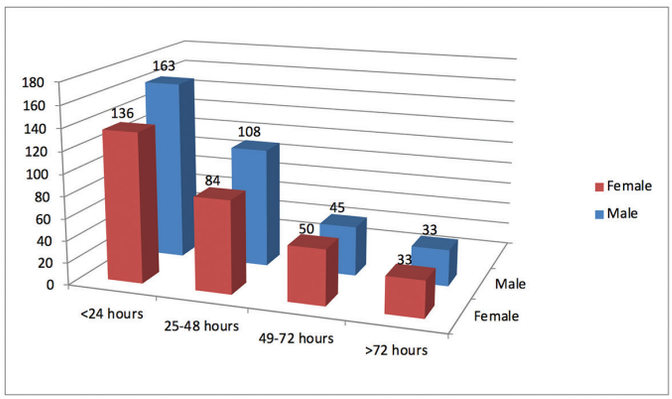

Figure 4. Distribution of the patients by time to revisit

Discussion

Primary duty of EDs is treatment of patients whose conditions are likely to worsen if immediately intervened. Patients who admit to ED also expect high-quality service, just like other patients. However, RV of patients to ED who can be managed in outpatient clinics will make ED, where is already an intensive working environment, more crowded and, thusly, will increase work load, lengthen patients' waiting time, lower quality of follow-up and treatment and lead to increased health care costs (1,9,10). As a paediatric ED that provides a tertiary health care, our RV rates in our study were determined to be lower compared to the international literature. We are in thought of that this result arose from differences in international health care systems and differences in defining RV (intervals of 48 hours to 1 month after initial visit).

Table 1. Distribution of age groups of the patients by admission timeframes, admission seasons and working hours

Age (year)	<5	5-10	11-15	>15	p
Admission time frames					
Morning	76 (60.3%)	27 (21.4%)	14 (11.1%)	9 (7.1%)	0.001
Afternoon	140 (70.7%)	24 (12.1%)	12 (6.1%)	22 (11.1%)	
Evening	181 (62.2%)	60 (20.6%)	19 (6.5%)	31 (10.7%)	
Night	18 (46.2%)	4 (10.3%)	9 (23.1%)	8 (20.5%)	
Season					
Fall	143 (64.1%)	46 (20.6%)	12 (5.4%)	22 (9.9%)	0.01
Winter	72 (61.5%)	19 (16.2%)	8 (6.8%)	18 (15.4%)	
Spring	78 (58.6%)	22 (16.5%)	22 (16.5%)	11 (8.3%)	
Summer	122 (67.4%)	28 (15.5%)	12 (6.6%)	19 (10.5%)	
Working hours					
Admitted within working hours	178 (70.6%)	40 (15.9%)	17 (6.7%)	17 (6.7%)	0.01
Admitted out of working hours	237 (59%)	75 (18.7%)	37 (9.2%)	53 (13.2%)	

Studies conducted in United States have reported RV ratios of 2.5% to 3.5% among all ED visits (7,8). Many institutions and hospitals have been using RV rate as a comparison tool for quality of service provided. While many previous studies evaluated RVs thorough focusing on determination of problems in medical care provided during first visit (11), other group studies, however, analyzed RVs in regard to patient demographics and revealed many redundant RVs (12). In the survey study conducted by Augustine et al. (13) with parents of the cases, most common cause of RVs was determined to be persistence or worsening of pre-existing complaints. It was observed that there were also reasons including that parents did not know how to help their child, that they could not comprehend the disease and that they did not await persistence of the complaints. In our study, it was determined that 1.32% of the patients examined in paediatric ED revisited the ED within first five years during a one-year period RV rates have been using as a comparison tool for quality of service provided. Conduction of large, regional and national studies examining main causes of RVs will provide reduction of medical errors in EDs.

In the study of Alessandrini et al. (11), it was determined that RVs of the patients under two years of age were more and it was considered that this could be related to increased anxiety of parents about the disease. Similarly, in the study of Goldman et al. (1), RV rate was determined to be higher among preschool-aged children (<6 years of age) compared to older children and it was concluded that the younger a child is, the higher RV rate observed. Similarly, in our study, 63.5% of the patients were determined to be under five years of age. These findings suggest that they might be due to underdeveloped communicative skills of younger children, their inability to express discomfort and distress and less experienced parents of a younger child, as well as the fact that physicians are more sensitive to worsening of symptoms in younger children, that they give advice for this issue and that they arrange a control visit for these patients more frequently.

In the study of Alessandrini et al. (11), the most common pediatric diagnosis in RVs was determined to be infectious diseases and it was concluded that RVs were more commonly observed during winter season and that could be associated

Table 2. Distribution of diagnoses of the patients by working hours

	Those admitted within working hours		Those admitted out of working hours	
	n	%	n	%
Upper respiratory tract infections	96	40.9	139	59.1
Acute bronchiolitis	15	35.7	27	64.3
Pneumonia	16	33.3	32	66.7
Acute gastroenteritis	76	42.2	104	57.8
Epilepsy	8	44.4	10	55.6
Febrile convulsion	10	41.7	14	58.3
Urinary tract infections	0	0	6	100
Exanthematous diseases	14	25	42	75
Others	17	37.8	28	62.2

n: Number

Table 3. Distribution of diagnoses of the patients by time to revisit

	<24 hours		25-48 hours		49-72 hours		>72 hours	
	n	%	n	%	n	%	n	%
Upper respiratory tract infections	114	48.5	66	28.1	30	12.8	25	10.6
Acute bronchiolitis	18	42.9	12	28.6	8	19	4	9.5
Pneumonia	16	33.3	16	33.3	8	16.7	8	16.7
Acute gastroenteritis	83	46.1	51	28.3	28	15.6	18	10
Epilepsy	11	61.1	6	33.3	0	0	1	5.6
Febrile convulsion	12	50	6	25	6	25	0	0
Urinary tract infections	2	33.3	1	16.7	1	16.7	2	33.3
Exanthematous diseases	26	46.4	17	30.4	9	16.1	4	7.1
Others	17	37.8	17	37.8	5	11.1	6	13.3

with infectious diseases. Similarly, also in the study of Cho et al. (14), RVs within first 72 hours were determined to be due to infectious diseases at a rate of 29.9%. In the study of de Vos-Kerkhof et al. (15) symptoms such as fever, shortness of breath and vomiting/diarrhea were determined to be associated with emergency medical care RVs in children. In consistency with the literature, the most common RV admission complaint in our study was fever, whereas the most common revisit diagnosis was upper respiratory tract infections. When the distribution of RVs by seasons was examined, it was determined that RVs were most common during fall. It was considered that this might be due to continental climate of our region and increased rate of infections with cooling of the climate during fall.

In the study of Saunders et al. (16), majority of RVs were determined to take place during evening and night shifts. Similarly, in the study of Alessandrini et al. (11), it was determined that of the RVs; 40% took place during day shift, 47% during evening shift and 13% during night shift and that this reflected general ED population. Similarly to the literature, it was determined that 44.5% of RVs took place most commonly during evening time and 61.5% of the patients admitted out of working hours and during holidays. It was considered that this might be due to preference of admission out of working hours because of working conditions, faster care providing in ED and difficulty in accessing outpatient care services.

In the study of Akenroye et al. (17), it was determined that of the RVs; more than 80% were re-discharged and only 19.7% were hospitalized. Similarly, also in our study, it was determined that of the RVs; 77.1% were discharged after being examined and 21.4% were hospitalized. In our study, one patient was found to be brought to the hospital as exitus. This patient was patient who was under one year of age, diagnosed with acute gastro-enteritis and could not be fed at home after being discharged and already died when brought to the hospital after recognition by the parents. It was observed in our study that vast majority of RVs were re-discharged and this, in turn, suggests that significant number of patients use EDs for non-emergency medical conditions. However, our patient who died indicates how fast symptoms can progress especially in younger patients. Therefore, sufficient informing of and giving advice to parents at initial visits are essential. Furthermore, it is necessary for clinicians not to consider RVs as patients who misuse or abuse EDand to take detailed history and to perform physical examinations in an extrajudicial manner.

Conclusion

RV rate was determined to be 1.32% in our study. It was observed that, of these; 77.1% were discharged just after RV, 63.5% were under five years of age, that the patients admitted most commonly due to an infectious disease, that vast majority of the patients admitted out of working hours and most commonly during fall. When ED clinicians inform the parents in details during first visit about their child's disease, course of the disease and when to revisit a hospital after discharge may be an effective way not only for prevention of redundant RVs, but also for prevention anxiety of the parents, as well as for reduction of medical errors and negative patient outcomes. Additionally, conduction of large, regional and national studies examining main causes of RVs together with clinical and demographical characteristics will provide reduction of medical errors in EDs, improvement of quality of health care provided and reduction of the financial load.

Ethics

Ethics Committee Approval: Ethical approval was obtained from Necmettin Erbakan University Meram Medical Faculty Paediatric Emergency Department (approval number, 2018/1166).

Informed Consent: Retrospective study.

Peer-review: Externally peer-reviewed.

Authorship Contributions

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

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

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Evaluation of Occupational Accidents in a Tertiary Emergency Department Introduction

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Abstract

Aim: Our study aimed to determine the characteristics of occupational accident cases admitted to an emergency department and evaluate these accidents in terms of emergency service cost.

Materials and Methods: This descriptive study evaluated the age and gender of the patients, admission time, reason for admission and the sector in which the patient works. Trauma to the body area and the patients' cost covered by Social Security Institution were also evaluated according to the hazard classification for business organisations.

Results: The study included a total of 410 patients admitted to the emergency department due to occupational accidents. Of these, 95.9% were male, of which 30.0% were working in construction sectors. The maximum number of admissions was between 800 and 1200 hours at a frequency of 34.6%. Furthermore, the costs of occupational accidents that the workers were exposed to in very dangerous sectors were the highest (p=0.012).

Conclusion: Occupational accidents result in the highest number of deaths after traffic and home accidents. They have a significantly negative impact on both the workers' health and national economy. In particular, in work places classified as dangerous and very dangerous, the employees are at a risk of accidents that may cause permanent injury and/or death.

Keywords: Occupational accidents, emergency department, costs

Introduction

An accident is defined as an event that causes undesirable and negative results that are unexpected, unintentional and incidentally occurring without a specific cause (1). The World Health Organization defined occupational accidents as follows: "Accidents are unplanned events that often lead to personal injury, damage to machines or tools and which may also stop production for a while" (2).

When the causes of occupational accidents were investigated, it was found in various studies that occupational accidents were 80-98% related to human factors (insufficient personal protective equipment and unsafe behavior) and 2-20% were related to non-human factors (physical, mechanical and technical disability). Considering all these investigations, the majority of occupational accidents can be considered as preventable accidents (3-5).

According to data from the International Labor Organization (ILO), 374 million employees are suffering from non-fatal work-related injuries and diseases each year and it is known that more than 2.78 million people die due to occupational accidents and work-related diseases (6). According to the data of the Social Security Institution (SSI) in Turkey, 359,653 occupational accidents occurred in 2017. 83.6% of the occupational accidents

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are male employees and 16.4% are female employees. In the year 2017, 1843 occupational accidents occurred in the province Kahramanmaraş, where our study was conducted. One thousand and seven hundred and six (92.5%) of these accidents were male employees and 137 (7.5%) were female employees (7,8).

The most important outcome of occupational accidents is the death, injury or disability of employees. In addition, direct costs (hospital costs, compensations, SSI payments, penalties, etc.) and indirect costs also occur after the accident (workday loss, court costs, damage to and/or loss of equipment, work interruption, inspection process, mood disorders, loss of prestige etc) (4).

According to the data of ILO, it is reported that the total cost of occupational accidents and occupational diseases in the countries which have completed industrialization varies between 1% and 3% of the Gross National Product (GNP) of these countries. For developing countries, this cost is estimated to be 4% of GNP (9).

Many cases apply to hospital emergency departments for different reasons and occupational accidents constitute a significant part of them. In the case of injuries caused by occupational accidents, the first intervention is usually carried out in emergency services. These emergency procedures also bring forensic and ethical responsibilities to the emergency department physician (10,11). The aim of our study was to define the demographic characteristics of occupational accident cases applying to an emergency department and to evaluate these accidents in terms of emergency service costs.

Materials and Methods

Type of Study

In this descriptive study, the files of the patients who were registered in the Adult Emergency Department of Medical Faculty Hospital between October 2015 and September 2017 due to occupational accident were examined retrospectively from the automation system.

The age and gender of the patients, admission time, reason of complaint, the sector in which the patient works (construction, textile, machinery-metal, service, transport-transportation, trade-office, agriculture-livestock, energy and other) were evaluated. Also, trauma to the body area due to the accident (head and neck, thorax, abdomen-pelvis, upper extremity, lower extremity) and patient' costs to SSI were determined according to the hazard classification of the business lines (less dangerous, dangerous, very dangerous). For this, a total of 410 patients with complete data were included in the study. Patients with missing file information, demographic data and cost reports, who were younger than 12 years and over 100 years of age were excluded from the study.

Our study was approved with the decision of the local ethics committee on 25.10.2017 (decision no: 09).

Statistical Analysis

Demographic data were summarized as numbers and percentages. While evaluating the cost, the sectors where the applicants work were divided into three groups as less dangerous, dangerous and very dangerous, based on the Occupational Health And Safety Communication of Employment Danger Classes. The construction sector, the machinery-metal sector, the transport-transportation sector and the energy sector were considered as very dangerous business lines whereas textile and agriculture were examined in the class of dangerous business and the service sector, trade-office work, food sector and wood carving sector were examined in the class of less dangerous business lines. Shapiro-Wilk test was used to determine whether the numerical measurements correspond to normal distribution. As a result of this evaluation, numerical measurements were presented as median and minimum-maximum. A regression tree model was used to determine the factors that affect costs. P values below 5% were considered statistically significant. SPSS 16.0 package program was used for the analysis and R 3.3.2. Software was used for regression tree analysis.

Results

A total of 410 patients who admitted to the emergency department due to occupational accidents were included in the study. Of the patients, 95.9% were male. The mean age was found to be 33.08±10.68 and 26.3% of the patients were aged 25 or under, 35.4% were between 26-35 years of age, and 38.3% were 36 years and over. Thirteen patients (3.1%) were determined to be 17 or under. Of those who had occupational accidents, 30.0% were working in construction sector, 20.7% in textile sector and 20.0% in machinery-metal sector. The demographic characteristics of the patients who admitted with an accident at work are presented in Table 1.

When the admission time to the hospital was evaluated, the maximum number of admissions was between 08:00-12:00 hours with a frequency of 34.6% and, of the admissions 30% were between 12:00-16:00 hours. Of the applications 30.2% were due to incision, 29.5% due to crush and 26.8% due to falls. It was determined that upper extremities were the most affected body part due to work accidents. The clinical characteristics of the applicants with regard to occupational accidents were summarized in Table 2.

Of the 410 patients, 84.1% (n=345) were discharged after being treated in the emergency department whereas 13.9% (n=57) patients were hospitalized. Of the patients who were hospitalized, 73.6% were referred to the orthopedics and traumatology clinic, 11.3% to the ophthalmology clinic, 5.6% to the anesthesia intensive care unit, 3.8% to the neurosurgery clinic and 1,9% to the plastic and reconstructive surgery, cardiovascular surgery and urology clinics.

Table 1. Demographic characteristics of the patients who admitted due to an accident at work

Demographic characteristics	Number	Percentage
Age (year)		
25 or under	108	26.3
26-35	145	35.4
36 years and over	157	38.3
Gender		
Male	393	95.9
Female	17	4.1
Sector		
Construction sector	123	30.0
Textile sector	85	20.7
Machinery-metal sector	82	20.0
Service sector	34	8.3
Transport-transportation sector,	20	4.9
Trade-office work	20	4.9
Agriculture and livestock	13	3.2
Energy sector	11	2.7
Other (Food industry, wood carving)	22	5.4

Table 2. Clinical characteristics of the applicants due to occupational accidents

Clinical characteristics	Number	Percentage
Time of admission		
8:00 a.m. - 12:00 p.m.	142	34.6
12:00 p.m. - 4:00 p.m.	123	30.0
4:00 p.m. - 12:00 a.m.	105	25.6
12:00 a.m. - 08:00 a.m.	40	9.8
Reason of complaint		
Incision or rupture	124	30.2
Crushing	121	29.5
Falls	110	26.8
Eye injury	20	4.9
Other[a]	35	8.6
Trauma area		
Upper extremity	193	47.1
Head and neck	99	24.1
Lower extremity	52	12.7
Thorax	28	6.8
Abdomen-pelvis	25	6.1
No trauma	13	3.2

aExplosion-burning, electric shock, poisoning, traffic-service accident etc.

When the forensic reports were evaluated, it was determined that 2% (n=8) of the patients had died due to injury whereas 1.7% (n=7) of the patients had a life-threatening condition and 96.3% of the patients had no risk of death.

The total cost of emergency services invoices of the 410 patients who applied due to occupational accidents to SSI was calculated as 54.152.77 ₺.

A regression tree model was used to determine the factors that affect costs. In the model, examination findings (multi-trauma, corrosive intake, fracture, dislocation, soft tissue injury, amputation, skin cut, tendon cut, vessel cut abrasion), reason of complaint (Incision or rupture, explosion-burning, electric shock, poisoning, traffic-service accident, eye injury, falls, crushing), trauma area (abdomen-pelvis, thorax, lower extremity, head and neck, upper extremity) , prognosis (hospitalisation, exitus, discharged), age, gender and degreee of danger (less dangerous, dangerous, very dangerous). The most important variables in estimating the cost were examination findings, reason of admission, traumatic region, prognosis and age. The effect of danger classification and gender on cost was very limited and insignificant (Figure 1).

Discussion

Occupational accidents are an important public health problem considering both physical and pecuniary damages they cause. Therefore, the aim of our study was to evaluate the clinical

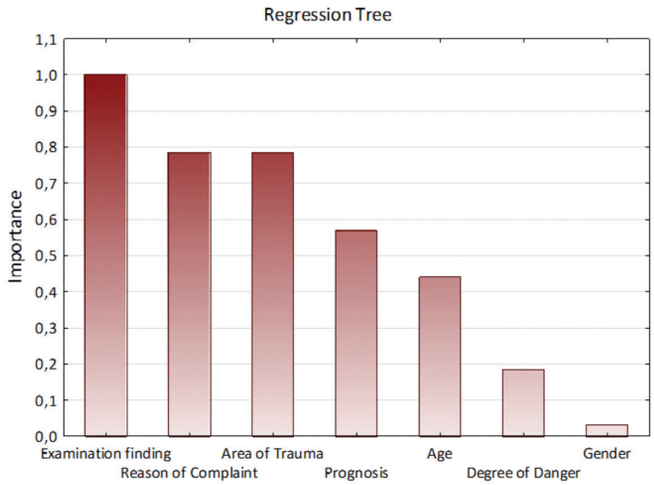

Figure 1. Factors affecting the costs due to occupational accidents (dependent variable: cost)

aspects of occupational accidents along with their emergency service costs.

According to the study of Karakurt et al. (12), 96.5% of the people who had occupational accidents were male and 3.5% were female. In the study of Dagli and Serinken (13) it was found that this rate was 86.4% to 13.7%. In other similar studies, occupational accident rates were found to be higher in males (84.4-98.7%) (14,15). In 2017 SSI data, this ratio was stated as 83.6% for males and 16.4% for females (7). Consistent with the literature, we also found that occupational accidents were more common in men. We consider that the main reason for this is the fact that women do not adequately take place in business life and that they work in less dangerous business areas where physical power is mostly not in the forefront. We also believe that women may act more rigorously than men to comply with occupational health and safety rules.

The distribution of occupational accidents by age groups in Turkey according to the data of SSI in 2016 was as follows: of the occupational accidents, 26.8% were in in people aged 25 and under, 35.3% were in people between the ages of 26-35 and 35.8% were in people who were the age of 36 and over (16). In an analysis that compared the occupational accident data in our country and the European Union, it was stated that the age range where occupational accidents were most common was between 22-29 years in our country and 25-34 years in the European Union (17). In many studies, the average age of those exposed to occupational accidents was found to be between 25 and 32 years and it was determined that the most risky age group in terms of occupational accidents was between 21-30 years of age (15,18-20). In our study, similar results to the data of SSI in 2016 were obtained and occupational accidents were mostly seen at the age of 36 years and over and secondly at the age between 26 and 35 years. As a result of the fact that the young-adult age group employees are more preferred in risk-bearing jobs and the employees of this age group are more likely to take risks during their work, occupational accidents occur in these age groups at a higher rate. In the SSI data, the rate of occupational accidents at the age of 17 years is below 2.2% (16). In our study, this rate was slightly higher (3.1%) and this situation is thought to be caused by the high number of migrant population in our province.

In a study conducted among the cleaning workers in our country, it was reported that the most common type of injury was incision and rupture (21). In another study, the most common type of injury was also incision and rupture and it was shown that this was followed respectively by crushing, falls and traffic accidents (18). In our study, the results were obtained similar to the literature. The most frequent injuries were due to incision and rupture (30.2%), thereafter due to crushing (29.5%) and then due to falls (26.8%). The reasons for the incidence of incision and rupture injuries in occupational accidents can be listed as the lack of compliance with the principles of occupational health and safety and the dependence of the basic labor force on manpower.

In a study conducted by Dagli and Serinken (13), the most frequent occupational accidents were reported as machinery-metal, textile and construction, respectively. In another study, sectors with the highest number of occupational accidents were reported as manufacturing, construction and agriculture, respectively (15). When the SSI data of the year 2016 were examined, it was seen that the construction sector was with the highest number of occupational accidents and that this was followed by the machine-metal sector (16). In our study, the sectors in which the occupational accidents were encountered most frequently were found similar to those of SSI data and were respectively construction, textile and machine-metal sector. These sectorial differences between the studies are thought to be caused by the industrial and commercial activities that are predominant in the province as well as the proximity of the location of the factories to the hospital where the study was conducted. The years when the studies are carried out are also important. Considering that activities related to infrastructure and superstructure in our country have increased rapidly in recent years, it is a foreseeable situation that most of the occupational accident is in the construction sector.

According to the occupational accident data of the Turkish Statistical Institute (TURKSTAT) between the years 2003-2005, it has been reported that occupational accidents occurred mostly within the first 3 hours after the start of the work (22). In a study conducted in our country, it was stated that accidents occur most between 08:00a.m and 16:00p.m (13). The findings our study is concordant to the data of TURKSTAT and the literature. Occupational accidents were determined to be most common between 08:00a.m-12:00 p.m hours. The reason why occupational accidents are more common in the morning is thought to be the result of lack of concentration at the time of start working.

In our study, the most common injury was found to be extremity injury with 59.8% in the cases who applied for occupational accident. It was also determined that the upper extremity (47.1%) was the region that was mostly exposed to trauma. In the data of SSI in 2016, the most frequently injured area was the extremity (57.1%) and the injuries of the upper extremity (38.2%) came first (16). Similar to our study, it has been found that upper extremities were most frequently injured in occupational accidents in our country (12,19,23). In jobs that require skill in all areas of work, the widespread use of upper extremities, particularly hands, has been envisaged as the main cause of this condition.

In a study, the rate of discharge from the emergency department was 90% and the rate of hospitalization was 7% (15). In another study, this rate was found to be 62.9% and 35.6% (19), and in another one 40.7% of the patients were treated as outpatient (24). In our study, the majority of patients were discharged after being treated in the emergency department. It was determined that a small number of the patients were treated by hospitalization. In terms of differences in hospitalization rates, we believe that the number of serious or mild cases is due to the diversity of applications, depending on the distance of the hospitals to the industrial zones and city centers. In most of the studies in the literature, orthopedics clinic is one of the most frequently clinics, where hospitalization is performed (12,19,25). In our study, this situation is similar to the literature and the patients were mostly referred to the orthopedics clinic.

Although more attention is paid to occupational health and safety issues in recent years, deaths related to occupational accidents are still observed. Mortality rates in European Union countries were determined as 0.16% in 2014 and 0.15% in 2015. In our country, the mortality rate in occupational accidents was determined as 0.71%, 0.73%, 0.51% and 0.49% between 2013 and 2016, respectively (17). In addition, in different studies conducted in our country, this rate is stated as 0.95% (12), 4.9% (18), 1% (15) and there are differences between the studies. This rate was found to be 2% in our study and it is similar to the literature studies in our country, but it is higher than the data of SSI. Our clinic is the emergency clinic of a tertiary university hospital, therefore it is the first clinic of choice for the transfer of severe cases by emergency line. We believe that the high mortality rate may be due to this fact. It is also noteworthy that the mortality rate in our country is higher than in the EU countries.

When the literature is examined, there are not enough studies examining the cost analysis in occupational accidents and this issue has been pointed out in our study. The most crucial independent variables in estimating the costs were examination findings, reason of admission, traumatic region, prognosis and age. The effect of danger classification and gender on cost was very limited and insignificant. The total cost of emergency services for the 410 patients who applied due to occupational accidents was calculated as 54,152,77 ₺, which only represents the direct emergency costs to SSI. Considering that 359,653 occupational accidents had occurred in 2017, with an optimistic estimation approximately 48,000,000 ₺ would only be the amount of direct annual emergency costs to SSI due to occupational accidents. When the indirect costs, such as workday loss, court costs, damage to and/or loss of equipment, work interruption, inspection process, mood disorders and rehabilitation costs were taken into account, it would be easily recognized that pecuniary costs caused by occupational accidents is a serious burden for a developing country such as Turkey.

Study Limitations

This study however has some limitations. Firstly, this study included only data of our hospital for occupational accidents which obstructed us to extrapolate the results. Secondly as it is a retrospectively planned study relying on the quality of the medical records, we could not make further estimations regarding costs, particularly the indirect ones. Despite its limitations, we believe that this study may shed light on future studies. We recommend further analytical studies to be conducted especially to address the indirect costs of occupational accidents.

Conclusion

In our country, occupational accidents cause most deaths after traffic accidents and home accidents and they are serious type of accidents which cause the majority of permanent injuries. Occupational accidents, which are an important public health problem, have a significant negative impact on both workers' health and the national economy. Particularly in workplaces classified as dangerous and very dangerous, employees are at risk for accidents that can cause permanent injury and death. Therefore, the occupational health and safety measures required by our legislation must be taken at all workplaces. The main objective should be to establish occupational health and safety culture in employers and employees and to control the risk factors at the source before these accidents occur. Adequate levels of inspections on occupational health and safety at workplaces will lead to a reduction in the number of accidents that may occur and consequently to a decrease in losses.

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Ethics

Ethics Committee Approval: Our study was approved with the decision of the local ethics committee on 25.10.2017 (decision no: 09).

Informed Consent: Retrospective study.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: H.H., C.Ö., Concept: H.H., R.A.O., M.S.G., A.İ.K., Ö.G., Design: H.H., C.Ö., R.A.O., M.S.G., A.İ.K., Ö.G., F.N.Y., M.K., Data Collection or Processing: H.H., C.Ö., R.A.O., M.S.G., A.İ.K., Ö.G., F.N.Y., M.K., Analysis or Interpretation: H.H.,

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