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The journal aims to publish scientifically high quality articles which can contribute to the literature and written in the emergency medicine field and other related fields. Review articles, case reports, editorial comments, letters to the editor, scientific letters, education articles, original images and articles on history and publication ethics which can contribute to readers and medical education are also published.

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Manuscript Types

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Statistical analysis to support conclusions is usually necessary. Statistical analyses must be conducted in accordance with the international statistical reporting standards (Altman DG, Gore SM, Gardner MJ, Pocock SJ. Statistical guidelines for contributors to medical journals. Br Med J 1983: 7; 1489-93). Information on statistical analyses should be provided with a separate subheading under the Materials and Methods section and statistical software that was used during the process must certainly be specified. Data must be expressed as mean±standard deviation when parametric tests are used to compare continuous variables. Data must be expressed as median (minimum-maximum) and percentiles (25th and 75th percentiles) when non-parametric tests are used. In advanced and complicated statistical analyses, relative risk (RR), odds ratio (OR) and hazard ratio (HR) must be supported by confidence intervals (CI) and p values.

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Editorial Comments: Editorial comments aim at providing brief critical commentary by the reviewers having expertise or with high reputation on the topic of the research article published in the journal. Authors are selected and invited by the journal. Abstract, Keywords, Tables, Figures, Images and other media are not included.

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Case Reports: There is limited space for case reports in the journal and reports on rare cases or conditions that constitute challenges in the diagnosis and treatment, those offering new therapies or revealing knowledge not included in the books, and interesting and educative case reports are accepted for publication. The text should include Introduction, Case Presentation, Discussion, Conclusion subheadings. Please check Table 1 for limitations for Case Reports.

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Clinical Imaging / Visual Diagnosis: Images must be typical for diagnosis, and should facilitate rapid diagnosis for emergency medicine and / or should be educational. Except for the header and references, it must consist of maximum 400 words. A maximum of three authors name, six images and five refecences should be included.

History: This type of manuscript explains events related to emergency and general medicine and presents information on the history of diagnosis and treatment of diseases. Historical findings should be a result of relevant research studies. Manuscript should not include sub-headings, should not exceed 900 words and total number of references should be limited to 10.

Publication ethics: This type of manuscript includes current information on research and publication ethics and presents cases of ethics infringement. Main text should not exceed 900 words and total number or references should be limited to 10.

Tables

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

Figures and Figure Legends

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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the submission, the figures too should be blind. Any information within the images that may indicate an individual or institution should be blinded. The minimum resolution of each submitted figure should be 300DPI. To prevent delays in the evaluation process all submitted figures should be clear in resolution and large in size (minimum dimensions 100x100 mm). Figure legends should be listed at the end of the main document.

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.

References

While citing publications, preference should be given to the latest, most up to date publications. If an ahead of print publication is being cited the DOI number should be provided. Authors are responsible for the accuracy of references. Journal titles should be abbreviated in accordance with the journal abbreviations in Index Medicus/ Medline/PubMed (for journal abbreviations consult the List of Journals indexed for MEDLINE, published annually by NLM). When there are 6 or fewer authors, all authors should be listed. If there are 7 or more authors the first 6 authors should be listed followed by "et al". In the main text of the manuscript, references should be cited using Arabic numbers in parentheses. The reference styles for different types of publications are presented in the following examples:

Journal article: Lewin MR, Stein J, Wang R, Lee MM, Kernberg M, Boukhman M, et al. Humming is as effective as Valsalva's maneuver and Trendelenburg's position for ultrasonographic visualization of the jugular venous system and common femoral veins. Ann Emerg Med. 2007;50:73-7.

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.

Editor(s) as author: Norman IJ, Redfern SJ, editors. Mental health care for elderly people. New York: Churchill Livingstone; 1996.

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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.

Manuscripts accepted for publication, not published yet: Leshner AI. Molecular mechanisms of cocaine addiction. N Engl J Med In press 1997.

Epub ahead of print Articles: Sarıtaş A, Güneş H, Kandiş H, Çıkman M, Çandar M, Korkut S, et al. A Retrospective Analysis of Patients Admitted to our Clinic with Aortic Dissection. Eurasian J Emerg Med 2011 Dec 10. doi:10.5152/jaem.2011.035. [Epub ahead of print]

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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Original Articles

Case Report

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Original Article
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Anual Evaluation of "Drug Poisonings, Emergency Service" Studies Published in Pubmed 01.01.2019-01.01.2020

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Abstract

Aim: This study aimed to evaluate studies on drug poisoning and emergency servics published in PubMed between January 2019 and January 2020.

Materials and Methods: The literature review was carried out using the terms "drug poisoning and emergency medicine" in PubMed (http://www.ncbi.nlm.nih.gov/sites/entrez) January 2019 and January 2020. All summaries defined in the searches were reviewed, and suitable studies were selected.

Results: Eighty-five studies were identified in PubMed between January 2019 and January 2020. 28.24% (24) of these studies are retrospective, prospective, and cohort studies and meta-analyses. 56.47% (48) were original studies, of which 20.83% (20) were on narcotic poisoning (opioid, synthetic cannabinoids, cannabis, and heroin), 8.33% (4) were on overdose paracetamol poisoning, 8.33% (4) were on allergic reactions due to drug use, 6.25% (3) were on acute alcohol poisoning, and 56.25% were other original studies. Studies on treating intoxication complications were 15.29%.

Conclusion: According to this annual evaluation, the most common studies on applications in emergency departments and poison centers were original articles on drug poisoning, 56.47%. Retrospective, prospective, and cohort studies and meta-analyses were 28.24%, and studies on the treatment of complications resulting from drug poisoning were 15.29%.

Keywords: Drug poisonings, emergency service, clinical toxicology

Introduction

Poisoning is an important public health problem that causes a major portion of emergency department (ED) admissions and may cause serious consequences to health (1,2). The demographic characteristics of poisoning cases differ in terms of regions and socioeconomic factors (3).

Poisoning events are generally; the use of prescription or non-prescription medication initiated by the patient occurs due to iatrogenic administration of high doses of drugs, accidental exposure to chemicals, or deliberate intake of biological agents for suicide (4). Medicinal drugs are the most encountered (47-86%) agents in poisonings.

Among medicinal drugs, paracetamol, nonsteroidal anti-inflammatory and antidepressants are mostly seen (5-7). Preventable adverse drug events (ADEs) are a common cause of ED visits, hospitalizations and death (8,9). ADEs cause or contribute to one in nine ED visits, and of deaths attributed to medical care, medications are the most common cause (10-13).

Our aim in this study is to evaluate the "drug poisonings and emergency service" studies published in Pubmed between 01.01.2019 and 01.01.2020.

Materials and Methods

The literature review was carried out using the terms "drug poisoning" and "emergency medicine" in PubMed (http://

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www.ncbi.nlm.nih.gov/sites/entrez) between 01.01.2019 and 01.01.2020. All summaries defined in the studies were reviewed and suitable research selected for later review. Toxicity studies; applications to the University Hospital Adult Emergency Service, National, Regional Poison Centers and Poison Control Centers are selected. IBM SPSS version 20.0 program was used for statistical analysis.

Results

Eighty five studies were identified in Pubmed between 01.01.2019 and 01.01.2020 with the keywords "drug poisoning and emergency service". 28.24% (24) of these studies are retrospective, prospective, cohort study, meta-analysis, 56.47% (48) original study and 15.29% treatment of complication (Table 1).

20.83% (10) of 48 original studies narcotic poisoning (opioid, synthetic cannabinoids, cannabis, heroin), 8.33% (4) overdose paracetamol poisoning, 8.33 (4) drug-related allergic reactions, 6.25% (3) acute alcohol poisoning, 56.25% (27) are other original studies (Table 2).

Some of the other original studies 56.25 % (27) "clinical toxicology of beta-blocker overdose in adults, acute deliberate salicylate toxicity, valproic acid toxicity, treatment of caffeine toxicity with metoprolol, central nervous system toxicity due to mefenamic acid, accidental mercury poisoning, the effects of amiodarone prophylaxis on cardiac dysrhythmia in acute aluminium phosphide poisoning, toxic epidermal necrolysis induced by allopurinol, deliberate self-poisoning with a lethal dose of pentobarbital, acute alcohol co-ingestion and hospital-treated deliberate self-poisoning" and similar cases.

15.29 (13) of 85 studies identified in Pubmed as a result of screening are studies to treat complications from poisoning. Some of those; antidote, intraveous lipid emulsion (ILE) therapy in fatal overdose cases, antidotal use of physostigmine for its treatment, the role and effect of brain computed tomography in drug treatment and guidance recommendations, Drug **Compliance Check:** To support drug surveillance clinical rules by applying advanced pharmacotherapy (Table 3).

Table 1. Distribution of poisoning studies types

Types of poisoning studies	**n**	**%**
Retrospective, prospective, cohort studies, meta-analyzes	24	28.24
Original studies	48	56.47
Treatment studies of complications	13	15.29
Total	**85**	**100**

n: Number

Table 2. Distribution of poisoning original studies

Type of original studies	**n**	**%**
Narcotic poisoning (opioid, synthetic cannabinoids, cannabis, heroin)	10	20.83
Overdose paracetamol poisoning	4	8.33
Allergic reactions due to drug use	4	8.33
Cases of acute alcohol poisoning	3	6.25
Other original studies	27	56.25
Total poisoning studies	48	100

n: Number

Table 3. Distribution of treatment studies of complications

Treatment studies of complications	
Antidote; Pharmacologist requires emergency doctors and toxicologists to work together	
Lipid emulsion (ILE) therapy in fatal overdose cases	
Antidotal use of physostigmine for its treatment	
The role and effect of brain computed tomography in drug treatment in drug treatment	
"Drug Compliance Check" (CMA): To support drug surveillance clinical rules by applying advanced pharmacotherapy	
Total studies	**13**

Discussion

Drug poisoning can be either intentional or unintentional and occurs in both young adults and elderly people. Unintentional drug poisoning occurs more often than intentional drug poisoning. Whereas in young adults, the majority of drug poisoning cases is intentional (14-17).

In our study, 85 studies were identified in Pubmed. 28.24% (24) of these studies were retrospective, prospective, cohort studies, meta-analysis, 56.47% (48) original study, and 15.29% complication treatment studies. Some of those; emergency management of deliberate self-poisoning (DSP) by drug overdose is common in emergency medicine. 48 hours cross-sectional study was carried out in 319 emergency medical service (EMS) and emergency services in France. Data from 703 patients (median age was 43 and men was 40%) were analyzed. One hundred and fifteen (16%) patients were attended by an EMS physician. These patients had more severe poisoning as suggested mainly by a lower Glasgow Coma Score and a higher rate of admission to an intensive care unit (18).

Over-the-counter analgesics are often used in suicide attempts. After the suicide attempt between 2009 and 2010 in Montreal, a cross-sectional study using the graphic examination of all individuals who applied to the emergency room of two adult general hospitals. Substances most frequently used were acetaminophen (30%), antidepressants (37%), anxiolytics (30%), opioids (10%), and anticonvulsants (9%) among prescription drugs, and cocaine (10%) among recreational drugs. Accessibility, toxicity and large amounts of unsupervised intake can be facilitators (19).

In a quantitative approach with data analysis of drug-related intoxication cases at the Poison Control Center University Hospital at Londrina State University in Brazil, the data were collected from the service notification records for the period 1985-2014. There was a trend for a higher proportion of cases of drug-related poisonings in males. Also, there was an increased trend towards cases involving analgesics/anti-inflammatories/immunosuppressants, antidepressants and antipsychotics (20).

Acetaminophen (APAP) poisoning, remains a leading cause of morbidity and mortality in developed countries. Time APAP is one of the most commonly used analgesics. The world can result in overdose hepatic injury and death antidotal treatment is delayed. For over 40 years, risk stratification decisions regarding antidotal treatment with N-acetylcysteine have been guided by the Rumack-Matthew nomogram (the nomogram). In a retrospective database analysis, changing nomogram risk zone classification with serial testing after acute acetaminophen overdose. Half of patients after acute APAP overdose cross nomogram risk areas, the current treatment threshold 150 mg/mL 4 hours after swallowing. Old age, male sex, independently of co-ingestants and final liver damage It is associated with a patient who moves to higher-risk areas (21).

Salicylate poisoning is a serious toxicologic problem with a complex pathophysiology. At the start of the session, teams received a 10-minute introduction to the activity. Upon entering a room in a simulated ED, teams had 15 minutes to complete a focused history and physical exam of the patient, interpret arterial blood gas and basic metabolic panel data, and administer treatment based on key findings and a presumptive diagnosis. This simulation exercise was successful in exposing students to the clinical presentation of salicylate toxicity and giving them the opportunity to apply and synthesize basic science knowledge during the scenario (22).

In a retrospective study examining the clinical toxicology of beta-blocker overdose, there was no significant difference in the severity of poisoning among beta-blockers in adults. No deaths were observed in case of overdose beta-blockers and single dose exposure. Other antihypertensives, sedatives or alcohol should be used with caution, and it is stated that death can develop (23).

In the systematic review incidence of mortality due to rebound toxicity in prehospital opioid overdose care: Mortality or serious adverse events in the included studies due to suspected rebound toxicity in patients treatment with naloxone was rare. There was very limited evidence available reporting on adverse events (24).

In retrospective study to assess the association of pregabalin misuse with use of other sedatives and with suicidal self-harm; to compare the characteristics of pregabalin misuse-related harms in people who misuse pregabalin according to whether or not they also used other sedatives. Rates of pregabalin misuse-related ambulance attendances have increased markedly over the past 6 years. Caution is required when prescribing pregabalin for people taking other sedatives. Limiting the dispensing of this drug may reduce the risks associated with its misuse (25).

Cyproheptadine is a serotonin and histamine antagonist that has been suggested as a treatment for serotonin syndrome. An 11-year retrospective review of cyproheptadine use in serotonin syndrome cases reported to the California Poison Control System. The benefits of and indications for cyproheptadine are uncertain and questionable for the management of a serotonin syndrome. Future recommendations on its use should be based on diagnostic criteria, severity of symptoms and management in conjunction with other supportive measures (26).

In a another retrospective cohort study acute alcohol ingestion and when the effect of self-harm was examined in patients treated intentionally with self-poisoning. There was no significant relationship between the coingestion of alcohol in an index DSP and subsequent repeated or suicide (27).

Little is known about the relative harms of edible and inhalable cannabis products. In an observational study examining acute diseases associated with cannabis use by exposure route, visits attributable to inhaled cannabis are more frequent than those attributable to edible cannabis, although the latter is associated with more acute psychiatric visits and more ED visits than expected (28).

In this retrospective analysis of all cases of human exposures (intentional abuse, accidental and unknown circumstances, and suicide attempts) for the period 2002-2016. Poisoning due to substance abuse has changed significantly during the last few years. Therefore, developments of substance abuse reported to the Poisons Information Centre Erfurt were investigated and compared to other circumstances of human exposures during the last 15 years. Clinical significance of substance abuse is shown by the fact that it resulted more often in moderate and severe symptoms than suicide attempts (29).

A cross-sectional observational study examining drug treatment deficiencies as a reason for admission to the intensive care unit in a university hospital. The frequency of drug therapeutic failures in our study was similar to that described in the literature; being the most common cause the inappropriate drug use, particularly for drugs with complex kinetics, such as antiepileptic drugs (30).

Pharmacogenetic relationship between *NAT2* gene polymorphisms and hepatotoxicity from isoniazid: in meta-analysis study. Genetic variants of the *NAT2* gene, plays an important role in hepatotoxicity from isoniazid. Thus, NAT2 genotyping, understanding of drug-enzyme metabolic capacity and helping early predisposition isoniazid-induced hepatotoxicity (31).

Urinary Drug Screening in Acute Drug Poisoning: A Prospective Cross-Sectional Study. In the treatment of patients suspected of acute drug poisoning, the patient's urine is usually performed. In Japan, using common screening kits at the point of care. They evaluated which kit was appropriate. In acute drug poisoning screening, the results are more useful compared to serum drug analysis results (32).

In a retrospective study, the examination of patient characteristics associated with taking home naloxone to an intensive, urban emergency room. Naloxane (THN) kits may be recommended for patients with an overdose of opioids. ED staff use illegal opioids or use a serious overdose because you can potentially benefit from THN, but may miss others who are at high risk for the future, overdose. Hospital EDs, all eligible people Patients at risk of overdose can access THN (33).

In the observational retrospective cohort study, the electronic medical record data of geriatric patients and the safety of parenteral ketorolac use for analgesia management in geriatric ED patients were examined. The respiratory side effects of the central nervous system and opioids have been investigated with a varying approach to optimal ED pain management with opioids in the geriatric population outbreak (34).

In this study physiostigmine and non-antidote treatment have been prospectively investigated in antimuscarinic therapy. Poison centers usually manage patients with antimuscarinic delirium. However, the discussion It surrounds the antidotal use of physostigmine for its treatment. This study provides further evidence of both the safety and efficacy of physostigmine in the treatment of antimuscarinic delirium (35).

Investigation of ILE therapy in fatal overdose cases in an observational study. Within the Association of Poison Control Centers National Poison Data System, hundreds of cases exist in which ILE therapy was given and death occurred. In many of these cases, ILE was given prior to cardiovascular collapse. Although there is some suggestion of transient improvement in a small subset of cases, adverse effects are also reported. When taken in totality, the number of published cases of failed lipid emulsion therapy outnumbers the published instances of ILE success. Given all the uncertainty generated by case reports, the evaluation of the role and efficacy of ILE therapy in non-local anesthetic poisoning needs robust controlled clinical trials (36).

In the study examining the development and characteristics of the Overdose Cohort in British Columbia Canada, hospitalization, doctor visits, poison center and ambulance overdose cases, emergency visits and forensic data were recorded. It is available from multiple sources. 10,456 people were overdosed by 14,292 from January 1, 2015 to November 30, 2016. In ambulance records, only 28% of overdose events were found in multiple data sets of the highest cases (32%). Compared to fatal overdoses, non-fatal events more frequently included women, young individuals (20 to 29 years old) and those 60 or older. 78% of illicit drug deaths had no associated ambulance response. In the year before the first overdose, 60% of individuals had at least one ED visit, 31% had at least one hospital visit, 80% had at least one doctor visit, and 87% had at least one visit in a community pharmacy. It was observed that he filled the prescription (37).

Conclusion

Preventable adverse drug events is an important public health problem that causes a major portion of hospital adult emergency service, national, regional poison centers and poison control centers admissions and may cause serious consequences to health.

Ethics

Ethics Committee Approval: Ethics committe approval is not obtained for studies conducted by examining the studies published in Pubmed.

Informed Consent: Informed consent is not made in studies using pubmed data.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Concept: İ.H.H., N.G., Design: İ.H.H., N.G., Data Collection or Processing: İ.H.H., N.G., Analysis or Interpretation: İ.H.H., N.G., Literature Search: İ.H.H., N.G., Writing: İ.H.H., N.G.

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Evaluation of Clinical and Laboratory Prognostic Risk Factors in Organophosphate or Carbamate-Poisoned Pediatric Patients

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Abstract

Aim: We aimed to determine the clinical and demographic features of pediatric patients monitored at our hospital after organophosphate or carbamate intoxication. Moreover, we aimed to determine the clinical and laboratory indicators that can affect the clinical severity scores and patients' prognosis.

Materials and Methods: We retrospectively analyzed 117 patients, aged less than 18 years and admitted to the pediatric emergency department for organophosphate or carbamate intoxication.

Results: The median age was 56 months (8-226 months), and the male-to-female ratio was 1.72 (74/43). The most frequent cause of intoxication was accidental ingestion (83.8%), and the oral route was the most common (73.5%). The Glasgow Coma Scale (GCS) score and serum pseudocholinesterase level were significantly low in the following groups: patients with a severe grade of intoxication, patients admitted to the intensive care unit, and patients with complications. However, lactate and glucose levels were significantly high in the previously mentioned patient groups ($p<0.001$). The mean range of red cell distribution width was significantly higher in patients admitted to the intensive care unit compared with those monitored in the emergency department ($p=0.029$).

Conclusion: This study shows that GCS score and serum pseudocholinesterase, glucose, and lactate levels at baseline can be helpful in predicting the presence of a serious intoxication and aid in the prognosis of pediatric patients.

Keywords: Organophosphates, carbamates, poisoning, pseudocholinesterase, lactate, children

Introduction

Organophosphates and carbamates, commonly used as pesticides in agricultural fields and industry, are covalent inhibitors of the enzyme acetylcholinesterase (AChE). The easy accessibility of these compounds leads to frequent cases of accidental or suicidal ingestion, especially in developing countries (1,2). According to data from the World Health Organization, approximately 3 million cases of pesticide intoxication occur annually worldwide, and 220,000 of these result in death, though some series have described mortality as high as 25% (3,4). The few studies that have reported on childhood poisoning deaths have found mortality rates between 0% and 8.5% (1,5-8).

Intoxication may occur via inhalation, oral ingestion, and absorption through the skin (1,9,10). Most of the intoxication cases due to ingestion of organophosphates can heal by supportive care and close monitoring. Life-threatening complications and death are rather rare. Many clinical and laboratory prognostic parameters to predict a serious clinical course and a poor prognosis in adulthood age groups have been investigated (11-13).

This study aimed to determine the clinical and demographic features of pediatric patients monitored after organophosphorus or carbamate intoxication in our hospital. We further aimed to determine the clinical and laboratory indicators that may be effective on the clinical severity scores and the prognoses of the patients.

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Materials and Methods

We retrospectively analyzed 117 cases who were younger than 18 years of age and were admitted to the pediatric emergency department for organophosphate or carbamate intoxication. The diagnosis of organophosphate or carbamate intoxication was established if any one of the following criteria were present: 1) self or family report of exposure to insecticides; 2) low serum pseudocholinesterase levels; 3) characteristic signs and findings of organophosphate or carbamate intoxication (sweating, vomiting, myosis, fasciculation, abdominal pain, hypotonia, bradycardia, diarrhea, hypotension, urinary incontinence); and 4) improvement in specific findings provided by atropine and oximes.

The following data for each of the cases were recorded: age, medical history, history of intoxication (ingestion time of organophosphates; cause and route of exposure), accompanying symptoms, clinical findings, and the Glasgow Coma Scale (GCS) score. We also recorded laboratory test results at baseline including: white blood cell count (WBC), hematocrit, hemoglobin, thrombocyte count, mean platelet volume (MPV), red blood cell distribution width (RDW), serum blood urea nitrogen, serum creatinine, serum aspartate aminotransferase (AST), serum alanine aminotransferase (ALT), glucose levels, sodium and potassium concentrations, lactate levels, arterial blood gas levels, and just the pseudocholinesterase levels at 0, 6, 12, 24, 48, and 72 hours. Additional data included electrocardiogram (ECG) findings, administered therapies, duration of the hospital stay at the hospital ward and intensive care unit, the need for endotracheal intubation and mechanical ventilation, and treatment outcomes.

The cases were grouped as patients with mild, moderate, and severe toxicity according to Dreisbach's classification (Appendix 1) (14).

Statistical Analysis

All parameters were analyzed with the Statistical Package for the Social Sciences (SPSS) software, version 21.0 (SPSS Inc., Chicago, IL, USA). Control of the normal distribution of data was made with Shapiro-Wilks tests. All categorical variables are represented as numbers and percentages, whereas numerical variables are displayed as mean ± standard deviation and median (minimummaximum). The values of patients were analyzed with Mann-Whitney U tests. A p-value of <0.05 was considered statistically significance. Receiver-operating characteristic curves for predicting the severity were generated from the data. Sensitivity and specificity were also calculated for glucose, GCS, lactate levels, RDW, and pseudocholinesterase levels.

Appendix 1. Dreisbach's classification showing severity of poisoning

Grade	Symptoms
Mild	Nausea, vomiting, diarrhoea, sweating
Moderate	Lacrimation, salivation, miosis, fasciculation
Severe	Incontinence, apnoeic spells, acute respiratory distress syndrome, areflexia, seizures, coma

Results

The median age of the cases was 56 months (8-226 months) and the male/female ratio was 1.72 (74/43). The most frequent causes of intoxication were accidental ingestion (83.8%) and oral ingestion (73.5%). Of all of the cases, 88.9% were exposed to organophosphorus or carbamate compounds in rural areas. The mean duration until admission to our hospital was 5.79±7.94 hours (0.5-72 hours). However, 47.9% of the cases were admitted to the hospital within the first 4 hours. The most common treatment applied in the patients' homes was washing (19.7%), while the most frequent intervention in the first admitted health facility was gastric lavage (59.8%). The demographic and clinical characteristics of the patients are presented in Tables 1 and 2.

The most frequent complaints in the cases for admission to the emergency department were nausea and vomiting (47.8% and 41%, respectively), while the most commonly detected physical examination finding in the emergency department was myosis (17.1%). According to evaluations of the cases based on states of consciousness, 94 (80.3%), 11 (9.4%), 5 (4.3%), and 7 (6.0%) were conscious, lethargic, in a stupor, and comatose, respectively. The complaints and findings of the patients are presented in Table 2.

According to patient evaluations in accordance with the Dreisbach's classification, 78.6% were in the group with mild-moderate grade intoxication. Respiratory failures, convulsions, and arrhythmias developed in 10 (8.5%), 4 (3.4%), and 3 (2.5%) of the cases, respectively (Table 2).

The GCS score and levels of pseudocholinesterase were significantly lower in the following groups: in the patient group with severe grade intoxication, in cases admitted to the intensive care unit, and in those with complications. However, lactate and glucose levels were significantly higher in those patient groups ($p<0.001$) (Tables 3 and 4).

Hyperglycemia was detected in 28 (23.9%) cases, whereas hypoglycemia was not observed in any of the patients. Hyponatremia, hypopotassemia, acidosis, and high levels of AST and ALT were encountered in 36 (30.7%), 15 (12.8%), 41 (35%), 4 (3.4%), and 3 (2.6%) of the patients, respectively.

Table 1. Demografic findings	
Gender, n (%)	
Male	74 (63.2)
Female	43 (37.8)
Cause of poisoning, n (%)	
Accidental	98 (83.8)
Suicide	19 (16.2)
Route of exposure, n (%)	
Ingestion	86 (73.5)
Inhalation	10 (8.5)
Skin	5 (4.3)
Multiple	16 (13.7)
Place of exposure, n (%)	
Rural	104 (88.9)
Urban	13 (11.1)
Duration between exposure and first medical intervention (hour), n (%)	
0-4 hour	56 (47.9)
5-8 hour	39 (33.3)
>8 hour	22 (18.8)
Pre-hospital applications, n (%)	
In home	
Bathe	23 (19.7)
Yoghurt feeding	15 (12.8)
Drink of milk	15 (12.8)
Induction of vomiting	11 (9.4)
In hospital	
Skin decontamination	62 (53.0)
Gastric lavage	70 (59.8)
Activated charcoal	51 (43.5)
Pralidoxime	3 (2.6)
Atropine	8 (6.8)
Treatment modalities in PEU, n (%)	
Skin decontamination	59 (50.4)
Gastric lavage	59 (50.4)
Activated charcoal	51 (43.5)
Both atropine and pralidoxime	13 (11.1)
Atropine only	2 (1.7)
Mechanical ventilation	8 (6.8)
Observation time (median, min-max)	
Outcomes, n (%)	24 (5-2880)
Observation in PEU	95 (85.4)
Admitted to PICU	17 (14.5)
Out of the hospital at his own request	5 (4.2)
Recovery with sequelae	1 (0.9)
Mortality	1 (0.9)
PEU: Pediatric emergency unit, PICU: Pediatric intensive care unit, min: Minimum, max: Maximum, n: Number	

Table 2. Clinical findings	
Dreisbach's classification, n (%)	
Mild-moderate	92 (78.6)
High	25 (21.4)
Glaskow Coma Score, n (%)	
GCS ≤8	18 (15.4)
GCS (9-12)	9 (7.7)
GCS (13-15)	90 (76.9)
Complication, n (%)	
Respiratory failure	10 (8.5)
Convulsion	4 (3.4)
Aritmia	3 (2.5)
Cardiac arrest	2 (1.7)
Shmic pneumonia	1 (0.9)
Parasthesia	1 (0.9)
Signs and symptoms, n (%)	
Vomiting	56 (47.9)
Nausea	48 (41.0)
Miosis	20 (17.1)
Tachycardia	13 (11.1)
Salivation	12 (10.3)
Respiratory failure	10 (8.5)
Urinary retention	9 (7.7)
Headache	7 (6.0)
Hypotension	5 (4.2)
Fever	5 (4.2)
Seizures	4 (3.4)
Arrhythmia	2 (1.7)
Hypothermia	2 (1.7)
Paresthesia	1 (0.9)
Bradycardia	1 (0.9)
Abnormal laboratory, n (%)	
pH	41 (35.0)
Sodium	35 (29.9)
Glucose	28 (23.9)
Potassium	15 (12.8)
AST	4 (3.4)
ALT	3 (2.5)
ALT: Alanine aminotransferase, AST: Aspartate aminotransferase, n: Number	

Table 3. The comparison of poisoned patient's severity according to demographic and laboratory findings			
	Mild-moderate (n=92)	**Severe (n=25)**	**p**
Demografic findings			
Age* (m)	55.5 (8-213)	65 (19-226)	0.489
Male/female (ratio)	64/28	10/15	0.013
GCS*	15 (13-15)	8 (3-15)	<0.001
SBP* (mmHg)	100 (70-150)	100 (50-140)	0.853
Body temperature* °C	36.4 (36-38.3)	36.5 (35-38.5)	0.327
Laboratory findings			
PChE level* (mg/dL)	7,689 (140-13414)	1,833 (106-10295)	<0.001
Lactate level* mmol/L	0.77 (0.33-1.61)	1.66 (0.38-3.11)	<0.001
WBC count* (cells/mm^3)	11,540 (4,900-26,800)	14,030 (2,500-29,360)	0.099
MPV* (fL)	7.4 (5.7-13)	7.8 (6.4-11.5)	0.159
RDW* (%)	14.6 (11.8-20.7)	15.3 (12.2-19.1)	0.178
Blood glucose* (mg/dL)	100 (69-278)	178 (75-735)	<0.001
Sodium* (mEq/L)	136 (124-143)	135 (128-143)	0.193
pH*	7.37 (7.27-7.54)	7.33 (6.79-7.45)	0.013
HCO_3 mmol/L	20.4 (7.40-25.70)	19.8 (7.10-27.80)	0.075

*Median (min-max).
GCS: Glasgow Coma Scale, SBP: Systolic blood pressure, PChE: Pseudocholinesterase, WBC: White blood cell, MPV: Mean platelet volume, RDW: Red distrubution width

Table 4. The comparison of patients admitted to emergency service and intensive care unit according to demographic and laboratory findings			
	Emergency service (n=100)	**Intensive care unit (n=17)**	**p**
Demografic findings			
Age* (m)	58 (8-213)	51 (19-226)	0.802
Male/female (ratio)	66/34	8/9	0.220
GCS*	15 (3-15)	9 (3-15)	<0.001
SBP* (mmHg)	100 (50-150)	100 (50-140)	0.789
Body temperature* °C	36.5 (35-38.3)	36.4 (35-38.5)	0.848
Laborotory findings			
PChE level* (mg/dL)	7,602 (130-13414)	1,007 (106-4267)	<0.001
Lactate level* mmol/L	0.77 (0.33-2.38)	0.94 (0.55-3.11)	0.002
WBC Count* (cells/mm^3)	11,890 (2,500-29,360)	14,030 (6,800-28,300)	0.347
MPV* (fL)	7.5 (5.7-13.0)	7.6 (6.4-8.9)	0.786
RDW* (%)	14.6 (11.8-27.2)	15.4 (12.2-19.1)	0.029
Blood Glucose* (mg/dL)	102 (69-278)	196 (75-735)	<0.001
Sodium* (mEq/L)	136 (124-143)	135 (128-143)	0.193
pH*	7.36 (7.16-7.54)	7.34 (6.79-7.43)	0.104
HCO_3 mmol/L	20.3 (7.40-27.80)	19.0 (7.10-26.20)	0.043

*Median (min-max).
GCS: Glasgow Coma Scale, SBP: Systolic blood pressure, PChE: Pseudocholinesterase, WBC: White blood cell, MPV: Mean platelet volume, RDW: Red distrubution width

There were no significant differences with respect to atrial blood pressure, fever, and levels of WBC, MPV, RDW, sodium, and HCO_3 between the severe intoxication group and patients who were monitored as admitted in the intensive care unit or detected to suffer complication and the group with mild-moderate intoxication and patients who were monitored in the emergency department or without complications. The mean RDW levels were significantly higher in the patient group admitted to the intensive care unit compared with the group monitored in the emergency department (p=0.029) (Table 4).

Whole body washing with plenty of soap and water after clothing removal was performed in the 59 patients suspected of becoming intoxicated through the skin. Gastric lavage was performed in the 59 (50.4%) patients who experienced intoxication via the oral route and admitted to our hospital within the first hour, and 51 (43.5%) patients were administered active charcoal. Atropine and pralidoxime sulphate were administered in 15 (12.8%) and 23 (19.6%) patients with muscarinic signs, respectively. Atropine was provided for 30.0±70.9 hours and the total dose range was 0.2-25 mg. Pralidoxime sulphate was provided for 26.2±72.6 hours with a total dose range of 25-175 mg.

All of the patients were monitored as admitted. Intensive care unit admissions comprised 14.6% of the cases. The median admission duration of the patients in the pediatric intensive care unit and hospital were 24 and 72 hours, respectively. Complications developed in 21 (17.9%) patients. Cardiopulmonary arrest developed in two (1.7%) cases and one (0.9%) of those patients died.

Discussion

Organophosphates and carbamates are commonly used worldwide. Intoxication caused by ingestion of these compounds due to ineffective regulatory control of their sale and easy availability is an important community health issue, especially in developing countries (2).

Organophosphate compounds may cause intoxication via several routes including transdermal, inhalation, transmucosal, and the gastrointestinal system (2). Studies conducted on childhood age groups have reported intoxication rates via oral ingestion and the respiratory route as 61-88.4% (2,7,15) and 11.5%, respectively (16). In our study, rates of intoxication via oral ingestion and the respiratory tract were 72.6% and 8.8%, respectively. The intoxication rate via multiple pathways was 13.7% in our study.

As an interesting feature of our study, one case was intoxicated via a self-intramuscular injection. A 5x5-cm scar formation secondary to the injection was present on the arm.

The frequent findings due to muscarinic receptor stimulation are myosis, bradycardia, bronchospasms, bronchorrhea, increased salivation, lacrimation, nasal discharge, sweating, vomiting, diarrhea, and urinary incontinence (2). Zwiener and Ginsburg (6) reported in their retrospective study on 37 children aged 1 month to 11 years that the most common findings were myosis, salivation, decreased muscular strength, and lethargy, while tachycardia developed in 49% of patients. The most frequent findings of another study were diarrhea, vomiting, and myosis with rates of 100%, 96%, and 89%, respectively. Dippenaar et al. (15) have determined the most frequent signs as pin-point pupils in 78% of patients and excessive increases in secretions. In our study, the most common findings were vomiting, nausea, and myosis in 56 (47.9%), 48 (41%), and 20 (17.1%) cases, respectively.

Many clinical and laboratory indicators such as the GCS score, systolic blood pressure, body mass index, Acute Physiology and Chronic Health Enquiry (APACHE) II score, serum cholinesterase level, amylase level, total leukocyte count, RDW, C-reactive protein, creatine phosphokinase, blood pH, and prolonged QT on ECG have been tested to predict clinical courses in adult cases with acute organophosphate intoxication (11-13).

Studies have demonstrated that GCS scores are effective in predicting potential outcomes in organophosphorus intoxication (17). Bilgin et al. (18) compared the effectiveness of GCS, APACHE II, and the Simplified Acute Physiology Score (SAPS) II in predicting the mortality risk in patients with organophosphorus intoxication and reported that these three scoring systems provided similar outcomes. However, they determined that the GCS was more easily applicable and superior to other scoring systems since it does not require laboratory and complicated physiological parameters (19). Grmec et al.'s study (20) reported that GCS is a predictive indicator in estimating respiratory failure and mortality rate. Our findings were similar to those in the literature with regard to the fact that GCS can be used as a prognostic factor in predicting serious intoxication, development of complications, and the need for treatment in the intensive care unit.

Previous reports suggest that symptoms and findings of the respiratory system (bronchorrhea, bronchospasm, and weakened respiratory muscles) and central nervous system (an altered state of consciousness and seizures) have an important place in predicting mortality rates (2,21). The essential determinants of mortality are respiratory failure and tissue hypoxia as the common result of involvement of both systems (2,19-21).

Many controversial studies on the relationship between the severity of intoxication and plasma AChE levels have been reported (22). There are many studies that have indicated there is no association between patients' clinical conditions at

baseline and enzyme cholinesterase levels in organophosphate intoxications (1-2,15). Chen et al. (23) have reported that the absence of an elevation in AChE levels within 48 hours after treatment for organophosphate intoxication is associated with a high mortality rate. Manu et al. (24) have reported in their study on patients followed-up after organophosphate intoxication that serial measurements of serum AChE levels may be helpful in predicting the duration of mechanical ventilation, the duration of stay in the intensive care unit, and the prognosis. The outcomes of our study make us consider that the serum pseudocholinesterase level at baseline can be used as an indicator in predicting serious intoxications and treatment needs in the intensive care unit in pediatric patients.

Lactate is a byproduct of anaerobic metabolism and is accepted as an indicator of tissue hypoxia (25). It has been emphasized that serum lactate levels may be helpful as a predictive indicator. Trzeciak et al. (26) found that in a study of 100 patients that lactate levels over 4 mmol/L are highly specific in predicting mortality. Shapiro et al. (27) have reported that moderate and high-grade elevations in lactate levels lead to 2.2-fold and 7.1-fold increases inmortality risk, respectively. In the current study, we found that serum lactate levels were effective in predicting the need for treatment in the intensive care unit, the development of complications, and serious intoxication findings in the patients. Also, the baseline lactate level of the patient who became exitus was 3.1 mmol/L in our study.

Serum glucose levels of the patients with organophosphorus intoxication have been investigated in various studies (28). It has been considered that hyperglycemia develops due to catecholamines secreted from the adrenal medulla (29-31). It has also been reported that there is a relationship between the severity of intoxication and serum glucose levels, and that glucose levels of the exitus cases were higher than those of survivors (29-31). Floris Levy-Khademi et al. (5) declared a median glucose level of 130.5 mg/dL in their retrospective study of 31 children who were between 0.8 years and 12 years of age. Lifshitz et al. (16) have noted an increase in serum glucose levels (155-280 mg/dL) in 23 of 26 cases. In our study, we found that serum glucose levels were significantly increased in those patients who were admitted to the intensive care unit and revealed findings of serious intoxication.

RDW is a hematological index that indicates varying size distributions of erythrocytes (32). In the studies conducted in recent years, high RDW levels have been shown to be associated with poor prognoses in various pathological conditions including heart failure, acute coronary syndrome, pulmonary embolism, and pancreatitis (33-35). The action mechanisms for elevated RDW levels have not been identified yet. However, it has been reported that a deformation of erythrocyte membranes due to acute or chronic inflammation may occur (35). Similarly, acute inflammation and oxidative stress, which are observed in organophosphate intoxication, may cause changes in the size and structure of circulating erythrocytes (36). A clinical trial found that RDW levels do not change in the patients with intoxication due to ingestion of low doses of organophosphates (37). Another study reported that RDW levels are an easy-to-use and valuable parameter in predicting the prognosis of patients poisoned with organophosphates (36). In our study, the mean RDW levels were significantly higher in the patient group who needed intensive care unit treatment compared to those who did not need this treatment.

Intoxication due to the ingestion of organophosphorus or carbamate compounds are serious situations that require early diagnoses and rapid treatments. The accepted treatment protocol involves decontamination, prevention of absorption, general supportive treatment, and pharmacological therapy (1,3). Early detection of respiratory failure, early intubation, and mechanical ventilation are life-saving factors. El-Naggar et al. (2) have reported that they performed gastric lavage in 39 (83%) cases while they used activated charcoal in all of the children who were intoxicated via the oral route. Lifshitz et al. (7) have reported that gastric lavage and activated charcoal were used in all of the children intoxicated via the oral route. In our study, 59 (51.8%) cases were washed, and gastric lavage and activated charcoal were provided in 59 (50.4%) and 51 (43.5%) cases of the 85 patients poisoned via the oral route, respectively.

Atropine is a competitive antagonist of the muscarinic acetylcholine receptors in the central and peripheral nervous systems. High doses of atropine may be needed depending upon the severity of the clinical status. The maximum dose within a 24-hour period is 10-12 mg (2,3). Pralidoxime is the most commonly used oxime worldwide and shows its effect by activating the enzyme cholinesterase on all the muscarinic and nicotinic receptors, which are under cholinergic effect and in the central nervous system (2,3). Dippenaar and Diedericks (15) have declared that they administered only atropine in 48% of cases, whereas they used both atropine together with a single dose of obidoxime in 39% of cases. El-Naggar et al. (2) have stated that they administered only atropine in 47.4% of cases, however, they used both atropine and a single dose of obidoxime in 59.7% of cases. In our study, atropine and pralidoxime were administered in 15 (13.2%) and 23 (20.2%) cases, respectively.

Only atropine was administered in two cases, whereas only pralidoxime was administered in 10 cases. Atropine and pralidoxime were administered together in 13 cases.

El-Naggar et al. (2) have detected that complications developed in 36% of cases. They reported the development of aspiration pneumonia, convulsions, and septic shock in 10.6%, 10.6%, and 2% of patients, respectively. Lifshitz et al. (7) have declared that pulmonary edema developed in 11.5% of patients. Dippenaar and Diedericks (15) reported that convulsions developed in 4.3% of patients. It has been detected in studies conducted on childhood age groups that the rate of requiring mechanical ventilation was 5.7-17.3% (2,7,15). In our study, the complication rate was 17.9%. The most frequent complications were compromised respiration, convulsions, and arrhythmias. Mechanical ventilation was needed in 10 (8.5%) cases.

Mortality rates of 1.9%, 4.3%, and 8.5% were reported in studies that were conducted in the childhood age groups (2,7,15). In our study, one (0.9%) patient was discharged with a sequela and one (0.9%) patient became exitus while the other patients completely recovered.

The main limitation of our study as one of the largest pediatric case series was that it had a retrospective study design and only pseudocholinesterase levels of the patients were tested.

Conclusion

The outcomes of our study helped us to conclude that the GCS score and serum AChE, serum glucose, and serum lactate levels at baseline can be helpful in predicting the presence of a serious intoxication and aid in the prognosis in pediatric cases. Thus, there is a need for further prospective studies to be conducted on larger case series.

Ethics

Ethics Committee Approval: Retrospective study

Informed Consent: Retrospective study

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The Effect of Blood Glucose Value on the Short-term Mortality of Acute Ischemic Stroke

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Abstract

Aim: This study aimed to examine the relationship between short-term mortality and blood glucose values (BGV) obtained during the first week of ischemic stroke, when neurological causes, such as increased intracranial pressure, are mainly predominant in mortality prediction.

Materials and Methods: This is a retrospective study that includes 417 patients with acute ischemic stroke (AIS), who were admitted to our hospital within the first 24 hours of the stroke. Data were recorded using the International Classification of Diseases Code. On the first, third, fifth, and seventh days of the stroke, the effect of BGV on the patient's functional outcome was evaluated.

Results: Of 417 patients, 90 (21.58%) died within a one-month follow-up period. There was no difference between the mortality and survival groups in terms of diabetes mellitus (DM) history ($\chi 2=0.783$; $p=0.224$). On the first, third, fifth, and seventh day of the stroke, BGV were significantly higher in the mortality group (130.5 mg/dL, 124.5 mg/dL, 133.5 mg/dL, and 132.5 mg/dL, respectively, according to the receiver operating characteristic analysis) than in the survival group ($p<0.05$). BGV of the fifth day (133.5 mg/dL) was an independent predictor for mortality (hazard ratio: 3.001; 95% confidence interval (1.43-6.3); $p=0.004$), while BGV of the other days were dependent on a coma scale.

Conclusion: Hyperglycemia predicting short-term AIS mortality might be a DM-independent stress hyperglycemia. Although hyperglycemia is predominantly a coma-scale-dependent [modified Rankin Scale (mRS)] predictor during the first week of blood glucose monitoring, BGV of the fifth day may be an independent predictor of short-term mortality.

Keywords: Glucose, stroke, mortality, outcome

Introduction

Cerebrovascular disease is a clinical syndrome characterized by sudden onset of focal or generalized loss of cerebral function, and lasting more than 24 hours or resulting in death, which is due to vascular causes. It takes the first place among morbidity causes and the second place among mortality causes. Mortality rate in cerebrovascular disease is about 20% (1). Atherosclerosis, the most important cause of ischemic stroke, is a chronic inflammatory process. For preventing or reversing this process, treatments of risk factors such as hypertension, diabetes mellitus (DM), coronary artery disease (CAD), smoking, and obesity have been included in the guidelines. The prevalence of stroke is 500-600/100,000 in Caucasian populations (1). Currently, there are many clinical studies aiming to decrease the frequency, mortality and morbidity of stroke by controlling these risk factors.

DM increases the risk of stroke by 2-6 times (2-5) and DM is responsible for 5% of all strokes (6). Therefore, blood glucose value (BGV) control is very important to protect the patient from stroke. Despite all these primary protection efforts, stroke incidence is 1-2/1,000 (1). Acute ischemic stroke (AIS) period is a different period from chronic vascular atherosclerotic inflammatory processes. Ischemic neuron deaths and liquefaction necrosis accompanied by an inflammatory process develop within minutes depending on the size and location of the occluded vessel in the brain tissue, which is very sensitive to ischemia. Metabolic

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stress caused by extensive clinical findings, ranging from mild hemiparesis to deep coma, suggests that we need to be more careful in controlling the primary risk factors during this period. There is conflicting information in literature regarding these effects of BGV control and DM history on the mortality and morbidity in acute-term ischemic stroke (7).

The aim of this study is to examine the relationship BGVs of first week with short-term mortality in patients with acute ischemic stroke.

Materials and Methods

This is a hospital-based retrospective study. Four hundred and seventeen patients with AIS were screened between 2010 and 2015. Patients admitted within the first 24 hours of stroke were included in the study. Exclusion criteria were given in the flow chart (Figure 1).

Study protocol

All patients were screened using the International Classification of diseases, 10th revision code "G46.0-2" from the database of the hospital's electronic record system. Four hundred and seventeen patients met the criteria. Clinical and demographic characteristics of the patient were obtained from the archive records of the patient. Glasgow coma scores (GCS) and the modified Rankin scores (mRS) were recorded. BGVs on the 1st, 3rd, 5th and 7th days were determined from biochemistry records. GCS is between 3-15 points (15, normal: 3, worst), mRS is between 0-5 (0, normal: 5, worst). The hospital mortalities of the patients were obtained from the medical records. Patients, who were discharged from the hospital before 30 days, were determined from the outpatient clinic records or contacted by the telephone.

Statistical Analysis

Data were analyzed using SPSS software (version 15.0;SPSS Inc, Chicago, IL) and presented as mean (±) standard deviation or median (95% confidence interval). "Kolmogorov-Smirnov test" was used as normality test. "Student t-test" was used for parametric comparisons between the two groups, and "Mann-Whitney U test" for nonparametric comparisons. χ^2 test was used for comparison of categorical data. Receiver operating characteristic (ROC) analysis was used to define areas the areas under the curve (AUC), sensitivity, and specificity,

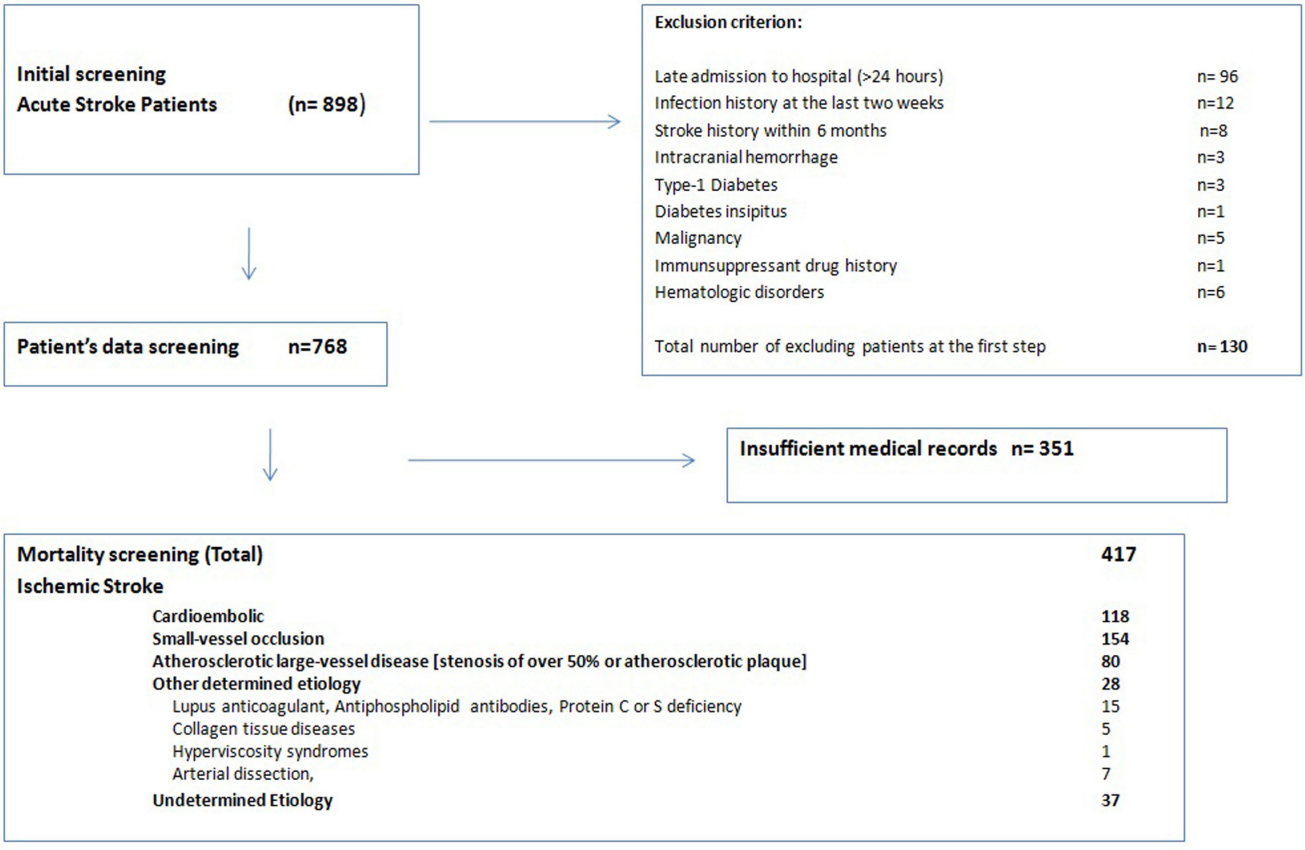

Figure 1. Flow chart of the study

positive and negative predictive values. "Kaplan-Meier" survival analysis was performed according to ROC estimation of BGVs. Cox regression analysis was performed to determine independent predictive risk factors for mortality. For the mortality analysis, two models were used to observe whether or not the coma score (mRS) effects on the variables. Model 1 includes coma scale (mRS), glucose and risk factors such as hypertension, DM, CAD, triglyceride, while model 2 includes only glucose and risk factors (hypertension, DM, CAD, and triglyceride). $P<0.05$ was considered statistically significant.

Results

Four hundred and seventeen patients with a mean age of 67.39±13.0 were included in the study. The demographic and clinical characteristics of the patients are shown in Table 1. The mortality rate during the 30-day follow-up was 21.58 (n=90). BGVs and HbA1c values are shown in Table 1 on the 1st, 3rd, 5th and 7th days of admission. Age, stroke history, hypertension, CAD were significantly higher in the mortality group. The mRS and the white cell count taken at admission, and the 1st, 3rd, 5th and 7th day BGVs were significantly higher in the mortality group, whereas HbA1c, triglyceride and hemoglobin values were significantly lower. Although hemoglobin and HbA1c values were significantly lower in the mortality group, these two parameters were neglected in further analyzes because the values were very close to each other and were within normal range (Table 1). Since there was no significant difference between the mortality and survival groups in terms of DM history (χ^2 =0.783, p: 0.224).45.3% (n=199) of all patients had hyperglycemia (>7 mmol) on the first day-blood glucose measurements [23.5% (n=103) with DM history and the remaining 21.8% (n=96) without DM history].

In ROC analysis of these 1st, 3rd, 5th and 7th day BGV's, blood glucose predictive values for mortality were 130.5 (AUC: 0.612); 124.5 (AUC: 0.618); 133.5 (AUC-B1: 0.630); 132.5 mg/dL (AUC: 0.652), respectively (Figure 2). Kaplan-Meier survival curves according to the 1st and 5th day predictive values are presented in Figure 3. It was found that the 5th and 7th BGVs below the threshold value were more sensitive and specificity than the others in the predicting of mortality, and cox regression models were applied. In the Model-1 analysis including mRS in the Cox regression analysis, the 5th day BGVs was an independent predictor, but the others (the 1st, 3rd and 7th days) were not. In the Model-2 analysis without mRS, the high BGVs according to their predictive value at all times were independent predictors of mortality (Table 2, 3). In addition, CAD and low triglyceride value were independent predictors of mortality.

Discussion

The DM history in stroke patients is about 10-20%, and hyperglycemia has been reported in 5-32% of patients with no history of DM in post-stroke hyperglycemia (8-10), which is similar to our results. 45.3% of all patients had high blood glucose concentration (23.5% of them were previously diabetics and the remaining 21.8% nondiabetics) in our study.

The mechanism of the increased glucose concentration in AIS is not fully understood. The first hypothesis is glucose intolerance or undiagnosed DM, the second is due to neurological diseases, and the third is to respond to the increased stress (8,11). In addition, Rosso et al. (12) emphasized that hyperglycemia worsened the transformation of the penumbral area into the infarct.

The literature and our results pointed out that type-2-DM has no effect on the severity of ischemic stroke (8,11,13-15). Stead et al. (16) also reported that hyperglycemia leads to clinical deterioration in AIS, which is worse in non-diabetic patients than in diabetics. O'Neill et al. (11) reported that hyperglycemia is a predictor of poor prognosis as a result of multiple samples taken on days 1, 3, 7, 14, 30 and 90. In the Second European Cooperative Acute Stroke Study (ECASS-II), BGVs above 140 mg/dL in nondiabetic patients within 24 hours after stroke was reported to be an independent predictor of 90-day poor functional outcome (17).

Despite the above literature, some reports suggest that stress hyperglycemia is not effective on the functional outcome of AIS, and it is suggested that the related studies do not include clinical severity in the analysis (7,18,19). Szczudlik et al. (8) reported that one-year periodic follow-up of hyperglycemia was not an independent predictor of 1-year mortality.

Prognosis studies are mostly examined the single BGVs at admission. There are a few studies in the literature regarding to periodic glucose follow-up (8,11), but the predictive value of BGV in the AIS short-term mortality is not clear yet in literature. The reason of speculative results may be that the acute stroke period, especially first a week, has not been examined in detail. Neurological problems are at the forefront among the causes of mortality in the first week. The most important mortality reason in this period is the increased intracranial pressure caused by severe brain edema. The maximum brain edema period is the first 3-5 days, and then clinic outcome gradually improves, because intracranial pressure gradually decreases. Therefore, the first week blood glucose monitoring was performed in patients with AIS in the study, and it was suggested that the 5th and day 7th day values might be more valuable for mortality. In particular,

Table 1. Demographic and laboratory findings of the patients			
	Surviving (n=327)	**Dead (n=90)**	**p**
Age, (mean SD)	65.97, 13.12	72.88, (10.96)	**<0.001**
Sex (female, %)	41.3%	54.4%	0.059
Diabetes mellitus (%)	36.1%	31.1%	0.224
Stroke history (%)	27.9%	67.8%	**<0.001**
Hypertension (%)	57.9%	76.7%	**0.001**
CAD (%)	12.8%	34.4%	**<0.001**
Drugs			
Antihypertensive	57.9%	76.7%	**<0.001**
ASA	5.4%	9.0%	0.219
Clopidogrel	2.6%	3.3%	0.717
Coumadin	5.7%	8.9%	0.330
Oral antidiabetic	13.7%	4.4%	0.016
Insulin	7.1%	5.6%	0.815
Statin	4.9%	4.1%	0.06
AF	9.2%	4.4%	0.06
WBC (103/mL), (median, 95% CI)	9.1 (4.0)	11.8 (6.2)	**<0.001**
Hgb (median, 95% CI)	13.25 (1.9)	12.7 (3.3)	**0.008**
Platelet (median, 95% CI)	234.0 (97.5)	230.0 (82.3)	0.319
CRP (median, 95% CI)	16.3 (25.0)	56.3 (70.5)	**<0.001**
Sedimentation (median, 95% CI)	20.0 (21.75)	25.5 (39.5)	**0.006**
Glucose -1 (mg/dL), (median, 95% CI)	120.0 (67.0)	139.0 (79.5)	**0.001**
Glucose -3 (mg/dL), (median, 95% CI)	112.0 (63.0)	137.0 (71.0)	**0.003**
Glucose -5 (mg/dL), (median, 95%CI)	116.0 (66.0)	146.5 (74.8)	**0.003**
Glucose -7 (mg/dL), (median, 95% CI)	117.5 (64.3)	148.5 (120.3)	**0.001**
HbA1c	6.5 (2.7)	6.35 (0.45)	**<0.001**
Creatinine, mg/dL, (median, 95% CI)	0.90 (0.3)	1.0 (0.57)	0.052
Total cholesterol, mg/dL (mean ± SD)	174.0 (45.04)	163.0 (39.5)	0.111
Triglyceride (mg/dL) (median, 95% CI)	120.0 (83.0)	90.0 (53.2)	**<0.001**
LDL (mg/dL), (median, 95% CI)	106.0 (46.0)	104.2 (54.0)	0.336
HDL (mg/dL) (median, 95% CI)	36.0 (12.0)	41.0 (17.59)	**0.037**
Glaskow coma score (median, 95% CI)	15.0 (1.0)	10.0 (5.3)	**<0.001**
Modified Rankin score (median, 95% CI)	2.0 (3.0)	5.0 (1.0)	**<0.001**

CAD: Coronary artery diseas, ASA: Asetylsalisilic acid, AF: Atrial fibrillation, WBC: White blood cell, Hg: Hemoglobin, CRP: C-reactive protein, LDL: Low density lipoprotein, HDL: High density lipoprotein, SD: Standard deviation, CI: Confidence interval, n: Number

the 5th day BGV (133.5 mg/dL) was found to be an independent predictor of mortality, which may be due to the period in which brain edema gradually decreases or co-incidence. The other 1st ,3rd ,7th day BGV'es were dependent to coma score (mRS) (Table 2,3). Kılıc et al. (20) also examined temporal hyperglycemia on the prognosis of AIS in Anatolian region, but they examined the single BGV at admission on the AIS outcome, and their study hasn't got multivariate analysis. They suggested that hyperglycemia had a negative effect on AIS.

The European stroke organization guideline stressed the need to adjust blood glucose concentrations above 10 mmol (180 mg/dL) by titrating with insulin (21). The American stroke association guideline emphasized the necessity of insulin treatment when it exceeded 140-185 mg/dL (American Society of Anesthesiologists).

The Shine study suggested the need for a target blood glucose concentration of 80-130 mg/dL (22). For blood glucose upper limit, Capes et al. (18) declared 126 mg/dL in their meta-analysis, and Ntaios et al. (23) reported an upper limit of 7.3 mmol (131.4 mg/dL), which are consistent with our results. In our study, a threshold value of blood glucose is about 130 mg/dL for mortality in acute ischemic stroke patients.

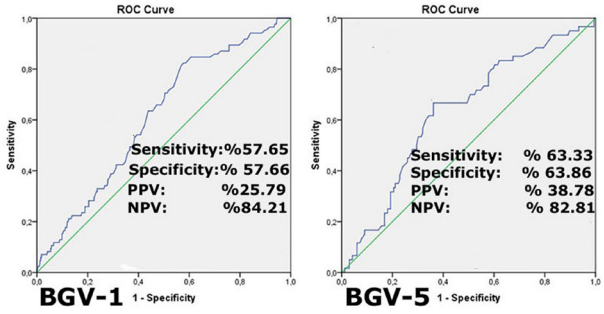

Figure 2. 1st and 5th days blood BGVs in the ROC analysis

BGV: Blood glucose value, ROC: Receiver operating characteristic

Study Limitations

Metabolic stress markers such as catecholamine and steroid values, the effect of insulin, body mass indexes are not recorded. The study had to exclude so many patients (about 40% of the cases) due to not enough information. A single-center study is also among the limitations of our study.

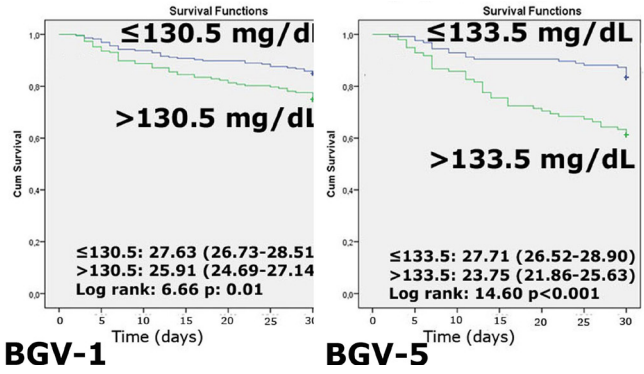

Figure 3. Kaplan-Meier survival curves according to the 1st and 5th day predictive values.

BGV: Blood glucose value

Table 2. Cox regression results for the predictors of mortality

1st day	**Model 1 HR (95% CI)**	**p**	**Model 2 HR (95% CI)**	**p**
HT	2.160 (1.09-4.27)	0.027	2.504 (1.26-4.96)	0.009*
DM	1.518 (0.76-3.04)	0.238	1.828 (0.92-3.63)	0.084
CAD	2.868 (1.57-5.24)	0.001	3.200 (1.77-5.79)	<0.0001*
TG	0.989 (0.98-0.995)	0.001	0.986 (0.98-0.995)	<0.0001*
BGV (1): >130.5 mg/dL	1.748 (0.977-3.13)	0.060	**2.189 (1.23-3.91)**	**0.008***
mRs	2.559 (1.84 - 3.55)	<0.0001*	-	-
3rd day	**HR (9% CI)**	**p**	**HR (95% CI)**	**p**
HT	1.914 (0.89-4.14)	0.099	2.581 (1.21-5.51)	0.014*
DM	1.380 (0.66-2.88)	0.390	1.776 (0.85-3.71)	0.127
CAD	2.258 (1.13-4.53)	0.022	2.115 (1.07-4.19)	0.032*
TG	0.99 (0.98-1)	0.005	0.989 (0.98-1)	0.001*
BGV (3): >124.5 mg/dL	1.566 (0.81-3.01)	0.179	**2.272 (1.19-4.35)**	**0.013***
mRs	2.473 (1.69-3.62)	<0.0001*	-	-

HT: Hypertension, DM: Diabetes mellitus, CAD: Coronary artery diseases, TG: Triglycerides, Blood glucose value, mRs: Modified Rankin scores, HR: Hazard ratio, CI: Confidence interval *: independent predictor of stroke mortality in Cox regression mode

Table 3. Cox regression results for the predictors of mortality

5th day	Model 1 HR (95% CI)	p	Model 2 HR (95% CI)	p
HT	1.662 (0.78-3.53)	0.187	1.877 (0.88-4.01)	0.104
DM	2.022 (0.93-4.41)	0.077	2.764 (1.28-5.97)	0.010*
CAD	2.206 (1.08-4.49)	0.029	2.475 (1.23 - 5)	0.012*
TG	0.987 (0.98-0.995)	0.002	0.984 (0.98-0.995)	0.000*
BGV (5): >133.5 mg/dL	**3.001 (1.43-6.3)**	**0.004***	**4.699 (2.32-9.5)**	**<0.0001***
mRs	1.767 (1.18-2.64)	0.006	-	-
7th day	**HR (95% CI)**	**p**	**HR (95% CI)**	**p**
HT	1.613 (0.74-3.5)	0.227	1.754 (0.8-3.82)	0.158
DM	1.382 (0.62-3.08)	0.428	1.834 (0.83-4.05)	0.134
CAD	2.607 (1.27-5.34)	0.009	2.826 (1.41-5.68)	0.004*
TG	0.99 (0.98-0.995)	0.010	0.988 (0.98-0.995)	0.003*
BGV (7): >132.5 mg/dL	1.854 (0.88-3.89)	0.103	**2.775 (1.36-5.66)**	**0.005***
mRs	1.869 (1.24-2.82)	0.003	-	-

HT: Hypertension, DM: Diabetes mellitus, CAD: Coronary artery diseases, TG: Triglycerides, Blood glucose value, mRs: Modified Rankin scores, HR: Hazard ratio, CI: Confidence interval

Conclusion

This is the short-term outcome study with a first-week-blood glucose monitoring in the acute ischemic stroke. Hyperglycemia without DM history during this period might be related to metabolic stress. Presented results show that patients die has higher glucose levels, but only on the 5th day the level of glucose is an explanatory factor. mRS, is as expected, has during all the period demonstrate higher predictive value. The 5th-day- BGVs may be an independent predictor for short-term ischemic stroke mortality, which coincides with the period when brain edema begins to decrease.

Ethics

Ethics Committee Approval: This study was approved by Necmettin Erbakan University, Meram Faculty of Medicine, Pharmaceuticals and Medical Devices Ethics Committee (decision no: 2019/1942, date: 21.06.2019).

Informed Consent: Retrospective study.

Peer-review: Externally peer-reviewed.

Authorship Contributions

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

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The Effectiveness of Routine Cranial Computerized Tomography in the Evaluation of Facial Bone Fractures

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Abstract

Aim: This study aimed to investigate the ability of routine cranial computed tomography (CT) to detect facial bone fractures, taking the maxillofacial, orbital, and temporal bones CT as reference.

Materials and Methods: Patients who presented to the emergency department with head trauma and undergoing cranial CT were included in the study. Cases in the study group were also assessed using at least one of maxillofacial, orbital, or temporal CT.

Results: Fracture was present in 155 patients who were examined by maxillofacial, orbital, or temporal CT. Moreover, 59 patients had a single fracture and 96 had more than one fracture. Fractures were determined completely and accurately in 71 patients using cranial CT. Cranial CT successfully provided the fracture diagnosis in 48 of 96 patients with multiple fractures, but all fracture lines in these patients were not shown. Eleven patients were reported as having false-positive results. The effectiveness of cranial CT was presented as a sensitivity of 45.8%, specificity of 93.1%, positive predictive value of 86.6%, negative predictive value of 63.8%, and kappa value of 0.39. Cranial CT identified 11 of 21 temporal, 33 of 50 nasal, 27 of 35 zygomatic, 3 of 4 occipital, 8 of 17 ethmoid, and 19 of 23 frontal bone fractures.

Conclusion: CT assists in the detection of small, non-displaced fractures at the temporal, maxillofacial, and orbital bones owing to its advantages such as having thin slice thickness, use of a bone algorithm, and ability to reformat images.

Keywords: Emergency department, fractures, maxillofacial injuries, multidetector computed tomography

Introduction

Trauma is a significant public health problem and one of the main causes of death in individuals under 40, in particular. Cerebral hemorrhage is significant in patients with general body trauma in terms of both its prevalence and fatal outcomes. The etiology of head trauma includes traffic accidents, accidents at work, violence, sports injuries and falls (1). Moreover, the prevalence of etiological factors varies depending on societies and sociocultural differences. For example, motor vehicle accidents predominate in developing countries and violence in developed countries (1,2). Cerebral hemorrhage and accompanying fractures in facial bones are common in these patients.

The priority is to prevent mortality due to cerebral injury, function impairment due to facial injuries and cosmetic problems. Mortality may rarely be seen and is primarily associated with hemorrhaging, foreign bodies and airway obstruction (3). Cranial computed tomography (CT) and, more rarely, magnetic resonance imaging are used to assess cranial trauma. Facial osseous structures, such as the orbital, temporal and maxillofacial bones, can also be assessed by cranial CT. However, cranial CT may be insufficient due to factors such as slice thickness, imaging angle and imaging area. For this reason, maxillofacial, orbital and temporal bone CT images are frequently employed. In this study, we investigated the capacity of cranial CT to identify facial bone fractures by using maxillofacial, orbital and temporal bone CT as a reference.

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Materials and Methods

The study population was selected from among patients presenting to the emergency department due to trauma and was assessed using cranial CT. Additionally, 314 patients assessed with at least one of a temporal bone, orbital or maxillofacial CT were enrolled in the study. Insufficient image quality was regarded as an exclusion criterion. All patients were evaluated by two radiologists, the first of whom reported orbital, temporal bone and maxillofacial CTs, while the second, blinded to those results, reported cranial CT.

The temporal, orbital and maxillofacial CT results were adopted as a reference, and the ability of cranial CT to detect bone fractures was evaluated. Approval was granted by our hospital's ethical committee. Furthermore, statistical analysis was performed using SPSS 19.0 software. Descriptive data were expressed as mean, standard deviation, minimum, maximum, percentage and frequency values. Comparisons between groups were performed using the Kruskal-Wallis and Mann-Whitney U tests for constant variables and the chi-square test for categoric variables. Moreover, the Cohen kappa statistical method was used to assess agreement between radiological methods.

Imaging Protocol

All patients were evaluated with a 4-multidetector CT scanner (Toshiba®Asteion TSX-021B) without intravenous or oral contrast media. CT imaging was performed according to the routine protocol employed in our hospital, with the removal of metal objects capable of causing artifacts, such as hair clips, earrings, and so on. The imaging field at maxillofacial CT comprised the mandible in the inferior aspect and the frontal sinus in the superior. The imaging protocol consisted of a slice thickness of 2 mm, 150 mA and 120 kV. Thin-slice axial source images and coronal-sagittal multiplanar reformation images were evaluated in the bone and soft tissue algorithm.

Axial images at orbital CT were obtained parallel to the orbitomeatal line. The imaging protocol consisted of a slice thickness of 1 mm, 80 mA and 120 kV. Cranial CT was performed from the foramen magnum as far as the vertex at a slice thickness of 8 mm in the supratentorial region and 4 mm in the infratentorial region, and at 200 mA and 120 kV.

Temporal bone CT was performed between the beginning of the mastoid air cells and the superior margin of the petrous bone, parallel to the infraorbital line, and in the bone algorithm. Parameters of a slice thickness of 1 mm, 120 kV and 150 mA were employed. No contrast media was used in any case during imaging.

Results

The mean age of the 314 patients in the study, consisting of 91 women (29%) and 223 men (71%), was 41.15-21.19 years. All patients underwent at least one of a maxillofacial, orbital or temporal bone CT in addition to cranial CT. Fractures were determined in 155 patients (49.4%) upon CT examination of the facial bones, while 159 (50.6%) patients were normal. A single fracture was present in 59 of the patients with fractures, and multiple fractures were present in 96. Additionally, 71 patients with fractures were reported fully and accurately with cranial CT, while 36 were misdiagnosed as normal. While fractures were determined in 48 of the 96 multiple-fracture patients, not all fracture lines could be displayed. False positivity was reported in 11 patients. The ability of cranial CT to reveal the presence of fractures and reveal all fractures accurately and completely is as follows: sensitivity, 45.8%; specificity, 93.1%; positive predictive value (PPV), 86.6%; negative predictive value (NPV), 63.8%; and kappa value, 0.39. The effectiveness of cranial CT for facial fractures is presented in Table 1.

In terms of location, fractures in the temporal bone were present in 21 patients. This was correctly identified in 11 patients upon undergoing cranial CT, while false negativity was present in 10, and two cases were incorrectly reported as having fractures (Figure 1)

Thirty-three of the 50 patients with nasal bone fractures and 27 of the 35 with zygomatic fractures were reported correctly with cranial CT. False positivity in the zygomatic and nasal bones was present in one patient each at cranial CT. Fractures in the maxilla was present in 42 patients, 27 of whom were reported correctly, while fractures could not be shown in 15, and false positivity was present in three patients. Thirty patients had orbital fractures, which were displayed in 18 of these patients with cranial CT, while false positivity was present in two patients. Five of the 14 patients with sphenoid fractures were reported correctly, while false negativity was present in nine and false positivity in one. Three of the four patients with occipital fractures (Figure 2), eight

Table 1. The effectiveness of cranial CT in the patient with fracture (n=155)

Fracture (completely and accurately, n)	71
False positivity (n)	11
Sensitivity (%)	45.8
Specificity (%)	93.1
Positive predictive value (%)	86.6
Negative predictive value (%)	63.8
Kappa value	0.39

CT: Computed tomography, n: Number

of the 17 with ethmoid fractures, and 19 of the 23 with frontal fractures were reported correctly. The sensitivity, specificity, PPV and NPV values for cranial CT fracture locations are presented in Table 2.

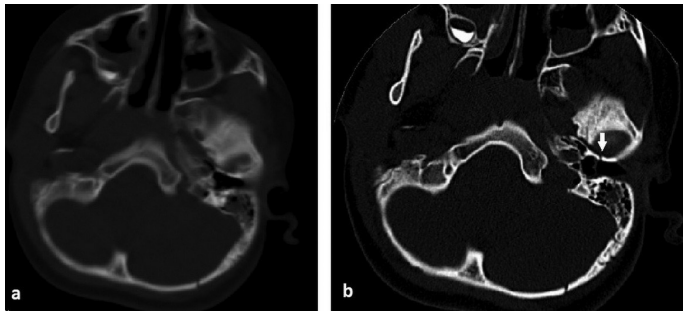

Figure 1. Axial non-contrast cranial (a) and temporal bone CT (b). Axial high-resolution multi-detector CT image of the temporal bone reveals a fracture on the anterior wall of the external auditory canal

CT: Computed tomography

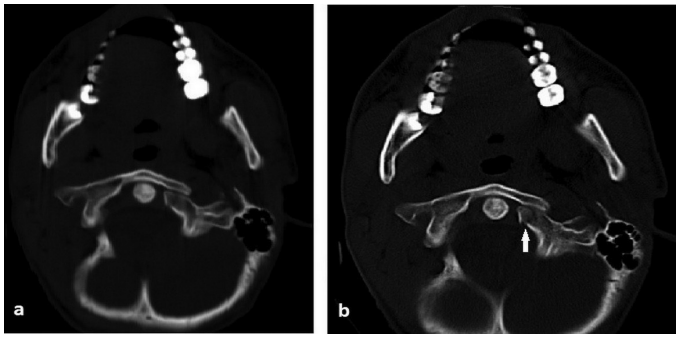

Figure 2. Cranial (a) and maxillofascial (b) axial CT images from skull base. A fracture line is present on the left occipital condyle

CT: Computed tomography

Discussion

Facial trauma and fractures are significant health problems resulting in economic losses due to their high incidence. Facial fractures are not often life-threatening, though complications include impairment of functions, such as sight, hearing and smell, and esthetic problems (3,4). The incidence of complications increases in high-energy trauma and complicated fractures. One study reported life-threatening injuries such as hemorrhagic shock or airway obstruction in facial trauma with an incidence of 6.2% (5).

The etiology of trauma varies among countries and even in different sociocultural regions within the same country (1). The mean age in the study by Shah et al. (6) was 33.7 years. Meanwhile, Sohns et al. (7) observed sex distributions of 36% in females and 64% in males. The mean age in our study was 41.15 years, with a sex distribution of 91 females (29%) and 223 (71%) males, which aligns with the previous literature. Factors such as the use of fast vehicles, dangerous sports activities and physical violence affect the variation in terms of age and sex. In addition, given that the facial bones and paranasal sinuses are not fully developed in children, the small volume of their facial bones and the flexibility of the facial structures suggest that facial fractures are less common in children (8).

Since fractures were detected in only 155 of the 314 subjects who underwent facial CT in this study, this suggests that maxillofacial CT was requested unnecessarily in approximately half of the patients. However, fractures could be detected in only 119 of the 155 fracture patients using cranial CT, and false positivity was diagnosed in 11 patients. While fractures were shown in 48 of the 96 patients with multifractures, not all fractures' lines were detected. Cranial CT exhibited 45.8% sensitivity, 93.1% specificity

Table 2. Fracture locations and the effectiveness of cranial CT

Cranial CT results							
Localization	**Fracture (n)**	**Fracture**	**Sensitivity (%)**	**Specificity (%)**	**PPV**	**NPV**	**Kappa**
Nasal	50	33	66	99.6	97.1	93.9	0.75
Maxilla	42	27	64.3	98.9	90.0	94.7	0.71
Zygomatic	35	27	77.1	99.6	96.4	97.2	0.84
Orbita	30	18	60.0	99.3	90.0	95.9	0.69
Frontal	23	19	82.6	100	100	98.6	0.89
Temporal	21	11	52.4	99.3	84.6	96.7	0.62
Ethmoid	17	8	47.1	100	100	97.1	0.62
Mandible	14	2	14.3	99.7	66.7	96.1	0.22
Sphenoid	14	5	35.7	99.7	83.3	97.1	0.48
Occipital	4	3	75	100	100	99.7	0.85

CT: Computed tomography, PPV: Positive predictive value, NPV: Negative predictive value, n: Number

and a kappa value of 0.39 for facial fractures. Therefore, these results indicate that cranial CT is insufficient when potential complications are considered. Additionally, because maxillofacial trauma is painful and the area of trauma is edematous, physical examination is insufficient and additional imaging is essential.

The most common sites of fracture in this study were, in descending order, the nasal bone, maxilla, zygomatic bone and orbital bone. Various previous studies have reported inconsistent findings in terms of fracture prevalence. For example, Sohns et al. (7) reported that fractures in the orbito-zygomatico area and maxilla fractures were more common, while Hwang and You (9) maintained that fractures were most prevalent in the nasal bone.

The nasal bone was also the most common site in our study. Deformities and nasal obstructions in nasal trauma can be determined through physical examination. Old fractures, vascular structures and suture lines yield false positive results upon radiography, while cartilaginous injuries yield false negative results (10). We were unable to identify 17 of the 50 patients with nasal fractures using cranial CT. The slice thickness affects the inability to identify nasal fractures, even though the nasal bone enters the imaging field.

Twenty-seven of the 42 patients with maxillary fractures and two of the 12 patients with mandibular fractures were reported correctly with cranial CT. The numbers of patients diagnosed with false positive fractures in these two sites at cranial CT were three and one, respectively. All the mandibular fractures could not be identified, and 8 of the 15 maxillary fractures were outside the cranial CT imaging field. Indirect findings, such as fluid inside the sinus or the presence of air contiguous to the sinus are suggestive of fractures, particularly in fractures affecting the maxillary sinus. Therefore, fractures involving the maxillary sinus are frequently accurately identified. Shah et al. (6) investigated the efficacy of three-dimensional computed tomography in the diagnosis of maxillofacial fractures. They compared their study findings with those of Baek et al. (11) and attributed the resulting discrepancies in the determination of undisplaced fractures to slice thickness (6). We were unable to identify seven of the maxillary fractures, though inside the cranial CT imaging field, these were undisplaced in character. This supports the assertion of Shah et al. (6).

Orbital trauma is frequently accompanied by multiple organ trauma. The second most common form of fractures, after blunt orbital fractures, is “blow-out” fractures. Compression fractures may be observed in the lamina papyracea that constitutes the medial wall of the orbit. Injuries to the dura occasionally accompany orbital roof fractures (12). Ophthalmological evaluation is limited by the presence of soft tissue swelling and pain. Radiological imaging is particularly important for diagnosis, and the gold standard imaging technique is orbital CT. A slice thickness (0.5-1.25 mm) and the presence of coronal and sagittal reformatted images in additional to axial plane images increase the diagnostic effectiveness. Kim et al. (13) compared orbital fractures in young and elderly patient groups. They reported that medial wall fractures were common in the non-elderly group, while lateral wall fractures were common in the elderly group. Eighteen of the 30 orbital fractures and 27 of the zygomatic fractures (n=35) in our study were reported correctly at cranial CT. Coronal and sagittal reformatted images at orbital CT were particularly helpful in revealing fractures within the orbital floor and roof. Small compression fractures in the lamina papyracea that could not be revealed at cranial CT were identified with 1 mm thin slices at orbital CT.

Nineteen of the 23 patients with frontal fractures and three of the four patients with occipital fractures were shown correctly with cranial CT. The occipital fractures that could not be detected had nondisplaced character in the craniocervical junction. Similarly, non-detected frontal fractures were small and undisplaced. The temporal bone is one of the strongest bones, and fractures occur with severe trauma. Fractures are more common in cavities through which large vessels and nerves pass and in weak points containing mastoid cells. Fractures in the temporal bone are known to occur in 14-22% of patients with skull fractures (14,15). Radiography and conventional tomography are insufficient for evaluation. Only half of the temporal bone fractures are reported to be capable of detection using cranial CT (16). Fractures can be detected to a significant extent with high resolution CT with a slice thickness of 1 mm and a bone algorithm. Additionally, transverse fractures can be identified more easily in sagittal images and longitudinal ones on coronal images (17). In our study, 52.3% of temporal fractures were identified correctly and fully with cranial CT, which aligns with the literature.

Study Limitations

This study had some limitations. In particular, the 4-detector tomography device used served as a leading limitation. We believe that that reliability could be increased in similar studies with new-generation multi-detector computed tomography devices.

Conclusion

Fractures in the body of the maxilla and mandible cannot be detected at cranial CT, since they lie outside the imaging field. Temporal, maxillofacial and orbital CT offer many advantages in the detection of small undisplaced fractures, including a thin slice thickness, bone algorithm and reformatted image.

Ethics

Ethics Committee Approval: The study was approved by the Rectorship of Çanakkale Onsekiz Mart University Deanship of the Faculty of Medicine Clinical Researches Ethics Committee (decision no: 2011-KAEK-27/2017-E.16899, date: 06.03.2017).

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Simulation Based Endotracheal Intubation Education for Residents of Pediatrics

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Abstract

Aim: Endotracheal intubation is an important element of cardiopulmonary resuscitation. Gaining adequate experience with endotracheal intubation during pediatric residency is important. Our clinic initiated a simulation-based endotracheal intubation training for pediatric residents. This study aimed to evaluate the success of our endotracheal intubation training.

Materials and Methods: Residents received two programs of the simulation-based endotracheal intubation training at 1 year apart. Success rates were compared in terms of endotracheal intubation performance.

Results: Intubation success rates after the first and second programs were 80% (28/35) and 100% (35/35), respectively, and the difference was significant (χ^2=7.667, p=0.006). The mean durations of successful endotracheal intubation in both programs were 14.14±4.16 sec and 8.22±3.58 sec, respectively. Intubation durations in the second program were significantly lower than those of the first (p<0.01).

Conclusion: In this study, the simulation based-endotracheal intubation training, which was performed 1 year apart using high-fidelity manikins, increased the success rate of endotracheal intubation attempts and shorten the intubation time.

Keywords: Simulation, education, endotracheal intubation, pediatric residents, manikins

Introduction

Endotracheal intubation is one of the important steps of cardiopulmonary resuscitation (1). It is necessary to have an adequate experience for endotracheal intubation during pediatric residency, since the anatomy of the respiratory tract of children is different from adults and the majority of pediatric cardiopulmonary arrests are due to respiratory failure. Therefore, the curriculum of a pediatric residency includes endotracheal intubation training both theoretically and practically (2).

The need for endotracheal intubation is decreasing day by day due to the increase in the quality of health services and the development of non-invasive respiratory support facilities. Practical education cannot be provided adequately during the residency due to ethical problems, decreased intubation requirement, and increase in the number of residents (3).

Simulation based education (SBE) may play an important role to overcome this inadequacy. SBE is used in endotracheal intubation training because it creates a safe environment for acquiring technical skills, and the procedure can be repeated many times without the concern of harming the patient (4). In our clinic, simulation based endotracheal intubation educations are given regularly by using high fidelity simulators in a course program by faculty members of department of pediatrics.

In this study, we aimed to evaluate the success of this training program by comparing the results of two consecutive training sessions made with the same residents in terms of endotracheal intubation performance.

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Materials and Methods

The study included 35 residents who participated in simulation-based endotracheal intubation training at a tertiary university hospital. Endotracheal intubation education was prepared in accordance with the standards stipulated by the faculty education program. Program starts with a didactic lesson in which endotracheal intubation indications, types and steps of intubation are explained. After this theoretical briefing the participants are watched a real endotracheal intubation video made with a videolaryngoscope. At the end of the course, endotracheal intubation was performed practically on a high-reality simulator manikin under the supervision of a faculty member of department of pediatrics.

In this study, practical endotracheal intubation education was performed on a high-fidelity manikin (VEVOR PVC intubation manikin®), which is capable of simulating trachea, esophagus, lungs and stomach, and warns with sound when appropriate intubation is performed. The time between handling the blade of laryngoscope and inserting the intubation tube was measured. The American Academy of Pediatrics has reported that successful endotracheal intubation should be completed in less than 20 seconds (5). Accordingly, successful intubation criteria were accepted as placing the tube in the appropriate position in the trachea, completing the procedure before 20 seconds, and ventilating both lungs equally. If the first attempt was not successful, the manikin was ventilated with a balloon mask. Failure criteria were determined as intubation of the esophagus and ventilation of single lung. The same training process and measurements were made to all pediatric residents after one-year interval. All participants were given feedback after intubation attempts. Practical training was led by three faculty members of department of pediatrics. The results of the training were evaluated by the same people.

Statistical Analysis

Statistical analyses were performed with Statistical Package for the Social Sciences (SPSS, Ver 20) package program. Data were presented as mean ± standard deviation and percentile. Paired sample t-test was used to compare intubation procedure times, chi-square test for comparison of success rates, one-way ANOVA test was used to compare success rates and intubation times with the duration of residency. P-value <0.05 was taken for statistical significance.

Results

The study included 52 pediatric residents in the first program and 58 in the second. The number of residents attending to both programs was 35. We compared results of these 35 participants. Of the 35 participants, 20 were male and 15 females.

The distribution of the residency duration of the participants during the first program were as follows; 17,1% were in the first year, 31,4% in the second year, and 51,4% in the third year.

Intubation success rates were 80% (28/35) at the end of the first program and 100% (35/35) at the end of the second. Endotracheal intubation success rate of the residents after the second program was found to be (100%) higher than the success rate of first education (80%) which was statistically significant (χ^2=7.667, p=0.006).

The mean endotracheal intubation times of the residents who attended both programs were calculated. The mean time of successful endotracheal intubation in the first and second programs were 14.14±4.16 sec and 8.22±3.58 sec, respectively. Intubation times in the second program were found to be significantly lower than the first (p<0.01).

There was no statistically significant difference between groups among intubation success rates and years of seniority (p>0.05).

Discussion

Because the majority of childhood cardiopulmonary arrests develop as a result of respiratory failure, pediatricians must be able to manage airway successfully (2,6). Successful endotracheal intubation for cardiopulmonary arrest directly affects many systems, especially neurological functions of children (3). Theoretical and practical lessons about airway management are provided during the training of pediatric residency. As the number of children who need advanced airway support decreases each year, the number of patients undergoing endotracheal intubation also decreases. This situation causes the pediatric residents to have insufficient experience in airway management (7,8). Today, SBE are successfully being used in pediatric residency to overcome this lack of experience (9,10). This study showed that simulation-based endotracheal intubation education with high-reality manikins increased intubation success and shortened intubation time.

SBE has been on the agenda for a long time in business areas such as the aviation, nuclear power industry and medical education. Simulation based advanced airway management training is frequently used because it provides a safe training environment and unlimited repetition of training (11).

Providing advanced airway support for pediatric patients, is one of the important responsibilities of pediatric specialist in our country. Therefore, gaining the ability of providing advanced airway is important for residents of pediatrics' professional

development. In the study of Kendirli et al. (12) it was reported that the intubation success increased after training with manikins in the pediatric advanced life support course. In our study, it was also determined that the success of intubation increased as a result of simulation based endotracheal intubation education (12). These two studies were conducted in the same country. The reason why our study resulted in a similar way to the study of Kendirli et al. (12) may be that pediatric residents worked under similar conditions.

Nishisaki et al. (13) reported that simulation-based airway education did not affect endotracheal intubation success. It was noteworthy that a respiratory support team consisting of healthcare professionals in various branches was responsible for advanced airway support at their centers (13). In our country, providing advanced airway support for pediatric patients is among the primary duties of pediatric residents (12). The reason why this study's results differ from our study, may be that the advanced airway procedures were not primarily in the responsibility of residents of pediatrics in the mentioned study.

In the study conducted by Miller et al. (14) the intubation times were compared at the end of the second education that was carried out three months after the first education. When intubation times were examined at the end of these two trainings, there was no statistically significant difference. In our study, statistically significant difference was found between intubation times after first and second programs. The residents managed endotracheal intubation faster in the second program (14.14 sec vs 8.96 sec). This result may be related to the one-year interval for the second program in our study and residents might have the chance to practice entotracheal intubation on patients during this time period.

In the study of Campbell et al. (15) in which they used high and low fidelity simulators, the mean intubation time was reported to be 179 sec with high fidelity models and 268 sec with low fidelity models. The longer mean time in this study than our's may be due to the fact that the study was conducted on family medicine residents who had no experience of child endotracheal intubation. All of the participants in our study were residents of pediatrics. Since some of our participants were senior pediatric residents, the intubation times in our study may have been shorter than that study.

Study Limitations

Our study had some limitations. The first is that pre-test has not been performed for endotracheal intubation success before training. The second is that the factors other than education, which affect the ability of residents to perform endotracheal intubation, cannot be evaluated within a year between two training sessions. And the third is the low number of participants in both programs.

Conclusion

In our study, it was found that SBE, which were performed one year apart through high-fidelity manikins, increased the success of endotracheal intubation. It was also determined that these educations shorten the time for residents of pediatric to perform intubation. Gaining intubation skills is related to the psychomotor field of learning. The most effective method to acquire this skill in the pediatric residency process is intubation in the real patient and in case of real need. The low number of pediatric cases requiring intubation leads to the failure of every pediatric resident to use this method. For this reason, it is important to reinforce this skill by using high-fidelity simulators. More prospective, randomized controlled studies should be conducted in this area.

Ethics

Ethics Committee Approval: It was obtained from Ethics Committee of Necmettin Erbakan University Meram Faculty of Medicine Ethical Researches Non-Pharmaceuticals and Medical Devices (decision no: 2020/2502, date: 22.05.2020).

Informed Consent: Written and verbal consent was obtained from all participants for the study.

Peer-review: Externally peer-reviewed.

Authorship Contributions

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

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Evaluation of Specialty Training Level of Emergency Medicine Residents

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Abstract

Aim: This study aimed to determine the quality perceptions and factors affecting emergency medicine specialty training using a questionnaire answered by emergency department (ED) residents.

Materials and Methods: This study was conducted at the ED between February 2019 and June 2019. ED residents working at state universities, foundation universities, and educational research hospitals were included in the study. The first three survey questions aimed to reveal the characteristics of the participants. Other questions were focused on the application and practice of residency.

Results: Three hundred thirty-six residents were included in this study. 85.1% of the residents worked at public universities. Two hundred and fifty (74.4%) participants declared that they had between four to six instructors. 96.3% stated that training meetings were held every week, 32.2% stated that education was adequate, and 85.9% did not apply for a resident exam in their clinics. While there was a difference between patient care ($p=0.006$) and research ($p<0.001$) in the departments or institutions that received training, there was no significant difference in terms of education ($p=0.238$). When the numerical adequacy of the educational staff was evaluated, the quality perceptions of the educational staff and the education received in the institution affected each other ($p<0.001$).

Conclusion: It was concluded that a standard residency program was needed and the capacity, infrastructure characteristics, and training staff of the training institutions should be reviewed and properly regulated.

Keywords: Emergency medicine, medical education, resident

Introduction

Specialty training in medicine is an organized and comprehensive training program offered to the specialty training student (resident and research assistant) under guidance and supervision. The adequacy of the training period, rotation programs in subjects that are lacking, and underachieved are the elements that enrich the quality of the training. Feedback on trainers and residents is also a very important part of the training (1). In the studies, the factor affecting residency training was divided into two groups: factors directly related to training (such as instructor qualification, time allocated to training, feedback) and situations that caused the candidate of emergency medicine to spend unproductive time (2). Many medicine branches try to cover their deficiencies and deficiencies through their federations or associations (3). Written feedback and competency-based expertise training and evaluation are only possible with the establishment of an effective and standard curriculum. In recent years, these efforts in medical specialty training are not only performed in Turkey, but also in many countries in the areas of pre-graduation, post-graduation, and continuing medical education (1). Furthermore, the lack of a standard training curriculum will result in the inability to provide equal education among residents and the inability to take the proficiency exam provided for by the medical specialties

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statute (1). Efforts to achieve standardization at the national level in specialty training are increasing in our country. The realization and implementation of national education curricula, proficiency exams, and supervisory boards will accelerate this transformation (4).

It is important that the training provided in the EDs of the university hospitals, educational research hospitals, and Foundation University Hospitals providing specialty training in ED is qualified. In order to train qualified experts, training planning needs to be done in advance by the experts of the subject, and the educational infrastructure of the institutions must be sufficient. This study aims to analyze the educational status of emergency department residents (EDR) in our country and to reveal their problems. Thus, data to contribute to medical trainers and curriculum developers were summarized. In this context, both perception and fact-oriented questions were asked to the residents, and the results were tried to be presented with statistical evaluations. By investigating the characteristics of emergency medicine specialty training, a study was aimed to help to provide better training and establish a standard training program.

Materials and Methods

Type of Research

This study was conducted to evaluate the level of specialty training of EDR's working in emergency departments throughout Turkey between 01 February 2019-30 June 2019 at Mersin University Faculty of Medicine Department of Emergency Medicine. The study was conducted after the approval of the Clinical Research Ethics Committee of Mersin University Rectorate (dated 09.01.2017 and numbered 2019/03). The survey method was used to provide data to the research.

Universe of Research

EDR's working in State University Hospitals, training and research hospitals, and foundation university hospitals where emergency medicine expertise training is provided within the borders of Turkey were included in the study. It consists of 456 EDR physicians who are on the register of emergency medical professionals associations, who have received training in university hospitals, private foundation hospitals, and educational research hospitals. A total of 456 EDR were included in the study, including 266 from university hospitals, 138 from educational research hospitals, and 52 from foundation universities. According to this information, the sample size was planned in two stages to best predict the universe. In the first phase, universities and educational research hospitals in Turkey are divided into layers based on random sampling methods and institutions. Then emergency medical residents were randomly identified on each layer and from each institution. Sample numbers were determined by calculating 20% estimate of missing subjects. Accordingly, a total of 364 ED were scheduled to be included in the study.

Data Collection Tools

On 456 EDR internet-based survey sites registered in ED associations (www.survey.com) the pre-prepared questionnaire was filled out by e-mail or by hand. Those who completed the survey form incomplete or incorrect were excluded from the study from EDR physicians who returned by e-mail or by hand. A total of 348 surveys were evaluated. The survey results, either by e-mail or by hand, were examined individually by the researcher and recorded in a pre-prepared data form.

The survey consists of 20 questions. The first three survey questions are intended to reveal participant characteristics. Other questions are directed at the practice and practice of resident training. Participants were asked two different types of questions, closed to interpretation (perception) and open to interpretation (perception). 1-7, 9, 10, 13 and 15. questions closed to interpretation 8, 11, 12, 14, 16-20. the questions are open to interpretation. 8, 11, 12, 14, 16, 19 and 20. the ingredients are prepared on a Likert scale. Likert items are rated between 1-5. 1 indicates super negative and 5 indicates super positive perception.

Statistical Analysis

Normality controls for continuous measurements were tested with the Shapiro-Wilk method. The student test was used for differences in age averages in terms of sexes. The Levene test was used for homogeneity of the variances. One-way ANOVA test was used for cases where the variances were homogeneous, and Welch test was used for cases where the variances were heterogeneous, for differences between institutions in terms of service, education, and research rates, The Bonferroni test was used when the variances were homogeneous, and the Games-Howell test was used when the variances were heterogeneous, for binary comparisons. Mean and standard deviation values were calculated as descriptive statistics. Pearson chi-square and likelihood ratio chi-square tests were used to compare categorical data. Number and percentage values were calculated as descriptive statistics. $P<0.05$ was accepted for the statistical significance limit.

Results

A total of 336 EDRs were included in the study, of which 100 (29.8%) were female and 236 (70.2%) were male. 45.4% of EDRs are in the age range 25-27, while 27.6% are in the age range 28-

30. 23.3% of the EDRs included in the study were in their first year, 29.9% were in their second year and 24.4% were in their third year. Furthermore, 85.1% of the EDR's were employed at public universities, 4.9% at private/foundation universities, and 10.1% at educational research hospitals. The general characteristics and training information of the resident is included in the study are given in Table 1. The average age of the residents in the study was calculated as 28.8±3.4. There was no statistically significant difference in age averages when we examined them based on gender (p=0.189). The average age of the female residents included in the study was 28.5±3.1, while the average age of the male residents was 29.0±3.5.

Table 1. General features and training information of the residents included in the study

Variables	n	%
Gender		
Woman	104	29.9
Man	244	70.1
Age		
25-27 age	158	45.4
28-30 age	96	27.6
31-33 age	59	17.0
34-36 age	25	7.2
37-43 age	10	2.9
Working institution		
Public university	296	85.1
Private/foundation university	17	4.9
Educational research hospital	35	10.1
Residency period		
1	81	23.3
2	104	29.9
3	85	24.4
4	62	17.8
5	16	4.6
The number of residents in the department		
5-13 resident	19	5.7
14-22 resident	176	52.4
23-31 resident	126	37.5
32-38 resident	15	4.5
Total number of instructors in the department		
0 or undeclared	1	0.3
1-3	13	3.9
4-6	250	74.4
7-10	49	14.6
11+	23	6.8

n: Number

They stated that 96.3% were held according to whether a regular training meeting was held. In evaluating the training received by EDRs in their institutions, they evaluated 42.2% as medium. They evaluated the training activities as 39.9% in hours/amount and the training activities as 41.7% in terms of type/content. In the questionnaire applied, they stated that 85.9% of EDRs did not apply assistant exams in their institutions and 60% did not believe in the necessity of the exam. They also stated that 89% of EDRs did not have an assistant certificate. It has been determined that it is at a medium level of 38% in terms of "numerical sufficiency of the trainer staff". It has been determined that EDRs are the sources of information, mostly of classical books, consultant physicians and trainers, respectively. They found that the duration of rotation in other branches was moderate (37.1%) and that the contribution of rotations to clinical practice was moderate (40.5%) (Table 2).

There was a significant difference between the patient care rate of the department and the institution of education according to the relationship between the institution of education and the rates of Service-research-education (p=0.006). There was a significant difference between the education rate in the department and the institution of education (p<0.001). There was no significant difference between the research rate in the department and the educational institution (p=0.238) (Table 3).

The educational level at the institution was related to the educational staff (p<0.001). The perception of conformity of the duration of rotations in other branches and the perception of the contribution of rotations to clinical practice and the perception of the quality of training in the institution affects one another (p<0.001). There was no significant difference between the number of patients and the level of education when comparing the number of daily patients and the total number of instructors (p=0.708). However, there was a significant difference between the level of education and the total number of instructors (p=0.003) (Table 4).

Discussion

The learning environment encompasses both the student's written curriculum and the curriculum that expresses the social factors of medical practice, which include relationships, values, and behaviors encountered in clinical practice. Active training is a critical part of the specialty training to become an autonomous physician. One-on-one training, training on the patient creates degree autonomy in a short time (5). Physicians provide effective, patient care at the same time, while also performing the duties of evaluating and addressing the learning needs of residents and medical school students (6). The fact that male participants

Table 2. Educational data of the EDRs included in the study		
Is there a regular training session every week?		
Yes	335	96.3
No	13	3.7
Evaluate the training you have received at your institution		
Not adequate	89	25.6
Intermediate level	147	42.2
Adequate	112	32.2
Evaluate training activities in hours/quantity		
Not adequate	106	30.5
Intermediate level	139	39.9
Adequate	103	29.6
Evaluate educational activities as type/content		
Not adequate	76	21.8
Intermediate level	145	41.7
Adequate	127	36.5
Do you have a resident exam at your clinic?		
Yes	49	14.1
No	299	85.9
Do you believe in the necessity of a resident exam?		
Yes	139	40
No	209	60
Do you have a resident report card in your clinic?		
Yes	38	11
No	310	89
Is the training staff numerically adequate?		
Not adequate	94	27
Intermediate level	132	38
Adequate	121	35
Who/where do you get the most information from in your field?		
Senior Resident	10	2.9
Trainers	84	24.1
Classic books	133	38.2
Consultative physician	88	25.2
Internet/digital resources	33	9.6
Are your rotations and times in other branches adequate?		
Not adequate	113	32.5
Intermediate level	129	37.1
Adequate	106	30.4
Do you find the contribution of rotations in other branches to your clinical practice adequate?		
Not adequate	109	31.3
Intermediate level	141	40.5
Adequate	98	28.2
EDR: Emergency department residents		

were numerically greater than female participants in our study supports the belief that men preferred medical schools more. In other studies, the proportion of male students was higher than female students (7,8). According to the 2019 examination for specialty in medicine in Turkey (TUS) results, 58.26% of the candidates applying for emergency medicine specialty training were placed in state universities, 3.3% in foundation universities, and 38.44% in educational research hospitals (9). 85.1% of the respondents continue to study in public universities, 10.1% in educational-research hospitals, and 4.9% in foundation universities.

In our study, it is observed that the perception of the educational quality in foundation universities differs positively compared to other institutions. In a study comparing burnout syndrome of EDRs in medical school hospitals and educational research hospitals, it is known that state institutions are intensive in terms of workload (10). Considering that regular functioning will be disrupted even with specialty training under heavy workload, it may result in the context in expert candidates not seeing the education they have received as "adequate". It may also be possible for residents who are likely to experience burnout syndrome to negatively evaluate their environment. In a survey conducted by the İstanbul Medical Chamber, specialty training working group in 2001, which in the views of EDRs trained in educational hospitals and universities in Istanbul were evaluated, "Is there a structured resident training program in your institution? 64.1% of answers to the question: there is, applied" (11).

70.6% of EDRs who continue their specialty training at foundation universities have stated that the duration and content of their education are adequate, 28.0% of EDRs in public universities are adequate and 22.9% of EDRs in educational research hospitals have declared that the duration of their education is adequate. A study found that the duration of training in the fields was mostly adequate and concluded that structured training programs were implemented in a planned and functional manner (12). In another study, it was found that EDRs who were tested with different methods on "approach to multiple trauma patients" were more successful than those who were supported with visual training materials (13). The residents who are rich in content and visually filled and have enough time training for the field can be evaluated to be more successful in practice**.** The workload on public institutions can cause trainers to be unable to how enough attention, time to residents. As the number of emergency medical professionals increases, the workload will decrease, so it can be considered that there will be a decrease in overall dissatisfaction. However, the balance of education and practice can be well established and the binding of certain rules can be useful in terms of standardization.

Table 3. Patient care-education-research relationship with the institution of education				
	Public university	**Private/foundation university**	**Educational research hospital**	**p**
Patient care ratio	48.5±18.8	34.1±11.4	50.1±18.9	**0.006**
Research ratio	31.8±12.3	44.7±11.8	31.6±12.8	**<0.001**
Education ratio	19.5±10.2	23.5±10.1	18.4±11.9	0.238

Table 4. Evaluation of the level of training received in the institution, number of training staff and rotations				
Variables	**The level of education you receive at your institution**			**p**
	Not adequate	**Intermediate level**	**Adequate**	
Is the training staff numerically adequate?				
Not adequate	65 (73.0)	27 (18.4)	2 (1.8)	<0.001
Intermediate level	24 (27.0)	88 (59.9)	21 (18.8)	
Adequate	0 (0.0)	32 (21.8)	89 (79.5)	
Are your rotations and times in other branches sufficient?				
Not adequate	60 (67.4)	47 (32.0)	6 (5.4)	<0.001
Intermediate level	23 (25.8)	74 (50.3)	32 (28.6)	
Adequate	6 (6.7)	26 (17.7)	74 (66.1)	
Do you find the contribution of rotations in other branches to your clinical practice sufficient?				
Not adequate	62 (69.7)	39 (26.5)	8 (7.1)	<0.001
Intermediate level	25 (28.1)	83 (56.5)	33 (29.5)	
Adequate	2 (2.2)	25 (17.0)	71 (63.4)	
Daily number of patients (mean ± SD)	494.71±278.17	473.33±324.22	457.46±332.16	0.708
Total trainers (mean ± SD)	4.71±2.04	5.37±2.96	5.84±2.66	0.003
SD: Standard deviation				

Over 70% of EDRs who continue their education in institutions have declared that the resident exam is not applied. It can also be said that resident exams have not generally become a settled practice. The study published in 2011 on the specialty training period suggests the application of a modified resident report card instead of the current resident report card (14). In the proposed model, students of expertise are observed and evaluated by trainers. It is suggested that the number of observations and evaluations performed, the short evaluation notes and development plans of the trainers and residents should be included in the report card. The opinion grades given to the exam that is not performed and the resident report card that is not applied can negatively affect the perception of quality and competence of the education. Ensuring that the quality of education is given to the same standard without changing from institution to institution is an expectation of the beneficiaries of this service. It may be easier for physicians who have successfully graduated from certain standards of education and gained the title of the specialist physician to fulfill the requirements of their expertise with self-confidence.

When the numerical adequacy of the educational staff is investigated, there is a significant difference between the institutions. In the 2006 study, 77.1% of Ege University Faculty of Medicine (EUFM) residents and 64.5% of Adnan Menderes University Faculty of Medicine (AMUFM) residents stated that the number of trainers was sufficient (4). The fact that the field of ED is new and not enough experts have been trained yet is thought to have affected the existing data. They may also prefer foundation universities, where the conditions of existing emergency medical specialists are better due to the heavy of working conditions in public institutions. The workloads of trainers that differ from institution to institution can cause the time allocated to the training to differ. This can also cause a difference in perception.

According to the responses given, the source of educational information (senior resident, trainer, consultant doctor) was 52.3% and via classical-digital book-internet was 47.7%. In a study conducted at Dokuz Eylül and Ege University Faculty of Medicine, participants rated the scientific and educational skills of the individuals who trained themselves as 70.4% and 72.2%.

"From whom do you learn the most about your field? The most answers to the question were "from the faculty members" and "by reading books" (11). In a study conducted with thoracic surgery residents, 67.4% of trainers and 32.6% of classical books were cited as sources of Information (15). The sources of information are similar to the study mentioned. Due to the lack of the number of trainers in public institutions, EDR may be not able to care enough. Taking parts of EDR in scientific research throughout education, to evaluate scientific evidence and continuity of this is extremely necessary for educational processes (16).

Duration adequacy of rotations in other branches did not differ significantly between institutions. However, when asked about the contribution of rotations in other branches to clinical practice, significant differences were determined between institutions. In a study conducted, 28.1% of EUFM residents and 20.8% of ADUFM residents stated that they found the education taken in rotations adequate (4). A 2009 study indicated that the effect of rotations on emergency medicine specialist candidates was not desirable (17). In another study, 18% of emergency medicine residents stated their contribution level to the clinical practice of rotations as 0 (18). The patient-resident balance needs to be well planned, as public institutions assume the bulk of the burden in the health sector. Specialization training should include a structured training program, knowledge-skill-attitude goals, suggestions on how to learn theoretical and practical information, basic reading resources related to the field of expertise, mastering criteria related to the skill to be acquired (how many times to learn if the skill is applied), etc. (16).

Conclusion

As a result, EDRs should be able to receive specialized training with a smaller number of groups rather than crowds. When determining the capacities of educational institutions, the most appropriate capacities should be determined, not the maximum. It may be necessary to adjust the training infrastructures of the educational institutions according to the specialist training. It may be appropriate to go to standardization in specialty training to train the residents well. In general, although they are suitable for specialty training, the institutions within the staff shortage should be given expert candidates according to their staff. It will be related to the training that the candidates of experts adopt the educational institutions they graduated from. Therefore, satisfaction levels should be increased to increase the preference of educational institutions.

Ethics

Ethics Committee Approval: The study was conducted after the approval of the Clinical Research Ethics Committee of Mersin University Rectorate (date: 09.01.2017 and number: 2019/03).

Informed Consent: It is a survey study; It was obtained.

Peer-review: Extenally peer-reviewed.

Authorship Contributions

Concept: K.E.A., A.K., Y.U., Design: K.E.A., A.K., Y.U., Data Collection or Processing: K.E.A., A.K., Y.U., S.B.B., Analysis or Interpretation: K.E.A., A.K., S.E., Literature Search: K.E.A., A.K., Writing: K.E.A., A.K., S.B.B.

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Evaluation of Ophthalmic Surgical Injuries Presenting to an Ophthalmology Emergency Department

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Abstract

Aim: To determine the incidence and clinical characteristics of patients who presented with an ophthalmic emergency and required ophthalmic surgical intervention.

Materials and Methods: Patients who presented at our ophthalmology department with surgical ocular traumatic injuries from 2017 to 2018 were retrospectively examined. Information about demographic characteristics, details of the injury, diagnoses, examinations, and surgical procedures was obtained. The time between the occurrence of eye injury and presenting to the hospital and time of surgery were also recorded.

Results: Thirty-eight eyes of 35 patients [74% males and 26% females (mean age: 31±19)] were included. Three cases were bilateral. The main causes of ocular surgical injuries were traffic accidents (15 eyes; 39%), work accidents (11 eyes; 29%), assault (five eyes; 13%), and other causes (seven eyes; 18%). The most frequent was eye penetrating injury (58%). Most of the operations (33 eyes; 87%) were performed on the first day of the injury, while the rest were performed between the first and tenth days. Twenty-eight eyes (74%) underwent a single operation, while additional surgical procedures were necessary in 10 eyes (26%). Twenty patients (57%) were admitted to the ophthalmology service. There was an improvement in the visual acuity in 19 eyes (50%), no change in 12 eyes (32%), and worsening in seven eyes (18%).

Conclusion: Surgery-requiring ophthalmologic injuries involve mainly males at younger ages, and traffic accidents are the most common cause of trauma. In 50% of these patients, an increase in the visual acuity was observed after surgery, so performing a correct surgery as early as possible can prevent visual impairment and blindness.

Keywords: Eye injuries, penetrating, emergencies, surgical procedures, operative

Introduction

Ocular trauma accounts for nearly 10% of all body traumas and is a major cause of visual loss. An estimated 55 million patients worldwide suffer from ocular trauma each year and approximately 1.6 million of them develop blindness because of the trauma (1).

Ocular trauma is one of the most frequent reasons for ophthalmology emergency department visits in the world and preventable cause of visual morbidity. So, continues to be an important public health problem in Turkey, too. Therefore, it is necessary to attach great importance to the emergency treatment of ocular trauma, and to adopt practical and effective methods.

Although the vast majority of ocular trauma is minor (such as superficial injury of the eye and adnexa, foreign body on external eye surface) and not related to permanent visual impairment, severe eye injuries often require surgical intervention and result in poor vision outcome (2-4). Especially in pediatric age groups,

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the most common cause of unilateral blindness is ocular trauma, especially in developing countries. And it is simply preventable by the supervision of the parents and baby caregivers (5).

Ocular injuries also may result in significant economic burdens to families and countries because of time lost from work or school, family care giving, expensive hospital costs, specialist visits and treatment, prolonged follow-up and visual rehabilitation (6).

Since any study based on ocular traumatic emergency is limited by the accuracy of the code used, regional differences, there is little reliable information on the incidence, severity, and etiologies of ocular surgical injuries in Turkey (7,8).

Herein, we aim to determine the incidence and clinical characteristics of ophthalmic emergency cases who required ophthalmic surgical intervention.

Materials and Methods

Study Protocols

This study was a retrospective, observational study conducted at an urban hospital's ophthalmology emergency department. The study was approved by the Yıldırım Beyazıt University Faculty of Medicine Clinical Researches Ethics Committee (decree no: 118, date: 28/05/2018). Eligible participants included consecutive ocular trauma patients who underwent surgical management from February 2017 through January 2018. Data were collected from the Ophthalmology department medical records including demographic characteristics, mechanism of injury, diagnoses, best corrected visual acuity (BCVA) with Snellen chart, slit lamp exam findings and surgical procedures were obtained. The time period between the occurrence of eye injury and presentation to the emergency department and time to surgery were also recorded. Zone classification according to the Open-Globe Injury Classification was frequently absent from medical recordings so the location of injury was classified as corneal, scleral, or both (perilimbal lesions included) (9,10).

Improvement in visual acuity defined as two lines or more increase in BCVA on the Snellen chart.

Patients who were admitted to the eye emergency department due to isolated ocular trauma and requiring surgical intervention and who were followed up regularly were included in the study. Eye trauma was classified according to the Birmingham Eye Trauma Terminology system (11) (Figure 1).

Patients with multiple traumas, patients with total visual loss before trauma or patients without enough medical records and follow-up after surgery were excluded from the study. The research was performed according to the tenets of the Declaration of Helsinki.

Statistical Analysis

Statistical analyses were performed using SPSS for Windows 18.0 (Chicago, IL) software package. The data collected were analyzed and presented using frequencies, numbers, mean ± standard deviation and percentages.

Results

Forty-three patients' medical records were reviewed. Eight patients who did not meet study criteria were excluded from the study. Thirty-eight eyes of 35 patients were included the study. Twenty-six (74%) of the patients were males and 9 (26%) patients were females. Mean age was 31±19 (1 to 78) years. A total of 38 injuries were studied. Twenty (53%) injuries involved the right eye, 18 (47%) involved the left eye. Three of the patients had bilateral injuries.

The most injuries were seen in two age groups; 10 years and under group and between 21-30 years old group. The age distribution of the patients is shown in Figure 2.

The main causes of ocular surgical injuries were traffic accidents in 15 eyes (39%), work accidents in 11 eyes (29%), assault in 5 eyes (13%) and other causes in 7 eyes (18%). Associated non-ocular trauma was presented in 4 eyes (11%) and concomitant adnexa lesion was presented in 8 eyes (21%).

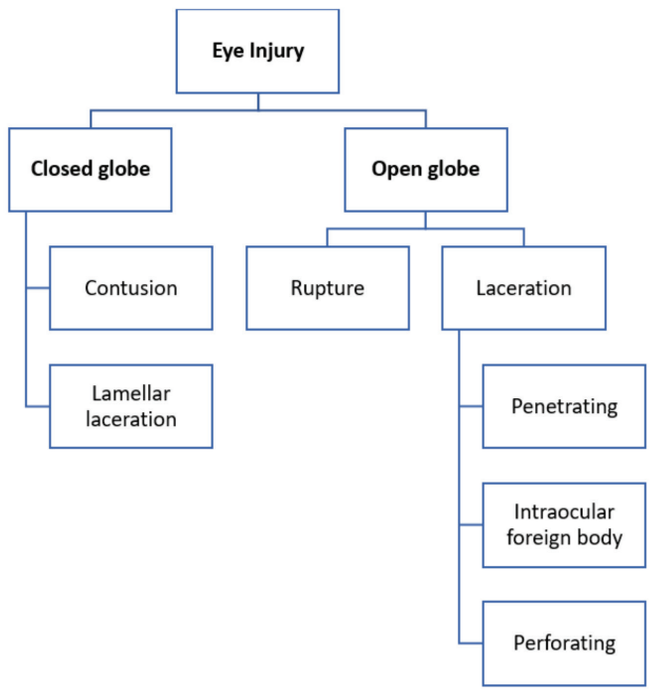

Figure 1. Birmingham Eye Trauma Terminology System classification of ocular injuries

As for the classification of ocular trauma; 12 (32%) were blunt trauma, 5 (13%) were projectile (3 gun, 2 explosion), 11 (29%) were sharp trauma and 10 (26%) were others. The most frequent type of lesion was penetrating injury [22 eyes (58%)].

Single disruption of either corneal or scleral penetration was present in 7 (18%) and 4 (11%) eyes, respectively. The most common concomitant ocular pathology was corneal-scleral penetration, which was presented in 8 (21%) eyes. Other diagnosis included conjunctival laceration in 17 eyes (45%), eyelid laceration in 11 eyes (29%), and hyphema in 3 eyes (8%). Mechanisms of injury with sharp objects were categorised into groups in Figure 3. The commonest type of injury was with metal tools. Intraocular foreign body (IOFB) is seen in 5 (13%) eyes. All foreign bodies were located in the posterior segment. Context of IOFB was metallic in 2 (40%) eyes, glass in 2 (40%) eyes and biologic material in 1 (20%) eye.

The surgical procedures performed are summarized in Table 1. The most common surgery was repairment of conjunctival laceration. [n=17 (45%)]. Other surgeries were canalicul and lid margin repair (29%), corneo-scleral reperation (21%), corneal reperation (18%), scleral reperation (11%) and anterior chamber irrigation (8%) (Table 1).

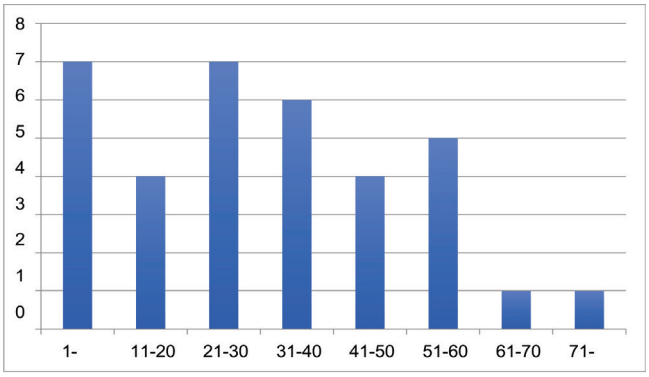

Figure 2. Distribution of patients age groups into 10-year interval

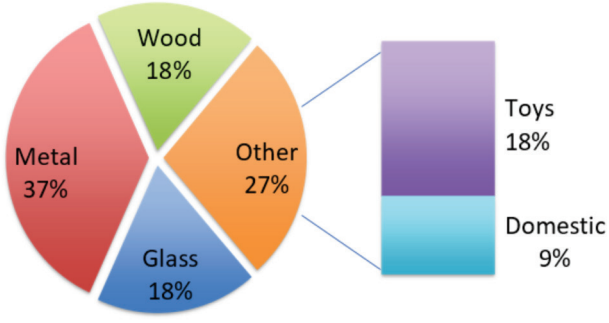

Figure 3. Mechanism of Injury with sharp objects

In most eyes [n=28 (74%)], one surgery was sufficient, while 10 eyes (26%) required two or more surgeries.

Most of the eyes (n=33, 86%) were operated on the first day of the injury. The others were operated between 1-10 days. Twenty (57%) patients were hospitalized to ophthalmology service. Mean hospitalization duration was 5.25±3.2 days (1-11). Other 15 (42%) patients did not need hospitalization but were given medical treatment. After treatment had been provided, final BCVA was 1/10 or worse in 10 (26%) of the eyes. In nine eyes (23%), final visual acuity was 9/10 or better. BCVA increased in 19 eyes (50%), while there was no change in 12 eyes (31%) and decreased visual acuity in seven eyes (18%) (Table 2).

Discussion

Previous studies showed that ocular trauma developed predominantly in males (72%-90%) and the young, with a majority under 30 years of age (12). Our study also showed a male dominancy with a majority in the third decade of life. It seems that the incidence and prevalence of ocular trauma between developed and developing countries are similar (12,13).

The high-risk group is generally known to be between the ages of 15 and 64 years in males in the United States (13), and our results are in agreement.

Corneal tear, sclera tear and lens damage are the most frequently observed morbidities of ocular trauma followed by lid and canalicular laceration, uveal prolapse, anterior chamber abnormality, retinal detachment and optic nerve avulsion (14-16). The most frequent type of lesion, in our study, was

Table 1. Surgical procedures

	Number of eyes (%)
Conjunctival suture	17 (45%)
Canalicul/lid margin repair	11 (29%)
Corneo-scleral suture	8 (21%)
Corneal suture	7 (18%)
Scleral suture	4 (11%)
Anterior chamber irrigation	3 (8%)

Table 2. Changes in visual acuity

Change in visual acuity	Number of eyes (%)
Improvement	19 (50%)
No change	12 (31%)
Worse	7 (18%)

penetrating injury (58%) as similar. Single disruption of either corneal or scleral penetration was present in 18% and 11% of eyes, respectively.

The most common concomitant ocular pathology was corneal-scleral penetration, which was presented in 21% of eyes. Other diagnosis included conjunctival laceration in 45%, eyelid laceration in 29%, and hyphema in 7% of eyes.

The previous studies have reported that primary lid-canalicular reconstruction and cornea-scleral suture were common surgical interventions in the emergency department for ocular injuries (17). In a study conducted in pediatric group, the most common mode of injury was wooden stick and the most common surgical intervention was cataract surgery with intraocular lens (18). In our study, the common mode of injury with sharp objects was metal and the common surgical interventions were conjunctival suture and cornea-scleral suture.

Since primary closure of eyelid can be performed directly in our emergency department by eye surgeon instead of operation room, our lid closure prevalence is less than expected.

A few studies from other countries have reported that about 3%-15% of patients required hospitalization (19,20). Akdur et al. (21) stated that 49.4% (n=40) cases were hospitalized in ophthalmology service and surgical treatment was applied to 67.5% (n=27) of the hospitalized patients. According to our results, 20 (57%) patients were hospitalized for operation. This difference in the incidence of hospitalization between previous studies and our study could be due to differences in the study size and distribution of the severe trauma cases. Because we see ocular traumas that require surgery more often because minor ocular traumas may be treated in other hospitals but especially severely injured ophthalmic patients usually come to our hospital.

In eyes with open globe injury, the most immediate question is the timing of wound closure. Thompson et al. (22) stated that the eyes undergoing surgical repair greater than 24 hours after the initial injury when compared with the eyes having primary repair within 24 hours, have a higher incidence of endophthalmitis. Kuhn and Slezakb (23) propose that in open-globe injuries, wound closure should be performed in the first 24 to 36 hours, as the risk of endophthalmitis does not measurably increase within this timing. In this study, surgical intervention was performed in the first 24 hours after admission in all open glob injuries.

We also preferred immediate surgery for open glob injuries but in case of IOFB, lid-canalicular reconstruction, cataract formation, we prefer to wait the other day for surgery, because vitreoretinal surgery and different surgical equipment may necessary.

Kutlutürk et al. (24) found the presence of foreign body 15.3% in the adult group and 5.1% in the pediatric group. AlMahmoud et al. (25) showed the percentage of IOFB was 21.3% in their study. Ozdamar Erol et al. (26) reported that all 14 patients with posterior segment IOFB and underwent vitrectomy were male and 12 of the foreign bodies were metallic, two were glass. In our study IOFB is seen in 5 (13%) cases and all of them were located in the posterior segment. Context of IOFB was metallic in 2 (40%) cases, glass in 2 (40%) cases and biologic material in 1 (20%) case. All cases with IOFB underwent vitrectomy within a week.

Our study has some limitations. First, due to its retrospective nature, there are not enough records of some epidemiological details (such as educational status, whether protective equipment is used or not). Second, it is single center study. Third; treatment of some minor traumas by family physicians before coming to the hospital or suturing some small incisions by emergency physicians may cause selection bias.

Conclusion

According to our study results, surgery-requiring ophthalmologic injuries involve mainly male at younger ages and traffic accidents are the most important cause of trauma. In 50% of these patients, an increase in visual acuity was observed after surgery so an early and correct surgery can prevent visual impairment and blindness.

Ethics

Ethics Committee Approval: This study was approved by Yıldırım Beyazıt University Faculty of Medicine Clinical Researches Ethics Committee (no:118, date: 28/05/2018).

Informed Consent: As this is a retrospective study, the participants' informed consent was not required.

Peer-review: Externally peer-reviewed.

Author Contributions

Concept: S.Y., Y.Y., Design: M.A.Y., Y.Y., Supervision: M.A.Y., Data Collection and/or Processing: S.Y., M.A.Y., Y.Y., Analysis and/or Interpretation: S.Y., M.A.Y., Literature Search: S.Y., Y.Y., Writing Manuscript: S.Y., M.A.Y., Critical Review: Y.Y.

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Levels of Total Platelet Mass in Patients Admitted to Emergency Department and Diagnosed with Obstructive Sleep Apnea Syndrome

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Abstract

Aim: The objective of this study was to investigate the possibility of a relationship between the value of the platelet mass index and obstructive sleep apnea syndrome (OSAS) and to compare biochemical parameters among comorbidity groups in OSAS patients.

Materials and Methods: The patients were divided into two groups; the patient group consisted of patients who had previously presented to the emergency department of our hospital and were diagnosed with OSAS through polysomnography, while the control group included individuals who had no diagnosed chronic diseases.

The patients in the OSAS group were further divided into subgroups of patients with diabetes, diabetes + hypertension, diabetes + hyperlipidemia, diabetes + cardiovascular disease, diabetes + hypertension + hyperlipidemia, hyperlipidemia, cardiovascular disease, and hypertension.

Physical examination, complete blood count, and biochemical test outcomes of both groups as well as polysomnography data of the patient group were evaluated retrospectively.

Results: The mean BMI value was statistically significantly higher in OSAS patients than in with patients of the control group (24.28±1.00 vs 29.73±2.51 kg/m^2). The mean platelet volume (MPV) was significantly higher in the control group (10.13±1.09) than in the OSAS group (7.98±1.32) ($p<0.001$). The total platelet mass index, calculated by multiplying the platelet count by the MPV, was significantly higher in the control group (2,737.92±548.90) than in the OSAS patient group (2,104.89±462.86) ($p<0.001$).

Conclusion: According to the results of this study, the platelet mass index, MPV, and/or total platelet count are not diagnostic. However, in patients presenting to the emergency department with complaints of fatigue, headache, inattention, and daytime drowsiness, they may be warning parameters indicating the possibility of OSAS.

Keywords: Emergency service, obstructive sleep apnea syndrome, platelet mass index

Introduction

Obstructive sleep apnea syndrome (OSAS) is a sleep-related respiratory disease characterized by repeating apnea and hypopnea episodes due to the obstruction of the airway. OSAS is associated with repeating nocturnal arterial oxygen desaturation and hypercapnia as well as with changes in systemic and pulmonary arterial pressure (1). The prevalence of OSAS has been reported as 4% in middle-aged men and 2% in middle-aged women (2). Moderate OSAS is seen in one of each five adults and moderate-to-severe OSAS in one of each fifteen adults (3). In OSAS, the interruption of the upper airway is defined as apnea, and decreased airway as hypopnea. These apnea and hypopnea cycles are repeated several times in every hour, causing fragmentation of sleep. Pharynx, and especially hypopharynx and oropharynx are the regions with obstructive processes that mostly lead to OSAS (4). OSAS is an independent risk factor for many diseases including heart failure, heart attack, cardiovascular events, and arrhythmias. OSAS has been associated with cardiovascular, growth and neurobehavioral anomalies and inflammation (5).

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Daytime drowsiness, decreased attention capacity, insufficient memory and learning, walking dysfunction, decreased motor performance and depressive symptoms may be seen in OSAS patients.

Platelets play an important role in the formation of atherosclerotic plaques and thus in the progression of atherosclerotic lesions to thrombosis. Platelets express and release substances involved in coagulation, inflammation, thrombosis and atherosclerosis processes (6,7). In addition, platelets also play a role in the pathogenesis of coronary artery disease. Larger platelets are associated with increased enzymatic and metabolic activities, showing an increased prothrombotic condition (8). Mean platelet volume (MPV) and platelet distribution width (PDV) are the most commonly measured platelet indices during routine blood count. Studies have reported that the activation of platelets, MPV and PDW are increased in OSAS patients (9,10). However, some studies have reported no association between platelet volume and OSAS (11). MPV should be interpreted with platelet count. Multiplying of MPV and platelet count is named as total platelet mass (12).

There are several studies in the literature about the relationship between platelet indices and OSAS (13-15). However, to our best knowledge the relation between platelet mass and OSAS has not been investigated previously. Therefore, the objective of this study was to investigate whether there was a relationship between the levels of platelet mass and OSAS and to compare biochemical parameters among comorbidity groups among OSAS patients.

Materials and Methods

Study Population

A total of 311 patients were included in the study with 208 who presented to the emergency department of our hospital with complaints such as fatigue, headache, distractibility and daytime drowsiness, and then were diagnosed with OSAS through polysomnography and 103 persons without the diagnosis of OSAS as the control group. Outcomes of the previously performed polysomnography of OSAS patients were evaluated together with a thoracic diseases specialist. Patients included in the study were divided into two groups as OSAS and non-OSAS patients. In addition, patients in the OSAS group were further divided according to their comorbidities into subgroups as diabetes, diabetes + hypertension, diabetes + hyperlipidemia, diabetes + cardiovascular disease, diabetes + hypertension + hyperlipidemia, hyperlipidemia, cardiovascular disease and hypertension. All patients underwent physical examination, electrocardiogram (ECG), complete blood count and biochemical laboratory analyses, while OSAS patients additionally underwent polysomnography.

Patients with a systolic blood pressure >140 mmHg or a diastolic blood pressure >90 mmHg or those receiving antihypertensive drugs were considered hypertensive. Patients with a fasting blood glucose > 126 mg/dL and those receiving antidiabetics were considered to have diabetes mellitus (DM). Patients aged under 18 years were excluded from the study.

Polysomnography

In this study, the diagnosis of OSAS was established with polysomnography which is accepted as the gold diagnostic method. All patients underwent a detailed nocturnal analysis with 44-channel polysomnography using the international 10-20 electrode insertion system.

Polysomnographic evaluation included electroencephalogram, electrooculogram with 256 μv/hour sampling rate, submental electromyogram with 10-100 Hz and ECG with 0.2-30 Hz filtration. Respiratory effort was measured with abdominal and thoracic piezoelectric belts with 0.05-3 Hz filtration, while airflow was monitored with a nasal cannula. Oxygen saturation and pulse were measured using a finger pulse oximeter. In order to record leg movements, motion sensors of 1-20 Hz were inserted to each leg. Polysomnography processes were performed according to the Rechtschaffen and Kales criteria by two thoracic diseases specialists that showed 80-95% compliance to 50 reference data and had an experience of at least 1,000 polysomnography processes (16).

Interruption of airway at least for 10 seconds as a result of polysomnography was considered as apnea, while a decrease ≥3% in capillary oxygen saturation was considered as desaturation. Whereas, stimulation or desaturation lasting for ≥10 seconds with a decreased air flow by 50% during sleep was considered as hypopnea.

Biochemical Measurements

Blood samples were collected using a sterile syringe from the antecubital vein between a.m. 08:00 and 10:00 following 12-hour fasting. Glucose, creatinine and lipid profiles were determined with standard methods in the samples. MPV and platelet values were measured from the blood samples put into the dipotassium Ethylenediamine tetraacetic acid (EDTA) containing tubes. Complete blood count was performed using an automated blood counter (Beckman Coulter, Dx500, USA). MPV measurements were performed within 30 minutes after the sampling in order to prevent platelet swelling resulted from EDTA.

Ethics Statement

Before the beginning, the study protocol was approved by the local ethics committee of our hospital with 11/05/2020 dated

and HRU/20.09.09 numbered decision. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

Statistical Analysis

Data obtained in the study were statistically analyzed using SPSS for Windows version 23.0 package software (SPSS, IBM Inc., Statistical Package for Social Sciences, Illinois, Chicago, USA). Normality of the variables was analyzed with the Shapiro-Wilk test. In the comparison of the numerical data between the patient and control groups, one-way variance analysis (ANOVA) and Duncan multiple comparison tests were used for the normally distributed variables, and Kruskal-Wallis and Dunn multiple comparison tests for the non-normally distributed variables. Descriptive statistics are expressed as mean ± standard deviation for numerical variables, while frequency and percentage were used for the categorical variables. P<0.05 values were considered statistically significant.

Results

In this study, a total of 311 patients with 208 who presented to the emergency department of our hospital with complaints such as fatigue, headache, distractibility and daytime drowsiness, and then were diagnosed with OSAS through polysomnography and 103 persons without the diagnosis of OSAS were included as the control group. In addition, OSAS patients were divided into subgroups according to their comorbidities and the results of biochemical analysis and polysomnography were studied among these subgroups. Accordingly, DM was found in 34, diabetes + hypertension in 15, diabetes + hyperlipidemia in 29, diabetes + cardiovascular disease in nine, diabetes + hypertension + hyperlipidemia in 13, hyperlipidemia in 62, cardiovascular disease in 15 and hypertension in 31 patients. Distribution of the comorbidities in OSAS patients is given in Figure 1.

The mean age of the patients was 51.87±11.07 (minimum-maximum: 26-80) years. The mean age was 55.25±10.86 years in the OSAS group and 46.85±9.23 years in the control group. Accordingly, the mean age was statistically significantly higher in the OSAS group than in the controls (p<0.001). The mean age was found to be statistically significantly higher in diabetes + cardiovascular group (60.89±14.31) compared to cardiovascular disease (60.47±11.60), diabetes + hypertension + hyperlipidemia (56.08±12.61), diabetes+hypertension (55.27±7.96) and significantly higher in diabetes patients (54.56±11.26) than in the control group (46.85±9.23), diabetes + hyperlipidemia (53.03±9.77) and hyperlipidemia patients (51.45±10.29) (for all p<0.05).

The mean body mass index (BMI) value was statistically significantly higher in OSAS patients compared to the control group (24.28±1.00 vs 29.73±2.51 kg/m^2). Examining according to the subgroups, no statistically significant difference was found in terms of BMI (p>0.05).

Distribution of the demographic and clinical features is given in Table 1.

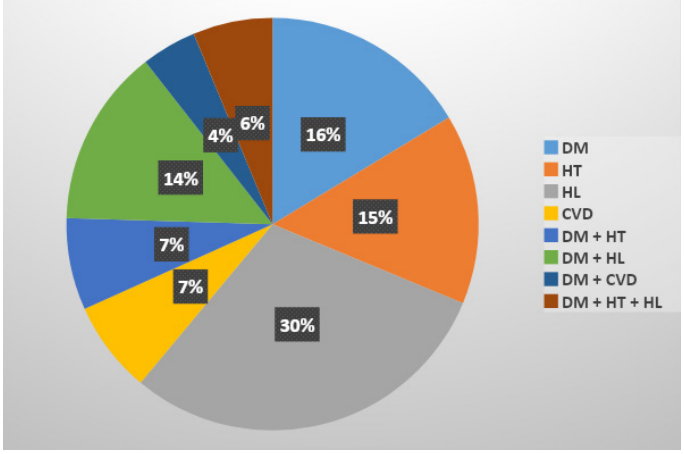

Figure 1. Distribution of the comorbidities in OSAS patients

OSAS: Obstructive sleep apnea syndrome, DM: Diabetes mellitus, HT: Hypertension, HL: Hyperlipidemia, CVD: Cardiovascular diseases

Table 1. Demographic and clinical characteristics of the patients

	Mean ± SD	Min-max
Age	51.87±11.07	26.00-80.00
BMI	27.93±3.34	21.97-36.93
WBC	9.06±2.30	1.46-19.59
Neutrophils	5.27±1.85	2.38-14.73
Lymphocytes	2.84±0.91	0.32-6.17
Monocytes	0.68±0.22	0.12-2.05
RBC	5.15±0.62	3.18-7.02
PLT	269.34±61.18	138.90-512.00
MPV	8.70±1.59	5.36-12.30
RDW	12.74±1.64	9.80-22.70
Lymphocyte to monocyte	4.56±2.18	1.14-23.58
Neutrophil to lymphocyte	2.11±1.71	0.78-25.91
PLT x MPV	2314.54±575.53	1104.90-4710.40
RDW/RBC	2.51±0.53	0.00-4.62
PLT/RDW	21.41±5.43	10.37-39.75
RDW/MPV	1.51±0.35	0.00-2.81
Gender, n (%)		
Male	215 (69.1)	-
Female	96 (30.9)	-

BMI: Body mass index, WBC: White blood cells, RBC: Reb blood cells, PLT: Platelet, MPV: Mean platelet volume, RDW: Red cell distribution width, n: Number, min: Minimum, max: Maximum

The MPV was significantly higher in the control group (10.13±1.09) compared to the OSAS group (7.98±1.32) (p<0.001). Total platelet mass found with multiplying platelet counts and MPV was significantly higher in the control group (2,737.92±548.90) compared to the OSAS patients (2,104.89±462.86) (p<0.001). Distribution of the demographic and clinical data of the participants is shown in Table 2.

Discussion

The association of OSAS with diseases such as cardiovascular disorders, hypertension and DM is well-known. Platelets are inflammatory markers playing a crucial role in the pathogenesis of numerous diseases, especially cardiovascular diseases (CVD). Larger platelets involve more granule and thromboxane A2 and express more glycoproteins IB and IIB/IIIA receptors. Therefore, these large platelets lead to an increase in thromboembolic events by accumulating more rapidly (17-19).

There are several studies in the literature investigating the relationship between OSAS and MPV (10,20,21). MPV is known to have an important role in the pathophysiology of CVD as an indicator of platelet activation (22). Since CVD increase in OSAS patients, studies in the literature have focused on the role of activated platelets. However, because as the size of platelets increases their effects on the above mentioned diseases increase, MPV should be interpreted together with platelet count. Total platelet mass is formulated as MPV x platelet count. Platelet mass is an indicator of platelet function and activation (23). To our best knowledge, there is no study in the literature evaluating the effect of total platelet mass on OSAS.

Personal characteristics such as advanced age, hypertension and obesity are risk factors for OSAS and CVD (24). Structural changes like obesity predisposes OSAS patients to upper airway resistance and larger respiratory effort. In the present study, the mean age was statistically significantly higher among OSAS patients compared to the controls. In addition, when the subgroups were analyzed,

Table 2. Distribution of the studied parameters among the subgroups

	Control	Diabetes	Diabetes + HT	Diabetes + HLD	Diabetes + CVD	Diabetes + HT + HLD	HLD	CVD	HT	p
Age	46.85±9.23	54.56±11.26	55.27±7.96	53.03±9.77	60.89±14.31	56.08±12.61	51.45±10.29	60.47±11.60	55.16±11.86	0.001
BMI	24.28±1.00	29.60±2.80	30.01±1.48	29.43±2.77	29.70±3.22	29.86±1.84	29.65±2.59	29.81±2.91	30.10±2.19	0.001
WBC	9.34±2.67	9.07±2.03	9.29±2.11	9.20±2.11	8.37±1.49	9.66±2.15	8.51±1.90	9.11±3.26	8.94±1.94	0.451
Neutrophils	5.53±2.27	5.18±1.58	5.73±1.77	5.35±1.62	4.48±1.07	5.82±1.56	4.84±1.45	5.20±2.32	5.15±1.39	0.348
Lymphocytes	2.94±0.99	2.88±0.81	2.64±1.24	2.84±0.80	2.86±0.81	2.86±1.05	2.72±0.78	2.81±0.94	2.83±0.94	0.965
Monocytes	0.69±0.24	0.67±0.20	0.62±0.19	0.69±0.19	0.64±0.22	0.70±0.19	0.65±0.18	0.73±0.41	0.68±0.17	0.813
RBC	5.02±0.60	5.24±0.57	5.06±0.66	5.25±0.60	5.12±0.68	5.10±0.90	5.30±0.58	5.01±0.64	5.21±0.68	0.235
PLT	272.42±57.26	271.17±65.03	285.73±74.13	273.44±62.66	270.50±61.98	275.05±63.36	263.54±56.36	250.21±66.68	263.49±70.72	0.868
MPV	10.13±1.09	8.02±1.37	8.07±1.32	7.94±1.28	8.13±1.45	7.89±1.29	8.01±1.29	8.20±1.42	7.79±1.29	**0.001**
RDW	13.10±1.84	12.46±1.55	12.65±1.55	12.57±1.61	12.84±1.85	12.98±1.42	12.46±1.54	12.67±1.81	12.58±1.15	0.132
Lymphocyte/ monocyte	4.68±2.61	4.70±2.07	4.39±2.23	4.49±1.99	5.02±2.20	4.49±2.47	4.47±1.77	4.43±1.99	4.33±1.76	0.976
Neutrophil/ lymphocyte	2.15±1.40	1.90±0.72	3.89±6.19	1.99±0.73	1.68±0.63	2.26±0.88	1.91±0.78	2.00±1.01	2.00±0.76	0.725
PLTxMPV	2737.92±548.90	2135.02±455.03	2280.39±594.50	2141.86±463.09	2141.38±340.79	2145.27±487.79	2081.01±424.86	2002.64±444.59	2022.05±517.34	**0.001**
RDW/RBC	2.65±0.52	2.42±0.46	2.57±0.64	2.35±0.66	2.56±0.57	2.64±0.64	2.39±0.46	2.57±0.54	2.46±0.42	**0.008**
PLT/RDW	21.11±4.97	22.08±6.15	22.44±4.26	22.16±6.19	21.24±5.38	21.44±5.44	21.49±5.47	19.80±5.16	21.17±6.22	0.918
RDW/MPV	1.30±0.21	1.60±0.35	1.62±0.41	1.56±0.46	1.62±0.35	1.70±0.42	1.59±0.30	1.59±0.33	1.66±0.33	**0.001**

HT: Hypertension, HLD: Hyperlipidemia, CVD: Cardiovascular diseases, BMI: Body mass index, WBC: White blood cells, RBC: Red blood cells, PLT: Platelets, MPV: Mean platelet volume, n: Number

the mean age was statistically significantly higher in diabetes + cardiovascular disease and cardiovascular groups compared to the other subgroups. Similarly, in our study the mean BMI value was statistically significantly higher in the OSAS group compared to the control group. As respiratory symptoms are more common in people with an advanced age and overweight persons, this situation is an expected finding.

It is well-known that MPV is increased with hypoxia (25). Nena et al. (26) reported that MPV and platelet distribution width (PDW) increase in OSAS patients.

OSAS is associated with insulin resistance and impaired glucose tolerance, and induces endothelial dysfunction (27). In our study, both MPV and total platelet mass were significantly higher among OSAS patients compared to the controls. Kanbay et al. (20) demonstrated that MPV levels increased as the severity of OSAS increased, and pointed out that high MPV levels were associated with the prevalence of CVD in OSAS patients (20). In the current study, CVD was found in 15, and both diabetes and CVD in nine OSAS patients. We think that, lower rate of CVD in our study was caused by the inability to measure the severity of OSAS, because the primary objective of our study was to investigate total platelet mass in OSAS patients.

Studies in the literature have reported higher MPV values in OSAS patients compared to the controls and accordingly, it has been argued that MPV value is a diagnostic marker for OSAS especially in patients presenting to emergency departments (20,25,26,28,29).

However, as we mentioned before MPV should be taken into account together with platelet count and not alone. In fact, in the majority of the above mentioned studies, MPV value was high in OSAS patients depending on the severity of the disease, while platelet count has been reported as low according to the number of patients. In the present study, both the mean MPV value and total platelet mass found by MPV x platelet count were statistically significantly lower in OSAS patients compared to the control group. Therefore, unlike the previous studies MPV and/or total platelet mass is not sufficient for the diagnosis of OSAS, especially in patients presenting to emergency departments with the complaints of fatigue, headache, distractibility and daytime drowsiness, and these patients must be directed to polysomnography.

Study Limitations

The main limitation of our study is its retrospective design and being conducted in a single center. The effects of geographic areas and climate can on OSAS can be investigated with further studies. However, the number of our patients is relatively high for such a study, which reflects the strong aspect of our study. In addition, this study is the first in the literature investigating not only MPV, but also total platelet mass in OSAS patients. Our results that are contrary to those of the previous studies should be supported with further multi-center comprehensive studies.

Conclusion

According to the results of this study; MPV and/or total platelet count is not diagnostic, especially in patients presenting to emergency departments with the complaints of fatigue, headache, distractibility and daytime drowsiness. These patients must be directed to polysomnography. However, the high prevalence of comorbidities such as hypertension, DM, CVD and hyperlipidemia is remarkable. Patient groups with these comorbidities can be evaluated for OSAS in future studies. We believe that the results of this study will create a new perspective in the literature in the role of platelet activation in OSAS.

Ethics

Ethics Committee Approval: Before the beginning, the study protocol was approved by the Local Ethics Committee of Harran University with 11/05/2020 dated and HRU/20.09.09 numbered decision.

Informed Consent: Retrospective study.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: E.S.Ş., Concept: E.S.Ş., Design: E.S.Ş., Data Collection or Processing: İ.H.Y., Analysis or Interpretation: İ.H.Y., Literature Search: İ.H.Y., Writing: E.S.Ş.

Conflict of Interest: The authors declare no conlict of interest to disclose.

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Accuracy of Field Assessment Stroke Triage for Emergency Destination for Diagnosis of Acute Ischemic Stroke Patients

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Abstract

Aim: Acute stroke is one of the most common and debilitating diseases. Rapid diagnostic measures undertaken upon hospital admission and reduction of the treatment duration will increase access to treatment. The purpose of this study is to examine the accuracy of Field Assessment Stroke Triage for Emergency Destination (FAST-ED) in terms of stroke diagnosis.

Materials and Methods: This prospective diagnostic accuracy study was conducted between March 2019 and January 2020. All adult patients transferred to the ED and suspected of having an acute ischemic stroke who had undergone brain magnetic resonance imaging (MRI) were eligible for inclusion. After data collection, receiver operating characteristic curve analysis was performed, and sensitivity, specificity, positive predictive value, and negative predictive value of FAST-ED were calculated and compared with those of the National Institute of Health Stroke Scale (NIHSS) scale.

Results: A total of 314 patients who had received MRI within the first 24 hours of symptom onset were included in this study. The mean age was 67.95±13.11 years, and 184 patients (58.60%) were male. Of all patients with suspicion of ischemic stroke, 274 (87.26%) were diagnosed on the basis of the gold standard. The best predictor of stroke in FAST-ED, with a sensitivity of 0.880 and specificity of 0.575, was a cut-off point of 2 (area under the curve: 0.836). The distribution of all FAST-ED symptoms was significant in the stroke and non-stroke groups, with the exception of "Eye deviation."

Conclusion: The FAST-ED scale is relatively simple and has a comparable ability to recognize AIS to that of the more complex NIHSS.

Keywords: Stroke, triage, acute cerebral ischemia, clinical prediction rules, emergency care

Introduction

Acute stroke is one of the most common and debilitating diseases (1). Despite major advances in recent years, however, stroke has become one of the leading causes of death worldwide. Stroke was the cause of one in 15 deaths in the United States, and 50% of these deaths occurred outside the hospital (2).

Previous studies have reported an incorrect stroke diagnosis (false positives) of 30-40% and a misdiagnosis of stroke (false negatives) of 2-26% (3). The post-ictal phase of seizures, hypoglycemia, etc., is the differential diagnosis of strokes and taking a complete history, careful physical examination, and the use of diagnostic tools can help differentiate them (3,4).

The main predictor of recovery in cases of acute ischemic stroke is the time elapsed between the onset of symptoms and reperfusion therapy. Rapid triage and rapid transport are critical for patients with acute stroke in a pre-hospital setting. Rapid diagnostic measures after entering the hospital and shortening the duration of treatment will increase the chances of access to treatment

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(5,6). Rapid treatment with intravenous treatment is effective for patients with an ischemic stroke of <4.5 hours after onset (5-7).

The National Institute of Health Stroke Scale (NIHSS) can comprehensively assess the degree of neurological impairment in stroke patients. However, NIHSS is complex and time-consuming (8).

Some existing simplified stroke screens, such as Melbourne Ambulance Stroke Screen, the Face Arm Speech Test (FAST), Cincinnati Prehospital Stroke Severity Scale (CPSSS) and its modification and Recognition of Stroke in the Emergency Room (ROSIER) were designed to detect strokes (1,8,9). The accuracy of these clinical scales varies between 0.75 and 0.80 and differs slightly from each other (8-10). Other prehospital stroke scales have been proposed to identify patients experiencing an acute stroke. Choosing a scale depends on both its accuracy and ease of use. An increasing number of studies assessing the diagnostic performance of clinical assessment tools have been seen in recent years. The accuracy and effectiveness of a new criterion that is comparable in sensitivity, specificity, etc. to other pre-hospital scales is important and plays an important role in the rapid and accurate diagnosis of acute stroke and thus increasing the patient's chances of successful treatment.

Therefore, we conducted a prospective cohort study to examined the Field Assessment Stroke Triage for Emergency Destination (FAST-ED) score and compared it to NIHSS for detecting acute stroke.

Materials and Methods

This prospective diagnostic accuracy study had been conducted between March 2019 to January 2020 at at Al-Zahra and Kashani Hospitals, two university hospitals in Isfahan, Iran. The study protocol has been approved by the Ethics Committee of Isfahan University of Medical Sciences (Code: IR.MUI.MED.REC.1397.336)

The FAST-ED Scale [facial palsy (scored 0-1), arm weakness (0-2), speech changes (0-2), time [documentation for decision making but no points], eye deviation (0-2), and denial/neglect (0-2)] was designed based on items of the NIHSS (Table 1).

We enrolled consecutive patients transferred to the emergency department (ED) and suspected of having an acute ischemic stroke. Those who did not receive magnetic resonance imaging (MRI) in the first 24 hours of symptom onset before intravenous thrombolysis or endovascular therapy were excluded.

Patients were excluded if there was evidence of head trauma, previous stroke, known neurological disease, or previous neurological surgery.

A checklist will be used to collect information. For this purpose, a checklist consisting of three sections will be prepared. The first part of the checklist is related to basic information and demographics data of patients, including age, gender, past medical history (hypertension, diabetes, dyslipidemia, ischemic heart disease, seizure, coagulopathy, cerebral infarction, and TIA), NIHSS Score, and time from onset of symptoms, the second part includes five items related to FAST-ED Criteria based on physical examination, and the third part includes the final diagnosis of patients. It was based on the results of the MRI, which was considered the gold standard in this study. The brain MRI was reported by radiologists.

In the present study, all patients transferred to the emergency department who have symptoms of stroke, or are suspected of having a stroke, will be evaluated by an emergency physician (emergency medicine resident, or specialist) and the FAST-ED Criteria and five items will be completed and registered in the checklist.

Statistical Analysis

SPSS v.22 software was used for statistical analysis. Continuous variables are presented as mean ± standard deviation. Categorical variables were reported as number and percentage.

Comparisons of variables between two groups (with and without stroke) were conducted by the chi-square test for categorical variables and the independent t-test for continuous variables. We used the Mann-Whitney U test to compare of median ± Interquartile Range Score of FAST-ED in patients with and without stroke.

Sensitivity and specificity with 95% confidence interval (CI), positive and negative predictive value, positive and negative likelihood ratio were calculated using several different thresholds of the FAST-ED. The discriminatory performances of FAST-ED were assessed by analysing the Receiver Operating Characteristic (ROC) curve. We calculated the area under the ROC curve (AUC) to distinguish between FAST-ED and NIHHS between two groups (with and without stroke). The Youden Index was used to evaluate the optimal threshold of the FAST-ED scale. A cut-off of 6, 7, and 10 points in the NIHSS was used for comparison.

P-value <0.05 was considered as statistically significant.

Results

A total of 363 patients suspected stroke were collected and 49 patients were excluded according to the exclusion criteria. Finally, 314 patients who receive MRI in the first 24 hours of symptom onset and before reperfusion therapy were included.

The mean age was 67.95±13.11 years (between 11 to 93 old years) and 184 patients (58.60%) were males. Of all suspected patients, 274 patients (87.26%) had ischemic stroke based-on gold standard diagnosis. The mean age in the stroke group was higher than the non-stroke group (69.05±13.62 vs 60.78±13.63; p<0.001). There was no significant difference in the past medical history (hypertension, diabetes, dyslipidemia, ischemic heart disease, seizure, coagulopathy, cerebral infarction, and TIA) between the two groups (Table 2).

The median of FAST-ED in with stroke group was significantly higher than the non-stroke group (4.0 vs 2.0; p=0.001). Of FAST-ED symptoms, "arm weakness" was highest (82.8%), and "eye deviation" was the lowest (22.6%) positive symptoms in the stroke group, respectively.

Except for "eye deviation", other FAST-ED criteria were present in more than half of the stroke patients.

Distribution of all FAST-ED symptoms was significant in stroke and non-stroke group except "eye deviation" (p<0.05) (Table 3).

The sensitivity, specificity, positive predictive value, negative predictive value, negative likelihood ratio, and positive likelihood ratio for different cut-off values of the FAST-ED scale for prediction of acute ischemic stroke (AIS) are shown in Figure 1. Better performance of FAST-ED could be shown at two distinct thresholds of ≥2 and ≥3 (Table 3). A FAST-ED scale ≥2 and ≥3 showed sensitivity of 0.88 and 0.77, specificity of 0.58 and 0.68, positive predictive value (PPV) of 0.88 and 0.89, and negative predictive value (NPV) of 0.58 and 0.45 in predicting AIS versus NIHSS ≥6 0.80, 0.60, 0.88, and 0.46 and NIHSS ≥10 0.78, 0.58, 0.88, and 0.38, respectively (Tables 4 and 5)

ROC curves of the FAST-ED scale with the NIHSS are shown in Figure 1.

Discussion

It is generally accepted that any patient with clinical signs of stroke needs to be an assessment at a stroke center with advanced imaging to make the best treatment decision for the patient. Rapid triage and rapid transport are very important for patients with acute stroke in a pre-hospital setting. Rapid diagnostic measures after entering the hospital and shortening the duration of treatment will increase the chances of access to treatment.

Most items included in FAST-ED scales except "eye deviation" had a strong correlation with AIS and were easy to assess.

Table 1. The FAST-ED Scale and its correspondence to the NIHSS

Item	FAST-ED Score	NIHSS Score Source
Facial palsy		
Normal or minor paralysis	0	0-1
Partial or complete paralysis	1	2-3
Arm weakness		
No drift	0	0
Drift or some effort against gravity	1	1-2
No effort against gravity or no movement	2	3-4
Speech changes		
Absent	0	0
Mild to moderate	1	1
Severe, global aphasia, or mute	2	2-3
Eye deviation		
Absent	0	0
Partial	1	1
Forced deviation	2	2
Denial/neglect		
Absent	0	0
Extinction to bilateral simultaneous stimulation in only 1 sensory modality	1	1
Does not recognize own hand or orients only to one side of the body	2	2

FAST-ED: Field Assessment Stroke Triage for Emergency Destination, NIHSS: National Institute of Health Stroke Scale

Table 2. Demographic characteristics and history of disease and risk factors in patients with and without stroke diagnosis			
	Stroke (n=274)	**Non-stroke (n=40)**	**p-value**
Age; mean (SD), year	69.05 (13.6)	60.78 (13.6)	<0.001
BS; glucometer, mean (SD)	151.60 (65.8)	160.43 (100.3)	0.981
Onset to ED mean (SD), hour	6.68 (19.88)	3.66 (4.75)	0.942
History of hypertension, n (%)			
Negative	102 (87.9)	14(12.1)	0.785
Positive	172 (86.9)	26 (13.1)	
History of IHD, n (%)			
Negative	175 (86.2)	28(13.8)	0.449
Positive	99 (89.2)	12(10.8)	
History of smoking, n (%)			
Non-smoker	246 (87.9)	34 (12.1)	0.363
Smoker	28 (82.4)	6 (17.6)	
DM, n (%)			
Negative	182 (87.9)	25 (12.1)	0.625
Positive	92 (86.0)	15 (14.0)	
Coagulopathy, n (%)			
Negative	273 (87.2)	40 (12.8)	0.999
Positive	1 (100.0)	0 (0.0)	
History of stroke, n (%)			
Negative	236 (86.1)	38 (13.9)	0.134
Positive	38 (95.0)	2 (5.0)	
HLP, n (%)			
Negative	234 (86.7)	36 (13.3)	0.434
Positive	40 (90.9)	4 (9.1)	
Seizure, n (%)			
Negative	270(87.4)	39 (12.6)	0.496
Positive	4 (80.0)	1 (20.0)	

BG: Blood glucose, SD: Standard deviation, DM: Diabetes mellitus, HLP: Hyperkeratosis lenticularis perstans, IHD: Ischemic heart disease, ED: Emergency department, n: Number

In analysing the strength of the FAST-ED scale for our patient population, FAST-ED scale ≥2 and ≥3 showed a sensitivity of 0.88 and 0.77, a specificity of 0.58 and 0.68, PPV of 0.88 and 0.89, and NPV of 0.58 and 0.45 in predicting AIS. This analysis compares with Lima et al.'s (11) and Carr et al.'s (12) study.

Lima et al. (11) assessed that FAST-ED ≥4 had a sensitivity of 0.60, the specificity of 0.89, the positive predictive value of 0.72, and a negative predictive value of 0.82.

Carr et al. (12) assessed the sensitivity for FAST-ED greater than or equal to 4 as 0.80, specificity 0.68, PPV 0.40, and NPV 0.93.

Our results were slightly different in which a positive predictive value of 88% and a negative predictive value of 57.5% were reported.

In our study, FAST-ED had a high PPV for acute stroke and appeared to be effective for identifying patients who required triage to a stroke center.

FAST-ED scales have also been developed to predict AIS in the prehospital setting and demonstrated good sensitivity and acceptable specificity, it has a sensitivity of 88.0% [95% Confidence interval (CI); 81.5%-92.9%] and a specificity of 57.5% (95% CI; 40.9%-72.9%) in its best cut-off point (score ≥2). It demonstrated a comparable ability when compared with the more complex NIHSS score and other similar scales.

Several scales have been developed to be used in pre-hospital and hospital settings to screen stroke patients. There is a significant difference in the diagnostic accuracy of the scales

Table 3. Distribution of FAST-ED symptoms and signs and score in patients with and without stroke diagnosis

	Total number (n=314); %	Final diagnosis		p-value
		Stroke (n=274); %	Non-stroke (n=40); %	
Facial palsy 0: Normal or minor paralysis 1: Partial or complete paralysis	 143 (45.5) 171 (54.5)	 117 (42.7) 157 (57.3)	 26 (65.0) 14 (35.0)	0.008
Arm weakness 0: No drift 1: Drift or some effort against gravit 2: No effort against gravity or no movement	 68 (21.7) 104 (33.1) 142 (45.2)	 47 (17.2) 92 (33.6) 135 (49.3)	 21 (52.5) 12(30.0) 7 (17.5)	0.001
Speech changes 0: Absent 1: Mild to moderate 2: Severe, global aphasia, or mute	 75 (23.9) 150 (47.8) 89 (28.3)	 57 (20.8) 136 (49.6) 81(29.6)	 18 (45.0) 14 (35.0) 8(20.0)	0.004
Eye deviation 0: Absent 1: Partial 2: Forced deviation	 247 (78.7) 49 (15.6) 18 (5.7)	 212 (77.4) 44 (16.1) 18 (6.6)	 35 (87.5) 5 (12.5) 0 (0.0)	0.206
Denial/neglect 0: Absent 1: Extinction to bilateral simultaneous stimulation in only 1 sensory modality 2: Does not recognize own hand or orients only to one side of the body	 68 (21.7) 150 (47.8) 96 (30.6)	 52 (19.0) 132 (48.2) 90 (32.8)	 16 (40.0) 18(45.0) 6(15.0)	0.004
FAST-ED score, median (IQR)	4.0 (3)	4.0 (3)	2.0 (3.75)	0.001

FAST-ED: Field Assessment Stroke Triage for Emergency Destination, IQR: Interquartile range, n: Number

Table 4. Sensitivity, specificity, PPV, NPV, -LR and +LR of the FAST-ED Scale

FAST-ED	Sensitivity (95% CI)	Specificity (95% CI)	LR+	LR-	PPV	NPV	Youden index
≥1	97.2 (92.9-99.2)	35.0 (20.6-51.7)	1.50	0.08	84.1	77.8	0.322
≥2*	88.0 (81.5-92.9)	57.5 (40.9-72.9)	2.07	0.21	88.0	57.5	0.455
≥3	76.8 (68.9-83.4)	67.5 (50.9-81.4)	2.36	0.34	89.3	45.0	0.443
≥4	57.0 (48.5-65.3)	75.0 (58.8-87.3)	2.28	0.57	89.0	33.0	0.320
≥5	39.4 (31.3-48.0)	90.0 (76.3-97.1)	3.94	0.67	93.3	29.5	0.294
≥6	16.9 (11.1- 24.1)	95.0 (83.0-99.2)	3.38	0.87	92.3	24.4	0.119
≥7	6.3 (2.9-11.7)	100.0 (91.1-100.0)	-	0.94	100.0	23.1	0.060
≥8	0.7 (0.1-3.9)	100.0 (91.1-100.0)	-	0.99	100.0	22.1	0.070
≥9	0.0 (0.0-2.6)	100.0 (91.1-100.0)	-	1.00	22.0	-	0.000

FAST-ED: Field Assessment Stroke Triage for Emergency Destination, CI: Confidence interval, LR+: positive likelihood ratio, LR-: Negative likelihood ratio, PPV: Positive predictive value, NPV: Negative predictive value
*: Best cut-off point

designed to diagnose AIS. Sensitivity values varied from 44% [Los Angeles Pre-Hospital Stroke Screen (LAPSS) 1998] to 91% (NIHSS-EMS). Specificity ranged from 27% [Medical Priority Dispatch System (MPDS)] to 98% (LAPSS 1998). FABS showed the best diagnostic accuracy values. The FABS tool which was designed specifically for detecting stroke mimics and included additional clinical information, such as atrial fibrillation compared to other well-established tools, for example, ROSIER, demonstrated high sensitivity and specificity rates of about 90% (PPV: 87%, NPV: 93%) (9).

Table 5. Comparison of threshold of the FAST-ED and NIHSS according to sensitivity, specificity, PPV and NPV						
	FAST-ED ≥2*	FAST-ED ≥3	FAST-ED ≥4	NIHSS ≥6	NIHSS ≥7*	NIHSS ≥10
Sensitivity	88.0	76.8	57.0	80.3	84.1	77.8
Specificity	57.5	67.5	75.0	60.0	88.0	57.5
PPV	88.0	89.3	89.0	87.7	89.1	88.3
NPV	57.5	45.0	33.0	46.2	42.9	38.0

FAST-ED: Field Assessment Stroke Triage for Emergency Destination, NIHSS: National Institute of Health Stroke Scale, PPV: Positive predictive value, NPV: Negative predictive value
*: Best cut-off point

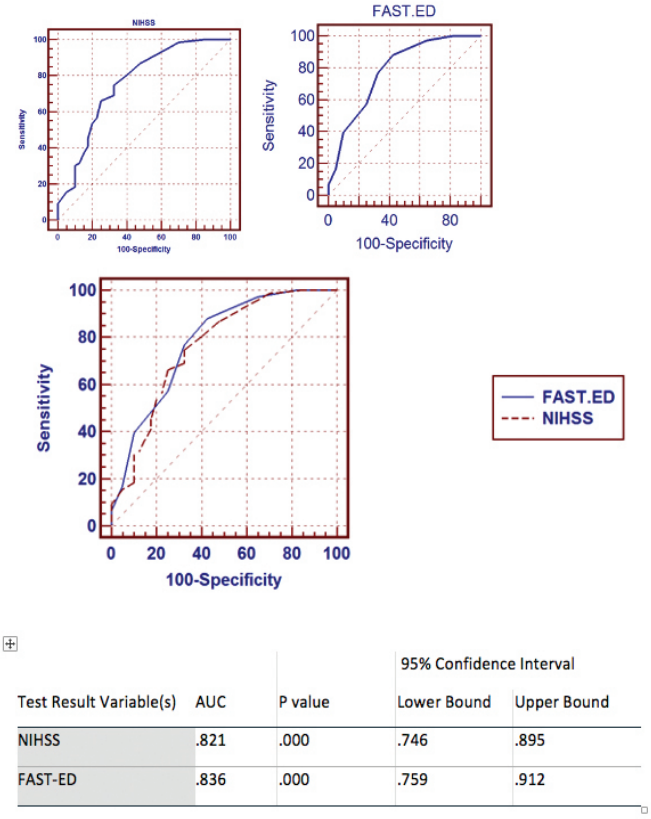

Figure 1. The sensitivity, specificity, positive predictive value, negative predictive value, negative likelihood ratio, and positive likelihood ratio for different cut-off values of the FAST-ED scale for prediction of acute ischemic stroke

Smith et al. (5) suggest that the NIHSS is the optimal large vessel occlusion (LVO) prediction instrument in the hospital emergency department, whereas in the prehospital setting, a variety of scales, including the CPSSS, FAST-ED, Los Angeles Motor Scale, and Rapid Arterial Occulsion Evaluation Scale (RACE), could be used without clear evidence for the superiority of 1 scale over the others.

FAST-ED are already familiar with the CPSS and just have added two items to it. Indeed, the FAST-ED scale is simpler than the RACE scale (six items), which has been validated in the prehospital setting.

In summary, the FAST-ED was designed to be user-friendly and applicable for pre-hospital and hospital settings. FAST-ED ≥2 has promising characteristics in predicting AIS and should be prospectively evaluated to demonstrate clinical use.

Study Limitations

This study has limitations. First, we did not report the final diagnosis of non-stroke cases. Secondly, we have not compared FAST-ED with all existing prehospital scales.

Conclusion

FAST-ED scale is relatively simple and has a comparable ability for recognizing AIS to more complex NIHSS. Assessment of both cortical and motor function using FAST-ED or NIHSS demonstrated the good diagnostic accuracy values for selecting subjects with LVO.

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Ethics

Ethics Committee Approval: The study protocol was approved by the Ethics Committee of Isfahan University of Medical Sciences (IR.MUI.MED.REC.1397.336).

Informed Consent: Before the study, written informed consent was obtained from all parents, before enrolment into the study.

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Authorship Contributions

Surgical and Medical Practices: F.H., M.N.E., E.I.D., A.F.G., Concept: M.N.E., F.H., E.I.D., A.F.G., P.N., Design: M.N.E., F.H., Data Collection or Processing: M.N.E., F.H., E.I.D., A.F.G., Analysis or Interpretation: F.H., P.N., Literature Search: M.N.E., F.H., E.I.D., A.F.G., P.N., Writing: M.N.E., F.H., E.I.D., A.F.G., P.N.

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The Effectiveness of the Combined Use of Intravenous Analgesia and Intercostal Nerve Block in Pain Control for Patients with Rib Fractures Admitted to the Emergency Service

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Abstract

Aim: Traumatic rib fractures are a common injury in the trauma population and may cause severe pain in cases of both isolated rib fractures and chest injuries. The aim of our study was to compare the early pain control of intercostal block with that of intravenous analgesia + intercostal nerve block in patients with rib fractures admitted to the emergency department due to blunt thoracic trauma.

Materials and Methods: Patients admitted to the emergency department due to blunt thoracic trauma in a tertiary medical facility were evaluated retrospectively. Forty-eight patients were included in the study. The patients were divided into two groups: on in which only intercostal nerve block was performed and another in which intravenous analgesia + intercostal block were performed concurrently.

Results: Nine patients (18.7%) were given only intercostal block, while 39 patients (81.3%) were given intravenous analgesia + intercostal nerve block. Considering the early pain results of group A (intercostal nerve block) and group B (intravenous analgesia + intercostal nerve block), significant improvement was observed in group B in terms of pain results after the first 15 minutes.

Conclusion: We conclude that the combination of intravenous nonsteroidal anti-inflammatory drugs or opioid derivatives and intercostal nerve block would be an effective combination in pain control in patients with rib fractures. In addition, intercostal nerve block would be beneficial in pain control and increase respiratory efficiency in patients with rib fractures, since it is both easy to apply and accelerates healing by providing effective analgesia. Due to these positive effects, we believe that it reduces the duration of hospital stay and would offer great advantages in terms of efficiency and cost.

Keywords: Rib fracture, pain control, emergency service, intravenous analgesia + intercostal block

Introduction

Traumatic rib fractures are a common injury in the trauma population and may cause severe pain in cases of both isolated rib fractures and chest injuries (1,2). Rib fractures are clinically important and even isolated fractures are associated with significant consequences such as long-term pain and disability (3). The number of rib fractures is indicative of the severity of the trauma, and 90% of patients with multiple rib fractures have injuries involving the head, abdomen, and/or extremities (1). Multiple traumas with an increasing number of fractures, advanced age, and rib fractures are associated with increased morbidity and mortality rates (1,4,5). Thoracic pain caused by rib fractures or chest contusion limits patients' coughing and deep breathing, which may cause atelectasis and pneumonia. Patients may also suffer from pulmonary contusion due to injuries and this situation may cause acute respiratory distress syndrome and/or respiratory failure; mechanical ventilation may be needed (6,7).

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A combination of adequate pain control, respiratory assistance, and physiotherapy is considered key in the management of patients with rib fractures (4,8). Approaches used in treatment include epidural catheters; intravenous (patient-controlled) narcotics; intercostal, paravertebral, or interpleural blocks; oral opioids; and different analgesic treatments (9,10).

The literature on the use of different analgesic treatments is insufficient. Epidural analgesia or multimodal approaches was recommended for patients with blunt chest trauma compared to opioids (9). In the systematic reviews of Duch and Møller (10) and Carrier et al. (11), it was reported that evidence for the use of epidural analgesia as the preferred method is insufficient.

However, comprehensive studies comparing modalities independently, including both observational studies and randomized controlled trials, were not analyzed. Therefore, the aim of our study was to compare the early pain control of intercostal block with that of intravenous analgesia + intercostal block in patients with rib fractures admitted to the emergency department due to blunt thoracic trauma.

Materials and Methods

Ethics committee approval of the study was obtained from the local ethics committee (Ankara City Hospital, decision no: E1-20-363, date: 27.02.2020). Patients admitted to the emergency department due to blunt thoracic trauma in a tertiary medical facility were retrospectively evaluated. A total of 48 patients were included in the study. The patients were divided into two groups as those receiving only intercostal block and those receiving intravenous analgesia + intercostal block. Patients were evaluated for early pain control parameters in terms of age, gender, trauma type, number of rib fractures, and method of treatment.

Patients with major trauma to the head and abdomen in addition to blunt thoracic trauma were excluded from the study. Patients with severe hemorrhagic trauma were also excluded. Patient groups were analyzed comparatively primarily in terms of age, gender, and number of rib fractures. According to the treatment method applied in both patient groups, results were compared according to pain levels at 0th, 15th, 30th, and 120th minutes.

Statistical Analysis

The chi-square test or Fisher's exact test was used to show the relationships between categorical data and demographic and clinical data of patients and descriptive statistics. Student's t-test and Mann-Whitney U analysis were used for continuous variables. Values of $p<0.05$ were considered significant in the study. SPSS 22 (IBM Corp., Armonk, NY, USA) was used for calculations.

Results

Of the 48 patients included in the study, 30 (62.5%) were male and 18 (37.5%) were female. The mean age was 46.08±20.01 years (range: 15-91). Thirty-seven patients were under 65 years of age, while 11 patients were 65 years of age or older. Eighteen (37.5%) patients had experienced traffic accidents, 11 (22.9%) assault, 14 (29.2%) falling, 2 (4.2%) rib fractures due to animal attacks, and 3 (6.3%) motorcycle accidents. Twenty-two patients (45.8%) had fractures on the right side and 26 patients (54.2%) on the left side. Nine patients (18.7%) were administered only intercostal block, while 39 patients (81.3%) were administered intravenous analgesia + intercostal block (Table 1).

The patient groups were compared according to the pain levels at 0th, 15th, 30th, and 120th minutes according to the treatment method applied, including only intercostal block and intravenous analgesia + intercostal block. Considering the early pain results of group A and group B, a significant improvement was observed in Group B in terms of pain results after the first 15 minutes ($p<0.05$) (Table 2).

Table 1. General characteristics of the patient groups

Variables n		Group A (Only intercostal bloc)		Group B (Intercostal block + intravenous analgesia)	
		%	n	%	
Gender	Female	1	11	17	43.6
	Male	8	88.9	22	56.4
Age (years), mean ± SD		25.77±12.37		50.76±18.52	
Age	<65	9	100	28	71.8
	>65	0	0	11	28.2
Rib fracture number	<2	9	100	25	64.1
	>2	0	0	14	35.9

SD: Standard deviation, n: Number

Discussion

The most important problem of rib fractures is pain. It is known that pain causes ineffective coughing, atelectasis with a decrease in the depth of respiratory capacity, hypoxemia, postoperative lung infection, and many other complications such as respiratory distress. These complications increase with age, smoking, obesity, and additional diseases. For this reason, various methods such as intravenous analgesia, intercostal block, epidural analgesia, and patient-controlled analgesia are used in pain control (12,13).

Intravenous narcotic analgesia is one of the most commonly used treatment modalities in patients with chest trauma. Patient comfort and treatment of respiratory depression should be carefully considered, especially in elderly patients (14). In the study of Bayouth et al. (15), it was noted that intravenous treatment with NSAI medications was very effective in reducing pain in patients with rib fractures. In the study of Kieninger et al. (16), it was reported that intravenous analgesic treatment was a more effective and reliable method with a low complication rate compared to epidural pain control.

One of the most effective methods of relieving acute pain is local anesthesia. Intercostal block is a simple and effective method that provides analgesia after upper abdominal and thoracic surgery. With this method, adequate analgesia may be provided and the ability to cough and breathe deeply may be increased. It is especially useful in the early stages of trauma and provides eight hours of analgesia. Since the drugs are used locally, the rates of side effects and morbidity are very low. In some articles, it has been stated that intercostal blocks provide pain control close to that of thoracic epidural analgesia (17). In the study of Sheets et al. (18), where intercostal nerve block was compared with epidural analgesia, the pain scores were the same in the two groups and the incidence of side effects was higher in the epidural analgesia group. In the study of Osinowo et al. (19), it was stated that intercostal block with 0.5% bupivacaine was very effective in pain control in patients with rib fractures and it may be applied safely. In the studies of Hwang and Lee (20) and Britt et al. (21), the intercostal block method applied for pain control in cases of rib fractures caused by blunt thoracic trauma increased the respiratory efficiency of the patients and significantly

Table 2. Pain levels at 0th, 15th, 30th, and 120th minutes according to the treatment method of the patient groups

Variables		Group A (Only intercostal block)		Group B (Intercostal block + intravenous analgesia)		p-value
	Pain level (1 to 5) 1-low 5-high	n	%	n	%	
Pain condition at first contact	2	5	55.6	3	7.7	0.004
	3	0	0	9	23.1	
	4	3	33.3	16	41	
	5	1	11.1	11	28.2	
Pain condition at 15th minutes	0	0	0	1	2.6	<0.001
	1	0	0	12	30.8	
	2	3	33.3	5	12.8	
	3	0	0	21	53.8	
	4	6	66.7	0	0	
Pain condition at 30th minutes	0	0	0	8	20.5	<0.001
	1	0	0	11	28.2	
	2	3	33.3	16	41	
	3	2	22.2	4	10.3	
	4	3	33.3	0	0	
	5	1	11.1	0	0	
Pain condition at 120th minutes	0	1	11.1	21	53.8	<0.001
	1	0	0	18	46.2	
	2	1	11.1	0	0	
	3	5	55.6	0	0	
	4	2	22.2	0	0	

reduced the duration of hospital stay. In our study, considering the early pain results of the group with only intercostal block and the group with intercostal block + intravenous analgesia, a significant improvement was observed in the intercostal block + intravenous analgesia group in terms of pain results after the first 15 minutes ($p<0.05$). For this reason, we concluded that the combined use of intravenous analgesia and intercostal block is more effective than other methods in pain control.

Study Limitations

The main limitation of the study that it was retrospective, the number of patients was insufficient. It could have been done by more than one center.

Conclusion

In our study, we found that the combination of intravenous NSAIDs or opioid derivatives and intercostal nerve block is an effective combination in pain control in patients with rib fractures. In addition, we think that intercostal nerve block will be beneficial in pain control and increase respiratory efficiency in patients with rib fractures, since it is both easy to apply and accelerates healing by providing effective analgesia. Due to these positive effects, we think that it may reduce the duration of hospital stay and be very beneficial in terms of efficiency and cost.

Ethics

Ethics Committee Approval: This study was approved by the Ethics Committee of Ankara City Hospital, decision no: E1-20-363, date: 27.02.2020.

Informed Consent: Retrospective study.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Concept: E.Ç., A.G., Ö.Ö.Y., Design: E.Ç., A.G., Ö.Ö.Y., Data Collection or Processing: E.Ç., A.G., Ö.Ö.Y., Analysis or Interpretation: E.Ç., A.G., Ö.Ö.Y., Literature Search: E.Ç., A.G., Ö.Ö.Y., Writing: E.Ç., A.G., Ö.Ö.Y.

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

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Case Report
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Invasive Pneumococcal Disease Associated with Austrian Syndrome

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Abstract

Austrian syndrome (AS) is named in honor of the eminent doctor Robert Austrian, an American physician specializing in infectious diseases who described this pathology in 1957. AS is a clinical entity caused by disseminated *Streptococcus pneumoniae* infection and is usually characterized by the triad of pneumonia, endocarditis, and meningitis. Before the discovery of penicillin, *S. pneumoniae* was one of the most common causes of endocarditis, but today it represents fewer than 1% of such cases. Current estimates place the occurrence rate of AS at 0.9-7.8 cases per 10 million people per year, with a mortality rate of approximately 32%. Alcohol abuse is the main risk factor, but it appears in only 40% of patients with AS. Additionally, 14% of AS patients have no associated risk factors. The majority of patients with AS are males, and it generally appears in middle age. AS more frequently affects the native valve, and in 50% of cases, the aortic valve is damaged. Timely and appropriate antimicrobial treatment and early surgery for endocarditis both decrease the risk of mortality. We present a case of a patient without predisposing factors who presented with this clinical entity and had a satisfactory outcome.

Keywords: Austrian syndrome, meningitis, endocarditis, pneumonia

Introduction

Austrian syndrome is named in honor of the eminent doctor Robert Austrian, an American doctor specializing in infectious diseases, who described this pathology in 1957 (1). Austrian syndrome is a clinical entity caused by disseminated Streptococcus pneumoniae infection and is usually characterized by the triad of pneumonia, endocarditis and meningitis. Before the discovery of penicillin, *Streptococcus pneumoniae* was one of the most common causes of endocarditis, but today it represents less than 1% (2). Currently it is estimated that there are 0.9-7.8 cases per 10 million people each year who have Austrian Syndrome, with a mortality rate of around 32% (3). Alcohol abuse is the main risk factor but it appears in only 40% of the patients. Additionally, only 14% of patients do not have any risk factor. The majority of the patients are males and it generally appears in people who are middle aged. It more frequently affects the native valve and in 50% of cases, the aortic valve is injured (3,4). Proper antimicrobial treatment and early surgery of endocarditis, both decrease the risk of mortality. We present a case of a patient without predisposing factors who presented this clinical entity with a satisfactory outcome.

Case Report

A 57-year-old patient with no past medical history was admitted by ambulance to Emergency Room (ER) in November 2019 with altered mental status. According to the family's account, two weeks before, the patient had an isolated episode of self-limited diarrhea and vomiting with appearance of a cold sore. Also, he was absent-minded and disoriented the day before.

Emergency medical services reported that the patient was found collapsed on the floor by his wife, with a Glasgow Coma Scale (GCS) of 12.

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On arrival at the ER, was febrile with a body temperature of 39.2 ºC. His heart rate was 116 beats per minute with a blood pressure of 136/73 mmHg [mean arterial pressure (MAP): 94]. His respiratory rate was 30 breaths per minute with an oxygen saturation of 99% in room air. He was agitated with a GCS of 10 (E3V2M5). His pupils were anisocoric with non-reactive mydriasis. The neck was stiff with positive signs of Brudzinski and Kernig. The rest of the examination was unremarkable. Initial blood test confirms systemic infection with abnormal complete blood count: hemoglobin=10.2 g/dL, white blood cell count: $8.2x10^3$/uL (85,9% neutrophils) and platelet count: $130x10^3$/uL. C-reactive protein was 20.3 mg/dL, procalcitonin was 6.2 ng/mL, and lactate was 2 mmol/L. Prothrombin activity: 52% [the international normalized ratio (INR: 1.54)]; Other blood examinations were unremarkable. The patient received a sedative (Midazolam 10 mg intravenous) due to significant agitation and cranial computed tomography (CT) scan was performed. After the patient´s stabilization, he was admitted to the intensitive care unit (ICU) where orotracheal intubation was performed (GCS decreased to 7) and broad-spectrum antibiotic treatment (Cefotaxime 2 gr/6 hours + Vancomycin 1500 mg/8 hours + Ampicillin 2 gr/4 hours + Acyclovir 800 mg/8 hours) for suspected meningitis was initiated. In addition, medication with inotropic drug (Norepinephrine 10 mL/h perfusion) was added to control the marked hypotension [mean arterial pressure (MAP: 54)], refractory to fluid therapy. Complete microbiological traceability (blood, sputum and urine cultures, antigens in urine and viral serologies) was taken before the initiation of the antibiotic therapy. After performing a cranial CT scan and correcting the observed coagulopathy (Prothrombin Activity 52%/INR: 1.54), a lumbar puncture was performed that confirmed the presence of *S. pneumoniae* in the cerebrospinal fluid. During the patient's admission to the ICU, the presence of pneumonia was confirmed with blood cultures and rapid Pneumococcal Urinary Antigen (PUAg) test positive for *S. pneumoniae*. Subsequently, the pneumonia responded favorably to antibiotic treatment. The patient progressed well, achieving neurological recovery without any neurological consequences, and was finally discharged 14 days after admission.

The patient returned to the ER at the beginning of January 2020 complaining of severe dyspnea and low limb edema. In addition, he presented altered mental status [GCS of 14 (O4V4M6)] and difficulty in breathing with involvement of accessory muscles. In the ER he showed severe hypotension (MAP: 56) and marked respiratory distress [respiratory rate (RR): 36; Peripheral oxygen saturation (SpO_2): 86%]. Our first diagnosis was a septic shock due to a previous history of pneumococcal meningitis and pneumonia, but serious shortness of breath and peripheral edema increased the possibility of an acute heart failure. After hemodynamic stabilization of the patient (PAM: 67; SpO_2: 95%) we admitted the patient to the ICU again. Once in the ICU, the presence of acute pulmonary edema was confirmed (Figure 1) and an echocardiography was performed, which detected significant aortic insufficiency and an image compatible with vegetation on the aortic valve (Figure 2). The next day the patient underwent urgent surgery for aortic valve replacement. The patient recovered well and upon discharge from the hospital, was referred to the cardiac rehabilitation unit.

Discussion

The groups at risk of developing invasive pneumococcal disease are children under the age of 2, older adults and the immunocompromised (5). The triad of pneumonia, meningitis and endocarditis secondary to bacteremia was first described in 1862 by Herchl after the autopsy of five patients. In 1882, Netter again revealed this clinical relationship, pointing to a clear predisposition for the aortic valve. In 1957 Robert Austrian,

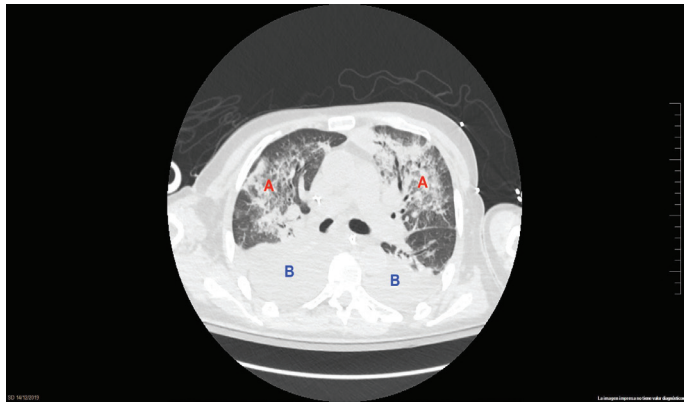

Figure 1. A. Airspace opacity in a central peribronchovascular distribution classic of acute pulmonary edema. **B.** Radiologic image compatible with bilateral pleural effusion

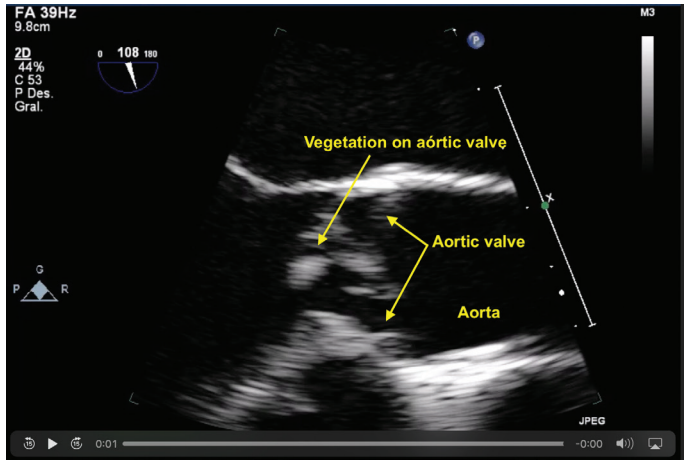

Figure 2. Ultrasonographic confirmation of the presence of vegetation on native aortic valve

reported a total of eight cases, of which six of them died, revealing that the fatal outcome of these patients was commonly the rupture of the aortic valve (1). This association is currently a clinical rarity, however, there is no data on its incidence. The physiopathology is not clear, but it is believed to be caused by *S. pneumoniae* bacteremia originating in any area, the most common being the sinuses or in cases of pneumonia, and here the cardiac valve was affected which, compromised the other systems by embolisms (6). The risk factors for developing Austrian syndrome are as follows; immunosuppressive conditions such as HIV infection, malignancies, organ transplants, chronic steroid use, age: in the early or the late stages of life, cardiovascular diseases such as heart failure and cardiomyopathies, chronic lung disease such as chronic obstructive pulmonary disease and asthma, cirrhosis, chronic renal failure, nephrotic syndrome, sinus and ear infections, influenza virus AH1N1 infection, diabetes, malnutrition, alcohol abuse, cocaine and intravenous drug use, pregnancy, lack of pneumococcal vaccination and cerebrospinal fluid fistula (7). In case of our patient there was no known history of any medical problems. Austrian Syndrome can be fatal if appropriate treatment is not administered early (8,9). In a recently published review of 111 cases of *S. pneumoniae* endocarditis in Spain, Austrian syndrome appears to be a poor prognostic factor and was present in 43.5% of patients with *S. pneumoniae* endocarditis. Pneumonia was reported to be the first clinical manifestation of Austrian syndrome in almost half of the cases (10). Austrian syndrome is characterized by implication of the left chambers of the heart, especially the aortic valve, and is highly aggressive, with almost constant valve destruction. *S. pneumoniae* endocarditis mainly affects native valves, although data on the most commonly affected valves are contradictory and vary among series of cases (10). The clinical profile presentation is an average age of 52 years, with 75% of men affected. There may be a delay of up to 4 or 6 weeks in the diagnosis of the disease. Predisposing cardiac lesions are not frequent and more than half of the patients present a systemic pathology that makes them susceptible to infection. Subacute presentation is a rare form, which was described by Robert Austrian, being more common in older patients, where the course of the disease is usually indolent. The treatment of choice continues to be penicillin, and the decrease in the incidence of *S. pneumoniae* endocarditis has been related to the effectiveness of antibiotic treatment. Owing to cases of moderate resistance to penicillin, third generation cephalosporins have been successfully used, except in rare cases of total resistance in which, vancomycin is the treatment of choice. In our case, we started with a treatment that includes third generation cephalosporin (Cefotaxime) + Vancomycin + Ampicillin amplifying the coverage for treatment of the herpes simplex virus by Acyclovir. Given the aggressiveness of the disease, which produces severe local destruction, surgical treatment is necessary in most patients, as seen in our patient who developed valve damage despite being on adequate antibiotic treatment. Surgical management with valve replacement should be carried out as soon as possible to avoid the development of cardiogenic shock. Despite correct antibiotic treatment and basic support measures, the main prognostic factor of the disease is valve destruction and this is the main cause of death (1). In the Robert Austrian series of case studies, 6 of the 8 patients died per clinic, due to secondary complications of valve destruction therefore the author concludes that antibiotic treatment serves to improve survival, but not to prevent valve rupture, and that patients who develop such a complication have a poor prognosis (1).

In conclusion, Austrian syndrome is a very rare pathology at present, but it is a critical condition and is often only diagnosed when complications arise at a late stage. It is important to maintain close clinical observation especially in the presence of signs of severe sepsis with suspected *S. pneumoniae* infection with or without predisposing factors. An early diagnosis, early initiation of antibiotic treatment and timely surgical management are the only factors that have been shown to decrease mortality and improve patient prognosis.

Ethics

Informed Consent: The patient and his family was informed orally about the suspected diagnosis, about the most appropriate investigation tests and treatment that require. Also the signed the informed consent to complete all of procedures.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: A.G., B.D.T.M., L.G.P.R., A.G.O., Concept: A.G., F.M.M.C., E.G., M.A.G., H.A.V., L.G.P.R., Design: A.G., F.M.M.C., E.G., M.A.G., L.P.L., H.A.V., E.C.G., L.G.P.R., J.L.G.F., A.G.O., Data Collection or Processing: A.G., F.M.M.C., B.D.T.M., M.A.G., S.R.S., E.C.G., A.G.O., Analysis or Interpretation: A.G., F.M.M.C., B.D.T.M., M.A.G., S.R.S., E.C.G., A.G.O., Literature Search: A.G., F.M.M.C., E.G., L.P.L., S.R.S., H.A.V, L.G.P.R., J.L.G.F., Writing: A.G., B.D.T.M., H.A.V., A.G.O.

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