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Aims and Scope

Eurasian Journal of Emergency Medicine (Eurasian J Emerg Med) is the open access, scientific publication organ of the Emergency Medicine Physicians' Association of Turkey that is published in accordance with independent, unbiased, double blind peer review principles. The journal is published 4 times in a year in March, June, September and December.

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.

The journal's target audience includes Emergency Medicine experts, School members who conduct scientific studies and work in the Emergency Medicine field, researchers, experts, assistants, practicing physicians and other health sector professionals.

Editorial and publication processes of the journal are shaped in accordance with the guidelines of the international organizations such as the International Council of Medical Journal Editors (ICMJE), the World Association of Medical Editors (WAME), the Council of Science Editors (CSE), the Committee on Publication Ethics (COPE), the European Association of Science Editors (EASE). The journal is in conformity with Principles of Transparency and Best Practice in Scholarly Publishing (doaj.org/bestpractice).

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Instructions to Authors

Eurasian Journal of Emergency Medicine (Eurasian J Emerg Med), as a double-blind peer reviewed journal published by the Emergency Medicine Physicians' Association of Turkey, publishes original articles on clinical, experimental and basic sciences in the Emergency Medicine field, review articles covering basic and up-to-date subjects, case reports, short editorial manuscripts and manuscripts covering medicine history and publication and research ethics.

Editorial and publication processes of the journal are shaped in accordance with the guidelines of the international organizations such as the International Council of Medical Journal Editors (ICMJE), the World Association of Medical Editors (WAME), the Council of Science Editors (CSE), the Committee on Publication Ethics (COPE), the European Association of Science Editors (EASE). The journal is in conformity with Principles of Transparency and Best Practice in Scholarly Publishing (doaj.org/bestpractice).

Originality, high scientific quality and citation potential are the most important criteria for a manuscript to be accepted for publication. Manuscripts submitted for evaluation should not be previously presented or published in an electronic or a printed medium. Editorial Board should be informed of manuscripts that have been submitted to another journal for evaluation and rejected for publication. Submission of previous reviewer reports will expedite the evaluation process. Manuscripts that have been presented in a meeting should be submitted with detailed information on the organization including the name, date and location of the organization.

Manuscripts submitted to Eurasian Journal of Emergency Medicine will go through a double blind peer review process. Each submission will be reviewed by at least two external, independent peer reviewers who are experts in the field in order to ensure an unbiased evaluation process. The editorial board will invite an external and independent editor to manage the evaluation processes of manuscripts submitted by editors or the editorial board members of the journal. The Editor in Chief is the final authority in the decision making process of all submissions.

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All submissions are screened by a similarity detection software (iThenticate by CrossCheck).

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Each individual listed as an author should fulfill the authorship criteria recommended by the International Committee of Medical Journal Editors (ICMJE - www.icmje.org). The ICMJE recommends that authorship be based on the following 4 criteria:

1. Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; AND

2. Drafting the work or revising it critically for important intellectual content; AND

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The manuscripts should be prepared in accordance with ICMJE-Recommendations for the Conduct, Reporting, Editing and Publication of Scholarly Work in Medical Journals (updated in December 2017 -

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http://www.icmje. org/icmje-recommendations.pdf). Authors are required to prepare manuscripts in accordance with CONSORT guidelines for randomized research studies, STROBE guidelines for observational original research studies, STARD guidelines for studies on diagnostic accuracy, PRISMA guidelines for systematic reviews and meta-analysis, ARRIVE guidelines for experimental animal studies and TREND guidelines for non-randomized public behavior.

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Authors are required to submit the;

- Copyright Transfer Form,

- Author Contributions Form,

- and ICMJE Potential Conflict of Interest Disclosure Form (should be filled in by all contributing authors) during the initial submission. These forms are available for download at www.eajem.com

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- The full title of the manuscript as well as a short title (running head) of no more than 50 characters,

- Name(s), affiliations and major degree(s) of the author(s)

- Grant information and detailed information on the other sources of support,

- The name, address, telephone (including the mobile phone number) and fax numbers and e-mail address of the corresponding author,

- Acknowledgement of the individuals who contributed to the preparation of the manuscript but do not fulfil the authorship criteria.

Abstract: An abstract should be submitted with all submissions except for letters to the editor. The abstract of Original Articles should be structured with subheadings (Aim, Materials and Methods, Results and Conclusion).

Keywords: Each submission must be accompanied by a minimum of three and a maximum of six keywords for subject indexing at the end of the abstract. The keywords should be listed in full without abbreviations.

Manuscript Types

Original Articles: This is the most important type of article since it provides new information based on original research. The main text of original articles should be structured with Introduction, Materials and Methods (with subheadings), Results, Discussion, Study Limitations, Conclusion subheadings. Please check Table 1 for limitations for Original Articles.

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.

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.

Review Articles: Reviews which are prepared by authors who have extensive knowledge on a particular field and whose scientific background has been translated into high volume of publication and higher citation potential are taken under review. The authors may be invited by the journal. Reviews should be describing, discussing and evaluating the current level of knowledge or topic used in the clinical practice and should guide future studies. Please check Table 1 for limitations for Review Articles.

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.

Letters to the Editor: This type of manuscripts can discuss important parts, overlooked aspects or lacking parts of a previously published article. Articles on the subjects within the scope of the journal that might attract the readers' attention, particularly educative cases can also be submitted in the form of "Letter to the Editor". Readers can also present their comments on the published manuscripts in the form of "Letter to the Editor". Abstract, Keywords, Tables, Figures, Images and other media are not included. The text should be unstructured. The manuscript that is being commented on must be properly cited within the manuscript.

Scientific letter: Manuscripts with prior notification characteristics, announcing new, clinically important scientific developments or information are accepted as Scientific Letters. Scientific Letters should not include sub-headings and should not exceed 900 words. Number of references should be limited to 10 and number of tables and figures should be limited to 2.

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.

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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 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.

Conference Proceedings: Bengisson S. Sothemin BG. Enforcement of data protection, privacy and security in medical informatics. In: Lun KC, Degoulet P, Piemme TE, Rienhoff O, editors. MEDINFO 92. Proceedings of the 7th World Congress on Medical Informatics; 1992 Sept 6-10; Geneva, Switzerland. Amsterdam: North-Holland; 1992.p.1561-5.

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/ncidodIEID/cid.htm.

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Editorial

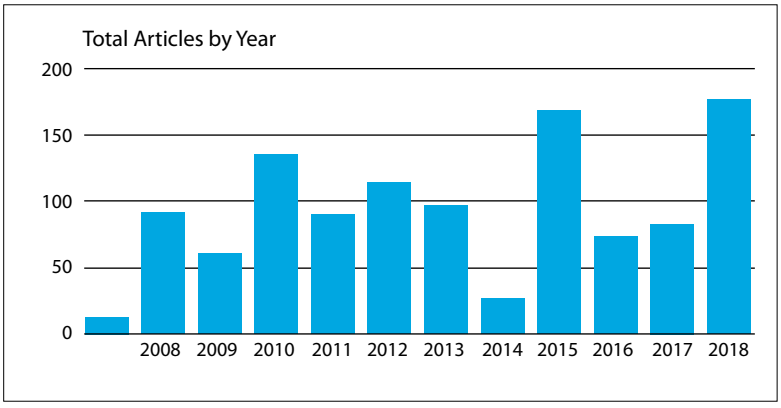
Dear Colleagues,

We present the last issue of 2018. To summarize the year of 2018, a total of 177 papers were submitted to our journal this year. Four issues included 28 clinical research articles, 16 case reports, 5 image cases, 3 letter to the editor, and one historical letter to the editor; 53 paper in total. The rate of articles that were accepted to be published in our journal was 29.9%. Please look at the below figure related to total articles submitted to Eurasian Journal of Emergency Medicine by year.

Due to the increased number of manuscripts submitted to our journal, we were also able to publish the articles that were ready for online publication on the "Ahead of Print" section of our website. For the accomplishment of all these, the elaborate cooperation of the AVES Publishing staff was also very important as well as your valuable supports.

Submission of a manuscript to our journal means doubtlessly a magnificent support. We would like to remind you again that referencing the article published in Eurasian Journal of Emergency Medicine revives our journal. You can reach the entire published article on our journal website.

On behalf of our editorial board, thank all researchers who made scientific contributions to our journal by sending their qualified studies to us, and all peer reviewer who are taking part in the evaluation of the publication process.



Sincerely,

Dr. Isa Kilicaslan
Editor in Chief

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CONTENTS

EURASIAN JOURNAL OF EMERGENCY MEDICINE

History of Snakebite Envenomation Treatment and Contribution of Turkey to Global Antivenom Production

Can Sarica[1], Leyla Topcu Sarica[2], Tarik Ozturk[2], Ruslan Abdullayev[2]
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Cite this article as: Sarica C, Topcu Sarica L, Ozturk T, Abdullayev R. History of Snakebite Envenomation Treatment and Contribution of Turkey to Global Antivenom Production. Eurasian J Emerg Med. 2018; 17 (4): 145-7.

Have you ever treated a case of human envenoming in the emergency department? If yes, did you pay attention to the origin of the antivenom used? Not so long ago, for until about a decade, we used to import antivenoms from various countries such as Egypt and Serbia. Antivenom treatment was available in only some well-equipped hospitals in our country; however, in this decade, things changed. We have been producing our own antivenoms, and they are available all over the country.

The first successful antivenin serum therapy dates back to 1895. Before that, antivenom treatment was not available, and people with a weak immune system died. The first horse-derived antivenom sera, produced by a protégé of Louis Pasteur named Albert Calmette, were used by Lépinay for antivenom treatment in present-day Vietnam (1). During that time, Calmette was living in Vietnam and decided to produce an antivenom after a flood forced cobras into a village near Saigon where they bit about 40 people and killed four (2). The preparation of the first antivenom involved the separation of the serum from the blood of hyperimmunized horses. Later, it was observed that the antibodies (immunoglobulins) were responsible for the therapeutic action (3); therefore, they were purified from the plasma and used instead of crude serum. Since then, immunoglobulin fragments have played an important role in the treatment. Despite the technological development, the principle of antivenom preparation has remained the same; however, for maximum quality, the production steps were standardized by the World Health Organization (WHO) in 2008 (4); we have explained this later.

In the clinical aspect, human envenoming is a recognized medical emergency with 421,000 to 2.5 million annual cases worldwide and 20,000 to 100,000 annual deaths (5). This condition is of particular interest to our country because there are approximately 40 different types of snakes classified under six families living in Turkey, which are described as follows (6):

- Typhlopidae: 1
- Leptotyphlopidae: 1
- Boidae: 1
- Colubridae: 27
- Viperidae: 9
- Elapidae: 1

Although there are some types belonging to the Colubridae family, which contain toxins dangerous to humans, only those belonging to the Viperidae and Elapidae families pose great danger to humans. Biting characteristics of the snakes from the Colubridae family make them far from being hazardous to humans (6).

Most of the venomous snakebites in our country occur in the East Black Sea, Southeastern Anatolia, East Anatolia, and Northwest Thrace regions. Of the 10 poisonous snakes, nine belong to Viperidae and one to Elapidae families; they have been described as follows (with Turkish names in the parentheses) (6):

- *V. ammodytes* (Boynuzlu engerek)
- *V. barani* (Baran engeregi)
- *V. kaznakovi* (Kafkas engeregi)
- *V. lebetina* (Koca engerek)
- *V. pontica* (Coruh engeregi)
- *V. raddei* (Agri engeregi)

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Figure 1. a-f. Steps of antivenom production. All snakes must be quarantined for at least 2 months in a special room before they qualify for milking. Venom is collected by snake milking (a), venom quality is checked in quality control laboratories using national venom references. Then venom doses are prepared using adjuvants following the World Health Organization guidelines on "Good Manufacturing Practices." Thereafter, the venom is injected into horses for immunization. Once the immune response to the immunizing venom mixture yields satisfactory antibody levels, the plasma is collected from the horses (b, c), the plasma is fractionated to extract the antivenom immunoglobulins. The bulk antivenom immunoglobulins are formulated (d) and filled into bottles in aseptic conditions (e), following macroscopic quality control tests, the potency of the antivenom is assessed by injecting it into rats. Bottled antivenoms are labeled and ready for release (f)

- *V. ursinii* (Kucuk engerek)
- *V. wagneri* (Vagner engeregi)
- *V. xanthina* (Seritli engerek)
- *Walterinnesia Aegyptia* (Col kobrasi)

The estimated economic burden of snakebites in Turkey is unclear. However, currently, we are fortunate regarding the treatment of this disease because one of the biggest antivenom manufacturers in the world, which is a candidate member of the WHO global antivenom producers database, was established in Adiyaman, Turkey, with $5 million of investments in 2006. The factory strictly conforms to the WHO guidelines for producing antivenom (4). This antivenom contains a mixture of horse-origin immunoglobulin fragments effective against three snakes from the Viperidae family: *Macrovipera Lebetina*, *Montivipera Xanthina*, and *Vipera Ammodytes*. These antivenins are found in the pharmacies of most hospitals where snake envenomation is endemic. In special circumstances, the antivenins can be obtained through communication with the National Venom Consultation Center (Ulusal Zehir Danisma Merkezi) from the hospital or via personal telephones (Phone no. 114). The center supplies the antivenins through the national pharmacy chain via land or air transportation. This is the only authorized center for antivenin production in Turkey, and it obtained authorization in 2007.

Currently, there are 45 antivenom production centers listed in the WHO database of antivenom producers (7). These centers strictly adhere to the WHO guidelines and are listed in the database. Vetal Serum Turkey® has conformed to these guidelines and applied to be listed; we look forward for it to be listed herein in the near future.

For more than a decade, we are not only meeting our national needs but also exporting snake and scorpion antivenoms to a broad range of countries from Argentina to China. Following the listing in the WHO database, we are also expecting antivenin exportation to

Europe and North America. We have summarized the production steps in Figure 1.

It should be considered that antivenin treatment can be more hazardous than the snake poison itself (8). Allergic reactions can be encountered during the treatment course. A cost-benefit analysis must be done before antivenin application. Adrenalin and H_1 and H_2 receptor blockers should be kept ready. Skin test is controversial before antivenin application and is generally omitted because of false-positive and negative results. Serum sickness, which is a type III hypersensitivity reaction, must be considered as a late complication on days 3-21 of treatment.

In conclusion, producing antivenoms helps us treat our patients without struggling with drug insufficiency problem, which is a common problem worldwide since the closure of big manufacturers at the end of 20th century (9). To provide a better healthcare experience for our patients, we must achieve success in more areas of pharmaceutical production, as in this study.

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Self-Administered Outpatient Parenteral Antimicrobial Therapy for Urinary Tract Infection from the Emergency Department: A Safe and Effective Strategy to Avoid Hospital Admission

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Abstract

Aim: To determine the safety and efficacy of self-administered outpatient parenteral antibiotic treatment (S-OPAT) within a hospitalization-at-home (HaH) program to manage a urinary tract infection (UTI) in patients referred directly from a hospital ED.

Materials and Methods: This was a retrospective study of UTI episodes in patients treated initially in the ED, who were subsequently enrolled in a HaH program to receive S-OPAT. Epidemiological, clinical, and microbiological data were recorded. Safety was evaluated by means of mortality and the occurrence of unexpected hospital returns (reason, intra-hospital death) during the domiciliary period. The efficacy was evaluated considering the healing rate and analysis of mortality and repeat hospital admissions because of the UTI recurrence during the first month after discharge.

Results: A total of 268 episodes of UTI were analyzed; the mean age of patients was 59.3 years, and 53% were female. The Charlson index was 1.97. The most common types of UTI were acute pyelonephritis and urosepsis. In 61.4% of urine cultures, microbiological documentation was obtained. E. coli was the most commonly isolated microorganism. A total of 27 strains of multidrug resistant microorganisms (MRD) were recorded. The most commonly used antimicrobial drug was ceftriaxone. There was one reported death. Clinical complications that resulted in returning to hospital occurred in 3.4% of cases. The healing rate was 96.5%. During the month after discharge, 4.4% of patients required repeat admission because of the UTI recurrence.

Conclusion: S-OPAT within a HaH program in patients with UTI who are referred directly from ED is safe and effective.

Keywords: Complications, hospital at home, self-administered outpatient parenteral antimicrobial therapy, urinary tract infections

Introduction

Urinary tract infection (UTI) is one of the most commonly treated pathologies in hospital emergency departments (EDs). UTIs comprise approximately 22% of all infectious processes and are a common reason for hospital admission (1). The growing prevalence of multidrug resistant microorganisms (MRM) as a cause of UTI and other infections currently entails a severe public health problem (2). The consumption of resources arising from the treatment of UTI is very high, and in the United States alone, it is responsible

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for approximately 100,00 hospital admissions out of more than 1 million visits to EDs and a cost of more than US$1 billion (3). All these circumstances make UTI a complex clinical entity and a challenge for health care professionals.

However, alternative care systems that avoid the patient admission into a conventional hospital ward should mean improved efficiency. In this sense, some models denominated the outpatient parenteral antimicrobial therapy (OPAT), which is based on the administration of parenteral antibiotics at home, have obtained excellent results in terms of safety and efficacy in the context of clinically stable infectious processes (4). Among them, there is a variant known as self-administered OPAT (S-OPAT) in which health care staff trains carers or the patient to administer parenteral medication, which raises the efficiency even more, given that the costs arising from nursing visits are vastly reduced (5).

Moreover, in Spain, there are hospitalization-at-home (HaH) units, a more complex alternative care resource than OPAT, which offer a diagnostic and therapeutic support at home similar to the one provided on the ward and can treat any clinical process with hospital admission criteria. In these units, not only antimicrobials are administered parenterally but also other drugs are administered intravenously. Serum therapy, prior oxygen therapy, analgesics, antipyretics, and nebulized medications can be administered, blood derivatives are transfused, and all kinds of biological samples can be collected at home (6).

The primary objective of our study is to determine the safety and efficacy of UTI treatment by means of an S-OPAT regimen supported within the scope of a HaH program in patients referred directly from ED.

Materials and Methods

Study design

This was a retrospective, observational study of a series of patients. The study was approved by the Ethics Committee of the Autonomous Community of Cantabria (2017.249).

Study context and population

In Marqués de Valdecilla University Hospital, a third level hospital with an approximate capacity of 900 beds, all episodes of patients diagnosed with UTI with hospital admission criteria according to the European Association of Urology, (7) who received S-OPAT in the HaH unit immediately after being treated in the ED during a two-year period (2015-2016) were analyzed.

Data collection

Epidemiological (sex, age), clinical (comorbidity, nephrourological history, the type of UTI, the type of antibiotic, S-OPAT duration), and microbiological study variables were obtained from the clinical history records (on paper and/or electronic) of the hospital and were included in a Microsoft Excel-like database.

Objectives

The objectives were to determine safety (domiciliary mortality, complications that obliged an unexpected return to hospital, and subsequent intra-hospital death) and efficacy (healing rate, recurrence of the UTI) of this care modality.

Statistical analysis

Variables were analyzed with the statistical software package Statistical Package for Social Sciences version 11.5 (SPSS Inc.; Chicago, IL, USA). A descriptive analysis was performed; quantitative and qualitative variables were expressed as the mean±standard deviation and percentage and proportions, respectively.

Results

Characteristics of the population studied

During the study period, emergency doctors admitted 1,394 episodes of UTI, of which 268 (19.2%) were in compliance with the HaH admission criteria, whereby they were transferred home to complete the stipulated therapeutic plan (Table 1). The description of the basal characteristics of patients and the most important microbiological characteristics of UTI episodes are summarized in Table 2.

Table 1. Inclusion Criteria for an Episode of UTI in the HaH, Avoiding the Hospital Admission Program of the HUMV

General:
Voluntary participation of the patient and carer(s) after being informed on the
functioning of the HaH
Requirement for a 24 h/day carer in the home of the patient
HaH operating within the catchment area of 15 km from the hospital
Specific:
Commitment on the part of the patients and carer(s) to the S-OPAT scheme
Clinical stability (hemodynamic stability)
Laboratory criteria (suitable stable renal function)
Absence of obstructive acute renal failure using urological ultrasound

HaH: hospitalization at home; HUMV: Hospital Universitario Marqués de Valdecilla; UTI: urinary tract infection; S-OPAT: self-administered outpatient parenteral antimicrobial therapy

Table 2. Basal characteristics, specific features, and microbiological finding of the UTI episodes in HaH

Basal Characteristics	
Age (mean, SD)	59.3 (22.0)
Women (n, %)	142 (53.0)
Existence of comorbidity (n, %)	161 (60.1)
Charlson index (mean, SD)	1.7 (1.9)
Urinary catheter carrier (n, %)	30 (11.2)
Neoplasia of the urinary tract (n, %)	21 (7.8)
Neurogenic bladder dysfunction (n, %)	11 (4.1)
Renal lithiasis (n, %)	7 (2.6)
Specific Type of UTI (n, %)	
Pyelonephritis	84 (31.3)
Urosepsis	63 (23.5)
Complicated cystitis	57 (21.3)
Prostatitis	43 (16.0)
Infection associated with urinary catheter	18 (6.7)
Orchiepididymitis	3 (1.1)
Antibiotics most commonly used (n, %)*	
Ceftriaxone	175 (46.6)
Gentamycin	88 (23.4)
Ertapenem	53 (14.1)
Piperacillin-tazobactam	13 (3.4)
Meropenem	12 (3.2)
Duration of S-OPAT (days, SD)	10.7 (7.1)
Microbiological finding	
Documented microorganisms in urine cultures (n, %)* **	
Total positive urine cultures (n, %)**	156 (61.4)
Escherichia coli	92 (59.0)
Klebsiella pneumoniae	18 (11.5)
Pseudomonas aeruginosa	14 (9.0)
Proteus mirabilis	8 (5.1)
Morganella morganii	6 (3.8)
Documented microorganisms on blood cultures (n, %)	
Total positive blood cultures (n, %)****	19 (14.7)
Escherichia coli	13 (68.4)
Proteus mirabilis	2 (10.5)
Klebsiella pneumoniae	2 (10.5)
Coagulase-negative *Staphylococcus*	1 (5.3)
Morganella morganii	1 (5.2)
Documented MDR microorganisms (n, %)	
Total positive MDR microorganisms in the 175 isolates (n, %)	27 (15.4)
Escherichia coli ESBL	10 (37.0)
Klebsiella pneumoniae ESBL	5 (18.5)
Morganella morganii ESBL	4 (14.8)
Pseudomonas aeruginosa MDR	4 (14.8)
Proteus mirabilis ESBL	2 (7.4)
Providencia stuartii ESBL	2 (7.4)

ESBL: extended spectrum beta-lactamase; HaH: hospitalization at home; MDR: multidrug resistant; SD: standard deviation; UTI: urinary tract infection
*The total number of antibiotics administered was 375. Other antibiotics used were; Ceftazidime, cefepime, amikacin, tobramycin, ciprofloxacin, levofloxacin, amoxicillin-clavulanic acid, aztreonam
**Total number of patients in whom a urine culture was processed: 254 (94.8%). Most (56.1%) patients with a negative urine culture had received antibiotic treatment before the sample was collected.
***Other documented microorganisms: *Enterococcus faecalis,* Coagulase-negative *Staphylococcus, Candida albicans, Ureaplasma urealyticum, Methicillin-resistant Staphylococcus aureus, Providencia stuartii.*
**** Total number of patients in whom blood cultures were processed: 129 (48.1%).

Safety and effectiveness

The results concerning safety and efficacy are summarized in Table 3. Regarding safety, during S-OPAT, only one death occurred at home because of broncho-aspiration in an extremely elderly patient with a highly deteriorated basal functional situation. In 16.1% of patients, a clinical complication appeared mostly unrelated to infection. Most of these (79.1%) could be resolved at home. A total of 20 patients had to return to hospital, nine because of major medical complications. Four of these complications may have been related to the infectious process (two episodes of exacerbation of chronic renal failure, one epileptic crisis probably following the administration of ertapenem, and one case of therapeutic failure despite theoretically correct initial treatment). Another eight patients returned because of socio-familial problems that made it impossible to continue the S-OPAT, and a further three returned because of having scheduled surgery unrelated to the UTI. One of the patients who returned died for reasons unrelated to UTI.

As for efficacy, once the 11 patients that returned to hospital for socio-familial reasons and scheduled surgery were excluded, the healing rate attained in those in whom it was possible to complete the S-OPAT program was 96.5%. During the first month following discharge from HaH, 11 (4.4%) patients who completed S-OPAT were readmitted because of the recurrence of the UTI. A further six did so for reasons outside the scope of the UTI (two because of broncho-aspiration, one because of superinfected pressure ulcers, and three because of scheduled surgery).

Table 3. Safety and efficacy of the HaH program based on S-OPAT during the UTI episodes

Safety	
Mortality (n, %)	1 (0.4)
Total number of patients who returned to the hospital (n, %)	20 (7.5)
Complications that required unexpected return (n, %)	9 (3.4)
2 heart failure	
2 severe exacerbated chronic renal failure	
1 ischemic stroke	
1 therapeutic failure of the UTI	
1 supraventricular tachycardia	
1 hematuria	
1 convulsive crisis	
Complications resolved at home (n, %)	34 (12.7)
5 episodes of diarrhea after antibiotics	
5 episodes of acute urine retention	
5 episodes of exacerbated chronic renal failure	
3 episodes of confusional syndrome	
3 episodes of hematuria	
3 episodes of thrush	
3 episodes of LFT abnormality induced by antibiotics	
2 episodes of unbalanced diabetes	
2 episodes of drug fever	
2 episodes of pseudomembranous colitis	
1 episode of supraventricular tachycardia	
Effectiveness	
Healing rate (n, %)	248 (96.4)
Recurrence of the UTI (n, %)	11 (4.4)

HaH: hospitalization at home; S-OPAT: self-administered outpatient parenteral antimicrobial therapy; UTI: urinary tract infection; LFT: liver functional tests

Discussion

This work reveals that despite the UTI complexity because of its various symptoms (fever, pain, dehydration, etc.) at the time of diagnosis, it is possible to safely and effectively perform S-OPAT within a HaH unit. To the best of our knowledge, our work is novel as there are no precedents in the literature that dealt with this issue.

Thanks to the HaH unit, the ED avoided the admission of almost one in every five patients diagnosed with UTI with hospital admission criteria and obtained from the outset, which had a positive impact on the management of hospital resources (relief of the ED congestion, improved availability of beds in the traditional hospital ward, etc.). In this context, in accordance with recent publications that advocate the need to set out new care strategies that would help to homogenize hospital admission decisions, the HaH could reduce the costs significantly (8). Therefore, Stuck et al. recently concluded that emergency physicians are highly receptive to referring patients to HaH units, but they demand that referral processes be quick (9).

Data obtained in our series share the epidemiological similarities with those observed in recent literature, and they revealed the increasingly more common onset of the MRM strains as causal UTI factors (9). From the microbiological point of view, our series is notable because of its extremely high index of collection of urine cultures with more than 60% coming back as positive; these figures are higher than those found in the literature (approximately 41%) (10). *E. coli* turned out to be the most commonly isolated microorganism, both in urine and blood cultures. The high presence of MRM strains in our series (more than 15% of isolates), well above the 5% from other studies, (11) highlights the important work of our HaH unit with the aim of limiting their dissemination within the hospital setting.

Our S-OPAT program was extremely safe because only a little more than 3% of patients returned to hospital because of major medical complications. The low mortality rate turned out to be more than assumable, given the baseline characteristics of the deceased patient. The results obtained in terms of efficacy were satisfactory, and a healing rate similar to the one published recently by a Spanish group that applied traditional OPAT (12) was attained.

The success of our S-OPAT model in this context is most likely due to several reasons. First, the close collaboration with the ED staff fosters an effective process of patients' home referral (9). However, early administration of antimicrobials and collection of microbiological samples favored a better clinical course in patients, something corroborated by the abundant literature that revealed that both actions improve the prognosis of infectious processes seen in ED (13). Finally, appropriate selection of patients and the efficacy of our HaH unit when responding to any complication at home were essential for the program's success.

Study limitations

We believe the internal validity of our work is high because there was no loss of information. Moreover, the S-OPAT model has been supported in a HaH unit with more than 30 years of experience. However, this study has some limitations, derived specifically from the concrete features of our HaH unit, which can hinder its practical application in other contexts. Such specificities would be their dependence on a tertiary hospital, their close daily collaboration with the ED for referral of any kind of HaH subsidiary process, and finally, their major capacity to provide with their own health care personnel and 24 hours a day, a fast response to any clinical complication of the patient in their own home. All of this can hinder the extrapolation of our conclusions to other medical care contexts.

Conclusion

To conclude, the S-OPAT model supported within a HaH unit is safe and effective in the treatment of complex UTI cases, referred directly from the ED. This also constitutes a doubly useful care tool for the hospital by improving the overall bed management and avoiding the intra-hospital dissemination of MRM strains.

Ethics Committee Approval: Ethics committee approval was received for this study from the Ethics Committee of the Autonomous Community of Cantabria (2017.249)

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

Peer-review: Externally peer-reviewed.

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Does Accelerometer Use Lead to Higher Quality CPR for Advanced Cardiac Life Support Providers? A Prospective Randomized Study

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Abstract

Aim: High-quality cardiopulmonary resuscitation (CPR) is the cornerstone to improved outcomes for patients with cardiac arrest. The aim of this prospective randomized study was to evaluate whether audio-visual feedback use affects the critical components of high-quality CPR compared with CPR without feedback.

Materials and Methods: One hundred in-hospital Advanced Cardiac Life Support (ACLS) providers volunteered as participants. Participants were tested on a high-fidelity manikin in a simulated cardiac arrest scenario performing 2 min of single-rescuer CPR. The control group completed the scenario with conventional CPR, whereas the intervention group adjusted CPR as instructed by the Philips MRx accelerometer. The primary outcome was mean compression rate, whereas the secondary outcomes included percent appropriate compression rate, mean compression depth, percent appropriate compression depth, percent complete chest recoil, percent chest compression fraction (CCF%), mean ventilations per minute.

Results: The intervention arm had a higher median percent of compressions with an appropriate rate (between 100 and 120 min^{-1}, 92.5% vs. 46.0%; p<0.001) and CCF% (mean 68.9% vs. 66.9%; p=0.029). Twenty percent of the control arm had zero chest compressions within the American Heart Association-recommended compression rate range. The intervention arm also had a significantly lower mean compression rate (110.3 min^{-1} vs. 117.3 min^{-1}; p=0.004). A trend toward decreased compression depth with the intervention group was found (44.2 mm vs. 47.5 mm; p=0.062).

Conclusion: In-hospital cardiac arrest providers provided a slower but more appropriate compression rate and a higher CCF% using the Philips MRx accelerometer than providers without the device. The intervention group trended toward a decreased compression depth.

Keywords: Adult cardiac arrest, CPR feedback, high quality CPR

Introduction

Despite dramatic advances in resuscitative medicine, survival rates for adult cardiac arrest remain poor ranging from 6% to 24% (1). One of the keys to improved survival rates is prompt and high-quality cardiopulmonary resuscitation (CPR). Despite the importance of CPR, studies continue to demonstrate low-quality CPR by properly trained healthcare providers (2-4). When CPR is delivered exactly as recommended by the American Heart Association (AHA) guidelines, it is still inherently inefficient with only 20% of normal blood flow to the heart and at best 30%-40% of normal blood flow to the brain (5-8).

Prior observational studies have helped define high-quality CPR (HQ-CPR) by identifying five critical components of CPR associated with improved survival rates. These components include minimizing interruptions in chest compressions, compression rates between 100 and 120 compressions min^{-1}, compression depth of 2-2.4 in., complete chest recoil, and appropriate ventilation rate and volume (3, 9). However, monitoring of these parameters remains inconsistent and is often completely absent, prohibiting real-time opportunities for improvements in CPR quality and possibly survival rates. With the advent of audio-visual feedback devices and high-fidelity training manikins, it is now possible to measure CPR parameters during active resuscitations and training simulation scenarios. Although small out-of-hospital studies have demonstrated improved performance with regard to chest compression rate and depth through the use of audio-visual feedback devices (10-13), other studies have demonstrated a possible overestimation of chest compression depth with these devices (14-17). The potential benefit of real-time feedback during CPR remains unclear, and less work has been done to evaluate such

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methods among cardiac arrest resuscitations in the emergency department (ED).

In this prospective study, we randomized providers to provide conventional provider-driven CPR or CPR guided by an audio-visual feedback accelerometer to determine if there is a difference in the quality of the five critical components of CPR (chest compression depth, chest compression rate, chest recoil, excessive ventilation, and percent chest compression fraction (CCF%)) when applied in simulated cardiac arrest with in-hospital providers in the ED.

Materials and Methods

Study design and randomization

This randomized controlled trial was conducted in the ED at a single academic institution between March 2015 and November 2015. One hundred AHA Advanced Cardiac Life Support (ACLS)-certified providers were enrolled in the study. All providers were current ED employees who volunteered. Written consent was obtained to participate in the study. Providers were randomized to either the control group or the intervention group. Using a random number generator, each participant was assigned a private, random number between 1 and 1000. Participants were assigned to the control group if they have an odd number and to the intervention group if even number. The control group was defined as CPR performed according to the provider's best practices, and the intervention group was defined as audio-visual feedback-guided CPR. Participants were not compensated for study participation. This study was granted approval by the IRB and Ethics committee at the institution prior to enrolling participants (Approval Date 8/8/14; Approval No.: IRB00010880).

Equipment

A Resusci Anne QCPR AED Airway manikin with SimPad technology (Laerdal Medical, Memphis, TN, USA) weighing 60 kg was used during all simulations. The SimPad BLS learner (Laerdal Medical) functioning in the assessment mode was used during the study. The 2010 and 2015 AHA guidelines were used as comparison settings for baseline metrics. The SimPad technology automatically recorded and stored both the primary and the secondary outcomes of interest, including chest compression rate, percentage of appropriate chest compression rate, chest compression depth, percentage of appropriate chest compression depth, percentage of complete chest recoil, ventilation volume, ventilations per minute, and CCF%. Data were downloaded to a secure, password protected Excel spreadsheet only accessible by the primary investigator.

A Philips MRx portable monitor defibrillator (Philips, Andover, MA, USA) with Q-CPR capability was used for each simulation. The Symbio CS1201 Simulator (Symbio Corporation, Beaverton, OR, USA) was used as a rhythm generator, and asystole was the rhythm provided for each simulation. For the intervention group, the Philips Q-CPR accelerometer (Laerdal Medical, Stavanger, Norway) was used to provide audio-visual feedback during simulated CPR. This feedback device provides audio and visual cues informing the rescuer of appropriate chest compression rate and depth, complete chest recoil, and audio cues at 10-second intervals when chest compressions are not being performed. This device was selected as this is the monitor-defibrillator deployed during all resuscitations at the study site.

Experiments

After randomization, each participant underwent 2 min of single-rescuer-simulated cardiac arrest resuscitation. The single-rescuer scenario was selected as this is often the setting during the initial phases of a cardiac arrest event. This scenario also better illustrates the integration of both the cardiac and the pulmonary components of resuscitation. Participants in the control arm were instructed to perform the AHA ACLS single-rescuer resuscitation comprised cycles of 30 chest compressions to 2 ventilations. All participants were allowed 1 min to familiarize themselves with the manikin, including practice compressions and ventilations before the 2-minute scenario started. Participants were allowed to modify the resuscitation environment prior to beginning by using a stool, changing the height of the bed, or using gloves based on their preference. A standard chest compression backboard was used for each simulation. Ventilations were provided using a standard bag-valve mask (Ambu SPUR II) without an oral or nasal airway adjunct. During the 2-minute simulation scenarios, participants were encouraged not to change any of the resuscitation environments and to focus on maintaining the 30:2 ratio for each cycle of CPR. A research assistant started, stopped, and timed each scenario, and the SimPad technology assessment mode automatically stopped collecting data at the end of the 2-minute period. At the completion of the 2-minute scenario, outcome data were downloaded from the SimPad to the Excel data set, and demographic information was collected from each participant.

The intervention arm underwent the same simulated cardiac arrest scenario as the control group with the addition of the audio-visual feedback accelerometer. Participants in the intervention arm were provided with a short voiceover PowerPoint presentation prior to the simulation explaining the appropriate placement and appropriate use of the feedback accelerometer. They were specifically instructed to adjust their resuscitation metrics based on feedback provided by the accelerometer.

Statistical analysis

A previous study found that the use of the device improved correct chest compression depth from 45% to 73% of the participants, and a power calculation based on this found that a sample size of 45 subjects in each group would result in 80% power to find a difference at a 5% two-tailed significance level (10). Based on this estimation, 50 participants were enrolled in each group.

Participant demographic characteristics included current medical position (nurse, resident physician, physician, student, and emergency medicine technician), date of the most recent ACLS training, and previous experience with a CPR feedback device. Participant characteristics were compared between the control and the intervention groups using the chi-square or Fisher's exact tests where appropriate to determine whether or not randomization was successful at balancing the potential confounders between the groups. The quality of CPR metrics included average compression rate, compression depth (mm), ventilation volume (mL) and ventilation rate, participant percentage of appropriate (as defined by the 2010 and 2015 AHA guidelines) compression rate, compression depth, complete chest recoil, and CCF%. The median values were used for comparison of non-normally distributed continuous variables.

The quality of CPR measures was plotted using box-and-whisker plots and compared between the control and the intervention groups using t-tests or Wilcoxon two-sample tests where appropriate. We used the chi-square and Fisher's exact tests for comparison of categorical measures. All statistical analyzes were made using SAS 9.4 (SAS Institute Inc., Cary, NC, USA). All reported p-values are two-sided. A $p<0.05$ was considered statistically significant.

Results

A total of 100 trial participants, with 50 randomized to standard CPR and 50 randomized to feedback-guided CPR, were included in the study. Participants were predominantly nurses, and the majority had received ACLS training within the last year. The majority of the participants (60%) had prior experience with a CPR feedback device (Table 1). There were no differences between the control and the intervention groups with regard to their position, most recent ACLS training, or previous experience with a CPR feedback device; thus, all outcome analyzes were performed via bivariate, two-sample tests.

Table 1. Baseline characteristics of the study participants

Participant Characteristics	Control (n=50)	Intervention (n=50)	p
Medical provider type, n (%)			
Physician	7 (14)	9 (18)	0.191
Nurse	27 (54)	27 (54)	
Resident physician	13 (26)	6 (12)	
EMT	3 (6)	5 (10)	
Student	0 (0)	3 (6)	
Last ACLS training, n (%)			
<1 year	30 (60)	31 (62)	0.838
1-2 years	20 (40)	19 (38)	
>2 years	0 (0)	0 (0)	
Previous CPR feedback device experience, n (%)	30 (60)	30 (60)	1.000

ACLS: advanced cardiac life support; CPR: cardiopulmonary resuscitation

Participants performing CPR with the feedback device had a statistically significantly higher median percent of compressions with an appropriate rate (between 100 and 120 min^{-1}, 92.5% vs. 46.0%; $p<0.001$) and a statistically significantly lower mean compression rate (110.3 min^{-1} vs. 117.3 min^{-1}; $p=0.004$) than participants not using the device. Of note, 20% of the control arm had zero chest compressions within the guideline-recommended chest compression rate range, all with a mean rate exceeding the currently recommended upper rate. Participants in the intervention arm also had significantly higher mean CCF% (68.9% vs. 66.9%; $p=0.029$) than participants without the feedback device (Table 2, Figure 1).

There was a trend ($p<0.1$) for participants using the accelerometer to have a lower average compression depth (44.2 mm vs. 47.5 mm; $p=0.062$) and lower median percent of compressions with appropriate depth (34.0% vs. 86.5%; $p=0.065$) than participants not using the device (Table 2, Figure 1).

There was no difference found between the intervention and the control groups with regard to percent appropriate recoil (99% vs. 99%; $p=0.3$), average ventilation volume (510 mL vs. 486 mL; $p=0.3$), or average ventilation rate (4.1 min^{-1} vs. 4.2 min^{-1}; $p=0.5$).

Discussion

With well-established evidence of the importance of HQ-CPR leading to improved outcomes in adult cardiac arrest, methods to continually measure and monitor CPR metrics in real time are of great value. According to the 2015 AHA guidelines, the definition for HQ-CPR has expanded to include upper limits for both compression rate (120 min^{-1}) and compression depth (60 mm) (9). These changes further emphasize

Table 2. Quality of CPR metrics

Quality of CPR Measures	Control (n=50)	Intervention (n=50)	p
Average compression rate (compressions min^{-1}), mean (SD)	117.3 (15.0)	110.3 (6.2)	0.004
Percent appropriate compression rate, median (IQR)	46.0 (2.0-85.0)	92.5 (80.0-99.0)	<0.001
Average compression depth (mm), mean (SD)	47.5 (10.0)	44.2 (7.1)	0.062
Percent appropriate compression depth, median (IQR)	86.5 (8.0-100.0)	34.0 (1.0-98.0)	0.065
Percent appropriate recoil, median (IQR)	99.0 (86.0-100.0)	99.0 (92.0-100.0)	0.341
Average ventilation volume (mL), mean (SD)	510.2 (118.9)	486.4 (132.4)	0.348
Average ventilation rate (ventilations min^{-1}), mean (SD)	4.2 (1.1)	4.1 (1.0)	0.569
CCF%, mean (SD)	66.9 (4.7)	68.9 (4.3)	0.029

Tests used: t-tests for unequal variances for average compression rate and depth; t-tests for equal variances for average ventilation volume, ventilation rate, and CCF%; Wilcoxon two-sample test for percent appropriate compression rate, percent appropriate compression depth, and percent appropriate recoil; SD: standard deviation; IQR: interquartile range; CPR: cardiopulmonary resuscitation

the importance of using real-time CPR feedback mechanisms to help guide CPR metrics, as it can be very challenging to determine the appropriate compression rate and compression depth in real time.

In the present study, we observed an overall slower chest compression rate with a statistically higher percentage of compressions within the appropriate range when an audio-visual feedback device was used to guide CPR. In the control arm, <50% of all the chest compressions were delivered at an appropriate rate, the majority of which were at rates exceeding the AHA upper limit recommendation of 120 compressions min^{-1}. Furthermore, we found that 20% of the participants in the control arm were never within the AHA-recommended compression range at

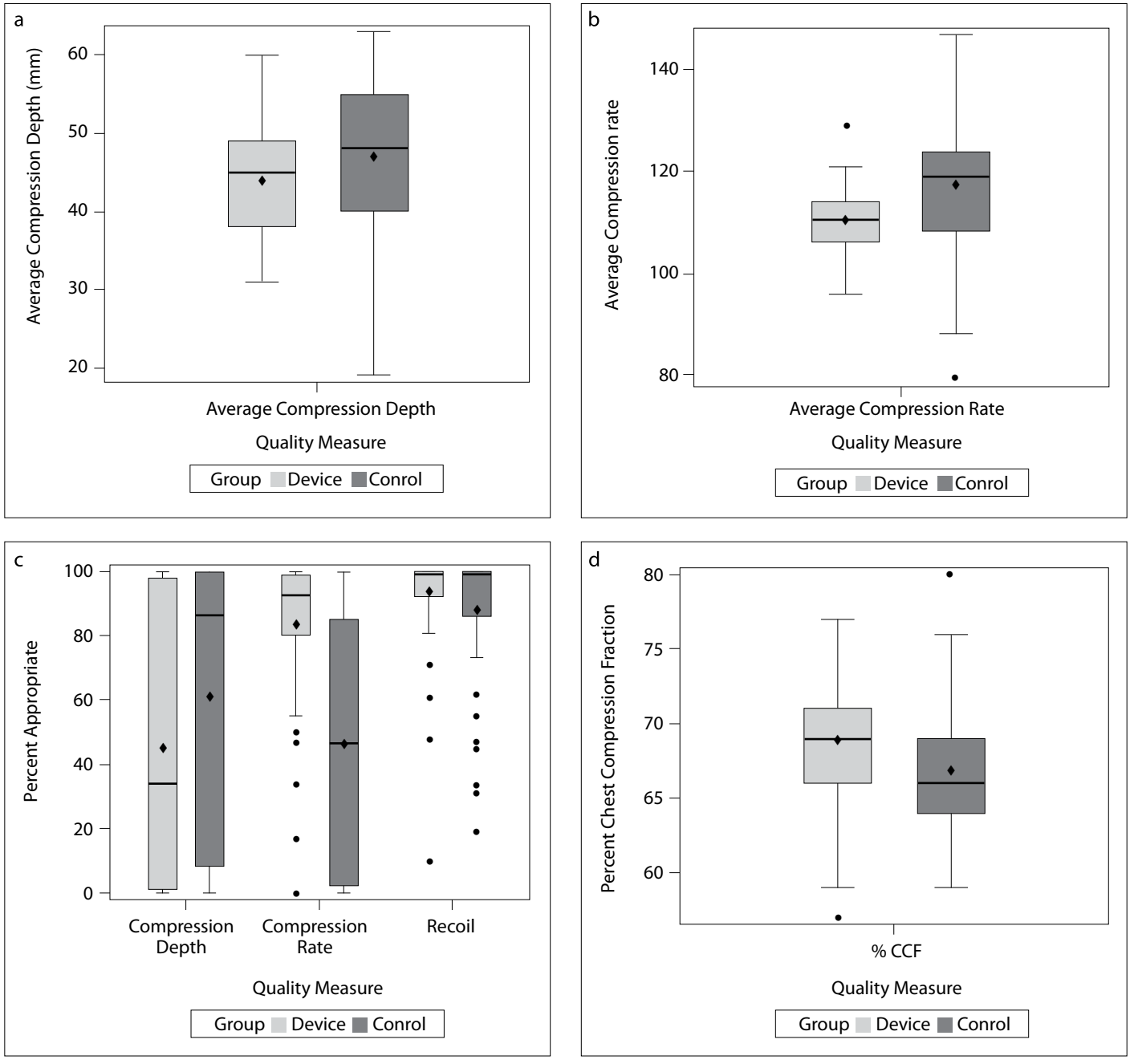

Figure 1. a-d. Boxplot CPR metrics for best practice-driven CPR and audio-visual-driven CPR in simulated in-hospital cardiac arrest. Average compression depth (a), average compression rate (b), appropriate percentage depth, rate, and recoil (c), and chest compression fraction percent (d)

◘ Box Limits indicate the intra-quartile range (IQQ; 25th and 75th percentiles)
– Box Line represents the median
♦ Black Diamonds indicate the means
I Upper and lower fences indicate the highest and lowest values that are not outliers
• Outliers indicated by filled dots, and are values that are greater than 1.5 times the IQR.

any point during their simulation scenario. This finding supports the need for real-time guidance and feedback during CPR to achieve the recommended CPR rate metrics. Idris et al. (18) reported that return of spontaneous circulation rates peak with a compression rate of 125 min^{-1} but then decline at rates greater than this, suggesting that faster may not be better. Faster compression rates have been associated with inadequate compression depth, inappropriate chest recoil, decreased cardiac preload, and possibly increased rescuer fatigue, all of which compromise cardiac output. Our findings demonstrate that the use of a feedback accelerometer may be helpful in achieving a much greater percentage of compressions within the recommended rate range.

The CCF% was also statistically higher when CPR was guided by the accelerometer. While the device studied does not provide continuous audio or visual feedback on CCF%, it does prompt the provider if 10 s lapses without signs of chest compressions. This is important since time can be difficult to track during resuscitation. Additionally, our simulation scenario only examined one 2-minute period of resuscitation, and it is possible that in longer arrests, the use of the audio-visual device could be associated with even greater improvements in CCF%. Despite the improved CCF% in the feedback arm, both the control arm (66.9%) and the feedback arm (68.9%) performance measures were below the AHA-recommended CCF% of 80% (3). The single-rescuer model in our study design likely contributed to the observed lower CCF% given that the provider had to change positions to provide rescue breaths; however, this is often the case during the initial phases of a cardiac arrest event. Prior studies have shown that providers can take up to 16 s to deliver two ventilations (19). This further emphasizes the importance of team dynamics and care coordination to maximize this clinically important metric of CPR when multiple rescuers are present and possibly suggests a lower goal of CCF% as a reasonable achievable metric for single-rescuer resuscitations.

Despite improved chest compression rate and CCF% with the use of the accelerometer feedback device, we observed a trend toward lower compression depth in the intervention arm than in the control group. This finding is consistent with findings from prior studies suggesting that the accelerometer device may overestimate chest compression depth when chest compressions are performed on a soft surface, such as a mattress, even with the use of a CPR backboard, as was done in our study (14-17). While our finding was not statistically significant and only a trend, it does suggest that future investigations should focus on strategies to accurately detect chest compression depth, particularly with a narrower recommendation window of a depth between 50 and 60 mm (9). Oh et al. (15) described a dual accelerometer method that was better at detecting true sternal-spine compression depth. Perkins et al. (20) have published on the development of a "smart backboard," a novel device that helps subtract mattress compression for improved accuracy of feedback information with regard to depth. An anterior-posterior approach in determining chest compression depth, as demonstrated in both of these techniques, could also lead to a more patient-specific appropriate compression depth, such as >1/3 of the anterior-posterior chest diameter instead of the "one-size-fits-all" recommendation of 50-60 mm for all patients regardless of body habitus. While the 2015 AHA guidelines do define an upper limit for chest compression depth to help avoid injury (21), most studies, including ours, continue to demonstrate that compressions are more often too shallow rather than too deep (9, 22). Future studies searching for novel ways to overcome the overestimation of compression depth and other limitations of currently available CPR feedback devices are needed to continue to improve CPR metrics. Resuscitation leaders should be aware of these limitations when using feedback devices and should take corrective steps, such as ensuring the use of a backboard, to help improve compression depth measurement. Education platforms, such as ACLS training programs, should also take into account these device limitations when teaching resuscitation science to healthcare providers.

Study limitations

Our study has several limitations. While this was a prospective randomized study, it was performed at a single academic institution and only evaluated a single-rescuer model. It is possible that we would have detected greater difference in certain CPR metrics if we were to evaluate a two-rescuer model that did not require the CPR provider to transition from the chest compression position to the airway. While our sample size was sufficient to detect statistical differences in compression rate and CCF%, with a larger sample size, there may have been detectable differences in other metrics, including chest compression depth. CPR performance metrics may have also been different with a longer resuscitation scenario as opposed to the 2-minute scenario in the present study. Additionally, we only looked at one audio-visual feedback device; therefore, the present study is not generalizable to other feedback devices that are available and used in other EDs. In the present study, we sought to only evaluate selected CPR metrics that could be measured directly from the manikin and, thus, the choice of an asystole scenario during the simulation. Other contributing factors to CPR quality, such as pre-shock and post-shock pauses, were not assessed in the present study but are also important measures of CPR quality. As the majority of providers in the present study were emergency medicine nurses, these results may not be generalizable to other provider populations, such as physicians or emergency medicine technicians. The providers in our study were also all volunteers, which can introduce volunteer bias with an inherent difference in providers who choose to participate in the present study compared with those who did not. Finally, in this scenario, the patient did not have an advanced airway, and the placement of an advanced airway may affect ventilation volumes, as well as chest compression quality.

Conclusion

For ED-based cardiac arrest resuscitation, providers provided a slower but more appropriate chest compression rate with a higher CCF% when using the Philips MRx audio-visual accelerometer to guide CPR than providers not using this device. The audio-visual feedback device, however, trended toward a lower chest compression depth in this same provider population. There was no difference detected in the other critical components of CPR, including appropriate chest recoil and ventilation rate and volume.

Ethics Committee Approval: Ethics committee approval was received for this study from the Ethics Committee of Oregon Health and Science University (Approval Date 8/8/14; Approval No.: IRB00010880).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - J.G.K., M.D. ; Design - J.G.K, N.V.F., M.D.; Supervision - J.G.K., M.D.; Resources - J.G.K.; Materials - J.G.K., N.V.F., A.L.; Data Collection and/or Processing - J.G.K., N.V.F., A.L.; Analysis and/or Interpretation - J.G.K., A.L., M.D.; Literature Search - J.G.K., M.D.; Writing Manuscript - J.G.K., N.V.F., A.L., M.D. ; Critical Review - J.G.K., N.V.F., A.L., M.D.

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Comparison of Hgb, Htc, Na^+, and K^+ Levels Measured by Blood Gases Analyzer and Laboratory Auto-Analyzer in Different pH Stages

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Abstract

Aim: The primary aim of the present study was to detect whether blood gases analyzer (BGA) is reliable or not in daily practice by comparing sodium (Na^+), potassium (K^+), hemoglobin (Hgb), and hematocrit (Htc) levels measured by BGA and laboratory auto-analyzer (LAA). The secondary aim was whether BGA is reliable or not in daily practice by comparing Na^+, K^+, Hgb, and Htc levels measured by BGA and LAA in different pH stages.

Materials and methods: The study screened the electronic data and file records of all patients who were admitted to the emergency department with any complaint during the study period retrospectively. Patients who had results of venous blood gases and routine laboratory obtained at the same time were included the study. For each parameter, agreements and correlations between the results of BGA and LAA were evaluated by Bland-Altman test and Spearman's correlation test, respectively. An r-value >0.80 was considered a strong correlation.

Results: The laboratory results of 1374 patients were evaluated for statistical analyses. When evaluating the correlations between the results of BGA and LAA, it was found that there was only a strong correlation for K^+ ($p<0.001$, $r=0.83$). When assessing the agreements between the results of BGA and LAA, the mean differences were found to be 0.02±6.1 for Na^+, 0.3±0.44 for K^+, -0.5±1.6 for Hgb, and -0.6±5 for Htc.

Conclusion: Although there are strong correlation and relatively good acceptable agreement for K^+ measurement, there are no strong correlation and good agreement for other measurements, including Na^+, Hgb, and Htc. In addition, we found that these results did not change according to the different pH stages.

Keywords: Blood gases analysis, venous blood gases, potassium, sodium, hemoglobin, hematocrit

Introduction

In patients who have life-threatening conditions (trauma or medical) in emergency departments (EDs) or intensive care units, to decide the appropriate management way, routine laboratory results, especially sodium (Na^+), potassium (K^+), hemoglobin (Hgb), and hematocrit (Htc), need to be measured quickly and reliably. However, these laboratory results are measured by a laboratory auto-analyzer (LAA) in routine practice, and this method is time consuming. Therefore, today, many physicians increasingly prefer blood gases analyzer (BGA) more in addition to routine laboratory analyses, and they decide how to manage their patients (1, 2).

Contrary to this, it is known that there are measurement differences between the results of LAA and BGA (3, 4). However, the results of previous studies about how reliable these differences are for use in daily practice are controversial (4-7). Therefore, we believe that further studies on this topic are needed.

The aims of the present study were to detect whether BGA is reliable or not in daily practice by comparing Na^+, K^+, Hgb, and Htc levels measured by BGA and LAA and whether BGA is reliable or not in daily practice by comparing Na^+, K^+, Hgb, and Htc levels measured by BGA and LAA in different pH stages.

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Materials and Methods

This retrospective study was conducted with patients who were admitted to the ED of a training and research hospital and who had venous blood gases (VBG) and routine laboratory results obtained at the same time between January 2016 and March 2016. The Ethics Committee of Kecioren Training and Research Hospital approved the study (Protocol ID: 102016/1222-Number: 2012-KAEK-15/1222).

Study population and data collection

The present study screened the electronic data and file records of all patients who were admitted to the ED with any complaint during the study period retrospectively. Patients >18 years old who had results of VBG and routine laboratory obtained at the same time were included the study. Patients who lack one or more parameters in VBG or LAA, who had hemolysis in routine laboratory, who was <18 years old, who have treated with any intravenous transfusion before the sampling, and who did not have results of VBG and routine laboratory obtained at the same time were excluded from the study. Before the study period, three researchers, who were emergency physicians, were trained to collect data from the hospital data registration system.

For measurement of VBG, venous blood samples were obtained with heparinized syringes (PICO70 Arterial Blood Sampler; Radiometer Medical AsP, Brønshøj, Denmark) as bedside in our ED and analyzed by bedside BGA (GASTAT-1800 series pH/Blood Gas Analyzer; Techno Medica, St. Ingbert, Germany). During the study period, BGA was calibrated four times a day. The other venous blood samples, after venous blood samples were obtained, were sent to the core laboratory of the hospital for whole blood count by hematology analyzer (Abbott Cell-Dyn 3700 Hematology Analyzer; Abbott Laboratories, Abbott Park, IL, USA) and analyzing biochemistry tests by LAA using the ion-selective electrode diluted (indirect ISE) method (ARCHITECT c8000 Clinical Chemistry Analyzer-material used was 2P32 ICT sample Diluent kit; Abbott Diagnostics, Lake Forrest, IL, USA). During the study period, the core laboratory determined the calibration time as 24-hour intervals for hematology and biochemistry analyzers according to the manufacturers' instructions. Two levels of controls (normal and abnormal) were to be run every 8 h following calibration. The imprecision of the ICT assays for serum samples was as follows: Na^+ 1.5% and K^+ 2.7%. All blood samples were transferred from the ED to the core laboratory using a pneumatic system in the first 30 min. Finally, data collected from the hospital data registration system, including pH, Na^+, K^+, Hgb, and Htc values, were recorded by three researchers.

Statistical analysis

Statistical analysis were performed using Statistical Package for Social Sciences version 16.0 (SPSS Inc.; Chicago, IL, USA). The Shapiro-Wilk test was used to assess the normal distribution of all parameters. Non-parametric data were expressed as median values and interquartile range (IQR) (25%-75%). For each parameter (Na^+, K^+, Hgb, and Htc), correlations between the results of BGA and LAA were evaluated by Spearman's correlation test. An r-value >0.80 was considered a strong correlation. Finally, agreements between the results of BGA and LAA were assessed by Bland-Altman test with 95% CI limits of agreement.

Table 1. Demographic and clinical characteristics of the patients

Age (years), median (IQR 25%-75%)	59 (36-75)
Sex	
Male	584 (43%)
Female	790 (57%)
Comorbidities	
Ischemic heart disease	181 (13%)
Diabetes mellitus	282 (20%)
Hypertension	399 (29%)
Chronic obstructive pulmonary disease	155 (11%)
Congestive heart failure	66 (7.2%)
Chronic renal failure	36 (2.6%)
Others	40 (2.9%)
Final diagnosis of patients	
Acute abdomen	101 (7.3%)
Acute coronary syndrome	98 (7.1%)
Acute kidney injury	74 (5.3%)
Soft tissue problems	75 (5.4%)
Intoxication	96 (6.9%)
Acute diabetes mellitus complications	48 (3.4%)
Primer headache	68 (4.9%)
Altered mental status	62 (4.5%)
Peripheral vertigo	44 (3.2%)
Syncope	52 (3.7%)
Stroke	78 (5.6%)
Non-specific abdominal pain	194 (14%)
Primer epilepsy	30 (2.1%)
Infection disease	182 (13.2%)
Gastrointestinal hemorrhage	34 (2.4%)
Psychiatric disorder	17 (1.2%)
Moderate-severe trauma	121 (8.8%)

Results

In the study period, a total of 1562 patients who have both VBG and routine laboratory results were screened retrospectively. Of all patients, 123 who lack one or more parameters in VBG and 65 who had hemolysis in routine laboratory were excluded from the study. Finally, the laboratory results of 1374 patients were evaluated for statistical analyses. The median age of the patients was 59 (IQR 25%-75%: 36-75) years, and 790 (57%) patients were female.

Table 1 shows the demographic and clinical characteristics of the patients. Table 2 shows the results of VBG and routine laboratory of all patients.

When evaluating the correlations between the results of BGA and LAA, it was found that there was a strong correlation for K^+ ($p<0.001$, $r=0.83$), and there were moderate-high correlations for Hgb ($p<0.001$, $r=0.79$) and Htc ($p<0.001$, $r=0.78$). In contrast, there was a poor correlation for Na^+ ($p<0.001$, $r=0.46$) (Figure 1). However, when assessing the agreements between the results of BGA and LAA, the mean differences were found as (mean±SD) 0.02±6.1 mmol/L for Na^+, 0.3±0.44 mmol/L for K^+, -0.5±1.6 g/dL for Hgb, and -0.6±5% for Htc. After Bland-Altman analyses, it was found that although there was a relatively good acceptable agreement for K^+ measurements, there was a poor agreement for Na^+, Hgb, and Htc measurements for clinical use (Figure 2).

Table 2. Venous blood gases and routine laboratory results of the patients

	Venous blood gases	Routine laboratory results
Sodium (mmol/L)	137±7.1	137±4.1
Potassium (mmol/L)	3.8±0.7	4.2±0.6
Hemoglobin (g/dL)	13.4±2.5	12.8±2.1
Hematocrit (%)	39.4±7.4	38.8±5.8
pH	7.38±0.07	-

In addition, in the present study, agreements between values of VBG and routine laboratory were evaluated in different pH stages. Overall, 835 patients had normal pH range (7.35-7.45), 336 had acidosis (<7.35), and 203 had alkalosis (>7.45). Similar to the results of the analysis in which all samples were included, after Bland-Altman analysis in different pH stages, it was found that there was a relatively good acceptable agreement for K^+ measurement, and there was a poor agreement for Na^+, Hgb, and Htc measurements (Table 3).

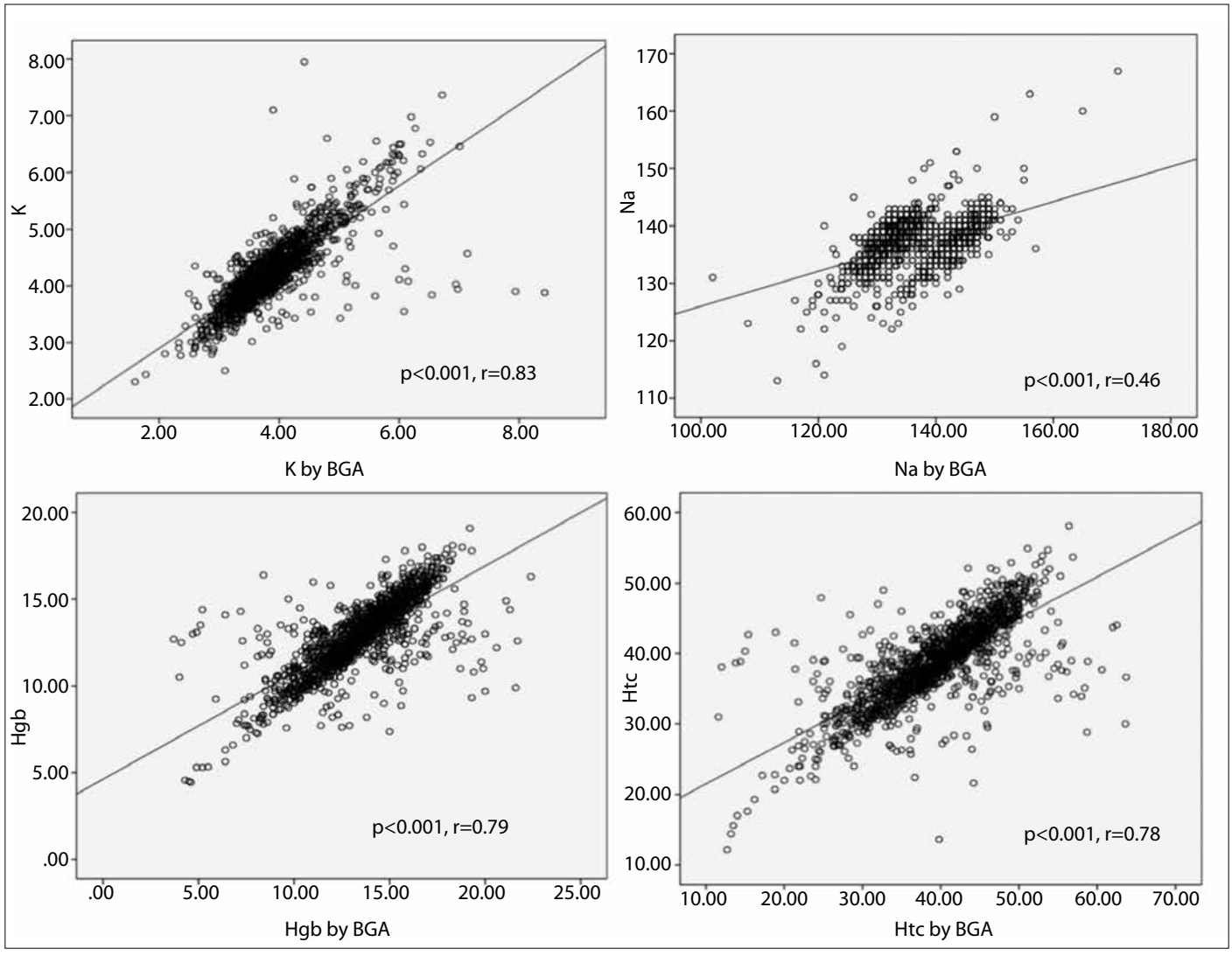

Figure 1. Scatter plots for the four parameters (Na^+, K^+, Hgb, and Htc) studied. BGA: blood gases analyzer

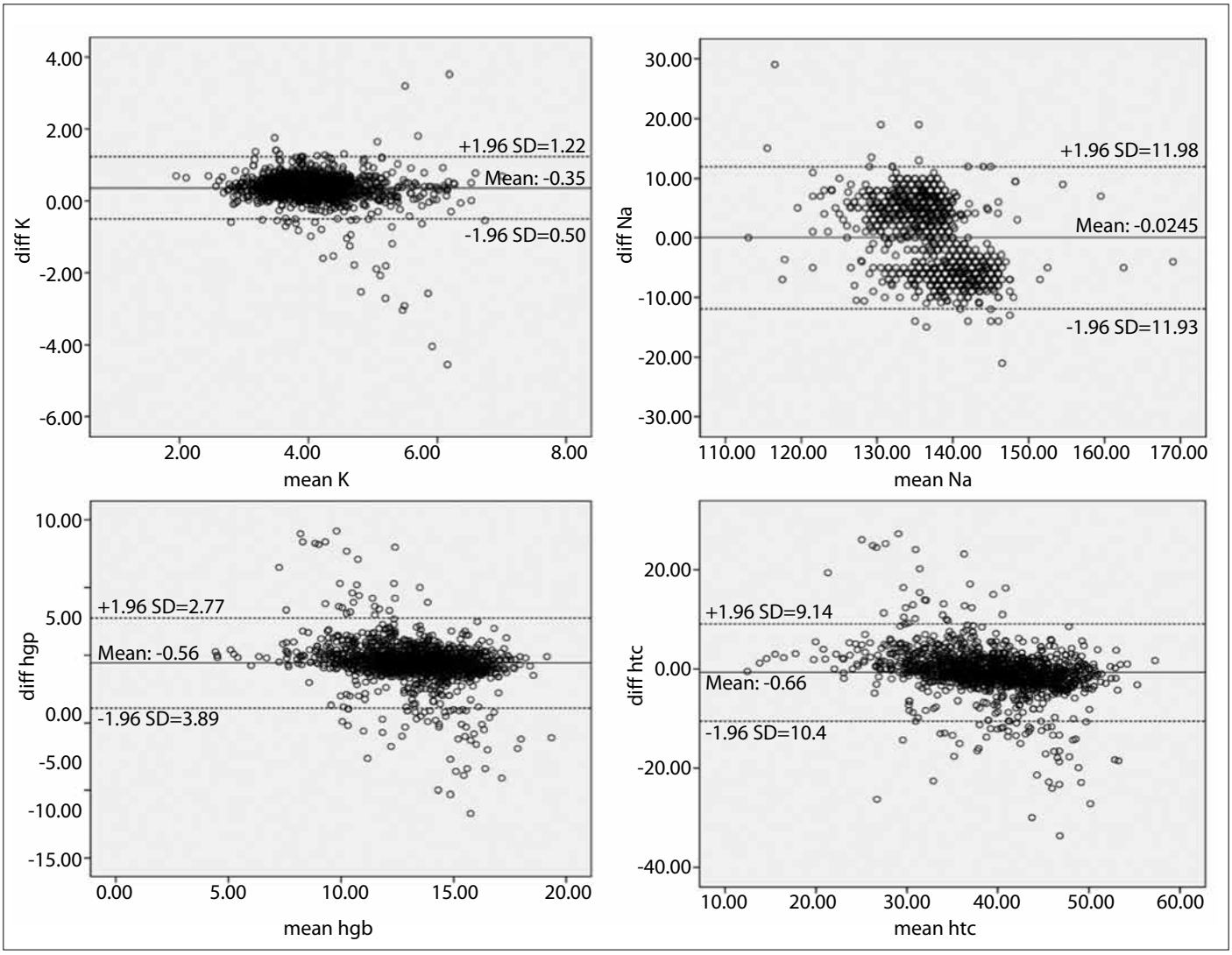

Figure 2. Agreement limits of K^+, Na^+, Hgb, and Htc variables according to the Bland-Altman analysis. Flat lines showed the mean differences of measurements by blood gases analyzer and laboratory auto-analyzer; dotted lines showed agreements limited with 95% CI

Discussion

The results of the present study showed that in measurements by BGA and LAA, although there are strong correlation and relatively good acceptable agreement for K^+ measurement, there are no strong correlation and good agreement for other measurements, including Na^+, Hgb, and Htc. In addition, we found that these results did not change according to the different pH stages.

K^+ and Na^+ measurements

It is known that quick and reliable measurements of K^+ and Na^+ are crucial in non-traumatic medical critical illness. For example, early detection of hypernatremia or hyponatremia in patients with acute altered mental status can be life-saving. Similarly, early detection of hypokalemia or especially hyperkalemia can be crucial for decision of hemodialysis and prevention of life-threatening ventricular dysrhythmia (8-9). In the present study, we found that there is no strong correlation for Na^+ between BGA and LAA. In addition, when evaluating the agreement limits for Na^+, we found quite a wide range of agreement limits as -11.9 to 11.9. We believe that this wide range is not acceptable for daily practice in the ED. In the litarature there are some studies, which had similar results with our study's results. For example, in Solak's study conducted on 2257 patients, evaluation of the agreements of Na^+ results was measured by BGA and biochemistry auto-analyzer (BAA) in different stages of Na^+ level, including hyponatremia, eunatremia, and hypernatremia. In addition, it has been reported that there are poor correlation and significant differences of measurements between LAA and BAA (10). In another study, which evaluated the agreements of Na^+ and K^+ results as measured by LAA and BGA, conducted by Budak et al. (11) with 1105 test samples, it was found that a wide range of agreement limits (mean diff: 4.94, LoA: -0.97 to 10.85) for Na^+ is similar to our result. In contrast to the results of these studies, in two different studies conducted by Zhang et al. (12) and Uysal et al. (5), they have found narrower agreement limits for Na^+ measurements (mean diff: 3.0, LoA: -1.2 to 7.3 and mean diff: -1.63, LoA: -6.63 to 3.37, respectively). Of course, interpretation of results by Bland-Altman is very subjective and can be changed in different clinical scenarios. However, we believe that even in the study that has the best agreement limit values, these values were distributed over relatively wide range. Therefore, we

Table 3. Mean and mean difference of Na+, K+, Hgb, and Htc levels in VBG and routine laboratory with agreement limits according to the Bland-Altman analyses

pH stage		VBG Mean±SD	Routine laboratory Mean±SD	MD Mean±SD	Agreement limits with 95% CI
Normal range (7.35-7.45) n=835	Na^+ (mmol/L)	137±6.6	137±3.9	0.26±5.8	-11.1 to 11.6
	K^+ (mmol/L)	3.8±0.6	4.1±0.5	0.3±0.4	-0.4 to 1.08
	Hgb (g/dL)	13.5±2.4	13±2	-0.5±1.5	-3.4 to 2.4
	Htc (%)	36.6±7.1	39.1±5.4	-0.4±4.7	-9.6 to 8.8
Acidosis <7.35 n=336	Na^+ (mmol/L)	140±7.6	137±4.9	-2.4±5.8	-13.7 to 8.9
	K^+ (mmol/L)	4.2±0.8	4.5±0.8	0.3±0.5	-0.6 to 1.2
	Hgb (g/dL)	13.2±2.6	12.6±2.2	-0.6±1.8	-4.1 to 2.9
	Htc (%)	38.9±7.7	38.1±6.5	-0.7±5.0	-10.5 to 9.1
Alkalosis >7.45 n=203	Na^+ (mmol/L)	133±6.1	136±3.9	3.1±5.8	-8.2 to 14.4
	K^+ (mmol/L)	3.6±0.6	4.0±0.5	0.4±0.3	-0.1 to 0.9
	Hgb (g/dL)	13.5±2.6	12.8±2.1	-0.6±1.8	-4.1 to 2.9
	Htc (%)	39.6±7.9	38.3±6.2	-1.2±5.8	-12.5 to 10.1

VBG: venous blood gases; MD: mean difference; Hgb: hemoglobin; Htc: hematocrit; SD: standard deviation

believe that Na^+ results measured by BGA are not reliable enough for use in the ED practice, and physicians should be aware of the risk of bias in using BGA for Na^+ measurements.

In contrast to Na^+ measurements, we found that there is a strong correlation for K^+ between BGA and LAA. In addition, when evaluating the agreement limits for K^+, we found a relatively good acceptable agreement (-0.5 to 1.22). In the literature, there are studies that have similar findings to our findings for K^+. However, these similar results were discussed with different perspectives by the authors of these studies. For example, in the study conducted by Uysal et al. (5) with 1094 patients, they aim to investigate the correlation and agreement of some results measured by BGA and core laboratory analyzer. They reported that there are strong correlation (r=0.82) and good acceptable agreement for K^+ measurements (mean: -0.46, LoA: -1.34 to 0.42). However, they warned that these results measured by BGA must be validated by core LA. Similarly, in another study conducted by Budak et al. (11), the agreement limit for K^+ was found as -0.5 to 1.1, and authors concluded that K^+ results obtained using BGA and LAA cannot be interchangeable in clinical practice (11). In contrast, although Zhang et al. (12) in their study found similar agreement limits for K^+ measurements as -0.29 to 1.16, they concluded that K^+ results measured by BGA are reliable. We believe that these different perspectives can cause that optimal agreement limits are subjective and can change in different clinical scenarios. However, we think that at least if K^+ results of BGA are in normal range, it can be reliable for exclusion of mortal hyperkalemia or hypokalemia with these agreement limits. Thus, we believe that K^+ measurements by BGA can be helpful in the management of patients in the ED practice.

Hgb and Htc measurements

In patients with hemorrhage (traumatic or non-traumatic), early evaluation of Hgb and Htc levels is crucial because the current guidelines stated that detected low initial Hgb/Htc values could be an indicator for severe bleeding (13). Therefore, at the beginning of our study, we thought that measurements of Hgb and Htc values by BGA could be useful for the assessment of the hemorrhagic stage in the early period of trauma management in the ED. However, in the present study, we found that there are no strong correlation and unacceptable agreement limits for Hgb and Htc measurements in the clinical ED practice. Similar to our results, in their study, Uysal et al. (5) found wide unacceptable agreement limits for Hgb and Htc measurements by BGA and LAA (mean diff. of Hgb: -0.03, LoA: -2.23 to 1.71 and mean diff. of Htc: -2.19, LoA: -8.75 to 4.36). Similarly, in another study conducted by Kozaci et al. (14) with 100 patients' laboratory results, some laboratory results, including Hgb and Htc measured by BGA and standard automatic devices in the core laboratory, were compared. Although they reported that there are high correlations between measurements by BGA and core laboratory analyzer for Hgb and Htc measurements, agreement limits for Hgb and Htc values are mean diff: -0.1, LoA -4.2 to 3.9 and mean diff: -1.5, LoA: -13.9, respectively (14). Moreover, although they concluded that BGA measurements for Hgb and Htc values can facilitate the management of patients with active bleeding based on high correlation in their results, we believe that the agreement limits in their study were very wide for use in the clinical practice in the ED, similar to our results. In contrast to the findings of these studies, in the study by Zhang et al. (12), narrower agreement limits for Hgb measurements were reported as mean diff: 0.1, LoA: -1.8 to 1.9, and they concluded that Hgb values measured by BGA are reliable. Consequently, despite the presence of different results and opinions in the literature, we think that especially initial Hgb and Htc values measured by BGA were not reliable in the management of patients with hemorrhage. However, when we consider that there is

a relatively high (r=0.78 and 0.79) correlation between BGA and LAA for Hgb and Htc measurements, serial measurements of Hgb and Htc by BGA could be useful and helpful for the prediction of severe bleeding.

Study limitations

There were three important limitations in the present study. First, since all data were analyzed retrospectively, standardization of obtaining VBG may not have been adequate enough. Similarly, although calibration of these BGA devices was performed daily in routine practice, daily calibration standardization may not have been adequate enough. In addition, our study groups were heterogeneous and consisted of various disease groups (medical and trauma). However, we believe that the results with these limitations may be more compatible with real-life scenarios. Second, we analyzed only venous blood samples and not arterial samples. Finally, we did not analyze the triglyceride and total protein levels of the patients. Owing to using indirect ISE in Na^+ and K^+ measurements, we could not evaluate the potential effect of triglyceride and total protein levels on measurements of Na^+ and K^+. If the present study did not have these limitations, more appropriate results might have been found.

Conclusion

In conclusion, our results showed that there is a strong correlation between measurements by BGA and LAA for K^+ values; however, there is no strong correlation for Na^+, Hgb, and Htc values. In addition, when considering the agreement limits, although relatively good acceptable agreement limits were found for K^+ values, agreement limits of Na^+, Hgb, and Htc values were found as unacceptable for use in the clinical ED practice.

Ethics Committee Approval: Ethics committee approval was received for this study from the Ethics Committee of Health Sciences Unviersity Kecioren Training and Research Hospital (Protocol ID: 102016/1222-Number: 2012-KAEK-15/1222).

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

Peer-review: Externally peer-reviewed.

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Does Simple Face Mask or Diffuser Mask Matter in the First Hour Treatment of Carbon Monoxide Intoxication? A Prospective Randomized Clinical Study

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Abstract

Aim: In patients who do not have any indication for hyperbaric oxygen (O_2) treatment, the main treatment to eliminate carbon monoxide (CO) is by giving O_2 using a face mask. In the absence of a non-rebreathing face mask, a diffuser mask (DMG) or simple face mask (SMG) is an option that can be used for treatment. There are insufficient data about the acute efficacy of these masks. To study the ability of DMG and SMG in lowering carboxyhemoglobin (COHb) levels after the first hour of O_2 treatment in patients with CO intoxication.

Materials and Methods: This was a prospective randomized clinical study conducted in patients aged ≥16 years old who were diagnosed with CO intoxication. They were randomly given 15 L/min O_2 (from hospital central O_2 supplies) treatment with DMG (n=29) or SMG (n=52). Partial pressure of O_2 (PaO_2), carbon dioxide, and COHb levels and saturation of O_2 were measured before and after 1 h of treatment.

Results: A total of 81 (42 female and 39 male) patients with a mean age of 39.1±14.7 years were included in the study. There were no differences with regard to age, gender, body mass index, comorbidity, source of CO, initial symptoms, and initial COHb levels before treatment. After the first hour of treatment, DMG had lower mean COHb (mg/dL) levels (9.6±5.0 vs. 12.8±6.2, p=0.0203) and higher mean PaO_2 levels (224.4±56.5 vs. 183.4±63.7, p=0.0046) than SMG.

Conclusion: Diffuser mask (DMG) appears to be better than simple face mask (SMG) in the first hour of treatment of CO intoxication.

Keywords: Carbon monoxide intoxication, diffuser mask, simple face mask, emergency department

Introduction

Carbon monoxide (CO) intoxication is the most common cause of death among all intoxications (1-3). It affects many organs through tissue hypoxia and causes damage at the cellular level. The central nervous system and the heart are the most important organs affected (4). CO can cause permanent neurological sequel (5), changes in heart rate, arrhythmia, myocardial damage, necrosis, cardiogenic shock, and sudden cardiac death.

It is important to start treatment early in cases of CO intoxication, as exposure time is one of the key factors that determine the severity of toxicity (6). Treatment consists of hemodynamic stabilization and elimination of CO. The elimination largely includes administering 100% oxygen (O_2) with non-rebreathing face mask or providing hyperbaric O_2 therapy (HBOT) (7-9). In the absence of a non-rebreathing face mask, diffuser mask (DMG) and simple face mask (SMG) are two types of masks commonly used. To the best of our

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knowledge, there is no study that compares the effectiveness of DMG with an SMG on CO intoxication treatment.

The aim of the present study was to evaluate the effectiveness of DMG and SMG on decreasing the levels of carboxyhemoglobin (COHb) after the first hour of CO intoxication treatment.

Materials and Methods

Study design

This was a prospective randomized clinical study conducted between December 1, 2012 and April 30, 2013. Patients were recruited from the emergency department (ED) of Dr. Lutfi Kırdar Kartal Training and Research Hospital, which has an average daily admittance of 800-1000 patients. Ethics committee approval was received for this study from the Ethics Committee of Dr. Lutfi Kirdar Kartal Training and Research Hospital (Approval Date: 30.04.2012, No:8951337/1009/141). Written informed consent was obtained from all patients who participated in this study.

Study population

Patients who were >16 years old, diagnosed with CO intoxication (COHb >10 mg/dL), having no indication of hyperbaric (n=48), or having indications of hyperbaric but needed to be monitored in the emergency room until transferred to another facility with available HBOT after at least 1 h of O_2 treatment with one of the masks used (n=33) were included in the study. Patients having no need for intensive care, receiving proper treatment protocol, and having full medical records were also included.

Patients who were <16 years old, refused to participate, and who needed intubation were excluded from the study. Patients with diseases that cause hemoglobin dissociation curve shift to the left or diseases that cause increased endogenous CO production, such as chronic obstructive pulmonary disease (COPD), asthma, sickle cell anemia, polycythemia vera, and smoking, were also excluded.

Patients who met the enrollment criteria were randomized to cohorts according to randomization numbers assigned by the computer and randomized (2:1 within each group) to receive O_2 with DMG or SMG (we had limited numbers of DMG in ED compared with SMG).

Data collection and processing

Patients were divided into two groups: one group treated with SMG and the other group treated with DMG. Five minutes after diagnosis, both groups received 15 L O_2 therapy/min from hospital central O_2 supplies.

Data on existing symptoms, height and weight of the patients, causes of CO exposure, smoking habits, and comorbidities were collected. Patients' brachial arterial blood gases, COHb, partial pressure of O_2 (PaO_2), saturation of O_2 (SaO_2), COHb values on admission, and PaO_2 and SaO_2 values 1 h after treatment were recorded for each patient. Before receiving treatment, electrocardiography (ECG) was obtained, and respiratory rate was noted for each patient. ECG was repeated 1 h after treatment, and speed was evaluated in terms of rhythm and ECG disparities.

All blood gas determinations were made by the Radiometer ABL 700 (441R0226N010) (Radiometer Medical, Bronshoj, Denmark). The ABL 700 series blood gas analyzer that incorporates co-oximetry, electrolyte, and metabolite measurements uses heparinized whole blood as the preferred sample (10). A 195 µL blood sample was required by the ABL 700. This analyzer is designed for laboratory use only and is not portable. The ABL 700 was routinely calibrated every 4 h according to the manufacturer's recommendations (11).

Features of the masks used

Diffuser mask (OxyMask; Southmedic Inc., Ontario, Canada) is an open-system mask that can deliver 24%-90% fractional inspired O_2 concentration when O_2 flow is between 1 and 15 L/min. The mask consists of two parts: a diffuser system that forms a vortex with O_2 molecules and a pin. An umbrella-shaped pin is located in the triangle-shaped diffuser cup. This form of pin channels provides a vortex of the gas stream. High velocity accelerates this vortex. This vortex, which formed through angled diffuser cup portion, is routed directly to the mouth and nose (12) (Figure 1).

Simple face mask (HS-3031; Hsiner, Taichung Hsien, Taiwan), placed on the patient's nose and mouth, is made of transparent plastic reservoirs. It is fixed to the patient's head with an elastic strip. O_2 reaches the mask with a small connection tube. There are holes on both sides of the mask, and these holes deplete the exhaled air. These holes also allow mixing of room air into the reservoir (Figure 2).

Statistical analysis

The patient characteristics between the two groups were compared using the chi-square test or Fisher's exact test for categorical variables and the Student's t-test for continuous variables. Differences between the two groups in terms of before and after treatment values of COHb, PaO_2, and SaO_2 were compared using the Wilcoxon-Mann-Whitney test, as the parametric test assumptions did not meet. Statistical analyses were performed using the Statistical Package for Social Sciences 12.0 software (SPSS Inc.; Chicago, IL, USA). A two-sided $p<0.05$ was considered statistically significant.

Results

Between the dates of our study, 151 patients were diagnosed with CO intoxication in the ED. Among those, 20 patients were excluded due to missing information on their medical records or standard treatment disruptions. The other 23 patients were excluded from the study, as they received HBOT (n=18) within the first hour of treatment and had admission to the intensive care unit (n=5) in the first hour they were admitted to the ED. Twenty-seven patients were also excluded from the study, as 2 of them had asthma, 4 had COPD, and 21 were smokers (Figure 3).

A total of 81 patients were enrolled in the study. There were 42 female and 39 male patients. The mean age of the patients was 39.11±14.7 years. DMG was used for 35.8% of the patients. Among all patients, the two most common complaints were headache (50.6%) and dizziness (14.8%), respectively. Other complaints were fatigue, confusion, syncope, nausea, vomiting, and shortness of breath. The least common complaint was chest pain (1.3%) (Table 1). There were no significant differences in patient's age, sex, and body mass index

Figure 1. Diffuser mask

(BMI) between patients who were treated with SMG and patients who were treated with DMG (Table 1).

Of the study participants, 75 were exposed to CO due to stove smoke, whereas 6 were exposed to CO due to house fire. There were no statistically significant differences between patients before treatment with SMG and patients treated with DMG in terms of the mean values of the initial COHb, PaO_2, and SaO_2 (Table 1).

The mean value of PaO_2 (183.4±63.7 mm Hg) in patients after treatment with SMG was higher than that (224.4±56.5 mm Hg) in patients treated with DMG (Z=2.83, p=0.0046) (Table 1). The

Figure 2. Simple face mask

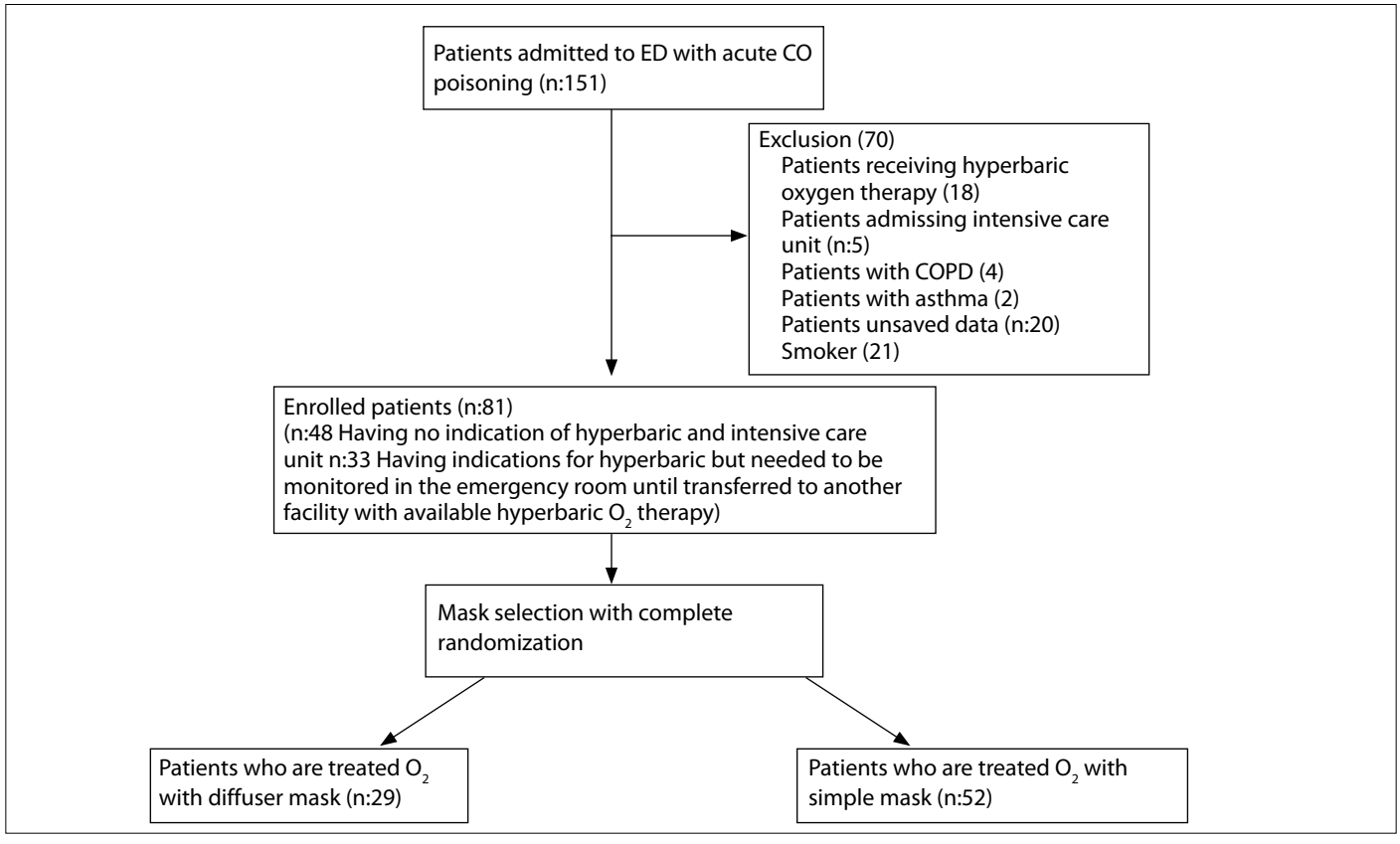

Figure 3. Flowchart of the study

Table 1. Demographic, clinical, and laboratory characteristics of the two groups

	Diffuser mask n (%)	Simple face mask n (%)	p	Total n (%)
n (%)	29 (35.8)	52 (64.2)	-	81 (100.0)
Gender				
Female	18 (62.1)	24 (46.2)	0.1693‡	42 (51.9)
Male	11 (37.9)	28 (53.8)		39 (48.1)
Symptoms				
Headache	16 (19.75)	25 (30.85)	0.690¥	41 (50.6)
Vertigo	7 (8.64)	5 (6.16)		12 (14.8)
Weakness	2 (2.47)	1 (1.23)		3 (3.7)
Confusion	0	4 (4.9)		4 (4.9)
Syncope	3 (3.74)	6 (7.46)		9 (11.2)
Nausea/vomiting	1 (1.2)	6 (7.4)		7 (8.6)
Chest pain	0	1 (1.3)		1 (1.3)
Dyspnea	0	4 (4.9)		4 (4.9)
Source of CO				
Stove fumes	28 (34.39)	47 (58.02)	0.412¥	75 (92.59)
House fire	1 (1.23)	5 (6.18)		6 (7.41)
	Diffuser mask Mean±SD	**Simple face mask Mean±SD**	**p**	**Mean±SD**
Age (year)	36.3±13.7	40.7±15.1	0.1851†	39.1±14.7
Weight (kg)	70.8±15.6	75.4±13.2	0.166†	73.8±14.2
Height (cm)	163.5±7.1	167.8±9.8	0.026†	166.3±9.1
BMI (kg/m^2)	26.6±6.2	26.8±4.1	0.8951†	
ECG rate (beats/minute)	92.3±17.5	87.3±19.3	0.304†	89.4±18.7
Hgb (g/dL)	13.8±2.3	14.5±1.7	0.124†	14.3±1.9
Initial ABG levels				
COHb (mg/dL)	23.2±9.1	23.9±10.5	0.9804*	23.6±10.0
PaO_2 (mm Hg)	87.7±7.5	87.8±8.7	0.8283*	87.8±8.6
SaO_2 (%)	93.6±14.4	96.3±3.7	0.4458*	95.3±9.1
After 1 h of Treat				
COHb (mg/dL)	9.6±5.0	12.8±6.2	0.0203*	11.7±5.9
PaO_2 (mm Hg)	224.4±56.5	183.4±63.7	0.0046*	198.0±64.0
SaO_2 (%)	97.6±6.9	98.6±1.3	0.4327*	98.3±4.2

SD: standard deviation; BMI: body mass index; Hgb: hemoglobin; CO: carbon monoxide; PaO_2: partial pressure of O_2, SaO_2: saturation of O_2, COHb: carboxyhemoglobin; ABG: arterial blood gas; Treat: treatment
‡p-Value was obtained using chi-square test
¥p-Value was obtained using Fisher's exact test
†p was obtained using Student's t-test
*Results were obtained using Wilcoxon-Mann-Whitney test

mean value of COHb (12.8±6.2 mg/dL) in patients treated with SMG was lower than that (9.6±5.0 mg/dL) in patients treated with DMG (Z=−2.32, p=0.0203) (Table 1). The mean values of SaO_2 in patients treated with SMG (98.6±1.3%) and DMG (97.6±6.9%) were comparable (Z=0.79, p=0.4327) (Table 1).

The relationship between the level of CO and the type of patients' complaints has been evaluated. There was a significant relationship between the level of CO and the type of complaints (p=0.001). It is also found that nausea, vomiting, and headache were the main complaints in patients who had COHb ≥25 mg/dL, whereas syncope was observed in patients who had COHb ≥34 mg/dL. There was a significant correlation between pre-treatment level of COHb and respiratory rate (r=0.293, p=0.008).

Admission ECG analyses of the patients were as follows: 80% normal sinus rhythm (NSR), 17% tachycardia, and 2.5% T wave inversion. After treatment, tachycardia decreased to 2.5%, and NSR ratio increased to 95%.

Change in CO (ΔCO) level was calculated by subtracting the pre-treatment value of CO from the post-treatment value of CO. There was no significant relationship between BMI and ΔCO among patients treated with DMG (correlation analysis r=−0.12, p=0.522 and percentage change r=−0.27, p=0.158). Similarly, among patients treated with SMG, there was no significant relationship between BMI and ΔCO values (r=−0.16, p=0.265 and percentage change r=−0.14, p=0.335). As a result, we found that BMI did not affect the treatment in our study group.

Discussion

Our study shows that in acute CO intoxication cases, DMG decreases the blood COHb levels and increases the blood PaO_2 levels significantly faster than SMG in the first hour of treatment.

After exposure, CO enters into the bloodstream rapidly. Compared with O_2, CO shows 230-270 times greater affinity to hemoglobin and forms COHb causing the O_2-hemoglobin dissociation curve shift to the left and leading to severe tissue hypoxia (1, 13). As tissue hypoxia is the main mechanism of CO intoxication, to accelerate CO elimination, normobaric 100% O_2 treatment should be started with a mask as soon as possible for patients whose airway is protected and who have adequate ventilation (14, 15). Giving O_2 through a mask is easily accessible and a safe treatment and can be made using different types of masks. DMG that provided concentrated O_2 directly to the mouth and nose and SMG were two treatment options.

Even with low flow rates, DMG helps to achieve the highest O_2 concentration without any risks that may occur in a closed mask system. In DMG, carbon dioxide (CO_2) retention does not occur, as it is an open system (12). In SMG, CO_2 can be inhaled back if O_2 flow is insufficient. Patient cannot be fed during the use of SMG.

After vomiting, there is a high risk of aspiration. SMG may not be fit to each face type, and if it is tight fitted, it can cause irritation (16). To avoid inhalation of CO_2 and additional respiratory failure load, at least 5 L/min flow rate has been proposed (17).

Based on our study results, after the first hour of treatment, DMG can cause a significant decrease in CO levels compared with SMG. It seems to create this effect by increasing the level of PaO_2 much faster than SMG. DMG can deliver the same level of O_2 more effectively than SMG. In a study by Beecroft et al. (12), they found that using DMG increases the level of PaO_2 significantly higher than venture mask even though the O_2 flow was low. In other studies, it has been shown that O_2 is delivered effectively and reliably with DMG (18, 19).

In our study, we did not find any difference between the two groups in terms of SaO_2 levels after the first hour of treatment. Although saturation of hemoglobin with O_2 increases depending on arterial PaO_2 level, this increase is not linear (20).

Study limitations

Our study has several limitations. First, this is a single-center study. Second, our findings cannot be generalized to intubated patients or patients who need HBOT. Third, this is not a blinded study as the type of mask was seen by both the patient and the doctor.

Conclusion

In conclusion, in the first hour of CO intoxication treatment, DMG appears to be more effective than SMG. It is because of the fact that O_2 can be delivered more effectively by a DMG. It will be beneficial to keep DMG in a quick and easily accessible location. In addition, it may be a more appropriate choice to treat patients with DMG when preparing patients for HBOT.

Ethics Committee Approval: Ethics committee approval was received for this study from the Ethics Committee of Dr. Lutfi Kırdar Kartal Training and Research Hospital (Approval Date: 30.04.2012; No:8951337/1009/141).

Informed Consent: Written informed consent was obtained from all patients who participated in this study.

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Does Patient Demand Affect the Physicians' Decision to Prescribe Antibiotics in Emergency Departments? A Survey Study

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Abstract

Aim: Antibiotic resistance is a growing public health problem, and one of the important reasons for this is an inappropriate prescription of antibiotics. The aim of this study was to evaluate the knowledge and perceptions related to antibiotic prescription among physicians in the emergency department (ED) and also to find out if the patient demand affects the physicians' decision to prescribe antibiotics.

Materials and Methods: A cross-sectional survey of physicians working at ED. The study was conducted during 2017 with an online questionnaire, and results were analyzed by Statistical Package for Social Sciences (SPSS).

Results: Out of 282 relevant questionnaires, in 62.1% of them, the participants think that inappropriate antibiotic prescription was frequent, and some even mentioned that they sometimes (39%) prescribed antibiotics inappropriately. The awareness of antibiotic stewardship was poor in half of the participants. More than two-thirds of the physicians noted that patients had been forcing them to prescribe antibiotics; and physicians who were newer at the profession (<5 years) noted that this was affecting their decision more often (31.5%). Among other factors, need for making quick decisions at ED and overcrowding of the ED leading to inappropriate antibiotic prescription, and there was no relationship between the responses and professional seniority (p=0.7 and p=0.1, respectively), but there was an inverse relation between clinical practice and overcrowding (p=0.01).

Conclusion: Our study demonstrated that all physicians thought antibiotics had been prescribed inappropriately. Patient demand, need for making quick decisions, and overcrowding of EDs are some of the factors that affect the antibiotic prescription decisions of physicians, and the effect of these factors was inversely proportional to increased clinical practice.

Keywords: Antibiotic, inappropriate, demand, overcrowding

Introduction

Although the history of antibiotics is not very old, antibiotic resistance has already become a major problem that threatens human health worldwide. According to data of the World Health Organization, if no preventive measures are taken, by 2050, 10 million deaths may be attributable to antimicrobial resistance all around the world (1). Despite previous reports showing the "slowly emerging disaster" related to antibiotic resistance, there is evidence of continuing over-prescription (2). A 2013 report by the Organization for Economic Co-operation and Development has identified the countries with the highest antibiotic consumption rate: Turkey is in the first place with a defined daily dose of 42.2 per 1,000 people, followed by Greece, France, and Italy (3).

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Antibiotic overuse, incorrect dosing, and extended duration are some of the leading causes of antibiotic resistance (4). Inappropriate antibiotic prescription is a public health problem and is most commonly seen among patients with upper respiratory tract infections (URTI) (5). It is known that physicians are influenced by many factors when prescribing a certain drug unnecessarily, among which the chief factor is the aim of pleasing the patient (2). Accordingly, patient demand is a significant factor for a physician's drug prescription (5). To tackle the current worldwide bacterial resistance crisis, antibiotic stewardship programs, which are a set of interventions aiming at prescribing antibiotics appropriately and responsibly, have come to the fore (6).

The aim of this study was to examine the antibiotic prescription habits of physicians (general practitioners (GP), emergency medicine (EM) residents; and emergency medicine specialists) working in emergency departments (EDs) and also to investigate their awareness related to antibiotic resistance and knowledge levels related to antibiotic stewardship programs. Furthermore, we aimed to investigate whether increased patient demand for antibiotics was affecting the physician's opinion during prescription and to consequently determine if there is a relationship between this situation and the clinical practice of the physician.

Table 1. Characteristics of participants and indications, and group of antibiotics commonly prescribed

Variable	Number (%)
Gender	
Male	156 (55.3)
Female	126 (44.7)
Professional Status	
General practitioner	92 (32.6)
Emergency medicine resident	50 (17.7)
Emergency medicine specialist	140 (49.6)
Duration of clinical practice (years)	
0-5	73 (25.9)
5-10	113 (40.1)
10-15	59 (20.9)
15-20	26 (9.2)
20+	11 (3.9)
Indications antibiotics most commonly prescribed for	
URTI*	171 (60.6)
LRTI*	64 (22.7)
UTI*	41 (14.5)
AGE*	3 (1.1)
Others	3 (1.1)
Group of antibiotics most commonly prescribed	
Penicillin	160 (56.7)
Cephalosporin	90 (31.9)
Macrolide	17 (6)
Quinolone	13 (4.6)
Others	2 (0.7)

URTI: upper respiratory tract infection; LRTI: lower respiratory tract infection; UTI: urinary tract infection; AGE: acute gastroenteritis

Materials and Methods

This was a cross-sectional survey study, and it was approved by and carried out in accordance with the regulations of the local research ethics committee. Physicians at different levels of professional seniorities, who were GPs, EM residents, and EM specialists, working in EDs of hospitals were invited to participate. There was no informed consent form because the invitation was sent either by e-mail, SMS messages, or via social media groups. Further, no personal identifying information was required; all email addresses and phone numbers were kept secret and strict confidentiality was maintained; and participation was voluntary. An online questionnaire, including 22 items, was created in an easily accessible, smartphone-friendly website. Demographic data including gender, age, professional status (GP, EM resident, or EM specialist), and duration of clinical practice were collated. Next, three questions were asked to understand the antibiotic prescription habits of doctors: "How many patients do you see in a day?"; "For which indication do you prescribe antibiotics most?"; and "Which group of antibiotics do you prescribe most?" Other items focused on the physicians' opinions regarding antibiotic resistance and were as follows: their awareness of antibiotic resistance prevalence, their knowledge of antibiotic stewardship programs, and their beliefs about inappropriate antibiotic prescription. To assess the factors of inappropriate prescription, we asked whether the patients' demands and persistent attitudes, as well as overcrowding and need for making quick decisions at EDs, were affecting the prescription decision of the doctor. The questions about beliefs and attitudes used a 5-point scale for the response options from "always" to "never" and from "excellent" to "poor." Full survey wording is presented in Appendix 1.

Statistical analysis

Statistical analysis was performed using the Statistical Package for Social Science version 15.0 (SPSS Inc.; Chicago, IL, USA). Reliability and validity of the questionnaire were measured by Cronbach's alfa, and it was found to be 0.71. Demographic data related to participants were expressed as numbers and percentages. Descriptive variables such as age and gender, were categorized, and all the categorical variables were analyzed using the Pearson Chi-square and Fischer's exact test. p less than 0.05 was considered statistically significant.

Results

Among 299 returned questionnaires, we had 282 completed and relevant ones. More than half of the participants were males (55.3%). The sample included 92 (32.6%) GPs, 50 (17.7%) EM residents; and 140 (49.6%) EM specialists. Only one-quarter of them (25.9%) were relatively new with a clinical practice of fewer than five years (Table 1).

Of all the physicians, 61.3% see more than 100 patients per day; it was even more than 200 for 31.9% of them. The most common indication for the prescription of antibiotics was upper respiratory tract infections (URTI) (60.6%), followed by lower respiratory infections

Table 2. Relation between the responses and professional status of the physicians

Questions						
Professional status	**n* (%)**					
Do you think that you prescribe antibiotics in accordance with the guidelines for the correct indications?						
	Never	**Rarely**	**Sometimes**	**Often**	**Always**	**p**
GP*	4 (4.3)	4 (4.3)	20 (21.7)	54 (58.7)	14 (15.2)	0.324
EM* resident	4 (8)	4 (8)	9 (18)	34 (68)	3 (6)	
EM specialist	15 (10.7)	15 (10.7)	32 (22.9)	74 (52.9)	19 (13.6)	
Are you aware of antibiotic stewardship?						
	Excellent	**Good**	**Average**	**Below average**	**Poor**	
GP	13 (14.1)	13 (14.1)	12 (13)	12 (13)	55 (59.8)	0.034
EM resident	6 (12)	6 (12)	9 (18)	5 (10)	57 (41)	
EM specialist	19 (13.7)	19 (13.7)	42 (30.2)	21 (15.1)	30 (60)	
Does the patient demand affect your antibiotic prescription decision?						
	Never	**Rarely**	**Sometimes**	**Often**	**Always**	
GP	13 (14.1)	29 (31.5)	34 (37)	14 (15.2)	2 (2.2)	0.491
EM resident	7 (14)	13 (26)	15 (30)	12 (24)	3 (6)	
EM specialist	13 (9.3)	53 (37.9)	39 (27.9)	29 (20.7)	6 (4.3)	
Do you prescribe antibiotics to avoid discussion with the patient?						
	Never	**Rarely**	**Sometimes**	**Often**	**Always**	
GP	15 (16.3)	23 (25)	22 (23.9)	25 (27.2)	7 (7.6)	0.011
EM resident	6 (12)	8 (16)	19 (38)	8 (16)	9 (18)	
EM specialist	12 (8.6)	49 (35)	39 (27.9)	33 (23.6)	7 (5)	
Does need for making quick decisions at the emergency department affect your antibiotic prescription?						
	Never	**Rarely**	**Sometimes**	**Often**	**Always**	
GP	7 (7.6)	22 (23.9)	33 (35.9)	24 (26.1)	6 (6.5)	0.758
EM resident	4 (8)	10 (20)	14 (28)	17 (34)	5 (10)	
EM specialist	13 (9.3)	22 (15.7)	52 (37.1)	45 (32.1)	8 (5.7)	
Does the overcrowding at ED* cause you to prescribe unnecessary antibiotics?						
	Never	**Rarely**	**Sometimes**	**Often**	**Always**	
GP	8 (8.7)	27 (29.3)	25 (27.2)	26 (28.3)	6 (6.5)	0.136
EM resident	2 (4)	10 (20)	21 (42)	9 (18)	8 (16)	
EM specialist	13 (9.3)	32 (22.9)	35 (25)	46 (32.9)	14 (10)	
n: number; GP: general practitioner; EM: emergency medicine; ED: emergency department						

(LRTI) (22.7%). Those conditions did not differ across professional seniority (GPs, EM residents, and EM specialist) (p=0.1); however, the second common indication for physician group with less than five years of practice was urinary tract infections (UTI). The most commonly prescribed antibiotics were penicillin and cephalosporins (56.7% and 31.9%, respectively); this did not differ between the specialty level (p=0.2), but there was a significant difference between the antibiotic choice and clinical practice (p=0.02). The preferred antibiotic choices of physicians who had less than 15 years of practice were similar to those of all participants, but there was no difference between the groups of antibiotics chosen by the physicians who had more than 15 years of practice (Table 1).

Most of the participants noted that they were aware of the rapidly spreading antibiotic resistance worldwide (excellent 59.2%, good 30.1%). More than half of them think that antibiotics were often prescribed inappropriately (62.1%), and some even mentioned that they sometimes (39%) prescribed antibiotics inappropriately. On the other hand, 57.4% stated that they often prescribed antibiotics in accordance with the guidelines for the correct indications, and this did not change with the professional seniorities (p=0.3) or the level of training (p=0.3) (Tables 2 and 3). In any case, antibiotic stewardship awareness was poor among half of the participants (50.5%), and there was a significant difference across the professional seniority (p=0.03). It was better among the EM specialists group, 43.9% of whom noted

Table 3. Responses of the participants to the questions related to their beliefs and attitudes toward antibiotic prescription and resistance

Questions					
Responses of participants to the questions about the antibiotic resistance and inappropriate prescription					
	Excellent	**Good**	**Average**	**Below average**	**Poor**
Are you aware of the antibiotic resistance rapidly spreading all around the world?	167 (59.2%)	85 (30.1%)	27 (9.6%)	1 (0.4%)	2 (0.7%)
Are you aware of antibiotic stewardship?	12 (4.3%)	26 (9.3%)	63 (22.4%)	38 (13.5%)	142 (50.5%)
	Always	**Often**	**Sometimes**	**Rarely**	**Never**
Do you think that antibiotics are prescribed inappropriately?	41 (14.5%)	175 (62.1%)	58 (20.6%)	8 (2.8%)	
Do you think that you prescribe antibiotics inappropriately?	7 (2.5%)	50 (17.7%)	110 (39.0%)	100 (35.5%)	15 (5.3%)
Do you think that you prescribe antibiotics in accordance with the guidelines for correct indications?	36 (12.8%)	162 (57.4%)	61 (21.6%)	19 (6.7%)	4 (1.4%)
Responses of participants to the questions about the factors affecting antibiotic prescription decision of the physicians					
	Always	**Often**	**Sometimes**	**Rarely**	**Never**
Do the patients force you to prescribe antibiotics?	61 (21.6%)	126 (44.7%)	82 (29.1%)	10 (3.5%)	2 (0.7%)
Does the patient demand affect your antibiotic prescription decision?	11 (3.9%)	55 (19.5%)	88 (31.2%)	95 (33.7%)	33 (11.7%)
Do you prescribe antibiotics to avoid arguing with the patient?	23 (8.2%)	66 (23.4%)	80 (28.4%)	80 (28.4%)	33 (11.7%)
Does need for making quick decisions at ED affect your antibiotic prescription?	19 (6.7%)	86 (30.5%)	99 (35.1%)	54 (19.1%)	24 (8.5%)
Does the over-crowding at ED cause you to prescribe unnecessary antibiotics?	28 (9.9%)	81 (28.7%)	81 (28.7%)	69 (24.5%)	23 (8.2%)
Responses of participants to the questions regarding informing patients about antibiotic necessity and resistance					
	Always	**Often**	**Sometimes**	**Rarely**	**Never**
Do you inform the patients who demand antibiotics that the antibiotic use is not appropriate when there is no indication?	113 (40.1%)	119 (42.2%)	35 (12.4%)	11 (3.9%)	4 (1.4%)
Do you give information to patients about the antibiotic use and resistance?	39 (13.9%)	93 (33.1%)	83 (29.5%)	50 (17.8%)	16 (5.7%)
Would you spend much more time for patient information and inducement related to use of antibiotics, if possible?	115 (40.9%)	115 (40.9%)	28 (10.0%)	15 (5.3%)	8 (2.8%)
ED: emergency department					

their awareness level of stewardship was average as well as above average (Tables 2 and 3).

There were also questions related to the factors affecting the physician's opinion during prescription. We asked whether the patients force the physician to prescribe antibiotics; 126 (44.7%) of participants answered "often," and 61 (21.6%) of participants answered "always." However, it was seen that patient demand did not significantly affect the physician's decision. Nearly one-third of the participants answered the question related to this "rarely" (33.7%) and one-third "sometimes" (31.2%) (Table 3). This condition did not differ between the professional seniority (p=0.4) and the gender (p=0.1), but it changed with clinical practice (p=0.03), while physicians who were newer to the profession (<5 years) noted that patient demand affected their decision more often (31.5%) (Tables 2 and 4). We also asked if physicians prescribed antibiotics to avoid arguing with the patients. Attitudes did not differ across gender (p=0.1), but differed across professional seniority (p=0.01) and levels of training (p = 0.003). This behavior was more common among the EM residents and physicians with less clinical practice (Tables 3 and 4). When questioned about the other factors, which were whether they had to make quick decisions at the ED or overcrowding of the ED caused inappropriate antibiotic prescription, there was no relation between the responses and professional seniority (p=0.7 and p=0.1, respectively) (Table 2). Also associated with the clinical experience, there was no significant difference between the responses to the question,if need for making quick decisions affects physicians antibiotic prescription; however in connection with the overcrowding of the ED's effect on antibiotic prescription, there was an inverse relationship with the clinical experience (p=0.07 and p=0.01, respectively) (Table 4).

Other questions were related to informing patients about the necessity for antibiotics and resistance. More than 80% of the participants noted that they informed patients who demanded antibiotics that it was inappropriate when there was no indication. Related to the antibiotic resistance, percentages of physicians giving information about this topic were lower. However, almost all of

Table 4. Relations between the responses and clinical practice of the physicians

Questions						
Clinical practice	**n* (%)**					
Do you think that you prescribe antibiotics in accordance with the guidelines for correct indications?						
	Never	**Rarely**	**Sometimes**	**Often**	**Always**	**p**
0-5 years	5 (6.8)		18 (24.7)	43 (58.9)	7 (9.6)	0.3
5-10 years	11 (9.7)		29 (25.7)	60 (53.1)	13 (11.5)	
10-15 years	6 (10.2)		8 (13.6)	33 (55.9)	12 (20.3)	
15+ years	1 (2.7)		6 (16.2)	26 (70.3)	4 (10.8)	
Does the patient demand affect your antibiotic prescription decision?						
	Never	**Rarely**	**Sometimes**	**Often**	**Always**	
0-5 years	7 (9.6)	17 (23.3)	26 (35.6)	23 (31.5)		0.03
5-10 years	11 (9.7)	35 (31)	38 (33.6)	29 (25.7)		
10-15 years	11 (18.6)	23 (39)	16 (27.1)	9 (15.3)		
15+ years	4 (10.8)	20 (54.1)	8 (21.6)	5 (13.5)		
Do you prescribe antibiotics to avoid arguing with the patient?						
	Never	**Rarely**	**Sometimes**	**Often**	**Always**	
0-5 years	5 (6.8)	14 (19.2)	23 (31.5)	20 (27.4)	11 (15.1)	0.003
5-10 years	12 (10.6)	25 (22.1)	36 (31.9)	32 (28.3)	8 (7.1)	
10-15 years	9 (15.3)	23 (39)	13 (22)	11 (18.6)	3 (5.1)	
15+ years	7 (18.9)	18 (48.6)	8 (21.6)	3 (8.1)	1 (2.7)	
Does need for making quick decisions at the emergency department affect your antibiotic prescription?						
	Never	**Rarely**	**Sometimes**	**Often**	**Always**	
0-5 years	4 (5.5)	13 (17.8)	25 (34.2)	24 (32.9)	7 (9.6)	0.07
5-10 years	11 (9.7)	17 (15)	37 (32.7)	39 (34.5)	9 (8)	
10-15 years	8 (13.6)	9 (15.3)	24 (40.7)	16 (27.1)	2 (3.4)	
15+ years	1 (2.7)	15 (40.5)	13 (35.1)	7 (18.9)	1 (2.7)	
Does the overcrowding at ED* cause you to prescribe antibiotics unnecessarily						
	Never	**Rarely**	**Sometimes**	**Often**	**Always**	
0-5 years	1 (1.4)	13 (17.8)	26 (35.6)	22 (30.1)	11 (15.1)	0.01
5-10 years	10 (8.8)	23 (20.4)	32 (28.3)	36 (31.9)	12 (10.6)	
10-15 years	7 (11.9)	18 (30.5)	12 (20.3)	17 (28.8)	5 (8.5)	
15+ years	5 (13.5)	15 (40.5)	11 (29.7)	6 (16.2)	0 (0)	
N: number; ED: emergency department						

the participants assumed that they would spend much more time informing and inducing patients if possible (Table 3).

Discussion

This study demonstrated that 95% of the physicians agreed that they occasionally prescribed antibiotics unnecessarily. Almost all the physicians stated that patients forced them to prescribe antibiotics; however, this situation did not affect the prescription decision of the physician as much as predicted. Other important factors that affected physicians' antibiotic prescription decision were avoiding discussion with the patient and overcrowding of the ED, and their effects were proportionally reduced with the duration of the clinical practice of the physician.

Our survey confirmed that URTI was the most common indication for antibiotic prescription, and the most commonly prescribed antibiotics were penicillin and cephalosporins. Our results were similar to those of other studies in the literature. A study from China demonstrated that 90% of URTI prescriptions include antibiotics, and even 21% of them include a combination of antibiotics (7). Kho et al. (8) also demonstrated that 64.8% of patients with URTI received antibiotic prescription, but the chosen antibiotics changed across the countries. In a cohort study from Denmark, the most commonly prescribed antibiotic was penicillin V, which accounted for 58% of all prescriptions, followed by macrolides (18%) (9). However, in another study from Qatar, cephalosporin group was in the first line of treatment (43%), followed by penicillins (28%) (10).

Antibiotic resistance is a growing public health problem, and almost all participants noted that they were aware of this. It is the main cause of morbidity and mortality from otherwise treatable infections, and it is largely attributed to the inappropriate use of antimicrobials (11). Nearly 40% of the participants noted that they sometimes prescribe antibiotics inappropriately. A study by Timbrook et al. (12) demonstrated that 39% of prescribed antibiotics at the ED did not meet the criteria for appropriateness; also, among appropriate indications, 13.8% had inappropriate dosing, duration, or expense. Antibiotic stewardship programs (ASP) are a set of interventions aiming at prescribing antibiotics appropriately and responsibly (6). Unfortunately, half of the participants were not aware of these. Dinh et al. (13) demonstrated in their study that ASP markedly decreased the number of unnecessary antimicrobial prescriptions, but it had little impact on most other aspects of the inappropriate prescription at the ED.

More than half of the participants assumed that patients force them to prescribe antibiotics. Our survey demonstrated that this insistent demand could sometimes affect the physician's decision, especially among those who were newer to the profession. In a study from Egypt, it was demonstrated that among patients with acute respiratory tract infections, 83% had been prescribed at least one antibiotic, and patient demand was a factor leading to over-prescription (14). Pan et al. (2) organized a virtual reality study, and it showed that eight out of nine trainees prescribed antibiotics, whereas seven out of the 12 GPs did so. The same study demonstrated that GPs were more likely to withstand the pressure to prescribe antibiotics than trainee doctors (2). According to a study by Gidengil et al. (15), 59% of the participants noted that patient demand was a problem in their practice.

Another problem affecting the physician's decisions during drug prescription was overcrowding of the ED, which forced the physician to make quick decisions. Almost one-third of the participants noted that those factors "often" affect their decision, and one-third noted the frequency as "sometimes." Gidengil et al. (15) had similar results. They demonstrated that about one-third of clinicians reported feeling rushed almost always or most of the time.

The reason for patients' antibiotic demand can be attributed to their inadequate knowledge related to this topic. According to the results of a systematic review, 53.9% of the sample did not know that antibiotics are not effective against viruses. Furthermore, although 59.4% of the sample was aware of antibiotic resistance, 26.9% of them did not know that misuse of antibiotics can lead to this problem (16). As Davis et al. (17) also demonstrated, patients reported experiencing confusion about which illnesses may be treated by antibiotics and unclear communication from clinicians about the appropriate use of antibiotics. In our study, 80% of the participants noted that they gave information to their patients related to the appropriate use of antibiotics, and almost all of them assumed that they would spend much more time for patient information and inducement if possible.

Study limitations

The number of the respondents was very small compared with the total number of the physicians working at the EDs all around the country. Also, physicians participated on a voluntary basis; hence, the survey might represent only the group of physicians who were more interested in antibiotic use.

Conclusion

Our study demonstrated that all physicians thought antibiotics had been prescribed inappropriately, with even 95% of them accepting that they also inappropriately prescribe antibiotics from time to time. Patient demand, having to make quick decisions, and overcrowding of EDs were some of the factors that affect the antibiotic prescription decisions of physicians, and the effect of these factors was inversely proportional to increased clinical practice.

Ethics Committee Approval: Ethics committee approval was received for this study from the Ethics Committee of Batman Region Community Hospital (Date 08/11/2017/File no: 75144452-000-3570).

Informed Consent: Written informed consent was not obtained from patients, because this survey was applied to E.M. physicians not to the patient and we also sent information related to aim of the study to participants as well.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - G.C.I.; Design - G.C.I.; Supervision - E.E.; Resources - G.C.I.; Materials - E.E.; Data Collection and/or Processing - G.C.I.; Analysis and/or Interpretation - G.C.I.; Literature Search - G.C.I.; Writing Manuscript - G.C.I.; Critical Review - G.C.I., E.E.

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Appendix 1. Does patient demand affect the physicians' antibiotic prescription decision in emergency departments?

Age
- o 25-30
- o 30-35
- o 35-40
- o 40-50
- o 50+

Gender
- o Female
- o Male

What is your professional status?
- o General practitioner
- o Emergency medicine resident
- o Emergency medicine specialist

How long is your clinical practice?
- o 0-5
- o 5-10
- o 10-15
- o 15-20
- o 20+

How many patients do you see per day?
- o 0-20
- o 20-50
- o 50-100
- o 100-200
- o 200+

For which indication do you prescribe antibiotics most?
- o Upper respiratory tract infection
- o Lower respiratory tract infection
- o Urinary tract infection
- o Acute gastrointestinal infection
- o Others

Which group of antibiotics do you prescribe most?
- o Penicillins
- o Cephalosporins
- o Macrolides
- o Quinolones
- o Others

Do you think that antibiotics are prescribed inappropriately?
- o Always
- o Often
- o Sometimes
- o Rarely
- o Never

Do you aware of the antibiotic resistance rapidly-spreading all around the world?
- o Excellent
- o Good
- o Average
- o Below average
- o Poor

Do the patients force you to prescribe antibiotics?
- o Always
- o Often
- o Sometimes
- o Rarely
- o Never

Do you think that you prescribe antibiotics inappropriately?
- o Always
- o Often
- o Sometimes
- o Rarely
- o Never

Does the patient demand affect your antibiotic prescription decision?
- o Always
- o Often
- o Sometimes
- o Rarely
- o Never

Do you aware of antibiotic stewardship?
- o Excellent
- o Good
- o Average
- o Below average
- o Poor

Does having to make quick decisions at emergency department affect your antibiotic prescription?
- o Always
- o Often
- o Sometimes
- o Rarely
- o Never

Do you give information to patients with antibiotic demands that it is not appropriate when there is no indication?
- o Always
- o Often
- o Sometimes
- o Rarely
- o Never

Do you give information to patients related to antibiotic use and resistance?
- o Always
- o Often
- o Sometimes
- o Rarely
- o Never

Does the patient's persistent attitude affect your decision?
- o Always
- o Often
- o Sometimes
- o Rarely
- o Never

How often antibiotics are prescribed inappropriately according to you?
- o Very often
- o Often
- o Average
- o Rare
- o Very rare

Do you spend much more time for patient information and inducement if possible?
- o Always
- o Often
- o Sometimes
- o Rarely
- o Never

Does the overcrowding at ED cause you to prescribe antibiotics unnecessarily
- o Always
- o Often
- o Sometimes
- o Rarely
- o Never

Would you prescribe antibiotics to avoid arguing with the patient?
- o Always
- o Often
- o Sometimes
- o Rarely
- o Never

Do you think that you prescribe antibiotics in accordance with the guidelines for the correct indications?
- o Always
- o Often
- o Sometimes
- o Rarely
- o Never

The Duration of Fasting in Ramadan Affects the Admissions to the Emergency Department

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Abstract

Aim: One of the ways that Muslims worship in Ramadan is by fasting. People who are fasting may prefer to receive health services in the period between iftar and pre-dawn meal owing to the concern that their fasting may be interrupted with the medical interventions to be administered. For this reason, the workload of emergency departments that serve for continuous 24 h may increase in Ramadan. We have not encountered any study analyzing the comparison of emergency visits in the seasons when the period between iftar and pre-dawn is the shortest and longest. We aimed to compare the characteristics of visits to the adult emergency department between those in the year 2016 that included the longest fasting time and those in the year 2000 that included the shortest fasting time.

Materials and Methods: Patient visits made in the Ramadan months in the years 2000 and 2016 were included in the study.

Results: There was a statistically significant difference between the total number of visits to the emergency department in the Ramadan months of 2000 and 2016 ($p<0.001$). Moreover, there was a statistically significant difference in terms of the numbers of complaints between the Ramadan months of 2000 and 2016 ($p<0.001$).

Conclusion: The results of our study can be useful for the management of emergency department and risk estimation.

Keywords: Crisis management, emergencies, fasting, Ramadan

Introduction

Ramadan is the ninth month of the Islamic calendar and is enshrined by Muslims. Fasting is one of the ways that Muslims worship in this month. Fasting, in the apparent sense, is achieved by abstaining from food, drinks, and sexual intercourse between the times of pre-dawn and iftar, which is the evening meal during Ramadan (1).

The location of the Republic of Turkey between the northern latitudes of 36°-42° and the eastern meridians of 26°-45° causes the sunshine duration to be approximately three times more in the summer than in the winter (2). As a consequence of this, when Ramadan occurs between the months of June and August that include the longest days of summer, the fasting period lasts for approximately 18 h (3). This period is significantly shorter in winter. For instance, it is slightly longer than 11 h in December.

People who are fasting may prefer to receive health services in the period between iftar and pre-dawn meal owing to the concern that their fasting may be interrupted with the medical interventions to be administered. Many health institutions do not provide health care services in the outpatient clinics at these hours. When acute diseases, which were proven in previous studies to increase in Ramadan, are also considered, the workload of emergency departments that serve for continuous 24 h increases even more (4, 5).

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Balhara et al. (6) suggested that the patterns of pediatric and adult patient admissions to the emergency departments change significantly in Ramadan in the study that was performed in Abu Dhabi. The authors showed that emergency admissions decrease significantly in the hours before iftar while they peak in the first hours following iftar. In the study by Halasa (7) in Jordan, it was shown that the complaints of admission did not change, whereas the times of admission changed during Ramadan compared with the other months. Butt et al. (8) emphasized the necessity of improving the quality of emergency patient care at special times, such as holidays and Ramadan, and to make some arrangements for the effective management of patient circulation. Indeed, establishing the emergency admission patterns of the patients is of great importance in terms of programming emergency medical services.

During the month of Ramadan, with the arrangements made in the personnel of the emergency department, medical equipment, and physical environment within the period between iftar and pre-dawn, the quality of health services may be improved. All these studies in the literature revealed the characteristics of admissions in Ramadan in various Muslim countries. Nevertheless, when we reviewed the literature, we have not encountered any study analyzing by comparing the emergency visits in the seasons when the period between iftar and pre-dawn is the shortest and longest.

From this point of view, the aim of the present study was to describe the emergency department demand during the fasting and non-fasting periods of Ramadan. We also aimed to compare the differences in the characteristics of the patients and the main complaints in the shortest and longest fasting periods.

Materials and Methods

This retrospective observational study was conducted in Baskent University Ankara Hospital. Ankara is the capital city of Turkey and is located in the Central Anatolia Region. In Ankara, the fasting period lasts approximately 11 h in December and 17 h and 30 min in June. The Ramadan months were December in 2000 and June in 2016. Therefore, those two years were used to compare the longest and shortest fasting periods. The period between pre-dawn and iftar was expressed as fasting hours.

Data of all patients who were admitted to our adult emergency department in Ramadan in the years 2000 and 2016 regarding of age, gender, time of emergency visit, and emergency complaints were collected from the hospital information management system and archive of patient files.

Statistical analysis

The Kolmogorov-Smirnov test was used to determine whether the age information of the patients showed a normal or non-normal distribution. The chi-square test was used for comparisons of the absolute numbers of emergency visits in the months of Ramadan. Data were presented as proportions for gender and as mean±standard deviation for the ages of the patients. The chi-square test was also used for comparison of the absolute number of emergency complaints in terms of years. A p-value<0.05 was considered as statistically significant. Data were analyzed using the Statistical Package for Social Sciences 17.0 for Windows package program (SPSS Inc.; Chicago, IL, USA).

Baskent University Medical and Health Sciences Research Committee approved the study (project no. KA17/192).

Results

The number of patient visits in the Ramadan months of the years 2000 and 2016 was analyzed. In 2000, a total of 920 patients visited the emergency department. Data about the time of visit of three patients in 2000 could not be reached when the patient records

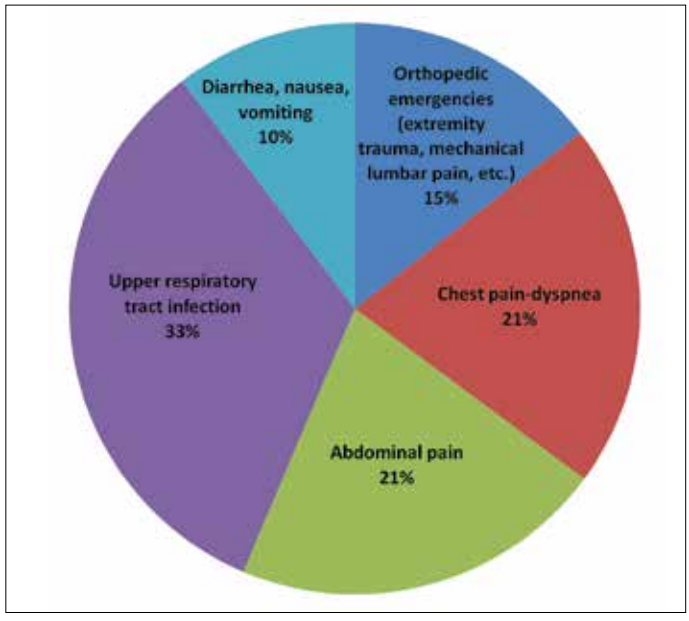

Figure 1. Distribution of the five most common emergency complaints in the Ramadan month of the year 2000

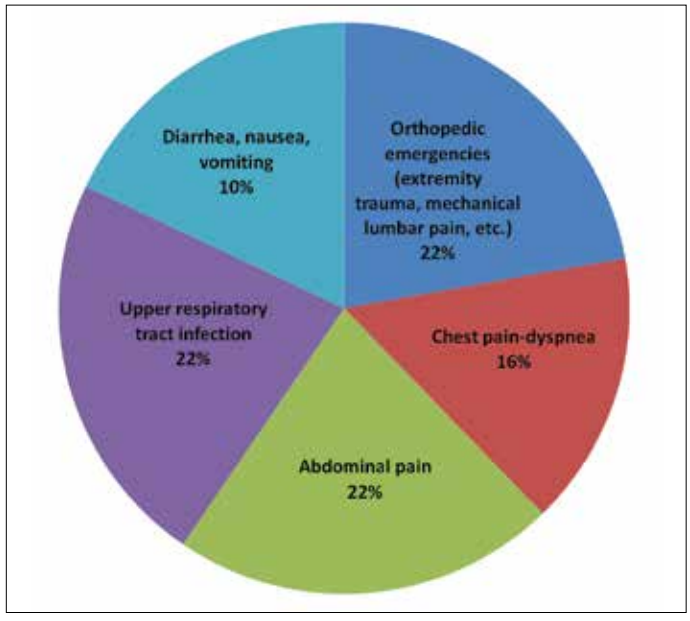

Figure 2. Distribution of the five most common emergency complaints in the Ramadan month of the year 2016

Table 1. The number of emergency visits during the fasting hours of Ramadan and other hours according to years

Year	Fasting hours n (%)	Other hours n (%)	Total	p
2000 Ramadan	474 (51.6)	443 (48.3)	917	<0.001
2016 Ramadan	1421 (65.6)	744 (34.3)	2165	
Total	1895	1187	3082	
*Chi-square test.				

were kept in notebooks. These three patients were excluded from the analyses. Of the 917 patients, 51.6% (n=474) were admitted in the fasting period, whereas 48.3% (n=443) were admitted in other times. In the Ramadan month in 2016, a total of 2165 patients visited our emergency department. Among them, 65.6% (n=1421) were admitted in the fasting period, and 34.3% (n=744) were admitted in other times. There was a statistically significant difference between the groups in terms of the number of visits (Table 1).

The mean ages of the patients were 41.9±18.5 years in the Ramadan of 2000 and 48±20.4 years in the Ramadan of 2016.There was a statistically significant difference between the two years in terms of the patients' age (p=0.001).

Of the 920 patients who visited the emergency department in the Ramadan of 2000, there were 495 (53.8%) female and 425 (46.1%) male patients. Of the 2165 patients in the Ramadan of 2016, there were 1282 (59.2%) female and 883 (40.7%) male patients. There was a statistically significant difference in terms of gender between the emergency visits in the Ramadan of 2000 and 2016 (p=0.001).

Figures 1 and 2 show the distribution of the numbers of the five most common admission complaints according to months. The most common five admission complaints were the same in the two months included in the study. There was a statistically significant difference in terms of the numbers of complaints between the Ramadan months of 2000 and 2016 (p<0.001).

Discussion

Specialized medical staffs are needed in the emergency medicine field for the most appropriate management of complicated and numerous patients admitted to the emergency departments. However, unfortunately, the number of specialists of emergency medicine is known to be inadequate worldwide. When this is the case, the importance of arranging the working schedule of the personnel according to the hours with less and more patient admissions in terms of the quality of patient care is emphasized (8, 9). The month of Ramadan is a special time period in which the characteristics of admissions may change in countries where Muslims fast mostly. Our study investigated whether there was a difference in terms of emergency admissions between 2016 when Ramadan included the longest days of fasting and 2000 when Ramadan included the shortest days of fasting. A clear increase in the number of visits during Ramadan from 2000 to 2016 was found. The number of visits during fasting hours is higher in 2016 than in 2000. This reflects the changes in our emergency department structure. In 2000, our emergency department served as an "emergency room" with four rooms. In 2016, our emergency department was a fully equipped emergency department with 19 beds. We think that the difference is associated with the increase in the physical and personnel facilities of our emergency department. In addition, an increase of 352% in the emergency department visits between 2002 and 2013 in Turkey was seen. Owing to this, the number of patients who visited our emergency department has also increased (10).

In recent years, there has been an increase in the number of visits of geriatric patients to the emergency departments (11). We believe that this condition might cause significant differences in the age of admitted patients.

According to the statistical data of our emergency department, the rate of female patients is higher than that of male patients. This may be the cause of the significant difference between the two groups.

The number of emergency visits was 2165 in the Ramadan month of 2016. The number was below our average patient number. The decrease may originate from this period that occurred at the same time as summer months and holiday.

Different results were obtained from studies on emergency admissions in Turkey and some Muslim countries in Ramadan. For example, Pekdemir et al. (12) detected no statistically significant difference between the admission times of patients in Ramadan and the control group (p=0.576). However, they showed that the mean number of patients in Ramadan is significantly higher than that of the control group (p=0. 046). In the study by Butt et al. (8) conducted in Saudi Arabia, patient admissions at night shifts (19:00-6:59) were shown to be statistically significantly higher in Ramadan than in other months of the year (p<0.0001). In contrast, in our study, we searched for changes in the two Ramadan periods (fasting and non-fasting). We suggest that the differences between the studies are caused by cultural and personal characteristics. In addition, Turkey, among the countries in which the majority of the population is Muslim, is one of the countries with the longest fasting period since it is located in the Northern Hemisphere. For this reason, the geographical locations of the countries should be considered in the evaluation.

In the present study, the most common five admission complaints to the emergency department were the same in the two months included in the study. However, there was a significant difference among the groups in terms of the number of admission complaints to the emergency department. In the study by Tlemissov et al. (13) including geriatric patients, similar to our results in 2016, there was no significant change in admissions associated with trauma in Ramadan. Similar to our study, Topacoglu et al. (4) revealed that although the admission numbers of patients with unstable angina pectoris, acute myocardial infarction, chronic obstructive pulmonary disease, and asthma (in our study, chest pain-dyspnea group) decrease, there is no statistically significant difference. In contrast to our study, Balhara et al. (6) showed that the admissions with abdominal pain increase to 7.37% from 6.49% and that it increases in a statistically significant fashion. We suggest that these differences are caused by the personal

characteristics of the patients in the regions where the hospitals were located.

Study limitations

We were not able to ask whether the patients who were admitted to our emergency departments are fasting or not owing to ethical reasons unless there is a medical necessity. In addition, our study results did not contain the comparison of the non-Ramadan and Ramadan periods. The present study was conducted in a single city in Turkey and in a single hospital with the mean annual admissions of 30.000 emergency patients. We believe that multicentered studies that will be conducted in a wider geographical area in the future will exhibit the situation in Turkey more accurately.

Conclusion

The results of the present study can be useful for the management of emergency department and risk estimation.

Ethics Committee Approval: Ethics committee approval was received for this study from the Ethics Committee of Baskent University Medical and Health Sciences Research Committee (project no. KA17/192).

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

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Evaluation of Violence Against Emergency Physicians in Turkey

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Abstract

Aim: Violence against healthcare workers is most commonly experienced in emergency rooms. The present study aimed to assess the extent of increasing violence toward emergency physicians in Turkey and to define their opinions about reasons of violence.

Materials and Methods: This descriptive cross-sectional study was carried out in 2013 in Ankara, Turkey. Emergency physicians attended a questionnaire that included 25 multiple-choice questions. Emergency physicians working in training and research, university, and state hospitals were included in the study.

Results: A total of 502 emergency physicians were included in the study. Overall, 338 (67.3%) participants were male. The number of participants who stated that they witnessed violence against physicians or other healthcare workers at least once during their career was 494 (98.4%). In total, 414 (82.5%) participants stated that they faced violence at least once. Exposure to violence negatively affected the social life of 251 (60.6%) participants and resulted in decreased job satisfaction or interest toward their profession in 227 (54.8%) participants. The number of participants who believed that healthcare policies affected the increase of violence against healthcare workers was 490 (97.0%).

Conclusion: Our results indicate that violence against emergency physicians has reached very high levels and affects job satisfaction of physicians working under such circumstances.

Keywords: Violence, emergency medicine, physician

Introduction

Violence has several available definitions in literature. Michaud defined violence in a broad sense as "harmful behaviors of a party toward bodily integrity, moral integrity or property, or symbolic and cultural values of others in a reciprocal relationship" (1).

Studies on violence in a workplace indicate that the number of cases of violence in the healthcare sector is much higher than that in other sectors. Violence in the healthcare sector is most frequently seen in emergency services followed by psychiatry clinics (2). Studies also revealed that only assaults that resulted in injury are considered to be cases of violence and are reported to authorities, whereas other forms of violence are usually not reported. The actual incidence of violence is unknown owing to underreporting (2-4).

The present study aimed to assess the extent of increasing violence toward emergency physicians in Turkey and to define the reasons of this violence through their opinions.

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Materials and Methods

This descriptive and cross-sectional study included 502 emergency physicians working at university hospitals, education and research hospitals, state hospitals, and private hospitals in various provinces in Turkey. A questionnaire was used to collect data. The study was conducted between April 15 and July 15, 2013 in Ankara, Turkey. The local ethics committee of Yildirim Beyazit University School of Medicine approved the study protocol. The questionnaire comprised of 25 multiple-choice questions. The number of emergency physicians in Turkey was approximately 1600 at the time of the study. Written information about the study was provided and informed consent was obtained before participants filled out the questionnaires.

The questionnaire was filled out face to face with 253 physicians working in hospitals in Ankara. Emergency physicians working outside Ankara were contacted via e-mail. E-mail addresses were obtained from two emergency medicine associations in Turkey. A total of 1309 e-mail addresses were obtained, and 121 of them were incorrect. The survey was sent to the rest of the e-mail addresses. At the end of the fourth week, 134 answers were received, and in the fifth week, the questionnaire was re-sent to the physicians who did not respond. A total of 249 responses were received in the 10th week. The e-mail response rate was 20.9%.

Table 1. Demographic characteristics of the physicians

Variables	n	(%)
Job title		
Emergency medical assistant	319	63.5
Specialist	144	28.7
Assistant professor	39	7.8
Institution		
State hospital	62	12.4
Training and research hospital	270	54.1
University hospital	164	32.9
Private hospital	3	0.6

Table 2. Effects of violence on physicians

Variables	n	(%)
I am injured	24	5.8
I needed treatment	69	16.7
I could not go to work	6	1.4
I thought of quitting my job	92	22.2
Loss of motivation	224	54.1
Loss of job satisfaction	227	54.8
Decrease in working quality	221	53.4
Acute stress disorder	124	30.0
Traumatic stress disorder	192	46.4
Fear/panic/restlessness	198	47.8
Sleep disorder	181	43.7
Headache	55	13.3
Abdominal pain	136	32.9
Negative effects on social life	251	60.6
Decline of trust to the administration	167	40.3
Property damage	37	8.9
Carrying a knife/tear gas	88	21.3

Statistical analysis

Normally distributed variables for age and working period in the health sector were assessed using the Shapiro-Wilk test. Descriptive statistics for variables that were not normally distributed were presented by median and interquartile ranges (IQR). Demographic characteristics such as gender, job title, the number of patients seen during a shift in the emergency room, and the distribution of responses given to questions were presented as numbers (n) and percentages (%). Chi-square test was used to analyze the relationship between exposure to violence and variables including gender, job title, and the institutions of occupation. Similarly, comparisons between the stated questions were analyzed using the chi-square test. The relationship between the frequency of exposure to violence and the duration of profession was evaluated using the Kruskal-Wallis test. Pairwise comparisons were performed using Bonferroni correction to determine the group causing the difference according to the Kruskal-Wallis results. IBM Statistical Package for the Social Science for Windows, v.21.0. (IBM Corp., Armonk, NY, USA) and MS Excel 2007 were used for statistical analysis and calculations. $p<0.05$ was considered to be statistically significant.

Results

A total of 502 emergency physicians were included in the study, of which 338 (67.3%) were males and 164 (32.7%) were females. The median age was 31.0 years (IQR=7.0). Table 1 presents the participants characteristics.

Security guards were present in 95% of the emergency rooms where the participants worked, whereas security was insufficient as thought by 89% of the participants. Security cameras were available in 93.4% of the institutions; however, they were insufficient as thought by 76.5% of the participants. Security officers were easily accessible in 66.5% of the institutions; 97% of the security officers did not have a metal detector.

A total of 494 (98.4%) individuals stated that they witnessed violence against doctors or health professionals at least once during their careers. The number of individuals who stated that they were a victim of violence during their profession was 414 (82.5%).

No statistically significant relationship was observed between sex and exposure to violence ($\chi^2=0.01$; $p=0.973$). There was a statistically significant difference between exposure to violence and job title ($\chi^2=11.941$; $p=0.018$). Emergency medicine physicians had been exposed to violence more than the other groups. Exposure to violence was significantly higher in the training and research hospitals than in other institutions ($\chi^2=22.236$; $p=0.000$).

Table 3. Demographic characteristics of the aggressors

Variables	n	(%)
Gender		
Male	336	81.6
Female	76	18.4
Age		
15-25 years	92	22.3
25-40 years	232	56.3
40-55 years	84	20.4
>55 years	4	1.0
Socio-economic level		
Higher	170	41.3
Lower	240	58.7
Education		
Primary school	69	16.7
High school	54	13.1
University	52	12.7
Unknown	237	57.5
Additional features of aggressors		
History of psychiatric/metabolic disease	80	20.0
Disorientation	27	6.5
Confusion	20	4.8
Intoxication	17	4.1
Neurological diseases		
(Alzheimer's disease/dementia)	84	20.3
Drug/alcohol/substance abuse	209	50.5
Pain/anxiety	79	19.1
History of violence	90	21.8

Table 4. Causes of increased violence against healthcare workers according to physicians

Variables	n	(%)
Health policies	490	97.0
Publications that undermine the dignity of physicians	472	93.5
Increase in society's expectations	328	65.0
Ignorance or misinterpretation of patient rights	373	63.9
Economic problems	220	43.6
Problems related to education and culture	406	80.4
Devolution of beliefs and values	265	52.5
Intolerance	423	83.8
Lack of authority and legal gaps	407	80.6

Four hundred and fourteen individuals who stated that they were exposed to violence (100%, n=414) were exposed to verbal violence; 74.4% (n=308) were exposed to physical violence, and 28.3% (n=117) were exposed to sexual violence. Exposure to physical violence was significantly higher in men (χ^2=3.940; p=0.047). No significant difference was observed between genders in other types of violence (p>0.05).

During their entire career, 216 (52.2%) participants faced violence 1-5 times, 113 (27.3%) faced violence 5-10 times, and 151 (36.5%) faced violence >10 times. The median working periods of the participants were significantly different with regard to how many times they have faced violence (χ^2=40.142; p<0.001). The duration of profession of participants who faced violence >10 times throughout their career was observed to be longer than those who faced violence 1-5 and 5-10 times (p<0.001 and p<0.001, respectively).

In total, 85 (20.5%) individuals stated that they were exposed to violence during working hours between 8:00 and 17:00, whereas 329 (79.5%) individuals stated that they were exposed to violence during afterhours between 17:00 and 8:00 (night shifts).

With regard to how many patients were examined by the participants during a shift (24 h) in the emergency department, we found that 17.6% (n=88) of the physicians examined <50 patients, 31.5% (n=157) examined 50-100, 22.8% (n=114) examined 100-200, and 28.1% (n=140) examined >200 patients during a shift. No relationship was observed between the number of patients examined during a shift and the exposure to violence (χ^2=5.263; p=0.511).

With regard to the negative effects of facing violence, 60.6% (n=251) of the participants stated that their social life was negatively affected, 54.8% (n=227) reported a decrease in job satisfaction or interest toward their profession, and 53.4% (n=221) stated a decline in work quality (Table 2). No significant differences between sex and the specified individual effects of violence were observed (p>0.05).

With regard to attackers, 336 (81.6%) were male, and most of them were aged between 25 and 40 years (Table 3). When we compared the types of violence and the gender of the attackers, we found that only exposure to sexual violence was associated with the gender of the attacker. Among the victims of sexual violence, 75.0% (n=87) stated that the aggressor was male (χ^2=4.609; p=0.032). No significant relationship was observed between the type of violence and the other characteristics of the aggressors (p>0.05).

The number of participants who believe that health policies in Turkey triggered the increase of violence against healthcare workers in the society was 490 (97.0%). Two hundred and twenty (43.6%) participants attributed this increase primarily to the economic problems in the society (Table 4).

Discussion

The rate of exposure to violence among healthcare workers was high in several studies. Gokce et al. (5) reported the frequency of physicians' exposure to violence as 71.4%, whereas Behnam et al. (6) reported this rate as 78%. According to the Violence against

Physicians Workshop report of the Istanbul Chamber of Physicians in 2009, the ratio of healthcare workers who witnessed violence throughout their career was reported as 96%, and 64% of them faced violence at least once during their career (7). In our study, the ratio of those who witnessed violence against healthcare workers was 98.4%, and the ratio of those who were exposed to violence throughout their career was 82.5%. These results reveal that violence against healthcare workers has been increasing since 2006.

A majority of studies show that verbal violence is experienced more often than other forms of violence. According to the report of the Violence against Physicians Workshop of the Istanbul Chamber of Physicians, the rate of healthcare workers who experienced verbal violence was reported to be 100%, and the rate of those who experienced physical violence was 88% (7). Similarly, in a study conducted by Behnam et al. (6), the rate of exposure to verbal violence was higher than that of physical violence. In a study by Crilly et al. (8), the ratio of verbal violence (53%) was also significantly higher. The results of our study were in accordance with literature, indicating that physicians' rate of exposure to verbal violence was higher than other kinds of violence.

A statistically significant relationship was obtained between exposure to violence and job title. In 2006, Ayranci et al. (9) reported that general practitioners, followed by resident doctors, are exposed to violence most frequently. In our study, 53.4% of the individuals who were victims of violence were resident physicians. In our opinion, the reasons why resident doctors are more exposed to violence may be: 1) they are not experienced enough to intuit and manage violence, 2) they have longer working hours, 3) they see greater numbers of patients, and 4) they spend more time with patients and their relatives.

Exposure to violence in the workplace leads to decreased motivation, performance, self-esteem, and dignity, and increased depressive symptoms, anxiety, and stress. May and Grubbs (10) reported that violence against healthcare workers leads to problems such as physical damage, abrasion, muscle pain, bone fractures, permanent disability, and emotional stress. In 2005, Kowalenko et al. (11) reported that 16% of the physicians consider changing hospitals; 1% of them changed their hospital, and 19% stated that they want to leave the emergency department because of the violence they experienced during their career. The workshop report on the Violence against Physicians of the Istanbul Chamber of Physicians indicated that burnout, adjustment disorder, anxiety, acute stress disorder, and posttraumatic stress disorder are observed in physicians because of exposure to violence (7). Gates reported that healthcare workers experience problems in concentrating and in controlling emotions after violence (3). In our study, we found that healthcare workers experienced problems such as loss of morale and motivation, decreased job satisfaction, decreased job quality, traumatic stress disorder, anxiety, panic, and adverse effects on social life because of exposure to violence in their workplace.

Individuals with a tendency to aggressive behavior usually have lower socio-economic status, problems with authority, and have experienced legal issues previously. A majority of these individuals are alcoholics or drug addicts. In addition, individuals with metabolic, neurological (e.g., Alzheimer's disease, epilepsy, and dementia), and psychiatric disorders have a higher tendency to violence (12). In our study, 58.6% of the attackers had low socio-economic status. In addition, 50.5% (n=209) of the physicians who were exposed to violence stated that the attackers used drugs, alcohol, or other substances, 21.8% (n=90) stated that the attackers had a history of violence, 20.3% (n=84) stated that the attackers had neurological disorders (Alzheimer's disease and dementia), and 20% (n=83) stated that the attackers had psychiatric disorders. No statistically significant difference was detected between these conditions and the occurrence of violence.

Several studies have shown that social reasons were effective in the increase of violence against healthcare workers. In the Report on Violence in the Healthcare Sector published by the Gaziantep-Kilis Chamber of Physicians in 2008, factors such as ethnic and religious tension, economic problems, cultural level of the society, and devolutions experienced in the beliefs and values in the society have been blamed for the increase of tendency to violence in Turkey (13). In the Report on Violence against Healthcare Workers and Perception of Violence published by Isparta, Burdur Chamber of Physicians in 2008, economic, social, and cultural problems are reported to cause the spread of violence in the society, and misleading of media and individuals' distrustfulness to the legal system are stated to increase the susceptibility to violence (14). In our study, 97% of the participants blamed health policies for the increase of violence in the society, 93% blamed publications that erode the physicians' reputation, 80% referred to educational and cultural issues, and 83% referred to lack of tolerance.

The results of our study reveal that violence toward healthcare workers has been increasing in recent years, and a majority of healthcare workers either witness or experience violence at least once in their career. Physicians attribute this increasing tendency to the health policies that discredit the hard work of the physicians.

Study limitations

The e-mail response rate was 20.9% in our study, limiting the generalisability of our results to all emergency physicians in Turkey.

Conclusion

Violence against physicians and other healthcare professionals has become a global problem that affects public health. Therefore, precautions should be taken against violence as soon as possible, and a more secure and peaceful working environment should be provided for healthcare professionals.

We believe that the present study will help future studies to resolve problems related to this issue and enhance efforts to maintain a more secure work environment.

Ethics Committee Approval: Ethics committee approval was received for this study from the Ethics Committee of Yildirim Beyazit University School of Medicine (Date: 29.4.2013- Number:56).

Informed Consent: Written informed consent was obtained from doctors who participated in this study.

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Relationship of Serum Pentraxin-3 with Peripheral Arterial Disease

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Abstract

Aim: Atherosclerosis is a chronic inflammatory process associated with peripheral artery disease (PAD). The aim of this study was to investigate the role of pentraxin (PTX) as an inflammatory marker in the pathogenesis of PAD.

Materials and Methods: This cross-sectional clinical study was performed at the tertiary university hospital emergency department and cardiovascular surgery departments in Turkey. The purpose was to determine the value of PTX3 in the diagnosis of PAD. This study was performed on 43 symptomatic patients aged >18 years and diagnosed with PAD.

Results: Median PTX3 value was 1.027 (25–75th percentile: 0.395–2.902) in the control group and 0.585 (25–75th percentiles: 0.406–5.467) in the PAD group (p=0.913). A comparison of PTX3 with ankle brachial index (ABI) values revealed a weak and non-significant correlation (rho: 0.016, p=0.886). Analysis of PTX3 values with other parameters (age, systolic and diastolic blood pressure, heart rate, respiratory rate, temperature, and SpO_2) revealed no significant correlation with any of the other parameters.

Conclusion: Our findings indicate that PTX3 levels cannot be used as a marker in patients with the chronic process of PAD.

Keywords: Atherosclerosis, inflammation, pentraxin-3, peripheral arterial disease

Introduction

Peripheral artery disease (PAD) is a widely occurring condition. The main cause is atherosclerosis, and the causes of atherosclerosis constitute the predisposing factors for the disease (1).

Atherosclerosis, the cause of PAD, is generally a condition of advanced age. It develops in association with intimal plaques affecting arterial circulation of the vascular system and containing varying proportions of lipids, macrophages, fibroblasts, smooth muscle cells, and extracellular materials. Atherosclerosis is also a chronic inflammatory condition (2).

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Pentraxins (PTX) are multifunctional protein superfamily that play a role in the inflammatory response. PTX3 is one of the main acute phase reactants, which may increase in circulation 3-5 times above the baseline in inflammatory conditions. PTX3 is produced in the region of inflammation and binds immediately to the endothelium. PTX3 levels are believed to be an independent marker of disease activity (3).

Since a chronic inflammatory process is involved in atherosclerosis, PTX3 is an inflammatory marker that might be expected to increase in PAD. This study investigated whether PTX3 increases in patients with PAD.

Materials and Methods

Patients with suspected PAD based on symptoms at presentation to the tertiary university hospital emergency department and cardiovascular surgery departments over a 12-month period were included in this cross-sectional clinical study after receiving of approval from the local ethics committee. The study enrolled 43 consecutive adult patients presenting to the aforementioned units with suspected PAD and 40 age- and sex-matched healthy controls contacted from outside the hospital.

Patients aged ≥18 years presenting to the departments with suspected PAD and agreeing to participate were included. Exclusion criteria were patients with acute coronary syndrome, acute kidney failure, chronic kidney failure, hemorrhagic stroke, cerebrovascular disease, liver failure, acute pulmonary edema, cardiopulmonary arrest, acute mesenteric ischemia, or pulmonary thromboembolism.

Clinical and demographic characteristics, such as symptoms, physical examination findings and Doppler ultrasound, peripheral arterial with contrast computerized tomography, and magnetic resonance angiography details were recorded into a study form.

The control group inclusion criteria included non-pregnant or puerperant patients, aged ≥18 years with no acute kidney failure, chronic kidney failure, sepsis, ischemic stroke, liver failure, acute pulmonary edema, PAD, deep vein thrombosis, acute coronary syndrome, pulmonary embolism, mesenteric ischemia, cardiopulmonary arrest, multi-trauma, Tissue Plasminogen Activator (TPA)-related hemorrhage or acute trauma.

For PTX3 measurements at the time of presentation, a complete blood count (CBC) was performed by collecting blood samples in the anticoagulant ethylenediaminetetraacetic acid (EDTA) tubes. Plasma was separated by centrifugation at 1800× g for 10 min and then stored at −80°C until PTX3 study.

Measurement of plasma pentraxin-3

PTX-3 levels in human plasma were determined using a commercial enzyme-linked immuno-sorbent assay (ELISA) kit (R&D Systems, Cat No: DPTX30, Minneapolis, USA) following the manufacturer's instructions. Plasma stored at −80°C was thawed to room temperature. Briefly, 200 µL of PTX3 biotinylated antibody was added into each well of a streptavidin-coated plate. Plates were incubated for 60 min at room temperature on a microplate shaker. The plates were subsequently washed using 300 µL washing buffer to remove non-binding antibodies. PTX3 standards were prepared in line with the kit procedures. Standards, controls, and specimens were activated with pre-treatment D solution for 30 min. Further, 100 µL assay diluent solution was added to each plate; 20 µL of pre-treated standards, controls, and specimens were added to the solution and incubated for 120 min in a microplate shaker at room temperature. Following incubation, the plate was washed four times with washing buffer in a plate washer; 200 µL of PTX3 conjugate was added into the wells and incubated at room temperature for 120 min on a microplate shaker. Following incubation, the plate was washed four times using washing buffer in a plate washer. Subsequently, 200 µL of Tetra Metil Benzidin (TMB) substrate solution was added to each well for color development and incubated in dark for 30 min at room temperature; 50 µL of color stop solution was added to each well, and specimens were observed to turn yellow in color. Absorbance was measured at a wavelength of 450 nm using a microplate reader (Versamax, Molecular Devices, CA, USA). A standard chart was prepared using the absorbance values against standard concentrations obtained. PTX3 levels in specimens were calculated as ng/mL using this standard chart. The intra-assay distribution reliability of this ELISA method was 3.6% and the inter-assay distribution reliability was 4.9%.

Statistical analysis

Statistical analyses were performed using the Statistical Package for Social Sciences (SPSS Inc.; Chicago, IL, USA) version 11 software. The normality of the distribution of variables was tested using visual (histogram and probability charts) and analytical methods (Kolmogorov-Smirnov/Shapiro-Wilk tests). Descriptive analyses were expressed as mean and standard deviation for normally distributed variables. These were compared on 2×2 grids using Person's chi square and Fisher's exact tests. Since PTX3 and ankle brachial index (ABI) values were not normally distributed, these were analyzed using the Mann-Whitney U test between two groups and with the Kruskal-Wallis test between more than two groups. Spearman's correlation test was used to investigate correlations. P values less than 0.05 were regarded as statistically significant.

Results

The mean age of the participants was 63.9±11.9 years (min: 40, max: 86) in the control group and 64.5±13.8 years (min: 21, max: 88) in the patient group. Males comprised 67.5% of the control group and 81.4% of the patient group. No significant difference was observed between the two groups in terms of age or gender distribution ($p>0.05$; Table 1).

When physical examination findings were compared between the control and patient groups, no ulcer, muscular atrophy, claudication, rash, or edema were observed in the control group; however, ulcer was present in 41.9%, muscular atrophy in 9.3%, claudication in 100%, rash in 53.5%, and edema in 44.2% of the patient group ($p<0.001$ except for muscular atrophy; Table 1).

Table 1. Basic demographic and clinical characteristics of the control and patient groups

	Control (n=40)		Patient (n=43)		
	n (mean)[1] (median)[2]	% (±SD)[1] (min–max)[2]	n (mean)[1] (median)[2]	% (±SD)[1] (min–max)[2]	p
Age, years					
<44	3	7.5	2	4.7	0.956*
45-54	5	12.5	6	14.0	
55-64	13	32.5	14	32.6	
65+	19	47.5	21	48.8	
Sex					
Female	13	32.5	8	18.6	0.146*
Male	27	67.5	35	81.4	
Physical examination					
Ulcer	0	0.0	18	41.9	<0.001*
Muscular atrophy	0	0.0	4	9.3	0.117**
Claudication	0	0.0	43	100.0	<0.001*
Rash	0	0.0	23	53.5	<0.001*
Edema	0	0.0	19	44.2	<0.001*
Vital signs					
Systolic BP	(125.00)[2]	(105-160)[2]	(130.00)[2]	(100-190)[2]	0.628[2]
Diastolic BP	(85.00)[2]	(70-105)[2]	(80)[2]	(50-110)[2]	0.005[2]
Heart rate	(76.70)[1]	(10.52)[1]	(76.44)[1]	(13.32)[1]	0.922[1]
Respiration rate	(14.00)[2]	(11-20)[2]	(17)[2]	(11-20)[2]	<0.001[2]
Temperature	(36.80)[2]	(36-38)[2]	(36.70)[2]	(34.4-37.6)[2]	0.049[2]
SpO_2	(96.00)[2]	(91-99)[2]	(96)[2]	(85-99)[2]	0.654[2]
Comorbid diseases					
CAD	18	45.0	23	53.5	0.440*
HT	24	60.0	29	67.4	0.481*
HPL	10	25.0	10	23.3	0.853*
DM	14	35.0	23	53.5	0.122*
ECG					
NSR	40	100.0	37	86.0	0.026**
AF	0	0.0	6	14.0	0.026**
AFL	0	0.0	1	2.3	1.000**
Non-ST	0	0.0	1	2.3	1.000**
Ischemic ST	0	0.0	11	25.6	0.001*

*Pearson's chi square test, **Fisher's exact test, [1]Independent groups t test, [2]Mann–Whitney U test, SD: standard deviation; DM: diabetes mellitus; HPL: hyperlipidemia; CAD: coronary artery disease; ECG: electrocardiography; AF: atrial fibrillation; AFL: atrial flutter; NSR: normal sinus ritm; BP: blood pressure; HT: hypertension

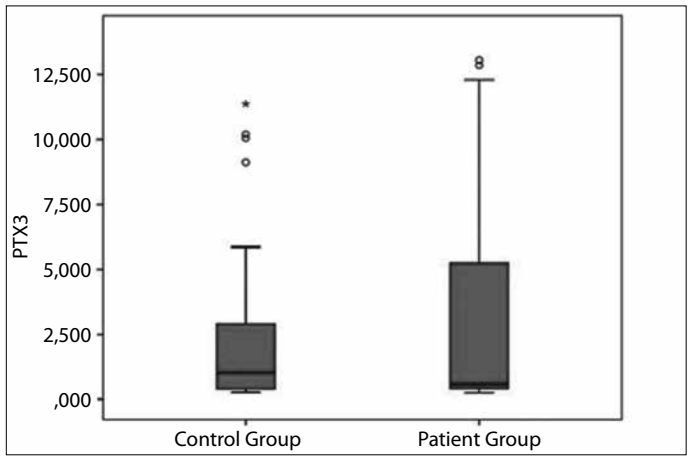

Figure 1. PTX3 values in the control and patient groups. PTX: pentraxin

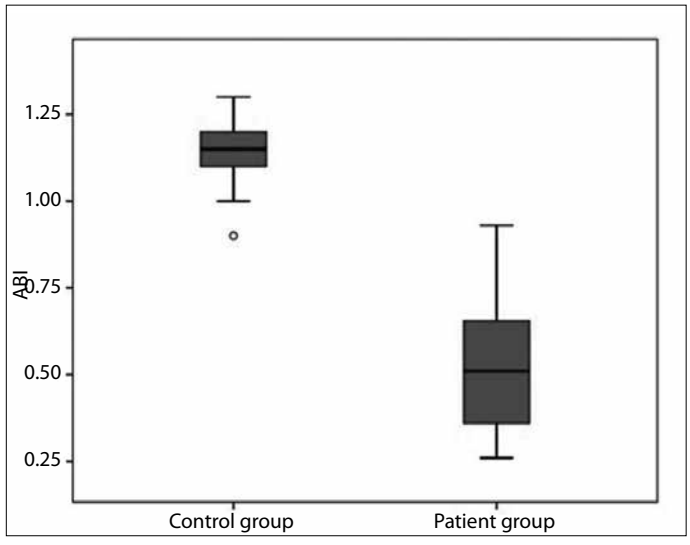

Figure 2. ABI values in the control and patient groups. ABI: ankle brachial index

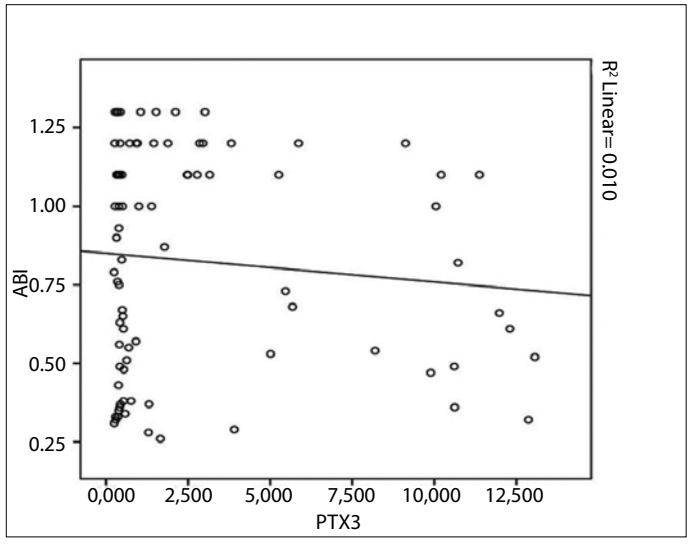

Figure 3. PTX3 and ABI correlation chart. PTX: pentraxin; ABI: ankle brachial index

In terms of vital findings, mean diastolic blood pressure (BP) in the patient group (77.58±12.55 mmHg) was significantly lower than that in the control group (100.25±98.6 mmHg; p=0.005). Similarly, in contrast, respiration rate was significantly higher in the patient group compared to the controls (p<0.001; Table 1).

When patients were questioned about comorbidities other than PAD, coronary artery disease (CAD) was present in 45% of the control group and 53.5% of the patient group, hypertension (HT) in 60% of the control group and 67.4% of the patient group, hyperlipidemia (HPL) in 25% of the control group and 23.3% of the patient group, and diabetes mellitus (DM) in 35.0% of the control group and 53.5% of the patient group. No significant correlation was determined between the groups in terms of CAD, HT, HPL, or DM (p>0.05; Table 1).

When participants' electrocardiography (ECG) findings were compared, normal ECG results were determined in almost all in the control group, while atrial fibrillation (AF) was determined in 14% of the patient group, atrial flutter (AFL) in 2.3%, non-ST changes in 2.3%, and ischemic ST elevation in 25.6% (Table 1).

Median PTX3 level in the control group was 1.027 ng/mL (25-75th percentile: 0.395-2.902), and 0.585 ng/mL (25-75th percentile: 0.406-5.467) in the patients with PAD(p=0.913; Figure 1). Median ABI in the control group was 1.15 (25-75th percentile: 1.10-1.20), significantly higher than the median value of patients with PAD at 0.51 (25-75th percentile: 0.36-0.66; p<0.001; Figure 2).

A weak and insignificant correlation was observed when we compared ABI values currently used as a diagnostic test with the new method PTX3 (r=0.016; p=0.886; Figure 3). PTX3 values investigated as a novel method also exhibited no significant correlation with any other measurement parameters (age, systolic BP, diastolic BP, heart rate, respiration rate, temperature, and SpO_2) (p>0.05).

Examination of the relations between PTX3 and sociodemographic variables, physical examination, and additional chronic diseases showed that none was a probable confounding factor. Accordingly, no correlation was determined between age, muscle atrophy, claudication, rash, edema, CAD, HT, HPL, DM, or smoking status and PTX3 values (p>0.05).

Discussion

Mean PTX3 values were 1.027 (25-75th percentile: 0.395-2.902) in the control group and 0.585 (25-75th percentile: 0.406-5.467) in patients with PAD. The difference was not statistically significant (p=0.913). Comparison of ABI values used as an existing diagnostic test and PTX3 revealed a weak and non-significant correlation (r=0.016; p=0.886). No significant association was observed with factors shown in the literature with PTX3 values.

Studies have reported varying prevalence of PAD. The prevalence of PAD in the general population aged over 40 years in Spain was reported as 9.7% in women and 11.4% in men (4). A prevalence level of 5% for PAD (ABI <0.9) has been reported in individuals representing the general population aged ≥40 years in the USA (5). A study conducted in a care home in Turkey involving 507 individuals aged >60 years reported a prevalence of PAD of 5.9%, while a study that screened the general population aged >40 years reported a prevalence of 19.76% (6).

Various studies have been performed for the early identification of PAD (7). However, the application of PTX3, an inflammatory marker, in the diagnosis of PAD has not been previously investigated. As described, PTX3 plays an important role in the primary inflammatory response. It is therefore included among the diagnostic tests for several diseases and cardiovascular diseases (CVDs) in particular, from ovarian torsion to pleural fluid effusion and pulmonary contusion (8, 9). Immunohistochemical studies have shown that plasma PTX3 levels increase in atherosclerotic lesions but not in non-atherosclerotic lesions and have demonstrated that PTX3 is a marker of localized vascular inflammation. This has emphasized the importance of investigating the relation between clinical atherosclerotic events and PTX3 levels. Additionally, the determination of higher PTX3 levels in subjects with CVD compared to those without CVD among patients with myocardial infarction with systolic BP elevation has led to PTX3 levels also being investigated in this group (10). Zhou et al. (11) reported a negative, highly significant correlation between PTX3 and ABI values. In our study, PTX3 and ABI did not correlate to age, systolic BP, diastolic BP, heart rate, respiration rate, body temperature, or SpO_2. Although Tomandlova et al. (10) referred to a significant correlation between age and PTX3, they reported no correlation between systolic or diastolic BP and PTX3, in agreement with our study. In a study investigating the relation between severity of PAD and endothelial progenitor cells (EPCs), Morishita et al. (12) reported that EPCs and PTX3 increased in a correlated manner in patients with PAD compared to those without PAD. In our study, and in contrast to Morishita et al. (12), PTX3 levels were lower in subjects with PAD, although the difference was not statistically significant. In addition, Morishita et al. (12) reported a 33.3% prevalence of DM, 71.4% of HT, and 38.1% of CVD among subjects with PAD. In our study, the prevalence values in patients with PAD were 53.5% for DM, 67.4% for HT, and 53.5% for CVD, indicating higher prevalence of DM and CVD but not HT. Additionally, mean systolic (137.38±26.20 mmHg) and diastolic (73.81±14.74 mmHg) BP values in the study by Morishita et al. (12) were similar to those of our study (systolic: 128.23±18.59 mmHg; diastolic: 77.58±12.55 mmHg). Inoue et al. (13) compared mean plasma PTX3 levels by collecting blood specimens from 252 patients undergoing angiography for CAD evaluation at a university hospital, with 162 patients under monitoring due to HT, HPL, DM, or CVD. Mean PTX-3 values of patients undergoing angiography with a preliminary diagnosis of ischemic heart disease were significantly high. In the study of patients with type 2 DM, Rashtchizadeh et al. (14) observed significantly higher mean PTX3 in patients with CAD compared to those with no CAD. However, no such relationship was observed in our study.

Studies regarding PTX3 have revealed that the levels of PTX3 also increase in some inflammatory diseases. In a study of patients with arthritis, Ishihara et al. (15) observed higher serum PTX3 levels in periods when the disease was active compared to when it was not active and compared to a healthy control group. They reported

that PTX3 is more specific than C-reactive protein (CRP) in showing arterial inflammation. Fazzini et al. (3) investigated PTX3 levels in 43 patients with vasculitis. They observed higher PTX3 levels in active vasculitis compared to during times of no activation. Moreover, PTX3 levels when the disease was not activated and in the healthy control group was similar. The study also observed high PTX3 levels in an untreated vasculitis group and low levels in subjects receiving immunosuppressive therapy. They concluded that PTX3 may be a reliable acute phase reactant in showing inflammation in active vasculitis (3). Studies investigating risk factors for PAD have identified DM, HL, HT, smoking, and obesity as such factors (16). More than 91% of patients with PAD were reported to have at least one risk factor for atherosclerosis (4). Similarly, in our study, 94% of patients had at least one such risk factor.

Several previously published studies have reported that coronary problems are encountered frequently in patients with PAD. In addition, one necroscopy study involving cases with lower extremity ischemia sufficiently severe to require amputation observed diffuse and severe coronary atherosclerotic and myocardial lesions in almost all these cases (17). CAD was diagnosed in 23 (53.5%) of the PAD cases in this study. A history of non-ST elevation was present in 1 (2.3%) patient and ischemic ST elevation in 11 (25.6%). In addition, median value of ABI of 1.15 (25-75th percentiles: 1.10-1.20) in the control group was significantly higher than median value of ABI 0.51 (25-75th percentiles: 0.36-0.66) in the subjects with PAD ($p<0.001$), indicating that consistent results were obtained in the diagnosis of PAD.

Study limitations

The absence of any significant finding in this study despite PTX3 being closely associated with atherosclerosis and the fact that the result did not change despite the grading of confounding factors, show the need for a larger and randomized sample.

Conclusion

We consider that PTX3 levels remained unchanged in this study because despite its atherosclerotic foundation, PAD is a chronic process that does not develop acutely. Further studies with a larger patient group and with PAD classified according to subtypes are needed.

Ethics Committee Approval: Authors declared that the research was conducted according to the principles of the World Medical Association Declaration of Helsinki "Ethical Principles for Medical Research Involving Human Subjects", (amended in October 2013).

Informed Consent: Written informed consent was obtained from all participants who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - B.K.; Design - O.T.; Supervision - B.K.; Resources - B.K., A.A.; Materials - S.D.; Data Collection and/or Processing - U.M., B.K.; Analysis and/or Interpretation - A.M., A.O.; Literature Search - G.A., B.K.; Writing Manuscript - B.K., A.A.; Critical Review - O.T.

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

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Is There a Difference Between the Readabilities of Informed Consent Forms Used for Procedures in the Emergency Services of State and University Hospitals in Turkey?

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Abstract

Aim: The aim of the present study was to evaluate the readability levels of informed consent forms (ICFs) used for procedures in the emergency services of state and university hospitals by comparing through readability formulas.

Materials and Methods: ICFs used in emergency medicine clinics in different university and state hospitals in Turkey were collected, and forms that were the same were included in the evaluation only once. A total of 32 ICFs, with 15 from university hospitals and 17 from state hospitals, were evaluated. Average word number, syllable number, and words with syllable number of four and above were calculated. Different formulas were used to determine readability levels.

Results: Although the readability of ICFs used in university hospitals was found to be better than those in state hospitals, the readability levels of the ICFs for both groups were detected to have medium difficulty according to the Atesman formula, very difficult according to the Flesch-Kincaid formula, difficult according to the Gunning-Fog formula, and at high school level according to the Bezirci-Yilmaz formula.

Conclusion: In conclusion, the readability rates of emergency procedure ICFs in both state hospitals and university hospitals were detected to be rather low according to the present study. The education level of our country and the local environment should be considered while preparing these ICFs.

Keywords: Emergency medicine, informed consent form, readability, understandability

Introduction

The negative perception of being ill causes the need of being aware of the phases the patients will go through. People should acquire, encode, preserve, and process information to better understand the intervention phase. It should also be considered that reading a text is an activity, including caution, memory, understanding, and knowledge. Memory is the amount of information that can be processed, formed,

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and recorded by humans. In this regard, the reader should be able to read a text well to be able to understand it (1-4).

For the presentation of some quantitative data on texts, readability provides information on whether the text is easily understandable by the reader at a certain level through the characteristics of the syllables, words, and sentences in that language. Factors influencing readability are the word length, word frequency, multi syllable number, sentence length, ambiguous word number, and syllable number. The readability of the sentence decreases as the number of words in a sentence increases (2-4). There are many formulas developed for readability analysis (5-8).

Acting in accordance with the standard applications determined in the emergency medicine field and knowing the occupational legislation are rather important. Thus, informed consent is one of the important aspects of ethical medical practice. Making an intervention without informed consent may mean negligence or malpractice and may cause a legal action, maltreatment, and even attack against the doctor (2, 3).

The aim of the present study was to evaluate the readability levels of informed consent forms (ICFs) used for procedures in the emergency services of state and university hospitals by comparing through readability formulas.

Materials and Methods

The present study was conducted using a descriptive scanning method based on a document review from April to September 2017. We contacted 14 hospitals in Konya, Ankara, and Istanbul, which are large cities in Turkey, through phone and e-mail. ICFs used in emergency clinics of four different universities and five state hospitals, with two training and research hospitals and three state hospitals, the consent forms of which could be reached, were collected. A total of 126 ICFs were gathered. There were 61 consent forms from universities and 65 from state hospitals. ICFs included tube thoracostomy, endotracheal intubation, blood products transfusion, cardioversion and defibrillation, intramuscular injection, intravenous injection, closed reduction of fractures and dislocations, small surgical interventions, lumbar puncture, paracentesis, peritoneal lavage, fibrinolysis, central venous catheterization, sedation, thoracentesis, and tracheostomy procedures. ICFs that were exactly the same were included in the evaluation only once. A total of 32 ICFs, with 15 from university hospitals and 17 from state hospitals, were evaluated. The study was designed in conformity with the Declaration of Helsinki.

Information text available in these consent forms was copied and transferred to Microsoft Word (Microsoft, Redmond, WA, USA) program and was calculated manually using the Microsoft Excel (Microsoft) program. Average word number, syllable number, and words with syllable number of four and above were calculated. The Atesman (5) and Bezirci-Yilmaz (6) formulas defined for determining the readability level of Turkish texts and the Gunning-Fog (8) and Flesch-Kincaid (7) formulas for measuring the general readability level were used for calculating the readability level of consent forms.

Atesman readability formula

The Atesman readability formula is based on the length of the word and sentence.

Readability Score is calculated as 198.825-40.175×(total syllables/total words)-2.610×(total words/total sentences). It is understood that the readability level of a text is considered easier when it comes closer to 100 and harder when it comes closer to 0 according to the Atesman formula.

Bezirci-Yilmaz readability formula

The Bezirci-Yilmaz readability formula was developed based on the sentence length and syllable number in words, characteristics in different formulas developed until today, and statistical characteristics of the Turkish language. According to this formula, the readability difficulty of the texts increases when the sentences in the texts are longer. Similarly, an increase of the syllable number in the words makes the readability of that word and the sentences harder most of the time.

The Bezirci-Yilmaz readability formula is calculated as:

Where, $\sqrt{\text{AWNx}\left((\text{S3x}0.84) + (\text{S4x}1.5) + (\text{S5x}3.5) + (\text{S6x}6.26.25)\right)}$

AWN: average word number,
S3: number of words with an average of three syllables,
S4: number of words with an average of four syllables,
S5: number of words with an average of five syllables,
S6: number of words with an average of six or more syllables.

The result acquired from this formula explains which class level a text addresses to according to the education system in our country. The education system shows elementary school education level for classes 1-8, secondary (high) school education for classes 9-12, bachelor's degree for classes 12-16, and academic education level for classes ≥16.

Flesch-Kincaid formula

The length of the words and sentences is determined according to the following formulas:

Readability= (0.39×sentence length)+(1.18×word length)-15.59,
World length=syllable number/word number,
Sentence length=word number/sentence number.

Syllable number is divided into the word number for the word length, and word number is divided into sentence number for sentence length. The text is evaluated as easy when the syllable number of each word is closer to 1 and as difficult when the syllable number increases up to 10. The same operation is valid for the sentence. The text is evaluated as easy when the word number decreases to 1 and as difficult when it is more than 10.

Gunning-Fog Index formula

There are two important aspects in the Gunning's formula. These are words containing three or more syllables and the average number of words used in sentences. These are calculated as follows:

Table 1. Readability intervals of the readability formulas used in our study

Atesman value	**Readability interval**	
90-100	Very easy	
70-89	Easy	
50-69	Average difficulty	
30-49	Difficult	
1-29	Very difficult	
Bezirci-Yilmaz value	**Readability interval according to education level**	
1-8	Elementary school	
9-12	High school	
12-16	Bachelor's degree	
>16	Academic	
Gunning-Fog Index value	**Readability interval**	
8-10	Easy	
>11	Difficult	
Flesch-Kincaid grade level	**Numeric level of the text**	**Readability interval**
5	90-100	Very easy
6	80-90	Easy
7	70-80	Rather easy
8-9	60-70	Standard
10-11	50-60	Rather difficult
12-16	30-50	Difficult
Adults	0-30	Very difficult

Fog Index=0.4×(word rate with three syllables+average number of words),

Word rate with three syllables=(number of words with three or more syllables/remaining number of words)×100,

Average number of words=word number/sentence number.
It is an easy text if the result is between 8 and 10 and a difficult text above 11. Table 1 shows the readability intervals of the readability formulas used in the study.

Statistical analysis

Dataset analyses were made using the Statistical Package for Social Sciences volume 23.0 (IBM Corp.; IL, Chicago, USA) program. Continuous variables are presented as mean and standard deviations. Normality of distribution of constant numeric variables was made using the Kolmogorov-Smirnov test. Independent T-test and Mann-Whitney U test was used for analyzing two independent groups. A $p<0.05$ was accepted as statistically significant.

Results

Informed consent forms were used for emergency tube thoracostomy, endotracheal intubation, blood products transfusion, cardioversion and defibrillation, intramuscular injection, intravenous injection, closed reduction of fractures and dislocations, small surgical interventions, lumbar puncture, paracentesis, peritoneal lavage, fibrinolysis, central venous catheterization, sedation, thoracentesis, and tracheostomy.

The sentence, word, letter, character, and syllable numbers were significantly lower in ICFs used in university hospitals than in those in state hospitals ($p<0.001$, $p=0.003$, $p<0.001$, $p<0.001$, and $p<0.001$, respectively).

When readability formulas of both groups were evaluated, it was detected that the ICFs used in university hospitals were more readable according to the Atesman, Gunning-Fog, and Flesch-Kincaid formulas and very readable at a lower education level according to the Bezirci-Yilmaz formula ($p=0.01$, $p<0.001$, $p=0.04$, and $p=0.89$, respectively).

Table 2. Numerical values for the consent forms used in emergency service clinics of state and university hospitals in Turkey.

Parameters	University hospital ICFs	State hospital ICFs	p
Sentence number	56.5±5.8	76.8±56.6	<0.001
Word number	610±135	746±99	0.003
Letter number	3753±456.4	5038±687	<0.001
Character number	4862±668	6099±808	<0.001
Syllable number	1612±194.5	2182±295	<0.001
Words with an average syllable number of four and above	138.9±32.8	227±32	<0.001
Flesch-Kincaid	20.3±3.18	22.6±0.7	0.014
Gunning-Fog	13.6±1.8	15.9±0.95	<0.001
Atesman	62.7±9.8	56.6±4.6	0.04
Bezirci-Yilmaz	10±1.12	10.8±1.1	0.89

ICFs: informed consent forms

Although the readability of the consent forms used in university hospitals was found to be better than those in state hospitals, the readability levels of the consent forms for both groups were detected to have medium difficulty according to the Atesman formula, very difficult according to the Flesch-Kincaid formula, difficult according to the Gunning-Fog formula, and at high school level according to the Bezirci-Yilmaz formula. Table 2 shows the numerical values for readability parameters of both groups.

Discussion

Readability is a language concept that appeared in the United States at the beginning of the 19th century. For presentation of some quantitative data on texts, readability provides information on whether the text is easily understandable by the reader at a certain level through the characteristics of the syllables, words, and sentences in that language (2). Informed consent process ensures that patients are properly informed of all aspects of the procedures. Obtaining informed consent is considered a responsible conduct (2). Most written consent forms are lengthy and difficult to read for patients, particularly those with low health literacy. Consent forms used for procedures are known to be more difficult to understand because of the increased disclosure requirements, which is often too much information for the average reader to process at once (9-11). Thus, it was concluded that there was a relationship between education and understanding levels in general according to previous studies made. Stating the target education level for a text provides a certain rate of information on its understandability. Consent forms for emergency procedures should be understandable by the patient population at every education level (2, 3). In addition, ICFs typically include complex information regarding procedures, contain several unfamiliar medical terms, and are often required to include difficult to understand legal terminology. As a result, it is very common for patients to have difficulty understanding the information written in the consent form before agreeing to patients in the procedures, leaving many to wonder if patients are actually providing informed consent (11-13).

The National Institutes of Health and the American Medical Association suggest that the readability of patient materials should be at ≤6th grade reading level as the average readability level of adults in the USA is at 8th grade level (14, 15).

A recent review of written consent forms revealed that most are currently written at a 10th grade reading level or higher across all medical specialties (16). Readability levels of ICFs were measured in different countries for different medical branches before. A study made in the USA reported that invasive operation ICFs were written at an average of 15th grade level (i.e., a third year of college) (16).

A study in 2014 detected that two-thirds of the society in Turkey has an inadequate level of health literacy (17). While the average education level of the whole population >15 years old is reported as 7.18 years in Turkey according to the 2010 data, the average education level of only females >15 years old is reported as 6.33 years (18).

Consent documents that are written at a high-grade level may create additional risks for patients due to lack of understanding. To ensure that patients are fully informed of all aspects of the procedure and completely understand what is expected when agreeing to participate, it is important to ensure that consent forms are written in plain language, that is, writing that is clear and easy to understand the first time the participant reads or hears it (9).

Mariscal-Crespo et al. (19) reported that ICFs used in public hospitals are analyzed globally in Spain, and it was shown that 62.4% had "somewhat difficult," 23.4% had "normal," and 13.4% had "very difficult" readability. Gargoum and Keeffe (20) evaluated the information forms used for endoscopic interventions in Ireland and reported that only 62% of the forms are easy to read, and 57% are at the reading level for 13-15 years old.

Norberto et al. (21) evaluated the ICFs of different branches, such as urology and cardiovascular surgery, and reported that the ICFs do not have an adequate level of readability although there is a difference in readability among these branches.

In our study, consent forms of both groups did not have an adequate level of readability, which was in line with previous studies. Readability levels of both groups were hard according to the Atesman, Flesch-Kincaid, and Gunning-Fog formulas and at high school level according to the Bezirci-Yilmaz formula.

Vučemilo et al. (22) reported that the consent forms used in Croatia are at 16th grade level, there is no difference in readability among the consent forms used in internal medicine and surgery, and readability levels of ICFs do not change with the degree of the health institution.

In contrast to their study, in our study, although it was detected that the consent forms used in university hospitals were detected to have higher readability, readability range of both groups classified according to readability formulas was similar.

Boztas et al. (2) compared the readability of the anesthesia ICFs used in state, training and research, and university hospitals in Turkey and reported that ICFs used in university hospitals have higher readability than those in state hospitals according to the Gunning-Fog formula and are readable at a lower education level according to the Atesman formula. Similar to their study, in our study, it was detected that ICFs used in university hospital were more easily readable than those in state hospitals according to the Atesman, Gunning-Fog, and Flesch-Kincaid formulas and readable at a lower education level according to the Bezirci-Yilmaz formula.

We think that better readability level in emergency clinics of university hospitals where more complex procedures are applied than state hospitals would be more advantageous for the patients.

Previous studies reported that these forms are made easier with marked texts and diagrams so that ICFs can be understood and remembered more easily, and these video-supported forms are more understandable and rememberable (23).

Readability level of ICFs made easier and enriched by visual information, such as videos and diagrams, would increase ratios for understanding the procedure and remembering its possible risks. Thus, the language used on ICFs should be at a reading level suitable for the target audience, contain a proper and readable text style, and contain visual presentation as much as possible. Generally, the first few lines are very important for the readability of the text because these have a critical importance for the reader to continue reading the consent form.

Use of interesting samples and stories for the reader, forming a logical structure with important points at the beginning of each paragraph, and ordinary use of the language are other general suggestions.

Conclusion

Informed consent forms are commonly used in emergency procedures and change in different centers. Consent forms are not adapted to the local environment where the intervention will be made. If the patient does not understand the aim of the intervention and believes that the application may provide benefit, then there is a "therapeutic misunderstanding." Although readability tests cannot provide certain results on the understandability of the text, they provide some ideas on the text level. As a result, the readability rates of emergency procedure consent forms in both state hospitals and university hospitals were detected to be rather low according to the present study. The education level of our country and the local environment should be considered while preparing these consent forms.

Ethics Committee Approval: Authors declared that the research was conducted according to the principles of the World Medical Association Declaration of Helsinki "Ethical Principles for Medical Research Involving Human Subjects", (amended in October 2013).

Informed Consent: Written informed consent was not necessary because no patient data has been included in the manuscript.

Peer-review: Externally peer-reviewed.

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

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EURASIAN JOURNAL OF EMERGENCY MEDICINE

A Rare Diagnosis of Flank Pain in an Emergency Department as Wunderlich Syndrome

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Abstract

Wunderlich syndrome (WS) is an uncommon cause of flank pain wherein spontaneous bleeding occurs into the subcapsular and perirenal spaces of the kidney. İt is most commonly attributed to renal tumors, especially angiomyolipomas. We report a case of a patient who presented to an emergency department (ED) with flank pain and symptoms of hemodynamic instability; radiologic imaging led to the diagnosis of WS. The patient's condition was managed conservatively first; then, selective embolization was performed. For patients who present to ED with flank pain and negative hematuria, an important diagnosis that can be fatal, if not recognized early, is WS. İt is classically presented with acute flank pain, flank mass, and hypovolemic shock, together known as Lenk's triad. İt can be fatal if not recognized and managed early, and radiological confirmation is required for accurate diagnosis.Therefore, physicians in ED should keep this syndrome in mind to prevent misdiagnosis (for e.g., as renal colic pain); and thereby the mortality.

Keywords: Wunderlich, flank pain, renal hemorrhage

Introduction

Wunderlich syndrome (WS) is a very uncommon (frequency not known) cause of flank pain wherein spontaneous bleeding occurs into the subcapsular and perirenal spaces of the kidney (1). İt is most commonly attributed to renal tumors, especially angiomyolipomas (AMLs) (1). If not recognized and treated aggressively, it can be fatal (2).

We report a case of a patient who presented to an emergency department (ED) with flank pain and symptoms of hemodynamic instability and was soon diagnosed with WS.

Case Presentation

A 73-year-old female presented with sudden right sided flank pain. She had no complaints of fever or hematuria, and there was no history of trauma or previous urolithiasis. She had hypertension and diabetes and was on medications for the same. On physical examination, she was pale and had tenderness over the right flank.

She had a blood pressure of 97/58 mmHg, pulse rate of 93 beats/min, respiratory rate of 20 breaths/min, and body temperature of 36°C. A complete blood count was performed, and the results revealed hemoglobin of 10.7 g/dL, platelet count of 284000/µL, and white blood cell count of 19200/µL. Her renal function tests were normal with a creatinine level of 0.84 mg/dL.

Abdomen Ultrasonography (US) of the abdomen revealed a generally hyperechoic lesion with local hypoechoic areas measuring 6.6×9.9 cm in the upper pole of the right kidney (AML). There was associated heterogeneously hypo-anechoic collection measuring 2.2 cm in depth around the middle and lower parts of the right kidney, suggestive of retroperitoneal hemorrhage.

Based on the results of US, an urgent contrast-enhanced computed tomography (CT) scan was performed for further examination (Figure 1). It showed a mass lesion arising from posterior of middle and lower pole of right kidney, measuring 7.9×7.1 cm with few hypodense areas of fat attenuation, confirming it as AML. There was a retroperitoneal

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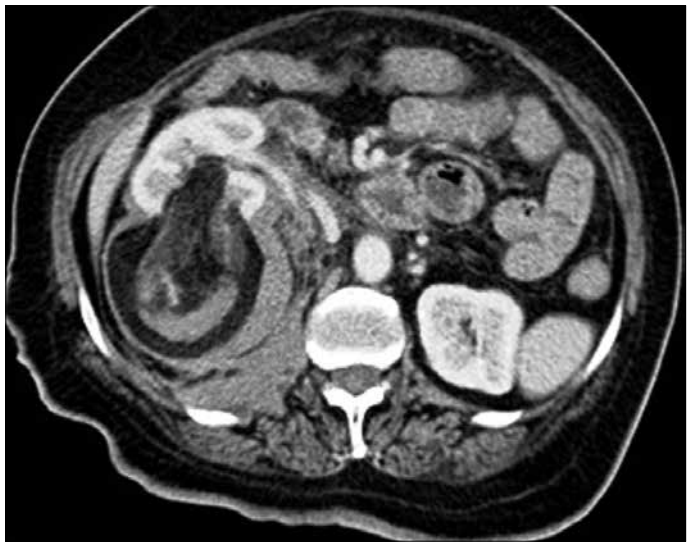

Figure 1. Contrast-enhanced abdominal CT showed a mass lesion arising from posterior of middle and lower pole of right kidney, measuring 7.9×7.1 cm with few hypodense areas of fat attenuation, confirming it as angiomyolipoma

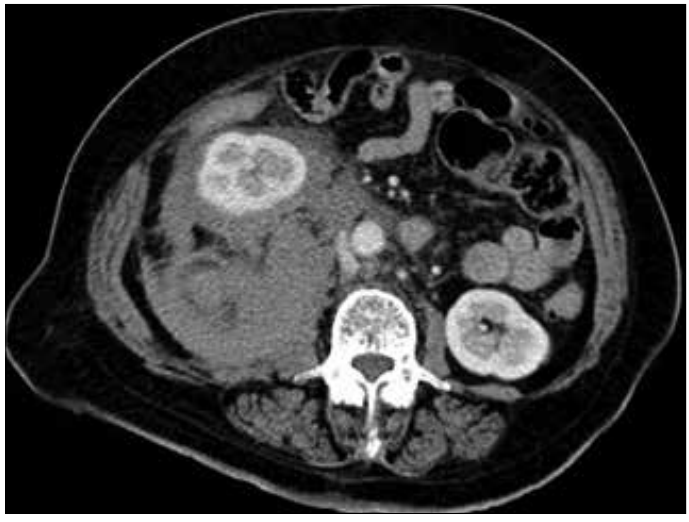

Figure 2. Contrast-enhanced abdominal computed tomography demonstrated a retroperitoneal hematoma

hematoma 9.5 cm in depth secondary to AML, and it displaced the kidney anteriorly (Figure 2).

The patient was consulted with urologist and was admitted. The patient was managed conservatively under active monitoring for 10 hours, and then, selective embolization was performed. Partial nephrectomy, with the intention of enucleating the AML and removing of the hematoma was decided as the definitive treatment.

Written informed consent was obtained from the patient who participated in this study.

Discussion

Wunderlich syndrome is a rare condition of acute spontaneous renal hemorrhage into the subcapsular and perirenal spaces. This condition was first described by a German physician called C.R. Wunderlich in 1856 (1). Patients classically presented with acute flank pain, flank mass, and hypovolemic shock, collectively known as Lenk's triad (2). According to a meta- analysis, frequency of these symptoms were 83%, 19%, and 11% for acute onset of flank pain, hematuria, and signs and symptoms of hypovolemic shock, respectively (3).

The most common etiological factor of WS is renal neoplasms (61.5%), with a predominance of AML (29.1%) and renal cell carcinoma (26.1%) (3). AMLs are benign tumors originating from perivascular epithelioid cells and composed of abnormal blood vessels, muscle cells, and adipose tissue (4). Nearly 10% of patients with AML presenting with WS, and the risk of WS is increasing especially if the mass is larger than 4 cm in diameter (1, 4). Moreover, other underlying conditions include arteriovenous malformations, vasculitis (polyarteritisnodosa), cystic renal diseases, infections, nephritis, and renal calculi (2, 5).

Patient with mild symptoms of WS can be misdiagnosed as having renal colic pain; however, 33% of patients with AML bleeding can develop hypovolemic shock. Therefore, imaging is necessary (5, 6). US is usually the initial choice of imaging for rapid evaluation, but sometimes, retroperitoneal hemorrhages may be misdiagnosed as renal tumor or abscess using US; CT is 100% sensitive for diagnosis and much more valuable for demonstrating the underlying etiology of hematoma (2, 5).

Management of WS is based on the hemodynamic status of the patient and the underlying etiology. Because the most common cause is malignancy, in past, urologists recommended expletory laparotomy or nephrectomy in most cases (5). However, beside the improvement of the life-threatening condition, the secondary goal of treatment is trying to preserve the kidney. For asymptomatic AML, minimal invasive techniques, such as selective renal arterial embolization or radiofrequency ablation, can be treatment options (6). These techniques can also be used preoperatively to avoid excess blood loss during surgery. Another treatment option; which was the treatment modalıty that chosen for our patient, is laparoscopic partial nephrectomy and this technique also preserves the kidney (1).

Conclusion

For patients who present to ED with flank pain and negative hematuria, an important diagnosis that can be fatal, if not recognized early, is WS. It refers to spontaneous renal hemorrhage into the subcapsular and perirenal spaces, and in 1/10th of the patients hypovolemic shock can be observed. It is difficult to diagnose clinically and can be a life-threating condition if not recognized and managed early; radiological confirmation is required in almost all cases.

Informed Consent: Written informed consent was obtained from patient who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - H.A.; Design - G.C.I.; Supervision - Y.C.; Materials - H.A., S.D.; Data Collection and/or Processing - G.C.I.; Analysis and/or İnterpretation - G.C.I.; Literature Search - G.C.I.; Writing Manuscript - G.C.I.; Critical Review - G.C.I.

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

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Metallic Foreign Bodies in the Thoracic Wall in Three Cases

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Abstract

There are many reports and reviews about foreign objects in various body parts, but the thoracic wall foreign objects are rarely seen, and there is no treatment consensus. In this study, we aimed to investigate the treatment of three patients who were admitted to the emergency department due to a thoracic gunshot wound. In their follow-up, they survived with a bullet in their thoracic wall, and there were no further thoracic complications associated. Details of the hospital records of the three patients referred to the Nyala Sudan-Turkey Training and Research Hospital, with foreign bodies-bullets or shrapnel-in the thoracic wall were reviewed, retrospectively. The treatment of thoracic wall foreign bodies is still controversial and as a result, small, noninfectious, non-complicated thoracic wall foreign bodies can be followed, after consulting with the patients.

Keywords: Metallic foreign body, chest wall, three patients

Introduction

There are a great number of various reports and reviews about foreign objects in every part of the body, but thoracic wall foreign bodies are rarely described, and there is no treatment consensus (1). It is difficult to determine the location of metallic foreign bodies in the thoracic wall, and they vary with interventions and may cause complications such as pneumothorax or an internal organ injury (2). In this study, we aimed to investigate the treatment of three patients admitted to the emergency department due to a thoracic gunshot wound. In their follow-up, they survived with a bullet in their thoracic wall, and there were no further associated thoracic complications.

Case Presentation

Details of the hospital records of the three patients referred to the Nyala Sudan-Turkey Training and Research Hospital who were injured with foreign bodies-bullets or shrapnel-in the thoracic wall were retrospectively reviewed.

Case 1: A 19-year-old male was admitted a day after the firearm injury. On the physical examination performed in the previous health center, there was a suture line, approximately 2 cm proximally to the superior section of the left scapula and parallel to the upper border of the scapula, with a size of approximately 4 cm in the midclavicular area. Approximately the left 5thintercostal space (ICA)level had mid-axillary line on tube thoracostomy; there was no air leak, and also there was an oscillation, and no hemorrhagic drainage was evident. Clinical and vital findings were stable. Respiratory sounds were natural, and laboratory test results including hemogram, biochemistry analysis, and coagulation parameters were normal. A foreign body formation with metallic density was observed at the 3rd ICA level, adjacent to the intercostal muscle, between the scapula and the thoracic wall on the thoracic computed tomography (CT)and chest X-ray (Figure 1a, 1b). The patient was admitted to the service for further follow-up. On the 2nd day, the tube thoracostomy was terminated without the removal of the bullet core, and both the lung wings were seen as expansive in the control films, and the patient was discharged on the 3rd day. No complications have been encountered in further assessments.

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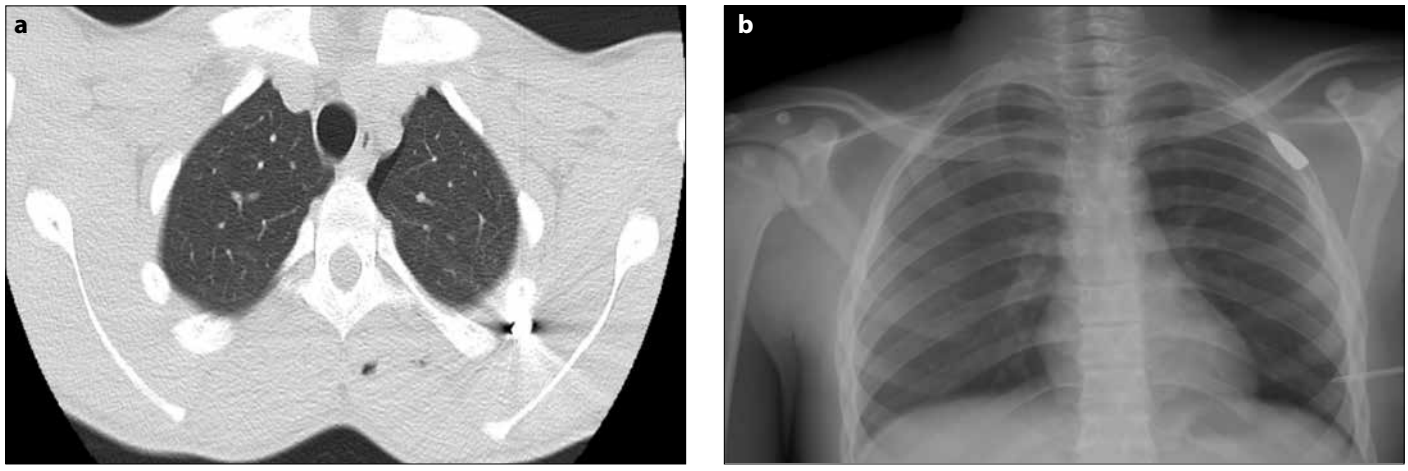

Figure 1. a, b. Computed tomography scan (a), posterior anterior chest X-ray (b)

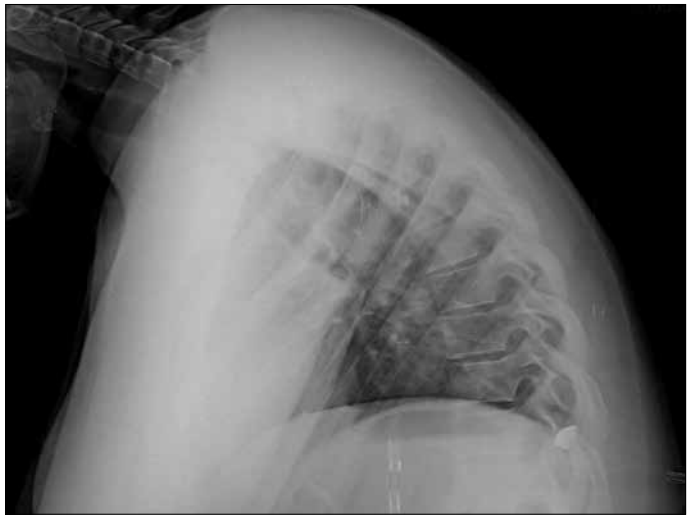

Figure 2. Lateral chest X-ray

Case 2: A 36-year-old female applied with a gunshot wound on the day of the incident. On the physical examination, a bullet entry hole approximately 1x1.5 cm size was found in the midclavicular line at approximately the 9th-10th ICA level on the right side of the back. Clinical and vital findings were stable. Respiratory sounds were natural, and laboratory test results including hemogram, biochemistry analysis, and coagulation parameters were normal. On the chest x-ray, at the 9th-10th ICA level, the right paravertebral area, there was a foreign body formation with metallic density in the posterior thoracic wall (Figure 2), and no thoracic pathology was observed. The bullet core was not removed. The patient was followed for 1day at the hospital and discharged subsequently. No complications have been encountered in the following assessments.

Case 3: A 25-year-old male was admitted 3 days after a gunshot injury. On the physical examination, at approximately the 6th-7th ICA level, an entry gun bullet hole 1x1.5 cm in size was present in the lateral line on the right side, and part of the bullet in the right axilla could be identified by deep palpitation. Clinical and vital findings were stable. There was sensitivity at palpation on the left side and diminished breathing sounds by auscultation. Laboratory test results including hemogram, biochemistry analysis, and coagulation parameters were normal. In the chest X-ray, there was pneumothorax on the left and in the right axillary region, a foreign body formation with metallic density at approximately the 5th-6th ICA level (Figure 3a, 3b). From the left 5th ICA mid-axillary line, tube thoracostomy was applied. The foreign body was not removed. On the 5th day, thoracic drain was terminated, and patient was discharged on the 7th day. No complications have been encountered in the next sequent assessment.

Discussion

Metallic foreign bodies in the thoracic wall are rare and are usually related to a history of trauma. Foreign bodies in the thoracic wall are more noticeable on chest radiographs and thoracic CT than on materials such as non-radio-opaque wood and plastics due to their characteristics (3). Thoracic CT provides more detailed information about characteristics of the foreign body, complete localization, other thoracic pathologies, as well as diagnosis (4). We used the plain lateral chest X-ray in three patients and thoracic CT in one patient. Verbal informed consent was obtained from patients who participated in this study.

Although the thoracic wall metallic foreign bodies do not cause any complications, they may migrate over time. They may cause pneumothorax or hemothorax, chest pain, infection, and systemic poisoning and may require further evaluating methods such as magnetic resonance imaging (3, 5). There are also studies in the literature reporting that metallic foreign bodies in the chest may cause hypovolemic shock due to patient's bleeding or may impair psychology of the affected person (4, 5). In two of our patients, we did not encounter any complications in the follow-up. One patient had unilateral pneumothorax at the time of admission and had developed hemithorax during tube thoracostomy. The patient's tube thoracostomy was terminated on the 2nd day when the pneumothorax completely disappeared, and the air leak was cut off, and no complications were encountered in ongoing assessments of this patient.

The treatment of thoracic wall foreign bodies is still controversial (1). They can be followed or surgically removed. The ones that are large, sharp, infected, close to major vascular structures and may cause bleeding, loss of function, and possible intoxication

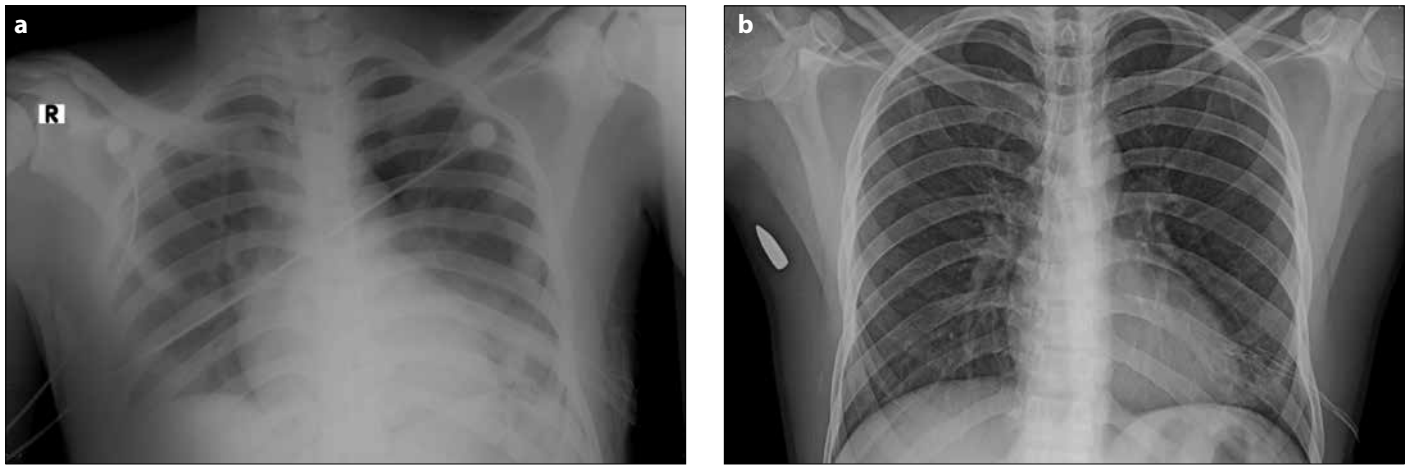

Figure 3. a, b. Posterior anterior chest X-ray with tube thoracostomy (a), posterior anterior chest X-ray after tube thoracostomy (b)

should be removed. The foreign bodies planned to be removed by surgical intervention may be found by using dynamic radiological examinations such as fluoroscopy, even if the foreign body migrates during the intervention, and thus simplifying both the surgeon's job and reducing unnecessary tissue disruption and morbidity (2). In particular, there are studies advocating the follow-up of small, non infectious, tolerated metallic foreign bodies on the chest wall that have not caused organ damage, as well as studies suggesting the removal of foreign bodies that sharp, pointed, large, contaminant and may cause hemorrhage (1, 2). We shared detailed information about the clinical conditions and treatment options of thoracic wall foreign bodies and the follow-up processes with our patients.

Conclusion

As a result, thoracic wall metallic foreign bodies that are small, noninfectious, blunt, uncomplicated and may not cause intoxication, bleeding, or functional disorders can be followed with a proper cooperation between the physician and the patient.

Informed Consent: Verbal informed consent was obtained from patients who participated in this study.

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Author Contributions: Concept - H.F.S., H.D.; Design - H.F.S., H.D.; Supervision - H.F.S., H.D.; Resources - H.F.S., H.D.; Materials - H.F.S., H.D.; Data Collection and/or Processing - H.F.S., H.D.; Analysis and/or Interpretation - H.F.S., H.D.; Literature Search - H.F.S., H.D.; Writing Manuscript - H.F.S., H.D.; Critical Review - H.F.S., H.D.; Other - H.F.S., H.D.

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EURASIAN JOURNAL OF EMERGENCY MEDICINE

Life-Threatening Upper Airway Compression: Quincke's Disease

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Clinical Image

A 34-year-old man presented with sudden onset of dyspnea and throat pain for 2 hours. He had no clinical history of trauma, fever, or allergies and was consuming sea food when he developed the symptoms. There was no history of similar episodes in the past. Examination of the upper airway including the oropharynx revealed an enlarged, swollen, and congested uvula (Figure 1). The remaining physical and indirect laryngeal examination findings were normal and his vitals were stable. He was diagnosed with Quincke's disease was treated with dexamethasone and chlorpheniramine maleate. The patient's symptoms improved in 3 hours and he was discharged on oral cetrizine 10 mg once a day for two days.

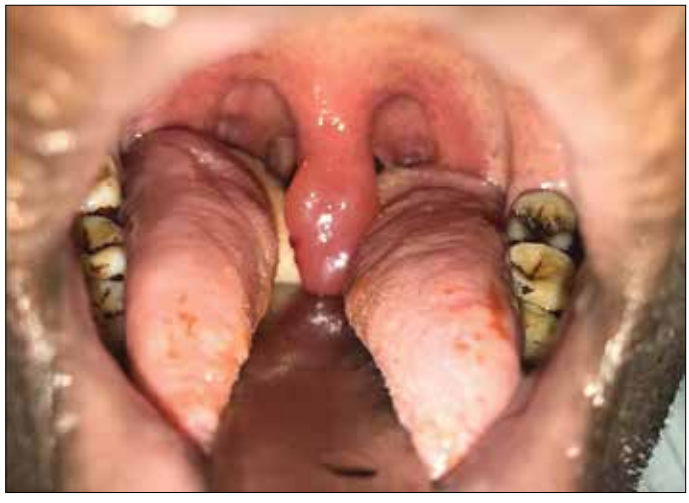

Figure 1. Patient with swollen and erythematous uvula

In 1882, Quincke first described isolated uvular angioedema. It is a relatively rare presentation of angioedema of the upper airway (1). Several causes have been implicated, such as trauma, hereditary angioedema, inhalation exposure, medication reactions, and infectious causes (2). Although rare, the uvular edema may cause obstructive respiratory distress and require immediate airway care. The treatment consists of intravenous H1 and H2 histamine blockers, corticosteroids, and rarely epinephrine (1, 2). Because of its potent anti-inflammatory properties and long half-life, dexamethasone is considered the medication of choice; however, for epinephrine has proven life-saving for emergency airway care injection. Recurrent attacks are observed in hereditary angioneurotic edema, which is caused by deficiency of the enzyme C1 esterase.

Conclusion

Quincke's disease or uvular edema is an uncommon presentation which can compromise the airway and lead to potentially a life-threatening situation. The treatment includes the administration of antihistamines, corticosteroids, and epinephrine.

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EURASIAN JOURNAL OF EMERGENCY MEDICINE

Patient with Anaphylaxis Following Blunt Abdominal Trauma

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A previously healthy 22-year-old man presented to the emergency department with abdominal pain, nonbloody and nonbilious vomiting, flushing, and a syncopal episode following a minor blunt abdominal trauma. The patient denied any history of allergic reaction and drug usage. His temperature was 36.3°C, pulse was 127 beats/minute, and blood pressure was 95/52 mmHg. Physical examination revealed tenderness of the epigastric region and the upper right quadrant, with diffuse flushing of the skin. White blood cell counts, hemoglobin and hematocrit levels, and liver functions were found to be normal. Laboratory studies demonstrated elevated arterial-

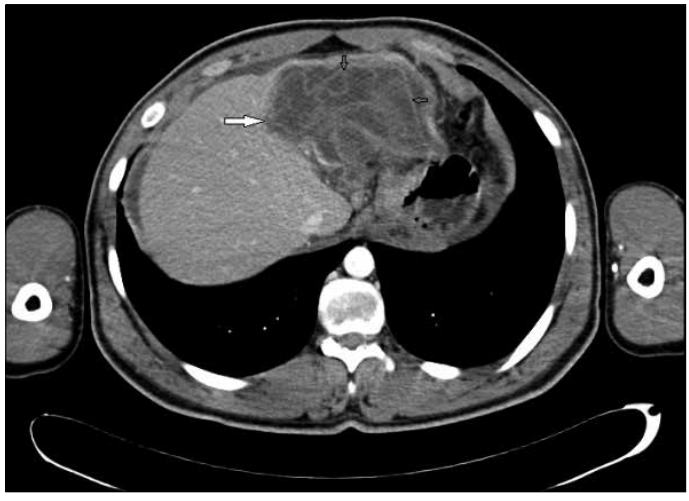

Figure 1. Abdominal computed tomography with intravenous contrast (axial view) showing a partially collapsed cystic lesion (white arrow) with a diameter of 11 cm at its widest portion, losing its normal spherical shape, having a lobulated margin, and containing a number of septations (red arrows) within

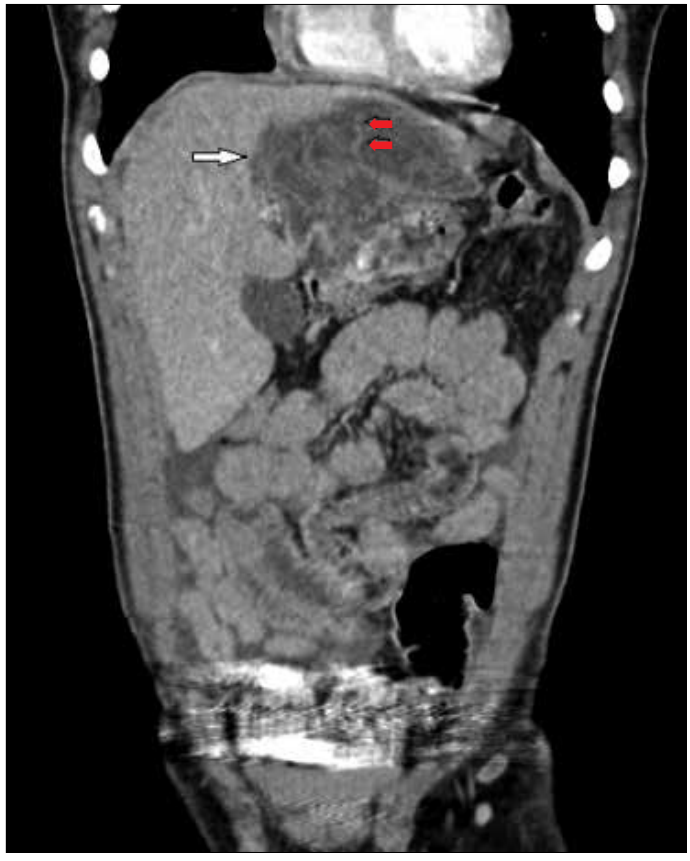

Figure 2. Abdominal computed tomography with intravenous contrast (coronal view) showing a partially collapsed cystic lesion (white arrow), losing its normal spherical shape, having a lobulated margin, and containing a number of septations (red arrows) within

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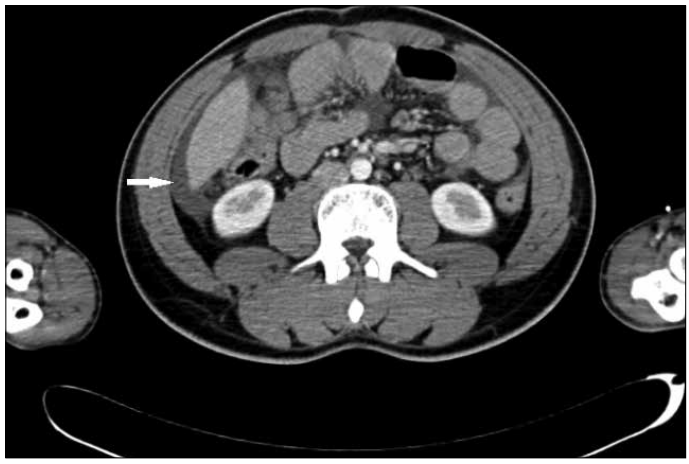

Figure 3. Abdominal computed tomography with intravenous contrast (axial view) showing free fluid (arrow) in the perihepatic region.

lood lactate level of 3.3 mmol/L (reference range, 0.5-1.6 mmol/L). Focused assessment with sonography in trauma revealed free fluid in all abdominal quadrants. Contrast-enhanced computed tomography of the abdomen was performed because the diagnosis was not clear (Figures 1-3).

The patient was diagnosed with acute anaphylaxis due to a ruptured hydatid cyst of the liver. Hydatid cyst is a parasitic disease caused by four distinct *Echinococcus* species (*E. granulosus*, *E. multilocularis*, *E. vogeli*, and *E. oligarthrus*) (1). Humans are infected through the ingestion of parasite eggs, which are released in the stool of infected canines (2, 3). The most common presentation is hydatid cyst with liver localization (1). Hydatid cyst rupture due to strenuous physical activity, abdominal trauma, or surgical trauma is a well-known etiology of anaphylaxis (2, 4). If a hydatid cyst ruptures, release of cystic content can result in allergic reactions ranging from a mild allergic reaction to anaphylaxis (1).

The patient was treated with fluid resuscitation, diphenhydramine, nasal oxygen, and glucocorticoids and operated thereafter. Albendazole was prescribed following the surgery. The patient was discharged home with cure on the 7th day of admission. Informed consent was obtained from the patient who participated in this case.

Informed Consent: Written informed consent was obtained from patient who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - K.K.; Design - K.K., C.O.; Supervision - K.K., H.Y.; Resources - K.K., C.O.; Materials - K.K., H.Y.; Data Collection and/or Processing - K.K., H.Y.; Analysis and/or Interpretation - K.K.; Literature Search - K.K., C.O.; Writing Manuscript - K.K.; Critical Review - K.K., C.O.

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

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

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EURASIAN JOURNAL OF EMERGENCY MEDICINE

Leriche Syndrome

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A 62-year-old male was admitted to the emergency department due to complain of sudden onset of weakness, pain, and hypoesthesia in the right leg. The patient's history revealed hypertension. On initial examination, patient was constantly changing postures and had a pattern of panics, his Glasgow coma scale was 15. And we found no abnormality except that the bilateral femoral pulse was absent. However, there was no coldness or paleness in the lower limbs. Additionally, his right leg experienced hypoesthesia up to the knee level. Vital findings were stable, and results of kidney and liver function tests and electrolyte levels were all within normal limits. Abdominal ultrasonography and right lower extremity Doppler ultrasonography were also performed. A monophasic flow pattern was present in the right femoral artery and its distal part although the abdominal aorta could not be seen. We performed abdominal contrast-enhanced tomography and lower-limb computed tomography (CT) angiography. The infrarenal abdominal aorta and major iliac arteries had a filling defect due to dense thrombus material. The patient was diagnosed with Leriche syndrome and requested a cardiovascular surgical consultation; hence, he was admitted to a cardiovascular surgery clinic. Anticoagulant therapy was initiated, and an elective operation was discussed and planned.

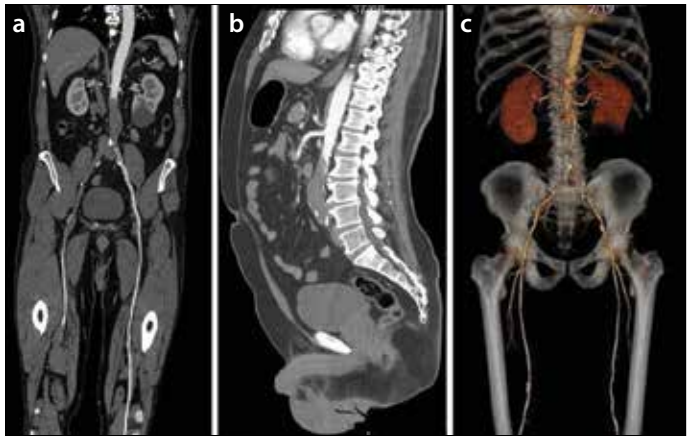

Figure 1. a-c. Coronal and sagittal view of contrast-enhanced computed tomography of the abdomen and (a, b) 3D-volume rendering images showing a filling defect of the infrarenal abdominal aorta and major iliac arteries (c)

Discussion

Leriche syndrome is an aorta-iliac occlusive disease resulting from thrombotic occlusion of the region just above the abdominal aorta bifurcation (1). The classic triad is hip and throat claudication, absence of the femoral pulse, or general weakening and impotence. It can have atypical presentations, such as renal infarction (2).

Leriche syndrome is named after René Leriche, the famous French surgeon who performed the first operative treatment for this disease. Leriche syndrome is more common in smokers, in patients of hypercholesterolemia, and in those with peripheral arterial disease (3). For the diagnosis of Leriche syndrome, ankle brachial index measurement, duplex Doppler ultrasonography, and CT angiography are important imaging modalities. Conventional surgical treatment for aortoiliac occlusive diseases include aortoiliac endarterectomy and aortobifemoral bypass. For high-risk patients, axillofemoral

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bypass (extra-anatomic technique) and percutaneous angioplasty are also viable alternatives (2, 3).

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Author Contributions: Concept: I.T.; Supervision - I.T.; Data Collection and/or Processing - F.C., G.A.D.; Analysis and/or Interpretation - I.T.; Literature Search - F.C., G.A.D.; Writing Manuscript - I.T.; Critical Review - I.T.

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