MIDDLE BLACK SEA JOURNAL OF HEALTH SCIENCE

NOvember 2022 VOLUME 8 ISSUE 4

ISSN 2149-7796

MIDDLE BLACK SEA JOURNAL OF HEALTH SCIENCE (MBSJHS)

The Middle Black Sea Journal of Health Science, which is international journal, is published by Ordu University Institute of Health Sciences on behalf of the Middle Black Sea Universities Collaboration Platform

e-ISSN 2149-7796

Middle Black Sea Journal of Health Science

Editorial Office

Ordu University

Institute of Health Sciences

Cumhuriyet Campus

52200, Ordu, TURKEY

Tel: +90 (452) 234 5010-6105

Fax: +90 (452) 226 52 28

E-mail: ukaraman@odu.edu.tr

Correspondence Address: Ulku KARAMAN, PhD, Assoc. Prof. Dr.
Institute of Health Sciences,
Ordu University,
Cumhuriyet Campus,
52200 Center/ Ordu TURKEY

Phone: +90 452 234 50 10
Fax: +90 452 226 52 55
Email: ukaraman@odu.edu.tr
ulkukaraman44@hotmail.com

Web site: https://dergipark.org.tr/en/pub/mbsjohs

Sort of Publication: Periodically

Publication Date and Place: 30 /11/ 2022, ORDU, TURKEY

Publishing Kind: Online

Indexing: *Turkey Citation Index, SOBIAD, Rootindexing, Academic Resource ındex, Fatcat index, Researcgate, EuroPub, Gooogle Scholar, Turk Medline, Index Copernicus*

The Middle Black Sea Journal of Health Science, which is international journal, is published by Ordu University Institute of Health Sciences on behalf of the Middle Black Sea Universities Collaboration Platform

Aims and Scope

Middle Black Sea Journal of Health Science is an international journal that publishes original clinical and scientific research. Middle Black Sea Journal of Health Science, published by Ordu University, publishes basic innovations in health education, case reports, reviews, letters to the editor, case reports and research articles.

The aim of the journal is to contribute to the international literature with clinical and experimental research articles, case reports, reviews and letters to the editor in the field of health sciences.

The target audience of the journal is all scientists working in the field of health, graduate students and researchers in this field.

Middle Black Sea Journal of Health Science is an open access, independent and impartial, international journal based on double-blind peer-reviewed principles.

The publication language of the journal is English. The journal is published every three months, in February, May, August and November, and four volumes are completed.

Middle Black Sea Journal of Health Science - adheres to the standards of publication ethics in health science research, Higher Education Council's Scientific Research and Publication Ethics Directive, Committee on Publication Ethics (COPE), Directory of Open Access Journals (DOAJ), Open Access Scholarly Publishers It also adopts the ethical publishing principles published by the Association (OASPA) and the World Association of Medical Editors (WAME).

No fee is charged from the authors for the evaluation and publication of the article.

Publication Ethics Statement

Middle Black Sea Journal of Health Science - adheres to the standards of publication ethics in health science researches, Higher Education Council's Scientific Research and Publication Ethics Directive, Committee on Publication Ethics (COPE), Directory of Open Access Journals (DOAJ), Open Access Scholarly Publishers It also adopts the ethical publishing principles published by the Association (OASPA) and the World Association of Medical Editors (WAME); The address for the principles expressed under the Principles of Transparency and Best Practice in Scholarly Publishing is given below.

https://publicationethics.org/resources/guidelines-new/principles-transparency-and-best-practice-scholarly-publishing

Submitted research is original, has not been published before and should not be in the evaluation process of another journal. Each article is double blinded by one of the editors and at least two referees. Plagiarism, duplication, fraudulent authorship / denied authorship, research / data fabrication, article slicing, slicing publishing, copyright infringement and concealing conflict of interest are considered unethical behavior.

All articles that do not comply with ethical standards are removed from publication even if they are accepted. This situation is valid for articles containing possible irregularities and inconveniences detected after publication.

Research Ethics

• The authors are responsible for the compliance of the articles with the ethical rules.

• Ethical standards of the Declaration of Helsinki must be followed in human studies.

• Attention should be paid to ethical principles in designing, reviewing and conducting the research.

• The research team and the participants should be fully informed about the purpose of the research, the participation rules and, if any, the risks involved.

• Confidentiality of the information and answers given by the research participants should be ensured. Research should be designed in a way that preserves the autonomy and dignity of its participants.

• Participants in the research should take part in the research voluntarily and should not be under any coercion.

• The research should be planned in a way that does not put the participants at risk.

• Be clear about research independence; If there is a conflict of interest, it should be indicated.

• In experimental studies, written informed consent must be obtained from the participants who decide to participate in the research. The legal guardian's consent must be obtained for children, those under guardianship and those with confirmed mental illness.

• If the study is to be carried out in an institution or organization, the necessary approval should be obtained from this institution or organization.

• In studies with a human element, it should be stated in the "method" section that "informed consent" was obtained from the participants and the ethics committee approval was obtained from the institution where the study was conducted.

Authors' Responsibility

The authors are responsible for the compliance of the articles with scientific and ethical rules. The author should provide assurance that the article is original, has not been published elsewhere, and is not being reviewed for publication elsewhere, in another language. Copyright laws and treaties in practice must be observed. Corresponding materials (eg tables, figures or large quotations) should be used with necessary permissions and acknowledgments. Work or sources of other authors, contributors should be appropriately used and cited in references.

All authors should have a direct contribution in academic and scientific terms in the submitted article, accordingly, the "author" is someone who contributes to the conceptualization and design of a published research, obtaining, analyzing or interpreting data, writing the article or reviewing it critically in terms of content. Other conditions for being an author are planning or executing and / or revising the work in the article.

Funding, data collection, or general supervision of the research group alone does not provide authorship rights. All individuals designated as authors must meet all the criteria listed, and any individual who meets the above criteria can be shown as an author. The name order of the authors should be a joint decision. All authors must indicate the author order signed on the

Copyright Agreement Form.

All individuals who do not meet the sufficient criteria for authorship but contributed to the study should be listed in the "thank you" section. Examples of these are people who only provide technical support, help with writing or just provide general support, financial and material support.

All authors must declare financial relationships, conflicts of interest and competition of interest that have the potential to affect the results of the research or scientific evaluation. If writer detects a significant error or inaccuracy in his published manuscript, he / she bears the responsibility to immediately contact and cooperate with the editor for correction or retraction of these inaccuracies.

Editor and Referee Responsibilities

The editor-in-chief evaluates the articles regardless of the authors' ethnicity, gender, sexual orientation, nationality, religious belief, and political philosophy. It ensures that the articles submitted for publication go through a fair double-blind peer review. It guarantees that all information about the submitted articles will remain confidential until the article is published. The editor-in-chief is responsible for the overall quality of the content and publication. It should publish an error page or make a correction when necessary.

Editor in Chief; It does not allow any conflict of interest between authors, editors and referees. It has full authority to appoint a referee and is responsible for making the final decision on the articles to be published in the journal.

Reviewers should not have conflicts of interest with the authors and / or financial supporters of the research. They should reach an impartial judgment as a result of their evaluation. They must ensure that all information regarding submitted articles is kept confidential and report to the editor if they notice any copyright infringement or plagiarism on the part of the author. In cases where the subject of the article is not his area of expertise or cannot return on time, the referee should inform the editor of this situation and state that he cannot be a referee.

Referees and editorial board members cannot discuss articles with other people. Care should be taken to keep the identity of the referees anonymous. In some cases, with the decision of the editor, the relevant referees' comments on the article may be sent to other referees who interpret the same article.

Publication Policy

Authors undertake that their publications are created in accordance with all universal ethical rules and research is accepted accordingly.

Authors are responsible for all statements in their work. Submitted studies should be prepared in line with the journal's writing rules. Studies that do not comply with the spelling rules are rejected or sent back to the authors for correction.

The journal has the right to make corrections in the accepted works without changing the content and meaning.

The journal accepts the research provided that it has not been published in another journal or publication.

All authors should indicate their relationships with individuals or organizations that may have conflicts of interest. Support received for the study, if any, should be stated in detail. Conflicts of interest should also be indicated on the title page.

In the management and publication processes of the journal, attention is paid to the publishing principles of "International Committee of Medical Journal Editors (ICMJE)" and "Committee on Publication Ethics (COPE)".

Evaluation process

-Only articles uploaded to the journal's system are evaluated. Studies sent via e-mail are not considered.

- All submitted studies go through pre-evaluation, language editor, statistical editor and referee evaluation processes. The evaluation process is carried out by the editor of the journal.

Pre-Evaluation Process

After the article is uploaded to the journal, the pre-evaluation process begins. At this stage, the editor examines the article in terms of content, form, purpose and scope of the journal. As a result of this thinning

• Decides that the work is not suitable for the journal and declines the work.

• Resend the work to the responsible author for corrections.

• The study sends to the language editor and can request a correction.

• The study is evaluated by sending it to a statistics advisor. After this evaluation, the author may ask for a correction.

• Can direct the article to the referees and initiate the referee evaluation process.

Referee Evaluation Process

All articles in the journal are double-blind peer-reviewed. In order to ensure the impartial evaluation process, each article is evaluated by at least two independent referees who are experts in their fields. If there is no consensus among the referees, the article is evaluated by the third referee. The editor in chief makes the final decision in the decision-making process of all articles.

Revision

Authors should mark the changes they made in the main text in color while submitting the article revision files. The responses to the referees should be specified in a separate Word file. Revised articles should be submitted to the journal within one month following the decision letter. If the revised version of the article is not uploaded within the specified time,

the revision option can be canceled. If the authors need additional time for revision, they must submit their publication requests to the journal before the end of one month.

Articles accepted for publication are checked again for grammar, punctuation and format.

Accepted articles are edited in accordance with the journal's publication format and the final version is sent to the responsible author in pdf format before publication, and approval is obtained for publication. Authors should review the article and approve for publication. If the article requires any correction other than the publication format, the request for correction is notified to the editor at ulkukaraman44@hotmail.com. Requests for correction are evaluated by the editor and notified to the responsible author. Articles that are not approved by the corresponding author are not published.

Plagiarism

The similarity rate of the articles should be made over iThenticate and should be at most 20%, excluding the "References" section.

The journal is published online only.

The journal is free and does not require any publication fee from researchers.

GENERAL RULES

Middle Black Sea Journal of Health Science publishes experimental and observational research articles, clinical reviews, case reports and review articles on health science. Manuscripts must be submitted online at https://dergipark.org.tr/en/login

All submissions must be accompanied by a signed statement of scientific contributions and responsibilities of all authors and a statement declaring the absence of conflict of interests.

Any institution, organization, pharmaceutical or medical company providing any financial or material support, in whole or in part, must be disclosed in a footnote. Manuscripts must be prepared in accordance with ICMJE-Recommendations for the Conduct, Reporting, Editing and Publication of Scholarly Work in Medical Journals (updated in December 2013 - http://www.icmje.org/icmje-recommendations.pdf).

An approval of research protocols by an ethical committee in accordance with international agreements (Helsinki Declaration of 1975, revised 2002 - available at http://www.vma.net/e/policy/b3.htm, “Guide for the care and use of laboratory animals - www.nap.edu/catalog/5140.html/) is required for experimental, clinical and drug studies. A form stating that the patients have been informed about the study and consents have been obtained from the patients is also required for experimental, clinical and drug studies. All

submissions must be accompanied by a letter that states that all authors have approved the publication of the paper in the Middle Black Sea Journal of Health Science.

Submission of the studies requiring ethical committee decision must be accompanied by a copy of the submission to the ethical committee.

SUBMISSION POLICY

Submission of a paper to Middle Black Sea Journal of Health Science is understood to imply that it deals with original material not previously published and is not being considered for publication elsewhere. Manuscripts submitted under multiple authorships are reviewed on the assumption that all listed Authors concur with the submission and that a copy of the final manuscript has been approved by all Authors. After acceptation of an article, it should not be published elsewhere in the same form, in either the same or another language, without the written consent of the Editors and Publisher.

If excerpts from other copyrighted works are included, the Author(s) must obtain written permission from the copyright owners and credit the source(s) in the article.

The layout and style should adhere strictly to the instructions. No revisions or updates will be incorporated after the article has been accepted and sent to the Publisher (unless approved by the Editors).

SUBMISSION PROCEDURE

The Middle Black Sea Journal of Health Science welcomes submitted manuscripts online at http://dergipark.gov.tr/login Manuscripts submitted online are received on the day of submission and quickly assigned to reviewers. Through individual Author Centers on this website, authors can view the status of their manuscripts as they progress through the review process. Notification of the disposition of each manuscript will be sent by e-mail to the corresponding author on the day of decision.

To establish your account for online submission, go to http://dergipark.gov.tr/register/ Authors are encouraged to check for an existing account. If you are submitting for the first time, and you do not have an existing account, then you must create a new account. If you are unsure about whether or not you have an account, or have forgotten your password, enter your e-mail address into the Password Help section on the log-in page. If you do not have an account, click on the Create Account link on the top right of the log-in page. You then will be able to submit and monitor the progress of your manuscripts. Once you have logged

in, you will be presented with the Main Menu and a link to your Author Centre. Submit your manuscript from the Author Centre. At the end of a successful submission and you will receive an e-mail confirming that the manuscript has been received by the journal. If this does not happen, please send an e-mail to ulkukaraman44@hotmail.com

To submit your manuscript online, please prepare the text and illustrations according to the instructions listed below. You may enter and exit the manuscript submission process at the completion of each step. After submission of the manuscript, however, you will not be able to edit it.

Web submission is required- instructions are available for downloading on the website https://dergipark.org.tr/en/pub/mbsjohs/writing-rules

COPYRIGHT TRANSFER AGREEMENT

A signed COPYRIGHT RELEASE FORM by all authors of the manuscript should be sent during manuscript submission. http://mbsjohs.odu.edu.tr/files/copyright_transfer_form_1.pdf

Middle Black Sea Journal of Health Science

Editorial Office

Ordu University, Institute of Health Sciences

Cumhuriyet Campus

52200, Ordu, TURKEY

Tel: +90 (452) 226 52 14-5234

Fax: +90 (452) 226 52 28

E-mail: ulkukaraman44@hotmail.com

Authors should write their information exactly (Full address, telephone and fax numbers, e-mail address).

PREPARING ELECTRONIC MANUSCRIPTS

In the writing of words for the studies, "Oxford English Dictionary (https://www.oed.com)" should be taken as a reference. The symbols of the units used in the text should be given according to the http://www.bipm.org/en/si/

Author should submit manuscript in both ways as explain in below:

1- The text must be single-spaced, 12-point font (except with URL addresses); and all illustrations, figures, and tables must be placed within the text at the appropriate points, rather than at the end.

2- Files you need to add:

Title Page,

Full Text,

Tables,

Figures,

Images,

Copyright Form,

Similarity Report (Similarity should be at most 20%.).

Cover Letter

Ethics Committee Approval.

3- Please insert all attachments that are tables, figures and graphics into the text file in appropriate place.

When mentioning parasites, bacteria, virus and fungi in the main text and references, the genus and species names must be italicized, and the genus name must be written with an initial capital letter.

Abbreviations should be expanded at first mention and used consistently thereafter.

Graphic files: Each figure should be a separate file.

All figure files must be submitted in sufficiently high resolution.

Electronic submission of articles via the Web

http://dergipark.gov.tr/mbsjohs

Full instructions for uploading data and files etc. are given on the website when submitting a manuscript. It is the responsibility of the Authors to create the proper files as instructed above for the electronically submitted manuscript. The editorial office cannot make conversions beyond the supported file types.

ORGANIZATION OF THE ARTICLE

Manuscripts should be prepared electronically using "Time News Roman" font, formatted according to A4 page size, single-spaced from beginning to end, 2.5 cm margins on all sides and 12-point font. Words should not be hyphenated to fit on a line. Pages should be numbered.

Title page: A separate title page should be submitted with all submissions and this page should include:

The title page should include full and short title English.

Meeting and congress presentations of the manuscript must be stated, if any.

Name(s), affiliations, highest academic degree(s) and ORCID ID's of the author(s),

Example: Ulku Karaman[1], Yeliz Kasko Arici[2], Cemil Colak[3]

[1]Institution of the first author, e -mail, orcid no

[2]Second Author's Institution, e -mail, orcid no

[3]Third Author's Institution, e -mail, orcid no

Name, address, telephone (including the mobile phone number) and fax numbers, and email address of the corresponding author,

Ethics Committee Approval: Ethics committee approval was received for this study from ……. Clinical Research Ethics Committee of …… University (No…….).

Author Contributions: Concept: …….., Design: …….., Literature search:……..... Data Collection and Processing: ……..., Analysis and Interpretation:……, Writing - …….

Acknowledgements:

Conflict of Interest:

Financial Disclosure:

Note: Kongress participation……..

In the article sent, the sections that should be below are listed.

1. Abstract, 2. Keywords, 3. Introduction, 4. Methods, 5. Results, 6. Discussion, 7. Conclusion, 8. References, Tables and Figures sections.

1. Abstract Page: The first page should include abstracts written English, and key words. The abstract of Original Articles should be structured with subheadings (Objective, Methods, Results, and Conclusion) (average 200-400 word).

2. Keywords: Provide at least 3-6 keywords and avoiding general and plural terms and multiple concepts. These keywords will be used for indexing purposes. Key words in should follow the abstract. Please select keywords in Turkish Science Terms (http://www.bilimterimleri.com).

3. Introduction: The objectives of the research should be clearly stated in this section. Relevant background information and recent published studies should be described concisely and be cited appropriately.

4. Methods: This section should contain all the details necessary to reproduce the experiments. Avoid re-describing methods already published; only relevant modifications should be included in the text. Experimental subjects when human subjects are used, manuscripts must be accompanied by a statement that the experiments were undertaken with the understanding and written consent of each subject.

When experimental animals are used, the methods section must clearly indicate that adequate measures were taken to minimize pain or discomfort.

5 Results: These sections should present the results and interpret them in a clear and concise manner. Results should usually be presented descriptively and be supplemented by figures.

6. Discussion: Extensive citations and discussion of published literature should be being used.

7. Conclusion: In this section, the results obtained from the article should be written.

8. Literature references:

Care should be taken to cite Turkey-based studies and journal of national during the granting of resources (www.atifdizini.com).

References should be listed according to the order of appearance in the text, and "in parentheses" should be indicated in the relevant places. References should be written according to the "Vancouver" system of the American National Library of Medicine (U.S. National Library of Medicine; http://www.nlm.nih.gov/).

Examples: Hypotension is one of the most common and critical problems in hemodialysis patients (1,2).

References

While citing publications, preference should be given to the latest, most up-to-date publications.

If an ahead-of-print publication is cited, the DOI number should be provided.

The accuracy of references is the responsibility of the author. The references should include only articles that are published or in press.

Unpublished data, submitted manuscripts, or personal communications should be cited within the text only. Personal communications should be documented by a letter of permission.

All items in the list of references should be cited in the text and, conversely, all references cited in the text must be presented in the list.

The abbreviations of journal titles should conform to those adopted by the List of Serial Title Word Abbreviations, CIEPS/ISDS, Paris, 1985 (ISBN 2-904938-02-8).

Journal titles should be abbreviated in accordance with the journal abbreviations in Index Medicus/ MEDLINE/PubMed.

For citation of references with one to six authors, the names of all authors should be included, and for the articles with more than six authors, “et al.” should be written after typing the six names. The surnames of authors should be written exactly, and the initials of their names should be indicated with capital letter without any punctuation mark.

Please use the following style for references:

Examples

Journal: Stephane A. Management of Congenital Cholesteatoma with Otoendoscopic Surgery: Case Report. J Med Sci 2010;30(2): 803-7.

Levine WC, Pope V, Bhoomkar A, Tambe P, Lewis JS, Zaidi AA, et al. Increase in endocervical CD4 lymphocytes among women with nonulcerative sexually transmitted diseases. J Infect Dis. 1998;177(1):167–174.

Chapter in Edited Book: Hornbeck P. Assay for antibody production. In: Colign JE. Kruisbeek AM, Marguiles DH, editors. Current Protocols in Immunology. New York: Greene Publishing Associates; 1991. p. 105-32.

Book with a Single Author: Fleiss JL. Statistical Methods for Rates and Proportions. Second Edition. New York: John Wiley and Sons; 1981. p. 105-32.

Editor(s) as Author: Balows A. Mousier WJ, Herramaflfl KL, editors. Manual of Clinical Microbiology. Fifth Edition. Washington DC: IRL Press. 1990. p. 105-32.

Conference Paper: Entrala E, Mascaro C. New structural findings in Cryptosporidium parvum oocysts. Eighth International Congress of Parasitology (ICOPA VIII); October 10-14; Izmir-Turkey: 1994. p. 1250-75

Thesis: Erakinci G. Searching for antibodies against parasites in donors. Izmir: Ege University Health Sciences Institute. 1997.

Article in Electronic Format: Morse SS. Factors in the emergence of infectious diseases. Emerg Infect Dis (serial online) l995 Jan-Mar (cited 1996 June 5): 1(1): (24 screens). Available from: URL: http:/ www.cdc.gov/ncidodlElD/cid.htm.

ILLUSTRATIONS AND TABLES

Illustrations:

The illustrations should be numbered in Arabic numerals according to the sequence of appearance in the text, where they are referred to as Figure. 1, Figure. 2, etc.

If illustrations (or other small parts) of articles or books already published elsewhere are used in papers submitted to MBSJHS, the written permission of the authors and publisher concerned must be included with the manuscript. The original source must be indicated in the legend of the illustration in these cases.

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. To prevent delays in the evaluation process, all submitted figures should be clear in resolution and large in size (minimum dimensions: 100 × 100 mm).

Tables: Tables should be so constructed together with their captions and legends.

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. Tables of numerical data should each be typed (with one-spacing) and numbered in sequence in Arabic numerals (Table 1, 2, etc.). They are referred to in the text as Table 1, Table 2, etc. The title of each table should appear above it. A detailed description of its contents and footnotes should be given below the body of the table.

Revisions: Authors should mark the changes they made on the main text in color while submitting their article revision files. The responses to the referees should be specified in a separate Word file. Revised articles should be sent to the journal within one month following the decision letter. If the revised version of the article is not uploaded within the specified time, the revision option may be canceled. If the authors need additional time for revision, they are required to submit their extension requests to the journal before the end of one month.

PROOFS, OFFPRINTS, MISCELLANEOUS

Proofs

Proofs will be sent by e-mail, as a pdf. Only printer's errors may be corrected; no change in, or additions to, the edited manuscript will be allowed at this stage. It should be kept in mind that proofreading is solely the authors' responsibility. A form with queries from the copyeditor may accompany the proofs. Please answer all queries and make any corrections or additions required. Corrections to the proofs must be returned by e-mail within 48 hours after receipt. If the publisher receives no response from the authors after 3 days, it will be assumed that there are no errors to correct and the article will be published.

Page charges

The journal is free and does not require any publication fee from the authors.

The journal is only published online.

The similarity rate of the articles should be done through iThenticate and should be at most 20% excluding the "References" part.

The editorial board has the authority to make necessary revisions in the format of the manuscript (without making any revision in the context) that does not comply with the above-mentioned requirements.

TYPES OF ARTICLES

The studies submitted to the Journal are accepted in Original research, Short papers, Case report, Review articles,

a) Original research: Prospective, retrospective and all kinds of experimental studies

Structure

Title

Abstract should be structured with subheadings (Objective, Methods, Results, and Conclusion) (average 200-400 word)

Key words

Introduction

Methods

Results

Discussion

Conclusion

Acknowledgements

References (most 40)

Whole text should not exceed 4500 words except for resources and English summary.

b) Short papers: Prospective, retrospective and all kinds of experimental studies

Structure

Title

Abstract should be structured with subheadings (Objective, Methods, Results, and Conclusion) (average 200-400 word)

Key Words

Introduction

Methods

Results

Discussion

Conclusion

Acknowledgements

References (most 20)

Whole text should not exceed 2700 words except for resources and English summary.

c) Case Report: They are rarely seen articles which differs in diagnosis and treatment. They should be supported by enough photographs and diagrams.

Structure

Title

Abstract (average 100-300 word)

Key words

Introduction

Case report

Discussion

Conclusion

Acknowledgements

References (most 20)

Whole text should not exceed 2200 words except for resources and English summary.

d) Review articles

Structure

Title

Abstract (average 200-400 word)

Key words

Introduction

The compilation text also including appropriate sub-headings,

Conclusion

Acknowledgements

References (most 50)

Whole text should not exceed 6550 words except for resources and English summary.

NOVEMBER 2022 **VOLUME 8** **ISSUE 4**

CONTENTS

Editorial Sayfa sayısı

Ülku Karaman.……. ... …… XXIII

Original Articles

1. Derya Yenibertiz, Deniz Güven, Filiz Koç, Enes Gökler, Faruk Bolu, Hakan Buluş. What is the predictive value of the prognostic nutritional index for the severity of COVID 19 hospitalized patients? …… 481-489

2. Öznur Özdemir Gökmen, Nülüfer Erbil, Birsel Demirbağ. Adaptation Of Birth Satisfaction Scale-Revised To Turkish Society……... 490-505

3. Halit Demir, Hamam Hamam, Mesut Aydın, Canan Demir. Determination Of Some Antioxidant Activities (Superoxide Dismutase, Catalase, Reduced Glutathione) And Oxidative Stress Level (Malondialdehyde Acid) İn Cirrhotic Liver Patient ……..... 506-514

4. Mevlüt Keleş, Mustafa Aydın, Lokman İrkilata, Alper Bitkin, Ebubekir Akgüneş, Mustafa Kemal Atilla. Does Transrectal Prostate Biopsy Cause Sexual Dysfunction? Cross-Sectional Evaluation Of 252 Patients …… 515-524

5. Selahattin Aydemir, Önder Akkaş, Esra Gürbüz, Sadeddin Coşkun, Abdurrahman Ekici, Ahmed Galip Halidi, Sevil Alkan Çeviker. Relationship Of Demodex Mites İn İmmunodeficiency, Rocesea, Blepharitis And Some Clinical Findings……... 525-532

6. Alkay Kara, Nurgül Bölükbaş. Determination Of Pain Behaviours On Endotracheal Tube And Oral Care Practice İn Intubated Intensive Care Patients …….. 533-549

7. Nurgül Karakurt, Pınar Sevda Gül. Perceıved Stress And Copıng Strategıes Of Nurses Workıng In The Emergency Servıce Durıng The Covıd-19 Pandemıc ……..... 550-562

8. Mümin Demir, Çağrı Akalın. Comparison Of Primary Closure + Limberg Flap Combination With Primary Closure And Limberg Flap Alone İn The Treatment Of Pilonidal Sinus Disease: A Retrospective Study……..... 563-569

9. Çiğdem Güler, Zerrin Ünal Erzurumlu, Didem Odabaşı, Ebru Uslu Cender, Kerem Erzurumlu. The Effects Of Polymerızatıon In Dıfferent Lıght Power Modes On The Radıopacıty Of Composıte Resıns ……... 570-581

10. Zeynep Küçükakçalı, Onural Özhan. Estimation Of Risk Factors Related To Heart Attack With Xgboost That Machine Learning Model……. 582-591

11. Tamer Tunçkale, Tezcan Çalışkan. Effect Of Sodium Fluorescein Use On Surgical Outcomes And Survival İn Cases With High Graded Glial Tumor: A Retrospective Study……. 592-602

12. Ümit Aygün, Murat Bölükbaşı. Evaluation Of Radiological And Functional Results Of Long Bone Diaphyseal Fractures İn Children Aged 5-15 Years Who Underwent Titanium Elastic Nail …… 603-614

13. Dudu Alptekin, Hamide Şişman, Refiye Akpolat, Derya Gezer, Esma Gökçe, Sevban Arslan. Evaluation Of Chronic Pain Management İn The Elderly Living İn A Nursing Home…. 615-623

14. Feyza Nur Topçu Yenerçağ, Ahmet Tevfik Sünter. Effects Of Air Pollution On Mortality And Morbidity İn Samsun, Turkey ……..……... 624-638

15. Elif Dağlı, Nilüfer Topkara. Sexual Dysfunctıon In Turkısh Women Durıng The Covıd-19 Pandemıc: Anxıety And Related Factors …….……... 639-652

16. Atakan Savrun, Şeyda Tuba Savrun. Elif Dağlı, Nilüfer Topkara. Analysis Of Cases Referred From A Tertiary University Hospital Emergency Service: The Case Of Ordu Province …….... 653-660

EDITORIAL

In the last issue of 2022

We are happy to conclude another year of our magazine with you. It is a pleasure to share with you the articles of different disciplines in this issue. I would like to thank everyone who contributed to the publication of the journal.

Hope to meet you in our first issue of the new year...

PhD, Assoc. Prof. Ülkü KARAMAN

Editor

Middle Black Sea Journal of Health Science / Mid Blac Sea J Health Sci **November 2022; 8(4):481-489**

RESEARCH ARTICLE **DOI:** 10.19127/mbsjohs.1114583

What is the predictive value of the prognostic nutritional index for the severity of COVID 19 hospitalized patients?

Derya Yenibertiz[1], Deniz Güven[2], Filiz Koç[3], Mehmet Enes Gökler[4], Faruk Bolu[5], Hakan Buluş[6]

[1]Department of Pulmonology, Dr. Abdurrahman Yurtaslan Ankara Oncology Training and Research Hospital, University of Health Sciences, Ankara, Turkey
[2]Department of Pediatrics, Ankara Atatürk Sanatoryum Training and Research Hospital, University of Health Sciences, Ankara, Turkey
[3]Department of Infectious Diseases, Ankara Atatürk Sanatoryum Training and Research Hospital, University of Health Sciences, Ankara, Turkey
[4]Department of PublicHealth, University of Yıldırım Beyazıt, Ankara, Turkey
[5]Department of Pulmonology, Yozgat City Hospital, Yozgat, Turkey
[6]Department of, General Surgery, Ankara Atatürk Sanatoryum Training and Research Hospital, University of Health Sciences,Ankara, Turkey

Received: 13 May 2022, Accepted: 11 September2022, Published online: 30 November 2022

Abstract

Objective: Malnutrition is a risk factor for severe coronavirus disease 2019 (COVID-19) and early nutritional risk assessment should be performed consistently and promptly to determine the proper nutritional therapy and lead to a good prognosis. We aimed to investigate the predictive value of the prognostic nutritional index (PNI) in determining the severity of hospitalized COVID-19 patients.

Methods: In this retrospective single-center research, a total of 686 hospitalized adult patients with COVID-19 between April 2020-June 2020 were analyzed. Demographic, clinical, radiological and laboratory data were registered from patient files. Nutritional status was evaluated using the BMI and PNI. Patients were divided into three groups according to PNI values: severe (PNI ≤ 35), moderate (35<PNI<38) and normal (PNI≥38).

Results: The study group's average PNI score was 35.56 ± 4.58.PNI values were found to be normal in 37.3 percent (N: 256) of the patients, moderate in 28.3 percent (N: 194), and severe in 34.4 percent (N: 236). Male patients, those over the age of 65, referred patients, intubated patients, and those who died were at a higher risk of severe PNI. Patients with normal computed tomography scans were found to have a higher incidence in the normal PNI. The length of hospitalization increased in proportion to the severity of PNI. As the severity of the PNI category increased, so did albumin, C reactive protein, D-dimer, ferritin, lactate dehydrogenase, and neutrophil levels. The total protein value decreased, as the severity of the PNI category increased.

Conclusion: PNI can be determined easily and quickly using routine blood tests and it can be useful for early detection of potentially fatal illnesses, giving medical care and improving prognosis.

Key words: COVID 19, malnutrition, Prognostic Nutritional Index, prognosis

Suggested Citation: Yenibertiz D, Güven D, Koc F, Gökler E, Bolu F, Bulus H. What is the predictive value of the prognostic nutritional index for the severity of COVID 19 hospitalized patients? Mid Blac Sea J Health Sci, 2022; 8(4):481-489

Address for correspondence/reprints:
Name And Surname: Derya Yenibertiz
Telephone number: +90 (312) 336 09 09

E-mail: yenibertizderya@gmail.com

INTRODUCTION

Coronavirus disease 2019 (COVID-19) is still the most serious public health problem all over the World, by the end of the 2021, the number of COVID-19 patients reported worldwide was over 273 million, while the number of deaths exceeded 5 million according to the World Health Organization (WHO) (1).

COVID-19's clinic spectrum varies from asymptomatic infection and moderate upper respiratory tract infection to severe pneumonia with life-threatening complications such as acute respiratory failure which can lead to multi-organ dysfunction and death (2-6).

High levels of inflammation are linked to severe malnutrition. COVID-19 patients with severe or life-threatening disease exhibit extreme systemic inflammation as well as poor nutritional status (7). The majority of COVID 19 fatalities occur in older, multi-morbid patients with severe malnutrition (6). Malnutrition can both enhance the risk and severity of infections by compromising the patient's immune system and treatment effectiveness, as well as develop as a result of infections (8). It is regarded as a risk factor for increased morbidity and mortality (9). Poor nutritional status and immunological dysfunction have been identified as potential risk factors for severe COVID-19 (10).

Malnutrition is a modifiable risk factor and early nutritional risk assessment in COVID-19 patients, as in other infectious diseases, should be done consistently and immediately in order to determine the appropriate nutritional therapy that may promote a stronger immune response and lead to a favorable prognosis (11,12). As a result, a simple and effective index for assessing COVID-19 patients' nutritional status should be developed. There is, however, no known standard tool for nutritional risk screening and nutritional status assessment.

The Prognostic nutritional index (PNI), which was originally developed to predict the risk of postoperative complications following gastrointestinal surgery, is calculated using the serum albumin levels and total lymphocyte counts in peripheral blood (13,14). It is a measurable indicator of immune, inflammatory, and nutritional condition. It has been demonstrated to have prognostic significance in a number of clinical situations such as cancers, infectious diseases, cardiovascular diseases. In COVID-19 patients, PNI also more accurately reflects nutritional and inflammatory status, and a lower score indicates poor nutritional status (15-16).

There are few studies that have investigated the function of PNI in reflecting the inflammatory status and predicting the disease severity in COVID 19 patients (17-20).

The purpose of this study was to investigate the relationship between PNI and COVID-19 severity in hospitalized patients as well as the

predictive usefulness of PNI for the severe form of COVID-19.

METHODS

We performed a single-center, retrospective research on 686 adult patients with COVID-19 hospitalized in a Pandemic Hospital between April 2020-June and 2020 to evaluate the prognostic role of PNI. All patients were diagnosed with COVID-19 based on the criteria of World Health Organization. Patients with missing data and other diagnoses during hospitalization were excluded from the study. Age, gender, symptoms, severity of the disease according to radiological appearance, length of hospital stay, discharge status, body mass index (BMI), polymerase chain reaction (PCR) test results and laboratory parameters of the patients checked at the time of diagnosis (lactate dehydrogenase (LDH), procalcitonin, D-dimer, Ferritin, C reactive protein (CRP), albumin, total protein, neutrophil, lymphocyte, and platelet) were recorded from patient files. Nutritional status was evaluated using the BMI and PNI. BMI was calculated as body weight (kg) divided by the square of the height (m2) (21). PNI scores were calculated as 10 x serum albumin level (g/dL) + 0,005 x absolute lymphocyte count (/mm3). Patients were stratified into the following three groups according to PNI values: severe PNI (PNI ≤ 35), moderate PNI (35<PNI<38), and normal PNI (PNI≥38) (15).

Informed consent was obtained from participants in the study and the ethics committee approval were obtained from the hospital ethics committee (Approval date and number: 24.06.2020/ 2012-KAEK-15/2130).

IBM SPSS v20.0 (IBM Corp., Armonk, NY, USA) was used for the data analysis. The demographic characteristics of the study group were reported using descriptive statistics (frequencies, proportions, means, medians) and dispersion measures (standard deviation, min-max, 25-75% quartile range). Initially, the normality of the total scores was tested using the Kolmogorov-Smirnov normality test and graphs. Therefore, the median scores were compared using Kruskal Wallis (and Bonferroni's ad hoc test), and groups were compared using a Chi-Square test. A significance level of $\alpha = 0.05$ (two-tailed) was applied for all p values.

RESULTS

A total of 686 hospitalized adult patients with COVID-19 were included in the study. The mean age of the research group was 58.27±14.67 (between 18-93) years, and 46.1 percent of the participants were female (N: 316). The study group's average PNI score was 35.56±4.58 points (ranging from 12.01 to 48.01). PNI values were found to be normal in 37.3 percent (N: 256) of the patients, moderate in 28.3 percent (N: 194), and severe in 34.4 percent (N: 236). Male patients, those over the age of 65, referred patients, intubated patients, and those who died were at a higher risk of

severe PNI. Furthermore, patients with normal computed tomography (CT) scans were found to have a higher incidence in the normal PNI category. The distribution of demographic data of the study group according to PNI degrees is presented in Table 1.

The research group's mean BMI was 28.46±3.95 (range 16.72-40.43). It was determined that the average length of stay in the hospital for COVID-19 patients was 8.49±6.80 (range 1-79) days. Patients with normal PNI were found to be overweight and to have a higher BMI than those with severe PNI. The length of hospital stays increased with rising PNI grade. The distribution of the study group's height, weight, BMI, and length of hospitalization according to PNI grades was demonstrated in Table 2.

In our investigation, as the severity of the PNI category increased, so did the levels of albumin, C reactive protein (CRP), D-dimer, ferritin, lactate dehydrogenase (LDH), and neutrophil rose. The total protein value decreased, as the severity of the PNI category increased. The distribution of various laboratory results based on the research group's PNI degrees is presented in Table 3.

Table 1. The distribution of the research group's demographic characteristics based on PNI degrees

		PNI normal		PNI moderate		PNI severe		p
		n	%	n	%	n	%	
Gender	Male	119	50.4	95	49.0	156	60.9	**0.017**
	Female	117	49.6	99	51.0	100	39.1	
Age	<65 years	193	81.8	140	72.2	118	46.1	**<0.001**
	>65 years	43	18.2	54	27.8	138	53.9	
Status of death	No	236	100.0	194	100.0	241	94.1	**<0.001**
	Yes	0	0.0	0	0.0	15	5.9	
Status of intubation	No	234	99.2	192	99.0	236	92.2	**<0.001**
	Yes	2	0.8	2	1.0	20	7.8	
Status of dispatch	No	234	99.2	193	99.5	242	94.5	**0.001**
	Yes	2	0.8	1	0.5	14	5.5	
CT involvement	No	55	23.3	22	11.3	25	9.8	**<0.001**
	Mild	83	35.2	60	30.9	74	28.9	
	Moderate	79	33.5	81	41.8	111	43.4	
	Severe	19	8.1	31	16.0	46	18.0	

DISCUSSION

The prognostic nutritional index has been identified as a tool for risk stratification in a variety of disorders (7-10). In this study, the role of the PNI in predicting the severity of COVID-19 was researched. Some COVID-19 individuals have minor symptoms in the early stages of the disease that worsen over time. Such COVID-19 cases have a dismal prognosis and a high fatality severity and enable therapy in the have been described in the literature in order to

Table2. The distribution of the study group's height, weight, BMI, and number of hospitalized days according to PNI degrees

	PNI normal			PNI moderate			PNI severe			P[1-2] P[1-3] P[2-3]
	Median	Q_1	Q_3	Median	Q_1	Q_3	Median	Q_1	Q_3	
Height	165.0	160.0	173.0	165.0	160.0	173.0	168.0	160.0	173.0	0.285 0.285 0.285
Weight	80.0	70.0	90.0	80.0	70.0	86.0	80.0	70.0	85.0	1.000 **0.033** 0.433
Body Mass Index	29.0	25.9	31.9	28.7	25.8	31.2	27.7	25.6	30.7	0.131 **0.006** 1.000
Number of hospitalized days	5.0	5.0	7.0	6.0	5.0	10.0	8.0	5.0	12.0	**<0.001** **<0.001** **0.014**

Q_1:25th percentile, Q_3:75th percentile

Table3. The distribution of various laboratory results based on the research group's PNI levels

	PNI normal[1]			PNI moderate[2]			PNI severe[3]			P[1-2] P[1-3] P[2-3]
	Median	Q_1	Q_3	Median	Q_1	Q_3	Median	Q_1	Q_3	
Albumin,(g/dL)	4.0	3.8	4.1	3.6	3.5	3.7	3.2	3.0	3.3	**<0.001** **<0.001** **<0.001**
CRP(mg/L)*	8.3	3.4	19.0	17.5	7.9	39.2	37.9	13.3	91.5	**<0.001** **<0.001** **<0.001**
D-dimer(mg/L)	370.0	270.0	595.0	480.0	310.0	740.0	720,0	430.0.	1260.0	**<0.001** **<0.001** **0.013**
Ferritin(ng/mL)	186.9	79.4	355.8	293.6	168.4	588.9	401.0	208.0	725.6	**0.025** **<0.001** **<0.001**
LDH*(IU/L)	233.0	207.5	279.0	260.0	224.0	312.0	282.5	231.0	366.0	**0.028** **<0.001** **0.001**
Lymphocytes, x10^3/µL	1.7	1.4	2.2	1.6	1.1	2.1	1.2	0.8	1.6	**0.026** **<0.001** **<0.001**
Neutrophils, x10^3/µL	3.3	2.6	4.6	4.1	2.8	5.6	5.2	3.4	7.5	**0.002** **<0.001** **<0.001**
Platelet, x10^3/µL	243.0	196.0	318.0	300.0	230,0	397.0	274.5	215.0	383.0	0.462 **<0.001** **0.002**
Procalsitonin, (ng/mL)	0	0	0	1	0	0.2	0.1	0.1	0.2	0.086 0.086 0.086
TotalProtein (g/dL)	7.1	6.9	7.5	6.9	6.6	7.1	6.4	6.0	6.7	**<0.001** **<0.001** **<0.001**

Q_1:25th percentile, Q_3:75th percentile
*LDH: Lactat dehydrogenase; CRP: C-Reactive Protein

estimate hospital mortality and illness severity in COVID-19 hospitalized patients (17-21).

In our study, the status of death, intubation early stages of disease. A few studies on PNI,

dispatch, length of hospital stays, and severe CT involvement all increased with increasing PNI grade. Patients with severe COVID-19 have severe systemic inflammation and poor nutritional status (23, 24). Nutritional disorders can cause nosocomial infections that directly increase mortality and morbidity (25). Our findings indicate that a severe PNI predisposes to severe COVID illness.

Patients with severe PNI were found to be male and older age in our study. In previous studies, age and severe COVID-19 were found to be substantially associated and older age was an important prognostic factor of death for COVID-19 patients. Older age may be associated with more comorbidities, resulting in a higher mortality rate (26-29). Data from countries around the world show that women and men have similar numbers of cases, but men have a higher case fatality rate. New data on disease progression and severity suggest that males are 50 percent more likely than women to be hospitalized (30-32).

In our investigation, as the severity of the PNI category increased, the levels of albumin, CRP, D-dimer, ferritin, LDH, PLT and neutrophil rose. The total protein, lymphocyte value decreased, as the severity of the PNI category increased. Previous research found that patients with severe COVID-19 had higher levels of neutrophils, CRP, fibrinogen, D-dimer, ferritin and lower levels of lymphocyte, PLT, albumin (33-38). Serum albumin levels and lymphocyte counts are the primary determinants of PNI. Albumin is a measure of the liver's function, the body's nutritional status, and the body's overall health. Hypoalbuminemia is associated with severe inflammation (39). The hyperinflammatory state associated with the "cytokine storm" has highlighted the possible predictive relevance of hypoalbuminemia and a low albumin level may result in the exudation of intravascular fluid. Both reasons may exacerbate the severity of pulmonary edema in COVID-19. The albumin level in patients with COVID-19 was found to be inversely related to patients who developed acute respiratory distress (ARDS) (40). In most of these patients, there was a correlation between lymphopenia and the severity of the disease. Considering the lymphocyte rates of COVID-19 patients who died, it was found that they were significantly lower than those who survived (33, 41, 42). These findings corroborated our findings, which revealed that PNI was important parameter for prognosis of COVID-19 patients.

CONCLUSION

As a result, PNI represents an immune-nutritional condition as well as chronic inflammation and immunological dysfunction is a major cause of severe COVID-19. PNI can be easily and quickly determined using routine blood tests and it can be useful for early detection of potentially fatal illnesses,

providing medical care and improving prognosis.

Ethics Committee Approval: Ethics committee approval was obtained from the hospital ethics committee (Approval date and number: 24.06.2020/ 2012-KAEK-15/2130
Peer-review: Externally peer-reviewed.
Author Contributions:
Concept: DY, EG; Design: DY, FK; Supervision: DY, HB, FK; Data Collection and/or Processing: DY, EG, FB; Analysis and/or Interpretation: DY, DG, FB; Writing: DY, DG, EG; Critical: DY, DG, EG;Review: D.G, E.G
Conflict of Interest: No conflict of interest was declared by the authors.
Financial Disclosure: The authors declared that this study hasn't received no financial support.

REFERENCES

1. World Health Organisation. Weekly epidemiological update on Coronavirus disease 2019. 21 December 2021.Available from:https://www.who.int/publications/m/item/weekly-epidemiological-update-on-covid-19-21-december-2021
2. Weiss P, Murdoch DR. Clinical course and mortality risk of severe COVID-19. Lancet Lond Engl. 2020;395:1014–1015.
3. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet Lond Engl. 2020; 395:497–506.
4. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. JAMA. 2020;323:1061–9.
5. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China descriptive study. Lancet Lond Engl. 2020;395:507–513.
6. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult in patients with COVID-19 in Wuhan, China: A retrospective cohort study. Lancet 2020;395:1054–1062.
7. Peter K. Katona-Apte J. The interaction between nutrition and infection. Clin Infect Dis. 2008;May15;46(10):1582-1588.
8. Xue G, Gan X, Wu Z, Xie D, Xiong Y, Hua L et al. Novel serological biomarkers for inflammation in predicting disease severity in patients with COVID-19. Int Immunopharmacol.2020;89(Pt A): 107065.
9. Ahn SS, Yoo J, Jung SM, Song JJ, Park YB, Lee SW. Comparison of the Clinical Implications among Five Different Nutritional Indices in Patients with Lupus Nephritis. Nutrients. 2019;11(7):1456.
10. Zabetakis I, Lordan R, Norton C, Tsoupras A. COVID-19: The Inflammation Link and the Role of Nutrition in Potential Mitigation. Nutrients. 2020;19;12(5):1466.
11. Caccialanza R, Laviano A, Lobascio F, Montagna E, Bruno R, Ludovisi Set. al. Early nutritional supplementation in non-critically ill patients hospitalized for the 2019 novel coronavirus disease (COVID-19): Rationale and feasibility of a shared pragmatic protocol. Nutrition. 2020;74: 110835.
12. Azzolino D, Saporiti E, Proietti M, Cesari M. Nutritional Considerations in Frail Older Patients with COVID-19. J Nutr Health Aging. 2020;24(7):696-698.
13. Rashedi S, Keykhaei M, Pazoki M, Ashraf H, Najafi A, Kafan S et.al. Clinical significance of prognostic nutrition index in hospitalized patients with COVID-19: Results from single-center experience with systematic review and meta-analysis. Nutr Clin Pract. 2021;36(5):970-983.
14. Onodera T, Goseki N, Kosaki G. Prognostic nutritional index in gastrointestinal surgery of malnourished cancer patients. Nihon Geka Gakkai Zasshi. 1984;85:1001–1005.
15. Wang R, He M, Yin W, Liao X, Wang B, Jin X et. al. The Prognostic Nutritional Index is associated with mortality of COVID-19 patients in Wuhan, China. J Clin Lab Anal. 2020;34(10):e23566.

16. Hu X, Deng H, Wang Y, Chen L, Gu X, Wang X. Predictive value of the prognostic nutritional index for the severity of coronavirus disease 2019. Nutrition. 2021; 84:111123.
17. Wang ZH, Lin YW, Wei XB, Li F, Liao XL, Yuan HQ et. al. Predictive Value of Prognostic Nutritional Index on COVID-19 Severity. Front Nutr. 2021;14;7:582736.
18. Wei W, Wu X, Jin C, Mu T, Gu G, Min Met. al. Predictive Significance of the Prognostic Nutritional Index (PNI) in Patients with Severe COVID-19. J Immunol Res. 2021; 2021:9917302.
19. Hu X, Deng H, Wang Y, Chen L, Gu X, Wang X. Predictive value of the prognostic nutritional index for the severity of coronavirus disease 2019. Nutrition. 2021; 84:111123.
20. Çınar T, Hayıroğlu Mİ, Çiçek V, Kılıç Ş, Asal S, Yavuz Set. al. Is prognostic nutritional index a predictive marker forestimating all-cause in-hospital mortality in COVID-19 patients with cardiovascular risk factors? Heart Lung. 2021;50(2):307-312.
21. WHO Expert Consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies.Lancet.2004;363(9403):157-163.
22. Arabi YM, Murthy S, Webb S. COVID-19: a novel coronavirus and a novel challenge for criticalcare. Intensive Care Med. 2020;46(5):833-836.
23. Zhao X, Li Y, Ge Y, Shi Y, Lv P, Zhang J et. al. Evaluation of Nutrition Risk and Its Association with Mortality Risk in Severely and Critically Ill COVID-19 Patients. JPEN J Parenter Enteral Nutr. 2021;45(1):32-42.
24. Lidoriki I, Frountzas M, Schizas D. Could nutritional and functional status serve as prognostic factors for COVID-19 in the elderly? Med Hypotheses. 2020;144: 109946.
25. Bresnahan KA, Tanumihardjo SA. Undernutrition, the acute phase response to infection, and its effects on micronutrient status indicators. Adv Nutr. 2014;5(6):702-711.
26. Li X, Xu S, Yu M, Wang K, Tao Y, Zhou Y et. al. Risk factors for severity and mortality in adult COVID-19 inpatients in Wuhan. J Allergy Clin Immunol. 2020;146(1):110-118.
27. O' Driscoll M, Ribeiro Dos Santos G, Wang L, Cummings DAT, Azman AS, Paireau J et al. Age-specific mortality and immunity patterns of SARS-CoV-2. Nature. 2021;590(7844):140-145.
28. Yang W, Kandula S, Huynh M, Greene SK, Van Wye G, Li W et. al. Estimating the infection-fatality risk of SARS-CoV-2 in New York City during the spring 2020 pandemic wave: a model-based analysis. Lancet Infect Dis. 2021;21(2):203-212.
29. Verity R, Okell LC, Dorigatti I, Winskill P, Whittaker C, Imai Net. al. Estimates of the severity of coronavirus disease 2019: a model-based analysis. Lancet Infect Dis. 2020;20(6):669-677.
30. Gebhard C, Regitz-Zagrosek V, Neuhauser HK, Morgan R, Klein SL. Impact of sex and gender on COVID-19 outcomes in Europe. Biol Sex Differ. 2020;11(1):29.
31. Grasselli G, Zangrillo A, Zanella A, Antonelli M, Cabrini L, Castelli A et. al. COVID-19 Lombardy ICU Network. Baseline Characteristics and Outcomes of 1591 Patients Infected With SARS-CoV-2 Admitted to ICUs of the Lombardy Region, Italy. JAMA. 2020;323(16):1574-1581.
32. Xue G, Gan X, Wu Z, Xie D, Xiong Y, Hua L et. al. Novel serological biomarkers for inflammation in predicting disease severity in patients with COVID-19. Int Immunopharmacol. 2020;89(PtA):107065.
33. Liu Y, Yang Y, Zhang C, Huang F, Wang F, Yuan Jet. al. Clinical and biochemical indexes from 2019-nCoV infected patients linked to viral loads and lung injury. Sci China Life Sci. 2020;63(3):364-374.
34. Yang AP, Liu JP, Tao WQ, Li HM. The diagnostic and predictive role of NLR, d-NLR, and PLR in COVID-19 patients. Int Immunopharmacol. 2020;84:106504.
35. Liu S, Luo H, Wang Y, Cuevas LE, Wang D, Ju Set. al. Clinical characteristics and risk factors of patients with severe COVID-

19 in Jiang suprovince, China: a retrospective multicentre cohort study. BMC Infect Dis. 2020;20(1):584.
36. Luo Y, Xue Y, Mao L, Yuan X, Lin Q, Tang G et al. Prealbumin as a Predictor of Prognosis in Patients with Coronavirus Disease 2019. Front Med (Lausanne). 2020; 7:374.
37. Mattiuzzi C, Lippi G. Serum prealbumin values predict the severity of coronavirus disease 2019 (COVID-19). J MedVirol. 2021;93(2):620-621.
38. Violi F, Cangemi R, Romiti GF, Ceccarelli G, Oliva A, Alessandri F et. al. Is Albumin Predictor of Mortality in COVID-19? Antioxid Redox Signal. 2021;35(2):139-142.
39. Soeters PB, Wolfe RR, Shenkin A. Hypoalbuminemia: Pathogenesis and Clinical Significance. JPEN J Parenter Enteral Nutr. 2019; 43(2):181-193.
40. Wu C, Chen X, Cai Y, Xia J, Zhou X, Xu Set. al. Risk Factors Associated with Acute Respiratory Distress Syndrome and Death in Patients with Coronavirus Disease 2019 Pneumonia in Wuhan, China. JAMA Intern Med. 2020;180(7):934-943.
41. Miyashita E, Konuma T, Kataoka J, Oiwa-Monna M, Mizusawa M, Isobe M.et al. The Prognostic Impact of Pretransplant Inflammatory and Nutritional Status in Adult Patients after Myeloablative Single Cord Blood Transplantation. Biol Blood Marrow Transplant. 2019;25(5):981-988.
42. Mo P, Xing Y, Xiao Y, Deng L, Zhao Q, Wang Het. al. Clinical Characteristics of Refractory Coronavirus Disease 2019 in Wuhan, China. Clin Infect Dis. 2021; 73(11):e4208-e13.

Middle Black Sea Journal of Health Science / Mid Blac Sea J Health Sci **November 2022; 8(4):490-505**

RESEARCH ARTICLE **DOI:** 10.19127/mbsjohs.1080337

Adaptation of Birth Satisfaction Scale-Revised to Turkish Society

Öznur Özdemir Gökmen[1](ID) , Nülüfer Erbil[2](ID) , Birsel Canan Demirbağ[3](ID)

[1]Vocational School of Health Service, Iğdır University, Iğdır, Turkey
[2]Department of Gynecologic and Obstetrics Nursing, Faculty of Health Sciences, Ordu University, Ordu, Turkey
[3]Department of Public Health Nursing, Faculty of Health Sciences, Karadeniz Technical University, Trabzon, Turkey

Received: 28 February 2022, Accepted: 18 October 2022, Published online: 30 November 2022

Abstract

Objective: The aim of this study was to adapt the Birth Satisfaction Scale-Revised (BSS-R) to Turkish and test its reliability and validity.

Methods: The methodological study was conducted in maternity ward of Iğdır State Hospital between the dates of 15.06.2016-15.09.2016. All of the women in the maternity ward that had given birth formed the population of the study. The study was completed by interviewing 219 volunteer women that are suitable for the criteria before making a sampling choice. Validity and reliability analysis, language and content validity, and explanatory and confirmatory factor analysis were tested by using Cronbach's alpha coefficient.

Results: The language validity of the BSS-R was provided by the translation-retranslation method, later its content validity was provided by making necessary changes in the direction of opinions of specialists. The scale in its final form was applied to women in the sample group after making pre-application. The factor analysis of scale was evaluated by explanatory and confirmatory factor analysis. It was obtained that factor load distribution of scale changes between 0.593-0.899 and keeps the three-dimensional structure it's in original form. Factor load distribution of BSS-R of scale changes between 0.593-0.899 and keeps three-dimensional structure as its original form. Fit index values were found as x2/SD value 2.06, RMSEA 0.070, CFI 0.95, SRMR 0.078, GFI 0.93, AGFI 0.89 and NFI 0.92. The Cronbach's alpha coefficient of the 10-item BSS-R was 0.72, and the Cronbach's alpha coefficients of its sub-dimensions were between 0.70 and 0.78.

Conclusion: It was obtained that BSS-R which was adapted to Turkish is a reliable, valid and suitable measurement instrument means for Turkish culture.

Key words: Birth satisfaction, scale, validity and reliability, nursing.

Suggested Citation: Gökmen Ö Ö, Erbil N, Demirbağ B C. Adaptation of Birth Satisfaction Scale-Revised to Turkish Society.Mid Blac Sea J Health Sci, 2022;8(4):490-505.

Address for correspondence/reprints:
Name and Surname: Öznur Özdemir Gökmen
Telephone number: +90 (476) 223 00 10
E-mail: oznurr.ozdemir@gmail.com

Note: This study was submitted as oral presentation in I. International and II. National Women Health Congress, 22-24 March, 2018, İstanbul, Turkey.

INTRODUCTION

Measurement of patient satisfaction is a beneficial practice for the evaluation of the quality of health services and is recommended to resolve possibilities for dissatisfaction (1). With the measurement of patient satisfaction, patient perceptions, satisfaction levels and factors affecting satisfaction levels may be defined. Thus, changes and regulations can be made to health services offered as a competitive element to preserve patient satisfaction (2).

The birth process has increased sensitivity requiring aid and empathy, involves changes in psychosocial balances and this process is stated to be a crisis period when the mother and family experience intense stress (4). While women find themselves in an unknown environment during birth and encounter situations like the inability to protect their privacy, they may experience fear, worry, and anxiety due to do not sufficiently knowing, understanding, or controlling what they experience or what happens, while simultaneously attempting to deal with the birth process (5).

Satisfaction related to birth is an important marker to evaluate birth experiences. Determination of birth satisfaction is important in terms of showing the well-being status of the newborn and mother, as much as a marker of maternal care quality (3,6,7). Two studies in Sweden found negative birth experiences at rates of 7% (8) and 9.6% (9). Another study found that three years after birth, 16% of women looked back negatively on their birth experiences, with more than 1 in 5 primiparas looking back negatively compared with 1 in 9 multiparas (10). A study in Turkey stated there were good levels of satisfaction related to birth among participants, with the birth satisfaction of those with vaginal births being higher compared to those with planned or emergency cesarean births (7). It was found that the application of vacuum forceps, medical birth, and experiencing problems related to the baby reduced birth satisfaction. The study stated that those with social security, those who were not employed, and multipara births had higher satisfaction. There is a weak negative correlation between women's satisfaction with birth and pain experienced after birth and a weak positive significant correlation with early mobilization and holding the baby in the expected period (7).

Risk factors affecting the negativity of birth experiences include unexpected medical problems like emergency operative birth, induction, lengthened labor, and transfer of the newborn to intensive care; factors related to the woman's social life like unwanted pregnancy and lack of support from partners; related to women's feelings during birth, pain and lack of control; services provided by care providers like insufficient time for women's questions during antenatal check-ups, deficiency of support during birth and administration of obstetric analgesia (8); and anal sphincter injury

and administration of oxytocin beginning in the first stage of labor (9).

Considering negative birth experiences are thought to be related to the occurrence of postnatal depression in women and even posttraumatic stress disorder, the importance of ensuring patient satisfaction with birth is clear (11,13). Emotional stress, especially depression, worry, and anxiety, increase pregnancy and birth complications, negatively affect the health of the newborn, and are reported to cause premature birth, low birth weight and intrauterine growth retardation.

The duty of nurses and midwives during labor and birth is not just to ensure a safe birth but also to create a positive and satisfactory birth experience (14). Professional support provided during labor may develop women's ability to control feelings and cope with birth pain and prevent negative experiences (5). A study stated that interviews with assisting midwives before birth and sustaining treatment by noting the needs of the mother and partner, encouragement, and competency reduced the risk of negative birth experiences (8). The same study stated that satisfaction related to information about the birth and labor process, allowing women to participate in decisions made during birth and supportive midwives and doctors reduced the risk of having a negative experience (8). Another study found women cared for by midwives had a significantly higher degree of control and birth satisfaction compared to women cared for by obstetric specialists while the incidence of cesarean birth did not affect both measures (15).

Maternal/perinatal death, birth trauma and cesarean rates, accepted as traditional quality markers for birth services, have begun to be reviewed in recent years. The rapid reduction in mortality and morbidity rates and developing technology have reduced the importance of these traditional markers and revealed the need for multidimensional constructs suitable for quality evaluation in varying conditions. As a result, evaluation of satisfaction of women in relation to experiences of birth and postnatal period and satisfaction with care received are important markers for the presentation of quality services (16,17).

It has become easier to use concepts/models and scales to obtain objective data for the measurement of patient satisfaction. The BSS-R form is a scale that can be applied in a time period where the woman can clearly remember her experiences in the postpartum 10-day period and to determine the whole process and influencing factors with evaluation questions that include components for satisfaction. In Turkey, there are limited numbers of valid and reliable scale tools measuring birth satisfaction. The aim of this methodological research is to adapt the "Birth Satisfaction Scale-Revised (BSS-R)" form developed by Hollins Martin and Martin (18) to Turkish culture and perform validity and reliability studies.

Research Question:

Is the BSS-R an appropriate, valid, and reliable scale tool for Turkish culture?

METHOD

Design and Setting

This methodological type of study was completed in the postnatal unit of Iğdır State Hospital, in Turkey. The rooms in the birth and postnatal units where data for the research were collected are two-person rooms. The hospital employs five Gynecology and Obstetrics specialist doctors, and one specialist doctor is on duty every night. A total of 13 midwives and nurses provide services in the birth unit. Each night two midwives and one neonatal nurse are on duty. Women stabilized after birth are transferred to the postnatal care unit and observed for at least 24 hours. The first communication between the newborn, with an initial evaluation by the neonatal nurse after birth, and the mother occurs after the mother is transferred to the postnatal care unit. In this process, the mother is given breastfeeding training by the neonatal nurse and the baby feeds for the first time. As there are insufficient numbers of personnel for a total of two midwives and one neonatal nurse at night and four midwives to serve the birth unit during the day, they work from a work center.

Participants

Adaptation of a scale to a different culture requires accessing a sample with a size at least 5-10 times the number of scale items (19). The number of scale items for adaptation in this study was 10. As a result, we aimed to reach 20 times this number with 200 individuals. Sampling in this research included a total of 219 women in the postnatal period due to the possibility of excessive and missing values.

Inclusion criteria: Inclusion criteria for the study were age older than 18 years, literacy, volunteering to participate in the research, risk-free pregnancy, spontaneous vaginal birth, term birth, and being less than 10 days postpartum.

Exclusion criteria: Exclusion criteria for the study were known mental disease, pregnancy duration of 36 weeks or less, mental disability, communication disability, and mothers with cesarean births.

Procedures

The cross-cultural adaptation process of the BSS-R

For validity and reliability of the BSS-R in Turkey, firstly linguistic validity studies were performed. For linguistic validity of the BSS-R, translation, and reverse translation from English to Turkish were performed by two academics from the Department of Foreign Languages. The translated Turkish items were investigated, and a common form was created. The scale items included on this form were reverse translated by another language expert. For scope validity of the BSS-R Form, after translation processes were completed, interviews were held with 10 professors employed in Gynecology and Obstetrics

Nursing and Midwifery Department in universities in Turkey. These experts investigated the scale in terms of understandability and cultural suitability and reported their opinions by e-mail. To evaluate scope validity results, the Davis technique was used (20,23). Experts evaluated scale items according to four grades used in the Davis Technique. The means of points given to scale items were as follows; 1 point for "item not appropriate", 2 points for "item should be made appropriate", 3 points for "appropriate but requires small changes", and 4 points for "very appropriate". The scope validity index (SVI) was used to evaluate the points given by experts for BSS-R items. According to this assessment, the SVI for all items being larger than 0.80 means the items are sufficient in terms of scope validity (20). After scope validity analysis in this study, the scale was preliminarily applied to 20 women. After this application, it was observed there was no need to make any changes to the items.

Data Collection

Data in the research were collected with the personal information form and the Turkish version of the BSS-R from 15 June 2016 to 15 September 2016. The BSS-R should be applied to women in the first 10 days after vaginal birth, comprises 10 items, and has 3 subdimensions. The subdimensions of the BSS-R are *"Quality of care provision" (*3rd, 5th, 6th, and 10th items), "S*tress experienced during labor" (*1st, 2nd, 7th, 9th items), and "*women's personal attributes*" *(*4th and 8th items). The scale has a 5-point Likert type with points of 0 for disagree, 1 for disagree, 2 for undecided, 3 for agree, and 4 for definitely agree. The lowest points that can be obtained on the scale are 0, with the highest point of 40. The scale contains 6 positive statements, and 4 negative statements, with 4 items given inverse points. The 2nd, 4th, 7th, and 8th items are given inverse points. As points obtained from the scale increase, the woman's satisfaction with birth is interpreted to increase (18). In this study, the scale had Cronbach alpha reliability coefficients of 0.72 for the total BSS-R, 0.78 for the "*Quality of care provision"* dimension, 0.71 for the "S*tress experienced during labor"* dimension, and 0.70 for the "*woman's personal attributes*" dimension.

Ethical Considerations

Before beginning the research with the aim of adapting the BSS-R to Turkish culture and measuring its suitability for use in Turkey, written permission was obtained by e-mail from the author who developed the scale and performed validity and reliability studies for the original form of the scale. In order to perform the research, written permission was obtained from the organization linked to the hospital where the research was to be performed and ethics committee permission was obtained for implementation of the research from Ordu University Clinical Research Ethics Committee (26.01.2017/87). Women accepting

participation in the research were informed about the research and provided informed written consent. The consent form provided information that participation in the research was based on volunteerism, that they were free to leave at any time, and that responses given would be confidential.

Analysis of Data

Before evaluating the factorial structure of the BSS-R, the Shapiro-Wilk test was used to assess the univariate normality of each item (24). The Shapiro-Wilk test showed the BSS-R had normal distribution ($p>0.05$). The fitness of the sample size and data set for factor analysis was evaluated with the Kaiser-Mayer-Olkin (KMO) Index and the Bartlett test. Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were used to evaluate the construct validity of the BSS-R. In the research, principal component analysis, varimax vertical transformation and Scree plot test were used for EFA. For CFA, Root Mean Square Error of Approximation (RMSEA), Standardized Root-mean-Square Residual (SRMR), Comparative Fit Index (CFI), Non-Normed Fit Index (NNFI), Goodness of Fit Index (GFI), and Adjusted Goodness of Fit Index (AGFI) fit indices were used (25). In CFA, structural equation modeling (SEM) was assessed with the x^2/SD, RMSEA, CFI, SRMR, GFI, AGFI, and NFI. Evaluation of internal consistency used the Cronbach alpha coefficient, item-total point correlation, Spearman-Brown coefficient, and Student t-test to compare upper (27%) and lower (27%) ranges. Data were analyzed with SPSS for Windows 17 and LISREL 8.8 programs.

RESULTS

Participant Characteristics

The mean age of the women included in the study was 25.84 ± 5.77 years (range, 18-43), 30.6% were literate, 94.5% were housewives, 57.5% had nuclear families, 80.8% had social security, and 72.1% had moderate income. The spouses of 29.7% of women were educated at primary level and 64.8% of the spouses were self-employed. When the distribution of birth experiences, applications, and postnatal thoughts of women included in the scope of the research are investigated, 94.1% of women wanted their partner with them while in pain, while 61.6% stated their partner was with them while in pain. Of women, 81.3% stated they experienced fear of birth. Before and during labor, 61.2% of women had episiotomy, 36.1% had enemas, 74.4% had oxytocin and 60.7% had fundal pressure applications. The applications performed with the lowest frequency were anesthesia (4.6%) and vacuum (5.5%). Of women, 74.5% wanted their partner with them, 55.5% wanted someone they knew with them, while 88.6% wanted their next birth to be normal birth, and 92.7% recommended normal birth. The mean duration between admission to the hospital and birth was 12.27±14.85 hours.

Construct Validity of the BSS-R

Before analysis of the principal components of the BSS-R, sample sufficiency of data for factor analysis was investigated with the KMO and Bartlett tests. In this study, the KMO value was determined as 0.72. This value shows it is appropriate for principal component analysis. The Bartlett test was performed to determine the suitability of the data for factor analysis. Later the factor structure of the scale was evaluated with both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). The KMO value was 0.72, while the Bartlett test value was identified as x^2=661.532, p=0.000. These findings show the data are associated with each other and the data set is suitable for factor analysis.

Results of Exploratory Factor Analysis

The three-factor structure of the Birth Satisfaction Scale explains 63.980% of the total variance (see Table 1).

The eigenvalue for the differentiation points in the three-dimensional structure of the Birth Satisfaction Scale was found to be above 1 (see Figure 1).

Exploratory factor analysis for the BSS-R, subdimensions, and factor loads are presented in Table 2. Just as in the original language, when the items on the see BSS-R are investigated in three subdimensions, factor loads appear to vary from 0.593-0.899. With the three-dimensional structure in the original language, the BSS-R appears to preserve this original structure in the Turkish form. At this stage, no items were removed as the factor loads for all items were above 0.30. The results of exploratory factor analysis determined the BSS-R comprised three subdimensions called "Quality of care provision" (3rd, 5th, 6th, and 10th items), "Stress experienced during labor" (1st, 2nd, 7th, and 9th items), and "Women's personal attributes" (4th and 8th items), in accordance with the original.

Results of Confirmatory Factor Analysis

The confirmatory factor analysis results for the BSS-R are presented in Table 3. Many fit indices were used to investigate the model fit of the BSS-R. These were found as x2/SD value 2.06, RMSEA 0.070, CFI 0.95, SRMR 0.078, GFI 0.93, AGFI 0.89, and NFI 0.92. Based on the relevant fit index values, the model was concluded to be suitable in this form. As a result, there were no changes required for the 10-item, three-subdimension Birth Satisfaction Scale Turkish form compared to the original.

The factor structure obtained as a result of confirmatory factor analysis related to the BSS-R items is presented as a PATH diagram (see Figure 2). Factor loads for all items on the BSS-R were determined to vary from 0.43 to 0.88 as a result of confirmatory factor analysis. For all these reasons, there appeared to be no need to remove items from the scale (26).

Results Related to Internal Consistency for Reliability of the BSS-R

The Cronbach alpha, Spearman-Brown coefficient, and item-total point correlation coefficients were evaluated to determine the internal consistency and homogeneity of the BSS-R Turkish version (see Table 4). For the total scale, the Cronbach alpha coefficient was 0.724, the Spearman-Brown coefficient was 0.597 and the item-total point correlations varied from 0.25 to 0.48. For the BSS-R, the Cronbach alpha coefficient for the total scale was 0.724, for the "Stress experienced during labor" subdimension it was 0.713, for the "Quality of care provision" subdimension it was 0.788 and for "Women's personal attributes" subdimension it was 0.703.

Mean points for participants for the full BSS-R Turkish version were 19.37±5.90 with a point range from 4 to 34. According to the range comparison analysis of the upper and lower 27% on the scale, the difference in the range comparison of the upper and lower 27% on the BSS-R Turkish version was statistically significant ($p<0.05$) (see Table 5). This value is further evidence that the scale has the ability to differentiate.

Table 1. Explained total variance of BSS-R with three factors

Item number	Eigenvalues			Square Loads Sum		
	Total	Variance %	Cumulative %	Total	Varyans %	Cumulative %
1	2.941	29.412	29.412	2.575	25.747	25.747
2	2.239	22.391	51.803	2.191	21.909	47.656
3	1.218	12.177	63.980	1.632	16.324	63.980
4	.807	8.071	72.050			
5	.669	6.695	78.745			
6	.604	6.037	84.782			
7	.514	5.137	89.919			
8	.415	4.154	94.073			
9	.378	3.776	97.849			
10	.215	2.151	100.000			

Method: *Principal Components Analysis*

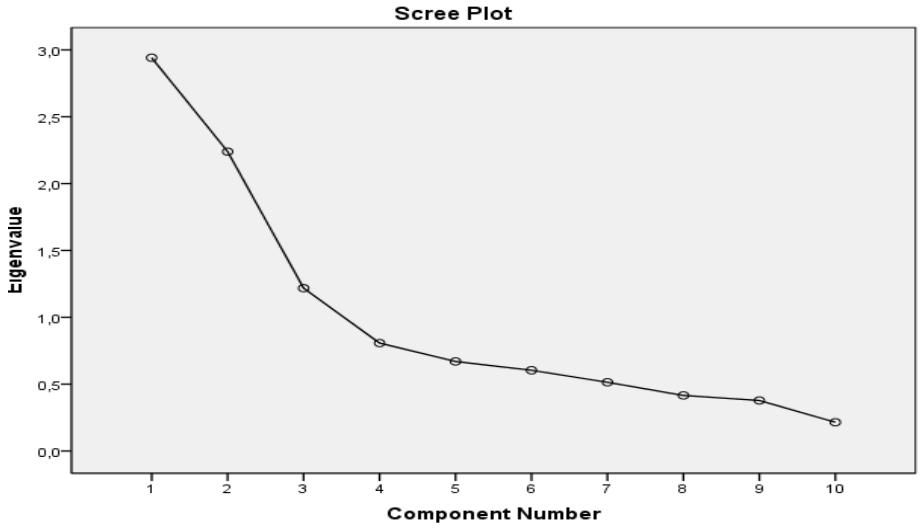

Figure 1. Eigenvalues of factor structure scree plot graph

Table 2. Scale Items and Factor Loads in Three Factor Structure *

Items	BSS-R Items	BSR- Subscales**		
		1	2	3
1.	I came through childbirth virtually unscathed.		0.593	
2.	I thought my labour was excessively long.		0.691	
7.	I found giving birth a distressing experience.		0.808	
9.	I was not distressed at all during labour.		0.787	
3.	The delivery room staff encouraged me to make decisions.	0.712		
5.	I felt well supported by staff during my labour and birth.	0.872		
6.	The staff communicated well with me during labour.	0.899		
10.	The delivery room was clean and hygienic.	0.623		
4.	I felt very anxious during my labour and birth.			0.859
8.	I felt out of control during my birth experience.			0.856

** Varimax rotation method has been applied*
***[1]Quality of care provision subscale; [2]Stress experienced during labour subscale; [3]Women's personel attributes subscale*

Table 3. Confirmatory factor analysis fit indices of the BSS-R Turkish version

Fit indices	Found	Appropriate	Acceptable
x^2/SD	2.06	<2	<5
RMSEA	0.070	<0.05	<0.08
CFI	0.95	>0.95	>0.90
SRMR	0.078	<0.05	<0.08
GFI	0.93	>0.95	>0.90
AGFI	0.89	>0.95	>0.90
NFI	0.92	>0.95	>0.90

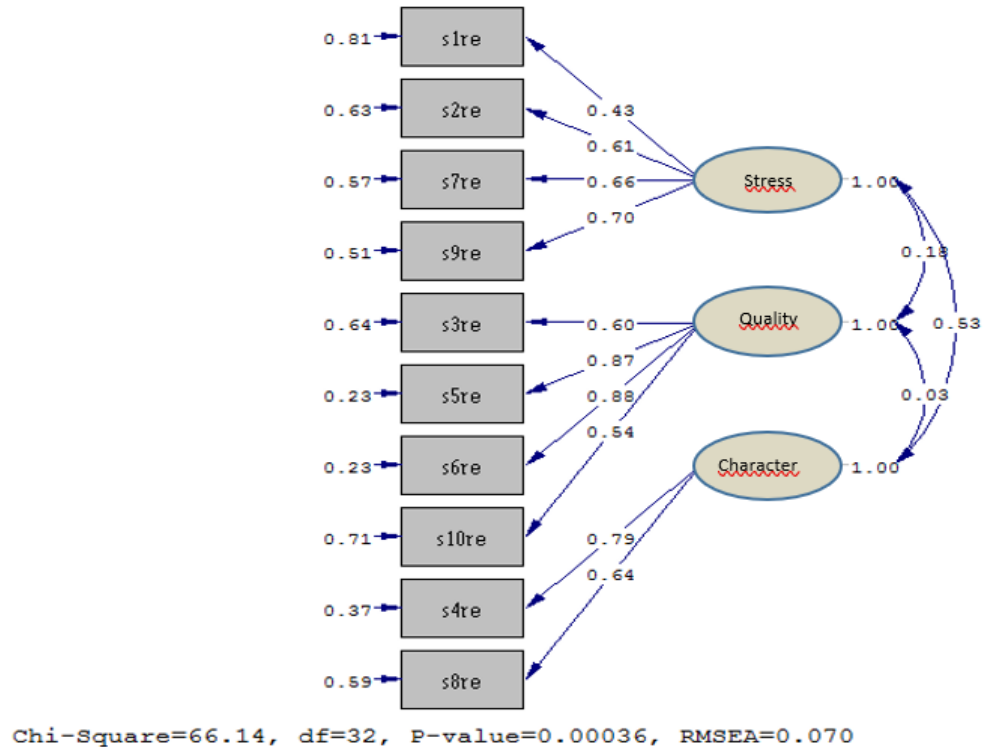

Figure2. Confirmatory factor analysis of the BSS-R Turkish version standardized coefficients and error variances

DISCUSSION

This research was performed with the aim of adapting the BSS-R, with validity and reliability studies by Hollins Martin and Martin (18), to Turkish, performing validity and reliability studies and making it available for Turkish society. This study was needed due to the limited standard scale tools to investigate birth satisfaction in Turkey. In this section, results related to linguistic validity, scope validity, construct validity, internal consistency, and comparison of some variables with mean points on the Birth Satisfaction Scale are discussed for the 10-item, 3-factor Birth Satisfaction Scale.

When performing scale adaptation studies, defined as all systematic studies for the adaptation and use of a certain scale in a different culture and language, it is very important to abide by certain rules for validity and reliability (21, 27). Scale adaptation studies are performed with three main methods including a range of processes. These are, in order, performing linguistic adaptation, performing validity and reliability studies and comparing intercultural traits (21).

Translation from the original language a scale written into another language and used in many cultures is among the methods used in nursing science. To test whether a scale to be adapted to another language and culture is reliable, valid, and appropriate, linguistic adaptation leads to the list of methods applied (20).

Linguistic adaptation studies for the BSS-R were completed using the translation-reverse translation method. In the first stage of the translation-reverse translation method for the linguistic adaptation study, the Birth Satisfaction Scale was translated from English to Turkish by two English language scientists. Translations were investigated and revised by a thesis advisor and the researcher and then a scale form was created. The created scale form was translated into English by two English language scientists who know both languages well (Turkish-English). After the translation-reverse translation processes were performed by independent translators, the preliminary application was performed with 20 women, and opinions were requested to test the understandability of the scale items. Necessary corrections were made in line with recommendations from the preliminary application and the scale was given its final form. According to the results of this study, it is possible to say the Birth Satisfaction Scale Turkish Form is a suitable tool for measurement in terms of linguistic validity.

One of the techniques used to test validity is scope validity and this is a mandatory process to understand the degree to which the planned variable is measured or not by a scale tool (26). Stated differently, scope validity shows whether scale items are qualitatively and

quantitatively sufficient to measure the variable desired for measurement. The most common methods used to test scope validity are the Lawshe technique and the Davis technique. The research entitled adaptation of the BSS-R for Turkish society used the Davis technique. With the Davis technique, expert opinions are given

Table 4. Scale items, mean values, item total correlation and Cronbach alfa values if item deleted of Turkish BSS-R

BSS-R Item Number	n	Mean	Sd	Total item correlations	If the Item Is Deleted Cronbach α
1. I came through childbirth virtually unscathed.	219	2.75	1.23	0.39	0.70
2. I thought my labour was excessively long.	219	1.62	1.40	0.48	0.69
7. I found giving birth a distressing experience.	219	0.78	1.10	0.40	0.70
9. I was not distressed at all during labour.	219	1.08	1.30	0.39	0.70
3. The delivery room staff encouraged me to make decisions.	219	2.65	1.22	0.25	0.72
5. I felt well supported by staff during my labour and birth.	219	2.86	1.08	0.39	0.70
6. The staff communicated well with me during labour.	219	2.87	1.11	0.44	0.70
10. The delivery room was clean and hygienic.	219	2.58	1.23	0.46	0.69
4. I felt very anxious during my labour and birth.	219	0.98	1.23	0.30	0.72
8. I felt out of control during my birth experience.	219	1.67	1.47	0.36	0.71
Spearman Brown Katsayısı	0.597				
BSS-R subscales	**Item Number**				**Cronbach α**
Quality of care provision	3,5,6,10				0.78
Stress experienced during labor	1,2,7,9				0.71
Women's personal attributes	4,8				0.70
BSS-R Total	1,2,3,4,5,6,7,8,9,10				0.72

Table 5. Comparison of analysis of BSS-R scores

BSS-R	**n**	**Mean**	**SD**	**Test and p**
Lower %27	65	11.70	3.00	t=-28.377 p=**0.000**
Upper %27	54	27.27	2.46	

in 4-way grading as, 1: inappropriate, 2: item should be made appropriate, 3: appropriate but requires small changes, and 4: very appropriate.In this technique, the number of experts marking choices 3 and 4 is divided by the total number of experts to obtain the "scope validity index" for the item and the criterion value is accepted as 0.80 (28). The introduction/explanation text on the form presented to experts clearly states what is expected of the expert. It is expected that experts will have 90-100% levels of agreement

about the validity and understandability of each item. Contrary to this, if there are items with 70-80% levels of agreement, they may be retained in the scale after revision according to criticism (29). After completing the translation processes, to test scope validity, the scale was presented to 10 expert academics and they were requested to grade each item on the scale with points from 1 to 4 (1: inappropriate, 2: item should be made appropriate, 3: appropriate but requires small changes and 4: very appropriate). They were also requested to provide opinions about items considered inappropriate in their grading. After scope validity analysis, items numbered 1, 2, 3, 4, 5, 6, 7, 8, and 9 were revised in line with expert opinions. The SVI for the scale items with scope validity analysis performed varied from 0.80 to 1.00.

In the literature, it is stated that the number of experts who should be consulted during scale adaptation studies should be between 3 and 20 (23). In the research, the opinions of 10 expert academics were sought, and the scale adaptation stage was completed. It can be said that the number of expert academics consulted is in parallel with the literature information. Additionally, studies stated that the SVI score should be 0.80 and above. In line with this information, it was concluded that the scope validity of the BSS-R was sufficient. Construct validity is an abstract concept that cannot be directly observed or measured and evaluates the degree to which the scale tool achieves the aim of measuring the behavior or dimension, the abstract concept that is desired to be measured, and how accurately the behavior or dimension is measured. Factor analysis to test construct validity uses methods like comparison of contrasting and/or known groups, testing hypotheses, and multivariate-multimethod matrix approach (19, 20, 30).

Analyses for the construct validity of the BSS-R used factor analysis, or if defined differently, the principal component analysis method. Before performing principal component analysis, the Kaiser-Meyer-Olkin (KMO) and Bartlett tests were applied with the aim of determining whether the sample is sufficient or not, and hence whether the data is suitable for factor analysis or not. If the KMO is above 0.60 and the Bartlett test is significant, it shows the data are suitable for factor analysis (31). The sample population should show the normal distribution for factor analysis. The Bartlett sphericity test is performed to determine whether data have a multivariate normal distribution. Just as with other tests, the significance level of this test is checked. If the significance level is <0.05, it indicates the correlation matrix for items in the scale is suitable for factor analysis (32). In this research, Bartlett was $\chi 2$ =661.53, p=0.000 which is significant. These findings show data have a normal distribution, so the measurement results are not affected by sample size and the

sample has dimensions suitable to perform factor analysis.

In principal component analysis, aiming to obtain reduced variables and meaningful conceptual constructs and the most frequently and commonly used method, factor load values are correlated between items and factors, and it means items measure a concept-construct-factor. If factor load values are 0.45 or higher, it is a good criterion for selection; however, for low numbers of items in practice, this limit value may be reduced to 0.30 (31).

Exploratory factor analysis is based on reducing the variable numbers and the correlation between variables with the aim of revealing new constructs (33). When exploratory factor analysis for the BSS-R is investigated, it appears to have a structure with three subdimensions, just like the original structure. The factor loads for the three subdimensions of the BSS-R vary from 0.593 to 0.899 so no item was removed from the scale (see Table 1).

Additionally, the results of total variance evaluation with the three-factor structure of the BSS-R were 63.980%, showing the item factor loads were sufficient for explained variance analysis (see Table 2).

After exploratory factor analysis, confirmatory factor analysis is performed for scale items to test the significance level between the observed variables and the construct. Factor analysis is among the mandatory applications required for scale adaptation studies (26). Data for the model resulting from confirmatory factor analysis had x2/SD value 2.06, RMSEA 0.070, CFI 0.95, SRMR 0.078, GFI 0.93, AGFI 0.89, and NFI 0.92 (see Table 3). In the literature, it is reported that the RMSEA and SRMR values should be below 0.08, while GFI, AGFI, and CFI values should be greater than 0.90 (34, 36). In this study, confirmatory factor analysis results for the BSS-R show the factor loads vary from 0.43 to 0.88. According to Çapık (26) and Harrington (25), the factor loads should be above 0.30 for confirmatory factor analysis. In light of this information, there was no need to remove items from the BSS-R Turkish version.

In conclusion, the three-factor structure of the 10-item BSS-R was a suitable model and ensured construct validity. For determination of whether all aspects of the measurement ability of a scale are suitable or not in scale adaptation studies, the criterion most researchers use is reliability. The way to understand whether a scale has reliability related to internal consistency or not is possible by proving whether all subdimensions of a scale measure the same features or not. There are four methods commonly used to measure internal consistency. These are the half-test division method, Cronbach alpha reliability coefficient, Kuder-Richardson 20-21 reliability coefficient, and item-total point scale reliability-kappa adaptation coefficient (37).

To be able to determine the internal consistency and homogeneity to test the reliability of the Birth Satisfaction Scale in scale adaptation studies, the Cronbach alpha, Spearman-Brown coefficient, and item-total point correlation coefficients were used. One of the methods recommended for internal consistency analyses for Likert-type scales and used in line with recommendations is the Cronbach alpha reliability coefficient with values between 0 and 1. If the Cronbach alpha reliability coefficient is close to 1, the items forming the scale are compliant and exist within a consistent correlation (21,38). The Cronbach alpha reliability coefficient for the BSS-R scale was 0.724 for the total scale, 0.713 for the "Stress experienced during labor" subdimension, 0.788 for the "Quality of care provision" subdimension, and 0.703 for the "Women's personal attributes" subdimension. When compared with literature information, the Cronbach alpha reliability coefficient having values from 0.60 to 0.80 indicates that it can be used in research and shows the Cronbach alpha reliability coefficient points in the study are sufficient (26,33).

To measure internal consistency, item-total point reliability was used along with the Cronbach alpha reliability coefficient. Item total point reliability or item total point correlations are examined to obtain information about the reliability of each item forming a scale. The variance of each item forming the scale is compared with the total variance and the level of correlation between them is examined. High item total point correlations indicate the items forming the scale is reliable (37). The variation of item total point correlations for the study between 0.25 and 0.48 shows the scale items have a sufficient level of reliability.

Limitations

A convenience sampling method was used for participant recruitment from one hospital in Turkey. The sample of the study included women who had vaginal delivery in the early postpartum period.

CONCLUSIONS

The BSS-R shows a good psychometric quality for Turkish postpartum women. The findings in this study provide evidence that the BSS-R is a valid and reliable scale tool that can be rapidly and easily applied for use as a tool to determine the birth satisfaction of postpartum women in the early period after birth. Given the ease of application, it may be useful to determine BSS-R birth satisfaction and plan interventions. Applying the scale to a different sample group is recommended to check whether the factor structure is preserved or not.

Ethics Committee Approval: Ethics committee approval was received for this study from Ordu University Clinical Research Ethics Committee (2017/87)
Peer-review: Externally peer-reviewed.
Author Contributions: Concept: ÖÖG, NE, BCD; Design: ÖÖG, NE; Literature search:

ÖÖG, NE, BCD; Data Collection and Processing: ÖÖG.; Analysis or Interpretation: ÖÖG, NE, BCD; Writing: ÖÖG, NE, BCD

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

Financial Disclosure: The author declared that this study hasn't received no financial support.

Acknowledgements

The authors would like to thank C. Hollins Martin for developing an instrument and providing the opportunity to adapt it into Turkish culture.

This study was produced from Öznur Özdemir Gökmen's master thesis.

REFERENCES

1- Erbil N, Marangoz YT, Şen A, Kılıç H. Measurement of patient satisfaction and experiences with nursing care in a maternity gynecology hospital. Turkiye Klinikleri J Gynecol Obstet. 2009;19(3):122-30.
2- Polat A. Quality, satisfaction in health institutions and determination of satisfaction levels of inpatients: the case of Tavas state hospital. İstanbul: Beykent University Institute of Social Sciences.2016.
3- Goodman P, Mackey MC, Tavakoli AS. Factors related to childbirth satisfaction. J Adv Nurs.2004;46(2):212-219.
4- Pınar G, Pınar T. Satisfaction of women who gave birth with nurses/midwives on expectations related to empathic. Journal of Medical Research. 2009;7(3):132-140.
5- Karaçam Z, Akyüz EÖ. Supportive Care in Labor and The Rol of Midwife / Nurse Florence Nightingale Nursing Journal.2011;19(1):45-53.
6- Cones Ferrer MB, Canteras Jordana M, Ballesteros Meseguer C, Garcia CC, Roche MEM. Comparative study analysing women's childbirth satisfaction and obstetric outcomes across two different models of maternity care. BMJ Open 2016;26,6(8): e011362.
7- Çıtak Bilgin N, Ak B, Coşkuner Potur D, Ayhan F. Satisfaction with birth and affecting factors in women who gave birth. Arch Health Sci Res. 2018;5(3): 342-52.
8- Waldenström U, Hildingsso I, Rubertsson C, Radestad I. A negative birth experience: Prevalence and risk factors in a national sample. Birth 2004;31(1):17-27.
9- Johansson C and Finnbogadottir H.First-time mothers'satisfaction with their birth experience-a cross-sectional study. Midwifery. 2019;21:79,102540.
10- Rijnders M, Baston H, Schönbeck Y, van der Pal K, Prins M, Green J et al. Perinatal factors related to negative or positive recall of birth experience in women 3 years postpartum in the Netherlands. Birth 2008;35(2):107-116.
11- Ford S, Schofield T, Hope T. What are the ingredients for a successful evidence-based patient choice consultation? A qualitative study. Soc Sci Med. 2003;56:589-602.
12- Rudman A, El-Khouri B, Waldenström U. Women's satisfaction with intrapartum care–a pattern approach. J Adv Nurs. 2007;59:474-487.
13- Sözeri C. Effect of assessment of psychosocial health during pregnancy on determination of postpartum depression. İstanbul: Marmara University Institute of Health Sciences. 2011.
14- Chen CH, Wong SY,Chang MY .Women's perceptions of helpful and unhelpful nursing behaviors during labor: A study in Taiwan. Birth 2001;28(3):180–185.
15- Fair CD, Morrison TE. The relationship between prenatal control, expectations, experienced control, and birth satisfaction among primiparous women. Midwifery 2012;28(1):39-44.
16- Britton JR. Global satisfaction with perinatal hospital care: stability and relationship to anxiety, depression, and stressful medical events. Am J Med Qual. 2006;21(3):200-205.
17- Güngör İ, Beji NK. Development and psychometric testing of the scales for measuring maternal satisfaction in a normal and cesarean birth. Midwifery 2012;28(3):347-357.
18- Hollins Martin CJ, Martin CR. Development and psychometric properties

of the birth satisfaction scale- revised (BSS-R). Midwifery 2014;30:610-619.
19- Şencan H. Reliability and Validity in Social and Behavioral Measurements. Seçkin Publishing, 2005, Ankara.
20- Gözüm S, Aksayan S. A Quide for transcultural adaptation of the scale. Turkish Journal of Research and Development in Nursing. 2002;4(1):9-14.
21- Gözüm S, Aksayan S. A guide for transcultural adaptation of the scale II: psychometric characteristics and cross-cultural comparison. Turkish Journal of Research and Development in Nursing. 2003;5:3–14.
22- Ercan İ, Kan, İ. Reliability and validity in the scales. Journal of Uludag University Faculty of Medicine, 2004;30(3):211-16.
23- Tavşancıl E. Measuring Attitudes and Data Analysis with SPSS. 2010. p. 5-200.
24- Shapiro SS, Wilk MB. An Analysis of Variance Test for Normality (Complete Samples). Biometrika,1965;52;591-611.
25- Harrington D. Confirmatory Factor Analysis, New York, Oxford University Press, 2009. p. 22-30.
26- Çapık C. Use of confirmatory factor analysis in validity and reliability studies. J Nursology. 2014;17(3):196-205.
27- Yurdugül H. Using content validity indexes for content validity in scale development studies. XIV. National Educational Sciences Congress, September 28-30; Denizli- Türkiye: 2005
28- Güneş BN. The Study of Turkish Validity and Reliability of the Braden Q Scale for Predicting Pressure Ulcer Risk in Pediatric Patients. Ankara: Gazi University Institute of Health Sciences.2012.
29- Burns N, Grove SK. The Practice of Nursing Research: Apprasial, Synthesis and Generation of Evidence (6th ed.) 2009. St.Louis, Missouri: Saunders & Elsevier.
30- Büyüköztürk S. Some Statistics Used in the Validity and Reliability of Tests. Data Analysis Handbook for Social Sciences.16. Print, Ankara: Pegem Academy;2017. p. 167-182.
31- Çokluk Ö, Şekercioğlu G, Büyüköztürk Ş. Multivariate Statistics SPSS and LİSREL Applications for Social Sciences. 2014.3. Print, Pegem A Publishing, Ankara.
32- Akgül A. Statistical Analysis Techniques in Medical Research, SPSS Applications. 2005.Emek Ofset, Istanbul.
33- Schumacker RE, Lomax RG. A Beginner's Guide to Structural Equation Modeling. 3 Nd Ed. Taylor & Francis Group, New York, London, 2010.p. 320-332.
34- Waltz CF, Strcikland OL, Lenz ER. Measurement in Nursing and Health Research, 4th Ed. Springer Publishing Company, New York, London, 2010.p. 3-11.
35- Wang J, Wang X. Structural Equation Modeling: Applications Using Mplus: Methods and Applications, 1 nd ed. West Susex, John Wiley & Sons, 2012. p. 391-406.
36- Erdogan S, Nahcivan N, Esin NM. Research in Nursing. Process, Application and Critical. Istanbul Nobel Medicine Bookstores, 2014. p. 221-223.
37- Polit DF, Beck CT. Essentials of Nursing Research: Appraising Evidence for Nursing Practice. (7th Ed.), Wolters Kluwer and Lippincott Williams and Wilkins Philadelphia. 2010.
38- Peters GJY. The alpha and the omega of scale reliability and validity: why and how to abandon Cronbach’s alpha and the route towards more comprehensive assessment of scale quality. European Health Psychologist 2014;16(2):56–69.

Middle Black Sea Journal of Health Science / Mid Blac Sea J Health Sci

November 2022; 8(4): 506-514

RESEARCH ARTICLE

DOI: 10.19127/mbsjohs.1108726

Determination of some Antioxidant Activities (Superoxide Dismutase, Catalase, Reduced Glutathione) and Oxidative Stress Level (Malondialdehyde Acid) in Cirrhotic Liver Patients

Hamam Hamam[1](ID), Halit Demir[1](ID), Mesut Aydın[2](ID), Canan Demir[3](ID)

[1]Department of Chemistry, Faculty of Science Van Yuzuncu Yil University Van,Turkey
[2]Department of Gastroenterology, Faculty of Medicine, Van Yuzuncu Yil University Van,Turkey
[3]Vocational School of Health Services, Van Yuzuncu Yil University Van,Turkey

Received: 25 April June 2022, Accepted: 05 September 2022, Published online: 30 November 2022

Abstract

Objective: The aim of this study was to determine the levels of malondialdehyde (MDA) and antioxidants such as reduced glutathione (GSH), catalase (CAT), and superoxide dismutase (SOD) in the blood serum of liver cirrhosis patients.

Methods: İn This investigation, we took blood from 31 healthy individuals, and 30 patients with Cirrhosis in both males and females. In this study, serum MDA levels, SOD, GSH, and CAT activities were measured spectrophotometrically. In paired group comparisons in terms of continuous variables; the T-test was utilized where normal deviation was achieved, and Mann-Whitney U statistics was utilized where it was not. In addition, ROC curve analysis was performed to evaluate their performance in differentiating the patient group from the control group.

Results: SOD, CAT, and GSH activities were significantly decreased in the patient groups compared to the healthy control group ($p<0.05$). MDA levels were significantly higher in the patient group compared to the healthy control group ($p <0.05$).

Conclusion: In conclusion, in this study, oxidative stress may play an important role in the development of liver cirrhosis. This study is the first one to show the relationships of MDA, SOD, CAT, and GSH in liver cirrhosis. Further studies are essential to investigate antioxidant enzymes and oxidative stress status in liver cirrhosis.

Keywords: Liver Cirrhosis, SOD, GSH, CAT, MDA

Suggested Citation: Hamam H, Demir H, Aydın M, Demir C. Determination of Some Antioxidant Activities (Superoxide Dismutase, Catalase, Reduced Glutathione) and Oxidative Stress Level (Malondialdehyde) in Cirrhotic Liver Patients. Mid Blac Sea Journal of Health Sci, 2022;8(4):506-514

Address for correspondence/reprints:
Name and Surname: Halit Demir
Telephone number: +90 (532) 661 80 65
E-mail: halitdemir@yyu.edu.tr

INTRODUCTION

A free radical is basically an element with an atom or molecule that has an unpaired electron in its outer orbit. Due to the unpaired electron, it contains, the atom, ion, or molecule of the free radical is very reactive. This free electron is harmful to various biological systems as it is capable of "stealing" an electron off a stable molecule and causing it to become a free radical as well. The tissue may lose some of its functionality (1).

Reactive oxygen species (ROS) occur as a result of normal cellular metabolism. Oxidative stress (OS) is known to play a role in the development of various diseases such as Alzheimer's disease, Parkinson's disease (2), diabetes-induced pathologies, rheumatoid arthritis and motor neuron diseases, and neurodegeneration (3).

Oxidative damage in DNA can cause cancer. Various antioxidant enzymes such as SOD, CAT, GSPx, GR, GST, etc. protect DNA from OS (4).

Cirrhosis is an advanced stage of liver fibrosis that is accompanied by distortion of the hepatic vasculature. It leads to the shunting of the portal and arterial blood supply directly into the hepatic outflow (central veins), compromising the exchange between hepatic sinusoids and the adjacent liver parenchyma, i.e., hepatocytes (5).

Cirrhosis is characterized by vascularized fibrotic septa that link portal tracts with each other and with central veins, leading to hepatocyte islands that are surrounded by fibrotic septa and are devoid of a central vein. The major clinical consequences of cirrhosis are impaired hepatocyte (liver) function, increased intrahepatic resistance (portal hypertension), and the development of hepatocellular carcinoma (HCC). Cirrhosis and its associated vascular distortion are traditionally considered to be irreversible but recent data suggest that cirrhosis regression or even reversal is possible (6,7).

The aim of this study is to measure antioxidants GSH, CAT, and SOD and level OS such as MDA in patients with cirrhosis.

METHODS

Materials

In our investigation, we took blood from 31 healthy individuals, and 30 patients with Cirrhosis in both males and females. From each healthy patient individuals, we took 4 ml of blood from an antecubital venous vein and added 2 ml to the biochemistry tube and the other 2 ml to the serum tube.

Analysis Methods

Sample analysis

The study starts, with brachial vein blood samples (4cc), which were taken from the cases in the patient group (liver cirrhosis) and the control groups. The tubes serum was separated from plasma by centrifugation in "Nuve NF 800 centrifuge" at (5000 rpm) for 5 minutes and obtained serums were conserved (at 20-°C)

until they are processing. Local ethics committee approval was obtained before starting the study. Informed consent forms were obtained from patients and healthy individuals. When adequate numbers of samples were obtained, serum MDA levels and SOD, GSH, and CAT activities were measured spectrophotometrically in the Biochemistry laboratories of the Department of Chemistry, Faculty of Science, Van Yuzuncu Yil University

Determination of SOD activity

SOD activity was determined by using the proposed method of Popov et al. (8). According to this method, xanthine oxidase was used as substrate. Blank and sample tubes were read against bidistilled water at 560 nm. Results were expressed as U/L.

Determination of CAT activity

CAT enzyme activity was determined according to Aebi's method (9). The principle of the test is based on the determination of the H2O2 decay rate at 240 nm. Results were expressed as U/L.

Determination of GSH level

Glutathione level was determined according to the method Beutler et al., 1963 (10). 800 µl of phosphate buffer was added to 200 µl of serum. The first absorbance (OD1) at 412 nm was recorded. 100 µl of Ellman's reagent was added to the same tube, and the 2nd absorbance (OD2) was recorded.

Determination of MDA level

MDA level was determined according to the method reported by Gutteridge (11). The absorbances were read in a UV/Vis spectrophotometer at 532 nm.

Statistical Analysis

Mean and standard deviation was used in descriptive statistics of the data. In paired group comparisons in terms of continuous variables; the T-test was utilized where normal deviation was achieved, and Mann-Whitney U statistics was utilized where it was not. In addition, ROC curve analysis was performed to evaluate their performance in differentiating the patient group from the control group. The statistical significance level was taken as $p<0.05$ in the calculations and SPSS (ver:13) package program was used for the calculations.

RESULTS

The results obtained in the present study were from a total number of 61 subjects out of which 31 were healthy controls and 30 were liver cirrhosis cases. Contains descriptive statistics and comparative results for SOD, MDA, GSH, and CAT in Table 1. When samples were examined, the difference between the patient and control group mean SOD, MDA, GSH, and CAT were statistically significant ($p <0.05$). When Table 1 was examined for SOD, GSH, and CAT levels, the mean of the patient group was lower than the average of the healthy control group (Figure 1, 3, 4). When Table 1

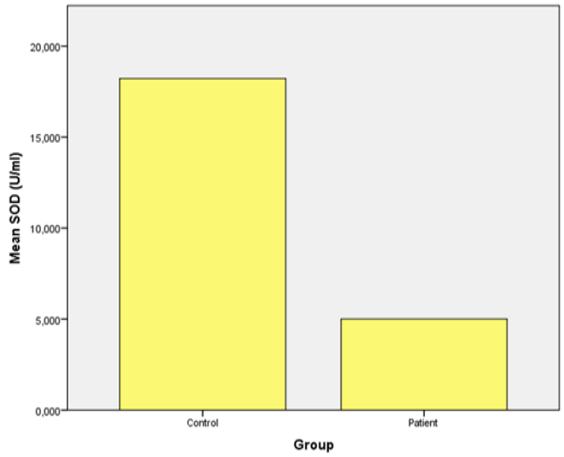

Figure 1. The level of SOD enzyme for control and cirrhosis patient

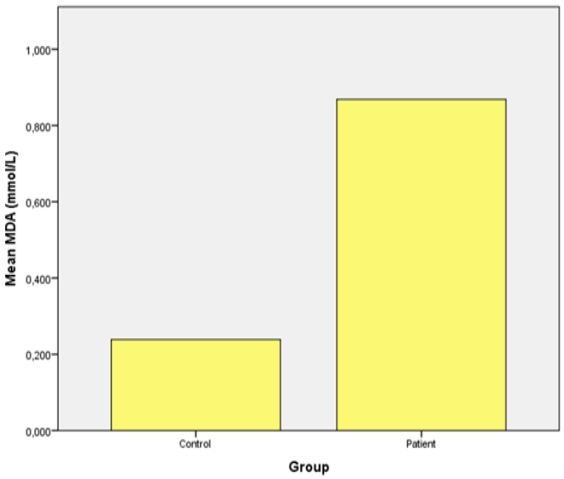

Figure 2. The level of MDA for control and cirrhosis patient

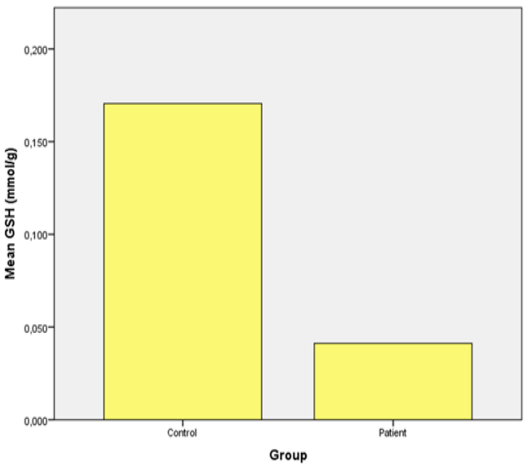

Figure 3. The level of GSH for control and cirrhosis patient

was examined for MDA levels, the mean of the patient group was higher than the average of the healthy control group (Figure 2) ($p<0.05$).

According to the test results made with the ROC curve for MDA in the study; the area under the curve is 1.000±0.001. The cut-off value for MDA was found to be 0.454 (sensitivity 100%, specificity 100%) (Figure 5).

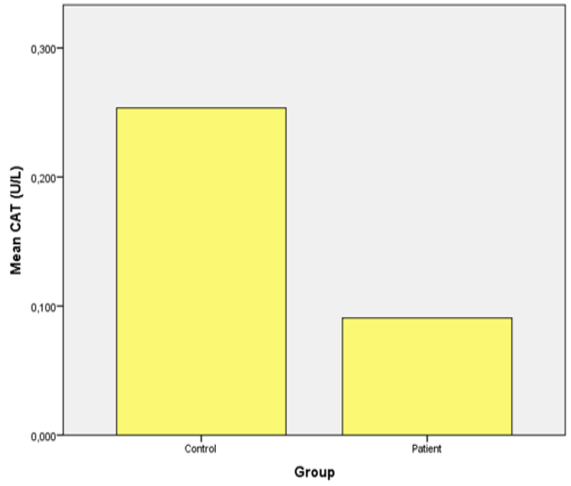

Figure 4. The level of CAT enzyme for control and cirrhosis patient

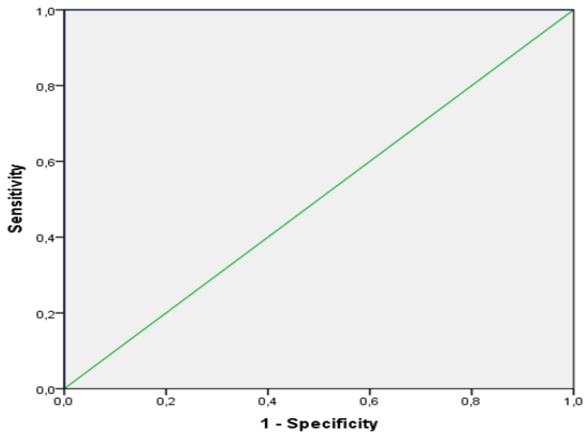

Figure 5. ROC Curve

Table 1. Comparison according to the control group and patients with liver cirrhosis

Group		n	Mean ± Std. deviation	P
SOD **(U/L)**	Control	31	18.213 ± 1.382	0.001
	Patient	30	5.008 ± 1.303	
MDA **(µmo/L)**	Control	31	0.239 ± 0.045	0.001
	Patient	30	0.869 ± 0.256	
GSH **(µmo/L)**	Control	31	0.171 ± 0.017	0.001
	Patient	30	0.041 ± 0.022	
CAT **(U/L)**	Control	31	0.254 ± 0.018	0.001
	Patient	30	0.091 ± 0.009	

Table 2. ROC curve analysis

	Group	cut-off value	area under the curve	St. Error	Sensitivity	Specificity	p
MDA (µmol/L)	Patient-Control	0.45400	1.000	0.001	1.000	1.000	0.001

DISCUSSION

ROS are associated with many diseases; they can also cause potential diseases that can lead to death. These comprise long inflammation and autoimmune illness like rheumatoid arthritis, diabetes mellitus, and cardiovascular diseases such as atherosclerosis, hypertension, and ischemia. As well OS is found to have a significant effect on several kinds of cancer, including renal, lung, liver, and breast cancers (12). Oxygen and nitrogen are the basis of reactive species that cause the oxidation of cells and tissues. The cytochrome p450 enzymes act on the formation of reactive oxygen species in hepatocytes (mitochondria and endoplasmic reticulum), which attack both proteins and lipids hepatocytic in addition to DNA, due to a shortage of antioxidants and imbalance with OS factors (13).

Under the right conditions, maintains a balance between oxidant and antioxidant molecules and domination the level of ROS, it requires preparation of the cells with special molecular strategies. ROS is troubling an imbalance between oxidant agents and antioxidants (13). Oxygen-free radicals have useful functions in the body like phagocytosis, detoxification reactions, the killing of precancerous cells, and apoptosis. Besides, the normal composition of the ROS can control some metabolic cellular functions such as proliferation, migration, immunities, wound curative, and gene expression (14). Lipids, proteins, carbohydrates, and other cell components are exposed to oxidation when increased OS, which causes significant damage to cell structures. The cumulation of damage is called OS (15). Free radicals work to oxidize unsaturated fatty acids on the membranes

catalyzed, this process is called lipid peroxidation. MDA is a marker for OS, and one of the end products of lipid peroxidation (16).

Structural abnormalities, functional disorders, and other disorders (such as proliferative, metabolic, and inflammatory) occur in the liver, as a result of the Redox state which is infecting liver cells. Therefore, in light of the diseases that arise as a result of OS, should be checked for OS in liver disease, it may have a major role in fibrosis, as well as can determine the stages of cirrhosis, monitoring cells damage, and follow the actual results of drug treatments (13).

Antioxidants help to reach advanced stages of treatment, in addition, they have a great ability to protect liver cells from damage caused by free radicals, which causes OS, that in the case of high levels of ROS leads to damage to the cells through necrotic mechanisms. When an imbalance between oxidizing agents and antioxidants occurs, OS will increase, and this plays a role negatively in liver disease and degenerative and chronic disorders (17). Chronic alcoholism is a major cause of cirrhosis. Alcohol causes an increase in free radicals. Alcohol is also known to increase OS in experimental rat models. Enzymatic antioxidants such as CAT and SOD and systems such as non-enzymatic glutathione, vitamins A, C, and E prevent free radicals (18,19,20).

We found through the results obtained an increased level of MDA in serum due to increased severity of fibrosis and in contrast, found a significant reduction in the concentrations of vitamins E and C, which are important indicators of antioxidants. In several studies, compared with healthy controls, were observed a significant decrease in GSH levels in patients with alcoholic liver diseases. However, it is possible that the amount and time of alcohol consumption do not interfere in making a significant difference to the activity of SOD and CAT according to some reports that showed increases or the absence of changes or decreases in it, and this has caused controversy in the scientific community (21,22).

OS is one of the known pathological mechanisms and as mentioned earlier it has negative roles on the liver and is involved from the beginning of the disease until the development of the disease. Also, other factors affecting the liver such as alcohol, drugs, radiation, and pollutants all increase OS, which gradually destroys the liver and causes many diseases such as chronic viral hepatitis, alcoholic liver disease, non-alcoholic steatohepatitis, which can develop to cirrhosis (23,24).

As a conclusion of this study, antioxidants levels like SOD, CAT, and GSH are decreased, and OS is increased (as evidenced by elevated levels of lipid peroxidation like MDA in patients with liver cirrhosis than healthy

controls (P<0.05). In liver cirrhosis patients, oxidants in high concentrations, which cause oxidative, are released by stress-activated macrophages and neutrophils. This can lead to damage to the DNA, proteins, lipids, and carbohydrates. Lipid peroxidation and MDA react with unsaturated fatty acids (released from cell membranes) that cause damage to cells and tissues (25).

The mean level of SOD activity showed a statistically significant decrease in liver cirrhosis cases when compared to the control group (P<0.05). Some studies suggested that lowered SOD activity may be caused by the inhibitory effects of hydrogen peroxide. This would demonstrate that the increased production of hydrogen peroxide during the dismutation reaction influences the process (26).

In this study, the resulting level of CAT activity was statistically and significantly decreased when it is compared to the control group in liver cirrhosis (P<0.05). Significant findings have been found in CAT activity in patients with cirrhosis (27). This decreased CAT activity in the liver cirrhosis group may have occurred due to catalase being inactivated by H2O2. Both of these also show reduced CAT activity in liver cirrhosis patients' serum. The change of H_2O_2 into H2O and O2 may be a cause of reduced catalase. Consequently, it preserves the cells from the harmful effects of accumulated hydrogen peroxide.

In this study, our result level of GSH was statistically and significantly decreased when it is compared to the control group in liver cirrhosis (P<0.05). Glutathione reductase also takes part as a peroxyl scavenging mechanism. GSH is a non-protein sulfhydryl molecule and is considered a very essential antioxidant defense system for body metabolism. The molecule acts as an intra-cellular reluctance in redox reactions by keeping the cellular element protected against potentially damaging ROS.

In conclusion, in this study, antioxidant enzymes such as SOD, CAT, and GSH were decreased and increased lipid peroxidation level such as MDA was increased in patients with cirrhosis. The results show that OS has related to liver cirrhosis and may increase the danger of cirrhosis liver. This study shows that OS affects tissue cellular damage very well in cirrhosis liver patients. While HBV, HCV, and alcohol are the main factors associated with it. ROS are produced in normal metabolism and living cells, also it is considered signaling molecules that mediate the response. DNA, proteins, and lipids are exposed to oxidative damage when the ROS level in the cell increases. Other problems include DNA damage, loss of enzyme activity, and inhibition of protein synthesis that leads to cell death. ROS is a key product in cells and contributes to the regulation of oxidation and reduction and signal transmission pathways. Liver cirrhosis patients may receive support from antioxidant

therapy along with therapeutic drugs and the cessation of drinking alcohol. Combined with catalase and SOD antioxidants helpful effects might be elevated. In this study, serum MDA level was found to be significantly higher in liver cirrhosis than in the healthy control group, and its specificity and sensitivity were found to be 100%. With these findings, it can be said that serum MDA level can be used as a biomarker in liver cirrhosis. This study is the first one to show the relationships of MDA, SOD, CAT and GSH in liver cirrhosis. Further studies are essential to investigate antioxidant enzymes and OS status in liver cirrhosis.

Ethics Committee Approval: Ethics committee approval was received for this study from Van Yuzuncu Yil University Clinical Research Ethics Committee (2018/103)
Peer-review: Externally peer-reviewed.
Author Contributions: Concept: HH, HD, MA, CD; Design: HH, HD, MA, CD; Literature search: HH, HD, MA, CD; Data Collection and Processing: HH, HD, MA, CD; Analysis or Interpretation: HH, HD, MA, CD; Writing: HH, HD, MA, CD.
Conflict of Interest: No conflict of interest was declared by the authors.
Financial Disclosure: The author declared that this study hasn't received any financial support.

REFERENCES

1. Tiwari AK. Antioxidants: new-generation therapeutic base for treatment of polygenic disorders. Curr Sci. 2004; 86:1092.
2. Wood-Kaczmar A, Gandhi S, Wood NW. Understanding the molecular causes of Parkinson's disease. Trends in molecular medicine. 2006;12(11):521-528.
3. Giugliano D, Ceriello A, Paolisso G. Oxidative stress and diabetic vascular complications. Diabetes care. 1996;19(3):257-267.
4. Khan MA, Tania M, Zhang DZ, Chen HC. Antioxidant enzymes and cancer. Chinese Journal of Cancer Research. 2010;22(2): 87-92.
5. Schaffner F, Popper H. Capillarization of hepatic sinusoids in man. Gastroenterology. 1963;44(3):239-242.
6. Wanless IR, Nakashima E, Sherman M. Regression of human cirrhosis: morphologic features and the genesis of incomplete septal cirrhosis. Archives of pathology & laboratory medicine. 2000;124(11):1599-1607.
7. Desmet VJ, Roskams T. Cirrhosis reversal: a duel between dogma and myth. Journal of hepatology. 2004;40(5):860-867.
8. Popov B, Gadjeva V, Valkanov P, Popova S, Tolekova A. Lipid peroxidation, superoxide dismutase and catalase activities in brain tumor tissues. Archives of physiology and biochemistry, 2003;111(5): 455-459.
9. Aebi H. Catalase In: Bergmeyer, H.U., Ed., Methods of Enzymatic Analysis, Verlag Chemie/Academic Press Inc., Weinheim/NewYork, 1974; 673-680.
10. Beutler E, Duron O, Kelly BM. Improved method for the determination of blood glutathione. J. Lab. Clin. Med. 1963;61:882–888.
11. Gutteridge JM. Lipit peroxidation and antioxidants as biomarkers of tissue damage, Clin. Chem 1995;41(12):1819–1828.
12. Salman KA, Ashraf S. Reactive oxygen species: A link between chronic inflammation and cancer. Asia-Pacific Journal of Molecular Biology and Biotechnology. 2013;21(2):42-49.
13. Cichoż-Lach H, Michalak A. Oxidative stress as a crucial factor in liver diseases. World journal of gastroenterology: WJG, 2014;20(25):8082.
14. Salganik RI. The benefits and hazards of antioxidants: controlling apoptosis and other protective mechanisms in cancer patients and the human population. Journal of the American College of Nutrition. 2001;20(sup5):464S-472S.

15. Cerutti PA. Oxy-radicals and cancer. The Lancet. 1994;344(8926):862-863.
16. Moncada S, Higgs A. The L-arginine-nitric oxide pathway. N Engl J Med. 1993;329:2002-12.
17. Li AN, Li S, Zhang YJ, Xu XR, Chen YM, Li HB. Resources and biological activities of natural polyphenols. Nutrients. 2014;6(12):6020-6047.
18. Babczyńska A, Wilczek G, Migula P. Effects of dimethoate on spiders from metal pollution gradient. Science of the total environment. 2006;370(2-3):352-359.
19. Mallikarjuna K, Shanmugam KR, Nishanth K, Wu MC, Hou CW, Kuo CH, Reddy KS. Alcohol-induced deterioration in primary antioxidant and glutathione family enzymes reversed by exercise training in the liver of old rats. Alcohol. 2010;44(6):523-529.
20. Shanmugam KR, Mallikarjuna K, Reddy KS. Effect of alcohol on blood glucose and antioxidant enzymes in the liver and kidney of diabetic rats. Indian journal of pharmacology. 2011;43(3):330.
21. Videla LA, Rodrigo R, Orellana M, Fernandez V, Tapia G, Quinones L, et al. Oxidative stress-related parameters in the liver of non-alcoholic fatty liver disease patients. Clinical science. 2004;106(3):261-268.
22. Das SK, Balakrishnan V, Mukherjee S, Vasudevan DM. Evaluation of blood oxidative stress-related parameters in alcoholic liver disease and non-alcoholic fatty liver disease. Scandinavian journal of clinical and laboratory investigation. 2008;68(4):323-334.
23. Singal AK, Jampana SC, Weinman SA. Antioxidants as therapeutic agents for liver disease. Liver International. 2011;31(10):1432-1448.
24. Li S, Tan HY, Wang N, Zhang ZJ, Lao L, Wong CW, Feng Y. The role of oxidative stress and antioxidants in liver diseases. International journal of molecular sciences. 2015;16(11): 26087-26124.
25. Moncada S, Higgs EA. Endogenous nitric oxide: physiology, pathology, and clinical relevance. European Journal of Clinical Investigation. 1991;21:361-374.
26. Kalpakcioglu B, Senel K. The interrelation of glutathione reductase, catalase, glutathione peroxidase, superoxide dismutase, and glucose-6-phosphate in the pathogenesis of rheumatoid arthritis. Clinical Rheumatology. 2008;27:141-145. doi:10.1007/s10067-007-0746-3.
27. Abrahamovych M, Abrahamovych O, Fayura O, Fayura L, Tolopko S. The effect of oxidative stress on the autonomic nervous system in patients with liver cirrhosis. Georgian Med News. 2020;298:94-99.

Middle Black Sea Journal of Health Science / Mid Blac Sea J Health Sci
November 2022; 8(4): 515-524

RESEARCH ARTICLE **DOI:** 10.19127/mbsjohs.1110819

Does transrectal prostate biopsy cause sexual dysfunction? Cross-sectional evaluation of 252 patients

Mevlüt Keleş[1(ID)], Mustafa Aydın[2(ID)], Lokman Irkılata[2(ID)], Alper Bıtkın[3(ID)], Ebubekir Akgunes[4(ID)], Mustafa Kemal Atılla[2(ID)],

[1]Department of Urology, Faculty of Medicine, Ordu University, Turkey
[2]Department of Urology, Samsun Training and Research Hospital, University Health of Sciences, Samsun, Turkey
[3]Department of Urology, Bakırköy Sadi Konuk Training and Research Hospital, University of Health Sciences, Istanbul, Turkey
[4]Department of Urology, Urfa Metrolife Hospital, Sanlıurfa, Turkey

Received: 29 April June 2022, Accepted: 21 August 2022, Published online: 30 November 2022

Abstract

Objective: In this study, we aimed to evaluate whether there are negative effects of transrectal prostate biopsy (TPB) on sexual functions (SF).

Methods: This study includes 252 male patients evaluated prospectively who underwent TPB in our clinic between January 2015 and September 2016. Patients with chronic diseases (e.g. diabetes mellitus, hypertension) and the use of drugs (e.g. antihypertensive drugs, antidepressants) that can affect SF were excluded. Patients completed the IIEF-15 forms before TPB, in the first, third, and sixth months after TPB. Patients were evaluated in terms of erectile function (EF), orgasmic functions (OF), sexual desire (SD), intercourse satisfaction (IS), and overall sexual satisfaction (OSS).

Results: The relationship between follow-up time and EF, OF, SD, IS and OSS scores were analyzed. A significant difference was observed in EF scores before TPB and in the first month after TPB (p=0,007). However, in subgroup analyses, it was determined that this significant difference was only in the PCa patients. In BPH-diagnosed patients, there was no significant difference between the ED score and the follow-up times. OF, IS, and OOS scores in the 1st, 3rd, and 6th months decreased significantly according to the initial score (p = 0,001). SD scores showed no significant differences among follow-ups (p=0,191).

Conclusion: Erectile dysfunction (ED) is not likely for all patients who undergo TPB. Our study revealed that PCa patients are short-term sufferers of ED after TPB. But, according to our data, it is not clear whether the cause is TPB or anxiety due to PCa diagnosis.

Keywords: Erectile Dysfunction, Prostate, Prostate-Specific Antigen, Biopsy

Suggested Citation: Keles M, Aydin M, Irkilata L, Bitkin A, Akgunes E, Atilla MK. Does transrectal prostate biopsy cause sexual dysfunction? Cross-sectional evaluation of 252 patients. Mid Blac Sea Journal of Health Sci, 2022;8(4):515-524

Address for correspondence/reprints:
Name and Surname: Mevlüt Keleş
Telephone number: +90 (532) 727 92 04
E-mail: mkatilla@hotmail.com

INTRODUCTION

Prostate cancer (PCa) is one of the most important health problems for males. Incidence and mortality rates differ with the race, lifestyle, diet, and geographic features of patients. The main diagnostic tools for PCa are digital rectal examination (DRE), and serum prostate-specific antigen (PSA) levels. Pathological investigation of biopsy material provides a definite diagnosis and verification of the adenoma (1).

Erectile dysfunction (ED) is defined as the inability to maintain a penile erection or maintain adequate penile erection for sexual intercourse for at least six months.

Ejaculation and orgasmic disorders are evaluated in different categories (2).

TPB-related ED was examined in many clinical trials before. But the conclusions of these trials were controversial. According to these trials, TBP-related ED, maybe, based on neurovascular bundle damage during the process and/or negative psychological effects of a possible prostate cancer diagnosis. But we do not clearly document whether TPB causes ED exactly. So, the pathophysiological mechanism could not be documented clearly. In this clinical trial, we aimed to determine if there are negative effects of TPB on sexual functions. And we aimed to document if there is a necessity for treatment in terms of sexual dysfunction after TPB. In the ligt of these aims, we examined and evaluated the long-term effects of TPB on erectile functions in the context of literature.

METHODS

Materials

Patient Population

Study approval for this clinical trial was received from our institution on 11 February 2015 (Session number: 2, decision number: 6). The sample size calculation was performed using G*Power 3.1.9.2 program. It was calculated according to the previous article (5). After considering the alpha level, 0.05, beta error, 0.20, and the effect size, 0.7, the total required sample size was calculated as 121. Then, 252 male patients undergoing transrectal ultrasonography-guided prostate biopsy in our clinic between January 2015 and September 2016 were evaluated in this cross-sectional study. The selection of the study population is summarized in the following diagram (Figure 1).

Written informed consent from all patients who agreed to participate in the study was obtained. Prostate biopsies were performed in each patient with transrectal ultrasonography, and twelve cores of prostate tissue were sampled for pathological investigation. Biopsy decision criteria were determined as abnormal digital finger examination findings and/or PSA levels > 4 ng / mL. All patients' biopsies were performed by the same clinician. Controls were

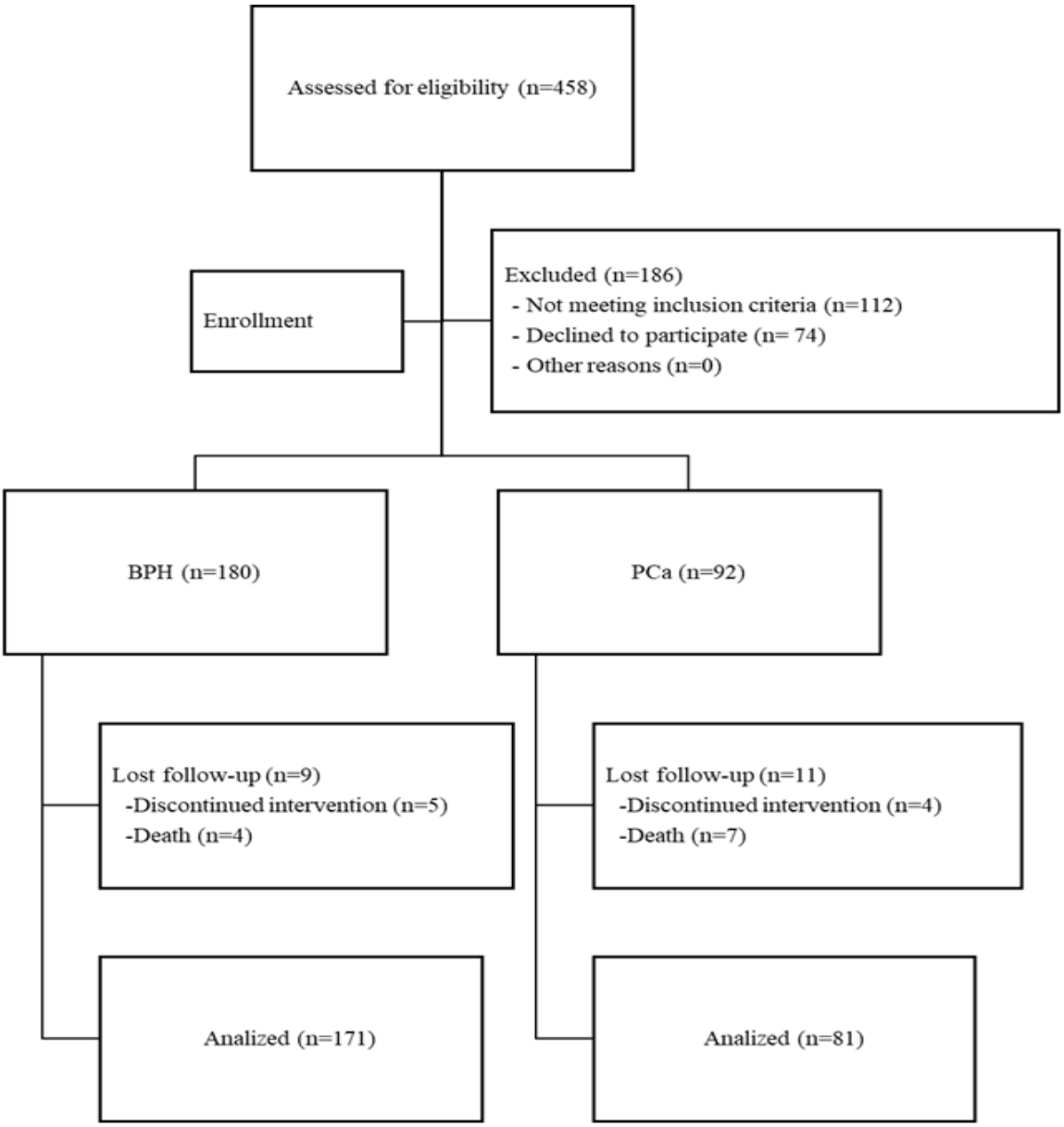

Figure 1. Selection of the study population

made in the urology clinic to assess the ED complaints of the patients and to identify possible ED-related pathologies. A detailed medical and sexual history of all cases was taken and the age of the patients, the presence of a complaint of erectile dysfunction was questioned. All patients with hypertension, diabetes mellitus, presence of malignancy, endocrinologic pathologies which requires hormonotherapy, receiving medical treatment

for psychotic disorders, ED predisposing drug use (e.g., antihypertensive, antidepressant drugs), ED-related surgical trauma, all patients with surgical and/or pelvic trauma history that could be associated with ED were excluded. Also, patients with suspected biopsy results

such as atypical small acinar proliferation (ASAP), low-grade prostatic intraepithelial neoplasia (LGPIN), and high-grade prostatic intraepithelial neoplasia (HGPIN) were excluded. International Erectile Function Index 15 (IIEF-15), consisting of 15 standard questions, was filled out for each of the 252 eligible patients selected for the study. IIEF-15 includes fifteen items referring to EF, OF, SD, IS, and OSS. Questions 1-5 and 15 evaluate EF, with a score range of 0-5 for each question and a maximum score of 30. The ninth and tenth questions evaluate OF, with a score range of 0-5 for each question and a maximum score of 10. The eleventh and twelfth questions evaluate SD with a score range of 1-5 for each question and a maximum score of 10. Questions 6-8 evaluate IS, with a score range of 0-5 for each question and a maximum score of 15. The thirteenth and fourteenth questions evaluate OSS with a score range of 1-5 for each question and a maximum score of 10. Patients were asked 15 questions by their physicians and their answers were recorded.

Biopsy Procedure:

All of the patients were informed by the same clinician doctor about the procedure. And the same clinician performed all of the TPB procedures. Patients were questioned for implants, heart valve disease, anticoagulant / antiaggregant use, allergic diseases, and history of previous allergic reactions. In the presence of active urological infective pathologies, prostate biopsy procedures of patients were delayed after treatment. About 2 hours before the procedure for bowel cleansing, they were told to apply one laxative-purpose sorbitol and glycerin-containing enema to the rectum. Ciprofloxacin 500 mg tablet was given orally 1 day before the procedure and on the morning of the biopsy. Biopsy was performed with an 18-gauge biopsy needle and automatic biopsy gun (GEOTEK Estacore, Daventry, UK) under standard gray-scale ultrasonography and a 7.5 MHz frequency rectal probe (Mindray M5, Shenzen, PRChina). Twelve cores of biopsy specimens from each patient were taken and all the specimens were sent for pathological examination in individually numbered tubes. When the patients came to control with the results of pathology on the 30th day after the biopsy the IIEF-15 form was filled. Then, they were recalled in 3rd and 6th months after the biopsy and the IIEF-15 form was filled again.

Statistical Analysis

The statistical package for the Social Sciences version 22 (SPSS Inc, Chicago, USA) was used for the statistical analysis of the study. The Shapiro-Wilk test was used to assess whether the data were fit to normal distribution. The use of non-parametric tests seemed appropriate as the distribution of data did not fit the normal distribution. Median and interquartile range values were used to represent distribution ranges. The Friedman test was used to assess excess repeat measures, and the Wilcoxon test

was used to evaluate pairwise post hoc comparison. The Mann-Whitney U test was used for the comparison of binary groups. In all statistical analyzes of the study
p <0.05 was considered statistically significant.

RESULTS

The study included 252 men with no risk factors for ED, no chronic disease that could lead to ED, no drug use that could lead to ED, no surgical and/or trauma that could lead to ED. The demographic data of the cases are summarized in Table 1.

When the relationship between the follow-up times of the patients and erectile function scores was examined, the erectile function score at 1st month decreased significantly compared to the baseline score (p = 0.007). There was no significant difference between baseline and 3rd and 6th-month scores. According to biopsy pathology results, patients were divided into 2 groups (BPH and PCa) and the changes in erectile function scores during follow-up were examined (Table 2).

The ED scores of patients who were diagnosed with PCa decreased over time and the difference between the baseline and first-month, third-month, and sixth-month scores were statistically significant (p = 0.0001). In BPH-diagnosed patients, there was no significant difference between the ED score and the follow-up times (Table 2).

When the IIEF subgroups were examined, the orgasmic function scores at the 1st, 3rd, and 6th months decreased significantly according to the initial score (p = 0,001). There was no significant difference between the sexual desire points of the patients (p = 0,191).

It was found that the sexual satisfaction scores of the first month, third month, and sixth month of the cases were significantly lower than the initial score (p = 0.001).

Patients' overall satisfaction scores at 1 month, 3 months, and 6 months were found to be significantly lower than the baseline score (p = 0,045).

Comparisons of IIEF-15 scores according to pathology results of the prostate biopsy were also made in 252 cases evaluated in the study. All IIEF-15 subscale scores other than sexual desire were significantly lower in patients with pathologically proven prostate cancer (PCa) than those with benign prostatic hyperplasia (BPH) (p <0,05) (Table 3).

Table 1. The demographic data of the cases

Features	Median	(Interquartile Range)
Age (years)	63	59 – 67.7
BMI (Body Mass Index) kg/m^2	22	20 – 24
Total PSA (ng/ml)	7.01	4.9 – 10.9
Free PSA (ng/ml)	2.04	1.2 – 3.6
Prostate Volume (ml)	48.15	38.2 – 70
IPSS	14.00	9 – 20.7

Table 2. Change of ED scores during follow-up in BPH, PCa and in all patients

IIEF (International Index of Erectile Function) (ED)	n	Baseline (Interquartile Range)	1th Month (Interquartile Range)	3rd Mont (Interquartile Range)	6th Month (Interquartile Range)	P*
Pca	81 (%32.1)	8 (1-23)[a]	3 (1-19.5)[b]	2 (1-18.5)[b]	1 (1-11.5)[b]	0,0001
BPH	171 (%67.9)	18.0(6-24)	17. (3-24)	18 (6-24)	18 (6-24)	0,0820
Total	252	15.5 (2-24)	13 (1-24)	13.5(1-24)	12 (2-24)	0,0075

*=Friedman test, Groups with different letters are different from each other (Wilcoxon test).

Table 3. Evaluation of the research group according to pathology results

Variables	AdenoCa	BPH	
	Mean (Interquartile Range)	Mean (Interquartile Range)	p
Age (years)	65 (62 – 70.5)	61 (59 – 66)	<0.001
Erectile Function	8 (1 – 23)	18 (6 – 24)	0,014
Orgasmic Function	2 (0 – 8)	6 (2 – 8)	0,003
Sexual Desire	6 (2 – 8)	6 (4 – 8)	0,119
Sexual Satisfaction	4 (0 – 10)	7 (3 – 10)	0,011

DISCUSSION

Prostate cancer (PCa) is one of the most important health problems seen in men. Incidence and mortality rates differ with the race, lifestyle, diet, and geographic features of patients. The main diagnostic tools for PCa are digital rectal examination (DRE), and serum prostate-specific antigen (PSA) levels. Pathological investigation of biopsy material provides a definite diagnosis and verification of the adenoma (1).

Transrectal ultrasound-guided prostate biopsies are thought to lead to erectile dysfunction because of direct damage of the periprostatic neurovascular bundle, nerve damage due to compression of the neurovascular bundle while periprostatic blockade and secondary to compression due to periprostatic neurovascular bundle edema and/or hematomas (3). When we look at studies examining ED marrow with TPB, Zisman et al. (4), it has been reported that TPB may make acute ED in the early post-biopsy period (days 7 - 30) and this condition should be shared with patients before the procedure. Christofos et al. (5) reported that no significant difference was found between IIEF-5 scores before TPB and IIEF-5 scores at 1 month and 3 months after TPB (up to 3 months after biopsy). In the studies of Aktöz et al. (6), the mean IIEF-5 scores in the first month after TPB showed a significant decrease compared to the baseline mean IIEF-5 scores, but when the mean IIEF-5 scores in the third month after TPB were taken into consideration, no significant decrease was determined. In another study, a significant decrease was detected in the IIEF-5 scores in the first week after TPB compared to the before biopsy and it was reported that this significant decrease continued at 4 weeks after TPB and at 12 weeks after TPB (7). Another study reported a decrease in post-TPB IIEF-5 scores and that ED was a short-lived and transient condition,

and that the post-TPB erectile function correction after the biopsy was initiated from the first lunar month and that total healing was achieved in approximately six months (8).

In our study, the relationship between follow-up time and EF, OF, SD, IS and OSS scores were analyzed. A significant difference was observed in EF scores before TPB and in the first month after TPB (p=0,007). However, in subgroup analyses, this significant difference was only determined in the PCa patients. In BPH-diagnosed patients, there was no significant difference between the ED score and the follow-up times. OF, IS, and OOS scores in 1st, 3rd and 6th months decreased significantly according to the initial score (p = 0,001). SD scores showed no significant differences among follow-ups (p=0,191).

In our study, similar to the studies of Linden-Castro et al. (8) and Aktöz et al. (6), a statistically significant decrease in IIEF-15 scores occurred in the early post-TPB period (at 1-month post-TPB). However, the IIEF-15 score decrease in the long term after TPB (3 months after TPB and 6 months) is statistically insignificant. Additionally, IIEF-15 subgroups were also evaluated. 252 patients were evaluated prospectively in terms of orgasmic function, sexual desire level, relationship satisfaction, and overall satisfaction scores during the follow-up period. Statistically significant decreases in orgasmic function scores at 1 month, 3 months, and 6 months after TPB compared to baseline scores were found. There was no statistically significant decrease in sexual desire level scores according to baseline scores at 1 month, 3 months, and 6 months after TPB. Sexual satisfaction of the patients at the 1st, 3rd, and 6th months after TPB and overall satisfaction scores were found to be statistically lower than the baseline scores.

There are many studies in the literature, including our study, that examines the relationship between TPB and ED, and there is no consensus on the relationship between TPB and ED in these studies. In the year 2016, Murray et al. (7), reported different opinions on the relationship between TPB and ED. According to some studies, TPB - related ED development was reported (9, 10). A few studies have also been cited in the article indicating that there is no significant relationship between TPB and ED development (11, 12). Murray et al. (7), reported that a significant decrease in IIEF-5 scores at 1-, 4-, and 12 weeks post-TPB was found in their study.

When studies are evaluated in terms of the relationship between TPB and ED, it is revealed that anxiety is an important factor thought to be an effect on the development of ED after TPB. Since Zisman et al. (3), investigated the relationship between anxiety with TPB and ED for the first time, many other investigators have investigated the relationship between PCa diagnosis and anxiety (13-17). Some of them

found a positive correlation between PCa diagnosis-based anxiety and ED (14). Conversely, some of them didn't (17). In a recent study, Turgut et al. (18), evaluated the sexual function in patients who underwent a transrectal ultrasonography-guided prostate needle biopsy (TRUS-Bx) using 16G and 18G needles. They found no difference in terms of erectile functions.

In our study, no validated forms were used to document procedure-related anxiety.

However, in order to minimize the effect of TPB - related anxiety on erectile function, patients' initial post-biopsy evaluations were made after four weeks with benign pathology results. To determine the effect of PCa diagnosis on ED, the patients with BPH were assessed between themselves, and the patients with PCa were assessed between themselves separately for a six-month follow-up. PCa patients' IIEF -15 scores were significantly lower than the BPH group at baseline and at the six-month follow-up. These results may be related to low initial IIEF-15 scores of PCa patients and/or cancer-related anxiety as mentioned above. Lack of anxiety and or depression assessment via validated questionnaires is an important limitation of our study. Similarly, it is known that some infectious/inflammatory diseases occur in a hidden/silent manner in males, especially at older ages. We didn't perform the MAGI score (Male Accessory Gland Infection /inflammation) score of the patients before undergoing TPB and that's an important limitation for our study, too. Additionally, we didn't evaluate hormone profiles, e.g., total testosterone measurement and free testosterone calculation in our cohort. So, no patient had been excluded for subtle etiologies of ED, e.g., hypogonadism late-onset or testosterone levels in a gray zone. That's an additional limitation of our study.

When all this literature information is taken into account, it is clear that the design of studies dealing with the change in erectile function of patients with TPB can be achieved by establishing patient/case populations excluding all other factors affecting erectile function. It is also evident that, although all factors affecting erectile function are tried to be excluded, it can be stated that TPB procedure-related and pathology-related (BPH / PCa) anxiety can cause ED.

In order to clarify the relationship between TPB and ED, there is a need for comprehensive studies with several homogeneous patient populations, several different erectile function surveys, and patients' health-related quality-of-life assessments.

In conclusion, our study showed that after TPB, erectile function was significantly decreased at 1 month after TPB but not at 3 and 6 months after TPB. Transrectal prostate biopsy, which is the gold standard in the diagnosis of PCa and which is used frequently,

may have various negative effects on sexual functions, especially in the short term. But our data analyses are not sufficient to determine whether ED is related to the TPB procedure or PCa. Therefore, it is not mandatory to inform all patients who will undergo TPB about the biopsy-related ED.

The main points of our study are:

1-Erectile dysfunction (ED) is possible after transrectal prostate biopsy (TPB) but only in PCa patients.

2-We cannot say that patients must be informed about TPB-related ED.

After pathology results, PCa patients can be informed about TPB-related short-term

ED. But it is not clear that ED is related to TPB or anxiety due to PCa diagnosis.

Ethics Committee Approval: Study approval for this clinical trial was received from Samsun Training and Research Hospital Educational Planning Board on 11 February 2015 (Session number: 2, desicion number: 6).
Peer-review: Externally peer-reviewed.
Author Contributions: Concept - MA; Design – MK; Süpervision – MKAT; Data Collection – MK, EA; Analysis and Interpretation – Lİ; Literature search – AB, MK; Writing Manuscript – MK; Critical Review – Mustafa KA, MA.
Conflict of Interest: No conflict of interest was declared by the authors.
Financial Disclosure: The author declared that this study hasn't received any financial support.
Acknowledgement: For his valuable contribution to statistical analysis, Dr. We would like to thank Hasan Durmuş.

REFERENCES

1. Heidenreich A, Bastian PJ, Bellmunt J, Bolla M, Joniau S, van der Kwast T, et al. EAU guidelines on prostate cancer. Part 1: screening, diagnosis, and local treatment with curative intent—update 2013. European urology. 2014;65(1):124-37.
2. NIH Consensus Conference. Impotence. NIH Consensus Development Panel on Impotence. Jama. 1993;270(1):83-90.
3. Zisman A, Leibovici D, Kleinmann J, Siegel Yi, Lindner A. The impact of prostate biopsy on patient well-being: a prospective study of pain, anxiety and erectile dysfunction. The Journal of urology. 2001;165(2):445-54.
4. Zisman A, Leibovici D, Kleinmann J, Cooper A, Siegel Y, Lindner A. The impact of prostate biopsy on patient well-being: a prospective study of voiding impairment. The Journal of urology. 2001;166(6):2242-6.
5. Chrisofos M, Papatsoris A, Dellis A, Varkarakis I, Skolarikos A, Deliveliotis C. Can prostate biopsies affect erectile function? Andrologia. 2006;38(3):79-83.
6. Aktoz T, Kaplan M, Turan U, Memis D, Atakan I, Inci O. 'Multimodal'approach to the management of prostate biopsy pain and effects on sexual function: efficacy of levobupivacaine adjuvant to diclofenac sodium–a prospective randomized trial. Andrologia. 2010;42(1):35-40.
7. Murray KS, Bailey J, Zuk K, Lopez-Corona E, Thrasher JB. A prospective study of erectile function after transrectal ultrasonography-guided prostate biopsy. BJU international. 2015;116(2):190-5.
8. Linden-Castro E, Pelayo-Nieto M, Espinosa-Perezgrovas D, Rubio-Arellano E, Catalán-Quinto G, Guzmán-Hernández F, et al. The impact of transrectal prostate biopsy on erectile function. Actas Urológicas Españolas (English Edition). 2016;40(7):453-6.
9. Klein T, Palisaar RJ, Holz A, Brock M, Noldus J, Hinkel A. The impact of prostate biopsy and periprostatic nerve block on erectile and voiding function: a prospective study. The Journal of urology. 2010;184(4):1447-52.
10. Fujita K, Landis P, McNeil BK, Pavlovich CP. Serial prostate biopsies are associated

with an increased risk of erectile dysfunction in men with prostate cancer on active surveillance. The Journal of urology. 2009;182(6):2664-9.
11. Hilton JF, Blaschko SD, Whitson JM, Cowan JE, Carroll PR. The impact of serial prostate biopsies on sexual function in men on active surveillance for prostate cancer. The Journal of urology. 2012;188(4):1252-9.
12. Braun K, Ahallal Y, Sjoberg DD, Ghoneim T, Esteban MD, Mulhall J, et al. Effect of repeated prostate biopsies on erectile function in men on active surveillance for prostate cancer. The Journal of urology. 2014;191(3):744-9.
13. Dale W, Bilir P, Han M, Meltzer D. The role of anxiety in prostate carcinoma: a structured review of the literature. Cancer: Interdisciplinary International Journal of the American Cancer Society. 2005;104(3):467-78.
14. Macefield R, Metcalfe C, Lane J, Donovan J, Avery K, Blazeby J, et al. Impact of prostate cancer testing: an evaluation of the emotional consequences of a negative biopsy result. British journal of cancer. 2010;102(9):1335-40.
15. Mehnert A, Lehmann C, Graefen M, Huland H, Koch U. Depression, anxiety, posttraumatic stress disorder and health-related quality of life and its association with social support in ambulatory prostate cancer patients. European journal of cancer care. 2010;19(6):736-45.
16. Sharpley CF, Christie DR, Bitsika V. Variability in anxiety and depression over time following diagnosis in patients with prostate cancer. Journal of psychosocial oncology. 2010;28(6):644-65.
17. Brindle LA, Oliver SE, Dedman D, Donovan JL, Neal DE, Hamdy FC, et al. Measuring the psychosocial impact of population-based prostate-specific antigen testing for prostate cancer in the UK. BJU international. 2006;98(4):777-82.
18. Turgut, H., Sarıer, M., Öztorun, K. Yalçın K, Özgür G. Evaluation of Sexual Function According to the Size of the Needle Used in Transrectal-Ultrasonography-Guided Prostate Biopsy. Bull Urooncol, 2021;20(3), 138-141.

Middle Black Sea Journal of Health Science / Mid Blac Sea J Health Sci
November 2022; 8(4):525-532

RESEARCH ARTICLE
DOI: 10.19127/mbsjohs.1126190

Relationship of Demodex Mites in Immunodeficiency, Rocesea, Blepharitis and Some Clinical Findings

Önder Akkaş[1(ID)], Selahattin Aydemir[2(ID)], Esra Gürbüz[3(ID)], Sadeddin Coşkun[4(ID)], Abdurrahman Ekici[2(ID)], Ahmed Galip Halidi[5(ID)], Sevil Alkan[6(ID)]

[1]Department of Medical Microbiology, Erzincan Binali Yıldırım University, Faculty of Medicine, Erzincan, Turkey
[2]Department of Parasitology, Van Yüzüncü Yıl University Faculty of Medicine, Van, Turkey
[3]Department of Infectious Diseases and Clinical Microbiology, Van Training and Research Hospital,Van, Turkey
[4]Department of Dermatology, Van Training and Research Hospital, Van, Turkey
[5]Bulanık Vocational School, Muş Alparslan University, Muş, Turkey
[6]Department of Infectious Disease, Canakkale Onsekiz Mart University, Faculty of Medicine, Çanakkale, Turkey

Received: 06 June 2022, Accepted: 05 Semptember 2022, Published online: 30 November 2022

Abstract

Objective: *Demodex folliculorum* and *Demodex brevis* are two species known to settle on the skin of humans. Demodex mite infections are called demodicosis. Demodicosis, which is usually asymptomatic, is known to cause some skin diseases as a result of an imbalance in immune system mechanisms This study was conducted to investigate the relationship between *Demodex* spp. infestations and clinical signs, such as immunodeficiency, rosacea, blepharitis and facial itching, facial flushing, facial tenderness, facial rash, and sunburn.

Methods: A total of 350 patients, 178 of whom were immunosuppressed and 172 who were immunocompetent, were included in the study. Samples were taken from the nose, chin, and forehead areas, using the standard superficial skin biopsy method and were examined under a microscope.

Results: *Demodex* spp. was detected in 224 of the 350 patients, including 144 (80.90%) of the 178 immunosuppressed patients and 88 (51.16%) of the 172 immunocompetent patients included in the study. The difference between *Demodex* spp. positivity in the immunosuppressed patients and positivity in the immunocompetent patients was statistically significant. In addition, a relationship was found between *Demodex* spp. and some clinical symptoms.

Conclusion: *Demodex* spp. proceed a health problem in rosacea and immunosuppressed patients. It was concluded that *Demodex* spp. should definitely be considered in cases of facial sensitivity, facial rash, and facial flushing in both immunosuppressed and immunocompetent patients, especially in the presence of sunburn in immunosuppressed patients, which was revealed by this study.

Keywords: Rosacea, Blepharitis, Demodex

Suggested Citation: Akkaş O, Aydemir S, Gürbüz E, Coşkun S, Ekici A, Halidi A G, Alkan S. Relationship of Demodex mites in immunodeficiency, rocesea, blepharitis and some clinical findings. Mid Blac Sea J Health Sci, 2022; 8(4):525-532.

Address for correspondence/reprints:
Name and Surname: Selahattin Aydemir
Telephone number: +90 (530) 777 87 08
E-mail: saydmr23@gmail.com

INTRODUCTION

Demodex mites are microscopic arthropods that live on the skin of many mammals as well as humans. Unlike other mites, such as house dust mites, they are obligate parasites, and their host specificity is quite high. *Demodex folliculorum* and *Demodex brevis* are two species known to settle on the skin of humans. *D. folliculorum* lives in the follicular infundibulum, while *D. brevis* generally prefers sebaceous duct and meibomian glands. They feed on follicular and sebaceous epithelial cells and sebum. Demodex mites are known as the normal microfauna of hair follicles and sebaceous glands in the skin, but the mites have been reported to destroy epithelial layers with their penetrating mouthparts and claws, causing a lymphocytic infiltration around infested follicles (1,2).

Increased proliferation of Demodex has been associated with the impaired immune status of the host and/or immune response to the mite (3). It has also been suggested that these mites can both create a suitable environment for mite proliferation by showing immunosuppressive effects on the skin and preparing the ground for secondary infections on the skin (3,4). The link between the presence of the mites and the activation of inflammatory pathways is unclear, as the potential of Demodex mites to influence cellular immune-mediated responses has not been fully defined (4) Despite this uncertainty, demodicosis, which is usually asymptomatic, is known to cause some skin diseases as a result of an imbalance in immune system mechanisms (5).

This study was conducted to an evaluation of Demodex positivity and clinical findings such as rosacea, blepharitis and facial itching, facial flushing, facial tenderness, facial rash, and sunburn among immunocompetent and immunocompromised patient groups

METHODS

Sample Group

The study was approved by SBU Van Training and Research Hospital Clinical Research Ethics Committee (19.01.2022/ 02-05). Patients with skin problems who applied to the SBU Van Training and Research Hospital Dermatology outpatient clinic between September and November 2021 were included in the study. A total of 350 patients, 178 of whom were immunosuppressed and 172 who were immunocompetent, were included in the study.

Obtaining and Examining the Sample Materials

Samples were taken from the nose, chin, and forehead areas, defined as the T-zone, using the standard superficial skin biopsy method. While taking the sample, a drop of cyanoacrylate was dripped onto the cellophane tape and adhered to the patient's skin. After waiting for about 1 min, the cellophane tape was removed from the patient's skin and adhered to a slide. Potassium hydroxide (KOH) was dropped between the

cellophane tape and the slide, and the adult, larva, nymph, and egg forms of the mites were examined under 100 and 200 microscope magnification.

Statistical Analysis

Statistical evaluation of the data was done using SPSS Statistics for Windows. The chi-square test was used in the evaluation of categorical data, and $P < 0.05$ was considered statistically significant.

RESULTS

Demodex spp. was detected in 224 of the 350 patients, including 144 (80.90%) of the 178 immunosuppressed patients and 88 (51.16%) of the 172 immunocompetent patients included in the study. The difference between *Demodex* spp. positivity in the immunosuppressed patients and positivity in the immunocompetent patients was statistically significant. There were no statistically significant differences between the age and gender of the patients and *Demodex* spp. (Table 1).

Relationship between demodicosis and clinical manifestations in the immunosuppressed patients

While a statistically significant relationship was found between rosacea and demodicosis in the immunosuppressed patients, no statistically significant relationship was found between blepharitis and demodicosis (Table 2).

A statistically significant relationship was found between facial redness, facial tenderness, facial rash, and sunburn in the immunosuppressed patients and demodicosis, but no significant relationship was found between facial itching and demodicosis (Table 2, Figure 1).

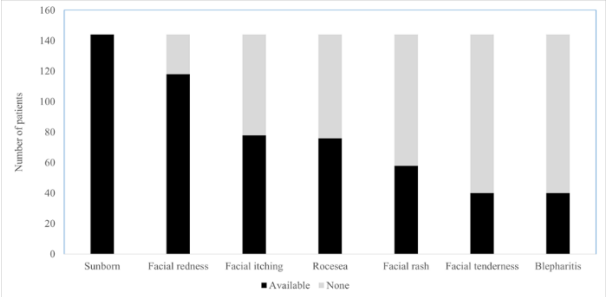

Figure 1. Evaluation of the incidence of *Demodex* spp. and some clinical findings in the immunosuppressed patients

Relationship between demodicosis and clinical manifestations in the immunocompetent patients

In the immunocompetent patients, as in the immunosuppressed patients, a statistically significant relationship was found between rosacea and demodicosis, but no relationship was found between blepharitis and demodicosis (Table 3). A statistically significant relationship was found between facial itching, facial redness, and sunburn, and demodicosis, which were the clinical findings seen in the immunocompetent patients, but no significant relationship was found between facial tenderness and facial rash and demodicosis (Table 3, Figure 2).

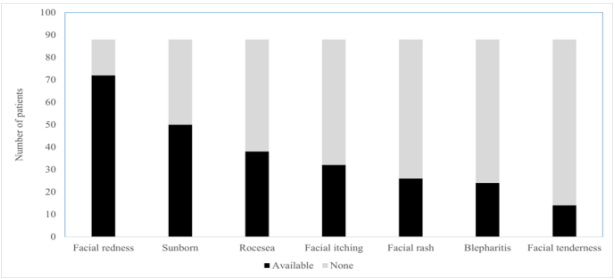

Figure 2. Comparison of the incidence of *Demodex* spp. and some clinical findings in the immunocompetent patients

Table 1. Comparison of the rates of *Demodex* spp. in the different groups.

Group		*Demodex* spp.		*p.*
		Number (n)	Percent (%)	
Research Group	Immunosuppressed (n: 178)	144	80.9	***0.001***
	Immunocompetent (n: 172)	88	51.2	
Age group	0–18 (n: 24)	16	66.7	*0.898*
	19–35 (n: 132)	88	66.7	
	36 and over (n: 194)	128	66	
Gender	Female (n: 273)	182	66.7	*0.127*
	Male (n: 77)	50	64.9	
Total (n: 350)		**232**	**66.3**	

Table 2. Comparison of demodicosis and the clinical signs in immunosuppressed patients.

Clinical Manifestations		*Demodex* spp.		*p.*
		Number (n)	Percent (%)	
Rosacea	Available (n: 78)	76	97.4	***0.001***
	None (n: 100)	68	68	
Blepharitis	Available (n: 47)	40	85.1	*0.392*
	None (n: 131)	104	79.4	
Facial itching	Available (n: 93)	78	83.8	*0.291*
	None (n: 85)	66	77.4	
Facial redness	Available (n: 132)	118	89.4	***0.001***
	None (n: 46)	26	56.5	
Facial tenderness	Available (n: 40)	40	100	***0.001***
	None (n: 138)	104	75.4	
Facial rash	Available (n: 61)	58	95.1	***0.001***
	None (n: 117)	86	73.5	
Sunburn	Available (n: 168)	144	87.3	***0.001***
	None (n: 10)	0	0	

Table 3. Comparison of demodicosis and the clinical signs in immunocompetent patients.

Clinical Manifestations		*Demodex* spp.		*p.*
		Number (n)	Percent (%)	
Rosacea	Available (n: 78)	76	97.4	***0.001***
	None (n: 100)	68	68	
Blepharitis	Available (n: 47)	40	85.1	*0.392*
	None (n: 131)	104	79.4	
Facial itching	Available (n: 93)	78	83.8	*0.291*
	None (n: 85)	66	77.4	
Facial redness	Available (n: 132)	118	89.4	***0.001***
	None (n: 46)	26	56.5	
Facial tenderness	Available (n: 40)	40	100	***0.001***
	None (n: 138)	104	75.4	
Facial rash	Available (n: 61)	58	95.1	***0.001***
	None (n: 117)	86	73.5	
Sunburn	Available (n: 168)	144	87.3	***0.001***
	None (n: 10)	0	0	

DISCUSSION

Demodex mites are organisms of high importance worldwide because they have been shown to be associated with various dermatological conditions in certain conditions and are common in humans (6,7). For this reason, many studies have been conducted on the prevalence of *Demodex* spp. and continue to be performed today. In studies conducted with different patient groups in Turkey, the prevalence of *Demodex* spp. was found to be 26.3%–78%. In some studies, the prevalence of *Demodex* spp. in women (8-11) and in men (12-17) was found to be higher than the opposite sex, but the difference between the sexes was not statistically significant. In this study, *Demodex* spp. was detected in 66.3% of the patients, and there was no statistically significant difference between the incidence of *Demodex* spp. and gender.

In Demodex infestations, symptoms are directly caused by an overpopulation of mites. The Demodex density increases, possibly due to changes in the sebum or immune status (6,7). There is an increase in *Demodex* spp. infestations after immunosuppressive diseases. It has been reported that the frequency of Demodex spp. in patients with hematological malignancies is higher than in control groups18. In this study, the rate of *Demodex* spp. detected in the immunosuppressed patients (80.9%) was higher than in the immunocompetent patients (51.2%). With this result, it was concluded that *Demodex* spp. is still a health problem in immunosuppressed patients and *Demodex* spp. should definitely be considered in this patient group.

Although the etiology of rosacea is not known exactly, it is known that the Demodex mite density is higher in patients with rosacea, and treatment with acaricidal agents is effective in relieving symptoms in these patients (1,19). The relationship between rosacea and Demodex can be explained by two predictions. The first estimation is that rosacea patients have increased blood flow in the papillary dermal vessels, providing a favorable habitat for *Demodex* spp. The second guess is that these mites may mechanically obstruct the follicular opening or vector to microorganisms, contributing to the development of rosacea lesions (19). A meta-analysis of the role of Demodex infestations in rosacea reported that rosacea patients were infested with *Demodex* spp. at a higher rate than the control patients (20). In this study, it was determined that the incidence of *Demodex* spp. was higher in patients with rosacea when compared to the control group, regardless of the immune status of the patients. This result is similar to other studies (1,20,21). It was concluded that *Demodex* spp. is still an important health problem in patients with rosacea.

Although the pathogenicity of Demodex mites is controversial, it has been reported that this parasite has a role in the etiopathogenesis

of many dermatological disorders and may be pathogenic in immunosuppressed patients (22,23). In one study, it was reported that facial erythema, dryness, flaking, and roughness may be a result of *D. folliculorum* proliferation (24). In some studies, it was reported that symptoms such as facial redness, itching, rash, and a burning sensation are associated with *Demodex* spp. Positivity (24-28). In a study examining the relationship between papulopustular rosacea and *Demodex* spp., it was found that the most common clinical symptom in cases with parasites was a burning sensation and rash on the skin (29). In this study, the clinical symptoms in the immunosuppressed patients and clinical symptoms in the immunocompetent patients were evaluated separately. A statistically significant correlation was found between facial flushing and sunburn in both the immunosuppressed patients and the immunocompetent patients and the incidence of *Demodex* spp. In the literature review, no data were found regarding the sunburn sensation of *Demodex* spp. It was determined that all of the patients who were immunosuppressed and found to have *Demodex* spp. had a feeling of burning in the sun. With this study, it was revealed for the first time that *Demodex* spp. caused the feeling of burning in the sun. A statistically significant correlation was found between facial sensitivity and rash symptoms and the incidence of *Demodex* spp. in immunosuppressed patients. All of the patients with immunosuppression and facial sensitivity were found to be *Demodex* spp. positive. In this study, it was concluded that *Demodex* spp. should be considered in the presence of sunburn and facial redness. Another symptom whose relationship with *Demodex* spp. was examined in this study was itching. Many studies have reported that there is a relationship between *Demodex* spp. infestation and itching (24-28). In this study, a significant relationship was found between *Demodex* spp. infestation and itching in the immunocompetent patients, but no such relationship was found in the immunosuppressed patients. According to these results, it can be thought that the feeling of itching is reduced in the case of immunosuppression in these mite infestations, just as pruritus is not observed in immunosuppressed patients in Norwegian scabies (30).

CONCLUSION

Demodex spp. proceed a health problem in rosacea and immunosuppressed patients. It was concluded that *Demodex* spp. should definitely be considered in cases of facial sensitivity, facial rash, and facial flushing in both immunosuppressed and immunocompetent patients, especially in the presence of sunburn in immunosuppressed patients, which was revealed by this study.

Ethics Committee Approval: The study was approved by the SBU Van Training and

Research Hospital Clinical Research Ethics Committee (19/01/2022- 2022/02-05).
Peer-review: Externally peer-reviewed.
Author Contributions:
Concept: ÖA, SA, AE; Design: EG, SC, SA, AE; Literature search: SA, AGH, AE; Data Collection and Processing: EG, SC, ÖA, SA Analysis or Interpretation AE, ÖA, SA; Writing: SA, ÖA, AE
Conflict of Interest: No conflict of interest was declared by the authors.
Financial Disclosure: The authors declared that this study hasn't received any financial support.

REFERENCES

1. Forton F. The pathogenic role of Demodex mites in rosacea: a potential therapeutic target already in erythematotelangiectatic Rosacea?. Dermatol Ther. 2020;10(6):1229-53.
2. Aytekin S, Göktay F. Demodicosis. Turkiye Klinikleri J Dermatol-Special Topics. 2015;8(3):35-41.
3. Gazi U, Ozkan AT, Mumcuoglu KY. Immune mechanisms in human and canine demodicosis: a review. Parasite Immunol. 2019;41(12):e12673.
4. Lacey N, Russell-Hallinan A, Zouboulis CC, Powell F. Demodex mites modulate sebocyte immune reaction: possible role in the pathogenesis of rosacea. Br J Dermatol. 2018;179(2):420-30.
5. Rather PA, Hassan I. Human Demodex mite: the versatile mite of dermatological importance. Indian J Dermatol. 2014;59(1):60.
6. Litwin D, Chen W, Dzika E, Korycińska J. Human permanent ectoparasites; recent advances on biology and clinical significance of Demodex mites: narrative review article. Iran J Parasitol. 2017;12(1),12.
7. Foley R, Kelly P, Gatault S, Powell F. Demodex: a skin resident in man and his best friend. J Eur Acad Dermatol Venereol. 2021;35(1):62-72.
8. Yazisiz H, Çekin Y, Koçlar FG. The presence of Demodex Mites in patients with dermatologic symptoms of the face. Turkiye Parazitol Derg. 2019;43(3):143-8.
9. Aycan ÖM, Otlu GH, Karaman Ü, Daldal N, Artambay M. Frequency of Demodicosis in Various Patient and Age Groups. Turkiye Parazitol Derg. 2007;31:115-8.
10. Özdemir MH, Aksoy U, Sönmez E, Akisu C, Yorulmaz C, Hilal A. Prevalence of Demodex in health personnel working in the autopsy room. Am J Forensic Med Pathol. 2005;26:18-23.
11. Sönmez Ö, Yalçın ZG, Karakeçe E, Çiftçi İH, Erdem T. Associations between Demodex species infestation and various types of cancer. Acta Parasitol. 2013;58:551-5.
12. Zhao YE, Guo N, Xun M, Xu JR, Wang M, Wang DL. Sociodemographic characteristics and risk factor analysis of Demodex infestation (Acari: Demodicidae). J Zhejiang Univ Sci B. 2011;12:998-1007.
13. Karaman Ü, Kolören Z, Enginyurt Ö, Özer A. The epidemiology of Demodex mites at the college students living in dormitories in the city of Ordu. Turkiye Parazitol Derg. 2014;38:166-71.
14. Durmaz S, Yula E, Aycan Kaya O, Aksoy Gokmen A, Kılınç C, Atambay M, et al. Sociodemographic characteristics of patients with *Demodex brevis* and *Demodex folliculorum*infestation and its association with rosacea and Behçet's disease. Biomed Res. 2015;26:549-55.
15. Roihu T, Kariniemi AL. Demodex mites in acne rosacea. J Cutan Pathol. 1998;25:550-2.
16. Özdemir H, Özer E, Özdemir S, Alkanat M. The prevalance of Demodex species in faculty of health science students. Arch Turk Dermatol Venereol. 2015;49:139-41.
17. Isa NH, Loong LW, Fang GH, Mohamad AM, Razali N, Rani NI, et al. Demodicosis among university medical students in Malaysia and the effects of facial cleanser and moisturizer usage. S Asian J Trop Med Public Health. 2011;42:1375-80.
18. Zeytun E, Ölmez H. Demodex (Acari: Demodicidae) infestation in patients with KOAH, and the association with immunosuppression. Erzincan University Journal of Science and Technology. 2017;10(2):220-31.
19. Türkmen D, Türkoğlu G. Demodex

infestation in patients with rosacea. Turkiye Parazitol Derg. 2019;43(4):194-7.
20. Chang YS, Huang YC. Role of Demodex mite infestation in rosacea: a systematic review and meta-analysis. J Am Acad Dermatol. 2017;77(3):441-7.
21. Casas C, Paul C, Lahfa M, Livideanu B, Lejeune O, Alvarez-Georges S, et al. Quantification of *Demodex folliculorum*by PCR in rosacea and its relationship to skin innate immune activation. Exp Dermatol. 2012;21(12):906-10.
22. Cengiz ZT, Yilmaz H, Özkol HU, Ekici A, Ödemis N. The prevalence of Demodex sp. in patients admitted to the parasitology laboratory of the Dursun Odabas Medical Center in Yuzuncu Yıl University, Van. Turkish Journal of Parasitology. 2014;38(1):9.
23. Koç AN, Utaş S, Şahin İ, Yılmaz A. The incidence of *Demodex folliculorum*in acne and comedonal dermatoses. Turkish Journal of Parasitology. 1996;20:71-4.
24. Bikowski JB, Del Rosso JQ. Demodex dermatitis: a retrospective analysis of clinical diagnosis and successful treatment with topical crotamiton. J Clin Aesthet Dermatol. 2009;2(1):20.
25. Ertuğ S, Tileklioğlu E, Yıldız İ, Malatyalı E, Ertabaklar H. The retrospective analysis of *Demodex* spp. results in Aydın Adnan Menderes University Faculty of Medicine Hospital Parasitology Laboratory. Turkish Journal of Parasitology. 2020;44(2):72.
26. Elston, Dirk M. Demodex mites: facts and controversies. Clin Dermatol. 2010;28:502-4.
27. Karincaoglu Y, Bayram N, Aycan O, Esrefoglu M. The clinical importance of *Demodex folliculorum* presenting with nonspecific facial signs and symptoms. J Dermatol. 2004;31:618-26.
28. Orak F, Yıldırım D, Set A, Hasbek M. Investigation of Demodex spp. frequency among skin surface biopsy taken from patients. Ankem Derg. 2015;29:90-4.
29. Forton F, Germaux MA, Brasseur T, De Liever A, Laporte M, Mathys C, et al. Demodicosis and rosacea: epidemiology and significance in Daily dermatologic practice. J Am Acad Dermatol. 2005;52:74-87.
30. Türsen B, Türsen Ü. Ivermectin treatment in dermatology. Dermatoz 2015;6.

Middle Black Sea Journal of Health Science / Mid Blac Sea J Health Sci **November 2022; 8(4): 533-549**

RESEARCH ARTICLE **DOI:** 10.19127/mbsjohs.1129622

Determination of Pain Behaviours on Endotracheal Tube and Oral Care Practice in Intubated Intensive Care Patients

Alkay Kara[1](ID), Nurgül Bölükbaş[2](ID)

[1]Departman of Medical Services and Techniques, Giresun University, Giresun, Turkey
[2]Departman of Surgical Nursing, Faculty of Health Sciences, Ordu University, Ordu, Turkey

Received: 12 June 2022, Accepted: 21 August 2022, Published online: 30 November 2022

Abstract

Objective: This study was performed to determine the pain behaviors of the adult intubated patients in the intensive care unit before and during the endotracheal tube care and oral care.

Methods: This cross-sectional descriptive study was conducted in level 3 Intensive Care Units of a Training and Research Hospital in Black Sea. The study sample consisted of 62 adult patients who complied with the criteria of inclusion for the study. The data was collected by the researcher using the "Patient Information Form", "Critical-Care Pain Observation Tool", "Ramsay Sedation Scale"and " Glasgow Coma Scale". Data analysis was performed on computer with a statistical program. Evaluation of data used number, percentage, arithmetic mean, and standard deviation.

Results: The mean score of the Critical Care Pain Observation Scale was 0.21±0.52 before the endotracheal tube and oral care, and the mean score was 3.39 ± 0.98 during the endotracheal tube and oral care, and this difference was statistically significant (p= .000). All subscale point averages of Intensive Care Pain Observation Scale were found to be higher during endotracheal tube and oral care (p= .000).

Conclusion: It was found that the level of pain during oral care and endotracheal tube care for intubated patients in intensive care is higher than immediately before.

Keywords: Intubation, Mouth Care, Pain, Critical Care, Nursing Care

Suggested Citation: Kara A, Bölükbas N. Determination of Pain Behaviours on Endotracheal Tube and Oral Care Practice in Intubated Intensive Care Patients Mid Blac Sea Journal of Health Sci, 2022;8(4): 533-549.

Address for correspondence/reprints:
Name and Surname: Alkay Kara
Telephone number: +90 (539) 441 64 97
E-mail: alkay@outlook.com.tr

INTRODUCTION

Pain is one of the most important stressors for intensive care patients (1, 2). Gélinas et al. (3) and Yaman Aktaş (4) stated that intensive care patients experience pain from mild levels to severe or uncomfortable levels. Causes of pain for these patients are factors like invasive diagnostic and monitorization methods, mechanical ventilation, tracheal aspiration, daily dressings, and position changes (1,5). Additionally, patients state they feel pain due to interventions like deep respiration and coughing exercises, endotracheal aspiration, wound care, position changes, dressing changes and catheter removal (6). Puntillo et al. (7) stated that patients' experience of pain was commonly due to positioning, removing drains, tracheal aspiration, removal of femoral catheters, insertion of central venous catheters, and changing wound dressings. Esen et al. (8) in studies researching the pain behavior of sedated and intubated intensive care patients, determined patients experienced pain during positioning and aspiration, but mostly during aspiration procedures.

For intensive care patients receiving mechanical ventilation support, in addition to many care interventions, prevention of pressure ulcers that may develop inside the mouth and around the lips and endotracheal tube care with the aim of protecting the patient against infections are very important (9). Oral care and assessment are very important to prevent complications that may develop due to insufficient oral care of intubated patients (9, 10). Oral care is performed in daily routine care administration by nurses in intensive care units. Al Sutari et al. (11) emphasized that intensive care patients experienced high levels of pain during noninvasive interventions like oral care and eye care.

Eti Aslan and Badır (12) stated that more than 60% of patients treated in intensive care units experienced severe pain, while Payen et al. (2) stated more than 70% of patients treated in these units experienced moderate and severe pain. Akıncı et al. (13) in a study of intubated intensive care patients stated that though patients were administered a sedation protocol dominated by analgesia, patients experienced stress countless times, sedation partly reduced the physical symptoms of stress and that 68% of patients felt pain in intensive care. Stanik et al. (14) stated that 96% of patients in the intensive care unit due to trauma experienced pain due to the injured region, while 36% experienced pain due to central venous catheters, arterial catheters, chest tubes, nasogastric tubes, Foley catheters, orthopedic fixation devices and wound drains. Young et al. (15) identified patients who experienced pain during positioning and eye care.

Currently, it is important to manage pain well as it has a significant effect on the quality of life of individuals. The quality of pain management is linked to the knowledge,

behavior, attitude and clinical decision-making status of the health team providing pain treatment. Within this team, nurses have an important role in pain management (16, 17). However, research by Eti Aslan et al. with the aim of determining approaches for intensive care nurses evaluating patient pain levels revealed that most nurses participating in the study did not know how to assess pain in patients with communication problems (18).

Providing quality care for critical patients and elevating patient comfort in intensive care units is an integral part of professional nursing care (19). Planning that includes the determination of pain levels during endotracheal tube care and oral care applied frequently in intensive care units and interventions to reduce pain is important to increase patient comfort (20). In this context, this study was conducted to determine the pain behaviors of adult intubated patients in the intensive care unit before and during endotracheal tube care and oral care.

METHODS

Study Design

This was a descriptive and cross-sectional study.

Study Population and sample

As this study was a cross-sectional study, 62 patients who met the inclusion criteria were included in the study between 18 July and 31 February 2018. The research included those aged 18 and over, unable to express their pain because they were intubated, scored 8-12 on the Glasgow coma scale, scored 2-3 on the Ramsay sedation scale, and were accepted by their relatives to participate in the study. The exclusion criteria for the sample were patients who were not intubated or extubated, received medical treatment for chronic pain, received sedating drugs, had unstable hemodynamic conditions, and had neurological defects that could preclude pain behaviors.

Data Collections

The aims and procedures of the study were explained to the patient relatives and health personnel. The Patient Information Form comprising 13 questions was completed from the patient files for patients abiding by the research criteria. Immediately before the endotracheal tube and oral care of patients, data were collected in line with the CPOT. Patients included in the study had an endotracheal tube and oral care was performed by the researcher. With the aim of determining pain behavior during endotracheal tube and oral care, data was collected with observations in line with the CPOT.

Process Stepsdure

1. Materials were prepared [personal protective equipment (single-use gloves, apron, mask, and goggles), moisturizing cream, ointment, kidney dish, mask, fixation connectors, sponge, plaster, injector 10 cc, scalpel/scissors, stethoscope, ambu bag, oxygen connection cannula].

2. Hands were washed, and necessary personal protective equipment was worn.

3. The procedure was explained to the patient.

4. An appropriate area was chosen for equipment. Curtains were pulled around the bed. The patient was given the appropriate position (semi-Fowler/Fowler).

5. Cuff inflation was checked. If the tube direction was to be changed, air in the cuff was emptied. Endotracheal tube connections were untied while holding the tube fixed and removed slowly and carefully. Lip edges where the endotracheal tube was fixed were observed for ulceration. For patients administered oral intubation, if no specific note was made about intubation tube location, care was taken that it was 22-23 cm at lip level for male patients and 20-21 cm for female patients. For mouth care, gums and oral mucosa were evaluated and mouth care was performed with an oral cleaning rod. Moisturizing cream was spread to prevent dry lips. Without moving the endotracheal tube, it slid toward the other lip edge. A new tube connection was attached by passing a finger between the patient's neck for endotracheal tube fixation. After finishing the procedure, materials were removed, and hands were washed again.

6. With the aim of determining pain behavior during endotracheal tube and oral care, data was collected by the researcher in line with the CPOT.

Data collection tools

Data for the study were collected by the principal researcher with a Patient Information Form, Critical Care Pain Observation Tool, Glasgow Coma Scale, and Ramsay Sedation Scale. First of all, the Glasgow coma scale and Ramsay sedation scale were evaluated in patients who met the inclusion criteria, and it was determined whether the patient's Glasgow coma scale total scores were between 8-12 points and Ramsay sedation scale scores. It was in the 2-3 point range. The pain behavior of the patients was evaluated twice with CPOT, before and during endotracheal tube and oral care.

Patient Information Form

The researcher prepared a patient information form containing socio-demographic characteristics and features related to the diseases of patients based on the literature (20-22). This form included information about the diagnosis, age, sex, educational level, occupation, marital status, number of children, place of referral to the intensive care unit, habits, duration of stay in the intensive care unit, physical limitation status, medication use related to sedation treatment and information related to pain treatment for the patients.

Critical-Care Pain Observation Tool

This was developed by Gelinas et al. (23) in 2006 to evaluate the pain of patients in intensive care units who cannot speak or verbally express

pain. The Turkish validity and reliability of the scale was performed by Yaman Aktaş and Karabulut, in 2013 (4). The pain tool includes 4 elements of facial expression, body movements, muscle tension, and compliance with mechanical ventilator (for intubated patients) or speaking (for extubated patients). The tool has a 3-point Likert type (0-2) with the lowest and highest points of 0 and 8. Low points on the scale indicate less pain is experienced by the patient. The Cronbach's alpha internal consistency coefficient was 0.72 during painful interventions. In this study, the Cronbach alpha internal consistency coefficient for the CPOT was 0.562.

Glasgow Coma Scale

This was developed in Glasgow, Scotland in 1974 to define the consciousness levels of patients. The scale is commonly used to evaluate the consciousness levels of patients in comas. The scale comprises 3 separate sections of eye-opening, verbal, and motor responses. The Glasgow Coma Score (GCS) is obtained by collecting the points obtained in each section. Points vary from three (3) to fifteen (15). If the Glasgow Coma Scale total points are 15, the patient is fully conscious, points below 8 indicate coma, and patients with 3 points do not respond to painful stimuli, do not open their eyes, and flaccidity of muscles is evaluated.

As a result, patients with Glasgow Coma Scale total points from 8-12 were included in this study (24).

Ramsay Sedation Scale

This was developed by Ramsay in 1974 with the aim of assessing the sedation levels of patients. The Ramsay Sedation Scale (RSS) is a scale frequently used to determine the sedation levels of patients in studies in Turkey. Studies determining pain levels of patients in intensive care units have evaluated sedation levels with the RSS (8, 25, 26).

As a result, the RSS was chosen to determine the sedation levels of patients, with patients with awareness levels of 2 and 3 points according to the RSS included in this study as conscious sedation levels end at the 4th stage. The scale comprises a total of 6 items, with three items determining the level of awareness and three items determining sleep levels.

The sedation level is evaluated with points from 1 to 6 on the scale. Increased points indicate an increased level of sedation (8, 27, 28).

Statistical Analysis

Data analysis was performed on a computer with a statistical program. Evaluation of data used numbers, percentages, arithmetic mean, and standard deviation. Data with normal distribution were analyzed using the t-test, variance analysis, and Pearson correlation analysis. Data without normal distribution were analyzed with the Wilcoxon or Mann Whitney U test, Kruskal Wallis test, and Spearman correlation analysis.

RESULTS

The study was completed with 62 patients abiding by the criteria. The mean age of patients was 76.90±12.25 years and 45.2% of these patients were aged 70-84 years. Of patients, 54.8% were female, and 53.2% were married, with a mean of 4.56 children. Of the patients, 51.6% were illiterate, 54.8% were housewives and 93.5% had no smoking or alcohol use (Table 1). Of the patients, 45.2% came from another intensive care unit while 35.5% came from the emergency services. For medical diagnosis, 25.8% of patients had cerebrovascular disease, 12.9% had pneumonia, and 9.7% had respiratory failure. The mean duration of stay in intensive care for patients was 10.23±18.78 days and mean the number of days intubated was 6.37±7.81. The patients had a median Glasgow coma scale value of 8 and a median Ramsay Sedation Scale value of 2. According to the Ramsay sedation scale, 77.4% of patients were cooperative. For 79% of patients, there was no physical fixation present (Table 2).

The mean total points for CPOT before endotracheal tube and oral care was 0.21±0.52, while this was identified as 3.39±0.98 during endotracheal tube and oral care and the difference was statistically significant (p=0.000). The differences in the means for all subdimension points on the CPOT before and during endotracheal tube and oral care were found to be statistically significant (p=0.000). It was determined that the means for total points and points for all subscales of the CPOT were higher during endotracheal tube and oral care (Table 3).

Table 1. Demographic Characteristics of the Sample (n=62)

Variable	n	%
Age ($\bar{X}$±SD)	62±12.25	
Age Groups		
40-54	3	4.8
55-69	11	17.7
70-84	28	45.2
85-99	20	32.3
Gender		
Male	28	45.2
Female	34	54.8
Education		
Not Literate	32	51.6
Literate	12	19.4
Primary School	16	25.8
University	2	3.2
Job		
Farmer	7	11.3
Self-employment	3	4.9
Teacher	1	1.6
Retired	15	24.2
Housewife	34	54.8
Finance official	1	1.6
Not working	1	1.6
Marital status		
Married	33	53.2
Single	29	46.8
Habits		
Cigarette	3	4.9
Alcohol	1	1.6
No	58	93.5

According to the demographic characteristics of patients, comparing the mean total and subdimension CPOT points before endotracheal tube and oral care, only age was found to be statistically significant for mean total CPOT points (p=0.040). Advanced analyses to determine which group was the source of difference (U) determined the mean pain points for the 40–54 year age group

(0.00±0.00) were lower than the mean pain points for the 85-99 year age group (0.50±0.76).

Table 2. Distribution of Patients Related to Intensive Care Process

Intensive care feature	n	%
Where patients come to ICU		
Home	2	3.2
Intensive care	28	45.2
Emergency department	22	35.5
Services	8	12.9
Operating theater	1	1.6
Palliative care center	1	1.6
Patient diagnosis		
Cerebrovasculer disease	16	25.8
Pneumonia	8	12.9
Shortness of breath	6	9.7
Post Cardiopulmonary Resuscitation	5	8.1
Myocardial infarction	4	6.4
Intracrania hemorrhage	4	6.4
Chronic obstructive pulmonary disease	3	4.9
Chronic heart failure	3	4.9
Sepsis	3	4.9
Lung cancer	2	3.2
Oral nutrition disorder	1	1.6
Coronary artery bypass graft	1	1.6
Acute renal failure	1	1.6
Necrotizing fasciitis	1	1.6
Acute cholecystitis	1	1.6
Hypertension	1	1.6
Pancreatitis	1	1.6
Gastric perforation operation	1	1.6
Ramsay Sedation Scale Categories		
Co-operative, oriented, and tranquil	48	77.4
Responding to commands only	14	22.6
Physical Restraint		
Yes	13	21.0
No	49	79.0
Length of stay in Intensive care units (days), mean (SD)	10.23 (18.78)	
Duration of mechanic ventilation (days), mean (SD)	6.37 (7.81)	
GCS, median	8	
RSS, median	2	

Comparison of mean total and subdimension CPOT points during endotracheal tube and oral care based on features related to the intensive care process found the difference between the referral location to the intensive care unit and the "muscle tension" subdimension mean points on the CPOT during endotracheal tube and oral care was statistically significant (p=0.014). Advanced analysis to determine which group caused the difference (U) found that patients referred to the intensive care unit from home had lower "muscle tension" CPOT points (0.50±0.71) compared to patients referred from other locations.

The difference between physical fixation status and CPOT "body movement" subdimension mean points were found to be statistically significant during endotracheal tube and oral care of patients (p=0.047). Advanced analysis to identify which group caused the difference (U) identified that the mean points for the "body movement" CPOT subdimension were higher in patients with physical fixation (1.15±0.38). There was a statistically significant, positive, and low-level correlation between the duration of stay in the intensive care unit and the mean total CPOT points and "facial expression" subdimension points before endotracheal tube and oral care (r=0.30, p=0.02). As the duration of stay of patients in the intensive care unit increased, the CPOT total points and "facial expression" subdimension points increased. There was a statistically significant, positive, and low-level correlation found between the intubation days of patients with the mean total CPOT points and "facial expression" subdimension points before endotracheal tube and oral care (r=0.31, p=0.01). As the number of days of intubation increased, the CPOT total points and "facial

expression" subdimension points increased. There were statistically significantly positive, and low-level correlations found between the Ramsay sedation scale points before endotracheal tube and oral care with the CPOT total points (r=0.295, p=0.020) and "facial expression" (r=0.228, p=0.023) subdimension points. As the Ramsay sedation score of patients increased, the CPOT total points and "facial expression" subdimension points increased. There was no statistically significant correlation identified between Glasgow coma scale points before endotracheal tube and oral care and CPOT total points (p>0.05) (Table 4).

There were statistically significant, positive, and low-level correlations between the duration of stay in the intensive care unit (r=0.26, p=0.05) and Glasgow coma scale points (r=0.278, p=0.029) with the CPOT total points during endotracheal tube and oral care. As the duration of stay in intensive care and Glasgow coma scale points increased, the CPOT total points increased. During endotracheal tube and oral care of patients, there were statistically significantly positive, and low-level correlations identified between CPOT "facial expression" (r=0.361, p=0.004) and "body movements" (r=0.358, p=0.004) subdimensions. During endotracheal tube and oral care of patients, as Glasgow coma scale points increased, the "facial expression" and "body movements" subdimension points on the CPOT also increased. There was a statistically significantly negative, and low-level correlation identified between Ramsay sedation score points with CPOT "muscle tension" subdimension points during endotracheal tube and oral care of patients (r=-0.277, p=0.029). As the Ramsay sedation score points increased during endotracheal tube and oral care, the "muscle tension" subdimension points on the CPOT decreased (Table 4)

Table 3. Comparison of CPOT Scores and Subscale Mean Scores Before and During Endotracheal Tube and Oral Care

CPOT Subdimensions	n	Min	Max	X̄±SD	Test*	p
Facial expressions						
Before practice	62	0	1	0.16±0.37	Z=-7.145	**.000**
During practice	62	1	2	1.21±0.41		
Body movements						
Before practice	62	0	0	0.00±0.00	Z=-7.508	**.000**
During practice	62	0	2	1.00±0.31		
Muscle tension						
Before practice	62	0	1	0.05±0.21	Z=-7.483	**.000**
During practice	62	0	2	0.95±0.34		
Compliance with the ventilator						
Before practice	62	0	0	0.00±0.00	Z=-3.742	**.000**
During practice	62	0	1	0.23±0.42		
CPOT Total Scores						
Before practice	62	0.00	2.00	0.21±0.52	Z=-6.987	**.000**
During practice	62	2.00	7.00	3.39±0.98		

* Z=Willcoxon Test

Table 4. The Correlation Between Mean Points for CPOT and Subdimensions Before and During Endotracheal Tube and Oral Care with Intensive Care Features of Patients

	Facial expressions	Body movements	Muscle tension	Compliance with the ventilator	CPOT Total Scores
ICU Length of stay, days					
Before practice					
r	.30	-	.16	-	.30
p	**.02**	-	.22	-	**.02**
During practice					
r	.19	.06	.19	.24	.26
p	.13	.64	.14	.06	**.05**
Duration of MV, days					
Before practice					
r	.31	-	.16	-	.31
p	**.01**	-	.21	-	**.01**
During practice					
r	.20	.09	.14	.10	.20
p	.11	.50	.29	.42	.12
GCS					
Before practice					
r	-.210	-	-.028	-	-.202
p	.102	-	.829	-	.116
During practice					
r	.361	.358	.028	.047	.278
p	**.004**	**.004**	.829	.718	**.029**
RSS					
Before practice					
r	.288	-	.238	-	.295
p	**.023**	-	.063	-	**.020**
During practice					
r	.006	-.124	-.277	-.107	-.197
p	.962	.337	**.029**	.407	.125

ICU: Intensive Care Unit, MV: Mechanical Ventilation, GCS: Glasgow Coma Scale, RSS: Ramsay Sedation Scale

DISCUSSION

In intensive care units, catheters used for a variety of aims, drains, noninvasive and invasive ventilation methods, treatment and care interventions, aspiration, dressing changes, position changes and rehabilitation applications can be listed among factors causing pain in patients (29-31) Though patients monitored in intensive care units encounter many painful stimuli, studies dealing with this problem in the ICU and attempting to solve it are very limited (29).

More than 60% of patients treated in intensive care units experience “moderate” or “severe” pain (2, 8). As a result, it is important that pain during the day and during invasive and noninvasive applications be evaluated and noted by nurses. This study was completed with the aim of determining pain behavior before and after endotracheal tube care and oral care among intubated adult patients in the intensive care unit.

During endotracheal tube and oral care, the mean CPOT pain points were higher and the difference was statistically significant

(p=0.000). Studies by Güneş (22) and Esen et al. (8) found there was no significant difference in mean pain points before positioning and aspiration; however, there was advanced degree of significance between mean pain points during positioning and aspiration. Studies by Al Sutari et al. (11) showed intensive care patients experienced high levels of pain during positioning, aspiration, invasive procedures, oral care, eye care, and nasogastric tube insertion. Similar to other studies, in this study, the pain levels of patients during noninvasive procedures like tube care and oral care were found to be significantly high for intensive care patients.

The means for all subdimension points on the CPOT during endotracheal tube and oral care were identified to be higher and statistically significant (p=0.000). In a study with a subject control group Yaman Aktaş (4) stated that there were significant differences in "body movement", "muscle tension" and "compliance with ventilator" subdimensions of the CPOT during endotracheal aspiration. The study by Güneş (22) observed comfort rates of 70.9% and 69.2% based on the facial expression of patients before positioning and aspiration of intubated and sedated patients in intensive care, while these rates fell to 15.4% and 8.2% during positioning and aspiration. The same study found 98.4% and 97.8% of patients tolerated ventilation before positioning and aspiration, while these values reduced to 91.8% and 56% during positioning and aspiration. Moreover, the same study stated the pain points for upper extremities (no movement) before positioning and aspiration were 74.2% and 74.7%, while these rates were 24.7% and 20.3% during positioning and aspiration (22). The results of our study are similar to the literature.

In our study, there was a statistically significant difference in the CPOT mean points before endotracheal tube and oral care according to the age of patients (p=0.040). This difference was determined to be due to the mean pain points of patients in the 85-99 year age group (0.50±0.76) being higher than the mean pain points in the 40-54 year age group (0.00±0.00). The results of studies completed about pain state that perception of pain increases in the elderly age group (32, 33).

There were statistically significant differences for "body movement" CPOT subdimension mean points according to physical fixation status and between referral location and "muscle tension" subdimension mean points during endotracheal tube and oral care (p=0.047, p=0.014). The mean "body movement" CPOT subdimension points were higher for patients with physical fixation. Physical fixation is applied in intensive care units for a variety of aims and there are results in the literature stating that remaining immobile for long periods causes pain in patients (34, 35). Patients referred to intensive care from home

were identified to have lower mean points for the "muscle tension" CPOT subdimension. This situation may be interpreted as being due to caregivers in the home environment taking more care during interventions like position changes of patients.

In this research, there were positive low-level significant correlations identified between duration of stay in the intensive care unit and CPOT total points and "facial expression" subdimension points before endotracheal tube and oral care (p=0.02). As the duration of stay in the intensive care unit increased, the mean points for the "facial expression" subdimension and CPOT total increased. The pain behavior most often used for intensive care patients who cannot communicate verbally or express pain is "facial expression" (36, 37). Though reactions occurring linked to pain change individually, the reactions formed in the Musculoskeletal system in patients who cannot express, or report pain are universal and are defined as "pain behavior" (36). In the ICU it was stated that the most commonly observed pain behavior is "facial grimacing" (36-38). These results of the study comply with the literature.

The study found positive and low-level significant correlations between the number of days intubated and mean total CPOT points (p=0.01) and "facial expression" (p=0.01) subdimension points before endotracheal tube and oral care. As the number of days intubated increased, the mean for the "facial expression" subdimension and CPOT total points increased. As patients who are intubated linked to mechanical ventilation cannot verbally express themselves during invasive and noninvasive procedures, they attempt to express themselves through behavioral reactions such as facial and forehead grimacing, facial reddening, pulling their knees upward, attempting to make sounds, pulling inward, pushing the person treating them, clenching their fists, biting the intubation tube, moving away from the painful stimuli in the region of intervention, etc (21, 37, 39). In accordance with the literature, in this study as the number of days of intubation of intensive care patients increased, there was an increase determined in behavioral pain reactions.

The study determined positive and low-level significant correlations between Ramsay sedation scale points with mean CPOT total points (p=0.020) and "facial expression" subdimension points (p=0.023) before endotracheal tube and oral care. As the Ramsay sedation points of patients increased, the CPOT total points and "facial expression" subdimension points increased. This result is similar to the literature. The reason for this is that within the scope of the research, patients without sedation and with Ramsay sedation points of 2 (oriented, calm patients) and 3 (responding to verbal stimuli and abiding by orders) were included, so these patients experienced pain and expressed their

behavioral reaction to pain through facial expressions.

During endotracheal tube and oral care of patients, there was a positive and low-level significant correlation found between the duration of stay in intensive care and mean CPOT total points (p=0.05). As the duration of stay in intensive care lengthened, the total CPOT points increased. It is considered that as the duration of stay in intensive care lengthens, patients have increased sensitivity due to exposure to more painful procedures.

There were positive and low-level significant correlations identified during endotracheal tube and oral care of patients between Glasgow coma scale mean points and mean CPOT total points (p=0.029), "facial expression" and "body movement" subdimensions (p=0.004). During endotracheal tube and oral care of patients, as the Glasgow coma scale points increased, the CPOT total points, "facial expression" and "body movement" subdimension points increased. High Glasgow coma scale points are a finding showing increased levels of consciousness among patients. As a result, the observations of increased mean CPOT total points, "facial expression" and "body movement" subdimension points among patients with increased Glasgow coma scale points is an expected situation (40).

During endotracheal tube and oral care, there was a negative and low-level significant correlation present between Ramsay sedation scale points and CPOT "muscle tension" points (p=0.029). As the Ramsay sedation scale points increased during endotracheal tube and oral care, the CPOT "muscle tension" subdimension points fell. In the study by Güneş (22) as the sedation level of patients increased, they stated there were reduced pain points before and during positioning and aspiration. This result is similar to our study. In the literature, there was a significant negative correlation between behavioral pain points and Ramsay sedation scale points during painful procedures (41, 42).

Limitations and Recommendations

The research may be generalized to patients within the scope of the study in the relevant education-research hospital but cannot be generalized to all intubated intensive care patients. The collection of research data by a single researcher is another limitation of the study.

Considering the result that pain levels significantly increase during noninvasive interventions like oral care and endotracheal tube care of intensive care patients, it is recommended that nurses evaluate the pain status of patients not only during invasive procedures but also during noninvasive procedures.

CONCLUSIONS

This research determined that the pain levels of intubated patients in intensive care units were higher during endotracheal tube and oral

care compared to immediately before the intervention. Nurses' more attentive approach will lead to reduced levels of ignored pain experienced by patients in noninvasive procedures, to feel spiritually better, and to decrease recovery times.

Ethics Committee Approval: This study was approved by Ordu University Clinical Research Ethics Committee (28/06/2018-150).
Peer-review: Externally peer-reviewed.
Author Contributions: Concept: AK, NB; Design: AK, NB; Literature Search: AK, NB; Data Collection and Processing: AK; Analysis or Interpretation
Conflict of Interest: No conflict of interest was declared by the authors.
Financial Disclosure: The author declared that this study hasn't received any financial support.

REFERENCES

1- Aslan FE, Badir A, Arli SK, Cakmakci H. Patients' experience of pain after cardiac surgery. Contemp Nurse 2009;34:48-54.
2- Payen J-F, Bosson J-L, Chanques G, Mantz J, Labarere J. Pain Assessment is Associated with Decreased Duration of Mechanical Ventilation in the Intensive Care UnitA Post HocAnalysis of the DOLOREA Study. The Journal of the American Society of Anesthesiologists 2009;111:1308-16.
3- Gélinas C, Fortier M, Viens C, Fillion L, Puntillo K. Pain Assessment and Management in Critically Ill Intubated Patients: A Retrospective Study. American Journal of Critical Care 2004;13:126-36.
4- Yaman Aktaş Y, Karabulut N. A Turkish version of the Critical Care Pain Observation Tool: Reliability and Validity Assessment. Journal of PeriAnesthesia Nursing. 2017;32:341-51.
5- Aljumah MI, Aboshoushah EF, Coric D, Alaithan AM, Almulhim AAA, AlOtaibi NM et al. Assessment and Management of Pain in the Intensive Care Unit. Egyptian Journal of Hospital Medicine. 2018;73:6439-45.
6- Çevik, S. Ağrı. In F. Eti Aslan & N. Olgun (Eds.), Management of Selected Symptoms and Findings in Intensive Care. Ankara: Akademisyen Kitabevi; 2016. p. 157-168.
7- Puntillo KA, Morris AB, Thompson CL, Stanik-Hutt J, White CA, Wild LR. Pain Behaviors Observed During Six Common Procedures: Results from Thunder Project Ii. Critical Care Medicine. 2004;32:421-7.
8- Esen H, Öntürk ZK, Badır A, Aslan Eti F. Pain behaviours of intubated and sedated intensıve care patients during positioning and aspiration. Acıbadem Üniversitesi Sağlık Bilimleri Dergisi. 2010;1:89-93.
9- Terzi B, Kaya N. Nursing care of critically ill patients. Yoğun Bakım Dergisi 2011;1:21-5.
10- Özveren H. Oral Care in Patients Receiving Mechanical Ventilator. Oral Care in Patients Receiving Mechanical Ventilator. 2010;17:92-9.
11- Al Sutari MM, Abdalrahim MS, Hamdan-Mansour AM, Ayasrah SM. Pain Among Mechanically Ventilated Patients in Critical Care Units. Journal of research in medical sciences: the official journal of Isfahan University of Medical Sciences. 2014; 19: 726.
12- Eti Aslan F, Badır A. Reality about pain control: The knowledge and beliefs of nurses on the nature, assessment and management of pain. Ağrı. 2005;17:44-51.
13- Akıncı S, Kanbak M, Güler A, Canbay M, Aypar Ü. Stressful experiences in mechanical ventilated patients. Türk Anest Rean Der Dergisi. 2007;35:320-8.
14- Stanik-Hutt JA, Soeken KL, Belcher AE, Fontaine DK. Pain Experiences of Traumatically Injured Patients in A Critical Care Setting. American Journal of Critical Care. 2001;10:252.
15- Young J, Siffleet J, Nikoletti S, Shaw T. Use of A Behavioural Pain Scale to Assess Pain in Ventilated, Unconscious and/or Sedated Patients. Intensive and Critical Care Nursing. 2006;22:32-9.
16- Demir Dikmen Y, Yıldırım Usta Y, İnce Y, Türken Gel K, Akı Kaya M. Determining of nurses' knowledge, behavior and clinical decision making regarding pain management. Çağdaş Tıp Dergisi. 2012;2:162-72.
17- Özer S, Akyürek B, Başbakkal Z. Investigation of nurses' pain related knowledge, attitude and clinical decision making skills. Ağrı. 2006;18:36-43.
18- Eti Aslan F, Badir A, Selimen D. How do intensive care nurses assess patients' pain? Nursing In Critical Care. 2003;8:62-7.

19- Cırık V, Emine E. Pain in intensive care unit and the role of the nurse. Yoğun Bakım Hemşireliği Dergisi 2014;18:15-21.
20- Yaman Aktaş, Y. The Effect of Music Therapy Applying in Endotracheal Suctioning of Mechanically Ventilated Patients on Pain and Physiological Parameters (Doctoral Dissertation). Erzurum: Atatürk University; 2013.
21- Vatansever, H. E. A study on the pain behaviours of patients attached to mechanical ventilators in surgical ıntensive care unit (Master's Thesis). İstanbul: Marmara University; 2004.
22- Güneş, D. Pain behaviours of intubated and sedated intensive care patients during positioning and aspiration (Master's Thesis). İstanbul: Haliç University; 2012.
23- Gélinas C, Fillion L, Puntillo KA, Viens C, Fortier M. Validation of the critical-care pain observation tool in adult patients. American Journal of Critical Care. 2006;15(4):420-7.
24- Karadakovan, A. Consciousness Level Changes. In A. Karadakovan & F. Eti Aslan (Eds.), Dahili ve Cerrahi Hastalıklarda Bakım. Ankara: Akademisyen Kitabevi; 2017. p. 1123.
25- Üzelli Yılmaz D, Akın Korhan E, Baysan B, Tan E, Erem A, Çelik S et al. The effect of music therapy on sedation levels and vital signs of patients under mechanical ventilatory support: A pilot study. İzmir Katip Çelebi Üniversitesi Sağlık Bilimleri Fakültesi Dergisi. 2016;1:21-7.
26- Yaman Aktaş Y, Karabulut N. The Effects of Music Therapy in Endotracheal Suctioning of Mechanically Ventilated Patients. British Association of Critical Care Nurses. 2015;21:44-52.
27- Akın Korhan E, Bor C, Uyar M. An assessment of pain in adult patient in intensive care. Yoğun Bakım Hemşireliği Dergisi. 2012;16:57-65.
28- Detriche O, Berré J, Massaut J, Vincent JL. The Brussels Sedation Scale: Use of A Simple Clinical Sedation Scale Can Avoid Excessive Sedation in Patients Undergoing Mechanical Ventilation in The Intensive Care Unit. British Journal of Anesthesia. 1999;83:698-701.
29- Badır A, Eti Aslan F. The problem of pain in intensive care units: An issue of widespread interest but inadequate questioning. Yoğun Bakım Hemşireliği Dergisi. 2003;7:100-8.
30- Ayasrah SM, O'Neill TM, Abdalrahim MS, Sutary MM, Kharabsheh MS. Pain Assessment and Management in Critically Ill Intubated Patients in Jordan: A Prospective Study. International Journal of Health Sciences. 2014;8: 287.
31- Puntillo KA, Max A, Timsit J-F, Vignoud L, Chanques G, Robleda G et al. Determinants of Procedural Pain Intensity in The Intensive Care Unit. The Europain® Study. American Journal of Respiratory and Critical Care Medicine. 2014;189:39-47.
32- Koçoğlu D, Özdemir L. The relation between pain and pain beliefs and sociodemographic-economic characteristics in an adult population. Ağrı. 2011;23:64-70.
33- Erdine S, Hamzaoðlu O, Özkan Ö, Balta E, Domaç M. Pain Prevalance Among Adults in Turkey. Ağrı. 2001;13:22-30.
34- Demir Y. Pain experience in intensive care unit care and pain assessment: Literature review. Düzce Üniversitesi Sağlık Bilimleri Enstitüsü Dergisi. 2012;2:24-30.
35- Erden S. Pain behaviours of intubated and sedated intensıve care patients during positioning and aspiration. Van Tıp Dergisi. 2015;22:332-6.
36- Arif-Rahu M, Grap MJ. Facial Expression and Pain in The Critically Ill Non-Communicative Patient: State of Science Review. Intensive and Critical Care Nursing. 2010;26:343-52.
37- Eti Aslan F, Karadağ Arlı Ş, Yavuz M, İlknur A, Temiz K, Çınar E et al. Responses to painful procedures of sedatized patients at intensive care. Anestezi Dergisi. 2010;18:163-7.
38- Ayasrah S. Care-Related Pain in Critically Ill Mechanically Ventilated Patients. Anaesthesia and Intensive Care. 2016;44:458.
39- Gündoğan O, Bor C, Korhan EA, Demirağ K, Uyar M. Pain assessment in critically ill adult patients: Validity and reliability research of the Turkish version of the critical-care pain observation tool. Journal of the Turkish Society of Intensive Care. 2016;14:93-9.
40- Sepit D. Level of Consciousness: Assessment and Glasgow Coma Scale as an Assessment Tool. Hemşirelikte Araştırma Geliştirme Dergisi. 2005;2:12-6.
41- Aïssaoui Y, Zeggwagh AA, Zekraoui A, Abidi K, Abouqal R. Validation of A Behavioral Pain Scale in Critically Ill, Sedated, and Mechanically Ventilated Patients. Anesthesia & Analgesia 2005; 101: 1470-6.
42- Bayrak Kahraman B, Özdemir L. Evaluation of behavioral and physiological pain ındicators during ınvasive procedures on the ıntensive care patients. Turkish Journal of Research & Development in Nursing. 2016;18:13-21.

Middle Black Sea Journal of Health Science / Mid Blac Sea J Health Sci **November 2022; 8(4):550-562**

RESEARCH ARTICLE **DOI:** 10.19127/mbsjohs.1130111

Perceived Stress and Coping Strategies of Nurses Working in the Emergency Service During the Covid-19 Pandemic

Nurgül Karakurt[1](ID), Pınar Sevda Gül[2](ID)

[1]Department of Psychiatric Nursing, Faculty of Health Sciences, Erzurum Technical University, Erzurum, Turkey.
[2]Department of Nursing, Clinical Nurse, Erzurum City Hospital, Erzurum, Turkey

Received: 13 June 2022, Accepted: 09 September 2022, Published online: 30 November 2022

Abstract

Objective: This study aims to investigate the perceived stress and coping styles of the nurses working in the emergency service during the COVID-19 pandemic.

Methods: The study population consisted of the nurses in the emergency service of the A Hospital, who met the research inclusion criteria between April 15th, 2021, and May 1st, 2021 (N:179). Without any sample selection, 156 nurses who agreed to participate voluntarily in the research were included in the study sample. Research data were collected using the survey program online, taking into account the COVID-19 conditions and the intensity of work in the emergency service. Permission of the Ministry of Health and approval of the ethics committee (no:B.30.2.ATA.0.01.00/) were obtained before conducting the study.

Results: The Perceived Stress Scale scores of the nurses working in the emergency service were found to be above the average (avg.value:26). In addition, of the Ways of Coping Questionnaire sub-scales, the Optimistic Approach, Self-Confident Approach, Seeking Social Support Approach sub-scale scores were found to decrease with the increase in the Perceived Stress Scale scores, whereas the Helpless Approach and Submissive Approach sub-scale scores were found to increase significantly with increasing Perceived Stress Scale scores ($p<0.05$). In addition, the study suggests that there is a positive and significant relationship between the Perceived Stress Scale scores and the Ways of Coping Questionnaire scores of the nurses ($p<0.05$).

Conclusions: The perceived stress level score of the emergency service nurses was found to be above average, and the Optimistic Approach, Self-Confident Approach, Seeking Social Support Approach sub-scale scores were found to decrease with the increase in the Perceived Stress Scale scores, but the Helpless Approach and Submissive Approach sub-scale scores were found to increase with increasing Perceived Stress Scale scores.

Keywords: Nurse, COVID-19, Emergency Service, Coping with Stress

Suggested Citation: Karakurt N, Gül P S. Perceıved Stress And Copıng Strategıes of Nurses Workıng In The Emergency Service Service During The Covid-19 Pandemic. Mid Blac Sea Journal of Health Sci, 2022;8(4): 550-562.

Address for correspondence/reprints:
Name and Surname: Nurgül Karakurt
Telephone number: +90 (505) 566 73 99
E-mail: nurgul.karakurt@erzurum.edu.tr

Note: This article is based on the master thesis of Atatürk University Institute of Health Sciences, Department of Psychiatric Nursing

INTRODUCTION

According to World Health Organization reports, infectious diseases that spread very quickly, and affect the entire world, causing many people to experience serious health problems or even die, are called pandemics (1). Although symptoms vary, fever, cough, respiratory distress, are fatigue are the most common symptoms of COVID-19, caused by the new type of coronavirus called SARS-CoV-2, which is considered a severe public health problem that concerns many people at the point of fighting against the disease (2).

During the pandemic, which is of international importance, the workload of healthcare professionals working at the forefront is also increasing every day since they exert superior efforts in the diagnosis, treatment, and care of the disease (3).

In particular, this increases the responsibilities of an emergency nurse, who is in close contact with the patients during their hospital admission, who performs their transfer, performs first interventions, and who plays an influential role in dealing with crisis situations. In order not to disrupt the service, it is very important to protect and improve the physical and mental health of nurses of emergency working at an intensive work pace (4).

According to the studies conducted so far, it is noteworthy that the anxiety levels of healthcare professionals increase, and their motivation decreases considerably with the increased workload (5). Studies report that severe insomnia, fatigue, and weakness affect the immune system, and deteriorate physical health and mental health, which in turn increase a person's stress factors that emphasize the severity of the situation (6). Working in an infected environment for long hours, with close one-on-one contact with the patients, leads to a constant increase in anxiety levels and fear in healthcare professionals (7).

Considering the condition of healthcare professionals in outbreaks in past years, it was determined that they felt inadequate in terms of knowledge and skills, especially in protecting themselves and their closest relatives from the epidemic, and that the level of fear and anxiety caused by insufficient knowledge of the disease was quite high (8).

The study conducted in the name of proper management of the process, prevention of physical and mental health problems, and improvement of mental state is noteworthy, especially because of the limited practices regarding health care professionals. In light of all this information, it is important to identify the stress experienced by the emergency nurse who is the first responder to the patient throughout the pandemic and to manage the methods of coping with the stress.

METHODS

The study population consisted of the nurses in the emergency service of the A Hospital, who met the research inclusion criteria between

April 15th, 2021, and May 1st, 2021 (N:179). Without any sample selection, 156 nurses who agreed to participate voluntarily in the research were included in the study sample (Table 1).

Table 1. Introductory characteristics of nurses included in the study (n=156)

	n	%
Gender		
Female	90	57.7
Male	66	42.3
Age		
18-24	44	28.2
25-30	76	48.7
31-35	36	23.1
Marital status		
Single	104	66.7
Married	52	33.3
Having Children		
Yes	22	14.1
No	134	85.9
Education status		
High school graduate	18	11.5
Bachelor's degree	114	73.1
Postgraduate	24	15.4
People Lived Together		
Alone	71	45.5
Living with friends	17	10.9
Living with family	40	25.6
Living with spouse and children	28	17.9
Presence of Chronic Diseases		
Yes	40	25.6
No	116	74.4
Working Time		
1-3 years	67	42.9
3-5 years	32	20.5
5 years and above	57	36.5
Corona virus infection		
Yes	104	66.7
No	52	33.3
Corona virus infection in the family		
Yes	106	67.9
No	50	32.1
Working in the emergency service willingly		
Yes	54	34.6
No	102	65.4
Manner of Working		
Daytime Only	38	24.4
In shifts	118	75.6

Data Collection Instruments

'Personal Information Form', 'Perceived Stress Scale', and Ways of Coping Questionnaire' were used.

Personal Information Form

The form prepared by a literature review consists of 12 items on personal information.

Perceived Stress Scale

It was developed by Cohen et al. The scale is designed to measure the stress perceived by a person in his/her life (9). It is a 5-point Likert-type scale, scored between "Never (0)" to "Very frequently (4)". Seven of the items with positive expressions are reverse-coded. The Turkish adaptation of the scale was conducted by Baltaş et al. a score between 11-26 corresponds to a low-stress level, 27-41 corresponds to a moderate stress level, and 42-56 corresponds to a high-stress level (10).

Ways of Coping Questionnaire (WCQ)

The scale, developed by Folkman and Lazarus, is a 4-point Likert-type scale, consisting of 30 items (11). The validity and reliability study of the WCQ was conducted by Şahin and Durak (12). The internal consistency coefficient calculated for the WCQ sub-scales was 0.68 for the Optimistic Approach sub-scale, 0.80 for the Self-Confident approach sub-scale, 0.73 for the Helpless Approach sub-scale, 0.70 for the Submissive Approach sub-scale, and 0.47 for the Seeking Social Support Approach sub-scale. In this study, Cronbach's Alpha internal consistency coefficient was found to be 0.942 for the Optimistic Approach sub-scale, 0.967 for the Self-Confident Approach sub-scale, 0.910 for the Helpless Approach sub-scale, 0.871 for the Submissive

Approach sub-scale, and 0.364 for the Seeking Social Support Approach sub-scale.

The scale has two dimensions problem-focused effective approaches, and emotions-focused ineffective approaches, which are grouped under 5 sub-scales. The total score from each sub-scale is divided by the number of items related to that sub-scale, resulting in an average score. The increase in the total score for each sub-scale indicates frequent use of the coping style in question.

Data Collection

The data were collected using an online survey program, after obtaining the necessary permissions. It took 5-10 minutes for the participants to answer questions. Before the data collection, emergency service nurses were informed about the content of the research. The principle of confidentiality was followed within the scope of the study.

Statistical analysis

In the data analysis, 10 different statistical analyses (frequency, percentage, Pearson product-moment correlation analysis, Linear Regression Analysis, t-test, one-way analysis of variance, Kruskal Wallis H test, Mann Whitney U test, LSD Post Hoc test, Cronbach's Alpha analysis) were used, and the analyses were performed by SPSS 22.00 statistical program.

RESULTS

Looking at Table 1, 57.7% of the nurses surveyed were female, 48.7% were 25-30 years old, 66.7% were single, 85.9% had no children, 73.1% had a Bachelor's degree, 45.5% were living alone, 74.4% had no any chronic condition, 42.9% was working for 1-3 years, 66.7% had COVID-19, 67.9% had a relative who had COVID-19, 65.4% was not working voluntarily in the emergency service, and 75.6% was working in shifts.

Table 2. Arithmetic mean and standard deviation values for the Perceived Stress Scale and Ways of Coping Questionnaire scores of the nurses

	Minimum	Maximum	Arithmetic mean	S.D.
Perceived Stress Scale	14	52	34.47	11.41
Problem-Focused Effective Approaches Sub-Scale				
Optimistic Approach Sub-Scale	.00	2.80	1.33	.87
Self-Confident Approach Sub-Scale	.00	3.00	1.46	.94
Seeking Social Support Sub-Scale	.38	1.13	.68	.24
Emotion-Focused Ineffective Approaches Sub-scale				
Helpless Approach Sub-Scale	1.17	4.00	2.57	1.01
Submissive Approach Sub-Scale	.50	4.25	2.55	1.19

Looking at Table 2, the average Perceived Stress Scale score was 34.47±11.41, the Optimistic Approach sub-scale average was 1.33±0.87, the Self-Confident Approach sub-scale score average was 1.46±0.94, the Seeking Social Support Approach sub-scale score average was 0.68±0.24, the Helpless Approach sub-scale score average was 2.57±1.01, and the

Submissive Approach sub-scale score average was 2.55±1.19.

Of the nurses included in the study, 21.8% had a low-stress level, 47.4% had a moderate stress level, and 30.8% had a high level of stress (Table 3).

Table 3. Perceived level of stress of the nurses

	n	%
Low level of stress	34	21.8
Moderate level of stress	74	47.4
High level of stress	48	30.8

While the correlation between the Perceived Stress Scale score and the Optimistic Approach sub-scale, Self-Confident Approach sub-scale, and Seeking Social Support Approach sub-scale scores was negatively significant at $p<0.05$ level of significance, the correlation with the Helpless Approach sub-scale score, and Submissive Approach sub-scale score was positively significant at $p<0.05$ level of significance (Table 4).

The Perceived Stress Scale scores significantly correlate with the Ways of Coping Questionnaire scores ($R=.904$, $R2=.817$, $p<0.05$). The Ways of Coping Questionnaire score explains 82% of the total variance of perceived stress levels of the nurses. Looking at the t-test results on the significance of regression coefficients, it's seen that the Seeking Social Support Approach sub-scale, Helpless Approach sub-scale, and Submissive Approach sub-scale variables were significant predictors of the stress that nurses perceive (Table 5).

According to the nurses' genders, the t values of the differences between the Perceived Stress Scale, Optimistic Approach, Self-Confident, Seeking Social Support, and Helpless Approach sub-scales scores were found to be significant at $p<0.05$ level (Table 6).

According to the marital status of the nurses, the t values of the differences between them were significant at $p<0.05$ level in terms of self-confident approach sub-scale scores (Table 6).

According to the nurses' educational status, the differences between the Perceived Stress Scale, Optimistic Approach, Self-Confident, and Helpless Approach sub-scales scores were found to be significant at $p<0.05$ level. The LSD Post Hoc test was performed to reveal the difference between the nurses in terms of their education (Table 6).

Table 4. The correlation between Perceived Stress Scale and Ways of Coping Questionnaire scores and the related correlation values

		Perceived Stress Scale
Optimistic Approach Sub-Scale	r	-.652**
	p	.000
Self-Confident Approach Sub-Scale	r	-.708**
	p	.000
Seeking Social Support Sub-Scale	r	-.660**
	p	.000
Helpless Approach Sub-Scale	r	.859**
	p	.000
Submissive Approach Sub-Scale	r	.745**
	p	.000

**. P< 0.01

Table 5. Results of the linear regression analysis on how the coping styles of nurses predict their perceived level of stress

Variable	B	Standard Error	Beta	t	p
Constant	25.271	2.471		10.229	.000
Optimistic Approach Sub-Scale	-.546	.295	-.207	-1.853	.066
Self-Confident Approach Sub-Scale	-.019	.218	-.011	-.085	.932
Seeking Social Support Sub-Scale	**-1.095**	**.290**	**-.187**	**-3.770**	**.000**
Helpless Approach Sub-Scale	**1.604**	**.158**	**.848**	**10.145**	**.000**
Submissive Approach Sub-Scale	**-.569**	**.195**	**-.238**	**-2.921**	**.004**
R=.904		R^2=.817			
$F_{(5.150)}$=134.177		p=.000			

a. Dependent variable: Perceived Level of Stress

As a result of the LSD Post-Hoc test, the differences between the Perceived Stress Scale scores and Helpless Approach sub-scale scores of the nurses with graduate degrees were higher and significant at p<0.05 level of significance than the nurses with Bachelor's degree and high school degree, and the differences between Optimistic Approach sub-scale and Self-Confident Approach sub-scale scores of the nurses with high school and Bachelor's degrees were higher and significant at p<0.05 level of significance than that of the nurses with graduate degrees (Table 6).

The KW values of the differences between the Perceived Stress Scale scores of the nurses were significant at P<0.05 level in terms of who they lived together with. LSD Post Hoc test was used to find the difference between the nurses in terms of the people they lived together (Table 6).

According to the result of the LSD Post-Hoc test, the differences between the Perceived Stress Scale scores of the nurses living with their spouses and children were higher and significant at p<0.05 level of significance, compared to the nurses living alone and living with their family (Table 6).

According to the nurses' working times, the F values of the differences between Perceived Stress Scale, Optimistic Approach, Self-Confident, Seeking Social Support, Helpless Approach, and Submissive Approach sub-scales scores were found to be significant at p<0.05 level. The LSD Post Hoc test was performed to reveal the difference between the nurses in terms of their working times (Table 6).

According to the LSD Post-Hoc test results, the Perceived Stress Scale scores of the nurses working for 3-5 years were higher than the nurses which were working for 1-3 years and 5 years and above (p<0.05); and, the Optimistic Approach sub-scale scores of the nurses working for 5 years and above were significantly higher than that of nurses working for 1-3 years (p<0.05); Seeking Social Support Approach sub-scale scores of the nurses working for 1-3 years and 5 years and above were significantly higher than that of the nurses working for 3-5 years (p<0.05); and Helpless Approach and Submissive Approach sub-scale

scores of the nurses working for 3 years and above were significantly higher than the nurses working for 1-3 years (p<0.05) (Table 6).

The t values of the differences between the Perceived Stress Scale, Self-Confident Approach sub-scale, and Seeking Social Support scores of the nurses were significant at p<0.05 level in terms of being infected with the coronavirus (Table 6).

According to the COVID-19 infection status in the family of the nurses, the t values of the differences between the Perceived Stress Scale, Optimistic Approach, Self-Confident Approach, Helpless Approach sub-scale, and Submissive Approach scores were found to be significant at p<0.05 level (Table 6).

Table 6. The differences between Perceived Stress Scale scores and Ways of Coping Questionnaire scores of the nurses according to their descriptive characteristics

		Perceived Level of Stress	Optimistic Approach	Self-confident Approach	Seeking Social Support Approach	Helpless Approach	Submissive Approach
		X±S.D.	X±S.D.	X±S.D.	X±S.D.	X±S.D.	X±S.D.
Gender	Female	37.44±11.161	1.08±.854	1.21±.939	.63±.263	2.74±1.040	2.54±1.383
	Male	30.42±10.528	1.65±.774	1.79±.849	.74±.198	2.34±.914	2.56±.884
	TEST	**t=4.011 p=.000**	**t=-4.337 p=.000**	**t=-4.002 p=.000**	**t=-3.008 p=.003**	**t=2.519 p=.013**	t=-.089 p=.929
Age	18-24	35.00±11.054	1.14±.763	1.33±.886	.62±.225	2.59±.998	2.47±1.285
	25-30	35.53±12.027	1.34±.931	1.46±.982	.70±.272	2.65±1.024	2.58±1.191
	31-35	31.61±10.244	1.50±.819	1.61±.937	.70±.185	2.40±.983	2.58±1.113
	TEST	F=1.514 p=.223	F=1.756 p=.176	F=.824 p=.441	F=1.951 p=.146	F=.754 p=.472	F=.135 p=.874
Marital status	Single	34.19±10.938	1.23±.809	1.32±.870	.67±.235	2.54±1.025	2.51±1.221
	Married	35.04±12.383	1.51±.948	1.72±1.036	.70±.260	2.63±.973	2.63±1.148
	TEST	t=-.436 p=.664	t=-1.967 p=.051	**t=-2.526 p=.013**	t=-.872 p=.384	t=-.505 p=.614	t=-.544 p=.587
Having Children	Yes	36.09±10.433	1.39±.859	1.56±.964	.68±.210	2.86±.856	2.66±1.283
	No	34.21±11.573	1.31±.869	1.44±.944	.68±.249	2.53±1.023	2.53±1.183
	TEST	U=1343.500 p=.502	U=1337.000 p=.480	U=1377.000 p=.618	U=1470.000 p=.983	U=1125.000 p=.073	U=1332.500 p=.466
Education status	High school graduate	31.44±11.470	1.36±.753	1.59±.895	.72±.256	2.22±1.051	2.26±1.177
	Bachelor's degree	33.89±11.015	1.42±.850	1.54±.903	.69±.231	2.53±.968	2.51±1.163
	Postgraduate	39.50±12.176	.83±.888	.95±1.047	.58±.275	3.03±1.036	2.95±1.306
	TEST	**KW=7.094 p=.029**	**KW=7.527 p=.023**	**KW=8.066 p=.018**	KW=4.264 p=.119	**KW=7.222 p=.027**	KW=4.412 p=.110
	Difference	**3>1-2**	**1-2>3**	**1-2>3**	-	**3>1-2**	-
People Lived Together	Alone	33.85±12.472	1.31±.899	1.52±1.023	.71±.265	2.55±1.075	2.54±1.281
	Living with friends	36.35±9.293	1.21±.723	1.31±.789	.67±.229	2.39±.941	2.28±1.166
	Living with family	30.88±10.358	1.26±.721	1.34±.812	.65±.224	2.61±1.011	2.74±1.009
	Living with spouse and children	40.07±9.084	1.50±1.048	1.55±1.014	.66±.225	2.70±.875	2.48±1.247
	TEST	**KW=17.646 p=.001**	KW=2.310 p=.511	KW=4.668 p=.198	KW=2.291 p=.514	KW=1.083 p=.781	KW=2.700 p=.440
	Difference	**4>1-3**	-	-	-	-	-

According to willingness in working in emergency service, the t values of the differences between Perceived Stress Scale scores and seeking social support sub-scale scores were found to be significant at $p<0.05$ level (Table 6).

DISCUSSION

The findings of the study, which was conducted to investigate the perceived stress and coping strategies of the nurses working in the emergency service during the COVID-19 pandemic, were discussed in accordance with the relevant literature.

In the study, it was found that nurses working in the emergency service had an average Perceived Stress Scale score of 34.47±11.41, indicating a moderate level of perceived stress (Table 2). In the literature review on the studies discussing the perceived stress during the COVID-19 process, it was found that the average score of the perceived stress level was approximately moderate, which parallels our research findings (13).

Of the nurses included in the study, 21.8% had a low-stress score average, 47.4% had a moderate stress score average, and 30.8% had a higher stress score average (Table 3).

Looking at the literature, the fact that 71.5% of healthcare professionals experienced stress with a high score average during the pandemic emphasizes the importance of the issue (3). In another study, which investigated the perceived stress level in health care professionals, it was found that the perceived stress scale score was above the average (14). In the study, in which the sources of stress experienced by the nurses were identified, factors such as the insufficient number of nurses in institutions, lack of effective communication between colleagues and managers, inadequate physical facilities in the work environment, and excessive working hours were found to cause problems. In addition, nurses reported that their post-stress mood was quite negatively affected and that they felt unhappy, angry, and aggressive (15). There have also been studies reporting that exposure to verbal and physical violence in emergency services increases perceived stress (16). In this context, the research findings are in line with the literature.

In the research findings, the Ways of Coping Questionnaire results were evaluated together with its sub-scales. Of the effective coping styles, the Optimistic Approach sub-scale score average was 1.33±0.87, the Self-Confident Approach sub-scale score average was 1.46±0.94, and the Seeking Social Support Approach sub-scale score average was 0.68±0.24. Of the ineffective coping styles, the Helpless Approach sub-scale score average was 2.57±1.01, and the Submissive Approach sub-scale score average was 2.55±1.19, which were above the average (Table 3).

As the perceived level of stress increases, the scores of the Optimistic Approach, Self-Confident Approach, and Seeking Social

Support Approach sub-scales decrease, whereas the Helpless Approach and Submissive Approach sub-scale scores increase (Table 4). Looking at the findings, it is noteworthy that the Ways of Coping Questionnaire Helpless Approach sub-scale average was higher than that of other sub-scale averages.

A study found that the Seeking Social Support sub-scale score of the Ways of Coping Questionnaire was higher in nurses (17). In another study, it was found that the Ways of Coping Questionnaire self-confident approach, optimistic approach, and seeking social support sub-scale scores were higher in nurses (18). It was found that the psychological impact of the COVID-19 pandemic was much greater than expected (19). An increase in anxiety and stress was inevitable during the current pandemic and in past epidemics. Concerns of healthcare professionals about their ability to meet expected service in human health increase their job responsibility, affecting their stress factors and way of dealing with stress (20). As a result of the study, it is noteworthy that the higher Ways of Coping Questionnaire Helpless Approach sub-scale score average shows the helplessness experienced by the nurses during the pandemic.

In the study, the Optimistic Approach, Self-Confident Approach, and Seeking Social Support Approach sub-scale scores were found to decrease with the increase in the Perceived Stress Scale scores, but the Helpless Approach and Submissive Approach sub-scale scores were found to increase with increasing Perceived Stress Scale scores (Table 4).

Looking at the literature, it was found that there were limited studies on how health workers cope with stress throughout the pandemic. A study found that in the early stages of the coronavirus outbreak, people preferred the optimistic approach, seeking social support, and the self-confident approach more. It was found that individuals who soothe themselves by collecting information about the process using the self-confident approach exhibit more positive behaviors, it is easier to be patient and to accept the changing conditions using the optimistic approach, and the support of family and friends were found to be beneficial in getting rid of the stress caused by the outbreak, as well as protecting health (21).

In the study, the Perceived Stress Scale scores were found to significantly correlate with the Ways of Coping Questionnaire scores ($p<0.05$). It's seen that the Seeking Social Support Approach sub-scale, Helpless Approach sub-scale, and Submissive Approach sub-scale variables were significant predictors of the stress that nurses perceive (Table 5). In one study, it was found that the Self-Confident Approach, Optimistic Approach, and Seeking Social Support Approach resorted during stress reduces the effect of the stress, whereas the Helpless Approach and Submissive Approach were found to increase their stress (18).

Factors such as social isolation after the COVID-19 pandemic, fear of transmission and infection, and witnessing losses in the close circle are known to increase intolerance. It is believed that while media awareness activities yield positive results, emphasizing that young people have a high risk of spreading the disease and resulting in death seriously affects stress levels. As stated in the studies, the increase in boredom due to continuous lockdown negatively affected the psychological health of people, causing them unable to use their way of coping with stress (22), which explains higher average scores in the Helpless Approach and Submissive Approach sub-scales of the Ways of Coping Questionnaire.

According to the nurses' genders, the t values of the differences between the Perceived Stress Scale, Optimistic Approach sub-scale, Self-Confident sub-scale, Seeking Social Support sub-scale, and Helpless Approach sub-scale scores were found to be significant at $p<0.05$ level and Perceived Stress Scale scores of the females were found to be higher than that of males (Table 6).

Looking at the literature, there were studies reporting that the level of stress perceived by women who experienced intense fear of infecting their families and children during the epidemic was higher (13). In this context, the results of the study are in line with the results in the literature, indicating that the average score of the perceived stress level in the COVID-19 pandemic was higher in females. According to the marital status of the nurses, the t values of the differences between them were significant at $p<0.05$ level in terms of self-confident approach sub-scale scores (Table 6). Findings indicate a difference between Self-Confident Approach scores in terms of marital status, in favor of married people, suggesting that married people prefer the Self-Confident Approach, among the effective coping strategies, compared to single people, which may be due to psychological support from the spouses or living together with children.

According to the nurses' educational status, the differences between the Perceived Stress Scale, Optimistic Approach sub-scale, Self-Confident sub-scale, and Helpless Approach sub-scale scores were found to be significant at $p<0.05$ level (Table 6).

As the level of education increased, the Perceived Stress Scale and Helpless Approach sub-scale scores were found to increase, while as the level of education decreased, the Optimistic Approach and Self-Confident Approach sub-scale scores were found to increase. It may be concluded that an increase in educational level changes people's expectations and perspectives, which in turn can affect the results.

The KW values of the differences between the Perceived Stress Scale scores of the nurses were significant at $p<0.05$ level in terms of who they lived together with (Table 6). People living

with their spouses and children were found to have a higher perceived stress scale score than people living alone and with their families. It is believed that these findings may be due to nurses' fear of infecting their children and spouses during the pandemic. It is also noteworthy that living alone will decrease such fear but living together with family can increase psychological support.

According to the nurses' working times, the F values of the differences between Perceived Stress Scale, Optimistic Approach sub-scale, Self-Confident sub-scale, Seeking Social Support sub-scale, Helpless Approach sub-scale, and Submissive Approach sub-scale scores were found to be significant at $p<0.05$ level (Table 6).

The Perceived Stress Scale scores of the nurses working for 3-5 years were higher than the nurses which were working for 1-3 years and 5 years and above; and, the Optimistic Approach sub-scale scores of the nurses working for 5 years and above were significantly higher than that of nurses working for 1-3 years; Seeking Social Support Approach sub-scale scores of the nurses working for 1-3 years and 5 years and above were significantly higher than that of the nurses working for 3-5 years; and Helpless Approach and Submissive Approach sub-scale scores of the nurses working for 3 years and above were significantly higher than the nurses working for 1-3 years ($p<0.05$). The differences between the scale scores indicate that the nurses' working time can be effective in perceived stress levels and their strategies in coping with stress.

The t values of the differences between the Perceived Stress Scale, Self-Confident Approach sub-scale, and Seeking social Support scores of the nurses were significant at $p<0.05$ level in terms of being infected with the coronavirus (Table 6). This indicates that there is a difference in disfavor of those who suffer from the COVID-19 disease.

According to the COVID-19 infection status in the family of the nurses, the t values of the differences between Perceived Stress Scale, Optimistic Approach sub-scale, Self-Confident Approach sub-scale, Helpless Approach sub-scale, and Submissive Approach scores were found to be significant at $p<0.05$ level (Table 6).These findings suggest that the uncertainty of how relatives of nurses will survive the disease and the thought that their relatives may have the very same severe course seen in patients brought in with a coronavirus infection in the emergency service may also increase stress.

According to willingness in working in emergency service, the t values of the differences between Perceived Stress Scale scores and seeking social support sub-scale scores were found to be significant at $p<0.05$ level. These findings may indicate that the willingness of the nurses can affect perceived stress.

CONCLUSION

The perceived stress level score of the emergency service nurses was found to be above the average, and the Optimistic Approach, Self-Confident Approach, Seeking Social Support Approach sub-scale scores were found to decrease with the increase in the Perceived Stress Scale scores, but the Helpless Approach and Submissive Approach sub-scale scores were found to increase with increasing Perceived Stress Scale scores.

Ethics Committee Approval: In this study, the Ethics Committee approval from the Faculty of Medicine and the institutional permission from the relevant institution was obtained to conduct the study (no:B.30.2.ATA.0.01.00/), in accordance with the ethical principles set out in the Helsinki Declaration.
Peer-review: Externally peer-reviewed.
Author Contributions:
Concept, Design, Literature search, Data Collection and Processing, Analysis or Interpretation, Writing- NK, PSG
Conflict of Interest: No conflict of interest was declared by the authors.
Financial Disclosure: The authors declared that this study hasn't received no financial support.

REFERENCES

1. Available from: URL: https://tr.wikipedia.org/wiki/Pandemi access date: June 2022
2. Til UDA. What you need to know about the new coronavirus disease. Detail Magazine. 2020;8(85):54-56.
3. Lai J, Ma S, Wang Y, Cai Z, Hu J, Wei N, ve ark. Factors Associated with Mental Health Outcomes Among Health Care Workers Exposed to Coronavirus Disease. Journal of the American Medical Association. 2019;3(3).
4. Söyük S, Kurtuluş SA. Evaluation of the problems experienced in the emergency services from the eyes of the employees. Gumushane University Journal of Health Sciences. 2017;6(4):44-56.
5. Saquib N, Zaghloul MS, Saquib J, Alhomaidan HT, Al-Mohaimeed A, Al-Mazrou A. Association of cumulative job dissatisfaction with depression, anxiety and stress among expatriate nurses in Saudi Arabia. J Nurs Manag. 2019;27(4):740-748.
6. Cox RC, Olatunji BO. Sleep in the anxiety-related disorders: A meta-analysis of subjective and objective research. Sleep Med Rev. 2020;51:101282.
7. Kang L, Li Y, Hu S, Chen M, Yang C, Yang BX, et al. Mental health of healthcare workers dealing with the 2019 novel coronavirus in Wuhan, China. Lancet Psychiatry 2020;7(3):e14.
8. Ives J, Greenfield S, Parry JM, Draper H, Gratus C, Petts JI, et al. Healthcare workers' attitudes to working during pandemic influenza: a qualitative study. BMC Public Health. 2009;9(1):1-13.
9. Cohen S, Kamarck T, Melmerstein R. A Global Measure of Perceived Stress. Journal of Health and Social Behavior. 1983;24:385-396.
10. Baltaş Z, Atakuman Y, Duman Y. Standardization of the Perceived Stress Scale: Perceived Stress in Turkish Middle Managers, Stress and Anxiety Research Society, 19th International Conference: İstanbul. 1998
11. Folkman, S. and Lazarus, RS. If İt Changes, İt Must Be a Process: Study of Emotion and Coping During Three Stages of College Examination. Journal of Personality and Social Psychology. 1985;50:992–1003.
12. Şahin NH, Durak A. The scale of coping styles with stress: Adaptation for university students. Turkish Journal of Psychology. 1995;10(34):56-73.
13. Göksu Ö, Kumcağız H. Perceived stress level and anxiety levels in individuals in the Covid-19 Outbreak. Electronic Turkish Studies. 2020;15(4).

14. Aşkın A. Analysis of the relationship between the time of participation in leisure activities, perceived stress levels, and psychological resilience of healthcare professionals (doctors and nurses). Siyami Ersek Chest Cardiovascular Surgery Training and Research Hospital example. Istanbul: Gelisim University Institute of Health Sciences. 2019.
15. Özdaş İ, Kızılkaya M. Stress sources perceived by emergency room nurses: A qualitative study. Journal of Health Academics. 2021;8(1):64-70.
16. Altıntaş N. Determination of violence against nurses working in health institutions, Istanbul: Istanbul University Institute of Health Sciences. 2006.
17. Ferreira JS, Ribeiro KV, Caromuru PS, Hanzelmann RS, Velasco AR, Passos JP. Stress and coping strategies in workers of nursing of a family health unit. Cuidado e Fundamental. 2017;9(3):818-823.
18. Avcı GG, Öztürk G, Azaklı N, Çekinmez ST. Determination of work-related tension levels and coping styles of nurses working in a private group hospital. Izmir Katip Celebi University Faculty of Health Sciences Journal. 2018;3(1):1-7.
19. Shigemura J, Ursano RJ, Morganstein JC, Kurosawa M, Benedek DM. Public responses to the novel 2019 coronavirus (2019-nCoV) In Japan: mental health consequences and target populations. Psychiatry And Clinical Neurosciences. 2020;74(4):281- 282.
20. Dündar Y. Sen Tanrı mısın? ISBN: 978-605-88309-8-1 Ankara, 2016.
21. Hatun O, Dicle AN, Demirci İ. Psychological reflections of the coronavirus epidemic and coping with it. Electronic Turkish Studies. 2020;15(4).
22. Bilge Y, Bilge Y. Investigation of the effects of the coronavirus epidemic and social isolation on psychological symptoms in terms of resilience and coping styles with stress. Journal of Clinical Psychiatry 2020;23.

Middle Black Sea Journal of Health Science / Mid Blac Sea J Health Sci **November 2022; 8(4):563-569**

RESEARCH ARTICLE **DOI:** 10.19127/mbsjohs.1133894

Comparison of Primary Closure + Limberg Flap Combination with Primary Closure and Limberg Flap Alone in the Treatment of Pilonidal Sinus Disease: A Retrospective Study

Mümin Demir[1](ID), Çağrı Akalın[1](ID)

[1]Department of General Surgery, Ordu Training and Research Hospital, Ordu, Turkey

Received: 26 June 2022, Accepted: 11 September 2022, Published online: 30 November 2022

Abstract

Objective: There are no definite rules for the treatment of pilonidal sinus disease (PSD). The aim of this study was to compare the primary closure (PC)+ Limberg flap (LF) combination with PC and LF alone in the treatment of PSD.

Methods: Patients with PSD who underwent PC, LF and PC+ LF between 2013–2020 in Tokat State Hospital were included in the study. Age, gender, sinus classification, and recurrence were evaluated. PSD staging was performed according to the Tezel classification. Patients were divided into three groups as PC, LF and PC+LF according to type of operation.

Results: Ninety-four patients (mean age of 26.5 ± 6.9 years) were included in the study. Group PC consisted of 17 male and 7 female patients with a mean age of 27.04 (18–44) years; group LF comprised 24 male and 12 female patients with a mean age of 27.39 (18–46) years and group PC+LF comprised 22 male and 12 female patients with a mean age of 25.26 (18-47) years. There were no significant differences between groups in terms of age and gender (p=0.36, p=0.87, respectively). The mean operative time was significantly longer for the LF group than the PC+LF group (p<0.001). Recurrence rate was 41.7% in the PC group, compared to 17.6% for the PC+LF group (p=0.04). There were no significant differences between LF and PC+LF group regarding recurrence (p=0.43).

Conclusion: The PC+LF combination provided less recurrence compared to PC and shorter operation duration compared to LF.

Keywords: Pilonidal sinus, primary closure, Limberg technique, recurrence, operation time

Suggested Citation: Demir M, Akalın C. Comparison of primary closure + Limberg flap combination with primary closure and Limberg flap alone in the treatment of pilonidal sinus disease: a retrospective study. Mid Blac Sea J Health Sci, 2022;8(4):563-569.

Address for correspondence/reprints:
Name and Surname: Mümin Demir
Telephone number: + 90 (541) 948 79 33
E-mail: Demir55aze@outlook.com

INTRODUCTION

Pilonidal sinus disease (PSD) is a condition limiting daily activity, disrupting life comfort, and causing loss of labor. The disease is now believed to be multifactorial and related to the depth of the natal cleft, degree of hirsutism, family history, and obesity (1-3).

Though there are many conservative and surgical treatment methods defined for PSD treatment, the search for the ideal treatment continues in the present day with primary closure (PC) and Limberg flap (LF) performed for a long time. In addition to the advantage of short operative duration in PC, the excess recurrence probability compared to other surgical procedures is noteworthy. For LF operations, the opposite situation is present in terms of operative duration and recurrence (4). The short operative duration and low recurrence rate are desired for PSD surgery, while it is probable that the combination of these operations will provide the advantages of each operation type. In the literature, there are limited numbers of studies about the combination of these surgical procedures.

Considering the operation techniques of PC and LF, the combined form of these operations was performed. The aim of this study was to compare the PC + LF combination with PC and LF alone.

METHODS

We retrospectively analyzed patients diagnosed with PSD who were operated on in Tokat State Hospital between January 2013 and January 2020. Of these patients, the study included patients with PC, LF, and PC+LF operations. Patients with information that could not be reached and undergoing different surgical interventions were not included in the study. Patient information was obtained from hospital information systems and patient files. Patients were reached by telephone and patients with pain, swelling, or pilus in the operation field were called to the hospital.

The age, sex, sinus stage, and recurrence status of patients were recorded. PSD staging was performed according to the Tezel classification (5). Patients with PSD pilus in the operation field was accepted as recurrence. Patients were divided into three groups PC, LF, and PC+LF according to the operation type.

All operations were performed under anesthesia in the jack-knife position by a single surgeon. Patients had prophylactic antibiotic treatment (cefazolin 1 g) administered 30 minutes preoperatively. Patients were given analgesic treatment for pain control during the postoperative period (diclofenac sodium or paracetamol) and monitored in the general surgery clinic.

In the PC group, an elliptical incision was made around the sinuses/pits and further dissection is done by using cauterization till the whole tract was excised. Full through and through sutures were applied by using 1/0 monofilament polypropylene sutures. The

wound was closed in layers. The skin was closed in 2/0 monofilament polypropylene sutures.

In LF group, the tissue was totally excised down to presacral fascia with a rhomboid incision including all sinuses and pits. Following hemostasis, the flap from the right gluteal area was raised so that it included skin, subcutaneous tissue, and the fascia overlying the gluteus maximus, and rotated to cover the defect. Rhomboid was inserted into the defect so that the lower end did not remain in the intergluteal space. The flap was sutured to presacral fascia and subcutaneous skin with 1/0 polyglactin sutures. The skin was closed in 2/0 monofilament polypropylene sutures.

In the PC+LF group, elliptical incisions in the caudal region were made 2 cm lateral to include sinuses and pits in the intergluteal sulcus (including lateral tracts), while oblique incisions were used for primary excision in the cranial region. The subcutaneous tissue was closed with an interrupted layer of 3/0 polyglactin suture, and the skin was closed with 2/0 monofilament polypropylene sutures (Figure 1).

Statistical Analysis

Data were analyzed using Statistical Package for Social Sciences (SPSS) Version 26 for Windows® (Chicago, IL, USA). Descriptive statistics for continuous variables are expressed as mean, median, standard deviation, minimum, and maximum values; they are expressed as numbers and percentages for categoric variables. The data distribution was evaluated using the Kolmogorov-Smirnov test. Mann-Whitney U and Kruskal-Wallis tests were performed for continuous variables. The chi-square test was used to determine the relationship between categoric variables. P-value <0.05 was considered statistically significant.

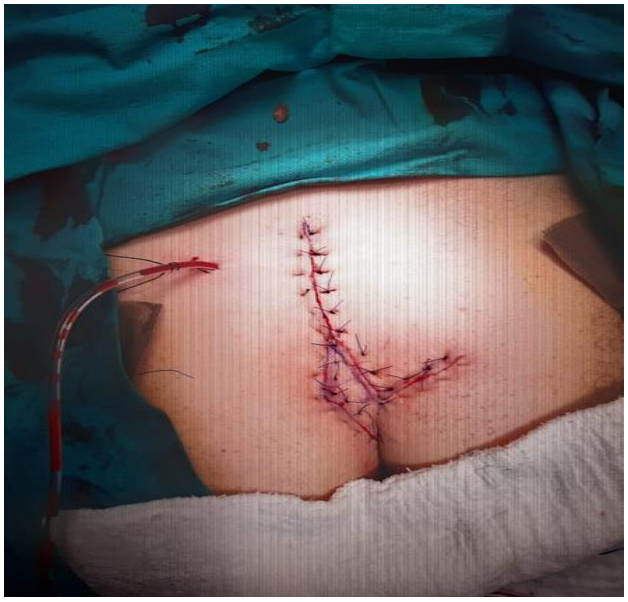

Figure 1. Postoperative view of PC+LF operation

RESULTS

Between 2013-2020, a total of 149 patients underwent PC, LF, and PC+LF. The information for 55 (36.9%) of these patients was not reached. Thus, a total of 94 patients (mean age 26.5 ± 6.9 years) were included in the study. Group PC consisted of 17 male and 7 female patients with a mean age of 27.04 (18–44) years; group LF comprised 24 male and 12 female patients with a mean age of 27.39 (18–

46) years and group PC+LF comprised 22 male and 12 female patients with a mean age of 25.26 (18-47) years. There were no significant differences between groups in terms of age and gender (p>0.05). The mean operative time was significantly longer for the LF group than the PC+LF group (p<0.001). The recurrence rate was 41.7% in the PC group, compared to 17.6% for the PC+LF group (p=0.04). There were no significant differences between LF and PC+LF groups regarding recurrence (p=0.43). Overall, the mean follow-up time was 29.53 ± 10.83 months. In the PC group, the mean follow-up time was statistically longer than in the other groups (p < 0.001). Demographic data and postoperative outcomes are summarized in Table 1.

Table 1. Demographic data and postoperative outcomes

	PC (n=24)	LF (n=36)	PC+LF (n=34)	p-value
Age (year)	27.04 ± 6.65	27.39 ± 7.27	25.26 ± 6.72	0.36
Gender				0.87
Male	17	24	22	
Female	7	12	12	
Sinus classification				0.003
Tezel I	-	-	-	
Tezel II	15	14	14	
Tezel III	8	8	16	
Tezel IV	-	11	2	
Tezel V	1	3	2	
Operation time (min)	28.63 ± 5.42	40.47 ± 6.34	36.24 ± 4.61	0.001
Recurrence	10	4	6	0.015
Follow-up time (month)	38.21 ± 12.44	28.72 ± 8.99	24.26 ± 7.28	**<0.001**

Values are presented as mean ± standard deviation. PC: Primary closure, LF: Limberg flap

DISCUSSION

Recurrence in PSD is mostly due to skipping of any sinus tract during operation, or the formation of infection or abscess of the wound; this may cause the formation of a new sinus tract within the scar tissue (6). Moreover, this involves many complications such as chronic wounds and even squamous cell carcinoma within sinus tracts (7). Therefore, the recurrence rate has become an advanced parameter for evaluating the effect of surgery. For this reason, recurrence after PSD surgery is an unwanted situation. After PSD treatment, those with the lowest recurrence rate of less than 6% had LF, Bascom Cleft Lift, and Karydakis flap surgery (8). The common feature of these surgical interventions is stated to be the removal of the natal cleft midline. Based on this thought, in our study we applied the combination of LF, removing the natal cleft midline, with PC surgery providing easy closure. This surgical procedure excised PSD with a primary incision performed to include fistulas progressing from the most distant pilus in the natal cleft or from the midline to lateral in addition to a rhomboid incision performed to include pilus or pits close to the anal region in the natal cleft. In this procedure, the LF in the

natal cleft is minimalized as much as possible with minimal incision applied to perform primary excision of the remaining PSD tissue.

In the literature, there are many studies comparing PC and LF for PSD treatment. The study by Elshalzy et al. (9) identified mean operative durations were 40.6 and 55.2 minutes for PC and LF, respectively, with a statistical difference in terms of operative durations. Similarly, a study in 2018 by Kartal et al. found operative durations were 26.9 min for PC and 54.3 min for LF and there were statistical differences in terms of these durations (10). In these studies, LF had longer surgical duration compared to PC and the reason was stated to be due to differences in the surgical technique. In our study, the operative duration was 28.63 min for PC and 40.47 min for LF and there was a statistically significant difference between the two groups, similar to the earlier studies.

However, the operative duration for PC+LF was similar to PC and statistically shorter than LF. Unfortunately, we could not compare our results objectively as there was no study found with a similar method in the literature. In spite of this, in terms of both surgical technique and incision, PC+LF was more advantageous compared to LF and we think the operative duration was shortened due to this.

In our study, according to the Tezel classification, the rates in the PC, LF, and PC+LF groups were no Tezel I patients, 62.5%, 38.9% and 41.2% in Tezel II, 33.3%, 22.2%, and 47.1% in Tezel III, 0%, 30.6%, and 5.9% in Tezel IV and 4.2%, 8.3% and 5.9% in Tezel V, respectively. There were significant differences in terms of distribution between the groups (p=0.003). In the 2009 review by Tezel et al., they stated that no surgical procedure was required for patients in Tezel I (5). In our study, in accordance with the authors' recommendation, Tezel I cases were not operated.

Additionally, Lee et al. recommended PC for Tezel I-IV and flap reconstruction for Tezel V cases (11). In our study, in the name of preventing possible recurrence, PC was performed for only one patient in Tezel V, with flap reconstruction performed for the other 5 patients. Moreover, considering that sinus tracts extending laterally may be missed in PC, LF or PC+LF was performed instead of PC for sinus orifices extending toward the lateral (Tezel IV). For recurrence of PSD, clinical recurrence was not identified to be different between LF and PC+LF, though not statistically due to the low number of patients (11.1% and 17.6%, respectively). Moreover, the PC+LF recurrence rate was identified to be significantly low compared to PC, but similar to LF (p=0.04, p=0.43, respectively).

A meta-analysis by Horwood et al. comparing PC and LF identified recurrence rates as 8.4% for PC and 0.79% for LF, with the clinical recurrence rate identified to be lower for LF (12). However, a study in 2013 by

Karaca et al. comparing PC and LF identified the recurrence rate as 9.2% for PC and 7.1% for LF, with no statistical difference identified between the two groups (13). In our study, the recurrence rates were 41.7% for PC, 11.1% for LF, and 17.6% for PC+LF. PC had a higher recurrence rate and longer follow-up duration compared to the other groups. A systematic review and meta-analysis by Stauffer et al. including more than 80,000 PSD cases concluded that the recurrence rate in PSD was largely linked to the follow-up duration and that PC was associated with the highest recurrence rate (14). For this reason, we think the longer follow-up duration for PC patients may have increased the recurrence rate. Unfortunately, if we consider the new operation technique we performed in recent years, the difference in terms of follow-up duration with other operations is unavoidable.

Our study has some disadvantages. The first is that the majority of patients could not be reached due to the retrospective design of our study and for this reason the population in the study groups is limited. Second, for the same reason, some parameters like postoperative pain, comfort, and duration to return to work could not be evaluated for patients. We could not measure the incision length due to the retrospective design of the study; in spite of this, theoretically, we think it was longer compared to PC and shorter compared to LF. For this reason, the shorter incision length may have positively affected the postoperative pain, comfort, and return to work duration. We believe prospective-randomized studies including these parameters will contribute to the literature in a similar way to our study. Third, as patients were communicated with by telephone, only patients with a probability of recurrence were examined. For this reason, patients with recurrence but without complaints may have been missed. Additionally, as this surgical procedure we performed is a new procedure, standardization in terms of procedure was deficient. If we accept that surgical procedures develop as the years pass, we believe our procedures will develop in future years.

CONCLUSION

According to the results of this study, the PC+LF surgical combination ensured less recurrence compared to PC and shorter operation time compared to LF.

Ethics Committee Approval: Ethical approval for this study was obtained from the Clinical Research Ethics Committee of Ordu University, Faculty of Medicine (Approval number: 12/150, Date: 17.06.2021).
Peer-review: Externally peer-reviewed.
Author Contributions: Concept and Design: MD, ÇA; Data Collection: MD, ÇA; Literature search: MD, ÇA; Analysis or Interpretation, Writing: MD, ÇA.
Conflict of Interest: No conflict of interest was declared by the authors.
Financial Disclosure: The author declared that this study hasn't received any financial support.

REFERENCES

1. Khanna A, Rombeau JL. Pilonidal disease. Clin Colon Rectal Surg. 2011;24:46–53.

2. Akinci OF, Bozer M, Uzunköy A, Düzgün SA, Coskun A. Incidence and aetiological factors in pilonidal sinus among Turkish soldiers. Eur J Surg. 1999;165:339–42.
3. Ahmed, AK, McCallum I, King PM, Bruce J. Healing by Primary versus secondary intention after surgical treatment for Pilonidal sinus. Cochrane Database Syst Rev. 2010:CD006213.
4. Mahdy T. Surgical treatment of the pilonidal disease: primary closure or flap reconstruction after excision. Dis Colon Rectum. 2008;51(12): 1816-22.
5. Tezel E, Bostancı H, Azılı C, Kurukahvecioglu O, Anadol Z. A New Perspective on Pilonidal Sinus Disease and Its Treatment.Marmara Medical Journal. 2015;22(1):85-89.
6. el-Khadrawy O, Hashish M, Ismail K, Shalaby H. Rhomboid flap outcome for recurrent pilonidal disease. World J Surg. 2009;33(5):1064–68.
7. Bi S, Sun K, Chen S, Gu J. Surgical procedures in the pilonidal sinus disease: a systematic review and network meta-analysis. Sci Rep. 2020;10(1):13720.
8. Vartanian E, Gould DJ, Lee SW, Patel KM. Pilonidal Disease: Classic and Contemporary Concepts for Surgical Management. Ann Plast Surg.2018;81(6):e12-e19. doi:10.1097/SAP.0000000000001585.
9. Elshazly WG, Said K. Clinical trial comparing excision and primary closure with modified Limberg flap in the treatment of uncomplicated sacrococcygeal pilonidal disease. Alexandria Journal of Medicine. 2012;48(1):13-18.
10. Kartal A, Aydın HO, Oduncu M, Ferhatoglu MF, Kıvılcım T, Filiz AI. Comparison of Three Surgical Techniques in Pilonidal Sinus Surgery. Prague Med Rep. 2018;119(4):148-155. doi: 10.14712/23362936.2019.2.
11. Lee PJ, Raniga S, Biyani DK, Watson AJ, Faragher IG, Frizelle FA. Sacrococcygeal pilonidal disease. Colorectal Dis. 2008;10(7):639–650.
12. Horwood J, Hanratty D, Chandran P, Billings P. Primary closure or rhomboid excision and Limberg flap for the management of primary sacrococcygeal pilonidal disease? A meta-analysis of randomized controlled trials. Colorectal Dis. 2012;14(2):143-51. doi: 10.1111/j.1463-1318.2010.02473.x.
13. Karaca AS, Ali R, Capar M, Karaca S. Comparison of Limberg flap and excision and primary closure of pilonidal sinus disease, in terms of quality of life and complications. J Korean Surg Soc. 2013;85(5):236-9. doi: 10.4174/jkss.2013.85.5.236
14. Stauffer VK, Luedi MM, Kauf P, Schmid M, Diekmann M, Wieferich K, Schnüriger B, Doll D. Common surgical procedures in pilonidal sinus disease: A meta-analysis, merged data analysis, and comprehensive study on recurrence. Sci Rep. 2018;8(1):3058. doi: 10.1038/s41598-018-20143-4.

Middle Black Sea Journal of Health Science / Mid Blac Sea J Health Sci **November 2022; 8(4):570-580**

RESEARCH ARTICLE **DOI:** 10.19127/mbsjohs.1134902

The Effects of Polymerization in Different Light Power Modes on the Radiopacity of Composite Resins

Çiğdem Güler[1(ID)], Zerrin Ünal Erzurumlu[2(ID)], Didem Odabaşı[1(ID)], Ebru Uslu Cender[3(ID)], Kerem Erzurumlu[4(ID)]

[1]Department of Pediatric Dentistry, Faculty of Dentistry, Ordu University, Ordu, Turkey
[2]Department of Oral and Maxillofacial Radiology, Faculty of Dentistry, Ordu University, Ordu, Turkey
[3]Department of Restorative Dentistry, Faculty of Dentistry, Ordu University, Ordu, Turkey
[4]Department of Computer Programming, Vocational School of Technical Sciences, Ordu University, Ordu, Turkey

Received: 24 June 2022, Accepted: 12 September 2022, Published online: 30 November 2022

Abstract

Objective: The aim of this study is to evaluate the effect of polymerization in different light power modes on the radiopacity of six different composite resins (Filtek Z250, Xtrafil, Tetric N Ceram, SureFil SDR Flow, Nova Compo HF, Grandio Flow).

Methods: Plexiglass molds (8 mm diameter, 2 mm thickness) were used for the preparation of the samples. Totally ten samples were formed for each composite resin (standard mode; n=5 and extra power mode; n=5). A 2-mm-thickness buccolingual section was obtained from the extracted premolar tooth for enamel and dentin samples. To evaluate the relationship between the density of the samples and tooth structure, an Al step wedge was used as a reference. The mean gray values of each composite resin, enamel, dentin, and Al step wedge were calculated with an image analysis program. Data were analyzed with an independent sample t-test, one-way ANOVA, and Tukey HSD test.

Results: All tested composites met ISO standards. Even if the radiopacity values of tested composites changed according to the light power mode, this change was found to be statistically significant only in SureFil SDR Flow ($p=0.037$). The difference between the radiopacity values of tested composites in both standard power and extra power mode was statistically significant ($p<0.01$). The highest radiopacity values were produced by the bulk-fill composites in both standard and extra power modes.

Conclusion: In this study, all tested composites were found to have sufficient radiopacity for restorations according to the criteria set by the ISO.

Keywords: Radiopacity, bulk fill composite resin, flowable composite resin

Suggested Citation: Guler C, Unal Erzurumlu Z, Odabasi D, Uslu Cender E, Erzurumlu K. The Effects of Polymerization in Different Light Power Modes on the Radiopacity of Composite Resins. Mid Blac Sea J Health Sci, 2022;8(4):570-580.

Address for correspondence/reprints:
Name and Surname: Cigdem Güler
Telephone number: +90 (452) 212 12 86
E-mail: cigdem_zehir@yahoo.com

INTRODUCTION

Composite resins are restorative materials used to provide aesthetics in the anterior region. Today, with the importance of dental aesthetics, composite resins have started to be used frequently in the posterior region. As known in the posterior region, the working area is narrow, and the risk of contamination is high. In direct composite restorations, the incremental layering technique is considered as the standard procedure since it reduces polymerization shrinkage stress and provides an adequate depth of cure (1,2). New materials such as highly filled flowable, bulk fill flowable, or non-flowable composites are developed in order to improve the physical and mechanical properties of composite resins and increase the clinical success rate.

Flowable resin composites were first introduced in 1996 (3). These materials have higher flow, easier application, better adaptation, and more elasticity (4,5). Bulk fill composites have lower viscosity compared with conventional composites but show lower polymerization shrinkage compared to flowable composites (6). The biggest advantage of bulk-fill composite resins is that they can be applied in bulk (single layer) with a thickness of 4-6 mm, shortening the clinical study time, showing low polymerization shrinkage, and having a high polymerization degree (7). Other advantages are that it provides ease of application to the dentist, better adaptation of the composite layer, no gap formation between the layers, good abrasion resistance against chewing forces, sufficient radiopacity, increased translucency, surface properties and color matching are clinically acceptable levels (8,9).

It is the polymerization mechanism that significantly affects the physical and mechanical properties of composite resins. The Light intensity of at least 400 mW / cm^2 has been recommended for the polymerization of composite resins (10). It is thought that short-term application of high light intensity and long-term application of low light intensity can provide equal polymerization degrees (11,12). Adequate polymerization does not occur in composite resins when light of the appropriate wavelength is not given. In addition, the polymerization reaction is affected by many factors such as layer thickness, type and color of the restorative material, type and intensity of light source used, polymerization time, and the diameter of the light tip. Lack of polymerization of composite resins affects mechanical properties, biocompatibility, volumetric shrinkage, degree of polymerization, and depth of polymerization (13). When composite resins are not sufficiently polymerized, their physical and mechanical properties weaken, and monomer is released into the environment. These residual monomers can cause estrogenic (14), mutagenic (15), genotoxic (16,17), and cytotoxic effects (18,19).

Radiopacity is an essential feature of all restorative materials. The Radiopacity value of restorative dental materials is generally detected by comparing them with enamel, dentin, or aluminum (20,21). It is stated by the International Standards Organization (ISO 4049) that the radiopacity of dental materials is to be equal to or greater than the same thickness of aluminum (22). The radiopacity of restorative dental materials should be both distinguishable from dental tissue and radiopaque enough to be distinguished from a void (23). The

adequate radiopacity of the restorative dental material allows the clinician to evaluate and detect secondary caries, voids, overhangs, and open margins and distinguish them from neighboring anatomical structures (24).

The difference in radiopacity of restorative materials results from the difference in monomeric resin formulations and filler properties of dental materials such as type, particle size, and volume of filler. Studies have observed remarkable differences in radiopacity between different restorative materials (25,26). Although a number of studies have been conducted on the radiopacity of bulk fill or flowable composite materials (21,27-31), there was no report in the literature about the effects of polymerization in different light power modes on the radiopacity of composite resins. The aim of the present study was to evaluate the effects of polymerization in different light power modes on the radiopacity of composite resins. The null hypotheses tested were that 1) polymerization in different light power modes would not affect the radiopacity of tested composite resins 2) no difference between the radiopacities of the tested composite resins.

METHODS

Sample Preparation

This study tested the radiopacity of six different composite resins (Filtek Z250, Xtrafil, Tetric N Ceram, SureFil SDR Flow, Nova Compo HF, and Grandio Flow). In order to determine the number of samples for each composite resin, a Power analysis was conducted by taking into account the study of Tarcin et al. (31). For each composite resin used in the study, a total of ten samples (Power 0.86) were formed according to light power modes (standard mode; n=5 and extra power mode; n=5). A total of sixty samples were prepared. The type, manufacturers, filler type, and filler loading of tested composite resins are listed in Table 1 (8,31-33).

Table 1. The type, manufacturers, filler type, and filler loading of tested composite resins

Composite Resin	Type	Manufacturer	Filler type	Filler loading (% volume)	Reference
Filtek Z250	Microhybrid	3M ESPE, St. Paul MN, USA	Zirconia/silica	60	8
X-tra fil	Microhybrid Bulk fill	VOCO, Cuxhaven, Germany	Barium-boron-alumino-silicate glass	70	32
Tetric® N-Ceram	High-viscosity bulk fill	Ivoclar Vivadent (Schaan, Liechtenstein)	Barium aluminum silicate glass, prepolymer filler	60	33
SureFil SDR Flow	Bulk fill flowable	Dentsply DeTrey, Konstanz, USA	Barium-alumino-fluoro-borosilicate glass, strontium alumino-fluorosilicate glass	45	31
Nova Compo HF	Nanohybrid flowable	Imicryl, Konya, Türkiye	Silanated barium glass, ytterbium, silanated higly dispersed silicon dioxide, silica-zirconia and prepolymer	55-61	Manufacturer
Grandio Flow	Nanohybrid flowable	VOCO, Cuxhaven, Germany	Barium-alumina borosilicate, silica	65.6	31

Plexiglass molds (8 mm diameter, 2 mm thickness) were used for the preparation of the samples to be tested. VALO third-generation LED light cure unit (Ultradent Products Inc., South Jordan, UT, USA) was used for polymerization. According to the manufacturer's instructions, the light was applied for 20 s once in standard mode (1000 mW/cm^2) and for 3 s twice in extra power mode (3200 mW/cm^2) for the polymerization of each composite resin. The polymerized samples were meticulously removed from the plexiglass mold. Samples were polished with standard procedures. It was checked whether the thickness of the samples was 2 mm using a digital caliper (Altas, 905 model, Istanbul, Turkey). One extracted intact human premolar was used for the enamel and dentine samples. This study was approved by Ordu University Clinical Research Ethic Committee (2021/115). The patient was informed that their tooth was to be extracted for orthodontic treatment.

In addition, written informed consent was obtained from the patient who confirmed that one of the extracted teeth was to be used in this in vitro study. The tooth was cut buccolingual using a slow-speed diamond saw (Mecatome T180, Presi SA, Angonnes, France) under water cooling. One enamel and dentin slab with a thickness of 2±0.2 mm was obtained.

Radiopacity Analysis

To evaluate the relationship between the density of the composites and tooth structure, an Aluminum (Al) step wedge (each step made 1mm thick, 4x6mm, 99.5% pure Al) was used as a reference. First of all, a tooth section containing enamel and dentine, an aluminum steep wedge sample polymerized in standard mode, and a sample polymerized in extra power mode from each tested composite were placed on the center of the size 4 photo-stimulated phosphor plate (Carestream CS7600, Carestream Health Inc., Rochester, NY, USA). The phosphor plate was exposed at 70 kVp, 7 mA, 0.3s at a distance of 30 cm and an angle of 90 degrees with a special holder apparatus. On the digital image (Fig. 1) obtained with the scanner (KODAK CR7600, Carestream Health Inc., Rochester, NY, USA), with 50x50 pixels region of interest (ROI) from the samples for each composite, the steps of the Al step wedge, enamel, and dentin were selected (34). The mean gray value (MGV) of each ROI was measured with the histogram function of an image analysis program (ImageJ 1.52a, National Institutes of Health, USA), and after that, the calibration curve creation was performed (34). Average mm Al thicknesses for each composite resin, enamel, and dentin were determined using the calibration curve. These processes were repeated independently for each of the five digital images. The mean mm Al thicknesses were detected for each composite resin, enamel, and dentin.

Statistical Analysis

All statistical evaluations were made with SPSS v26 statistical software (IBM Inc., Chicago, IL, USA). α was set as 0.05. The homogeneity of the radiopacity values was checked with The Kolmogorov-Smirnov normality test. To investigate the significant differences in radiopacity values for each composite resin according to light power modes, data were analyzed with an independent sample t-test. To study the significance of the differences between the composites, enamel, and dentin, data were analyzed with one-way ANOVA. The Tukey HSD test was applied for comparisons.

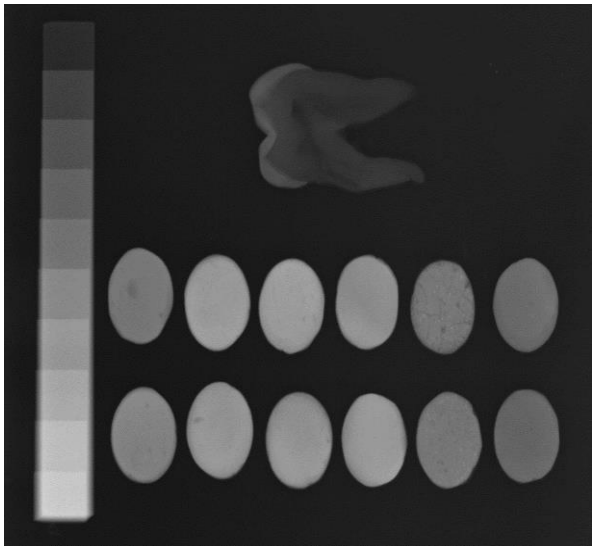

Figure 1: Representative radiograph showing of composite resins, Al step wedge, and tooth. Top row from left to right (extra power mode): Filtek Z250, Xtrafil, Tetric N Ceram, SureFil SDR Flow, Nova Compo HF, Grandio Flow.Bottom row from left to right (standard mode): Filtek Z250, Xtrafil, Tetric N Ceram, SureFil SDR Flow, Nova Compo HF, Grandio Flow

Table 2. The radiopacity values of tested composites according to light power mode.

Materials	Mean Radiopacity ±SD (mm eq AL)		p*
	Standard Mode	Extra Power Mode	
Filtek Z250	5.41±0.52	5.07±0.69	0.406
X-tra fil	6.91±0.76	6.75±0.53	0.703
Tetric® N-Ceram	6.35±1.14	7.05±0.46	0.241
SureFil SDR Flow	6.62±0.33	6.10±0.31	**0.037**
Nova Compo HF	4.51±0.21	4.62±0.38	0.590
Grandio Flow	3.51±0.10	3.38±0.46	0.538

p* Independent sample t test

RESULTS

All the tested composite resins met ISO standards. Table 2 presents the radiopacity values of tested composites according to light power mode. Even if the radiopacity values of all composites tested changed according to the light power mode, this change was found to be statistically significant only in SureFil SDR Flow (p=0.037). The highest radiopacity values were produced by the bulk-fill composites in both standard and extra power mode. The lowest radiopacity values were produced by the flowable composites in both standard and extra power mode.

The difference between the radiopacity values of all materials in both standard power and extra power mode was statistically significant (p=0.01). A comparison of the radiopacity values of the six composite resins, enamel, and dentin samples are shown in Table 3 for the standard power mode.

Table 3. Comparison of the radiopacity of tested composite resins for the standard power mode, enamel and dentin samples

Materials	Mean Radiopacity ±SD (mm eq AL)
Dentin	2.25 ± 0.21^{a}
Grandio Flow	3.51 ± 0.10^{b}
Enamel	3.70 ± 0.10^{b}
Nova Compo HF	4.51 ± 0.21^{bc}
Filtek Z250	5.41 ± 0.52^{cd}
Tetric® N-Ceram	6.35 ± 1.14^{de}
SureFil SDR Flow	6.62 ± 0.33^{e}
X-tra fil	6.91 ± 0.76^{e}
p*	**0.001**

p* One way ANOVA
Different superscripts show statistically significant difference according to Tukey HSD multiple comparison test.

The comparison of the radiopacity of tested composite resins, enamel, and dentin samples are presented in Table 4 for the extra power mode. In both standard and extra power mode, the radiopacity of all composites was found to be higher than those of the enamel, except Grandio Flow. In the standard power mode, the highest and lowest radiopacity values were determined as X-tra fil and Grandio Flow, respectively. In the extra power mode, the highest and lowest radiopacity values were

determined as Tetric® N-Ceram and Grandio Flow, respectively.

Table 4. Comparison of the radiopacity of tested composite resins for the extra power mode, enamel and dentin samples

Materials	Mean Radiopacity ±SD (mm eq AL)
Dentin	2.25±0.21[a]
Grandio Flow	3.38±0.46[b]
Enamel	3.70±0.10[b]
Nova Compo HF	4.62±0.38[c]
Filtek Z250	5.07±0.69[c]
SureFil SDR Flow	6.10±0.31[d]
X-tra fil	6.75±0.53[ef]
Tetric® N-Ceram	7.05±0.46[f]
p*	**0.001**

p* One way ANOVA
Different superscripts show statistically significant difference according to Tukey HSD multiple comparison test.

DISCUSSION

Adequate radiopacity of the restorative dental material allows the clinician to evaluate on radiographs. There was no report in the literature about the effects of polymerization in different light power modes on the radiopacity of composite resins. Therefore, this study was conducted.

In the current study, all the tested composites met ISO standards. Even if the radiopacity values of all composites changed according to the light power mode, this change was found to be statistically significant only in SureFil SDR Flow. Therefore, the first null hypothesis was partially rejected. In our study, the difference between the radiopacity of tested composite resins was statistically significant in both standard power and extra power mode (p=0.01). The highest radiopacity values were produced by the bulk-fill composites in both standard and extra power mode. In addition, the lowest radiopacity values were produced by the flowable composites in both standard and extra power mode. Therefore, the second null hypothesis was rejected.

Digital or conventional radiography can be used to measure the radiopacity of restorative materials (23). Digital image analysis is considered as a fast and easy method for the evaluation of the radiopacity of dental restorative materials (35). Digital radiographic systems enable the use of lower radiation doses compared with conventional films. In addition, digital radiographic systems eliminated the potential error related with processing conventional films (23,25,35). Because of these advantages, a digital radiographic system was used in our study.

The most important factor affecting the radiopacity of a restorative material is the composition of the material (26,36). The filler volume and the mass percentage of opacifiers in the filler particles should be more than 70% and 20% respectively to obtain a higher radiopacity value of dental composites than enamel (37). Researchers reported that restorative dental materials with high atomic number filler particles, such as barium, zirconium, and strontium, showed higher radiopacity values (37). However, quartz, lithium-aluminum glasses, and silica are not radiopaque. They are incorporated with other

filler particles into the inorganic filler phase of resin composites. According to the results of our study, the difference between the radiopacity values of composites in both standard power and extra power mode was found to be statistically significant ($p<0.01$). The highest radiopacity values were found in bulk fill composite resins. In the standard and extra power mode, the highest radiopacity values were determined as X-tra fil and Tetric® N-Ceram, respectively. X-tra fil and Tetric® N-Ceram bulk fill composite materials contain barium (Ba, atomic number: 56). In addition, filler loading (% volume) of X-tra fil and Tetric® N-Ceram bulk fill composite materials are 60 and 70, respectively. The type and amount of radiopaque filler particles may have contributed to a high level of radiopacity in bulk-fill composite resins.

The radiopacity value of the restorative material should be equal to or slightly higher than that of the enamel. Materials with higher radiopacity than that of enamel are favorable for a true-negative diagnosis (38). In addition, the radiopacity value of the restorative materials should not be lower than that of the dentine in order to be distinguished from decalcified dentine (39). In our study, the radiopacity of all tested composites was found to be higher than those of dentin. However, the radiopacity of only Grandio Flow was found to be lower than those of the enamel. Grandio Flow is a nanohybride flowable composite. Grandio Flow filler loading (% volume) is 65.6. This flowable composite contains barium and silica. Even though barium is radiopaque, silica is not radiopaque. The silica may have caused lower radiopacity than enamel.

In previous studies, different radiopacity values were detected for flowable or bulk-fill flowable composites (21,27-31). Yildirim et al. reported that the radiopacity of SureFil SDR Flow was higher than enamel and dentin. While Gul et al. (28) reported that the radiopacity of Grandio Flow is higher than that of enamel, Dukic et al. (30) reported that the radiopacity of Grandio Flow was similar to enamel with slight deviations at different exposure values. Tarcin et al. reported that while the radiopacity of Grandio Flow was similar to enamel, the radiopacity of SureFil SDR Flow was higher than enamel (31). In our study, the radiopacity of only Grandio Flow was found to be lower than those of the enamel. The differences in radiopacity values for the same restorative material from different studies can result from many factors such as variations in polymerization time, power mode for polymerization, purity of the Al step wedge, using different imaging techniques, different exposure factors, and thickness of the restorative materials.

The total radiant energy is calculated by radiant power (mW) × time (s) (40). In our study, two different modes (standard and extra power modes), which are frequently preferred

in clinical applications, were used for the polymerization of composite resins. For the polymerization of composite resin, light is recommended for 20 s once in standard mode (1000mW/cm^2) and for 3 s twice in extra power mode (3200 mW/cm^2). Even if the radiopacity values of tested composites changed according to the light power mode, this change was found to be statistically significant only in SureFil SDR Flow in the present study. In extra power mode, total radiant energy was 19.2 J/cm^2 while it was 20 J/cm^2 in standard mode. The fact that the total radiant energy value obtained in these two modes was very close to each other may have contributed to the result. There was no report in the literature about the effects of polymerization in different light power modes on the radiopacity of composite resins.

When the radiopacity value of each composite tested in our study was compared according to the power mode, it was found that the radiopacity decreased in the extra power mode, except Tetric® N-Ceram and Nova Compo HF. Tetric® N-Ceram bulk fill composite contains Ivocerin, an additional photoinitiator that is considered to be more effective than camforoquinone as a photoinitiator. The absorption range of Ivocerin is 390–445 nm (41) and the absorbance maximum is 418 nm (42). Ivocerin in Tetric® N-Ceram may be responsible for the increase in radiopacity by contributing to polymerization depth and degree of conversion of the material in the extra power mode. Even if the radiopacity values of all composites changed according to the light power mode, this change was found to be statistically significant only in SureFil SDR Flow ($p=0.037$). The radiopacity of Surefil SDR Flow is reduced in extra power mode. The differences of the type and amount of radiopaque filler particles, insufficient polymerization, and low polymerization time may have contributed to the low level of radiopacity for extra power mode in SureFil SDR Flow. Polymerization with extra power at a short period of time can affect the polymerization depth, degree of conversion, and radiopacity of composite resins.

This study is considered to have some limitations. First, this study is an in vitro study. Second, thermal cycles or aging procedures applied to simulate the effects of the oral environment were not conducted on the composites tested in our study. Third, the effect of two different power modes of the same light device on radiopacity was tested. Finally, samples were prepared in 2 mm thickness. The results may vary with different parameters such as light device, polymerization time, irradiation parameters, thickness, and oral environments. Additional research should be conducted to evaluate the effect of different parameters on the radiopacity of composite resins.

CONCLUSION

1. All of the tested composite resins met ISO standards.

2. Even if the radiopacity of tested composite resins changed according to the light power mode, this change was found to be statistically significant only in SureFil SDR Flow.

3. The difference between the radiopacity of tested composite resin materials in both standard power and extra power mode was found to be statistically significant. The highest radiopacity values were produced by the bulk-fill composites in both standard and extra power modes. The lowest radiopacity values were produced by the flowable composites in both standard and extra power modes.

Ethics Committee Approval: This study was approved by Ordu University Clinical Research Ethic Committee (2021/115).
Peer-review: Externally peer-reviewed.
Author Contributions: Concept: CG, ZUE, DO, EUC; Design: CG, ZUE, DO, EUC; Literature Search: CG, ZUE, DO, EUC; Data Collection and Processing: CG, ZUE; Analysis or Interpretation: KE; Writing: CG, ZUE, DO, EUC
Conflict of Interest: No conflict of interest was declared by the authors.
Financial Disclosure: The author declared that this study hasn't received any financial support.

REFERENCES

1- Park J, Chang J, Ferracane J, Lee IB. How should composite be layered to reduce shrinkage stress: Incremental or bulk filling? Dent Mater. 2008;24(11):1501-1505.
2- Abbas G, Fleming GJP, Harrington E, Shortall ACC, Burke FJT. Cuspal movement and microleakage in premolar teeth restored with a packable composite cured in bulk or in increments. J Dent. 2003;31(6):437-444.
3- Imperiano MT, Khoury HJ, Pontual MLA, Montes MAJR, da Silveira MMF. The comparative radiopacity of four low viscosity composites. Braz J Oral Sci. 2007;6(20):1278-1282.
4- Attar N, Tam LE, McComb D. Flow, strength, stiffness and radiopacity of flowable resin composites. J Can Dent Assoc. 2003;69(8):516-521.
5- Jandt KD, Al-Jasser AM, Al-Ateeq K, Vowles RW, Allen GC. Mechanical properties and radiopacity of experimental glass-silica-metal hybrid composites. Dent Mater. 2002;18(6):429-435.
6- Czasch P, Ilie N. In vitro comparison of mechanical properties and degree of cure of bulk fill composites. Clin Oral Investig. 2013;17(1):227-235.
7- Nascimento AS, Lima DB, Fook MVL, Albuquerque MS, Lima EA, Sabino MA, et al. Physicomechanical characterization and biological evaluation of bulk-fill composite resin. Braz Oral Res. 2018;32:e107.
8- El-Damanhoury H, Platt J. Polymerization shrinkage stress kinetics and related properties of bulk-fill resin composites. Oper Dent. 2014;39(4):374-382.
9- Leprince JG, Palin WM, Vanacker J, Sabbagh J, Devaux J, Leloup G. Physico-mechanical characteristics of commercially available bulk-fill composites. J Dent. 2014;42(8):993-1000.
10- Türkoglu O, Bulut AC. Polymerization Light-Curing Units from Past to Present. J Dent Fac Atatürk Uni. 2019;29(4):683-690.
11- Halvorson RH, Erickson RL, Davidson CL. Energy-dependent polymerization of resin-based composite. Dent Mater J. 2002;18(6):463-469.
12- Price RB, Felix CA, Andreou P. Effects of resin composite composition and irradiation distance on the performance of curing lights. Biomaterials. 2004;25(18):4465-4477.
13- Ishikiriama SK, Valeretto TM, Franco EB, Mondelli RF. The influence of "C-factor" and light activation technique on polymerization contraction forces of resin composite. J Appl Oral Sci. 2012;20(6):603-606.

14- Darmani H, Al-Hiyasat AS. The effects of BIS-GMA and TEG-DMA on female mouse fertility. Dent Mater. 2006;22(4):353-358.
15- Schweikl H, Schmalz G. Triethylene glycol dimethacrylate induces large deletions in the hprt gene of V79 cells. Mutat Res. 1999;438(1):71-78.
16- Visalli G, Baluce B, La Maestra S, Micale RT, Cingano L, De Flora S, et al. Genotoxic damage in the oral mucosal cells of subjects carrying restorative dental fillings. Arch Toxicol. 2013;87(12):2247-2248.
17- Tadin A, Galic N, Mladinic M, Marovic D, Kovacic I, Zeljezic D. Genotoxicity in gingival cells of patients undergoing tooth restoration with two different dental composite materials. Clin Oral Investig. 2014;18(1):87-96.
18- Knezevic A, Zeljezic D, Kopjar N, Tarle Z. Cytotoxicity of composite materials polymerized with LED curing units. Oper Dent. 2008;33(1):23-30.
19- Chang HH, Chang MC, Lin LD, Lee JJ, Wang TM, Huang CH, et al. The mechanisms of cytotoxicity of urethane dimethacrylate to Chinese hamster ovary cells. Biomaterials. 2010;31(27):6917-6925.
20- Chan DCN, Titus HW, Chung KH, Dixon H, Wellinghoff ST, Rawls HR. Radiopacity of tantalum oxide nanoparticle filled resins. Dent Mater. 1999;15(3):219-222.
21- Ergücü Z, Türkün L, Onem E, Güneri P. Comparative radiopacity of six flowable resin composites. Oper Dent. 2010;35(4):436-440.
22- International Standard 4049 (2009). Dentistry-polymer based filings, restorative and luting materials, 4th edn Switzerland, Geneva. 2009.
23- Nomoto R, Mishima A, Kobayashi K, McCabe JF, Darvell BW, Watts DC, Momoi Y, Hirano S. Quantitative determination of radio-opacity: Equivalence of digital and film X-ray systems. Dent Mater. 2008;24(1):141-147.
24- Cook WD. An investigation of the radiopacity of composite restorative materials. Aust Dent J. 1981;26(2):105-112.
25- Gu S, Rasimick BJ, Deutsch AS, Musikant BL. Radiopacity of dental materials using a digital X-ray system. Dent Mater. 2006;22(8):765-770.
26- Lachowski KM, Botta SB, Lascala CA, Matos AB, Sobral MAP. Study of the radio-opacity of base and liner dental materials using a digital radiography system. Dentomaxillofac Radiol. 2013;42(2):20120153.
27- Yildirim T, Ayar MK, Akdag MS, Yesilyurt C. Radiopacity of bulk fill flowable resin composite materials. Niger J Clin Pract. 2017;20(2):200-204.
28- Gul P, Çaglayan F, Akgul N, Akgul HM. Comparison of radiopacity of different composite resins. J Conserv Dent. 2017;20(1):17-20.
29- Garoushi S, Vallittu P, Lassila L. Mechanical properties and radiopacity of flowable fiber-reinforced composite. Dent Mater J. 2019;38(2):196-202.
30- Dukić W, Delija B, Lešić S, Dubravica I, Derossi D. Radiopacity of Flowable Composite by a Digital Technique. Oper Dent. 2013;38(3):299-308.
31- Tarcin B, Gumru B, Peker S, Ovecoglu HS. Evaluation of Radiopacity of Bulk-fill Flowable Composites Using Digital Radiography. Oper Dent. 2016;41(4):424-431.
32- Temirek MMA. Effect Of Packing Technique and Curing Time On The Marginal Sealing And Surface Hardness Of Two Bulk-Fill Resin Composites. Egyptian Dent J. 2019;65(3):2587-2596.
33- Jang JH, Park SH, Hwang IN. Polymerization shrinkage and depth of cure of bulk-fill resin composites and highly filled flowable resin. Oper Dent. 2015;40(2):172-180.
34- Erzurumlu ZU, Sagirkaya CE, Erzurumlu K. Evaluation of radiopacities of CAD/CAM restorative materials and resin cements by digital radiography. Clin Oral Investig. 2021;25(10):5735-5741.

35- Furtos G, Baldea B, Silaghi-Dumitrescu L, Moldovan M, Prejmerean C, Nica L. Influence of inorganic filler content on the radiopacity of dental resin cement. Dent Mater J. 2012;31(2):266-272.
36- Hara AT, Serra MC, Rodrigues Júnior AL. Radiopacity of glass-ionomer/composite resin hybrid materials. Braz Dent J. 2001;12(2):85-89.
37- Watts DC. Radiopacity vs. composition of some barium and strontium glass composites. J Dent. 1987;15(1):38-43.
38- Pedrosa RF, Brasileiro IV, dos Anjos Pontual ML, dos Anjos Pontual A, da Silveira MM. Influence of materials radiopacity in the radiographic diagnosis of secondary caries: evaluation in film and two digital systems. Dentomaxillofac Radiol. 2011;40(6):344-350.
39- Prévost AP, Forest D, Tanguay R, DeGrandmont P. Radiopacity of glass ionomer dental materials. Oral Surg Oral Med Oral Pathol .1990;70(2):231-235.
40- Carvalho AA, Moreira Fdo C, Fonseca RB, Soares CJ, Franco EB, Souza JB, Lopes LG. Effect of light sources and curing mode techniques on sorption, solubility and biaxial flexural strength of a composite resin. J Appl Oral Sci. 2012;20(2):246-252.
41- Alvim HH, Alecio AC, Vasconcellos WA, Furlan M, de Oliveira JE, Saad JRC. Analysis of camphorquinone in composite resins as a function of shade. Dent Mater. 2007;23(10):1245-1249.
42- Moszner N, Fischer UK, Ganster B, Liska R, Rheinberger V. Benzoyl germanium derivatives as novel visible light photoinitiators for dental materials. Dent Mater. 2008;24(7):901-907.

Middle Black Sea Journal of Health Science / Mid Blac Sea J Health Sci **November 2022;8(4):582-591**

RESEARCH ARTICLE **DOI:** 10.19127/mbsjohs.1142542

Estimation of Risk Factors Related to Heart Attack with Xgboost That Machine Learning Model

Onural Özhan[1](ID), Zeynep Küçükakçali[2](ID)

[1]Department of Medical Pharmacology, Inonu University, Medical Faculty, Malatya, Turkey.
[2]Department of Biostatistics and Medical Informatics, Inonu University Faculty of Medicine, Malatya, Turkey.

Received: 05 September 2022, Accepted: 08 July August 2022, Published online: 30 November 2022

Abstract

Objective: The objective of this work is to classify heart attack cases using the open-access heart attack dataset and one of the machine learning techniques called XGBoost. Another aim is to reveal the risk factors associated with having a heart attack as a result of the modeling and to associate these factors with heart attack.

Methods: In the study, modeling was done with the XGBoost method using an open access data set including the factors associated with heart attack. Model results were evaluated with accuracy, balanced accuracy, specificity, positive predictive value, negative predictive value, and F1-score performance metrics. In addition, 10-fold cross-validation method was used in the modeling phase. Finally, variable importance values were obtained by modeling.

Results: Accuracy, balanced accuracy, sensitivity, specificity, positive predictive value, negative predictive value, and F1 score from by XGBoost modeling were 89.4%, 89.4%, 88.4%, 90.3%, 88.4%, 90.3%, and 88.4%, respectively. According to the variable importance values obtained for the input variables in the data set examined in this study, thal2, oldpeak, thal3, ca1, and exang1 were obtained as the most important variables associated with heart attack.

Conclusions: With the machine learning model used, the heart attack dataset was classified quite successfully, and the associated risk factors were revealed. Machine learning models can be used as clinical decision support systems for early diagnosis and treatment.

Keywords: Heart attack, machine learning, XGBoost, modelling, variable importance

Suggested Citation: Özhan O, Küçükakçalı Z. Estimation of Risk Factors Related to Heart Attack with Xgboost That Machine Learning Model Mid Blac Sea J Health Sci, 2022;8(4):582-591.

Address for correspondence/reprints:
Name and Surname: Onural Özhan
Telephone number: +90 (535) 932 33 44
E-mail: onural.ozhan@inonu.edu.tr

INTRODUCTION

Deaths caused by cardiovascular diseases, which are included in the "Non-Communicable Diseases 2013-2020 Action Plan" of the World Health Organization (WHO), are in the first place in the world and in our country. Especially nowadays, it is the most common cause of mortality and morbidity in developed and western countries, and the possibility of the disease in developing countries is increasing day by day. Cardiovascular diseases such as peripheral vascular disease, coronary artery disease, heart failure, dyslipidemia, and hypertension (HT) affect 400 million people worldwide, representing a diverse range of races, ages, and genders. Studies show that between 1990 and 2020, the death rate from cardiovascular diseases will increase from 28.9% to 36.3% all over the world (1, 2). Cardiovascular diseases are more likely to affect people with metabolic problems like insulin resistance, glucose intolerance, abdominal obesity, HT, hypertriglyceridemia, high low-density lipoprotein (LDL) and low high-density lipoprotein (HDL). Cardiovascular diseases are generally characterized by atherosclerosis, thrombosis, and vascular dysfunction resulting from high blood pressure (3).

Myocardial infarction (MI), usually known as a heart attack, is the most prevalent cardiovascular disease (4). MI is a condition in which the cardiac muscle cells suffer damage from a lack of oxygen because the necessary amount of blood does not flow because a portion of the heart's blood supply has deteriorated. Additionally, if the heart muscle goes for an extended period of time without oxygen, death may result. Within the first hour, 50% of MI-related deaths occur, and within the first 24 hours, this rate rises to 80% (5). MI is a significant public health issue that regularly affects society's productive age group, results in serious issues because of post-acute consequences, and can even be fatal. It is one of the most significant causes of morbidity and mortality in our nation and industrialized countries, despite recent improvements in diagnosis and treatment (6). The importance of early disease diagnosis in disease prevention and treatment cannot be overstated. The fact that heart diseases, particularly MI, are the leading cause of death in people of all ages is the most important reason for long-term cardiovascular disease research (3).

The goal of machine learning, a subset of artificial intelligence, is to predict new data as it is presented to it through data-driven learning. The researchers' goal is to teach computers to detect complex patterns and make data-driven decisions (7). In recent years, one of the technologies that have seen widespread usage in the diagnosis of diseases and clinical decision support systems is machine learning methods. These approaches have a wide range of application areas and have been increasingly

popular in recent years. Machine learning techniques often carry out the classification process in the disease prediction process. Machine learning, which has a widespread application area in the field of health, constitutes the fundamental infrastructure of applications in the determination of genetic diseases, early diagnosis of cancer diseases and chronic diseases, and the identification of patterns in medical imaging. In the last decade, with more computing power, ML methods have achieved very high performances in the field of health (8,9). Extreme Gradient Boosting (XGBoost), one of the machine learning methods, is one of the most effective supervised learning algorithms and its basic structure is based on gradient boosting and decision tree algorithms boost is an ensemble method that uses boosting to combine a set of weak classifiers to create a strong classifier. Starting with a basic learner, the strong learner is trained iteratively (10,11).

The purpose of this study is to use the machine learning technique XGBoost on the open-access heart attack dataset to classify instances of heart attacks and identify the factors associated with them.

METHODS

Deaths caused by cardiovascular diseases, which are included in the "Non-Communicable Diseases 2013-2020 Action Plan" of the World Health Organization (WHO), are in the first place in the world and in our country. Especially nowadays, it is the most common cause of mortality and morbidity in developed and western countries, and the possibility of the disease in developing countries is increasing day by day. Cardiovascular diseases such as peripheral vascular disease, coronary artery disease, heart failure, dyslipidemia, and hypertension (HT) affect 400 million people worldwide, representing a diverse range of races, ages, and genders. Studies show that between 1990 and 2020, the death rate from cardiovascular diseases will increase from 28.9% to 36.3% all over the world (1,2). Cardiovascular diseases are more likely to affect people with metabolic problems like insulin resistance, glucose intolerance, abdominal obesity, HT, hypertriglyceridemia, high low-density lipoprotein (LDL), and low high-density lipoprotein (HDL). Cardiovascular diseases are generally characterized by atherosclerosis, thrombosis, and vascular dysfunction resulting from high blood pressure (3).

Myocardial infarction (MI), usually known as a heart attack, is the most prevalent cardiovascular disease (4). MI is a condition in which the cardiac muscle cells suffer damage from a lack of oxygen because the necessary amount of blood does not flow because a portion of the heart's blood supply has deteriorated. Additionally, if the heart muscle goes for an extended period of time without oxygen, death may result. Within the first hour,

50% of MI-related deaths occur, and within the first 24 hours, this rate rises to 80% (5). MI is a significant public health issue that regularly affects society's productive age group, results in serious issues because of post-acute consequences, and can even be fatal. It is one of the most significant causes of morbidity and mortality in our nation and industrialized countries, despite recent improvements in diagnosis and treatment (6). The importance of early disease diagnosis in disease prevention and treatment cannot be overstated. The fact that heart diseases, particularly MI, are the leading cause of death in people of all ages is the most important reason for long-term cardiovascular disease research (3).

The goal of machine learning, a subset of artificial intelligence, is to predict new data as it is presented to it through data-driven learning. The researchers' goal is to teach computers to detect complex patterns and make data-driven decisions (7). In recent years, one of the technologies that has seen widespread usage in the diagnosis of diseases and clinical decision support systems is machine learning methods. These approaches have a wide range of application areas and have been increasingly popular in recent years. Machine learning techniques often carry out the classification process in the disease prediction process. Machine learning, which has a widespread application area in the field of health, constitutes the fundamental infrastructure of applications in the determination of genetic diseases, early diagnosis of cancer diseases and chronic diseases, and the identification of patterns in medical imaging. In the last decade, with more computing power, ML methods have achieved very high performances in the field of health (8,9). Extreme Gradient Boosting (XGBoost), one of the machine learning methods, is one of the most effective supervised learning algorithms and its basic structure is based on gradient boosting and decision tree algorithms XGBoost is an ensemble method that uses boosting to combine a set of weak classifiers to create a strong classifier. Starting with a basic learner, the strong learner is trained iteratively (10,11).

The purpose of this study is to use the machine learning technique XGBoost on the open-access heart attack dataset to classify instances of heart attacks and identify the factors associated with them.

XGBoost METHOD

Gradient Boost is a powerful machine learning technique that is regularly used for regression and classification problems where weak prediction models frequently generate ensemble forms of decision trees. Gradient Boost is typically applied in situations where these problems arise. Using the boosting method, attempts to generate a large number of weak learners sequentially and incorporate them into a complex model (11, 12). XGBoost is a robust machine learning model that utilizes

gradient boosting and decision tree methods. In terms of speed and performance, it has a major edge over other machine learning algorithms, with the potential to process nearly ten times faster. It also has a variety of regularizations that enhance overall performance while reducing overfitting and over-learning. XGBoost is an ensemble method for creating a robust classifier by combining a set of weak classifiers with reinforcement. XGBoost can achieve better performance than other methods by using different regularization techniques to control the complexity of the trees (13,14).

Tablo 1. Explanations of the Variables in the Data Set and Their Characteristics

Variable	Explanations of The Variables	Variable Type	Variable Role
target	target: 0= less chance of heart attack 1= more chance of heart attack	Qualitative	Output
age	age	Quantitative	Predictor
sex	Sex of the patient (0=female;1=male)	Qualitative	Predictor
trestbps	resting blood pressure	Quantitative	Predictor
chol	serum cholestoral in mg/dl	Quantitative	Predictor
fbs	fasting blood sugar > 120 mg/dl 1 = true; 0 = false	Qualitative	Predictor
cp	Chest pain type 0 = Typical Angina, 1 = Atypical Angina, 2 = Non-anginal Pain, 3 = Asymptomatic	Qualitative	Predictor
thalach	maximum heart rate achieved	Quantitative	Predictor
exang	exercise induced angına 1 = yes; 0 = no	Qualitative	Predictor
restecg	resting electrocardiographic results (values 0,1,2) ○ Value 0: normal ○ Value 1: having ST-T wave abnormality (T wave inversions and/or ST elevation or depression of > 0.05 mV) ○ Value 2: showing probable or definite left ventricular hypertrophy by Estes' criteria	Qualitative	Predictor
slope	the slope of the peak exercise ST segment 0 = unsloping;1 = flat;2 = downsloping	Qualitative	Predictor
ca	number of major vessels (0-3) colored by flourosopy	Qualitative	Predictor
oldpeak	oldpeak = ST depression induced by exercise relative to rest	Quantitative	Predictor
thal	Thalium Stress Test result (0,3)	Qualitative	Predictor

Statistical analysis

The median (minimum-maximum) is used to summarize quantitative data, whereas qualitative factors are presented as numbers and percentages. Using the Kolmogorov-Smirnov test, a normal distribution was determined. The Pearson Chi-square test, Mann-Whitney U test, and Yates' correction chi-square test were used to determine whether there was a statistically significant difference between the output variable ("less probability of heart attack") and input variables. $p<0.05$ value was considered statistically significant. In all analyzes, IBM SPSS Statistics 26.0 for the Windows package program was used.

Modelling

XGBoost was used in the modeling. The n-fold cross-validation method was used for the analyses. The data set was divided 80:20 as a training and test dataset. The data is divided into n parts in the n-fold cross-validation method, and the model is applied to n parts. One of the n components is used for testing, while the remaining n-1 components are used to train the model. The modeling process in this study was carried out using 5-fold cross-validation. As performance evaluation criteria, accuracy, balanced accuracy, sensitivity, selectivity, positive predictive value, negative predictive value, and F1-score were used. In addition, variable importances were calculated, which gives information about how much the input variables explain to the output variable.

RESULTS

The mean age of the patients used in the current study was 54.37±9.08 years. Of the patients, 96 were female and 207 were male. Tables 2 and 3 contain descriptive statistics pertaining to the target variable that this study looked at. In terms of variables other than the "fbs" variable, there is a statistically significant difference between the dependent variable classes.

Accuracy, balanced accuracy, sensitivity, specificity, positive predictive value, negative predictive value, and F1 score obtained from the XGboost model were 89.4%, 89.4%, 88.4%, 90.3%, 88.4%, and 90.3%, and 88.4%, respectively.

Table 2. Descriptive statistics for Quantitative Input variables

Variables	Predicted Class		p*
	More Chance Of Heart Attack	Less Chance Of Heart Attack	
	Median (minimum-maximum)	**Median (minium-maximum)**	
age	52(29-76)	58(35-77)	<0.001*
trestbps	130(94-180)	130(100-200)	0.035*
chol	234(126-564)	249(131-409)	0.036*
thalach	161(96-202)	142(71-195)	<0.001*
oldpeak	0.2(0-4.2)	1.4(0-6.2)	<0.001*

*** Mann Whitney U test**

In Figure 2, the values of performance metrics are plotted for the XGboost model.

Table 4 shows the values of the performance criteria of the XGBoost model used in this study to classify cases of a heart attacks.

The graph of the variables associated with the output varies according to the variable importance obtained as a result of the modeling is given in figure 2.

DISCUSSION

Each year, cardiovascular disease kills 17,9 million people, accounting for 31 percent of all deaths globally. Cardiovascular diseases include coronary heart disease, cerebrovascular disease, rheumatic heart disease, and various heart and blood vessel diseases. Ischemic heart diseases are involved in the pathophysiology of most deaths due to cardiovascular diseases. Ischemic heart diseases cause mortality and morbidity worldwide (15,16). One of these diseases is MI, which is characterized as myocardial cell damage caused by persistent

ischemia. A heart attack is a physiological disorder that causes significant chest discomfort as a result of insufficiency caused by a defect in the coronary arteries of the heart and is fatal. A heart attack happens as a result of oxygen deprivation caused by a sudden decrease or halt in blood flow in the arteries that feed the heart for a variety of reasons. It can cause varying degrees of damage to the heart muscle fed by the blocked channel, as well as tissue death (17). Heart attack is a major health concern that is most prevalent in industrialized countries and is becoming more prevalent in emerging countries.

MI is a significant public health issue that occurs frequently in the productive age group of society, creates substantial problems owing to post-acute complications, and can result in mortality. According to World Health Organization (WHO) figures, 16.7 million people die each year as a result of heart attacks. This figure reflects one-third of all deaths worldwide (18). Machine learning is a subfield of computer science that focuses on the development and application of algorithms that give computers the ability to learn based on the types of data they are given.

Tablo 3. Descriptive statistics for Qualitative Input variables

Variables		Predicted Class		**p** value**
		more chance of heart attack	less chance of heart attack	
sex	0	72(43.6%)	24(17.4%)	**<0.001****
	1	93(56.4%)	114(82.6%)	
cp	0	39(23.6%)	104(75.4%)	**<0.001***
	1	41(24.8%)	9(6.5%)	
	2	69(41.8%)	18(13.0%)	
	3	16(9.7%)	7(5.1%)	
fbs	0	142(86.1%)	116(84.1%)	0.744
	1	23(13.9%)	22(15.9%)	
restecg	0	68(41.2%)	79(57.2%)	**0.007***
	1	96(58.2%)	56(40.6%)	
	2	1(0.6%)	3(2.2%)	
exang	0	142(86.1%)	62(44.9%)	**<0.001****
	1	23(13.9%)	76(55.1%)	
slope	0	9(5.5%)	12(8.7%)	**<0.001***
	1	49(29.7%)	91(65.9%)	
	2	107(64.8%)	35(25.4%)	
ca	0	130(78.8%)	45(32.6%)	**<0.001***
	1	21(12.7%)	44(31.9%)	
	2	7(4.2%)	31(22.5%)	
	3	3(1.8%)	17(12.3%)	
	4	4(2.4%)	1(0.7%)	
thal	0	1(0.6%)	1(0.7%)	**<0.001***
	1	6(3.6%)	12(8.7%)	
	2	130(78.8%)	36(26.1%)	
	3	28(17.0%)	89(64.5%)	

*:Pearson chi square test; **: Chi-square test with Yates correction

Table 4. Performance metrics of the XGboost model

Metric	Value (%) (95% CI)
Accuracy	89.4 (86-92.9)
Balanced Accuracy	89.4 (85.9-92.8)
Sensitivity	88.4 (81.9-93.2)
Specificity	90.3(84.7-94.4)
Positive predictive value	88.4 (81.9-93.2)
Negative predictive value	90.3 (84.7-94.4)
F1 score	88.4 (88.4-92)

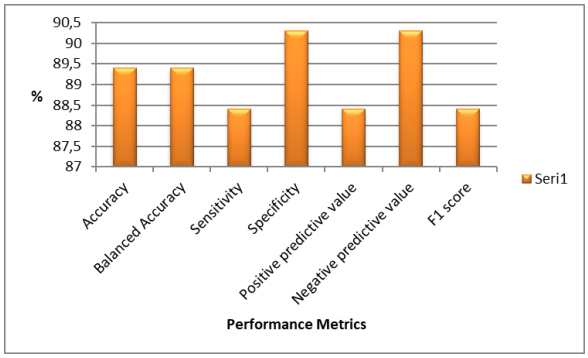

Figure 1. Graph of values for performance metrics for XGboost model

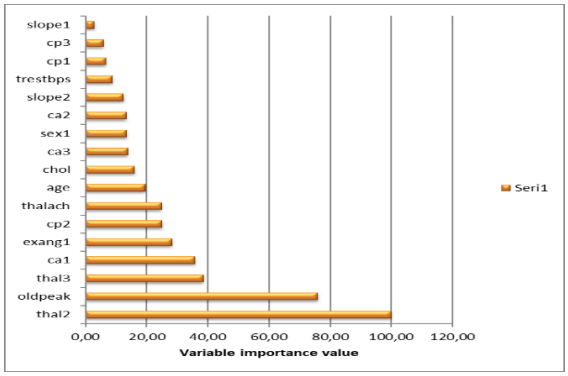

Figure 2. Variable importance graph

Not only is machine learning a database problem, but it is also a branch of artificial intelligence that models future events based on historical data and makes predictions about such events (19). In recent years, machine learning methods have been widely used in disease diagnosis and clinical decision support systems. Early disease detection and identification of disease-causing factors are made possible by machine learning methods, which are widely used in the field of health (20,21).

In the study, an open-source data set consisting of MI patients' data were classified using the XGBoost method, and factors associated with a case of more chance of heart attack, which is among the categories of the target variable, were determined. Accuracy, balanced accuracy, sensitivity, specificity, positive predictive value, negative predictive value, and F1 score from the performance criteria obtained by modeling were 89.4%, 89.4%, 88.4%, 90.3%, 88.4%, 90.3%, and 88.4%, respectively.

XGBoost method gave successful estimation results in the classification of heart attack status according to the values of performance metrics obtained from the study. In addition, risk factors for heart attack were also obtained with the variable importance values calculated as a result of the model. Thal2, old peak, thal3, ca1, and exang1 are among the most significant risk factors connected with having a heart attack. In research utilizing the same data set, the deep learning technique yielded an 81.4% accuracy rate. In addition, that, age, ca, old peak and exang variables were found to be associated with a heart attack in the study (22).

CONCLUSION

The XGBoost machine learning model utilized in the study correctly categorized the

state of having a heart attack. In addition, the study's results highlighted the risk factors for having a heart attack. Lastly, machine learning technology can be advantageous for medical data accessibility and early diagnosis.

Ethics Committee Approval: Ethics committee approval is not required in this study.
Peer-review: Externally peer-reviewed.
Author Contributions: Concept- OÖ, ZK Design- OÖ, ZK Literature Review- OÖ, ZK Critical Review- OÖ, ZK
Conflict of Interest: The authors have no interests to declare
Financial Disclosure: There are no financial supports.

REFERENCES

1- Abanonu G. Major risk factors for coronary artery disease and evaluation of C-Reactive protein. Published Specialization Thesis Istanbul. 2005.
2- House W. Follow-up to the political declaration of the high-level meeting of the general assembly on the prevention and control of non-communicable diseases. World Health Organization. 2013.
3- Lee CH, Kim J-H. A review on the medicinal potentials of ginseng and ginsenosides on cardiovascular diseases. J Ginseng Res. 2014;38(3):161-6.
4- Halıcı Z, Yasin Bayır HS, Çadırcı E, Keleş MS, Bayram E. Investigation of the Effects of Amiodarone on Erythropoietin Levels in Isoproterenol-induced Acute and Chronic Myocardial Infarction Model in Rats. The Eurasian Journal of Medicine. 2002;38:68-72
5- Storrow AB, Gibler WB. Chest pain centers: diagnosis of acute coronary syndromes. Ann Emerg Med. 2000;35(5):449-61.
6- Şentürk S. Investigation of the effect of l-lysine on total sialic acid levels in rats with myocardial infarction with isoproterenol. Trakya University Institute of Health Sciences Department of Biochemistry Master's Program Erzurum, 2008.
7- Polikar R. Ensemble learning. Ensemble machine learning: Springer; 2012. p. 1-34.
8- Akman M, Genç Y, Ankarali H. Random Forests Yöntemi ve Saglik Alaninda Bir Uygulama/Random Forests Methods and an Application in Health Science. Turkey Clinics Biostatistics. 2011;3(1):36.
9- Witten IH, Frank E. Data mining: practical machine learning tools and techniques with Java implementations. Acm Sigmod Record. 2002;31(1):76-7.
10- Dikker J. Boosted tree learning for balanced item recommendation in online retail. Master thesis. 2017.
11- Patrous ZS. Evaluating XGBoost For User Classification by Using Behavioral Features Extracted from Smartphone Sensors. [Master Thesis]: KTH Royal Institute of Technology, School of Computer Science and Communication, Sweden.; 2018. Access link: https://www.diva-portal.org/smash/get/diva2:1240595/FULLTEXT01.pdf
12- Wang J, Li P, Ran R, Che Y, Zhou Y. A short-term photovoltaic power prediction model based on the gradient boost decision tree. Appl Sci. 2018;8(5):689.
13- Ogunleye A, Wang Q-G. XGBoost model for chronic kidney disease diagnosis. IEEE/ACM Trans Comput Biol Bioinform. 2019;17(6):2131-40.
14- Li W, Yin Y, Quan X, Zhang H. Gene expression value prediction based on XGBoost algorithm. Frontiers in Genetics. 2019;10:1077.
15- Organization WH. Hearts: technical package for cardiovascular disease management in primary health care. 2016. Access link: https://apps.who.int/iris/bitstream/handle/10665/252661/9789241511377-eng.pdf
16- Thippeswamy B, Thakker S, Tubachi S, Kalyani G, Netra M, Patil U, et al. Cardioprotective effect of Cucumis trigonus Roxb on isoproterenol-induced myocardial infarction in rat. Am J Pharmacol Toxicol 2009;4(2):29-37.
17- Ateş S. Determining the Most Appropriate Ambulance Locations for Heart Attack Cases

with Geographic Information Systems: Graduate School of Sciences; 2010.
18- Upaganlawar A, Gandhi H, Balaraman R. Isoproterenol induced myocardial infarction: protective role of natural products. J Pharmacol Toxicol. 2011;6(1):1-17.
19- Alpaydin E. Introduction to machine learning: MIT press; 2020.
20- Davenport T, Kalakota R. The potential for artificial intelligence in healthcare. Future Healthc J. 2019;6(2):94.
21- Yu K-H, Beam AL, Kohane IS. Artificial intelligence in healthcare. Nat. Biomed. Eng. 2018;2(10):719-31.
22- Zeynep T, İpek BC, Guldogan E. Performance evaluation of the deep learning models in the classification of heart attack and determination of related factors. J. Cogn. Sci. 2020;5(2):99-103.

Middle Black Sea Journal of Health Science / Mid Blac Sea J Health Sci **November 2022; 8(4):592-602**

RESEARCH ARTICLE **DOI:** 10.19127/mbsjohs.1143930

Effect of Sodium Fluorescein Use on Surgical Outcomes and Survival in Cases with High-Graded Glial Tumor: A retrospective study

Tamer Tunçkale[1(ID)], Tezcan Çalışkan[1(ID)]

[1]Department of Neurosurgery, Tekirdag Namik Kemal University, Tekirdag, Turkey,

Received: 18 July 2022, Accepted: 09 September 2022, Published online: 30 November 2022

Abstract

Objective: The most effective factor on malignant glioma (MGs) treatment affecting overall survival is the extent of resection. The use of sodium fluorescein (FL) staining in order to increase the amount of resection, is applied more effectively and safely at lower doses with the aid of 560nm filtered surgical microscopes. Our aim was to investigate the effects of the use of FL in MGs surgery on the gross total resection rate (GTR), duration of surgery, length of hospital stays, and survival time.

Methods: A retrospective study was conducted on 17 patients whose histopathological evaluations were reported as MGs and operated under surgical white light (Group 1), and 23 patients who were operated under FL560 module surgical microscope (Group 2) with a low dose of (3mg/kg body weight) FL dye. The blood loss in the course of surgery, GTR, surgical time, and hospital stay were compared for both groups with the student-t-test. Kaplan-Meier method was used for the survival time analysis.

Results: GTR rates were found to be 82.3% for patients operated under surgical white light, and the percentage for FL-utilized patients was 91.3%. There was no significant difference in blood loss or hospital stay between the two groups; however, the surgical time for FL-utilized patients was found to be significantly low in comparison to the other group. The overall survival time for patients who were operated under surgical white light was found to be 64 weeks (448 ± 64 days) while it was determined as 84.7 weeks (593±55 days) for patients operated with the use of FL, however, the difference between them was not found out to be statistically significant. The use of FL enabled the surgeon to determine the cortical incision area in 13 cases, where the location of the tumor was close to the cortex.

Conclusions: While the use of FL shortens the surgical time in contrast-enhancing MGs, it increases the GTR rate. FL also functions well with the determination of the location of the surgical site for tumors close to the cortex.

Keywords: Sodium Fluorescein, High-Grade Glioma, Surgical Resection

Suggested Citation: Tamer Tunçkale T, Çalışkan T. Effect of sodium fluorescein use on surgical outcomes and survival in cases with high graded glial tumor: a retrospective study Mid Blac Sea J Health Sci, 2022;8(4):592-602.

Address for correspondence/reprints:
Name and Surname: Tamer Tunçkale
Telephone number: +90 (505) 373 71 03
E-mail: ttunckale@hotmail.com

INTRODUCTION

When a patient is diagnosed with a brain tumor, a great challenge begins in order to maximize the life span of the patient as well as to protect the present neurological competence. MGs are the most prevalent primary brain tumors and are unfortunately very invasive, and rapidly progressive tumors, which are surgically hard to resect totally (1). Today, survival time for patients with MGs is quite short despite standard microsurgery, radiotherapy, and chemotherapy (2). While the American Society of Clinical Oncology issued the overall survival time as 7.7 months for patients undergoing radiotherapy after surgery, the overall survival time for patients undergoing chemotherapy after radiotherapy was determined as 13.5 months (3). One of the most effective treatments for disease-free survival and overall survival is the maximum resection of the tumor (4). Therefore, the main objective of the treatment should be the total excision of the tumor without leading to neurological deficit. For this purpose, there are many techniques such as navigation systems, brain mapping, fluorescein guide, intraoperative ultrasound, and magnetic resonance images (MRI), which are used in order to enhance surgical safety, and also resection (5,6). Intraoperative fluorescent dye, which aimed to determine the edges of the tumor and thus, provides safe and maximum resection, was used first in 1948 by Moore et al. (7) FL stains the contrast-enhancing areas and it is useless in non-contrast lesions. It had been used at high doses such as 15-20 mg/kg for many years in order to determine the edges of the tumor macroscopically; however, many side effects including anaphylactic shock were reported (8,9). Lower doses such as 5-10 mg/kg were used safely and effectively with a special operative microscope module with excitation and observation filters (10,11). Recently, there have been numerous published reports indicating that the tumor edges can be identified much more clearly with the new generation 560nm filtered surgical microscopes with low level (2-4 mg/kg) FL, and thus, enable surgery (10,12-14). Fluorescein-guided surgery, which is conducted with extremely cheap and safe at low doses, has become a considerable alternative to 5-Aminolevulinic acid. The efficacy of low-dose FL use on surgery, which has recently been used in brain tumor surgeries via specially filtered microscopes, and its effect on long-term survival time is not known. In this study, patients with high-grade glial masses for whom FL was used in surgery were investigated in terms of GTR rate, length of hospital stay, duration of surgery, blood loss, and survival at three-year follow-up.

METHODS

A retrospective study was conducted at Namık Kemal University, School of Medicine on 40 patients with high-grade glial tumors. 17 patients who were operated on under white light

before receiving the FL560 filter in our hospital between June 2015 and November 2016 were accepted as group 1, and 23 patients who were operated on with the help of FL after having the FL560 filter between December 2016 and November 2018 were accepted as group 2. Data were collected and analyzed in January 2021. The approval for this study was granted by the Namık Kemal University Ethics Committee (date: 28.07.2020 number: 2020.189.07.22).

Inclusion and Exclusion criteria:

Patients between the ages of 39-85 with significant contrast enhancement on their MRI reports were evaluated by a neuroradiologist, who were evaluated by a neuropathologist according to the WHO criteria, (15) diagnosed with glioblastoma multiforme, operated and also treated according to Stupp protocol, which means applying radiotherapy plus concomitant and adjuvant temozolomide, were included in our study (16).

Patients whose performance status was deteriorating due to tumors passing to the other hemisphere, who have tumors located in the brainstem, basal ganglia, or posterior fossa, or due to postoperative radio necrosis, patients with no contrast enhancement on their MRI, those who are contraindicated for contrast administration, and those with renal failure, liver failure, and those who have other malignancies in other organs were excluded from the study.

Patients treated with FL were asked to fill out an informed consent form about the side effects.

All patients were operated on under general anesthesia. For the operations of both groups, ultrasound (Siemens Acuson X300) was utilized in order to determine the location of the tumor and differentiate the residue tumor. Group 1 (n=17) patients were operated on via a surgical microscope under surgical white light. Group 2 patients (n=23) were given 3 mg/kg FL 10% as bolus following anesthesia induction from the central catheter before skin incision. Leica M530 OHX microscope, which is an FL560 fluorescein module, was utilized for the operation of the patients. Tumor parts, which could not be differentiated clearly under white light, and those being highlighted in yellow color under FL560 were excised. Every surgical procedure was recorded and stored digitally.

Residue tumor volumes in the first month of post-operation via contrast-enhanced MRI were evaluated using open-source software (Sectra UniView,https://medical.sectra.com/product/sectra-uniview), and were calculated. While those with contrast enhancement of 0.175cm3 were evaluated as GTR, those with contrast enhancement above 0.175cm3 were determined as subtotal resection (STR).

The hospital stays, surgical time, and amount of blood loss of patients, which were taken from the patient files, were recorded. Surgery notes and videos were analyzed in

order to assess the utility of FL in the course of surgery. The time of death of patients was taken from the national recording system, and their life span after their first diagnosis was calculated accordingly.

Statistical analysis

While general survival time was determined as the period between the time of diagnosis and the date of their death, the general survival time of living patients was determined as the period between the time of diagnosis and their last control date on the national online health system.

Pearson's chi-squared test (or if it was not appropriate Fisher's Exact Test) was used for the comparison of categorical variables. Student-t-test were used for the comparison of continuous variables. Kaplan-Meier method was used for the survival time analysis, and the Log-Rank test was used for the comparison of groups. Data, in which the P value was found to be below 0.05, and error performance Type 1 was found out to be below 5%, were determined as statistically significant. All statistical analyses were carried out via SPSS 24 (SPSS Inc., Chicago, III) program.

RESULTS

The study comprised 40 patients with total 50 operations. For patients, who have operated again for recurrence, information of their first operation was evaluated. The median age of patients was 61.5 (min.39-max.85). The average age of patients in Group 1 (n=17) was 63.5± 8.3 (range 50 to 80 years, 9 males, 8 females), and in Group 2 (n=23), it was 59.6 ± 12.3 (range 39 to 85 years, 13 males, 10 female), and no difference in the average of age was found between these two groups (p= 0.269) (Table 1). There was also no difference determined between the groups in terms of the amount of bleeding and hospital stay duration (p=0.247, p=0.155, respectively) (Table 1).

In Group 1, 3 patients had a STR, and 14 patients had a GTR. The percentages of resection for 3 patients who had a STR in Group 1 were determined as 73.2%, 81.3%, and 92.3%. While patients who had a STR in Group 1 were reoperated within the first two months, one patient underwent surgery in the 8th and 20th months, which is for three times in total. In patients who had a GTR, 2 of the patients who had a recurrence underwent a second operation (Table 2).

In Group 2, 2 patients had a STR while 21 patients had a GTR. The resection percentages of STR-receiving patients were 87.6 and 89.1%. In Group 2, while 2 patients, who had a recurrence after the 6th month, underwent 2 operations, 1 patient underwent three operations in total in the 7th and 10th month (Table 3). The age, symptoms, size of the tumor and its location, amount of resection, and number of operations are given in Table 2 for Group 1; whereas these data were given in Table 3 for Group 2.

When survival was analyzed in Group 1 and Group 2, it was found that the overall survival time in Group 1 was 64 weeks (448±52 days), while it was 84.7 weeks (593±55 days) in Group 2, and when it was evaluated via long-rank test, it was found out that the survival time in both groups was similar (p=0.125) (Fig 1).

In 13 cases, the use of FL was beneficial for

Table 1. Characteristic features of both patient groups

		Group1		Group2		
		Mean ± s.s / n	**Median**	**Mean ± s.s / n**	**Median**	**p**
Age		63.5± 8.3	66.0	59.6 ± 12.3	61.0	0.269 [t]
Sex	Male	9 (%41)		13 (%59)		
	Female	8 (%44)		10 (%56)		0.822 [x2]
Resection	Total	14(%82.3)		21(%91.3)		
	Subtotal	3(%17.7)		2(%8.7)		0.634 [f]
Blood loss (cc)		308.2 ± 94.0	290.0	274.1 ± 88.3	270.0	0.247 [t]
Surgical time(min)		270.3 ± 44.6	260.0	241.1 ± 37,9	230.0	**0.031** [t]
Tumor volume(cm³)		33.4 ± 27.1	23.5	52.5 ± 38.2	47.1	0.086 [t]
Hospital stay (day)		9.2 ± 2.6	9.0	8.2 ± 1.9	8.0	0.155 [t]

Table 2. Clinical summary of patients operated under surgical white light (Group 1)

Number	Age/Sex	Symptoms/Signs	Localization	Tumor size (cm³)	% of resection	Number of operations
(1)	55/F	Seizure, headache	RP	14,6	100	2
(2)	59/M	Left hemiparesis	RF	5,8	100	1
(3)	58/M	Seizure	LF	19,6	100	2
(4)	70/M	Left hemiparesis	RT	12,2	100	1
(5)	56/F	Right hemiparesis	LF	40,1	100	1
(6)	70/F	Seizure, somnolence	LP	94,8	92,3	2
(7)	61/F	Visual field defect, headache	LO	86,6	100	1
(8)	75/F	Headache, dizziness	RP	11	100	1
(9)	66/M	Headache, left hemiparesis	RF/I/T	45,8	73,2	2
(10)	67/F	Aphasia, headache	RF/T	3,9	100	1
(11)	50/M	Amnesia, headache	RF	50,5	100	1
(12)	68/M	Right hemiplegia	LF	34,4	100	1
(13)	67/M	Headache, right hemiparesis	LP	7,1	100	1
(14)	67/M	Headache, agraphia	RP	42,8	100	1
(15)	80/F	Seizure, headache	RO	23,5	100	1
(16)	59/M	Headache	RF/T	19,7	100	1
(17)	51/F	Left hemiparesis, headache	RF	54,8	81,3	3

patients with a tumor close to the cortex in terms of determining the cortical incision area (Fig 2A-2B-2C). There was no side effect observed against FL given at 3mg/kg in Group 2.

Table 3. Clinical summary of patients operated via Na Flourescein dye (Group 2)

Number	Age/Sex	Symptoms/Signs	Localization	Tumor size (cm^3)	% of resection	Number of operations
(1)	39/M	Left hemiparesis, headache	RF	61,7	100	1
(2)	61/M	Headache	RP	31,9	100	2
(3)	51/F	Seizure, dysarthria	LT	3,1	100	1
(4)	62/F	Headache	RO	47,1	100	1
(5)	68/M	Left hemiparesis, headache	RP	27,2	100	1
(6)	66/M	Halusination	RF	16,8	100	1
(7)	66/M	Headache	LP	77,3	100	1
(8)	71/M	Headache	LF	9,5	100	1
(9)	60/F	Seizure, somnolence	LT/P	85,1	87,60%	1
(10)	44/F	Headache	RP	24,6	100	1
(11)	42/M	Seizure, headache	LF	172,2	100	1
(12)	57/F	Left hemiparesis	RF	75,4	100	3
(13)	62/F	Right hemiparesis	LF	30,3	100	1
(14)	52/M	Headache	RO	51,2	100	1
(15)	47/M	Headache	LT	33,9	100	1
(16)	52/M	Dysarthria	LT	65,2	100	2
(17)	51/F	Headache	LP	41,1	100	1
(18)	68/M	Left hemiparesis	LP	22,8	100	1
(19)	48/F	Visual field defect	LO	98	100	1
(20)	74/M	Headache	LO	19,4	100	1
(21)	83/F	Somnolence, shift	RF	105,5	89,10%	1
(22)	85/F	Aphasia, headache	LT	52,7	100	1
(23)	62/M	Seizure	RF	55,9	100	1

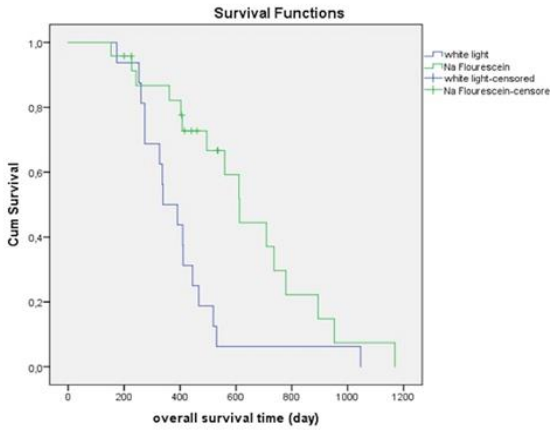

Figure 1. Kaplan-Meier plot stratified by using NA Fluorescein for overall survival (OS).

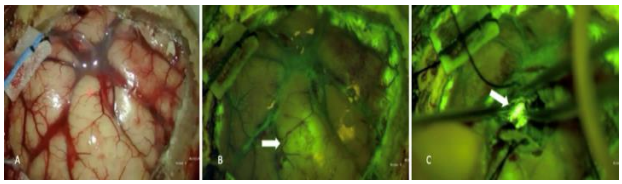

Figure 2A. Image of brain tissue before cortical incision under white light. **2B.** In masses close to the cortex, a yellow highlight is seen in the cortex under FL staining. **2C.** Arrow shows the FL stained tumor tissue after cortical incision.

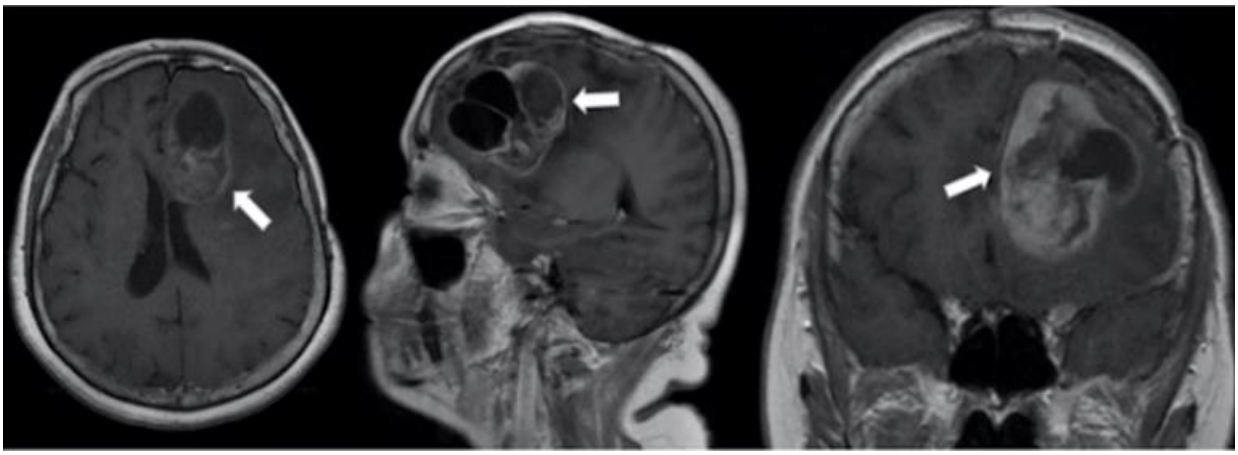

Figure 3. Left frontal cystic heterogeneous contrast-enhancing high-grade glial tumor.

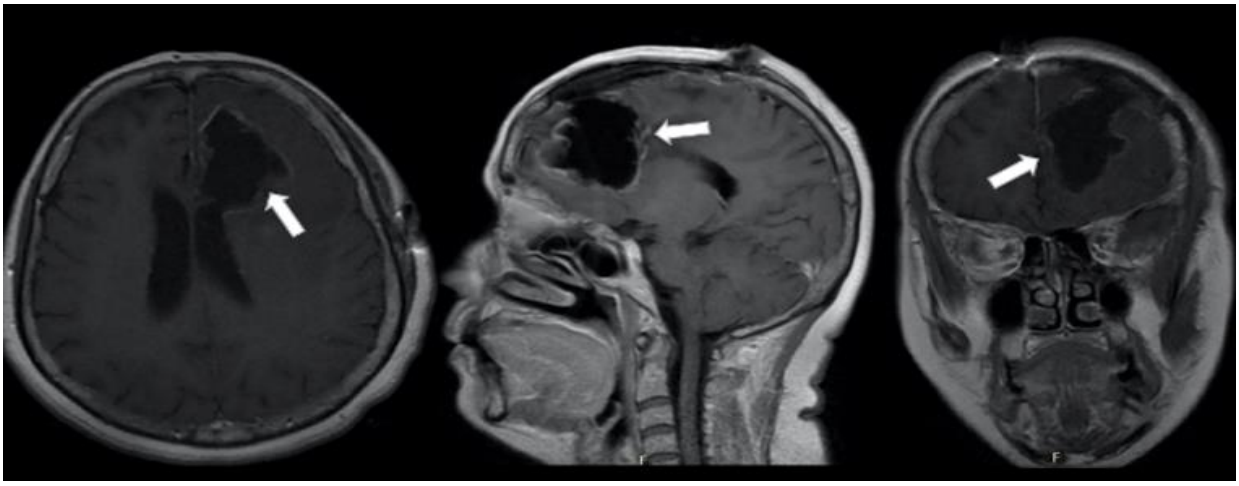

Figure 4. Total excision in the postoperative 24th hour MR image of the patient in whom FL staining was used.

DISCUSSION

Comparing the patients who were operated on for high-graded glial masses with and without the use of FL, it was found that the use of FL reduced the surgical time significantly. While there was no significant difference between the groups in terms of length of hospital stay and amount of bleeding, we found that the use of FL provided some improvement in GTR and survival rates, although there was no statistically significant difference. We experienced that the use of FL was considerably beneficial in 21 patients out of 23. We have observed that the two patients, in which the use of FL was not useful, the contrast enhancement was also relatively less. We can also say that during the surgery, as contrast enhancement in preoperative MRI increases FL highlighting ability becomes more effective.

Like other authors, we have also determined that the utilization of FL gives yellow highlights in the dura and contused brain tissue (11,12,14). The question is whether there is a tumor in the yellow highlighted areas during operation except for these areas, or it is possible that there is a false positivity. Many pathologically confirmed studies have been

designed in order to find an answer to this question. Acerbi F et al. stated that by using FL at 5-10 mg/kg in high-graded glial masses, the specificity, sensitivity, and GTR percentages of staining were determined as 89.5%, 94%, and 80%, respectively (10). There were similar results stated in many studies (8,14,17).

The fact that the maximum resection of the tumor is the most important factor affecting the overall survival in high-graded glial masses has led to the improvement of methods aiding the surgeon in tumor surgeries. The biggest handicap in the surgery of intra-axial mass surgeries is that it is sometimes impossible to differentiate the edges of the tumor from the normal brain tissue. In tumors, which lead to contrast enhancement due to the blood-brain barrier the use of fluorophores such as 5-Aminolevulinic acid, FL, or indocyanine green has become promising in the differentiation of brain tissue and tumor tissue (11,18-21). It has been stated that the utilization of FL in primary MGs and recurrent MGs, metastases, lymphomas, and spinal intramedullary lesions are extremely significant (10,22-24). Also, it has been approved that the use of FL dye increases the GTR rate, and in this study, this rate was found to be 91.3%, whereas the rate in those with no FL use was determined as 82.3%. (Fig 3-4) The GTR rate being high in our study may be due to the exclusion criteria we used in order to homogenize the two groups.

We can say that we have experienced that the FL dye provides confidence to the surgeon and that it decreases confusion during operation. This resulted in the surgical time being shortened in the group in which we used FL ($p=0.031$).

We found out that together with the surgical time, there was also a decrease in the amount of bleeding, and hospital stay; however, these decreases were not found to be significant. (Table 1) In particular, the amount of bleeding in Group 1 was determined as 308.2 ± 94.0 cc while it was found to be 274.1 ± 88.3 cc in Group 2. Although this difference is slight, we assume that this is due to the confidence of the surgeon knowing that he/she is in the tumor and acting quickly in the course of surgery. It is known that the low-dose FL use in a 560 nm filter microscope reduces the side effects of FL and is even used safely in pediatric cases (25). In our study, we did not encounter any side effects related to FL.

Another important point in tumor surgery is the determination of the entry point of the tumor. In tumors close to the cortex, they are reached through cortical incisions from non-eloquent areas (26). In our cases, we performed the operations with the help of ultrasound from the region closest to the cortex. In all of the 13 patients whose lesions were close to the cortex, the yellow highlight at the beginning of the surgery assisted us in finding the entry point (Fig 2B).

Apart from this, there are several studies reporting the effect of the use of FL on survival, and Koc K et al. first mentioned that in their series where they used high doses of FL, the overall survival was determined as 43.9 weeks, whereas it was 41.8 for the control group, and stated that there was no significant difference between the two groups (27). Katsevman et al., however, stated that in their series, in which they used 3-4 mg kg of FL, the median survival was better at 78 weeks compared to the control group, which was 60 weeks (28).

We have found a similar result in this study. The median survival was found to be 84.7 weeks for the group in which we used FL while it was determined as 64 weeks for the group in which no FL was used. (p= 0.634) (Fig 1) The median survival time in which we used FL improved; however, there was no statistical significance. We believe that this difference was parallel to the increase in GTR rate and that it should be studied on a larger series of MGs with different immunohistochemical classifications. This result can be explained through the impact of other factors affecting the limited number of patients as well as the overall survival. We can still say that the result found out on overall survival is promising.

Although the use of low-dose FL in 560 nm filter microscopes in glial tumor surgeries has only recently entered the surgical practice, it has been welcomed excitedly among surgeons, and its use has become prevalent. We have presented our experience in this short period of time in patients treated with the use of FL through observational and statistical data. As the use of FL becomes widespread, which in our opinion is a considerably beneficial technique, we think that the surgical efficacy in different tumor types and its effect on progression-free survival and overall survival should be investigated in larger series.

Limitations

The limitation of this study is the small number of tumors with different contrast enhancement features in this series. Studying in larger series in cystic tumors and MGs with less contrast enhancement will reveal the efficacy of FL more clearly.

CONCLUSION

The use of FL aids to determine the entry point during surgery on tumors close to the cortex, and also shortens the surgical time by helping to differentiate the tumor from the normal tissue. Since the GTR rate increases in MGs patients, it is necessary that its impact on progression-free survival and overall survival be studied on larger series.

Ethics Committee Approval: Ethics committee approval was received for this study from Tekirdağ Namık Kemal University Clinical Research Ethics Committee (ethics committee date 28.07.2020 and no: 2020.189.07.22)
Peer-review: Externally peer-reviewed.
Author Contributions: Concept, Design TT, TÇ, Literature search, Data Collection and Processing TT, TÇ, Analysis or Interpretation, Writing – TT, TÇ

Conflict of Interest: The authors have no interests to declare

Financial Disclosure: The authors received no financial support for the research, authorship, and publication of this article.

Acknowledgments: We would like to thank Assist Prof Birol Topçu, for the evaluation of the data

REFERENCES

1- Quinn T Ostrom, Haley Gittleman, Paul Farah, Annie Ondracek, Yanwen Chen, Yingli Wolinsky, et al. CBTRUS statistical report: primary brain and central nervous system tumors diagnosed in the United States in 2006–2010. Neuro-oncol. 2013;15(sup 6): p1–56.

2- Sant M, Minicozzi P, Lagorio S, Johannesen T B, Marcos-Gragera R, Francisci S, EUROCARE Working Group. Survival of European patients with central nervous system tumors. Int J Cancer. 2012;131(1):173 – 185.

3- James R. Perry, Normand Laperriere, Christopher J. O'Callaghan, Alba Ariela Brandes, Johan Menten, Claire Phillips, et al. A phase III randomized controlled trial of short-course radiotherapy with or without concomitant and adjuvant temozolomide in elderly patients with glioblastoma (CCTG CE.6, EORTC 26062-22061, TROG 08.02, NCT00482677). J Clin Oncol. 2016;34(18): Abstract. doi:10.1200/JCO.2016. 34.18_suppl.LBA2.

4- Almeida JP, Chaichana KL, Rincon-Torroella J, Quinones-Hinojosa A. The value of extent of resection of glioblastomas: clinical evidence and current approach. Curr Neurol Neurosci Rep. 2015;15(2):517. doi:10.1007/ s11910-014-0517-x.

5- Nancy Ann Oberheim Bush, Susan M Chang , Mitchel S Berger . Current and future strategies for treatment of glioma. Neurosurg Rev 2017;40:1–14 DOI 10.1007/s10143-016-0709-8.

6- Michael Weller, Martin van den Bent, Jörg C Tonn . European Association for Neuro-Oncology (EANO) guideline on the diagnosis and treatment of adult astrocytic and oligodendroglial gliomas. Lancet Oncol 2017;18(6):e315-e329. doi: 10.1016/S1470-2045(17)30194-8.

7- Moore GE, Peyton WT, French LA, Walker WW. The clinical use of fluorescein in neurosurgery; the localization of brain tumors. J Neurosurg 1948;5(4):392–8.doi:10.3171/jns.1948.5.4.0392.

8- Chen B, Wang H, Ge P, Zhao J, Li W, Gu H, Wang G, Luo Y, Chen D:. Gross total resection of glioma with the intraoperative fluorescence-guidance of fluorescein sodium. Int J Med Sci. 2012;9(8):708-714.

9- Dilek O, Ihsan A, Tulay H. Anaphylactic reaction after fluorescein sodium administration during intracranial surgery, J. Clin. Neurosci. 2011;18:430–431.

10- Francesco Acerbi, Morgan Broggi, Marica Eoli, Elena Anghileri, Lucia Cuppini, Bianca Pollo, et al. Fluorescein- guided surgery for grade IV gliomas with a dedicated filter on the surgical microscope: preliminary results in 12 cases. Acta Neurochir. 2013;155(7):1277–86.doi:10.1007/s00701-013-1734-9.

11- Kuroiwa T, Kajimoto Y, Ohta T. Development of a fluorescein operative microscope for use during malignant glioma surgery: A technical note and preliminary report. Surg Neurol. 1998;50(1):41- 48; discussion 48-49.

12- Acerbi F, Broggi M, Eoli M, Anghileri E, Cavallo C, Boffano C, et al. Is fluorescein-guided technique able to help in resection of high-grade gliomas? Neurosurg. Focus 36 (2014) E5.

13- Schebesch KM, Proescholdt M, Höhne J, Hohenberger C, Hansen E, Riemenschneider MJ, et al. Sodium fluorescein-guided resection under the YELLOW 560 nm surgical microscope filter in malignant brain tumor surgery- a feasibility study, Acta Neurochir. (Wien) 2013;155:693–699.

14- Hamamcıoğlu MK, Akçakay MO, Göker B, Kasımcan MÖ, Kırış T. The use of the YELLOW 560 nm surgical microscope

filter for sodium fluorescein-guided resection of brain tumors: Our preliminary results in a series of 28 patients. Clinical Neurology and Neurosurgery. 2016;143:39–45. doi: 10.1016/j.clineuro.2016.02.006.
15- Wesseling P, Capper D. WHO 2016 Classification of gliomas. Neuropathol Appl Neurobiol, 2018;44(2):139-150. doi: 10.1111/nan.12432.
16- Stupp R, Mason Van Den Bent WP, Weller MJM, Fisher B, Taphoorn MJB, et al. Radiotherapy plus concomitant and adjuvant temozolomide for glioblastoma. N. Engl. J. Med. 2005;352:987–996.
17- Rey-Dios R, Hattab EM, Cohen-Gadol AA. Use of intraoperative fluorescein sodium fluorescence to improve the accuracy of tissue diagnosis during stereotactic needle biopsy of high- grade gliomas. Acta Neurochir. 2014;156(6):1071-1075.
18- Cavallo C, De Laurentis C, Vetrano IG, Falco J, Broggi M, Schiariti M, et al. The utilization of fluorescein in brain tumor surgery: a systematic review. J Neurosurg Sci. 2018;62:690–703. doi: 10.23736/S0390-5616.18.04480-6.
19- Stummer W, Pichlmeier U, Meinel T, Wiestler OD, Zanella F, Reulen HJ. Fluorescence-guided surgery with 5-aminolevulinic acid for resection of malignant glioma: a randomised controlled multicentre phase III trial. Lancet Oncol. 2006;7:392–401.doi: 10.1016/s1470-2045(06)70665-9.
20- Acerbi F, Vetrano IG, Sattin T, de Laurentis C, Bosio L, Rossini Z, et al. The role of indocyanine green videoangiography with FLOW 800 analysis for the surgical management of central nervous system tumors: an update. Neurosurg Focus. 2018;44:E6. doi: 10.3171/2018.3.FOCUS1862.
21- Kuroiwa T, Kajimoto Y, Ohta T. Surgical management for supratentorial astrocytic tumors. Minim Invasive Neurosurg. 42(4):182-186, 1999.
22- Schebesch KM, Hoehne J, Hohenberger C, Acerbi F, Broggi M, Proescholdt M, et al. Fluorescein sodium-guided surgery in cerebral lymphoma. Clin Neurol Neurosurg. 2015;139:125–8. doi: 10.1016/j.clineuro.2015.09.015.
23- Höhne J, Hohenberger C, Proescholdt M, Riemenschneider MJ, Wendl C, Brawanski A, et al. Fluorescein sodium-guided resection of cerebral metastases—an update. Acta Neurochir. 2017;159:363–7.
24- Höhne J, Schebesch KM, de Laurentis C, Akçakaya MO, Pedersen CB, Brawanski A, et al. Fluorescein Sodium in the Surgical Treatment of Recurrent Glioblastoma Multiforme. World Neurosurg. 2019;125:e158-e164. doi: 10.1016/j.wneu.2019.01.024.
25- Göker B, Kırış T. Sodium fluorescein–guided brain tumor surgery under the YELLOW-560-nm surgical microscope filter in pediatric age group: feasibility and preliminary results. Childs Nerv Syst. 2019;35(3):429-435. doi: 10.1007/s00381-018-04037-4.
26- Duffau H. Lessons from brain mapping in surgery for low-grade glioma: insights into associations between tumour and brain plasticity. The Lancet Neurology. 2005;4(8):476– 486.
27- Koc K, Anik I, Cabuk B, Ceylan S. Fluorescein sodium-guided surgery in glioblastoma multiforme: A prospective evaluation. Br J Neurosurg. 2008;22(1):99-103.
28- Gennadiy A Katsevman, Ryan C Turner, Ogaga Urhie, Joseph L Voelker, Sanjay Bhatia. Utility of sodium fluorescein for achieving resection targets in glioblastoma: increased gross- or near-total resections and prolonged survival. J Neurosurg. 2019;132(3):914-920. doi: 10.3171/2018.10.JNS181174.

Middle Black Sea Journal of Health Science / Mid Blac Sea J Health Sci
November 2022; 8(4):603-614

RESEARCH ARTICLE
DOI: 10.19127/mbsjohs.1148801

Evaluation of Radiological and Functional Results of Long Bone Diaphyseal Fractures in Children Aged 5-15 Years Who Underwent Titanium Elastic Nail

Ümit Aygün[1](ID), Murat Bölükbaşı[2](ID)

[1]Department of Orthopaedics and Traumatology, Istinye University Faculty of Medicine, İstanbul, Turkey
[2]Department of Orthopaedics and Traumatology, VM Medical Park Samsun Hospital, Samsun, Turkey

Received: 23 July 2022, Accepted: 18 October 2022, Published online: 30 November 2022

Abstract

Objective: In this study, we aimed to evaluate the radiological and functional results of titanium elastic nail (TEN), which was used as a surgical method in pediatric long bone diaphyseal fractures between 5-15 years of age, by comparing it with the clinical features of the patient and the fracture.

Methods: In this study, 44 patients (11 girls, 33 boys) aged 5-15 years (mean 9.86 ±2.84) were included. The clinical features of the patient, family satisfaction, evaluation of the fracture according to Flynn Criteria, time to bone union, stay in the hospital, and school absence was examined.

Results: TEN was applied mostly to the femur (n;18), tibia (n;14), and forearm (n;12) diaphysis fractures, respectively. Most of the fractures were seen as a result of high energy and closed middle diaphysis, the transverse fracture pattern was the most. Most of the fracture surgeries were performed with the closed method. The family satisfaction of the patients was at a high level. In the evaluation of fractures according to Flynn Criteria, most of the results were excellent, but no poor results were observed. Bone union time was higher in patients aged ten years and older and undergoing open surgery, and less in transverse fracture shape ($p<0.05$). The time not to attend school was highest in open fracture type, tibia fractures, and open surgery patients ($p<0.05$). Ulna union time was 13.1 ± 1.8 weeks, which was higher than forearm fractures ($p<0.05$). The hospital stay was 3.50 ± 0.79 / 4.29 ± 1.54 / 3.33 ± 0.49 days in femur/tibia/forearm fractures, respectively, and was the highest in tibia fractures ($p<0.05$).

Conclusions: TEN is an effective and safe method for long bone diaphyseal fractures in children aged 5-15 years, with low complication rates and positive effects on the patient and the health system.

Keywords: Child, long bone fracture, titanium elastic nail, Flynn Criteria

Suggested Citation: Aygün Ü, Bölükbaşı M. Evaluation of radiological and functional results of long bone diaphyseal fractures in children aged 5-15 years who underwent titanium elastic nail. Mid Blac Sea J Health Sci, 2022;8(4):603-614

Address for correspondence/reprints:
Name and Surname: Ümit Aygün
Telephone number: +90 (505) 558 13 21
E-mail: aygun.umit55@gmail.com

INTRODUCTION

Child bone fractures are distinguished from the adult bone structure by features such as high remodeling capacity, fewer ligament injuries, and thicker periosteum of the bone structure. Conservative treatment is at the forefront in long bone fractures in children under the age of six (1). When it comes to the 6-16 age group, the variety of treatments accompanied by surgical methods increases. Traction, orthosis, plaster cast, plate or external fixation, and intramedullary nail are used in pediatric long bone fractures (2). Of course, these methods have their own complications. Long hospital stays, inactivity, developing scars, growth plate injuries, and infections are just some of them (3).

With the increasing age of the child, intramedullary fixation has become attractive in children due to the low tolerance to immobilization, some uncomfortable properties of the cast, and lowering the risk of malalignment. Ender and Rush's nails were used in the past, and the emergence of rotational problems created a problem in using these materials (4).

With the description of an elastic intramedullary nail in pediatric long bone fractures, this method gained popularity. With the discovery of titanium elastic nails (TEN), the treatment method for femoral shaft fractures has changed over the years (5, 6). It has found more widespread use for many reasons such as providing primary union without damaging the growth plate, making fewer incision scars, being minimally invasive, low infection rates and hospitalization times and allowing early mobilization (7). It is also used successfully in some metaphyseal fractures. Its disadvantage is that it provides less stability in some complex fractures accompanied by severe soft tissue injuries (8). Although prolongation of union time and compartment syndrome can be observed in children with advanced age and >50 kg, using TEN in cases with correct indications has been an advantageous treatment method (9).

In this study, we aimed to show the radiological and functional results of TEN treatment used as a surgical method in pediatric long bone diaphyseal fractures between 5-15 years of age by comparing with the clinical features of the patient and the fracture.

METHODS

This study was designed as a retrospective cohort and ethical approval was obtained Clinical Research Ethics Committee (Date: 25.02.2022; Decision No: 3/2022.K-18). We conducted this research in compliance with the principles of the Declaration of Helsinki. Between the years 2017-January and 2019-November, child patients with the diagnosis of long bone diaphysis fracture were admitted to our hospital. There were 54 patients aged 5-15 years, to whom we applied titanium elastic nails in their treatment. Pathological fractures caused

by metabolic bone disease, tumors, patients with multiple bone fractures undergoing intensive care treatment, those with neuromuscular disease, and grade 3 open fractures were not included in this study. Between those whom we could reach, the broken bones, fracture side, mechanism, type, shape, location, and type of surgery-anesthesia of 44 patients who underwent TEN were recorded using the information obtained from the hospital archive and outpatient controls. Family satisfaction was evaluated according to whether the child's school adaptation in the postoperative period was good or not by the family's own observations.

Evaluation of bone fractures in terms of healing was carried out by considering Flynn Criteria (10). These consist of Limb length discrepancy, Malalignment, Pain, and Complication parameters. Each parameter is evaluated as excellent, satisfactory, and poor. These criteria were also used in the comparative evaluation of the TEN applied to the patients who underwent casting treatment first and had a loss of reduction in the follow-ups with all the patients. The time of bone union, inability to attend school, full weight-bearing and hospital stay were evaluated by comparing the data of the patient and the broken bone.

Surgical technique

After all the fractures were reduced under the scope, the nail entry points were determined so that the physis lines would not be damaged. In fractures where closed reduction is not possible, the fracture line was opened with a mini-incision and manual reduction was achieved. The total diameter of the TENs was chosen to fill approximately 80% of the bone medulla (3, 6). Nail tips were left under the skin. Antibiotic treatment was applied. Postoperative plaster was applied to all patients for pain control and plasters were continued until the sutures were removed. Range of motion exercises was started after the splint was removed. In lower extremity fractures, patients were mobilized with assistance. The way of pressing and using the upper extremity was adjusted according to the callus tissue in the controls.

Statistical analysis

SPSS 21.0 program was used in our analysis. The chi-square test was used to examine the association between categorical variables. The difference between the numerical variables according to the categorical variables with two groups was analyzed with the t-test, and the difference between the categorical variables with three or more groups was analyzed with the ANOVA test. The statistical level of significance was established at $p < 0.05$.

RESULTS

The mean follow-up time of 44 patients (11 girls, 33 boys) aged 5-15 years (mean 9.86 ±2.84) included in the study was 22.4 (range 16-29) months. TEN was applied mostly to the femur (n;18 mean age; 9,67), tibia (n;14 mean

age; 9,21), and forearm (radius+ulna) (n;12 mean age; 11,92) diaphysis fractures, respectively (Figure 1-3). The mean weight of all patients was 38,42±13,54 kg, and 34,70 ±12,20 kg in those with lower extremity fractures. Grade 1 open fracture was seen in three tibias and two femur fractures. Most fractures were seen on the right side, in boys, as a result of high energy, and the closed, middle diaphysis and transverse fracture patterns were the most common. Most fractures were treated with the closed method and general anesthesia was applied to all patients. The family satisfaction of the patients who underwent TEN treatment was high (Table 1).

Table 1 Distribution of clinical features of patients.

		n	(%)
Bone	Femur	18	40,9
	Tibia	14	31,8
	Forearm (radius+ulna)	12	27,3
Gender	Girl	11	25,0
	Boy	33	75,0
Side	Right	33	75,0
	Left	11	25,0
Fracture mechanism	Low energy	20	45,5
	High energy	24	54,5
Fracture type	Open	5	11,4
	Closed	39	88,6
Fracture shape	Transverse	20	45,5
	Oblique	13	29,5
	Spiral	7	15,9
	Fragmented	4	9,1
Fracture location	Middle	29	65,9
	Proximal	10	22,7
	Distal	5	11,4
Type of surgery	Open	5	11,4
	Closed	39	88,6
Type of anesthesia	General	44	100
	Sedation	0	0
Family satisfaction	Yes	39	88,6
	No	5	11,4

n: number

Given the evaluation of the fractures according to Flynn Criteria, most of the results were excellent, some of them were satisfactory, and no poor results were observed (Table 2). When these criteria are examined in detail; in two femur fractures, limb length discrepancy was observed in the elongation direction of 1.3 and 1.7 cm. One femur fracture had 5-10° varus, three tibia fractures had 5-10° malalignment in the coronal and sagittal planes. As complications, three superficial infections (two in the tibia and one in the femur fracture), and three nail end prominence (one in each bone fracture) were seen. Transient pain of these two types of complications was observed in five patients.

Table 2. Evaluation of patients according to Flynn Criteria.

Flynn Criteria	Excellent, n (%)	Satisfactory, n (%)	Poor, n (%)
Limb length discrepancy	42 (95,5)	2 (4,5)	None
Malalignment	40 (90,9)	4 (9,1)	None
Pain	39 (88,7)	5 (11,3)	None
Complication	38 (86,4)	6 (13,6)	None

In evaluating patients who underwent surgery due to reduction loss after plaster treatment first according to Flynn Criteria, the results were excellent in ten, and satisfactory in three patients. When the four parameters were evaluated according to all cases in these patients, the two most affected criteria were malalignment and complication (Table 3) ($p<0.05$).

Bone union time was higher in patients aged ten years and older and undergoing open surgery, and less in transverse fracture type (p<0.05). The time not to attend school was highest in open fracture type, tibia fractures, and open surgery patients (p<0.05) (Table 4). Ulna union time was 13.1 ± 1.8 weeks, and union time was higher than forearm fractures (p<0.05).

Table 3. Evaluation of the cases who were cast first and then operated according to Flynn Criteria with all patients

Flynn criteria (All patients)		**Flynn criteria for those who were cast first and then operated**			
		Excellent, n (%)	Satisfactory, n (%)	Poor, n (%)	P
Limb length discrepancy	Excellent	10 (100)	3 (100)		
	Satisfactory			*None*	>0,05
	Poor		*None*		
Malalignment	Excellent	10 (100)	1 (33,3)		
	Satisfactory	*None*	2 (66,7)	*None*	**<,005***
	Poor		*None*		
Pain	Excellent	10 (100)	3 (100)		
	Satisfactory		*None*	*None*	>0,05
	Poor				
Complication	Excellent	10 (100)	1 (33,3)		**<,005***
	Satisfactory	*None*	2 (66,7)	*None*	
	Poor		*None*		

P; significance

Table 4. Evaluation of bone union and school absence time with clinical characteristics.

		Bone union time (w), mean ± sd	P	Not to attend school (w), mean±sd	P
Age [b]	*9 ≤*	7,43±1,33	**,000***	6,86±2,43	0,249
	10 ≥	12,17±1,83		7,91±3,50	
Gender [b]	*Girl*	8,91±2,47	0,186	7,0±3,03	0,614
	Boy	10,24±2,96		7,55±3,09	
Fracture mechanism [b]	*Low energy*	9,80±3,02	0,821	6,85±3,13	0,272
	High energy	10,0±2,81		7,88±2,97	
Broken bone [a]	*Femur*	9,83±2,94	0,889	8,19±1,68	**,000***
	Tibia	9,71±3,12		9,29±1,33	
	Forearm	10,25±2,70		3,0±0,85	
Fracture location [a]	*Middle*	10,03±3,03	0,632	7,14±3,15	0,82
	Proximal	9,20±2,30		7,90±3,21	
	Distal	10,60±3,29		8,0±2,45	
Fracture shape [a]	*Transverse*	6,57±0,79	**,001***	7,55±3,09	0,856
	Oblique	9,31±2,95		7,0±3,42	
	Spiral	11,20±2,53		7,0±2,52	
	Fragmented	9,8±2,82		7,1±2,95	
Fracture type [b]	*Open*	11,0±3,0	0,374	9,60±0,55	**,000***
	Closed	9,77±2,87		7,13±3,13	
Type of surgery [b]	*Open*	14,0±0,71	**,000***	9,40±3,65	**,001***
	Closed	9,38±2,61		7,41±3,02	

a ; ANOVA b ; t test w; week sd; standard deviation

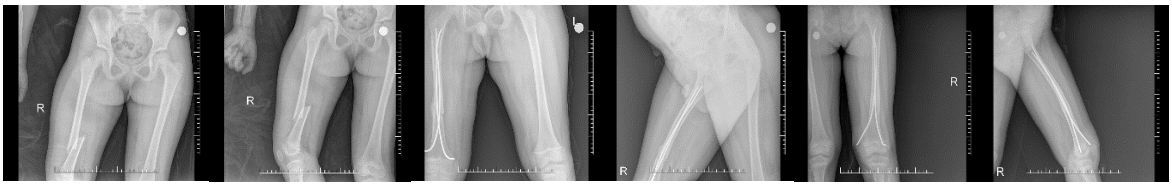

Figure 1. X-rays of femur fracture with TEN applied, A) preoperative B) postoperative and C) final polyclinic control

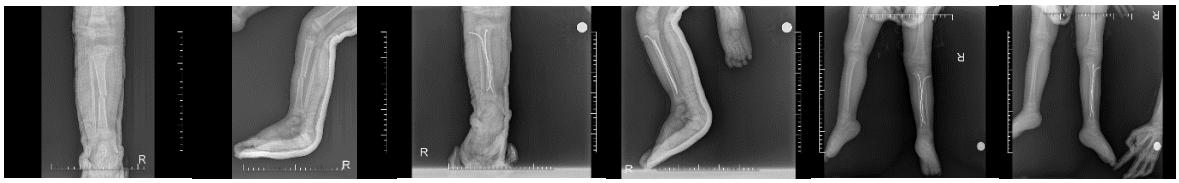

Figure 2. X-rays of tibia fracture with TEN applied, A) preoperative B) postoperative and C) final polyclinic control

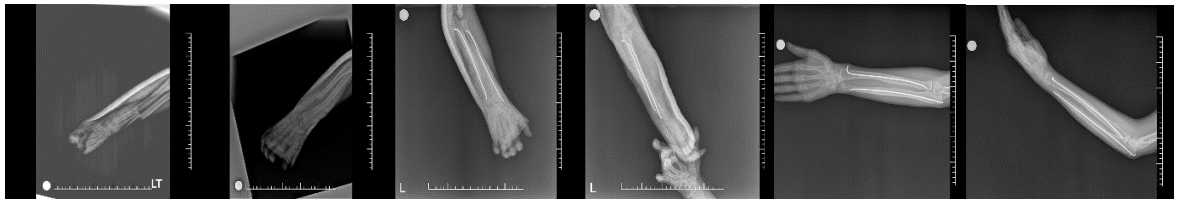

Figure 3. X-rays of forearm fracture with TEN applied, A) preoperative B) postoperative and C) final polyclinic control

Full weight-bearing time was 10.28 ± 2.89 and 10.71 ± 3.12 weeks in femur and tibia fractures, respectively ($p>0.05$). The hospital stay was 3.50 ± 0.79 / 4.29 ± 1.54 / 3.33 ± 0.49 days for femur/tibia/forearm fractures, respectively, and it was the highest for tibia fractures ($p<0.05$).

DISCUSSION

To treat long bone diaphyseal fractures in children, the most appropriate implant should be a load-sharing internal splint that preserves length and rotation until the callus tissue is formed, does not harm the physis, and allows early movement (11). TENs are the implants with these features. Since most of them are applied with closed methods, the fracture hematoma and periosteum remain unharmed, thus reducing the possibility of infection and increasing the chance of union of the bone (10, 12, 13). In a study conducted on 30 patients, 14% poor, 30% acceptable, and 56% excellent results were reported according to Flynn Criteria in tibial shaft fractures in which TEN was applied (14). In a study on 48 children with femur fractures, 83% excellent and 17% sufficient results were obtained (7). In another study evaluating patients with forearm fractures who underwent TEN, data with predominantly excellent results were obtained (13). Most of the results were excellent in all broken bones in this study, poor results were not observed. The fact that we obtained similar results in most of the patients who had to have a plaster cast first and then TEN treatment is appropriate with the literature and shows that TEN is a suitable method for treating children's long bone diaphyseal fractures.

Over time, TEN has started to be applied in some open fractures. In a study conducted on 16 tibias, 13 of which were open fractures except for grades 3b and 3c, 15 of the patients were excellent and one was satisfactory, according to the Flynn Criteria (15) . In another study on 11 patients, poor result was obtained in one of three patients with grade 1, 2, 3a open femur fractures, and satisfactory results were obtained in two (16). On the other hand, it was emphasized that the union time was prolonged in the TEN results applied to open fractures (17). In this study, open fractures were seen in the femur and tibia as grade 1, and the excellent results may contribute to the literature on the safe use of TEN in open fractures. We attribute our lack of difference in union time in open fractures to the low grade of the fractures, and to the postoperative cast and antibiotherapy we applied.

The development of length discrepancy in the healing process of bones has often been associated with the femur. For this, a minimum overlap of 1.5 cm between the fracture ends is recommended in the treatment. End-to-end alignment can be a problem in terms of excessive growth in TEN use (18). In a study on femoral shaft fractures in which 29 patients were evaluated after three years, a mean shortening of 11.7 mm was observed in three patients, and a mean increase in length of 2.7 mm in nine patients. No length difference was observed in ten patients. Fifteen patients were 8.7 mm long at the end of the first postoperative year. It has been emphasized that leg length discrepancy is frequently observed, but it does not pose a problem over time (19). Leg length discrepancy has also been reported after tibial diaphyseal fractures. In a study in which 54 patients with tibial fractures were evaluated, it was reported that a length difference of 15 mm-20 mm developed in two patients with comminuted fractures. This was healed by performing epiphysiodesis on the opposite side (20). Disruption of fracture alignment has been attributed to unstable fracture patterns, advanced age, unsuitable nail size and curve, and insufficient postoperative immobilization (18). In this study, the bone with the greatest length difference was the femur, and there have not been any difficulties created by this problem in patient follow-ups.

Angulation can be seen during union at a higher rate in TENs compared to open reduction and fixation of the fracture with a plate, which may cause false unions (8). In a study conducted on 47 femur fractures, malalignment was observed in six patients with spiral fractures. Revision surgery was performed on two patients because there was greater angulation than 10 degrees in the sagittal and coronal planes (3). In a study with 19 tibial fractures in which the mean follow-up period was 15.7 months, an angulation of 5-10 degrees was reported in the coronal plane in three patients (18.9%) and the sagittal plane in

one patient (6.3%) (21). In forearm fractures, malalignment may affect especially pronation and supination movements. Injuries in the proximal region have a greater negative impact on movement; spontaneous recovery can be observed in fractures approaching the wrist region (22). In this study, we attribute the angulation in femur and tibia fractures due to the incompatibility of the patients and their relatives, not using a cast for enough time in the postoperative period, and weight-bearing in the early period.

TENs may cause irritation and infection at entry points. In a study, it was shown that 13.6% of patients with tibial fractures had entry site-related irritation and 4.4% of patients had a superficial infection (23). It was reported that 8.5% of painful nail tips and 3.4% of superficial infections were observed in femur fractures (5). The most common complication related to TEN applied in pediatric long bone fractures followed for seven years was irritation and pain due to the entry site (3). It has been shown that causes such as shortening or angulation of unstable fractures, long nail tips left at a sharp angle, and entrances close to the distal physis predispose to this complication (12). It has been emphasized that the nail tips should remain under the skin to reduce the risk of infection, and the remaining nail tip outside the bone should be less than 2 cm (3, 10). Although we leave the nail tips under the skin in patients, we attribute our nail prominence and superficial infection to our early joint movements and leaving the nail tips under the skin long. These complications were resolved with oral antibiotic therapy and nail removal after the bone union.

TEN applications may not always be performed with the closed method. If the surgeon cannot advance the nail ends from the fracture site within 10 minutes, it is stated that open surgery should be performed, because unsuccessful attempts prolong the duration of the surgery and may increase the incidence of risks, such as compartment syndrome (24, 25). Conversion to open surgery brings risks to the union (26). In addition, in a study conducted on 50 tibial fractures, it was stated that the duration of union prolongs with age (27). In this study, it was observed that the duration of bone union was prolonged in patients aged 10 years and over and in three bone types that were switched to open surgery, and all fractures were unionized in the patient follow-ups.

It was shown that the only bone that developed non-union or malunion as a result of TEN application among all pediatric fractures was the tibia (28). The incidence of malunion in tibia fractures as a result of TEN application varies between 0-11% (27). It has been shown that this is due to the triangular cross-section of the tibia and the difficulty in maintaining the reduction (12). The incidence of non-union in tibial fractures is between 0-8%, and no non-union cases were observed in a study in which

many fractures were closed, and the nail was applied (17). Healing was achieved within 12 weeks without delay in the union in all 31 femoral fractures in which TEN was applied (6). In a study conducted on 30 diaphyseal non-unions, it was stated that most non-unions were in the tibia and femur, and severe traumas, open surgery, and infections might cause this (29). It has been reported in some publications that the ulna can fuse later in forearm fractures. Non-union is most often seen in the middle section, this area can be called the watershed zone. Inappropriate nail diameter, the development of distraction at the fracture line during retrograde nailing of the ulna, and the opening of the fracture line for reduction are among the accused theories (30, 31). Although we did not find any difference regarding union time in three types of bone fracture in this study, longer union time of the ulna compared to forearm fractures makes this bone special and shows us that more care should be taken during surgery and in patient follow-up.

Minimally fragmented, transverse, short oblique fractures are suitable fracture patterns for TEN applications. Experienced surgeons can also apply it successfully in long oblique spiral fractures. However, there may be a loss of stability in this type of unstable fracture type, and immobilization may be required after the operation (32). In the study conducted on femur fractures, union time was shorter in the transverse fracture type compared to oblique-spiral fractures. It has been shown that the fracture location and fracture mechanism are not related to the duration of bone union (5). This study is compatible with the literature regarding these parameters. Given that it has been examined in different bones from this point of view adds a special perspective to pediatric fractures.

With using TEN, the time to stay in the hospital, and so the financial burden on the health system, has also decreased. In a study on pediatric long bone fractures, the mean hospital stays of patients treated with TEN was 3.5 days. In all fractures, the union was achieved in an average of 9.6 weeks (33). In a prospective study evaluating femur and tibia fractures, the average hospital stay was 5.7 days, and most fractures healed within three months (34). In this study, we attribute the most frequent hospital stay in tibia fractures to the frequent encounters with compartment syndrome in our clinic and the necessity of following the patient closely.

Positive effects on bone healing without damaging the epiphysis blood circulation, low complication rates, early return to school, short hospital stay, and high family satisfaction rate are the main benefits of TEN treatments (35). Given that the time to attend school was longer in patients with tibial fractures, open fractures, and open surgery in this study may be due to psychological factors caused by the time of bone union and the long follow-up period in the

hospital. Despite this, family satisfaction was high in this research.

The limitations of this study are the absence of a control group in which other methods of treatment are used, the fact that the study was carried out in a single center, the short follow-up time, and the small sample size with widely distributed age groups

CONCLUSION

The findings obtained in this study suggest that using TEN is an effective and safe method in children aged 5-15 years with long bone diaphysis fractures, and its effects on the patient and the health system are positive with low complication rates. Rigid fixation can be considered in femoral diaphyseal fractures of elderly and overweight patients. We believe that multicenter studies with large patient participation and research in which treatment diversity is discussed comparatively will continue to guide surgeons in the approach to pediatric fractures.

Ethics Committee Approval: This study was approved by İstinye University Clinical Research Ethics Committee (Date: 25.02.2022; Decision No: 3/2022.K-18
Peer-review: Externally peer-reviewed.
Author Contributions: Conception-UA, design-UA, MB; manuscript reviewing, and data collection- UA; editing and writing-UA, MB
Conflict of Interest: The authors have no interest to declare
Financial Disclosure: The author declared that this study has received no financial support.

Acknowledgments: I would like to thank Prof.Dr Hakan Ömeroğlu for his comments on the research and his warnings about spelling rules and Merve Aygün for her help in conducting the statistical analysis of the study.

REFERENCES

1- Omeroglu H. Basic principles of fracture treatment in children. Eklem Hastalik Cerrahisi. 2018;29(1):52-7.
2- Becker T, Weigl D, Mercado E, Katz K, Bar-On E. Fractures and refractures after femoral locking compression plate fixation in children and adolescents. J Pediatr Orthop. 2012;32(7):e40-6.
3- Nisar A, Bhosale A, Madan SS, Flowers MJ, Fernandes JA, Jones S. Complications of Elastic Stable Intramedullary Nailing for treating paediatric long bone fractures. J Orthop. 2013;10(1):17-24.
4- Khuntia S, Swaroop S, Patro BP, Sahu S. Paediatric Long Bone Fractures Managed with Elastic Intramedullary Nails: A Retrospective Study of 30 Patients. Cureus. 2020;12(4):e7847.
5- Assaghir YM. Titanium elastic nail in femur fractures as an alternative to spica cast in preschoolers. J Child Orthop. 2012;6(6):505–11.
6- Sutphen SA, Mendoza JD, Mundy AC, Yang JG, Beebe AC, Samora WP 3rd, et al. Pediatric Diaphyseal Femur Fractures: Submuscular Plating Compared with Intramedullary Nailing. Orthopedics. 2016;39(6):353-8.
7- Govindasamy R, Gnanasundaram R, Kasirajan S, Ibrahim S, Melepuram JS. Elastic Stable Intramedullary Nailing of Femoral Shaft Fracture-Experience in 48 Children. Arch Bone Jt Surg. 2018;6(1):39-46.
8- Uludağ A, Tosun HB. Treatment of Unstable Pediatric Tibial Shaft Fractures with Titanium Elastic Nails. Medicina. 2019;55(6):266.
9- Pandya NK, Edmonds EW, Mubarak SJ. The incidence of compartment syndrome after flexible nailing of pediatric tibial shaft

fractures. J Child Orthop. 2011;5(6):439–47.
10- Flynn JM, Hresko T, Reynolds RA, Blasier RD, Davidson R, Kasser J. Titanium elastic nails for pediatric femur fractures: a multicenter study of early results with analysis of complications. J Pediatr Orthop. 2001;21(1):4–8.
11- Imam MA, Negida AS, Elgebaly A, Hussain AS, ErnstbrunnerL, Javed S, et al. Titanium elastic nails versus spica cast in pediatric femoral shaft fractures: a systematic review and meta-analysis of 1012 patients. Arch Bone Jt Surg. 2018;6(3):176-88.
12- Lascombes P, Haumont T, Journeau P. Use and abuse of flexible intramedullary nailing in children and adolescents. J Pediatr Orthop. 2006;26(6):827–34.
13- Cai L, Wang J, Du S, Zhu S, Wang T, Chen H. Comparison of hybrid fixation to dual plating for both-bone forearm fractures in older children. Am J Ther. 2016;23(6):e1391–e96.
14- Debnath S, Debbarma S, Sarkar A. Titanium elastic nailing osteosynthesis for diaphyseal tibial fracture in pediatrıc age group-our experience. Indian J Appl Res. 2017;7(7):52–3.
15- Heo J, Oh CW, Park KH, Kim JW, Kim HJ, Lee JC, et al. Elastic nailing of tibia shaft fractures in young children up to 10 years of age. Injury. 2016;47(4):832–36.
16- Kawalkar A, Badole CM. Percutaneous titanium elastic nail for femoral shaft fracture in patient between 5 and 15 years. J Orthop. 2018;15(2):695-700.
17- Pennock AT, Bastrom TP, Upasani VV. Elastic Intramedullary Nailing Versus Open Reduction Internal Fixation of Pediatric Tibial Shaft Fractures. J Pediatr Orthop. 2017;37(7):e403-e8.
18- Siddiqui AA, Abousamra O, Compton E, Meisel E, Illingworth KD. Titanium Elastic Nails Are a Safe and Effective Treatment for Length Unstable Pediatric Femur Fractures. J Pediatr Orthop. 2020;40(7):e560-e5.
19- Gogi N, Khan SA, Varshney MK. Limb length discrepancy following titanium elastic nailing pediatric femoral shaft fractures. Acta Orthop Belg. 2006;72(2):154-8.
20- Vallamshetla VR, De Silva U, Bache CE, Gibbons PJ. Flexible intramedullary nails for unstable fractures of the tibia in children. An eight-year experience. J Bone Joint Surg Br. 2006;88(4): 536-40.
21- Sankar WN, Jones KJ, Horn BD, Wells L. Titanium elastic nails for pediatric tibial shaft fractures. J Child. Orthop. 2007;1(5):281–6.
22- Sinikumpu JJ, Serlo W. The shaft fractures of the radius and ulna in children: current concepts. J Pediatr Orthop B. 2015;24(3):200-6.
23- Kc KM, Acharya P, Sigdel A. Titanium Elastic Nailing System (TENS) for Tibia Fractures in Children: Functional Outcomes and Complications. JNMA J Nepal Med Assoc. 2016;55(204):55-60.
24- Lu D, Lin Z, Zhang JD, Chen H, Sun LJ. Treatment of pediatric forearm midshaft fractures: is there a difference between types of orthopedic surgeon? Orthop Traumatol Surg Res. 2017;103(1):119–22.
25- Blackman AJ, Wall LB, Keeler KA, Schoenecker L, Luhmann SJ, O'Donnell JC, et al. Acute compartment syndrome after intramedullary nailing of isolated radius and ulna fractures in children. J Pediatr Orthop. 2014;34(1):50–4.
26- Flynn JM, Jones KJ, Garner MR, Goebel J. Eleven years' experience in the operative management of pediatric forearm fractures. J Pediatr Orthop. 2010;30(4):313-9.
27- Gordon JE, Gregush RV, Schoenecker PL, Dobbs MB, Luhmann SJ. Complications After Titanium Elastic Nailing of Pediatric Tibial Fractures. J Pediatr Orthop. 2007;27(4):442–6.
28- Slongo TF. Complications and failures of the ESIN technique. Injury. 2005;36(1):78-85.
29- Yeo JH, Jung ST, Kim MC, Yang HY. Diaphyseal Nonunion in Children. J Orthop Trauma. 2018;32(2):e52-e8.
30- Kapila R, Sharma R, Chugh A, Goyal M.

Evaluation of clinical outcomes of management of paediatric bone forearm fractures using titanium elastic nailing system: a prospective study of 50 cases. J Clin Diagn Res. 2016;10(11):12-5.

31- Ballal MS, Garg NK, Bruce CE, Bass A. Nonunion of the ulna after elastic stable intramedullary nailing for unstable forearm fractures: a case series. J Pediatr Orthop B. 2009;18(5):261–4.

32- Saikia K, Bhuyan S, Bhattacharya Td, Saikia Sp. Titanium elastic nailing in femoral diaphyseal fractures of children in 6-16 years of age. Indian J Orthop. 2007;41(4):381-5.

33- Karaduman ZO. Retrospective Evaluation of the Results of Elastic Intramedullary Nailing in Pediatric Femoral, Tibial, and Forearm Diaphyseal Fractures. Middle Black Sea Journal of Health Science 2019;5(2):226-32.

34- El-Adl G, Mostafa MF, Khalil MA, Enan A. Titanium elastic nail fixation for paediatric femoral and tibial fractures. Acta Orthop Belg. 2009;75(4):512–20.

35- Luo Y, Wang L, Zhao LH, Wang YC, Chen MJ, Wang S, et al. Elastic Stable Titanium Flexible Intramedullary Nails Versus Plates in Treating Low-Grade Comminuted Femur Shaft Fractures in Children. Orthop Surg. 2019;11(4):664-70.

Middle Black Sea Journal of Health Science / Mid Blac Sea J Health Sci **November 2022; 8(4):615-623**

RESEARCH ARTICLE **DOI:** 10.19127/mbsjohs.1148946

Evaluation of Chronic Pain Management in the Elderly Living in a Nursing Home Assessment of Age and Chronic Pain

Dudu Alptekin[1(ID)], Hamide Şişman[1(ID)], Refiye Akpolat[2(ID)], Derya Gezer[3(ID)], Esma Gökçe[4(ID)], Sevban Arslan[5(ID)]

[1]Çukurova University Abdi Sütcü Health Services Vocational School, Adana,Turkey
[2]Department of Nursing, Faculty of Health Sciences, Kocaeli Health and Technology University, Kocaeli, Turkey
[3]Nursing Department, Tarsus University Faculty of Health Sciences, Mersin, Turkey
[4]Vocational School of Health Services, Toros University,Mersin,Turkey
[5]Department of Surgical Nursing, Faculty of Health Sciences, Çukurova University, Adana, Turkey

Received: 26 July 2022, Accepted:09 September 2022, Published online: 30 November 2022

Abstract

Objective: There is a decrease in sensitivity to painful stimuli in the elderly. This study was conducted to determine the pain management status of the elderly living in nursing homes.

Methods: This descriptive study was conducted in the Nursing Home Elderly Care and Rehabilitation Center Directorate. Elderly Information Form, Mini-Mental Scale, and McGill Pain Scale were used. . Data were considered statistically significant at the $p < 0.05$ level. Parametric methods were used for normally distributed data.

Results: 82.9% of the elderly had a chronic disease and were using drugs continuously, and the number of drugs used by 42.9% was between 1-3. According to McGill's Pain severity assessment, 34.3% of them experienced mild pain. Between the gender of the elderly and the McGill Melzeck pain severity averages they experienced, the average pain score of the female gender was found to be significantly higher than the pain average of the male gender ($t(68)=-1.99$, $p=0.05$). When the behaviors of the elderly against pain were examined, 62.9% reported that they preferred to talk, 72.9% to rest, 52.9% to plan rest periods, and 55.7% to get support from their religious belief

Conclusion: In this study, the severity of pain and behaviors of the elderly against pain were evaluated.

Keywords: Nursing Home, Aging, Pain, Pain Management, Evaluation

Suggested Citation: Alptekin D, Şişman H, Akpolat R, Gezer D,Gökçe E, Arslan S. Evaluation Of Chronic Pain Management İn The Elderly Living İn A Nursing Home. Mid Blac Sea Journal of Health Sci, 2022;8(2):615-623.

Address for correspondence/reprints:
Name and Surname: Dudu Alptekin
Telephone number: +90 (542) 524 07 08
E-mail: dudubaysal@hotmail.com

INTRODUCTION

The World Health Organization (WHO) defines individuals aged 65 and over as “elderly”. Age periods according to the course of aging and changes in body functions; It is classified as "late adulthood" between the ages of 65-74, "old age" between the ages of 75-84, and "advanced old age" between the ages of 85 and over(1). According to the 2018 data from the Turkish Statistical Institute (TUIK), the proportion of the population aged 65 and over, defined as the elderly population in our country, is 8.7% in 2018, 10.2% in 2023, 16.3% in 2040, 22.6% in 2060. and it is predicted that it will be 25.6% in 2080 and it is estimated that our country will be among the countries with a “very old” population (2).

Aging is a process that includes biological, physiological, emotional-psychological, and functional dimensions. While biological aging expresses the changes in the structure and functions of the human body with chronological age; Physiological aging includes changes in organs due to biological aging, and emotional-psychological aging includes the change of human adaptation capacity as chronological age progresses in terms of perception, learning, psychomotor problem solving and personality traits. Functional old age, on the other hand, is the inability to maintain functions in society when compared to individuals of the same age (3). Changes in physiological processes in the elderly bring pain along with them. It is called chronic geriatric pain in the elderly when it occurs for more than three months. The resulting pain can affect the daily life activities of elderly individuals and cause depression. Pain in the elderly can cause multiple drug use, cognitive decline, gait disturbances, and accidents. For all these reasons, pain is one of the factors that should be evaluated in elderly individuals (4).

Diseases related to muscles, bones, and joints are the leading causes of pain in the elderly. These include osteoarthritis, spondylosis, osteoporosis, low back and leg pain, rheumatoid arthritis, fibromyalgia, myofascial pain, tenosynovitis, inactivity-related contractures, unhealed fractures, Paget's disease, and secondary myopathies. Other causes of chronic pain in the elderly are malignancy, neurological diseases (nerve root pain, peripheral neuropathy, etc.), vascular diseases (Angina Pectoris, arthritis, etc.), and visceral pain (peptic ulcer, constipation, etc.) (1,5).

There is a decrease in sensitivity to painful stimuli in the elderly. However, decreased pain sensitivity does not mean that the elderly feel less pain. The fact that the elderly express their pain may mean that the condition causing the pain is more serious than the younger individuals reporting the same pain (6,7). To effectively and successfully control pain in the elderly, pain should be adequately and accurately evaluated and diagnosed (8) and should be brought under control with appropriate interventions with a multidisciplinary approach (9). As with every symptom, the first step in pain assessment includes taking the patient's history. During the history taking, the time of onset and location of the pain, how the patient describes the pain (burning, discomfort, pain, etc.), factors that increase and decrease the pain, its severity, quality, changes according to time and situations, worst pain experienced in the last week, effect on daily life, the use of traditional pain relief methods and the drugs used for pain relief or other

disease/diseases should be learned. In addition, the pain behaviors of the elderly (grimacing, restlessness, withdrawing, etc.) should be evaluated (10). For the nurse, who has important responsibilities in the care of the painful patient, to help in the control and relief of the pain, it is necessary to know the pain behaviors of the patients and how the nurses define the patient with pain. For older patients, self-management of pain or treatments should improve health and reduce healthcare expenditure. Pain management of the elderly can be achieved with realistic and accurate goals and a plan that can be made together (11). Based on all of these, this study was planned to determine the level of pain experienced by the elderly living in nursing homes and what behaviors they resort to in pain management.

METHODS

This descriptive study was carried out between February and May 2019 by the Martyr Kara Pilot Captain Serhat Sığnak Nursing Home Elderly Care and Rehabilitation Center Directorate and Seyhan Nursing Home Elderly Care and Rehabilitation Center Directorate. The population of the study consisted of a total of 183 elderly people living in both nursing homes, and the sample of the study consisted of 70 elderly people who voluntarily agreed to participate in the study and met the study criteria (with chronic pain lasting for more than 3 months, without cognitive and mental problems, who could be contacted).

Data Collecting

Elderly Information Form, Mini-Mental Scale, Pain Management Inventory and McGill Pain Scale were used as data collection tools. The elderly living in a nursing home who agreed to participate in the study voluntarily had chronic pain lasting more than 3 months and scored between 24 and 30 on the Mini-Mental Scale were included in the study. The population of the study consisted of the elderly who met the sample selection criteria (the elderly who could be contacted, had chronic pain for more than 3 months, and had no cognitive and mental problems) and agreed to participate in the research.

Elderly Information Form: A 14-question survey form prepared by the researchers in light of the literature on the subject will be used. The questionnaire includes questions related to socio-demographics, the health status of the elderly, and the nursing home (10,11).

Mini-Mental Scale: The scale, which consists of eleven items gathered under five main headings as orientation, recording memory, attention and calculation, recall, and language, is evaluated out of a total score of 30, and between 24-30 points are considered normal. The Mini-Mental Test (MMT) was first used in 1975 by Folstein and Posted by friends (12).

McGill Pain Scale (MPS): McGill Pain Scale was developed by Melzack in 1975. It includes sensory, sensation, and evaluation dimensions of pain (13). Different scores can be obtained from the MAS. In the simplest scoring, the number of words selected in the second part of the questionnaire is between 0-78 and the current pain intensity in the fourth part is between 1 (mild) and -5 (unbearable). Many studies have shown that the MAS is a valid, objective, and reliable tool. It has been determined that the McGill Pain Scale is a valid and reliable tool for Turkish society (11).

Pain Management Inventory (PMI): It was developed to examine pain management methods

and the effect of these methods. The PMI is a 22-item Likert-type (0-6) scale. The individual completing the PMI will mark the appropriate option if he or she does not use a method, mark the appropriate option if he has used any method in the last week, and mark the option/number that best describes how useful the method is three different results emerge from the scale: (a) the list of recently used methods, (b) the total number of methods used, and (c) the usefulness rate of each method. The internal consistency of the PMI was found to be Cronbach alpha 0,76) (14). When the literature is examined, it has been reported that there is no need to conduct validity and reliability studies because the PMI is an inventory and only includes method questioning (15). For these reasons, validity and reliability studies of the inventory for our country have not been conducted. In our study, Cronbach's Alpha value was not calculated because we only used the list of recently used methods section of the inventory.

The study was approved by the Çukurova University Faculty of Medicine Ethics Committee (No. 85-35). All procedures were carried out by the principles of the 1964 Declaration of Helsinki and its subsequent amendments or comparable ethical standards. The elderly were informed in detail about the study protocols and their written consent was perceived.

Statistical Analysis

Data were analyzed using the IBM SPSS Statistics 24 program using descriptive statistics (frequency, percentage, and mean) and frequency tables. Data were considered statistically significant at the $p < 0.05$ level. Parametric methods were used for normally distributed data. As parametric methods, the "Independent Samples t-test" (t-table value) test was performed to compare the means of two independent groups.

RESULTS

Findings were obtained from the study conducted to determine the pain management status of the elderly living in nursing homes.

When we examine the variables related to the elderly, it is seen that 40% of the elderly living in nursing homes are in young old age. 70% of women stay in nursing homes, 62.9% of them are married, and 45.7% of them are illiterate, It was concluded that 72.9% of them had children. 82.9% of the elderly had a chronic disease and were using drugs continuously, and the number of drugs used by 42.9% was between 1-3 (Table 1).

According to McGill's pain severity assessment, 15.7% of the elderly did not experience pain, 34.3% had mild pain, 27.1% had disturbing pain, 15.7% had severe pain, and 5.7% had very severe pain. severe pain and 1.4% experienced excruciating pain (Table 2)

According to the results of the t-test performed to test the difference between the gender of the elderly and the McGill Melzeck pain severity averages they experience, the mean pain score of the female gender (1.83±1.08) was significantly higher than the pain average of the male gender (1.23±1.30) found (t=-.99, p=0.05) (Table 3)

A statistically significant relationship was found between the satisfaction levels of the elderly in the nursing home and the McGill Melzeck mean pain intensity averages. The mean pain score of the less satisfied elders was 2.50±1.50, the mean pain score of the moderately satisfied patients was 1.37±0.90,

and the mean pain score of the delighted patients was 1.64 ±1.19 (t=3.62, p<0.05). (Table 3)

Table 1. Examination of Variables Related to the Elderly

Variable (n=70)	n	%
Age [$\bar{X} \pm$ S.S.→77,70±1,00 year)]		
Young Old Age (65-74 years)	28	40
Middle Age (75-84 years)	23	32.9
Late Old Age (85 years and above)	19	27.1
Gender		
Woman	49	70
Male	21	30
Marital status		
Married	44	62.9
Single	26	37.1
Educational Status		
Illiterate	32	45.7
literate	4	5.7
Primary education	21	30
High school	13	18.6
Status of Having a Child		
Yes	51	72.9
No	19	27.1
Presence of Chronic Disease		
Yes	58	82.9
No	1	17.1
Continuous Medication Status		
Yes	58	82.9
No	12	17.1
Number of Drugs Used		
Doesn't Use Medication	10	14.3
1-3 drugs	30	42.9
4-6 drugs	18	25.7
7-9 drugs	4	5.7
10 or more drugs	8	11.4

Table 2. Evaluation of McGill Melzeck Pain Severity

McGill Melzack Score	n	%
No pain	11	15.7
Mild Pain	24	34.3
Disturbing Pain	19	27.1
Severe pain	11	15.7
Very Severe	4	5.7
Unbearable	1	1.4

When the behaviors of the elderly in the face of pain are examined, 42.9% of the massage, 51.4% to control their stress, 62.9% to talk, 72.9% to rest, and 20% to apply hot/cold. 35.7% avoid diverting attention, 15% avoid biological feedback, 18.6% take a shower, 17.1% use over-the-counter pain relievers, 45.7% avoid foods that cause pain, 7.1% exercise, 12.9% use TENS, 12.9% support the painful area, 65.7% use painkillers according to doctor's prescription, 65.7% physical activity that will increase pain reported that they preferred avoiding, 38.6% using positive suggestions, 52.9% planning rest periods, 55.7% preferring to receive support from their religious belief (Table.4).

Table 3. Examination of the Relationship between the Characteristics of the Elderly and McGill Melzeck Pain Severity

Variables	McGill Pain Level			t-test		
Gender	N	X	SS	F	Sd	p
Woman	49	1,83	1,08	-1.99	68	0.05
Male	21	1,23	1,30			
Level of Satisfaction with the Nursing Home						
A lot	31	1,64	1,19	3.62	67	0.03
Middle	29	1,37	0,90			
Little	10	2,50	1,50			

DISCUSSION

Although pain is one of the most common findings in the elderly, elderly individuals may accept pain as a natural consequence of the aging process and may find it unnecessary to express their discomfort (15). When the literature is examined, it has been reported that the prevalence of pain in the elderly is 88.5%-99.7% and the rate of chronic pain is 31-64.7% (16). Usta and Karadakovan as a result of their studies on the elderly living in nursing homes; elderly individuals they reported that 85.3% of them had a chronic disease (17). Research made; It reveals that gender, socioeconomic status, chronic diseases and the number of drugs used, working status, length of care, relations with other individuals, and participation in

indoor and outdoor activities affect the pain status and the life of the individual (18,19).

In the study by Miro et al. reported that the state of experiencing pain in the elderly ranged from 1.5% to 65.3% (20). Similarly, in the study of Saka et al. and in another study in which a total of 1059 elderly people living in 5 countries including the United States were evaluated, it was reported that the elderly experienced moderate pain (21). In this study, approximately one-fourth (27.1%) of the elderly experience severe pain, which confirms the frequency of severe pain in studies conducted in different areas where the elderly was present (20,22). Ferrell et al. also expressed the average pain intensity of elderly individuals is uncomfortable (24).

Table 4. Examination of Behaviors of the Elderly in the Face of Pain

Variable (n=70)	**n**	**%**
Massaging the painful area(s)	30	42.9
Using methods that help control stress (talking to someone, doing breathing exercises, etc.)	36	51.4
Talking to people I think can understand me	44	62.9
Have a rest	51	72.9
Applying cold to the painful area(s)	14	20
Using distracting techniques, such as watching TV, reading, or working	25	35.7
Using biofeedback by monitoring heart rate, blood pressure, or other physiological measurements (respiration, body temperature, etc.)	11	15.7
Using a hot tub or tub or taking a hot shower	13	18.6
Using painkillers that the physician does not recommend or prescribe	12	17.1
Avoiding foods that initiate or increase pain	32	45.7
Participating in support groups (patient associations, meetings, etc.) on pain	5	7.1
To exercise	20	28.6
Applying heat to the painful area(s)	12	17.1
Taking antidepressant medication prescribed by a physician	22	31.4
Using relaxation methods such as meditation or guided daydreaming	5	7.1
Using Transcutaneous Electrical Stimulation (TENS)	9	12.9
Supporting the painful area(s) using a splint or brace	9	12.9
Taking pain medication prescribed by a physician	46	65.7
Avoiding physical activity that will increase pain	46	65.7
Using positive suggestions such as “I can……”	27	38.6
Scheduling rest periods between activities	37	52.9
Focus on support from personal religious belief	39	55.7

In the study by Sezer et al. named Chronic Pain Status and Evaluation of Affecting Factors in the Elderly, it was reported that there is a significant difference (24). The difference between pain severity and gender was significant. Severe pain is more common in women. Similarly, in a study conducted with the same scale in three centers in Europe, it was seen that women experienced pain more (25). Şimşek et al. stated that the complaint of pain was mostly seen in women (26). This result may be related to the fact that women express their feelings and thoughts more easily than men, and that they assume some gender-specific responsibilities depending on cultural factors (27)

Considering the effect of the satisfaction level of staying in a nursing home on the pain

level of the elderly, it was seen in the study that the pain score average of those who were less satisfied with the nursing home was moderate and higher than those who were very satisfied. In the study of Kara et al., it was observed that the level of satisfaction with the nursing home was high and the pain assessment process and the state of experiencing pain were accordingly positive (28,29). The limited number of studies investigating the relationship between satisfaction with staying in a nursing home and pain status limits the comparison with the results of our study.

In this study, it was determined that the elderly used excessive painkillers (65.7%) to cope with pain. When individuals have pain, they first prefer to take painkillers because they can be applied easily and have a quick effect (15). Similar to this study, Güler et al (31) reported that 90.6% of the elderly, and Özel et al. (11) reported that 96.3% of the elderly were Hwang et al (32). determined that the rate of analgesic use in elderly individuals was 80%.

Non-drug pain management methods are simple and inexpensive methods of pain relief. Current guidelines stated that pain management is limited in elderly individuals and recommended using medicated and non-drug methods in pain management (31,32). In this study, it was seen that non-drug methods were used against pain. In the survey, resting in the face of pain and avoiding physical activity were found to be high (72.9%-65.7%). Previous studies reported that the elderly often used rest-activity restriction to relieve pain and found this method beneficial (11,33,34).

Consistent with the literature, rest and physical activity restriction is among the non-drug methods used by the elderly living in nursing homes.62.9% of the elderly individuals participating in the study reported that they coped with the pain by talking to people they thought they could understand and 55.7% of them focused on the support they received from their religious beliefs. When the literature is examined, talking with someone who understands them is defined as "somewhat helpful" (11). It can be thought that the need for speaking of elderly individuals staying in a nursing home increases this rate and thus supports each other. In the study of Özel et al., it was seen that this method was used in coping with pain based on religious belief, in parallel with our study (11). In the study of Tse et al., it was seen that praying and coping with pain were used (35).

CONCLUSION

Pain is one of the most common problems in old age and affects the quality of life negatively. Determining the health status of elderly individuals, knowing the situations that cause pain and increase the severity of pain, and knowing the practices against this situation will positively affect the quality of life and health status of elderly individuals. The increase in

studies on this subject will also contribute to the literature.

Ethics Committee Approval: Ethics committee approval was received for this study from Çukurova University Non-Interventional Clinical Research Ethics Committee (2019-85)
Peer-review: Externally peer-reviewed.
Author Contributions: Concept – D A, H Ş Design –DA, SA Audit– DG, EG, Data Collection and/or Processing – HŞ, RA, Analysis and/or Interpretation -DA, HŞ Writing– DA, Critical Review – RA,DG,EG
Conflict of Interest: No conflict of interest was declared by the authors.
Financial Disclosure: The author declared that this study hasn't received no financial support.

REFERENCES

1- Erten SN, Akpınar TS. Approach to pain in the elderly. Turkiye Klinikleri Journal of Geriatrics Special. 2015;1(1):82-90.
2- TÜİK. Population Projections, 2018-2080. Access Address: https://cse.google.com/cse?q=ya%FEl%FD+n%FCfusu. Access Date:29.12.2018.
3- Aslan FE, Uzun Ö. Pain in the Elderly. Aslan FE, editor. Pain Nature and Control. 2nd Edition. Ankara: Academician Medical Bookstore. 2014;357-74.
4- Kaye AD, Baluch A, Scott J. Pain management in the elderly population: A review. The Ochsner Journal. 2010;10(3):179-87.
5- Gündüzoğlu NÇ, Karadakovan A. Pain management in the elderly. Geriatric Neuropsychiatry. 2011;2(2-3):41-8.
6- Aslan FE, Uzun Ö. Pain in the Elderly. Aslan FE, editor. Pain Nature and Control. 2nd Edition. Ankara: Academician Medical Bookstore. 2016:357-74.
7- Molton IR, Terrill AL. Overview of persistent pain in older adults. Psychol. 2014;69(2):197-207.
8- Schofield P. Assessment and management of pain in older adults: current perspective sand future directions. Scot Universities Med J. 2014;3(3):1-7.
9- Çilingir, D, Bulut, E. Approach to Pain in Elderly Individuals. Journal of Anatolia Nursing and Health Sciences. 2017:(2).
10- Kress HG, Ahlbeck K, Dominic A, Alon E, Coaccioli S, Coluzzi F, et al. Managing chronic pain in elderly patients requires a change of approach. Curr Med Res Opin. 2014;30(6):1153-64.
11- Özel F, Yıldırım Y, Fadıloğlu Ç. Pain management in the elderly living in a nursing home. Journal of Pain. 2014;26(2):57-64.
12- Folstein MF, Folstein S, Mc Hugh PR. "Mini Mental State" A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res. 1975;12:189-198.
13- Melzack R. The Short-Form McGill Pain Questionnaire. Pain. 1987;30(2):191-197.
14- Davis G, Atwood JR. The development of the pain Management Inventory for patients with arthritis. Journal of Advanced Nursing. 1996;24(2), 236-243.
15- Parlar S, Fadiloglu C, Argon G, Tokem Y, Keser G. The effects of self-pain management on the intensity of pain and pain management methods in arthritic patients. Pain Manag. Nurs. 2013;14(3):133-42
16- Çilingir D, Bulut E. Approach to pain in elderly individuals. Anatolian Journal of Nursing and Health Sciences. 2017;20(2):145-153.
17- Tanriverdi G, Okanli A, Cetin H, Özyazıcıoğlu N. Pain in the elderly population. Turkish Journal of Geriatrics. 2009;12(4):190-7.
18- Usta Ö, Karadakovan A. Narlıdere. The Frequency of Falls in Elderly People Living in Rest and Nursing Homes and Factors Affecting Falls. Turkish Journal of Geriatrics. 2005;8(2):72-77.
19- Eyigor S, Karapolat, H, Durmaz. Evaluation of the relationship between quality of life and depression findings in elderly women admitted to a university clinic. Turkish Journal of Geriatrics. 2006;9(3):130-135.
20- Yazgan Ç, Kora, K, Topçuoğlu V, Kuşçu K. Factors affecting the quality of life in elderly people without dementia living in nursing homes. Turkish Journal of Geriatrics. 2006;9(3):143-149.
21- Saka SD, Gözüm S. Pain prevalence and pain self-management practices in the elderly living in the community. Cukurova Medical Journal. 2020;45(2):595-603.
22- Yıldız A, Erol S, Ergün A. The risk of pain and depression in the elderly living in a nursing home. Turkish Journal of Geriatrics. 2009;12:156-64.
23- Miro J, Paredes S, Rull M, Queral R, Miralles R, Nieto R. Pain in older adults. A prevalence study in the Meditarranean region of Catalonia. Eur J Pain. 2007;11: 83-92.

24- Ferrell BA, Ferrell BR, Rivera L. Pain in Cognitively İmpaired Nursing Home Patients. Journal of Pain and Symptom Management. 1995;10 (8):591-598.
25- Sezer O, Devran D, Dagdeviren HN. Evaluation of Chronic Pain Status and Affecting Factors in the Elderly. Turkish Journal of Family Medicine. 2021; 25(3):76-83.
26- Clough-Gorr KM, Blozik E, Gillmann G, Beck JC, Ferrell BA, Anders J, et al. The self-administered 24- item Geriatric Pain Measure (GPM-24-SA): psychometric properties in three European populations of community-dwelling older adults. Pain Med. 2008;9:695-703
27- Şimşek TT, Tütün Yumin E, Öztürk A, Sertel M, Yumin M. The relationship between pain and health status, mobility and activity level of daily living in elderly individuals living at home. Turkish Journal of Physiotherapy Rehab. 2011;57:216-220.
28- Şahin Ş. Pain and gender. Pain 2004;16(2):17-25.
29- Kara, H. Evaluation of pain in individuals living in nursing homes and determination of factors affecting pain (Master's thesis, Institute of Health Sciences) 2011.
30- Civi S, Tanrıkulu Z. An epidemiological study to determine the prevalence of chronic diseases and dependency and physical disability levels in the elderly. Turkish Journal of Geriatrics. 2000;3:85-90.
31- Güler G, Güler N, Kocataş S, Akgül N. Health care needs of the elderly. Cumhuriyet Medical Journal. 2009;31(4):367-373.
32- Hwang U, Richardson LD, Harris B, Morrison RS. The quality of emergency department pain care for older adult patients. J Am Geriatr Soc. 2010;58(11):2122-2128.
33- Ünsal A, Demir G, Özkan AC, Arslan GG. Chronic Disease Frequency and Drug Use in the Elderly in Nursing Homes. Journal of ADU Faculty of Medicine. 2011;12(3):5-10.
34- Stewart C, Leveille SG, Shmerling RH, Samelson EJ, Bean JF, Schofield P. Management of persistent pain in older adults: The Mobilize Boston Study. J Am Geriatr Soc. 2012;60(11):2081-6
35- Tse M, Wan VT, Wong AM. Pain and Pain-Related Situations Surrounding Community-Dwelling Older Persons. J Clin Nurs. 2013;22(13-14):1870-1879

Middle Black Sea Journal of Health Science / Mid Blac Sea J Health Sci **November 2022; 8(4): 624-638**

RESEARCH ARTICLE **DOI:** 10.19127/mbsjohs.1158787

Effects of Air Pollution on Mortality and Morbidity in Samsun Province of Turkey

Feyza Nur Topçu Yenerçağ[1](ID), Ahmet Tevfik Sünter[2](ID)

[1]Provincial Health Directorate, Ordu, Turkey
[2]Department of Public Health, Faculty of Medicine, Ondokuz Mayis University, Samsun, Turkey.

Received: 12 August 2022, Accepted: 12 September 2022, Published online: 30 November 2022

Abstract

Objective: We aimed to evaluate the relationship between hospital admissions and hospitalizations from respiratory system diseases, cardiovascular diseases, neurological and psychiatric diseases with air pollution. The second aim of the study was to calculate the total number of deaths that can be attributed to air pollution with the AIR Q + program.

Methods: The study is a descriptive type of ecological study. As the determinant of air pollution, daily PM10 data from all stations located in the central districts of Samsun were used. The records of all applications and hospitalizations that received any of the ICD-10 diagnostic codes I00-99, J00-99, F00-99, and G00-99 were included in the study. Correlation and regression analysis were conducted to explain the relationships between hospital admissions, hospitalizations, and PM10 and meteorological parameters.

Results: The annual average of PM10 was found to be 50.4±19.3 µg/m3. There were positive and statistically significant correlations between the daily number of admissions of all diseases evaluated with PM10. Positive and statistically significant correlations were found between hospitalizations for only respiratory and cardiovascular system diseases with PM10. Admissions from respiratory system diseases (3%), cardiovascular (2%), neurological (1%), and psychiatric diseases (1%) and hospitalizations from respiratory diseases (%2) increased for every 10 µg / m3 increase in PM10 level. The annual average of PM2.5 was found to be 31.8 µg/m3 using the AIR Q + program. The number of natural deaths that can be attributed to air pollution in 2018 was 835 (12.3%), and the estimated number of deaths attributable to 100,000 people at risk was 111.8 (RR: 1.14).

Conclusion: Hospital admissions and hospitalizations are increasing due to air pollution. Many deaths and adverse health effects can be prevented by reducing the air pollution that increases especially in the winter period to the determined limit values.

Keywords: Air pollution, morbidity, mortality

Suggested Citation: Topçu Yenerçag FN, Tevfik Sünter AT. Effects of Air Pollution on Mortality and Morbidity in Samsun Province of Turkey.Mid Blac Sea J Health Sci, 2022;8(4):624-638.

Address for correspondence/reprints:
Name and Surname: Feyza Nur Topçu Yenerçağ
Telephone number: +90 (530) 547 77 13
E-mail: fntopcu@hotmail.com

INTRODUCTION

Air pollution has become one of the most important environmental health threats worldwide. According to World Health Organization (WHO) data, more than 80% of people living in urban areas are exposed to air pollution above WHO limits (1). It is estimated that air pollution is responsible for 7 million deaths each year worldwide (2). Particulate matter, 10 μm of air pollutants (PM10) is released from various natural and human activities and has been shown to be associated with negative health effects as an indicator of air pollution in many epidemiological research studies.

Health effects of PM exposure; increasing hospital admissions range from hospital admissions and the risk of premature death (3). More and more evidence has been obtained from epidemiological research studies in recent years that it is associated with respiratory diseases, cardiovascular diseases, neurological and psychiatric diseases. While most of them examined hospital admissions and deaths associated with respiratory diseases and cardiovascular diseases, fewer studies have examined potential associations between neurological and psychiatric diseases and air pollution. It is estimated that PM initiates and promotes neurodegeneration by triggering oxidative stress and inflammation processes.

The importance of the relationship between PM10 and morbidity and mortality can differ from region to region due to significant differences in the level of pollution, climatic conditions, and individual sensitivity (4). However, most of the current studies investigating the adverse health effects of air pollution have been conducted in developed countries, and there is still limited evidence from developing countries. There are very few studies examining the effect of air pollution on hospital admissions and hospitalizations in our country. This can undermine the priority of environmental interventions and policy implementation. In a study conducted in Istanbul, it has been shown that the increase in PM10 has a significant effect on hospital admission rates from respiratory diseases (5). More studies are needed, especially at national and regional levels, to better understand the real impact of air pollution on public health.

In this study which is the first study to evaluate respiratory diseases, cardiovascular diseases, neurological and psychiatric hospital admissions, and daily PM levels in Turkey using negative binomial regression (NBR) in a generalized linear model (GLM) was used while controlling the time trends and meteorological factors. The aim of this study is to evaluate the relationship between the admissions made with the diagnosis of respiratory system diseases, cardiovascular diseases, neurological and psychiatric diseases, and hospitalizations to the 2nd and 3rd stage hospitals in the central districts of Samsun

province in 2018 with the air quality measurement data and meteorological parameters. In addition, this study, it was aimed to evaluate the relationship of PM10 measurement data with the number of measurements and to calculate the preventable number of deaths with the AIR Q + program.

METHODS

Procedure

This is a descriptive, ecological study, and it was conducted by evaluating the air quality measurements, admissions and hospitalizations in the central districts of Samsun province in 2018.

Study Area

Samsun is a city located in the coastal strip on the northern part of Turkey. Although the climate shows different characteristics in the coastline and inland areas, it generally has a mild climate. It is the most populous and industrialized city of the Black Sea geographical region with a surface area of 9579 km2. Atakum, İlkadim, Canik, Tekkekoy districts, which form the central districts, have a surface area of 661 km2. According to Turkish Statistical Institute (TSI) data for 2019, the total population of Samsun is 1,348,542 and the population of the central districts is 706,331 (6). In addition to the port and copper, fertilizer, and cigarette factories in the city, there are 6 organized industrial zones where large industrial enterprises are located (7). Five air quality measurement stations are located in the central districts of Samsun. Temporary malfunctions in the measurements may occur due to the displacement of the stations due to force majeure, and malfunctions in the measuring device and cabin (7). In Samsun, the main sources of air pollution depend on different emission sources such as motor vehicles, industrial processes, construction activities, residential heating and ship emissions.

PM10 Measurements

Hourly and daily PM10 measurement data between January 1, 2018, and December 31, 2018 were taken from the database of the Ministry of Environment and Urbanization and included in the study. The daily average of hourly measurements taken from 5 air quality monitoring stations was used. The average PM10 values of the days where at least 75% of the 24 measurements that need to be performed daily were analyzed. The days exceeding the 24-hour average limit between these days are considered as “the number of days exceeding the average”. Monthly and annual average PM10 values were calculated based on the number of days evaluated. The obtained results were contrasted with the daily and annual PM10 average upper limit values from the WHO, the European Union (EU), and Turkey.

Meteorological Parameters

Daily average temperature, pressure, humidity, wind speed, and direction data for 2018 were obtained from Samsun Meteorology

Directorate. Weather data included 100% of the average daily results in Samsun.

Data for Hospital Admissions

The daily data on outpatient and inpatient treatments of the patients were obtained from the hospital statistics of outpatient clinic applications, emergency room applications, and hospital admissions records in the central districts of Samsun. According to the International Statistical Classification of Diseases and Health Related Problems 2010 Version (ICD-10) system developed by WHO, the patient records made with the diagnosis of cardiovascular diseases (I00-99), respiratory system diseases (J00-99), neurological system diseases (G00-99) and psychiatric diseases (F00-99) were taken as the basis. The population of our study consists of the records of 1.455.943 patients who received any of the relevant ICD-10 diagnostic codes. Informed consent was not required as we are using aggregated data. Patient names, identity information, and full addresses were removed from the information provided for this study in accordance with national confidentiality provisions. The approval of the study was obtained from the ethics committee of Ondokuz Mayis University Medical Faculty.

Statistical Analysis

In this study, modeling was performed using GLM to estimate the relationship between daily air pollutant concentrations and hospital admissions. Daily hospital admissions and hospitalizations show excessive spread (variance > average). This situation violated the assumption of the equality of mean and variance of Poisson regression, which is the preferred modeling technique in census data (8). Therefore, the data; As in many other studies that associate air pollution with health, it has been evaluated using the Negative Binomial regression method, one of the regression models with counting data, which provides the requirement for variance to be greater than the average (9).

Since it was reported in previous studies that meteorological parameters were related to hospital admissions and hospitalizations, its effect on the model was smoothened (10). The days of the week and whether there is a holiday as a categorical factor are also defined as confounding factors (covariates that may be related) in the statistical model, as the pollutant concentrations appear different due to the industry's cessation of work on holidays and the admissions to health institutions are lower than normal. Since there was no strong correlation between independent variables, any variable was not removed from the model.

SPSS (version 20.0) was used for the statistical evaluation of the data and Jamovi statistical package program was used for regression analysis. Whether the data obtained in the study were suitable for normal distribution was analyzed with the Kolmogorov-Smirnov test. While expressing

descriptive analyzes, continuous variables fitting for normal distribution were expressed using the arithmetic mean ± standard deviation, and those that did not conform to normal distribution were expressed using median (min-max), and data obtained by counting were expressed using number and percentage (%).

Correlation analyzes were conducted to explain the relationships between hospital admissions and hospitalizations and PM10 and meteorological parameters such as temperature, pressure, humidity, and wind speed. Data fitting normal distribution were evaluated with the "Pearson correlation test", and those not fitting normal distribution were evaluated with the "Spearman correlation test". The relative risk (RR) was calculated as the natural exponent of the beta (B) NBR coefficient [RR = exp (B)]. Results are expressed as excess risk. Excess risk

values are multiplied by the coefficient of 0.65 was found for Turkey. By entering PM2.5 values and other necessary information, the number of deaths that could be prevented when the pollution levels were reduced to the WHO limits and the death rates attributable to pollution in a hundred thousand was calculated (12).

RESULT

The annual average of PM10 was found to be 50.4 ± 19.3 µg / m3 and the median was 45.4 µg / m3 (15.0-145.7 µg / m3) in Samsun central districts. The average PM10 values measured at stations in central districts were found to be the highest in Yuzuncuyil Station (63.5 ± 25.8 µg / m3) and the lowest at Atakum Station (37.6 ± 15.5 µg / m3). The relocation of Ilkadim Hospital station due to compulsory reasons caused long-term data loss in PM10 measurements between 12.07.2018 and 01.12.2018. 48 (15.4%) out of 311 days evaluated in Atakum, 97 (48.0%) out of 202 days at Ilkadım Hospital Station, 100 (34.8%) out of 287 days in Canik, Yuzuncuyil Station 354 days in 228 (64.4%), Tekkekoy in 337 days in 134 (39.8%) yielded daily average values which are above the limit value for the WHO, the EU, and Turkey (Table 1). PM10 limit

(ER) was calculated as the percentage (%) increase of the dependent variable [(RR-1) x100] for each unit increase of exposure to the independent variable (11). In this way, it is possible to obtain the increased risk of hospital admissions and hospitalizations due to the increased level of PM pollution. After setting the GLM with NBR, the model was tested using the z-test. In the study, $p < 0.05$ was determined as the statistical significance level for all tests.

Air Q+

Using the AIR Q + program developed for the WHO European region, the total number of deaths above the age of 30 that can be attributed to air pollution in a particular region can be calculated with PM2.5 averages. PM2.5 measurements; the program itself did it automatically; PM10 to PM2.5 cycle, the WHO suggests that the average PM2.5

values from WHO, the EU, and Turkey, and PM10 limit values being implemented in Turkey in 2018 are shown in Table 2. The annual averages at all stations are well above the WHO annual limit value (20 μg / m3).

Looking at the provincial monthly averages of PM10 measurements, the highest month was recorded in March (70.7 μg / m3) and the lowest in September (37.3 μg / m3). It was found that the average monthly hospital admissions of all the diseases evaluated in the study were higher in winter than in summer. Considering the number of days exceeding the 24-hour average, most of the days that pass above the limit values are in the winter period.

In Table 3, the relationship between the daily admissions, hospitalizations and meteorological parameters of the disease groups and daily average PM10 levels are evaluated. respectively. A positive, weak and statistically significant relationship was found between PM10 levels and admissions due to respiratory system diseases, cardiovascular diseases and neurological diseases. A positive, very weak and statistically significant relationship was found between PM10 and psychiatric disease admissions. A positive, very weak and statistically significant correlation was found between PM10 and hospitalizations due to respiratory system diseases and cardiovascular diseases. There was no statistically significant relationship between PM10 and hospitalizations due to neurological and psychiatric diseases. A negative, weak and statistically significant relationship was found between PM10 and average temperature and average wind speed.

GLM models created to determine the effects of air pollution on the number of respiratory system diseases admissions were significant ($p < 0.001$), and the coefficient of indication was found to be (r2: 0.69) 69% in the temporal variation of hospital admissions due to respiratory system diseases. In the GLM negative binomial regression model; A positive correlation was observed between each 1 μg / m3 increase in PM10 level and the number of SSH admissions (RR: 1.003, 95% CI: 1.00-1.004; p: 0.001). The coefficient of determination was found to be (r2: 0.92) 92% for hospital admissions due to cardiovascular diseases and in the GLM Negative binomial regression model; A positive correlation was observed between the number of cardiovascular diseases hospital admissions for every 1 μg / m3 increase in PM10 level (RR: 1.002, 95% CI: 1.0001-1.003; $p < 0.05$). The coefficient of determination is (r2: 0.88) 88% for hospital applications due to neurological diseases.

In the GLM negative binomial regression model, a positive correlation was observed between each 1 μg / m3 increase in PM10 level and the number of neurological disease admissions (RR: 1,001, 95% CI: 1,0001-1,003; $p < 0.05$). The coefficient of determination for hospital admissions due to psychiatric diseases

Table 1. Descriptive indices of the PM10 values (µg/m^3) in the central districts of Samsun, Turkey

Variables	The number of days evaluated	The number of days exceeding the average	PM10 Mean ± SD
Atakum	311	48	37.6±15.5
Ilkadim Hospital	202	97	54.0±19.6
Canik	287	100	48.1±21.2
Yuzuncuyil	354	228	63.5±25.8
Tekkekoy	337	134	48.3±24.8

PM10: 10 µg/m^3 particulate matter

Table 2. PM10 limit values from WHO, the EU and Turkey (µg/m^3)

		Limit Values			
		WHO	**EU**	**TR(2019)**	**TR(2018)**
PM10	**24 h average**	50	50	50	60
	Annual average	20	40	40	44

WHO: World Health Organization; EU: European Union; TR: Turkey; PM10: 10 µg/m^3 particulate matter

Table 3. Bivariate correlation analysis

Variables	**PM10, µg/m^3**
RHA	rs = 0.372, p < 0.001
CHA	rs = 0.243, p < 0.001
NHA	rs = -0.236, p < 0.001
HA	rs = -0.178, p < 0.05
HRD	rs = -0.176, p < 0.05
HCD	rs = 0.199, p < 0.05
HND	rs = 0.030, p > 0.05
HPD	rs = 0.025, p > 0.05
Meteorologic measures (24-h average)	
Temperature (◦C)	rs = -0.283, p < 0.001
Wind Speed (m / sec)	rs = -0.219, p < 0.001
Humidity (%)	rs = 0.019, p > 0.05
Air pressure (hPa)	rs = -0.020, p > 0.05

RHA: Respiratory hospital admissions; CHA: Cardivascular hospital admissions; NHA: Neurological hospital admissions; PHA: Psyhiatric hospital admissions; HRD: Hospitalization for respiratory diseases; HCD: Hospitalization for cardivascular diseases; HND: Hospitalization for neurological diseases; HPD: Hospitalization for psyhiatric diseases; rs: indicates Spearman correlation coefficient

Table 4. Relative risk (RR), confidence interval (CI) for significant variables.

Variables	**RR**	**CI (95%)**	**p value**
RHA	1.003	(1.001-1.004)	0.001
CHA	1.002	(1.0001-1.003)	0.021
NHA	1.001	(1.0001-1.003)	0.03
PHA	1.001	(1.0001-1.002)	0.027
HRD	1.002	(1.0001-1.003)	0.01
HCD	1.001	(1.000-1.003)	0.069
HND	1.001	(0.999-1.002)	0.204
HPD	1.000	(0.997-1.002)	0.998

RHA: Respiratory hospital admissions; CHA: Cardivascular hospital admissions; NHA: Neurological hospital admissions; PHA: Psyhiatric hospital admissions; HRD: Hospitalization for respiratory diseases; HCD: Hospitalization for cardivascular diseases; HND: Hospitalization for neurological diseases; HPD: Hospitalization for psyhiatric diseases

Is (r2: 0.93) 93%, and in the GLM Negative binomial regression model; a positive correlation was observed between each 1 µg / m3 increase in PM10 level and the number of psychiatric diseases (RR: 1,001, 95% CI: 1,0001-1,003; p < 0.05). In the models created for hospitalizations, only GLM models created to determine the effects on hospitalizations due to respiratory diseases were found to be significant (p < 0.001). The coefficient of

determination is (r2: 0.70) 70%, and in the GLM Negative binomial regression model; a positive correlation was observed between each 1 µg/m3 increase in PM10 level and the number of hospitalizations for respiratory diseases (RR: 1.002, 95% CI: 1.0001-1.003; p <0.05). No statistically significant results were obtained in the regression analysis for hospital admissions of other diseases (p> 0.05) (Table 4).

Table 5. Demographic data and death rates in Samsun, Turkey

Number of deaths	8562
Crude death rate	0.65 %
>30 age population	746.656
>30 age number of natural deaths	6830
>30 age natural death rate	0.91 %

Table 6. Estimated attributable proportion (AP) of mortality in a year due to short-term exposure above 10µg/m^3 for PM, in Samsun, Turkey.

Estimated number of attributable deaths (lower-upper)	835 (557-1084)
Estimated AP (lower-upper)	12.3 % (8.2-16)
Estimated number of attributable deaths per 100.000 people at risk (lower-upper)	111.8 (74.6-145.2)
Relative risk (lower-upper)	1.14 (1.08-1.18)

AIR Q+ Calculations

According to the Turkish Statistical Institute data, crude death rate of Samsun province in 2018 was calculated to be 6.5%. Frequently used in calculations; The natural mortality rate over the age of 30, which occurs except for reasons such as murder, suicide, accident and injury, was calculated as 9.1% in Samsun. (Table 5). Considering the number of deaths by month; The month with the highest number of deaths in 2018 in Samsun is January with 808 (9.4%) deaths, and the month with the lowest is June with 607 (7.1%) deaths.

The average of PM2.5 in Samsun province in 2018 was found to be 31.8 µg/m3. Based on this value, if the annual average of PM2.5 throughout the province is reduced to 10 µg / m3, which is the WHO's PM2.5 limit value, with the AIR Q + program, the number and rates of preventable deaths over the age of 30 and the estimated number of attributable deaths per 100,000 people at risk are calculated. In 2018, the number of natural deaths above the age of 30 attributable to air pollution was 835 (12.3%) and the estimated number of deaths attributable to 100,000 people under risk was 111.8 (RR: 1.14) (Table 6).

DISCUSSION

The annual averages of PM10 values measured in the study are above the WHO limit values at all stations. It was also observed that the limit was exceeded in terms of the number of days exceeding the daily average limit, which should be less than 35 times a year at all stations (13). In 2017, the annual average of all cities in our country is above the WHO upper limit (14). The main sources of air pollution in Turkey are motor vehicles, fuel use for domestic heating, and industry emissions (15). Intensive and wrong urbanization, the increasing number of motor vehicles can be counted among the reasons for the increase in air pollution in Samsun. In addition to these, the dominant meteorological conditions of the

industry and the region and the extremely rugged topographic structure increase pollution levels. Due to the mountainous structure, residences and industrial facilities were established intertwined in places that allow settlement and industrial sites remained in the center of the city.

In our study, in addition to the fact that monthly PM10 averages are higher in the winter period, the days that exceed the 24-hour average limit values are mostly in the winter period. In different studies carried out in Turkey and in the world's different regions it has been shown that the highest average PM10 values and limit exceedances occurred mostly during the winter (15-18). It is thought that the increase in air pollution during the winter period is mainly due to the increase in the use of fossil fuels for domestic heating as the temperatures decrease.

Our Samsun average wind speed of operation (1.8 m/sec), and the average of Turkey (for the years 2010-2017 to 1.9 m/sec) were lower (19). Yearly average relative humidity in Samsun (68.2%) was calculated to be respectively higher than the one in Turkey in general (62.4% for the period from 2009 to 2018) (20). In addition, while the monthly average pressure values were low in the summer period in the city, the average pressure was higher in the winter period. In our study, negative, weak, and statistically significant relationships were found between PM10 and mean temperature and wind. In studies evaluating the effect of meteorological parameters on air pollution in the literature, generally negative and significant relationships were found between PM10 and average temperature and humidity (5,21). A negative relationship between PM10 and wind speed is an expected situation, supporting that the wind causes the removal of pollutants from settlements and dilution, and the pollutant concentrations decrease during the periods when the speed increases (16).

When the pressure is low, it reduces air pollution by causing rising air movements (22). In addition, meteorological parameters greatly affect air pollution due to the suspending of air pollutants in the atmosphere and mixing with each other in the air. These values determined in the province of Samsun may have a negative effect on the air pollution of the region.

The findings obtained in our study regarding the relationship between PM10 and hospital admissions were compared with different studies, and it was found to be compatible with the literature. There are many studies in the current literature that reveal the relationship between hospital admissions due to respiratory system diseases and cardiovascular diseases and air pollution (5,23-25). Although the mechanism of the effect of air pollution on human health is not known yet, the pathophysiology of particulate matter is blamed for initiating inflammatory processes in the

respiratory system or in circulation (26). In the correlation analyses performed in our study, a positive and significant relationship was found between PM10 and hospitalizations due to respiratory system diseases and cardiovascular diseases, while no significant relationship was found between PM10 and hospitalizations due to neurological and psychiatric diseases.

Similar to the literature, the findings show that there is an increased risk in terms of hospitalizations due to respiratory system diseases and cardiovascular diseases due to the increase in air pollution (27-29). A positive correlation was found between PM10 and hospitalizations due to respiratory system diseases between 2000-2005 in Balıkesir (30).

Few studies have examined potential correlations between neurological and psychiatric illnesses and air pollution. Although studies on this subject have increased in recent years, inconsistent results have been reported. Few studies in the literature have examined neurological disease subtypes such as multiple sclerosis, migraine headache, Alzheimer's, Parkinson's disease (PD), and psychiatric disease subtypes such as depression and anxiety disorders (31,32). Although the effects of particulate matter on mortality have been described more broadly in the literature, the evidence for its effect on morbidity is limited, and there are even fewer studies investigating the relationship between particulate substances and hospitalizations. In some studies, in the literature, it has been observed that different subgroups of diseases have been examined. In addition, it is known that the geographical and climatic characteristics of the studied region influence the results. For these reasons, differences in the strength of the relationship may be determined.

According to the results of the regression analysis performed in our study, it was determined that the number of applications for respiratory system diseases increased by 3%, and the number of hospitalizations for respiratory diseases increased by 2% for every 10 µg / m3 increase in PM10 level. In a meta-analysis conducted in 2014, it was observed that there was an increase of 1% in China, 2% in the United States, and 1% in the EU in hospital admissions made for COPD for every 10 µg / m3 increase in PM10 (33). According to the study conducted in Lebanon, it has been determined that every 10 µg / m3 increase in PM10 increases the risk of admission to the emergency department due to respiratory diseases by 1.6% (34). Between 2013 and 2015 in Istanbul, Çapraz et al. (5) found that applications due to respiratory system diseases increased by 0.61% for every 10 µg / m3 increase in PM10. In Bangkok, it has been determined that the risk of hospitalization from respiratory system diseases increases 1.2% for every 10 µg / m3 increase of PM10 (35).

In our study, the risk increase for cardiovascular disease admissions was found to

be 2%, but no significant relationship was found in the regression analysis between PM10 and cardiovascular disease hospitalizations. In the study of Feng et al. (36), the increase rate in both respiratory system diseases and cardiovascular diseases was found to be 3% with each ten-unit increase in PM10 levels. In another study conducted in China due to respiratory system disease and cardiovascular disease, it was found that the application rates increased by 2.8% and 0.8%, respectively, for each 10 μg / m3 increase of PM10 (37). In the study conducted by Nascimento et al. (24) in Brazil, it was found that hospital admissions due to hypertension increased by 1-2% with a 10 μg / m3 increase in PM concentration. In another study conducted in 2019, it was determined that the risk of emergency service admission due to atrial fibrillation increased 1.4% for each 10-unit increase for PM10 (38).

According to the results of a meta-analysis, it was determined that every 10 μg / m3 increase in PM10 increases the risk of hospitalization due to cardiovascular disease by approximately 1.1-2.7% (28). Although the findings of our study are similar to the findings in the literature in general, the absence of an increase in the risk for hospitalizations due to cardiovascular diseases may be due to the hospitalization and transfer of patients from outside the province with the health facility capacity and coronary care units in Samsun.

In our study, it was determined that hospital admissions for neurological and psychiatric reasons also increased by 1% for every 10 μg / m3 increase in PM10 level. No significant relationship was found in regression analysis between PM10 and hospitalizations for neurological and psychiatric reasons.

In Canada, the relationship between daily emergency room admissions for headaches and air pollution has been examined and an increase in the risk of up to 4.2% has been found (39). In the study conducted by Gao et al. (32), it was found that total mental disorder admissions increased by 0.3% for every 10 μg / m3 increase for PM10.

There are also studies in the literature showing that neurological and psychiatric hospitalizations increase with the increase of air pollution. However, it is noteworthy that these studies are generally conducted with smaller subgroups of the diseases. In the study of Angelici et al. (31), it has been shown that there is a relationship between exposure to PM10 and hospitalizations associated with multiple sclerosis. In a study examining the relationship between PM10 and PM2.5 levels and the number of hospitalizations for depressive disorders in China, air pollution was associated with depressive disorders (HR: 1.44 for an increase of 10 μg / m3) (40). It is thought that the differences observed in the epidemiological studies conducted may be due to the geographical and climatic differences of the

region as well as the characteristics of person, place, and time.

While 835 deaths were attributed to air pollution with the AIR Q + program, it was shown that if the average PM2.5 was at the level of 10 µg / m3, approximately 112 people could be protected from death for a hundred thousand people over the age of 30 (RR: 1.14). According to the calculation methods of the AIR Q + program, where the average PM is high, the risk of death due to natural causes (RR) over the age of 30 is higher. However, the demographic characteristics of the researched region and the high population of the elderly may affect the results by increasing the mortality rate above the age of 30 used in calculations. According to a report prepared by Clean Air Rights Platform Turkey, in 2017 the overall number of deaths over the age of 30 attributed to air pollution was calculated as 51,574 (13%) of 399,025 deaths via the AIRQ+ program. In the report, the highest mortality rate attributed to air pollution per 100,000 people was found to be in the provinces Afyon (235.2) and Sinop (223.2) (14). In a study conducted in Macedonia, the natural mortality risk over 30 years old was found as RR: 1.3, which is attributed to air pollution in two different regions with a 5-year PM2.5 average of 41.8 and 45.9 µg / m3 (41). According to the research conducted by Lehtomaki et al. (42) in Finland, whose annual average, PM2.5 is 5.8 µg / m3, approximately 2000 people died in 2015 due to air pollution.

In the study conducted by Jirik et al. (43) in 2016, the mortality risk of over 30 years of age attributed to PM2.5 pollution for 2 different regions using AIR Q + was 44 RR: 1.09- 1.15 and 44 RR: 1.13-1.22 for the region of 31-45 µg / m3. In the research conducted in Tehran, using the AIR Q + program, 6710 deaths (13.0%) over the age of 30 and 128 deaths per 100,000 people in a 1-year period between March 2017 and March 2018 were attributed to air pollution from PM2.5 (44).

Limitations

Since many variables are considered in the study, it is one of the limitations of the study to examine only particulate matter measurements as a determinant of air pollution in order to reduce complexity. In addition, since the study is in ecological design, it does not provide information about the causality of the relationship, although a relationship has been determined between admissions, hospitalizations and deaths, and PM10 pollution. The arrival of patients from other districts of the province and even from neighboring provinces to hospitals in Samsun City Center may have affected our research results. In the PM10 measurements taken between the research dates, data was lost due to the days when there were not enough measurements. At the İlkadım Hospital station, the location of the measuring device was changed due to the risk of collapse of the construction wall, and data was lost for 4

months between August and November. Due to the absence of PM2.5 data in all the centers where air pollution measurements were taken in 2018, the PM2.5 averages for the calculations to be made in the AIR Q + program were calculated using the PM10 conversion method and it was assumed to reflect the real world.

CONCLUSION

As a result, it has been shown that air pollution has negative effects on hospital admissions, hospitalizations, and deaths worldwide. Although the increase in the risk of morbidity and mortality due to air pollution seems small when considered for a single individual, its total impact on the general population emerges as a serious public health problem due to the billions of people affected.

Our findings can support awareness raising and air pollution control measures by identifying problems at the local level. Although the results of our study cannot be generalized to the whole society, it is thought that our findings will contribute to other studies in the field.

Ethics Committee Approval: Ondokuz Mayis University Medical Faculty Ethic Committee (OMÜ KAEK-2019/531)
Peer-review: Externally peer-reviewed.
Author Contributions: Concept and Design: FNTY, ATS; Data Collection: FNTY; Literature search: FNTY; Analysis or Interpretation, Writing: FNTY, ATS
Conflict of Interest: No conflict of interest was declared by the authors.
Financial Disclosure: The author declared that this study hasn't received any financial support.

REFERENCES

1- WHO ambient air quality database Summary results, update 2018. https://www.who.int/airpollution/data/AAP_database_summary_results
2- WHO. 9 out of 10 people worldwide breathe polluted air, but more countries are taking action (2018). https://www.who.int/news-room/detail/02-05-2018-9-out-of-10-people-worldwide-breathe-polluted-air-but-more-countries-are-taking-action
3- WHO. Ambient air pollution: Health impacts. http://www.who.int/airpollution/ambient/health-impacts/en/ adresinden 22/01/2020 tarihinde erişilmiştir.
4- Burkart K, Canario P, Breitner S. Interactive short-term effects of equivalent temperature and air pollution on human mortality in Berlin and Lisbon. Environmental Pollution. 2013;183:54-63.
5- Capraz O, Deniz A, Doğan N. Effects of air pollution on respiratory hospital admissions in İstanbul, Turkey, 2013 to 2015. Chemosphere. 2017;181:544-50.
6- Samsun province 2018 Environmental Status Report.EIA and Department of Environmental Permits.Available from: URL: https://webdosya.csb.gov.tr/db/ced/icerikler/samsun_-cdr2018-20200117095833.pdf
7- Samsun province clean air action plan 2020-2024. Ministry of Environment and Urbanization, Samsun Provincial Directorate of Environment and Urbanization 2020. Available from: URL: https://samsun.csb.gov.tr/
8- Phung D, Hien TT, Linh HN, Luong LM, Morawska L, Chu C, Binh ND, Thai PK. Air pollution and risk of respiratory and cardiovascular hospitalizations in the most populous city in Vietnam. Sci. Total Environ. 2016;557:322–330.
9- Ardiles LG. Negative Binomial regression model for analysis of the relationship between hospitalization and air pollution.

Atmospheric Pollution Research. 2017;10:1039-42.
10- Koster ES, Raaijmakers JAM, Vijverberg SJH, van der Ent CK and Maitland-van der Zee A-H. Asthma symptoms in pediatric patients: differences throughout the seasons. J Asthma. 2011;48(7):694–700.
11- Gallucci M. GAMLj: General analyses for linear models. [jamovi module], 2019. Available from: URL: https://gamlj.github.io/
12- AirQ+ examples of calculations. WHO. Available from: URL: http://www.euro.who.int/__data/assets/pdf_file/0004/371551/AirQ-Examples-of-calculations_ENG.pdf?ua=1
13- Air Quality Assessment and Management Regulation. Available from: URL: http://cygm.csb.gov.tr/yonetmelikler-i-440
14- Air Pollution and Health Effect. Available from: URL https://www.temizhavahakki.com/wp-content/uploads/2019/05/Hava-Kirlili%C4%9Fi-ve-Sa%C4%9Fl%C4%B1k-Etkileri-Kara-Rapor-2019.pdf
15- Alkan A. An Example of Cıtıes Where Aır Pollutıon Has Reached Serıous Dımensıons: Siirt. SBE. 2018;7(2):641-66.
16- Kara G. Effect of Meteorological to Urban Air Pollutants: The Case of Konya Selcuk Univ J. Fac Eng Arch. 2012;27(3):73-86.
17- Chen W, Tang H, Zhao H. Diurnal, weekly and monthly spatial variations of air pollutants and air quality of Beijing. Atmospheric Environment. 2015;119:21-34.
18- Iskender S, Bolu F, Yılmaz M. The Investigation of Data of Düzce Air Quality Monitoring Station Between 1 October 2011-31 March 2015. Journal of Duzce University Health Sciences. 2016;6(3):161-67.
19- Yılmaz N. Modeling of wind climate, wave climate and current pattern in Samsun Bay coastal waters. Journal of the Faculty of Engineering and Architecture of Gazi University. 2018;33(1):279-97.
20- T.R. Ministry of Forestry and Water Affairs, General Directorate of Meteorology. Available from: URL: https://www.mgm.gov.tr/FILES/resmi-istatistikler/parametreAnalizi/Turkiye-Ortalama-Nem.pdf
21- Chen R, Chu C, Tan J, Cao J, Song W, Xu X. Ambient air pollution and hospital admission in Shanghai, China. J Hazard Mater. 2010;181(1-3):234-40.
22- Ozsahin E, Eroğlu I, Pektezel H. Air Pollution in Keşan. Selcuk University Journal of Social Sciences Institute. 2016;36:83-100.
23- Almeida S, Silva A, Sarmento S. Effects of exposure to particles and ozone on hospital admissions for cardiorespiratory diseases in Setúbal, Portugal. J Toxicol Environ Health A. 2014;77(14-16):837-48.
24- Nascimento LFC, Francisco JB. Particulate matter and hospital admission due to arterial hypertension in a medium-sized Brazilian city. Cad Saude Publica. 2013;29(8):1565-71.
25- Spiezia L, Campello E, Bon M, Maggiolo S, Pelizzaro E, Simioni P. Short-term exposure to high levels of air pollution as a risk factor for acute isolated pulmonary embolism. Thromb Res. 2014;134(2):259-63.
26- Finnbjornsdottir RG, Zoëga H, Olafsson O, Thorsteinsson T, Rafnsson V. Association of air pollution and use of glyceryl trinitrate against angina pectoris: a population-based case-crossover study. Environ Health. 2013;30:12:38.
27- Wellenius GA, Schwartz J, Mittleman MA. Particulate air pollution and hospital admissions for congestive heart failure in seven United States cities. Am J Cardiol. 2006;97(3):404-8.
28- Ab Manan N, Noor Aizuddin A, Hod R. Effect of Air Pollution and Hospital Admission: A Systematic Review. Annals of Global Health. 2018;84(4):670-78.
29- Chen C, Wang X, Lv C, Li WB, Ma DP, Zhang S. The effect of air pollution on hospitalization of individuals with respiratory and cardiovascular diseases in

Jinan, China. Medicine (Baltimore). 2019;98(22):15-34.
30- Tagıl S. Geostatistic Techniques for Understanding the Effects of Air Pollution on Spatial Distribution of Respiratory Diseases in the City of Balıkesir. Journal of Geographical Sciences. 2007;5(1):37-56
31- Angelici L, Piola M, Cavalleri T, Randi G, Cortini F, Brgamaschi R, et al. Effects of particulate matter exposure on multiple sclerosis hospital admission in Lombardy region. Italy. Environ Res. 2016;145:68-73.
32- Gao Q, Xu Q, Guo X, Fan H, Zhu H. Particulate matter air pollution associated with hospital admissions for mental disorders: A time-series study in Beijing, China. Eur Psychiatry. 2017;44:68-75.
33- Song Q, Christiani DC, Ren J. The global contribution of outdoor air pollution to the incidence, prevalence, mortality and hospital admission for chronic obstructive pulmonary disease: a systematic review and meta-analysis. Int J Environ Res Public Health. 2014;11(11):1822-32.
34- Nakhlé MM, Farah W, Ziadé N, Abboud M, Salameh D, Annesi-Maesano I. Short-term relationships between emergency hospital admissions for respiratory and cardiovascular diseases and fine particulate air pollution in Beirut, Lebanon. Environmental Monitoring and Assessment. 2015;187(4):196-203.
35- Phosri A, Ueda K, Phung VLH, Towatsupa B, Honda A, Takano H. Effects of ambient air pollution on daily hospital admissions for respiratory and cardiovascular diseases in Bangkok, Thailand. Science of The Total Environment. 2019;651(1):1144-53.
36- Feng W, Li H, Wang S, Van Halm-Lutterodt N, An J, Liu Y. Short-term PM10 and emergency department admissions for selective cardiovascular and respiratory diseases in Beijing, China. Science of The Total Environment. 2019;657:213-21.
37- Ma Y, Yang S, Zhou J, Yu Z, Zhou Ji. Effect of ambient air pollution on emergency room admissions for respiratory diseases in Beijing, China. Atmospheric Environment. 2018;191:320-27.
38- Solimini AG, Renzi M. Association between Air Pollutionand Emergency Room Visits for Atrial Fibrillation. International Journal of Environmental Researchand Public Health. 2017;14(6):661-80.
39- Szyszkowicz M. Ambient air pollution and daily emergency department visits for headache in Ottawa, Canada. Headache. 2008;48(7):1076-81.
40- Kim KN, Lim YH, Bae HJ, Kim M, Jung K, Hong YC. Long-term fine particulate matter exposure and major depressive disorder in a community-based urban cohort. Environ Health Perspect. 2016;124(10):1547-56.
41- Dimovska M, Mladenovska R. Losing Years of Human Life in Heavy Polluted Cities in Macedonia. Maced J Med Sci. 2019;7(3):428-34.
42- Lehtomaki H, Korhonen A, Asikainen A, Karvosenoja N, Kupiainen K, Paunu VV. Health Impacts of Ambient Air Pollution in Finland. Int. J. Environ Res. Public Health. 2018;15(4):736-44.
43- Jirik V, Machaczka O, Miturova H, Tomasek I, Slachtova H, Janoutova J, et al. Air pollution and potential health risk in Ostrava region-a Review. Central European Journal of Public Health. 2016;24:4-17
44- Ansari M, Ehrampoush MH. Meteorological correlates and AirQ+ health risk assessment of ambient fine particulate matter in Tehran, Iran. Environmental Research. 2019;170:141-50.

Middle Black Sea Journal of Health Science / Mid Blac Sea J Health Sci **November 2022; 8(4):639-652**

RESEARCH ARTICLE **DOI:** 10.19127/mbsjohs.1167712

Sexual Dysfunction in Turkish Women During the Covid-19 Pandemic: Anxiety and Related Factors

Elif Dağlı[1(ID)], Fatma Nilüfer Topkara[2(ID)]

[1]Abdi Sütcü Vocational School of Health Services, Çukurova University, Adana, Turkey.
[2]Provincial Health Department, Eskişehir, Turkey

Received: 27 August 2022, Accepted: 18 October 2022, Published online: 30 November 2022

Abstract

Objective: During the pandemic process, the sexual domain may have been affected in women due to the change in the routine, the limitation of freedom, and the psychological destructiveness of helplessness. Since it is not known how long the pandemic will last, it is necessary to clarify the consequences of the strict control measures on women's sexual satisfaction and experiences. Therefore, the current study aimed to evaluate the relationships between the prevalence of Sexual dysfunction (SDF) in women and anxiety and some other factors during the COVID-19 pandemic in Turkey.

Methods: This cross-sectional and descriptive study consisted of 520 women of reproductive age (18-49) who were sexually active, were married, and volunteered to participate in the study were included in the sample. We reached the women included in the study via the online questionnaire link. Exclusion criteria were being diagnosed with COVID-19, having a chronic or psychiatric illness, being pregnant or puerperal, breastfeeding, and taking medicine that reduces libido during the previous three months.

Results: The mean age of the women was 35.16 ± 5.53 years, 48.3% of them had equal income and expenses, and 77.3% had economic concerns. It was determined that 60.6% of the women had SDF, 55.4% had high state anxiety, and that 67.5% had high trait anxiety. As the state and trait anxiety scores of women increased, the desire, arousal, lubrication, orgasm, and satisfaction scores of the female sexual function index decreased, while the pain score of the index increased. It was found that the risk for SDF was 4.899 times higher in women who did not have social security, 3.401 times higher in those who were dissatisfied with their marriage, and 2.764 times higher in women with less sexual intercourse due to the pandemic process (OR = 4.899; OR = 3.401; OR = 2.764, respectively).

Conclusions: The results of this study indicated that SDF increased, and the frequency of sexual intercourse decreased compared to the pre-pandemic period due to the fear of COVID-19 infection and the high anxiety level brought in by the process. Women who experience the impact of the pandemic more and more every day are especially at risk for poor mental health outcomes.

Key words: COVID-19 pandemic, female sexual dysfunction, anxiety, Turkish women

Suggested Citation: Dağlı E,Topkara FN.Sexual dysfunction in Turkish women during the covid-19 pandemic: anxiety and related factors Mid Blac Sea Journal of Health Sci, 2022;8(4):639-652.

Address for correspondence/reprints:
Name and Surname: Elif Dağli
Telephone number: +90 (322) 338 65 38
E-mail: elifarik90@gmail.com

Note: This study was presented as an oral presentation at the 4th International 5th National Istanbul Midwifery Days Congress held on 24-26 September 2021

INTRODUCTION

The worldwide prevalence of COVID-19 has brought an unprecedented burden to all individuals with its high morbidity and mortality rates (1). Throughout the ongoing course of the disease, people have paid full attention to the course of the virus, and each state has taken various measures to effectively combat the pandemic. With the increase in cases in the country in which the study was conducted, some measures have been taken. Measures are taken to protect public health, such as recommendations to stay home, isolation, quarantine, and social distance are very important (2). However, in addition to the negative psychological effects caused by the pandemic itself, the measures taken, too, have negatively affected the psychology of individuals (3). Studies conducted in previous outbreaks reported psychological effects of the epidemic, such as anxiety, post-traumatic stress symptoms, and suicide (4). During the pandemic process, the sexual life of individuals may have been affected also by the change in routine, restriction of freedom, and despair (5). Staying away from sexual life may have stemmed from the implementation of social distance, compulsory homestay, working from home, distance education, constant stay of children at home, and avoiding contact, too (6). However, to have a healthy sexual life, there must be an intimate environment where the individual can live freely, happily, and without getting harmed (7).

Based on the available evidence, the coronavirus, which causes COVID-19 disease, does not spread through vaginal intercourse but is transmitted by kissing and physical touch (1, 7). Physical contact between couples may have decreased due to the fear of contamination. In addition, the difficulty of finding intimacy due to the constant presence of children at home and the obligation to share every moment with other family members because of compulsory stay at home and distance education can further aggravate discussions between couples and thus weaken the bonds between them. All these psychological factors and moods can inhibit sexual desire (5).

Most of the studies on the COVID-19 pandemic to date have evaluated its effects on physical health. This has led us to think that mental health and sexual health, which we consider important as physical health, should be addressed together. There are very few studies examining the effects of pandemics on sexual behaviors, and different opinions have been reported in these studies. In a study comparing sexual behaviors in Turkish women before and during the pandemic, it was reported that the frequency of sexual desire and intercourse increased significantly during the COVID-19 pandemic (8). On the other hand, in a study conducted in China, it was reported that the frequency of sexual activity and risky behaviors among women decreased significantly (9). Another study found that there was no significant

difference in the sexual activities of the participants (Bangladesh, India, and Nepal) (10).

Although the isolation process brought by COVID-19 seems to have allowed women to spend more time with their partners and thus to experience sexual activity more regularly, the quarantine measures taken during the epidemic may have reflected high anxiety in women and therefore their sexual relations negatively. The literature on how women's sexual life is affected by concerns about the risk of COVID-19 is scant. Given the importance of sexuality for health, there is a need to examine how the COVID-19 pandemic has changed women's sex lives and what factors are related to this change. For midwives, knowledge of the level of sexual problems of women and determining the factors affecting them during the pandemic is important in their planning and implementation of education and care. In addition, as the number of COVID-19 positive cases has increased, the number of women experiencing sexual problems may have increased because access to healthcare centers is now difficult. Therefore, the present study aimed to evaluate the correlation between the prevalence of sexual dysfunction (SDF) in women and anxiety and some other factors during the COVID-19 pandemic.

METHODS

Research design

This research is cross-sectional and descriptive.

Participants

The sample size consisted of 520 individuals. Data were collected between 05 December 2020 and 25 March 2021. Data was collected via an online survey link from Microsoft Office 365 Forms due to COVID-19 restrictions. The questionnaire was completed by any device with internet access, such as a mobile phone, tablet, or personal computer. Individuals were recruited through social media tools (e.g. Facebook, Instagram, Twitter, WhatsApp, etc.) and personal networks. The women who met the inclusion criteria were included in the study. Women of reproductive age (18-49) who were sexually active, married, and willing to participate in the study voluntarily were included in the sample. Exclusion criteria were being diagnosed with COVID-19, those with a history of menopause (hormonal/surgery) or gynecological surgery, having a chronic or psychiatric illness, being pregnant or puerperal, breastfeeding, and taking medicine that reduces libido during the previous three months. Exclusion criteria were asked in the questionnaire. According to the exclusion criteria, participants were excluded from the study, taking into account their own statements. Data were collected by random sampling method. The sample calculation was made as 520 with a 99% confidence interval and 5% margin of error, with an estimated 60% of the prevalence of SDF when the universe was known.

Measures

Three separate forms were used to collect the data. The data collection tools used in the study

included a descriptive information form questioning socio-demographic information, the Female Sexual Function Index, and the Spielberger State-Trait Anxiety Inventory.

The Descriptive Information Form: This questionnaire, designed by the researchers, included 18 questions to obtain participants' socio-demographic data, including age, educational status, marital status, family type, whether they had children, income level, and total work experience.

The Female Sexual Function Index (FSFI): This scale was developed by Rosen et al. to evaluate female sexual function. The validity and reliability study of the scale was conducted by Aygin and Aslan in Turkey. The scale consists of 19 items and evaluates sexual problems and function in the last 4 weeks. The scale comprises six sub-dimensions, namely, desire, arousal, lubrication, orgasm, satisfaction, and pain. Minimum and maximum scores range between 2 and 36. A total FSFI score of> 26.5 is interpreted as the absence of SDF, while a total FSFI score of ≤26.5 is interpreted as the presence of SDF (11, 12).

Spielberger State and Trait Anxiety Inventory (STAI-II): The Turkish validity and reliability study of this inventory, which was developed by Spielberger and a group of friends in 1970, was carried out by Öner and Le Compte in 1985. This inventory has two subscales. These are state and trait anxiety inventories consisting of 20 questions each. State anxiety domain of the scale indicates how a person feels at a given moment and under present circumstances. The trait anxiety, on the other hand, indicates how the person feels except for the current situation and circumstances. The scale has a Likert-type rating system. The total score of the inventory varies between 20 and 80. A total score of 36 and less on the scale shows the absence of anxiety, scores between 37 and 42 indicate mild anxiety, and scores of 43 and greater indicate high levels of anxiety. According to the scale, individuals who score above 60 need expert help (13, 14).

Procedure

At the outset, the approval of the Ethics Committee Unit of Çukurova University was obtained (date: 04.12.2020 and issue: 106/23) to carry out the study. The online questionnaire included the study purpose, information regarding the confidentiality of the data collected, and informed consent for participation. The questionnaires were filled in approximately within 12 minutes.

Statistical analysis

Statistical analyses were performed on the SPSS (IBM SPSS Statistics 24) software package. Frequency tables and descriptive statistics were used in the interpretation of the findings. Continuity correction according to expected value levels and Pearson-$\chi 2$ test statistics were used to examine the relationship between two qualitative variables. Spearman correlation coefficient was used to examine the relationship between measurement values that

did not have a normal distribution. The Backward LR model of the Binary Logistic Regression was used to determine the factors affecting SDF.

RESULTS

The mean age of the women was found to be 35.16 ± 5.53 (years), and 302 of them (58.1%) were in the 23-35 age group. The spouses of 324 women (62.3%) were in the age group ≥36, 497 (95.6%) had secondary or higher education, 293 (56.3%) were married for more than 10 years, 497 (95.6%)) had health insurance, 488 (93.8%) spouses were working, 251 (48.3%) had equal income-expenditure, 402 (77.3%) had economic concerns, 485 (93.3%) 3) nuclear family members, 339 (65.2%) were smokers, 444 (85.4%) did not drink alcohol, 501 (96.3%) had children, 456 (87.7%)) were satisfied with marriage, 344 (66.2%) had sexual intercourse <3/week before the pandemic, 406 (78.1%) had sexual intercourse <3/week during the pandemic period, 333 (64.0%) had cesarean section and 312 (60.0%) had 4 or more people living in the house. It was determined that 288 women (55.4%) experienced high state anxiety, 351 (67.5%) experienced high trait anxiety, and that 315 (60.6%) had SDF (Table 1).

A statistically significant relationship was found between FSFI scores and age groups ($\chi 2$ = 5.540; p = 0.019). The participants in the 23-35 age group had a higher rate of SDF than those in the >35 age group. There was no statistically significant relationship between FSFI groups and the age groups of partners, education levels, the length of the marriage, the employment status of the partner, the level of income, economic concerns, family type, smoking, and alcohol consumption (p>0.05). A statistically significant relationship was found between FSFI scores and health insurance ($\chi 2$ = 8.216; p = 0.004). It was determined that 294 people with SDF (93.3%) and 203 people without SDF (99.0%) had health insurance. The rate of having health insurance in women with SDF was lower than those without SDF (Table 2).

There was no statistically significant relationship between FSFI groups and having children, mode of delivery, and the number of households (p> 0.05). A statistically significant relationship was found between FSFI groups and satisfaction with the marriage ($\chi 2$ = 17.308; p = 0.000). It was determined that 54 individuals with SDF (17.1%) and 10 individuals without SDF (4.9%) were not satisfied with their marriage. The dissatisfaction rate of those with SDF was higher than those without SDF. A statistically significant relationship was found between FSFI groups and the frequency of pre-pandemic sexual intercourse (weekly) ($\chi 2$ = 9.929; p = 0.042). It was determined that 225 women with SDF (71.4%) and 119 without SDF (58.0%) had sexual intercourse <3 times a week before the pandemic. The rate of having sexual intercourse <3 times a week before the pandemic was higher in participants with SDF than those without SDF. A statistically significant

relationship was found between FSFI groups and the frequency of sexual intercourse (weekly) during the pandemic period ($\chi 2$ = 27.228; p = 0.000). It was determined that 270 women with SDF (85.7%) and 136 women without SDF (66.3%) had sexual intercourse <3 times a week during the pandemic period. The rate of having sexual intercourse <3 times a week during the pandemic period was higher in participants with SDF than those without SDF (Table 3).

Table 1 Distribution of findings about the women

Variable (N=520)		n	%
Age groups [$\bar{X} \pm$ S.S.→35,16±5,53 (year)]	23-35	302	58.1
	≥36	218	41.9
Age group of partners [$\bar{X} \pm$ S.S.→38,20±6,46 (year)]	23-35	196	37.7
	≥36	324	62.3
Level of education	Primary school	23	4.4
	Secondary school and above	497	95.6
Length of marriage (year)	<10	293	56.3
	≥10	227	43.7
Health insurance	Yes	497	95.6
	No	23	4.4
Economic concerns	Yes	402	77.3
	No	118	22.7
State anxiety inventory	≤36: No anxiety	141	27.1
	37-42: Mild	91	17.5
	≥43: High	288	55.4
Trait anxiety inventory	≤36: No anxiety	72	13.8
	37-42: Mild	97	18.7
	≥43: High	351	67.5
Sexual dysfunction (**FSFI**)	Yes (≤26,5)	315	60.6
	No (>26,5)	205	39.4

According to the table, the mean state anxiety scores of the women was 44.49 ± 11.67, and the mean trait anxiety score was 46.82 ± 9.30, indicating a high level of anxiety, and the FSFI total score was 22.59 ± 9.00, indicating the presence of SDF (Table 4).

A negative, weak, and statistically significant correlation was found between the state anxiety inventory scores of the women and their scores from the desire, arousal, lubrication, orgasm, satisfaction sub-dimensions, and the total of the female sexual function index; however, the relationship with the score of the pain sub-dimension was positive, weak, and statistically significant (p <0.05). As the women's state anxiety inventory scores increased, the desire, arousal, lubrication, orgasm, satisfaction sub-dimension scores, and the total female sexual function index scores decreased, but the pain scores increased (Table 5).

A negative, weak, and statistically significant correlation was found between the trait anxiety inventory scores of the women and their scores from the desire, arousal, lubrication, orgasm,

Table 2. The relationships between FSFI scores and some parameters

The Female Sexual Dysfunction Index Variable	SDF (Yes) (n=315)		SDF (No) (n=205)		Statistical analysis* Probability
	n	%	n	%	
Age groups					
23-35	170	54.0	132	64.4	χ^2=5.540
>35	145	46.0	73	35.6	**p=0.019****
Age groups of partners					
23-35	114	36.2	82	40.0	χ^2=0.767
>35	201	63.8	123	60.0	p=0.381
Level of education					
Primary school	12	3.8	11	5.4	χ^2=0.391
Secondary school and above	303	96.2	194	94.6	p=0.532
Length of marriage (year)					
<10	175	55.6	118	57.6	χ^2=0.203
≥10	140	44.4	87	42.4	p=0.652
Employment of the spouse					
Yes	295	93.7	193	94.1	χ^2=0.002
No	20	6.3	12	5.9	p=0.966
Health insurance					
Yes	294	93.3	203	99.0	χ^2=8.216
No	21	6.7	2	1.0	**p=0.004****
Economic concerns					
Yes	251	79.7	151	73.7	χ^2=2.569
No	64	20.3	54	26.3	p=0.109
Family type					
Core	294	93.3	191	93.2	χ^2=0.005
Extended	21	6.7	14	6.8	p=0.942
Status of smoking					
Yes	105	33.3	76	37.1	χ^2=0.765
No	210	66.7	129	62.9	p=0.382
Alcohol consumption					
Yes	44	14.0	32	15.6	χ^2=0.268
No	271	86.0	173	84.4	p=0.605

*"Continuity correction" or "Pearson-χ2 cross-tabulation" were used according to the expected value levels in the examination of the relationship between two qualitative variables. ** P <0.05 was accepted as the statistical significance value.

satisfaction, and total female sexual function index; but, the relationship with the score of the pain sub-dimension was positive and statistically significant (p <0.05).

As the trait anxiety inventory scores of women increased, the desire, arousal, lubrication, orgasm, satisfaction, pain sub-dimension scores, and total female sexual function index scores decreased, but the pain scores increased (Table 5). As a result of Backward: LR logistic regression analysis performed by using the parameters found significant in univariate analysis, the optimal model is given in the table. In the current model, it was determined that health insurance was an important parameter affecting SDF (p <0.05). The women without health insurance were 4.899 times more likely to have SDF than those with health insurance (OR = 4.899). Satisfaction with the marriage was an important parameter affecting SDF (p <0.05). The women who were dissatisfied with their marriages were 3.401 times more likely to have

Table 3. The relationships between FSFI scores and some parameters

The Female Sexual Dysfunction Index		SDF (Yes) (n=315)		SDF (No) (n=205)		Statistical analysis* Probability
Variable		**n**	**%**	**n**	**%**	
Having children	Yes	305	96.8	196	95.6	χ^2=0.233
	No	10	3.2	9	4.4	p=0.629
Satisfaction with the marriage	Yes	261	82.9	195	95.1	χ^2=17.308
	No	54	17.1	10	4.9	**p=0.000****
Pre-pandemic sexual activity/week	<3 times	225	71.4	119	58.0	χ^2=9.929
	≥3 times	90	28.6	86	42.0	**p=0.002****
During-pandemic sexual activity/week	<3 times	270	85.7	136	66.3	χ^2=27.228
	≥3 times	45	14.3	69	33.7	**p=0.000****
Mode of delivery	Nullipara	10	3.2	10	4.9	
	Normal	97	30.8	70	34.1	χ^2=1.867
	C-section	208	66.0	125	61.0	p=0.393
Number of households	2	13	4.1	17	8.3	
	3	114	36.2	64	31.2	χ^2=4.671
	≥4	188	59.7	124	60.5	p=0.198

**"Continuity correction" or "Pearson-χ2 cross-tabulation" were used according to the expected value levels in the examination of the relationship between two qualitative variables. ** P <0.05 was accepted as the statistical significance value.*

Table 4. Distribution of findings about the scales

The scales (N=520)	Mean	Standard Deviation	Median	Min.	Max.
The state anxiety inventory	44.49	11.67	44.0	20.0	80.0
The trait anxiety inventory	46.82	9.30	46.0	22.0	72.0
FSFI					
Desire	3.16	1.24	3.0	1.2	6.0
Arousal	3.48	1.63	3.6	0.0	6.0
Lubrication	4.02	1.65	4.2	0.0	6.0
Orgasm	3.75	1.84	4.0	0.0	6.0
Satisfaction	3.98	1.83	4.8	0.0	6.0
Pain	4.21	1.91	4.8	0.0	6.0
Total	22.59	9.00	24.6	1.2	36.0

Table 5. Examination of the relationship of the female sexual function index and its sub-dimensions with anxiety scores

The scales (N=520)		State anxiety inventory	Trait anxiety inventory
The female sexual function index			
Desire	*r*	-0.353	-0.287
	p	**0.000**	**0.000**
Arousal	*r*	-0.401	-0.350
	p	**0.000**	**0.000**
Lubrication	*r*	-0.380	-0.341
	p	**0.000**	**0.000**
Orgasm	*r*	-0.407	-0.369
	p	**0.000**	**0.000**
Satisfaction	*r*	-0.439	-0.363
	p	**0.000**	**0.000**
Pain	*r*	0.351	0.305
	p	**0.000**	**0.000**
Total	*r*	-0.457	-0.404
	p	**0.000**	**0.000**

**"The Spearman" correlation coefficient was used to examine the relationships of two quantitative data that did not have normal distribution.*

Table 6. Logistic Regression model based on SDF

Variable	B	S.H.	Wald	sd	p	OR	95% Confidence Interval (OR)	
							Lower	Upper
Age group	-0.213	0.191	1.175	1	0.278	0.808	0.550	1.188
Health insurance [1]	1.589	0.771	4.249	1	**0.039**	4.899	1.081	22.197
Satisfaction with the marriage [2]	1.224	0.371	10.905	1	**0.001**	3.401	1.645	7.032
Pre-pandemic sexuality	0.034	0.248	0.019	1	0.892	1.034	0.636	1.682
During-pandemic sexuality [3]	1.017	0.280	13.170	1	**0.000**	2.764	1.596	4.786
Constant	-0.484	0.242	4.002	1	0.045	0.616		
Reference category 1-2:Yes, 3:≥3 times		CCR=76.4%		$\chi^2_{(8)}$=1.494; p=0.960				

SDF than those who were satisfied (OR = 3.401). Besides, the frequency of weekly sexual intercourse during the pandemic period was found as an important parameter affecting SDF ($p < 0.05$). The women who had sexual intercourse <3 times a week during the pandemic period were at 2.764 times higher risk for SDF than those who had sexual intercourse ≥3 times a week (OR = 2.764) (Table 6).

DISCUSSION

Turkish women were adversely affected during the COVID-19 pandemic process in terms of sexual health, which is an aspect of general health. It was determined that more than half of the women had SDF and experienced high levels of state and trait anxiety. According to the data obtained from the study, as the severity of women's state and trait anxiety increased during the pandemic process, SDF was determined to increase. In addition, high anxiety levels, lack of health insurance, dissatisfaction with the marriage, and decreased frequency of sexual intercourse were significantly correlated with SDF in our study.

Compared to a meta-analysis study conducted in country in which the study was conducted before the pandemic, the prevalence of SDF was found to be higher in our study. Similarly, it was reported to be high in a study conducted in Egypt during the pandemic (15, 16). In our study, the FSFI score of the women was found to be low. Similar results were reported by Omar et al., Fuchs et al., and Yüksel and Özgör (8, 16, 17). Most of our women had pain, decreased desire, orgasm, satisfaction, and lubrication, and difficulties in arousal during sexual intercourse. Our results undeniably demonstrated the impact of the pandemic on the deterioration of the quality of sexual life among Turkish women.

The frequency of sexual intercourse is one of the main factors that determine the sexual satisfaction of individuals (18). Different opinions have been reported in the literature regarding the frequency of sexual intercourse during the pandemic. In a study comparing sexual behaviors among Turkish women before and during the pandemic, it was reported that the frequency of sexual desire and intercourse increased significantly during the COVID-19 pandemic (8). It was determined that there was no significant difference in sexual activities in Asian countries (Bangladesh, India and Nepal) and Italy (10, 19). However, the frequency of sexual intercourse decreased in our study. In another similar study, it was reported that the frequency of sexual intercourse and overall sexual satisfaction levels decreased compared to the pre-pandemic period (20). In a study conducted in England, it was reported that women were not sexually active during self-isolation/social distancing (9). In two studies conducted in China, it was stated that there was a decrease in sexual desire and sexual satisfaction (9, 21). These studies in the literature support our study.

During the pandemic process, where people move away from each other due to the social distance rule, it was observed that the frequency of sexual activity decreased with decreased sexual desire. In addition, it is thought that the new normal brought in by the process, such as compulsory homestay, working from home, the constant stay of children at home due to online education, and avoiding contact were also effective in decreased sexual activity.

Similar to the literature, as the level of anxiety increased, sexual desire, arousal, lubrication, orgasm, satisfaction, and total scores decreased, but pain scores increased in our study (17). In various studies, it has been stated that the psychological responses of the pandemic are mainly anxiety (22-24). Anxiety, in turn, has been associated with low levels of sexual desire (9). Sexuality, which is shaped by the interaction of psychological, social, and biological variables, is negatively affected by this process.

Our study also showed that women without health insurance were at risk for SDF. In our analyses, lack of women's health insurance was an independent risk factor for SDF, with 4.899 times increased risk. Similar to our study, Yılmaz et al. reported that lack of health insurance was associated with sexual dysfunction (25). It is thought that having health insurance allows women to meet their care needs appropriately, reduces their anxiety about care and treatment practices, and positively affects sexual function by increasing their well-being.

Finally, our findings indicated that being happy with the marriage was another important parameter affecting SDF. The women who were dissatisfied with their marriage were more

likely to have SDF than those who were satisfied.

Marital satisfaction has an important effect on an individual's general health, life satisfaction, and sexual pleasure (26). Frotan and Milany showed that 68.4% of women who applied for divorce in Iran were not satisfied with their sexual life (27). In another study, a significantly negative relationship was reported between SDF and satisfaction with the marriage (28). Sexual satisfaction plays a vital role in the stability of a marriage (29). SDF is an important health problem affecting marital life (25). This problem, which has a significant impact on the quality of life, is quite common in society and is often underestimated (30). Under unprecedented circumstances such as this pandemic, women who have problems in their marriage and whose sex life is also affected represent a potential area that must be addressed in terms of divorce issues.

The results of our study should be interpreted considering its limitations. Since sexual life was questioned, women may have given unrealistic answers. For this reason, the reliability of the data is limited to the accuracy of the information provided by the interviewees. In addition, women's sexual problems and anxiety were determined by self-report scales. These results may differ from the results determined by the clinical interview. Another limitation of our study was that the number of women with low educational level was low, as internet use was more common among women with higher education. Illiterate women could not be reached, as data were collected with an online survey. In addition, when interpreting the results, it should be taken into account that there is not enough evidence to say that sexual dysfunction is directly related to the COVID-19 pandemic, since there is no data from the pre-COVID period, considering that there was no control group in the study, and that female sexual dysfunctions were underdiagnosed due to the low number of applications.

CONCLUSION

Our results show that SDF has increased in women of reproductive age and the frequency of sexual intercourse has decreased during the pandemic compared to the pre-pandemic period because of the fear of spread of COVID-19 and the high level of anxiety brought in by the process. Considering independent factors, such as health insurance, satisfaction with the marriage, and sexual intercourse count that were found in our study, targeted screening of women should be planned during routine health follow-ups for SDF. The results of our study, in which we investigated a wide variety of variables compared to other studies, may contribute to the accumulation of knowledge of changes in women's sexual function during the COVID-19 pandemic.

In line with these data, midwives/nurses and doctors should evaluate women in terms of SDF

and anxiety levels and take into account related factors while doing these evaluations. Sexual health is an important part of the quality of life. Knowledge of what kind of problems are experienced in the sexual life of women during this period and what factors are affected by these problems can enable midwives/nurses and doctors working in this field to approach this issue more sensitively and provide a higher quality service. Therefore, it is thought that the services provided by midwives/nurses and doctors during the pandemic period can contribute to increasing the quality of life of women and their family. Women who experience the impact of the pandemic more and more every day are especially at risk for poor mental health outcomes. Providing women with digital mental health screening and treatment to improve their mental health can be helpful. Separating health insurance and employment can ensure continued access to health care, including mental health, for those who lost their jobs during the pandemic.

Ethics Committee Approval: Ethics approval was obtained from the Çukurova University Medikal Faculity Ethics Committee (date: 04.12.2020 and issue: 106/23).
Peer-review: Externally peer-reviewed.
Author Contributions:
Concept, Design, Literature search, Data Collection and Processing, Analysis or Interpretation, Writing – ED, FND
Conflict of Interest: The authors have no interests to declare
Financial Disclosure: The authors received no financial support for the research, authorship, and publication of this article.

REFERENCES

1- World Health Organization (WHO) (2020). Sexual and reproductive health and research including the Special Programme HRP. Date of access:03.15.2021 Access: https://www.who.int/reproductivehealth/about_us/en/
2- Ministry of Health. Date of access: 03.15.2021 Access: https://covid19bilgi.saglik.gov.tr/tr/haberler/turkiyedeki-gunluk-covid-19-vaka-sayilari.html
3- Xiang YT, Yang Y, Li W, Zhang L, Zhang Q, Cheung T, Ng CH. Timely Mental Health Care for the 2019 Novel Coronavirus Outbreak is Urgently Needed. The Lancet Psychiatry. 2020;(7)3:228-229.
4- Wheaton MG, Abramowitz JS, Berman NC, Fabricant LE, Olatunji BO. Psychological Predictors of Anxiety in Response to the H1N1 Pandemic. Cog. Therapy and Research. 2012;36(3):210–218.
5- Guan W, Ni Z, Hu Y, Liang W, Ou C, He J, et al. Clinical Characteristics of Coronavirus Disease 2019 in China. N Engl JMed.2020;382(18):1708-1720. doi: 10.1056/NEJMoa2002032
6- Ibarra FP, Mehrad M, Mauro MD, Godoy MFP, Cruz EG, Nilforoushzadeh MA, Russo GI. Impact of the COVID-19 Pandemic on the Sexual Behavior of the Population the Vision of the East and the West. Int Braz j Urol. 2020;46(1):104-112.
7- Jacob L, Smith L, Butler L, Barnett Y, Grabovac I, McDermott D, et al. Challenges in the Practice of Sexual Medicine in the Time of COVID-19 in the United Kingdom. J Sex Med. 2020;17(7):1229-1236.doi: 10.1016/j.jsxm.2020.05.001.
8- Yuksel B, Ozgor F. Effect of the COVID-19 Pandemic on Female Sexual Behavior. Int. J. Gynaecol. Obstet. 2020;150:98–102.
9- Li W, Li G, Xin C, Wang Y, Yang S. Challenges in the Practice of Sexual Medicine in the Time of COVID-19 in China. J Sex Med. 2020;17:1225–1228.
10- Arafat SMY, Alradie-Mohamed A, Kar SK, Sharma P, Kabir R. Does COVID-19

Pandemic Affect Sexual Behaviour? A Cross-Sectional, Cross-National Online Survey. Psychiatry Res. 2020;7:289,113050.doi: 10.1016/j.psychres.2020.113050.
11- Rosen R, Brown C, Heiman J, Leiblum S, Meston C, Shabsigh R, Dagostino R. The Female Sexual Function İndex (FSFI): A Multidimensional Self-Report İnstrument for the Assessment of Female Sexual Function. Journal of Sex & Marital Therapy. 2000;26(2):191-208.doi: 10.1080/009262300278597.
12- Aygin D, Aslan FE. Adaptation of Female Sexual Function Scale to Turkish. Turkiye Klinikleri Journal of Medical Sciences. 2005;25(3):393-399.
13- Spielberger CD. State-Trait Anxiety Inventory. In I. B. Weiner & W. E. Craighead (Eds.), The Corsini Encyclopedia of Psychology. John Wiley & Sons, Inc. 2010. https://doi. org/10.1002/9780470479216.corpsy0943
14- Oner N, Le-Compte A. Handbook of the Discontinuous State/Trait Anxiety Inventory (2nd Edition). Istanbul: Bogazici University Publications; 1985.
15- Karakas-Ugurlu G, Ugurlu M, Caykoylu A. Prevalence of Female Sexual Dysfunction and Associated Demographic Factors in Turkey: A Meta-analysis and Meta-regression Study. International Journal of Sexual Health. 2020;32(4):365-382.
16- Omar SS, Dawood W, Eid N, Eldeeb D, Munir A, Arafat W. Psychological and Sexual Health during the COVID-19 Pandemic in Egypt are Women Suffering More. Sex Med. 2021; 9(1):100-295.doi: 0.1016/j.esxm.2020.100295.
17- Fuchs A, Matonog A, Pilarska J, Sieradzka P, Szul M, Czuba B, Drosdzol-Cop A. Settings the Impact of COVID−19 on Female Sexual Health. Int. J. Env. Res. Public Health. 2020;17:19.
18- Palha-Fernandes E, Alves P, Lourenço M. Sexual Satisfaction Determinants and Its Relationship with Perfectionism: A Cross-sectional Study in an Academic Community. Sex Rel Ther.2019;1-15. doi.org/10.1080/14681994.2019.1677884
19- Micelli E, Cito G, Cocci A, Polloni G, Russo GI, Minervini A, et al. Desire for Parenthood at the Time of COVID-19 Pandemic: An Insight into the Italian Situation. Journal of Psychosomatic Obstetrics&Gynecology. 2020;41(3):183-190. doi: 10.1080/0167482X.2020.1759545.
20- Karagoz MA, Gul A, Borg C, Erihan IB, Uslu M, Ezer M, Bagcioglu M. Influence of COVID-19 Pandemic on Sexuality: a Cross-sectional Study Among Couples in Turkey. Int J Impot Res. 2020;33:815-823. doi.org/10.1038/s41443-020-00378-4
21- Grabovac I, Smith L, Yang L, Soysal P, Veronese N, Işık AT, et al. The Relationship between Chronic Diseases and Number of Sexual Partners: An Exploratory Analysis. BMJ Sex Reprod Health. 2020;46(2):100-107. doi: 10.1136/bmjsrh-2019-200352.
22- Lei L, Huang X, Zhang S, Yang J, Yang L, Xu M. Comparison of Prevalence and Associated Factors of Anxiety and Depression among People Affected by Versus People Unaffected by Quarantine during the COVID-19 Epidemic in Southwestern China. Med Sci Monit. 2020;26:e924609.
23- Chew QH, Wei KC, Vasoo S, Chua HC, Sim K. Narrative Synthesis of Psychological and Coping Responses towards Emerging İnfectious Disease Outbreaks in the General Population: Practical Considerations for the COVID-19 Pandemic. Sin Med J. 2020;61:350-356.
24- Brooks SK, Webster RK, Smith LE, Woodland L, Wessely S, Greenberg N, Rubin, J. The Psychological İmpact of Quarantine and How to Rreduce it: rapid Review of the Evidence. Lancet. 2020;395:912–920.
25- Yilmaz BA, Sonmez Y, Sezik M. Prevalence and Risk Factors for Sexual Dysfunction in Reproductive-Aged Married Women: A Cross-Sectional Epidemiological Study. J. Obstet. Gynaecol. Res, 2020;46:507-516.

26- Sotude M, Dindar R. Relationship Between Marital Satisfaction, Sexual Satisfaction and Social Security in Couples in Tehran. Q Policing J Kn. Cap.Pol. 2015;8:9-24.
27- Foroutan S, Jajid-Milany M. Prevalence of Sexual Dysfunction in Volunteers of Divorce Referred to Family Court. Daneshvar Med. 2008;78:39-41.
28- Karami J, Shalani B, Hoveyzi N. Relationship Between Sexual Self-Esteem and Sexual Dysfunction with Marital Satisfaction in Nurses Hopitals Kermanshah City. Qom Univ Med Sci J. 2017;11(9):86-93.
29- Mohammadzadeh-Moghaddam M, Moradi M, Mirzaii-Najmabadi K, Ramezani M, Shakeri M. Effect of Counseling on the Sexual Satisfaction Level of Women with Sexual Dysfunction Using PLISSIT Model Focused on Dysfunctional Sexual Beliefs. Evi. Based Care. 2019;9(3):49-57.
30- Masoomie R, Elsous A, Hussein H, Taghizadeh Z, Baloushah S. Female Sexual Dysfunction among Married Women in the Gaza Strip: an İnternet-Based Survey. Ann Saudi Med. 2019;39(5):319-327.

Middle Black Sea Journal of Health Science / Mid Blac Sea J Health Sci **November 2022;8(4): 653-660**

RESEARCH ARTICLE **DOI:** 10.19127/mbsjohs.1188899

Analysis of Cases Referred from A Tertiary University Hospital Emergency Service: The Case of Ordu Province

Seyda Tuba Savrun[1](ID), Atakan Savrun[1](ID)

[1]Ordu University, Faculty of Medicine, Department of Emergency Medicine, Ordu, Turkey

Received: 17 October 2022, Accepted: 30 October 2022, Published online: 30 November 2022

Abstract

Objective: University hospitals are health institutions that have sufficient and equipped personnel for diseases that require advanced examination and special treatment, contain high technolo,gy and/or have an infrastructure or are expected to provide education-research services. In some cases of medical necessity, patients can be transferred from tertiary hospitals to both the same level and lower-level health institutions, and in some cases even to other centers outside the province where the patient is located. In this direction, it was aimed to retrospectively analyze the data of the cases referred to other centers from a tertiary hospital emergency department and to determine the deficiencies.

Methods: Archive records of 133 cases who were referred to other health centers from Ordu University Medical Faculty Training and Research Hospital's emergency service between 01.06.2022 and 31.08.2022 were examined. The demographic characteristics of the cases, referral diagnoses, referral branches, reasons for referral, types of hospitals, the relationship between referral branches and the type of hospital referred were examined as the campuses of referral centers.

Results: The most common reason for transferring the cases was the lack of an intensive care unit (57.1%), while the second most common reason was the absence of a patient service bed (23.3%). The most frequently referred patients were cardiology patients (20.3%) and the reason was not intensive care unit (88.9%), followed by chest diseases patients (19.5%) and no intensive care unit (61.5%). It was determined that 67% of cardiology patients were referred to a private hospital, 33% to a secondary level hospital, and 11.1% to another province.

Conclusion: Tertiary hospitals are expected to be more equipped centers than other hospitals in terms of technical, personnel, patient service, intensive care, and many other aspects. Only the quality of equipment and personnel is not sufficient in such centers. Patient beds and intensive care units are very important factors that should not be ignored.

Keywords: Emergency medicine, Tertiary University Hospital, interhospital referral, lack of intensive care.

Suggested Citation: Savrun Ş T, Savrun A. Analysis of Cases Referred from A Tertiary University Hospital Emergency Service: The Case of Ordu Province. Mid Blac Sea Journal of Health Sci, 2022;8(4):653-660

Address for correspondence/reprints:
Name and Surname: Atakan Savrun
Telephone number: +90 (544) 264 70 70
E-mail: atakan4601@hotmail.com

INTRODUCTION

University hospitals are health institutions that have sufficient and equipped personnel for diseases that require advanced examination and special treatment, contain high technology, and/or have an infrastructure or are expected to provide education-research services. In this direction, university hospitals are centers that accept patients from other health institutions and from the scene, especially from primary and secondary hospital emergency services. However, in some cases of medical necessity, patients can be transferred from tertiary hospitals to both the same level and lower level health institutions, and in some cases even to other centers outside the province where the patient is located (1,2).

With the "Emergency Health Services Regulation", which was first published in our country in 2000, the rules to be followed in patient referrals from emergency services to other hospitals were determined, and the reasons for these referrals and the rules to be followed were determined. According to these determined rules, it has been stated that after the first medical intervention, advanced medicine will be done for different reasons such as insufficiency of existing medical-technical facilities, the inadequacy of advanced examination and treatment, and lack of treatment beds or branches to treat (3).

In the light of the source information reached; There are many studies on patient referral from primary and secondary healthcare institutions to tertiary healthcare institutions. However, it has been observed that there are not enough studies on patient referrals from the tertiary hospital emergency department to other health centers. In this direction, it was aimed to retrospectively analyze the data of the cases referred to other centers from a tertiary hospital emergency department and to determine the deficiencies.

METHODS

The presented study is a cross-sectional and retrospective study. Archival records of 133 cases who were referred to other health centers between 01.06.2022 and 31.08.2022 from the emergency department of Ordu University Medical Faculty Training and Research Hospital, with an average annual number of emergency service admissions of approximately 180,000, were examined. Demographic characteristics of the cases, referral diagnoses, referral branches, reasons for referral (lack of patient rooms, need for intensive care rooms, lack of related industry, advanced examination treatment) hospital types (2nd level state hospital, private hospital, and university hospital), the relationship between the referral branches and the type of hospital referred, was examined as the campuses of the referral centers (intra-provincial centers, out-of-province centers).

Inclusion criteria:

Cases who were referred to another center from the Emergency Service of Ordu University Faculty of Medicine Education and Research Hospital between 01.06.2022 and 31.08.2022 in accordance with the "Emergency Health Services Regulation" and whose information can be accessed will be included in the study.

Exclusion criteria:

Cases without love in line with the "Emergency Health Services Regulation" Cases outside the specified date range Cases with inaccessible or missing information will be excluded from the study.

Statistical Analysis

It was done using a package program called SPSS (IBM SPSS Statistics 28). Frequency analysis was performed to interpret the findings. Chi-square test was used for statistical analysis. Data were presented as mean ± standard deviation (SD). In our present study, a p-value less than 0.05 was considered statistically significant.

RESULTS

133 cases meeting the necessary criteria were included in the study. It was determined that 48.1% (n=64) of the patients were male and 51.9% (n=59) were female. The age range of the cases was determined as minimum 5/year, maximum 98/year, and mean age 64.86 ± 18.90/year. The branches that referred from the emergency department and the distribution according to the reasons for the referral according to the branches are summarized in Table 1.

Table 1. Relation of referrals from the emergency department with their fields of expertise

Department	Lack of patien room		Need for intensive care		Lack of related industry		Advanced examination treatment		Total	
	n	%	n	%	n	%	n	%	n	%
Chest Diseases	3	11,5	16	61.5	7	26.9	0	0	26	19.5
İnternal Medicine	6	24	16	64	3	12	0	0	25	18.8
Neurology	3	21.4	9	64.3	2	14.3	0	0	14	10.5
Cardiology	3	11.1	24	88.9	0	0	0	0	27	20.3
General Surgery	5	62.5	2	25	0	0	1	12.5	8	6
Thoracic Surgery	3	33.3	0	0	6	66.3	0	0	9	6.8
Gastroenterology	5	62.5	3	37.5	0	0	0	0	8	6
Anesthesia And Reanimation	1	12.5	6	75	1	12.5	0	0	8	6
Plastic Reconstructive Surgery	0	0	0	0	3	100	0	0	3	2.3
Psychiatry	0	0	0	00	1	100	0	0	1	0.8
Dermatology	0	0	0	0	1	100	0	0	1	0.8
Orthopedic Surgery	2	100	0	0	0	0	0	0	2	1.5
Urology	0	0	0		1	100	0	0	1	0.8

When the reasons for the referred patients are examined; patient rooms were 23.3% (n=31), need for intensive care rooms, was 57.1% (n=76), lack of related industry 18.8% (n=25), advanced examination treatment 0.8%(n=1). When the types of hospitals referred are examined; Private hospitals 45.1% (n=60), secondary level state hospitals 51.9% (n=69), and university hospitals 3% (n=4). The distribution of the cases referred from the emergency department by branch-based health center types is summarized in Table 2. When the campuses of the referral centers were examined, it was found that intra-provincial referral was 88.7% (n=118), and extra-provincial referral was 11.3% (n=15).

The distribution of the patients referred from the emergency department according to the branches between provinces is summarized in Table 3.

Table 2. Distribution of the cases referred from the emergency department according to the fields of expertise and health center types

Department	Private Hospital (n)	Public Hospital (n)	University Hospital (n)	Total (%)
Chest Diseases	13	13	0	19
İnternal Medicine	11	13	1	18.8
Neurology	8	6	0	10.5
Cardiology	17	10	0	20.3
General Surgery	2	5	1	6
Thoracic Surgery	0	9	0	6.8
Gastroenterology	3	5	0	6
Anesthesia And Reanimation	5	3	0	6
Plastic Reconstructive Surgery	0	2	1	2.3
Psychiatry	0	0	1	0.8
Dermatology	0	1	0	0.8
Orthopedic Surgery	0	2	0	1.5
Urology	1	0	0	0.8

Table 3. Inter-provincial referral distribution of patients referred from the emergency department according to fields of expertise

Department	City				Total	
	İn		Out			
	n	%	n	%	n	%
Chest Diseases	26	100	0	0	26	19.5
İnternal Medicine	20	80	5	20	25	18.8
Neurology	12	85.7	2	14.3	14	10.5
Cardiology	24	88.9	3	11.1	27	20.3
General Surgery	7	87.5	1	12.5	8	6
Thoracic Surgery	9	100	0	0	9	6.8
Gastroenterology	7	87.5	1	12.5	8	6
Anesthesia And Reanimation	7	87.5	1	12.5	8	6
Plastic Reconstructive Surgery	2	66.7	1	33.3	3	2.3
Psychiatry	0	0	1	100	1	0.8
Dermatology	1	100	0	0	1	0.8
Orthopedic Surgery	2	100	0	0	2	1.5
Urology	1	100	0	0	1	0.8

DISCUSSION

Health institutions that provide outpatient or inpatient health services to the sick and injured are called hospitals. Hospitals are divided into classes among themselves. Many different criteria are used in the classification of hospitals, such as ownership, educational status, size, location, and type of hospital services (4). However, in our country, classification is made according to who owns the most hospitals (Ministry of Health, universities, private institutions, municipalities, foundations, associations, hospitals belonging to foreigners and minorities), the type and quality of the service provided (5). According to the type and quality of the service provided by the hospitals, they are defined as primary, secondary and tertiary hospitals. The centers where the treatment is done with simple methods and fast and do not need advanced technological equipment are primary care hospitals. Secondary care hospitals are centers where primary care hospitals are inadequate and need more advanced technological equipment for longer-lasting diagnosis and treatment of diseases. Tertiary hospitals, on the other hand, are developed hospitals such as training-research hospitals and university hospitals, which are much more complex, more difficult to diagnose, have advanced technology, have high bed capacity, and are the most advanced center in their region (6). As it is known, tertiary care hospitals are mostly the last centers that accept patients. In the data of a center in the literature, it has been reported that 61% of interhospital referrals are made to tertiary hospitals (7). In a study conducted in another center, it was reported that two-thirds of referrals were made to university hospitals in a similar way (8). It has been reported in the literature that referrals are mostly made to tertiary care centers and that tertiary care centers are mostly referral hospitals rather than referrals (9). However, in some cases, patients are referred from tertiary centers to other health institutions. In the present study, patients referred to other centers from Ordu University Training and Research Hospital, which is a tertiary hospital, were examined. When the reasons for transferring the cases were investigated, the most common reason was the lack of an intensive care unit in the university hospital (57.1%), while the second most common reason was the absence of a patient service bed (23.3%). In the literature, Kilic et al. reported that "insufficiency of medical equipment and lack of a relevant department (71.5%) were the most common causes in a study conducted in a secondary hospital. In another study, when the reasons for the patients referred from the secondary level hospital were examined, it was reported that the most common reason was the lack of intensive care space (77.1%) in the center that referred the patient (10). Similarly, it has been reported in the literature that patients who were decided to

be admitted to the intensive care unit were referred to another center (84.9%) due to the lack of room in the intensive care unit and that the intensive care unit was not sufficient (11). According to the source information obtained, the most common reason for referral between hospitals is the absence of an intensive care unit. However, the cases were mostly referred to tertiary centers from less equipped centers. In the present study, the status and reasons for patient referral from tertiary care to other centers were investigated. Although the center where the study was conducted was the tertiary level, the most common reason for the cases referred was the lack of an intensive care unit (57.1%), and the second most common reason was the absence of a patient service bed (23.3%). Among the reasons for this situation are the aging of the society, the increase in comorbid diseases, the increase in intensive care indications and the easier indication of intensive care due to fear of malpractice. However, the most important problem in the center presented; The main building has a very limited number of service beds (n=113) and the intensive care unit (n=30). For these reasons, we think that these problems will decrease and referrals will be minimized, with the third step city hospital under construction in Ordu province.

In the source information reached, different results have been reached regarding the clinical diagnosis of the cases with interhospital transplants. There are studies reporting that the most common reason for referral is cardiological problems (12,13). However, there are also studies reporting that the most common reason for referral is trauma (14,15,16). In their study, Güler et al. reported that patients were referred mostly for cardiac reasons (12), and in the study of Zenginol et al. reported that trauma patients were more common (16). When the reasons referred to in the presented study are examined; The most frequently referred patients were cardiology (20.3%), and the reason was not intensive care unit (88.9%), followed by chest diseases patients (19.5%) and no intensive care unit (61.5%), and internal diseases (61.5%) and lack of intensive care unit (64%). It was determined that 67% of cardiology patients were referred to a private hospital, 33% to a secondary level hospital, and 11.1% to another province. Of the pulmonary diseases patients, 50% are referred to a private hospital, 56% to a secondary level state hospital and all within the province, while internal diseases patients are referred to 44% private hospitals, 52% secondary state hospitals and 4% tertiary hospitals, and 20% It was determined that he was sent out of the province. In fact, another striking point in the study was that almost all clinical branches were not referred for further examination and treatment purposes. This is due to the fact that the hospital is technically adequate, but lacks a service and intensive care unit. This situation led to the

conclusion that there was a patient referral due to preventable deficiencies and that a tertiary hospital was insufficient.

CONCLUSION

Tertiary hospitals are expected to be more equipped centers than other hospitals in terms of technical, personnel, patient service, intensive care, and many other aspects. Only the quality of equipment and personnel is not sufficient in such centers. Patient beds and intensive care units are very important factors that should not be ignored. For this reason, the adequacy of all factors should be taken into account during the establishment phase in order for tertiary care hospitals to be functional.

Ethics Committee Approval: Ethical approval was obtained from Ordu University Faculty of Medicine Clinical Research Ethics Committee (2022/209).
Peer-review: Externally peer-reviewed.
***Author Contributions*:** Concept and Design: STS, Data Collection: STS, Literature search: STS, AS Analysis or Interpretation, Writing: STS, AS
***Conflict of Interest*:** No conflict of interest was declared by the authors.
***Financial Disclosure*:** The authors also decline any financial support neither from any pharmaceutical company nor from a company that provides or produces medical instruments and materials.

REFERENCES

1- Atilla O D, Oray D, Akın S, Acar K, Bilge A. An Emergency Department perspective: Ambulance transfers and referral consents of the patients. Turk J Emerg Med 2010;10(4):175-180.
2- Göncer Demiral D, Ozen U. Analysis of patient transfers between hospitals: an application on east black sea hospitals. Journal of Management and Economics Studies. 2020;18(4)190-208.
3- Official Gazette (26.06.2008 Number: 26918) Circular on the Delivery of Emergency Health Services. (2008/13). p.1
4- Cigerdelen, Tümay, Public Relations in the Health Sector, International Public Relations Symposium Proceedings. 1, Akdeniz University Faculty of Communication Publications, Antalya 2009:378-389.
5- Gemlik Ni, Ayanoğlu Sisman F. "Management in Health Institutions" in Ayşegül Yıldırım Kaptanoğlu, Health Management, Beşir Bookstore, Istanbul 2010:90-120
6- Kavuncubaşı S. Health Institutions Management, Anadolu University Publications No: 1178, Eskişehir 2011
7- Assareh, H, Achat H M, Levesque J F, Leeder, S R. "Exploring Interhospital Transfers and Partnerships in The Hospital Sector in New South Wales, Australia", Australian Health Review. 2017;41:672– 79.
8- Lomi A, Mascia D, Vu, D Q, Pallott, Conaldi, G, Iwashyna, T J. Quality Of Care And Interhospital Collaboration: A Study Of Patient Transfers In Italy, Medical Care. 2014;52(5):407–14.
9- Mascia D, Vincenzo F D, Cicchetti, A. Dynamic Analysis of Interhospital Collaboration and Competition: Empirical Evidence from An Italian Regional Health System, Health Policy. 2012:105(2):273–81.
10- Yoldas H. Retrospective Analysis of Patients Referred to the 3rd Level Intensive Care Unit via 112 Command and Control Center. Firat Med. J 2020;25(1): 34-38.
11- Yılmaz Karakus B, Cevik E, Dogan H, Sam M, Kutur A. 112 Emergency Health Service in the Metropolis. J Ist Faculty Med. 2014; 77:3.
12- Güler S, Aksel, Ayılgan F T, Ozkan H I, Baz U, Orak Y. Evaluation of Emergency Interhospital Patient Transfers from Province of Mardin to Out-of-Province Hospitals in a

Year. The Journal of Academic Emergency Medicine. 2014;13: 62–66.
13- Kılıc M, Dokur M, Ulutasdemir N. Problems Experienced in Emergency Patient Referrals: An Evaluation at a Small Provincial Level. Summit Medical Journal. 2016;1(1):17–21.
14- Benli A R, Koyuncu M, Cesur O, Karakaya E, Cüre R, Turan M Evaluation of the Use of 112 Emergency Ambulance Services in K.Karabuk. Journal of Clinical and Analytical Medicine. 2015;6:271–74.
15- Onge T, Satar S, Kozacı N, Acıkalın A, Koseoglu Z, Gülen M, Karakurt U. "Analysis of Adult Patients Brought to Emergency Medicine Service by 112", Journal of Academic Emergency Medicine. 2013;12(3):150–54.
16- Zenginol M, Al B, Genc S, Deveci I, Yarbil P, Yılmaz D A, Sarcan E, Yıldırım C. 3-Year Study Results of 112 Emergency Ambulances in Gaziantep Province. Academic Journal of Emergency Medicine. 2011;10(1):27–32:963-7.