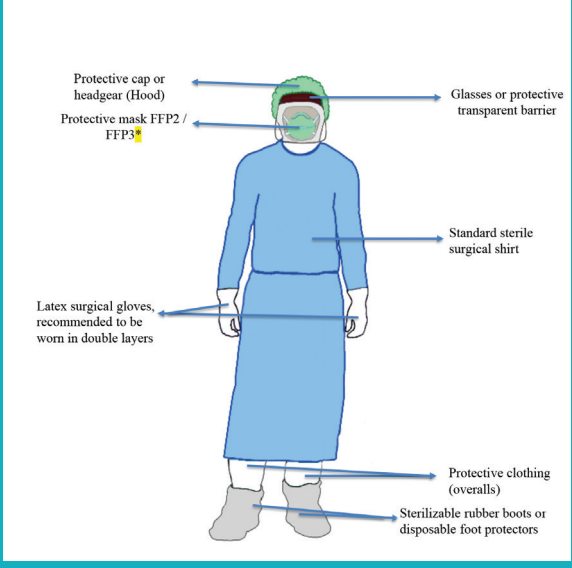
EISSN 2148-2373

BEZMIALEM VAKIF UNIVERSITY
1845

BEZMİÂLEM science

COVID-19; Experiences and Future Prospects

-Part I-



- ***The Relationship Between Median Age and Death Cases During the Coronavirus Disease 2019 (COVID-19) Pandemic: The Mediating Role of Current Health Expenditure***
  Kerem TOKER, Zekiye İrem GÖZÜBOL; İstanbul, Turkey
- ***The Relationship of Hemogram and Inflammatory Biomarkers to Lenght of Stay in Hospital and Clinical Course in Patients with COVID-19***
  Banu BÜYÜKAYDIN; İstanbul, Turkey
- ***Evaluation of Clinical Features and Prognosis in COVID-19 Patients with Hypertension: A Single-center Retrospective Observational Study***
  Gülay OKAY, Bülent DURDU, Yasemin AKKOYUNLU, Sibel BÖLÜKÇÜ, Asiye Bahar KAÇMAZ, Bilge SÜMBÜL, Hatice Dilara KARAKUŞ, Meliha Meriç KOÇ; İstanbul, Turkey
- ***Perioperative Precautions for Novel Coronavirus Outbreak***
  Mahmut DAĞCI, Hatice Merve ALPTEKİN; İstanbul, Turkey

Volume 8 • Supplement 2 • October 2020

bezmialemscience.org

galenos yayınevi

BEZMİÂLEM science

Galenos Publishing House
Owner and Publisher
Derya Mor
Erkan Mor

Publication Coordinator
Burak Sever

Web Coordinators
Turgay Akpınar

Finance Coordinator
Sevinç Çakmak

Graphics Department
Ayda Alaca
Çiğdem Birinci
Gülşah Özgül

Research&Development
Mert Can Köse
Mevlüde Özlem Akgüney

Digital Marketing Specialist
Seher Altundemir

Project Coordinators
Duygu Yıldırm
Gamze Aksoy
Gülay Akın
Hatice Sever
Melike Eren
Özlem Çelik Küççük
Pınar Akpınar
Rabia Palazoğlu
Saliha Tuğçe Evin

Publisher Contact
Address: Molla Gürani Mah. Kaçamak Sk. No: 21/1 34093 İstanbul, Turkey
Phone: +90 (212) 621 99 25 **Fax:** +90 (212) 621 99 27
E-mail: info@galenos.com.tr/yayin@galenos.com.tr
Web: www.galenos.com.tr
Publisher Certificate Number: 14521
Publication Date: October 2020
E-ISSN: 2148-2373
International scientific journal published quarterly.

BEZMIALEM VAKIF UNIVERSITY 1845

BEZMİÂLEM science

BEZMIALEM VAKIF UNIVERSITY 1845

BEZMİÂLEM science

AIMS AND SCOPE

Bezmialem Science is an independent, unbiased, international online journal that publishes articles in all branches of medicine in accordance with the double-blind peer-review process. The print version of the journal is not available and it is only accessible at www.bezmialemscience.org. The manuscripts published on this web page can be read free of charge and files can be downloaded in PDF format. Four issues are released per year, in January, April, July and October. Publication language is Turkish and English.

Bezmialem Science indexed in Science-Emerging Sources Citation Index, TUBITAK ULAKBIM TR Index, EBSCO, Cinahl, CiteFactor, TürkMedline, Türk Atıf Dizini, İdealOnline, ROOT INDEXING, J-Gate, EuroPub, DOAJ, Hinari, GOALI, ARDI, OARE, AGORA, ProQuest, CABI.

The target population of this journal includes medical academicians, specialists, assistants, and medical students. The aim of the journal is to publish high-ranking original researches in basic and clinical sciences, reviews covering contemporary literature about medical education and practice, reports of rare cases, and manuscripts that would contribute to continuous medical education.

Management of the editorial processes and pursued ethical policies are in accordance with the criteria of International Committee of Medical Journal Editors (ICMJE), World Association of Medical Editors (WAME), Council of Science Editors (CSE), European Association of Science Editors (EASE) and Committee on Publication Ethics (COPE).

Open Access Policy

This journal provides immediate open access to its content on the principle that making research freely available to the public supports a greater global exchange of knowledge.

Open Access Policy is based on the rules of the Budapest Open Access Initiative (BOAI) http://www.budapestopenaccessinitiative.org/. By “open access” to peer-reviewed research literature, we mean its free availability on the public internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. The only constraint on reproduction and distribution, and the only role for copyright in this domain, should be to give authors control over the integrity of their work and the right to be properly acknowledged and cited.

All manuscripts should be submitted over the web page at www.bezmialemscience.org. Instructions for authors, technical issues, and other necessary forms can be accessed over this web page. Authors are responsible for all content of the manuscripts.

All expenses of the Bezmialem Science are covered by Bezmialem Vakif University. Advertisements are welcomed for publication on the web page and all applications in this respect should be made to Galenos.

OPEN ACCESS

Editor: **Prof. Dr. Adem AKÇAKAYA**

Address: Bezmialem Vakıf Üniversitesi, Adnan Menderes Bulvarı, Vatan Caddesi 34093 Fatih, Istanbul, Türkiye

Phone: +90 (212) 453 17 00

Fax: +90 (212) 533 68 55

E-mail: info@bezmialemscience.org

Publishing House: GALENOS YAYINEVİ

Address: Molla Gürani Mah. Kaçamak Sk. No: 21/1 34093 Fındıkzade, İstanbul, Türkiye

Phone: +90 (212) 621 99 25

Fax: +90 (212) 621 99 27

E-mail: info@galenos.com.tr/yayin@galenos.com.tr

BEZMIALEM VAKIF UNIVERSITY 1845

BEZMİÂLEM science

INSTRUCTIONS TO AUTHORS

The journal Bezmialem Science is an international periodical published in electronic format in accordance with the principles of independent, unbiased, and double-blinded peer-review. Four issues are published per year, in January, April, July and October.

The print version of the journal is not available and it is only accessible at www.bezmialemscience.org. The manuscripts on this web page are accessible free of charge and full text PDF files can be downloaded.

Authors should submit manuscripts only to the web page at www.bezmialemscience.org. Manuscripts sent by other means will not be evaluated. Full text of the manuscripts may be in Turkish or in English.

The title, abstract and Keywords in every manuscript should be written both in Turkish and English. However, manuscripts submitted by foreign authors outside of Turkey do not necessarily include Turkish title, abstract and keywords.

Preliminary conditions for the approval of the manuscripts include being original, having a high scientific value and having high citation potential.

Submitted manuscripts should not have been presented or published elsewhere in electronic or printed format. A statement should be included for previous submission to and rejection by another journal. Relaying previous reviewer evaluation reports would accelerate the evaluation process. Name, date and place of the event must be specified if the study has been previously presented at a meeting.

The authors transfer all copyrights of the manuscript relevant to the national and international regulations to the journal as of evaluation process. Copyright Transfer Form signed by all authors should be submitted to the journal while uploading the manuscript through submission system. All financial liability and legal responsibility associated with the copyright of the contained text, table, figure, picture, and all other sorts of content protected by national and international laws belong to the author.

Author Contribution Form should be completed by the corresponding author in order to protect authors' rights and avoid ghost and honorary authorship issues.

All kinds of aids and support received from persons and institutions should be declared and ICMJE Uniform Disclosure Form for Potential Conflicts of Interest should be completed to clarify conflicts of interest issues.

The format of the manuscripts must conform to the journals instructions and to the standards of ICMJE-Recommendations for the Conduct, Reporting, Editing and Publication of Scholarly Work in Medical Journals (updated in December 2016 -http://www.icmje.org/icmje-recommendations.pdf) and the presentation of the content must be in accordance with appropriate international guidelines. CONSORT should be used for the reporting of randomized trials, STROBE for observational studies, STARD for diagnostic studies, PRISMA for systematic reviews and meta-analyses, ARRIVE for animal studies, Care for case reports and TREND for non-randomized behavior and public health intervention studies.

Ethics committee report prepared in accordance with "WMA Declaration of Helsinki-Ethical Principles for Medical Research Involving Human Subjects" and "Guide for the Care and Use of Laboratory Animals" is required for experimental and clinical studies, drug investigations and some case reports. The authors may be asked to submit ethics committee report or a substitute official report, if deemed necessary. In papers reporting the results of experimental studies, after explaining in detail all procedures that the volunteer subjects and patients underwent, a statement should be included in the text indicating that all subjects provided consent for the study. In animal studies, it should be clearly specified how the pain or discomfort has been relieved. Informed consents, name of the ethics committee, issue number and date of the approval document should be written in the Methods section of the main document.

All manuscripts are subject to preliminary evaluation by the Editors. The manuscripts are reviewed for possible plagiarism, replication and duplicated publication during this process. Our journal will impose sanctions in accordance with the guidelines of Committee on Publication Ethics (COPE) in conditions where such non-ethical issues may arise. Subsequently, manuscripts are forwarded to at least 2 independent referees for double-blinded peer-review. The reviewers are selected among independent experts with international publications and citations on the subject of the manuscript. Research articles, systematic reviews and meta-analyses are also evaluated by a statistician. Authors are deemed to have accepted that required revisions are to be made by the Editors provided that this will not make a comprehensive change in the original document.

Upon approval of the manuscript for publication, requests of addition to or removal from the author list or order change will not be accepted.

The manuscripts should be prepared with Microsoft Office Word and should comply with the following specifications.

Title Page

For each type of manuscript, title page should be uploaded through online submission system as a separate Microsoft Word document that includes Turkish and English title of the manuscript, names of the authors and latest academic degrees, name of the department and institution, city, and country. If the study has been conducted in more than one center, affiliation of each author must be specified using symbols. Correspondence address should include name of the corresponding author, postal address, e-mail address, phone and fax numbers. Name, date and place of

INSTRUCTIONS TO AUTHORS

the meeting must be specified if the study has been presented in a previous meeting. Disclosure of Conflict of Interest, Disclosure of Institutional and Financial Support, Author Contribution and Acknowledgments should be included in this page.

Original Research: Abstract should be written in Turkish and English, and be structured with Objective, Methods, Results and Conclusion sections. Abstract should not exceed 250 words. Keywords must conform to Medical Subject Headings (MeSH) terms prepared by National Library of Medicine (NLM) and contain minimum 3 and maximum 6 items; keywords should be written in Turkish and English just below the abstract. Main text should contain Introduction, Methods, Results, Discussion, Limitations of the Study, Conclusion, References, Tables, Figures and Images, and should be limited to 5000 words excluding references. References not exceeding 50 would be acceptable.

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

Editorial Comments: Editorial comments aim at providing brief critical commentary by the reviewers having expertise or with high reputation on the topic of the research article published in the journal. Authors are selected and invited by the journal. Abstract, Keywords, Tables, Figures, Images and other media are not included. Main text should not include subheadings and be limited to maximum 1500 words; references should be limited to 15.

Review: Reviews which are prepared by authors who have extensive knowledge on a particular field and whose scientific background has been translated into high volume of publication and higher citation potential are taken under review. The authors may be invited by the journal. Reviews should be describing, discussing and evaluating the current level of knowledge or topic used in the clinical practice and should guide future studies. The manuscript contains unstructured abstract not exceeding 250 words. The manuscript should include minimum 3 and maximum 6 keywords which conform to Medical Subject Headings (MeSH) terms prepared by National Library of Medicine (NLM). Main text should contain Introduction, Clinical and Research Consequences and Conclusion sections. Main text should not exceed 5000 words and the references should be limited to 50.

The originality of the visual media contained in the reviews should be confirmed by submitting a letter to the journal. The original versions of the printed or electronic copies of the images adapted from a published source should be cited properly and the written permission obtained from the copyright holder (publisher, journal or authors) should be forwarded to the journal.

Case Report: There is limited space for case reports in the journal and reports on rare cases or conditions that constitute challenges in the diagnosis and treatment, those offering new therapies or revealing knowledge not included in the books, and interesting and educative case reports are accepted for publication. The abstract should be unstructured and should not exceed 250 words. The manuscript should include minimum 3 and maximum 6 keywords which conform to Medical Subject Headings (MeSH) terms prepared by National Library of Medicine (NLM). The text should include Introduction, Case Report, Discussion, Conclusion, References, Tables, Figures and Images sections, and should be limited to 700 words. References should be limited to 10.

Letter to the Editor: Includes manuscripts discussing important parts, overlooked aspects or lacking parts of a previously published article. Articles on the subjects within the scope of the journal that might attract the readers' attention, particularly educative cases can also be submitted in the form of "Letter to the Editor". Readers can also present their comments on the published manuscripts in the form of "Letter to the Editor". Abstract, Keywords, Tables, Figures, Images and other media are not included. The text should be unstructured and should not exceed 500 words; references are limited to 5. Volume, year, issue, page numbers, and title of the manuscript being commented on, as well as the name of the authors should be clearly specified, should be listed in the references and cited within the text.

Images in Clinical Practices: Our journal accepts original high quality images related to the cases which we have come across in clinical practices, that cites the importance or infrequency of the topic, makes the visual quality stand out and present important information that should be shared in academic platforms. Titles of the images should not exceed 10 words and should be provided both in English and Turkish. Images can be signed by no more than 3 authors. Figure legends are limited to 200 words and the number of figures are limited to 3. Video submissions will not be considered.

Special Considerations

Names of the corresponding author and other authors, affiliations, and other information on the study centers should not be included in any part of the manuscript or images in order to allow double-blinded peer-review. Such information should be uploaded to the relevant section of the online submission system and separately added to the title page.

BEZMIALEM VAKIF UNIVERSITY 1845

BEZMİÂLEM science

INSTRUCTIONS TO AUTHORS

All tables, figures, graphs and other visual media must be numbered in order of citation within the text and must not disclose the names of the patients, doctors or institutions. Tables must be prepared in a Microsoft Office Word document using "Insert Table" command and be placed at the end of the references section in the main document. Tables should not be submitted in JPEG, TIFF or other visual formats. In microscopic images, magnification and staining techniques must be specified in addition to figure captions. All images should be in high resolution with minimum 300 dpi. Lines in the graphs must be in adequate thickness. Therefore, loss of details would be minimal if reduction is needed during press. Width must be 9 cm or 18 cm. It would be more appropriate if the drawings are prepared by the professionals. Gray color should be avoided. Abbreviations must be explained in alphabetical order at the bottom. Roman numerals should be avoided while numbering the Tables and Figures, or while citing the tables in the text. Decimal points in the text, tables and figures should be separated by comma in Turkish sections and by dots in English sections. Particularly, tables should be explanatory for the text and should not duplicate the data given in the text.

Pharmaceuticals should be specified with their generic names, and medical products and devices should be identified with brand name and company name, city and country.

References

References should be numbered in the order they are cited. Only published data or manuscripts accepted for publication and recent data should be included. Inaccessible data sources and those not indexed in any database should be omitted. Titles of journals should be abbreviated in accordance with Index Medicus-NLM Style (Patrias K. Citing medicine: the NLM style guide for authors, editors, and publishers [Internet]. 2nd ed. Wendling DL, technical editor. Bethesda (MD): National Library of Medicine (US); 2007 - [updated 2011 Sep 15; cited Year Month Day] (http://www.nlm.nih.gov/citingmedicine). All authors should be listed if an article has six or less authors; if an article has more than six authors, first six authors are listed and the rest is represented by "ve ark." in Turkish articles and by "et al." in English articles. Reference format and punctuation should be as in the following examples.

Journal: Muller C, Buttner HJ, Peterson J, Roskomun H. A randomized comparison of clopidogrel and aspirin versus ticlopidine and aspirin after placement of coronary artery stents. Circulation 2000; 101: 590-3.

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

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

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

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

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

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

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

Epub ahead of print Articles: Aksu HU, Ertürk M, Gül M, Uslu N. Successful treatment of a patient with pulmonary embolism and biatrial thrombus. Anadolu Kardiyol Derg 2012 Dec 26. doi: 10.5152/akd.2013.062. [Epub ahead of print]

Manuscripts published 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.

The latest status of the submitted manuscripts and other information about the journal can be accessed at www.bezmialemscience.org. Furthermore, contact details of the Editorial Office and Publisher are provided below for correspondence with the journal in every respect.

Editor: **Prof. Dr. Adem AKÇAKAYA**

Address : Bezmialem Vakıf Üniversitesi, Adnan Menderes Bulvarı, Vatan Caddesi 34093 Fatih, Istanbul, Türkiye

Phone: +90 (212) 453 17 00

Fax: +90 (212) 533 68 55

E-mail: info@bezmialemscience.org

Publishing House: GALENOS YAYINEVİ

Address: Molla Gürani Mah. Kaçamak Sk. No: 21/1
34093 Fındıkzade, İstanbul, Türkiye

Phone: +90 (212) 621 99 25

Fax: +90 (212) 621 99 27

E-mail: info@galenos.com.tr/yayin@galenos.com.tr

BEZMIALEM VAKIF UNIVERSITY 1845

BEZMİÂLEM science

CONTENTS

Original Articles

1 The Relationship Between Median Age and Death Cases During the Coronavirus Disease 2019 (COVID-19) Pandemic: The Mediating Role of Current Health Expenditure

Kerem TOKER, Zekiye İrem GÖZÜBO; İstanbul, Turkey

7 The Relationship of Hemogram and Inflammatory Biomarkers to Lenght of Stay in Hospital and Clinical Course in Patients with COVID-19

Banu BÜYÜKAYDIN; İstanbul, Turkey

15 Evaluation of Clinical Features and Prognosis in COVID-19 Patients with Hypertension: A Single-center Retrospective Observational Study

Gülay OKAY, Bülent DURDU, Yasemin AKKOYUNLU, Sibel BÖLÜKÇÜ, Asiye Bahar KAÇMAZ, Bilge SÜMBÜL, Hatice Dilara KARAKUŞ, Meliha Meriç KOÇ; İstanbul, Türkiye

22 Utility of Rapid Antibody Test for Screening COVID-19 Among Healthcare Professionals

Asiye Bahar KAÇMAZ, Bilge SÜMBÜL, Sibel BOLUKÇU, Gülay OKAY, Bülent DURDU, Yasemin AKKOYUNLU, Meliha MERİÇ KOÇ; İstanbul, Turkey

27 The Evaluation of the Health Care Professionals' Knowledge, Prevention and the Perceptions on the Treatment of New Coronavirus (COVID-19)

Aydın BALCI, Şule ÇİLEKAR, İbrahim Güven COŞĞUN; Afyon, Turkey

36 Relationship between ABO Blood Group and COVID-19: The Case of Siirt 36

Mehmet ÜYÜKLÜ, Osman ÖZÜDOĞRU; Siirt, Turkey

41 Risk Communication in Public Health Practices and Coronavirus Disease 2019 (COVID -19): Social Media Analysis of Health Authorities

Miraç Nevzat KARAKOÇ, Hüseyin KOÇAK, Cüneyt ÇALIŞKAN, Kerem KINIK; Çanakkale, İstanbul, Turkey

BEZMIALEM VAKIF UNIVERSITY 1845

BEZMİÂLEM science

CONTENTS

Review

48 COVID-19 Pandemic and Surge Capacity
Miraç Nevzat KARAKOÇ, Özcan ERDOĞAN; Çanakkale, İstanbul, Turkey

58 Perioperative Precautions for Novel Coronavirus Outbreak
Mahmut DAĞCI, Hatice Merve ALPTEKİN; İstanbul, Turkey

Letter to Editor

63 Effective implementation of unprecedented measures for the protection from COVID-19 syndrome
ÖZKARA, Katrina LAMBERT, Duygu AYHAN BAŞER, Bircan ERBAS; Ankara, Turkey, Australia

BEZMIALEM VAKIF UNIVERSITY 1845

BEZMİÂLEM science

EDITORIAL

COVID-19; Experiences and Future Prospects

Part I

The SARS-CoV-2 pandemic, which is showing its most destructive effects all over the world, is the biggest public health problem in human life history. The pneumonia induced by SARS-CoV-2 is named coronavirus disease 19 (COVID-19). To date, by 24th October 2020, 42.307.730 infected people globally is reported by "Johns Hopkins University & Medicine, Corona Virus Resource Center" while mortality cases are reported as up to 1.154.847 people (https://coronavirus.jhu.edu/map.html). COVID-19 pandemic created disruption in many aspects of daily life including functioning of institutions regulating public health from hospitals and universities to the local medical care centers. This pandemic not only introduced new treatment protocols to the known health care mechanisms but also was directed at serious changes in the state's health policies and budget allocations.

This special issue of Bezmialem Science, the scientific publication of the Bezmialem Vakıf University, is reporting the experiences of health professionals from different parts of Republic of Turkey along with their foresights and suggestions for similar future cases in the extension of 7 original articles, 2 review articles and one letter to editor.

At our first original article Toker K. et al. aimed to identify and define the relationships among the median ages of countries, their death cases, and current health expenditures during the Coronavirus disease 2019 (COVID-19) pandemic. With a very detailed analysis interestingly they have concluded that the health expenditures made, did not make a strategic contribution in the reduction of the mortality rates. Their results provide a unique theoretical framework for countries aiming to develop national health management strategies.

The second article by Buyuakydin B. reports the correlation between neutrophil-lymphocyte ratio, platelet-lymphocyte ratio, inflammatory markers, and length of stay in hospital. The studies of author on hospitalized 87 females and 84 males with mean age of 57.9±14.6 shows positive correlation between the neutrophil-lymphocyte and platelet-lymphocyte ratio. With mean length of stay in hospital of 8.83±6.4 days, the author show that patients with high inflammatory markers had higher stay period in hospital, while the need of intensive care unit was 14.6% and the mortality rate was 9.9%.

A single-center retrospective observational study by Okay G. Et al. reports the evaluation of clinical features and prognosis in COVID-19 patients with hypertension. Their results indicate the additional attention that should be paid to prevent poor prognosis in COVID-19 patients with hypertension. According to their results among 260 COVID-19 patients, the need for oxygen therapy was higher in hypertensive patients as well as the rates of transfer to intensive care unit and in-hospital mortality.

Kacmaz A.B. et al. have discussed another aspect of the Covid-19 pandemic by investigation of utility of rapid antibody test for screening occupational exposure to covid-19 among healthcare professionals. They mention that during pandemic, the reliability of rapid antibody tests has become under question due to validation issues. However, according to their results among 27 positive results obtained from rapid antibody tests on 222 health professionals, 24 showed COVID-19 diagnosis or potential symptoms of it, where 3 patients had no signs or symptoms of the disease. Thus, the authors report that the rapid antibody test may be feasible for COVID-19 screening among healthcare professionals to assess the precautions and prevent nosocomial infection.

Similarly, Balcı A. et al. call attention to the health care professionals' knowledge, prevention, and the perceptions on the treatment of COVID-19. Since the risk of getting infected as well as the concern levels of the health professionals on this issue is very high due to their close contact with the infected patients, the authors have aimed to evaluate their view and perception during the treatment of the COVID-19. Authors have gathered very interesting perceptions from 250 medical doctors and 169 assistant healthcare professionals using an online survey e.g. their desire for quitting smoking after experiencing pandemic period. As conclusion to this work, authors state the sufficient knowledge of health professionals and their belief in the success of the Republic of Turkey in fight with COVID-19 pandemic.

Among all epidemiological and clinical studies on COVID-19 pandemic relationship between ABO blood group and COVID-19 is one of the most discussed risk factors. Uyuklu M. and Ozudogru O. have evaluated the effects of blood groups in the incidence of COVID-19 on 179 patients from Siirt-Turkey and have concluded that despite studies showing that the risk of COVID-19 infection was higher in the A blood group and lower in the O blood group, no relationship was found between the blood group and the risk of COVID-19 infection and intensive care therapy.

BEZMIALEM VAKIF UNIVERSITY 1845

BEZMİÂLEM science

EDITORIAL

The authors of the last original research article of the current special issue analyze the online posts about COVID-19, which were shared for health professionals and the public on the official website and the social media of the Ministry of Health of Turkish Republic. Karakoc M.N. et al. document the early tweets of health authorities even before evidencing COVID-19 in Turkey and the positive correlation between the disease incidence and tweet traffics. Thus, they conclude the importance of social media as a risk communication factor during disasters such as pandemics.

In the first review article of this special issue Karakoc M.N. and Erdogan O. emphasize the need for enhancing the surge capacity of health care institutions and buildings. For this purpose they review the possibilities such as minimizing the resource consumption of patients and increasing the bed capacity and hence, creating alternative areas such as projecting the underground car parks of the hospitals as underground hospitals and the parks and reserve areas in the cities. With a very detailed SWOT analysis they conclude that rapidly increasing urbanization increases the patient burden in the health system and no matter how advanced the health systems and technology in the countries are, there may be an epidemic situation beyond predictions. At this point authors emphasize the necessity of making alternative plans and producing solutions against the worst scenario that may arise.

Perioperative precautions for novel coronavirus outbreak are discussed by Dağcı M. and Alptekin H.M. in the second and last review article of the current special issue. The authors review the pre- surgery process of patients with suspected or diagnosed COVID-19 surgery who need to be operated in urgent or emergent situations. They discuss the trainings should be provided on the effective use of personal protective equipment, precautions to be taken, and the abilities of health institutions in management of the preoperative, perioperative and postoperative process.

In the final article of the special issue a letter to editor is declaring the effective implementation of unprecedented measures for the protection from COVID-19 syndrome. In this letter Başer D.A. et al. discuss the success of the Republic of Turkey in crisis management and public compliance. They offer insight into the preparedness and response by Turkey of this continued global health threat posed by COVID-19.

A great quote from Albert Einstein will be suited to be used as the final sentence of this contribution: “If I had an hour to solve a problem I’d spend 55 minutes thinking about the problem and five minutes thinking about solutions.” The success relies under fighting with all disease arises from well-understanding of the disease mechanism and its reflections. This is why, the gained experiences become so precious. Now all thinking on COVID-19 is done and it is the time for the experiences to enlighten our way for future.

Finally, I would like to express my gratitude to the administration of Bezmialem Vakıf University and especially its Rector; Prof. Dr. Rümeyza Kazancıoğlu for supporting all our scientific studies, including the publication of this special issue throughout the pandemic, and I also owe to thank Prof. Dr. Adem Akçakaya, the Editor-in-chief of Bezmialem Science, for being the originator of this special issue and supporting every stage of its publication.

Guest Editor
Assistant Prof. Dr. Fatemeh Bahadori
Bezmialem Vakıf University
Faculty of Pharmacy
Department of Pharmaceutical Biotechnology

Original Article

DOI: 10.14235/bas.galenos.2020.4846
Bezmialem Science 2020;8(Supplement 2):1-6

The Relationship Between Median Age and Death Cases During the Coronavirus Disease 2019 (COVID-19) Pandemic: The Mediating Role of Current Health Expenditure

Koronavirüs Hastalığı 2019 (COVID-19) Pandemisinde Yaş Ortalaması ve Ölüm Olguları Arasındaki İlişki: Cari Sağlık Harcamalarının Aracılık Rolü (GSYİH'nin Yüzdesi)

Kerem TOKER, Zekiye İrem GÖZÜBOL

Bezmialem Vakif University Faculty of Health Sciences, Department of Health Management, İstanbul, Turkey

ABSTRACT

Objective: This study aimed to identify and define the relationships among the median ages of countries, their death cases, and current health expenditures [percentage (%) of gross domestic product (GDP)] during the Coronavirus disease 2019 (COVID-19) pandemic.

Methods: We analyzed the mediating role of current health expenditures (% of GDP) in the relationship between median age and death cases. Data from 60 countries with the highest COVID-19 cases were analyzed. Correlation and hierarchical regression tests were used in the analyses.

Results: The effect of the median ages of countries on COVID-19 death cases was 27.5%, and on current health expenditures was 56.3%. When the effect of the median age and current health expenditure variables on death cases was analyzed together, the effect of the median age was statistically insignificant and the effect of current health expenditures was 35.4%.

Conclusion: It was determined that current health expenditures have a positive mediating effect on the relationship between COVID-19 deaths and the median age of countries. It was determined that health expenditures did not make any strategic contribution to reducing mortality rates. The results provide an original theoretical framework for countries that aim to develop national health care management strategies.

Keywords: Coronavirus disease 2019 (COVID-19) pandemic, median age, death cases, current health expenditure (% of GDP)

ÖZ

Amaç: Bu çalışma, Coronavirüs hastalığı 2019 (COVİD-19) Pandemisi sırasında ülkelerin yaş ortalaması, ölüm olguları ve mevcut sağlık harcamaları [gayri safi yurt içi hasıla (GSYİH)'nin yüzdesi (%)] arasındaki ilişkileri belirlemeyi ve tanımlamayı amaçlamaktadır.

Yöntemler: Mevcut sağlık harcamalarının (GSYİH'nin %'si), ülkelerin yaş ortalaması ve ölüm olguları arasındaki ilişki üzerindeki aracı rolü incelendi. COVİD-19 olgularının en yüksek olduğu 60 ülkenin verileri analiz edildi. Analizlerde korelasyon testleri ve hiyerarşik regresyon testleri kullanıldı.

Bulgular: Ülkelerin yaş ortalamasının, COVİD-19 kaynaklı ölüm olguları üzerindeki etkisi %27,5, cari sağlık harcamaları üzerindeki etkisi ise %56,3 bulundu. Yaş ortalaması ve cari sağlık harcaması değişkenlerinin, ölüm olguları üzerindeki etkisi birlikte analiz edildiğinde, yaş ortalamasının etkisi istatistiksel olarak anlamsız, cari sağlık harcamalarının etkisi ise %35,4 olarak saptandı.

Sonuç: COVİD-19 nedenli ölümlerle ülke yaş ortalamaları arasındaki ilişkide cari sağlık harcamalarının pozitif aracılık rolü olduğu saptandı. Yapılan sağlık harcamalarının ölüm oranlarını azaltmada stratejik bir katkı sağlamadığı tespit edildi. Sonuçlar, ulusal sağlık yönetimi stratejileri geliştirmeyi amaçlayan ülkeler için özgün bir teorik çerçeve sunmaktadır.

Anahtar Sözcükler: Coronavirüs hastalığı 2019 (COVID-19) pandemisi, yaş ortalaması, ölüm olguları, cari sağlık harcamaları (GSYİH'nin %'si)

Address for Correspondence: Kerem TOKER, Bezmialem Vakif University Faculty of Health Sciences, Department of Health Management, İstanbul, Turkey
E-mail: ktoker@bezmialem.edu.tr **ORCID ID:** orcid.org/0000-000-1904-1406

Cite this article as: Toker K, Gözübol Zİ. The Relationship Between Median Age and Death Cases During the Coronavirus Disease 2019 (COVID-19) Pandemic: The Mediating Role of Current Health Expenditure (Percentage of GDP). Bezmialem Science 2020;8(Supplement 2):1-6.

Received: 11.06.2020
Accepted: 22.06.2020

Introduction

The coronavirus disease 2019 (COVID-19), which emerged as unexplained pneumonia cases in Wuhan, China in December 2019, is caused by a new coronavirus named Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) by the World Health Organization (WHO) on January 12, 2020 (1). The first 54 COVID-19 cases reported in Wuhan spread across the world, affecting hundreds of thousands of people in 195 countries (2). On March 11, 2020, the WHO declared COVID-19 as a global pandemic after the virus crossed Chinese borders and spread rapidly all over the world. Infection occurs through close contact with an infected person producing respiratory droplets in the range of approximately 1.5 meters during coughing or sneezing (3).

According to the WHO, COVID-19 mortality depends on a person's immunity. Most people infected with SARS-CoV-2 experienced mild to moderate respiratory disease and recovered without special treatment (4). Diseases such as hypertension, diabetes, coronary heart disease, hepatitis B, and cerebrovascular disease are among the main comorbidities that make the course of COVID-19 difficult; they increase the severity of the disease necessitating the use of mechanical ventilators and increase the length of stay in the intensive care unit (2). According to a report published by the WHO, SARS-CoV-2 is transmitted to people of all ages, but the risk of death is higher in the elderly (4). This situation leads to higher mortality rates in countries with an older population. For example, the mortality rate due to the COVID-19 was 2.3% in China, while the overall mortality was significantly higher (7.2%) in Italy. When the data were classified by age group, mortality in Italy and China appeared very similar for the 0-69 age group, but mortality rates were higher in Italy for people aged 70 years and above, and especially for those aged 80 years. In addition, mortality at the age of 90 years and above was 22.7% in Italy.

While there is a close relationship between mortality rates and average age, can health spending have a mediating role in this relationship? Could countries with older populations have reduced mortality rates by allocating more of the state budget for health? Based on these questions, this research aimed to determine the relationship between aging and COVID-19 related deaths and the mediating effect of the current health expenditures [percentage of gross domestic product (GDP)].

Aging and Mortality

According to the United Nations, people aged 60 years and over are defined as the elderly. However, this is stated as 65 years and over in many conditions (5). The WHO estimates the proportion of the world population over 60 to increase from 12-22% between 2015 and 2050 (6). The aging population will have an impact on the health system of countries. There are many links between aging and health care. The most critical of these is that an aging population causes the expansion of morbidity in the health system. Expanding morbidity means that healthy life increases less with increasing life expectancy; therefore, people live longer in poor health. The compression of morbidity is the opposite. Healthy life increases more than the increase in general life expectancy, and people become hospitalized for less time. The impact of these conditions on health expenditures is crucial (7).

From the COVID-19 cases examined, there is a relationship between the risk of aging and death (8). Approximately 23% of Italy's population in 2019, which is one of the countries most affected by the pandemic, is 65 years old and above. Since COVID-19 is more lethal in elderly patients, the elderly population rate in Italy explains the higher mortality/case ratio than in other countries (9). It is thought that this high rate is due to the demographic structure of the country. The median age is 46 years in Italy. Similar results were found in Spain, where the median age is 43.9 years. Over 28,000 COVID-19 deaths have been reported in Spain to date (10). These results show that there is a significant relationship between individuals who lost their lives due to the pandemic and their ages.

Current Health Expenditures

Health expenditure is crucial for health systems to maintain and develop human well-being. Employment of skilled health professionals, the supply of medical equipment, health promotion, and disease prevention cannot occur without the required funding (11). The level of health spending in a country is the most critical measure of its health investments. Therefore, health expenditure is a major input in improving health indicators, such as exercise and diet (12).

Total health expenditure consists of both public and private health expenditures and is critical for establishing effective health policies at national and regional levels because it has a share of the GDP (13). In 2015, the world spent US $7.3 trillion, about 10% of the global GDP, on health. Health expenditure per GDP is the highest, with an average of about 12%, in high-income countries. Health expenditure in low-income countries accounts for an average of 7% of GDP and 6% in middle-income countries (11). The highest increase in health expenditure has been in East African countries in the last decade (13). As one of the countries most affected by the pandemic, the National Health System of Italy has faced the risk of collapse. As a % of the GDP in the country, health expenditures are expected to decrease from 6.6% in 2018-2020 and 6.4% in 2022 (14). Rezapour et al. (15) found that public health expenditures are more effective than private health expenditures and they improve health conditions by generating positive external effects. Therefore, countries need to provide sufficient financial resources to improve their health systems. Additionally, Rana et al. (16) found a positive relationship between public health expenditure and health sector performance in 30 organisation for economic co-operation and development countries.

In the context of these findings, this research determined the relationship between mortality rates and median age and the mediating role of health expenditure in this relationship by using data from 50 countries with the highest number of deaths in the COVID-19 pandemic.

Method

It is a known fact that in the pandemic period, death cases are high in countries with a high median age. Factors such as weakening of the immune system, increase in chronic diseases, and the need for quality care services decrease the ability of patients to fight SARS-CoV-2 as they age. Reduced struggle potential causes the number of deaths to increase in the elderly population. Is there any other factor that affects the structure of the relationship between the median age of the population and death cases? This is the main research question. In the context of strategic health management, as the elderly population grows, demand for healthcare services increases, therefore governments need to allocate more resources to healthcare expenditure. Allocating more resources to healthcare expenditure enables more agile and higher-quality healthcare demands to be met. Thus, there should be a significant decrease in the number of deaths. This relational structure among variables constitutes the conceptual framework of the research and is represented in Figure 1.

Figure 1 shows the mediating role of the current health expenditures (% of GDP) in the relationship between median age and death cases. The H_1 hypothesis in this conceptual framework is as follows:

Sample and Data Collection Tools

While building datasets to test the research model, we worked with the most up-to-date data possible. Accordingly, the research was conducted by analyzing the data obtained from the first 60 countries with the most COVID-19 cases as of April 13, 2020 (17). This is because the top 60 countries are the countries most affected by the pandemic and are working hard to overcome the situation. Data on death cases were taken from the Worldometer statistics website (17), and data on current health expenditure and median age were obtained from the World Bank's database (18).

Results

First, the direction and power of the relationships in the research model with each other were analyzed. The correlation analysis results for this purpose are shown in Table 1.

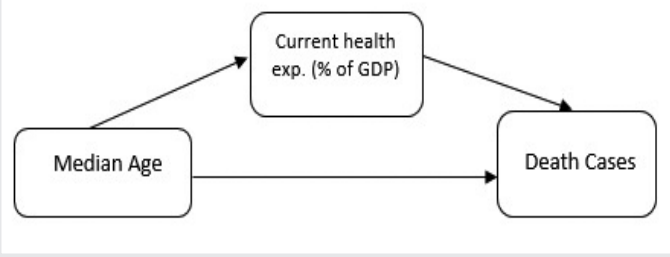


Figure 1. The research model

H_1: In the COVID-19 pandemic, current health expenditures (% of GDP) have a mediating role in the relationship between death cases in countries and their median age. The next section explains the dataset used to test the H_1 hypothesis. % of GDP: Percentage of the gross domestic product (current health expenditures)

Table 1 shows that there is a positive and significant relationship between the death cases and the median age at the rate of 27.5% (r=0.275; p<0.05). Schober et al. (19) have stated that a correlation ratio between 0.10 and 0.39 is weak and that between 0.39 and 0.69 is a moderate relationship. According to this result, when the median age of countries increases, the number of deaths also increases, but this relationship is weak. When the relationship between the median age and current health expenditures was examined, a moderate relationship was observed at the rate of 56.3% (r=0.563). This showed that there is a higher correlation between median age and current health expenditures than between COVID-19 deaths (0.275<0.563). Finally, when the relationship between health expenditures and the number of deaths was examined, it was found that there was a moderate level of 39.7% (r=0.397). Therefore, in the pandemic process, as the current health expenditures of the countries increase, the mortality rates increase moderately. How can this remarkable result be interpreted? Therefore, the effects of the variables on each other should be analyzed.

Hence, the three-stage regression analysis method proposed by Baron and Kenny (20) for the mediating effect test was used. According to the authors, for a variable to have a mediating effect, the effect of the independent variable (median age) on the dependent variable (death cases) is checked. If this effect is statistically significant (p<0.05), continue to the second stage. In the second stage, the effect of the independent variable on the mediator variable (% GDP) is tested. If this test result is statistically significant, then move on to the third stage. In the third stage, the effects of both the independent variable (median age) and the mediating variable on the dependent variable (death cases) are analyzed together. In the third test, if the effect of the independent variable is reduced, a partial mediation role is mentioned, and if this effect is eliminated, the full mediation role is mentioned. The regression analysis results performed according to these stages are shown in Table 2.

When Test 1 in Table 2 was analyzed, it was seen that the median age explained 6% of the changes in deaths due to COVID-19 (Adjusted R^2 =0.060; F (p) <0.05). This result revealed that, contrary to the general belief in the pandemic situation, there was no high relationship between the death cases and the median age. In Test 1, the effect of the median age on the death cases was determined to be 27.5% (Stand. ß =0.275; p<0.05). Similarly, this result showed that there was no high effect between the variables. In Test 2, this time, the effect of the median age on the mediator variable (% of GDP) was examined. The adjusted R^2 was 0.305 (F (p) <0.01). This result demonstrates that the

Table 1. Variables and correlations (n=60)

	Variables	1	2	3
1	Death cases	1	0.275*	0.397**
2	Median cases	-	1	0.563**
3	Current health expenditure (% of GDP)	-	-	1

*p<0.05; **p<0.01, n: Number

Table 2. Analysis results of the mediating role of current health expenditures (% of GDP) in the relationship between mean age and total deaths

Test 1	R	R^2	Adjusted R^2	F	F Sig.	Stand. β	t	p
Independent variable: median age	0.275	0.076	0.060	4.673	0.035	0.275	2.162	0.035
Dependent variable: death cases								
Test 2	R	R^2	Adjusted R^2	F	F Sig.	Stand. β	t	p
Independent variable: median age	0.563	0.317	0.305	26.496	0.000	0.563	5.147	0.000
Dependent variable: current health expenditure (% of GDP)								
Test 3	R	R2	Adjusted R^2	F	F Sig.	Stand. β	t	p
Model summary	0.401	0.161	0.131	5.380	0.007	-	-	-
Median age	-	-	-	-	-	0.076	0.513	0.610
Current health expenditure (% of GDP)	-	-	-	-	-	0.354	2.388	0.020

Sig: Significant, Stand: Standard, % of GDP: Percentage of the gross domestic product (current health expenditures)

median age of the countries explained 30.5% of the change in the resources allocated to current health expenditures. Stand. ß was 0.563 ($p<0.01$). Accordingly, it can be said that the median age of the population plays a major role in determining the resources to be allocated to the current health expenditures of the countries. As the median age of countries increases, resources allocated from the government budget to health expenditures also increase. Finally, in Test 3, the combined effect of the median age and current health expenditures (% of GDP) on the death cases was analyzed. Although the regression model established in this test was significant (F (p) <0.01), the effect of the median age was insignificant ($p>0.05$). The effect of current health expenditures on death cases was determined to be 35.4% (Stand. ß =0.354; $p<0.05$). According to these results, current health expenditures have a mediating role in the relationship between death cases in countries and their median age. The H_1 hypothesis was confirmed.

Discussion

The COVID-19 pandemic prompted countries to investigate the adequacy of their health systems. While countries such as Germany, Singapore, and South Korea struggled with rapid and effective strategies against the pandemic, countries such as the United States of America, Italy, Spain, and the United Kingdom, responded to the outbreak. This inadequacy caused death rates to increase dramatically. While it was stated that deaths due to high age increased at the beginning of the pandemic, studies conducted later in the pandemic indicated that social norms, social inequalities, and social and cultural context elements such as culture were among the factors affecting the spread of the virus (21). However, no significant relationship was found between the confirmed (positive) cases and death cases. This situation suggests that the quality and capacity of health systems may have an impact on death cases. Are the quality and capacity of the health systems of the countries related to the health expenditures that the countries allocate from GDP? This is because governments disburse these healthcare expenditures to establish a better healthcare system.

The hypothesis of this research was developed within the framework of these questions. First, the relationship between the median age of countries and deaths from COVID-19 was examined. For this purpose, the data of the first 60 countries with the highest number of death cases were included in the analysis. The results revealed a positive and significant ($p<0.05$) relationship between the median age of countries and the death cases at 27.5%. However, this was still a weak relationship. Could there be another variable that determines the direction and strength of the relationship between these variables? The ratio of the health expenditures of countries to their GDP is a critical indicator of their need for health services. When the relationship between death cases and health expenditure rates was analyzed, it proved that approaching the issue from this context was accurate. The relationship between the two variables was 39.7%, which was significant ($p<0.01$). This result has demonstrated that the strength of the relationship between the current health expenditures and the death cases is higher and significant compared to the median age.

Following these findings, a mediating test was performed to determine the structure of the relationship between the variables. For this purpose, the three-stage regression analysis method proposed by Baron and Kenny (20) for mediating testing was used. According to the results, although the regression model established in the third test was significant (F (p) <0.01), the

effect of the median age was found to be insignificant (p>0.05). The effect of health expenditures on death cases was determined to be 35.4% (Stand. ß =0.354; p<0.05). According to this result, the current health expenditures (% of GDP) have a mediating role in the relationship between COVID-19 death cases and median ages. The H_1 hypothesis was therefore confirmed.

Conclusion

This result revealed that countries with high median ages make more healthcare expenditures, but these expenditures are insufficient in reducing the impact of large and unexpected crises such as pandemics. However, strategic health management aims to address these risks predictable by writing scenarios for enormous risks. It was determined that the countries that made high expenditures to improve their health sectors could not reduce the number of deaths and that only monetary expenditure was insufficient. It can be stated that the ability to manage and organize the health system is necessary to generate positive results. In this context, there is a need for intangible resources such as strategic management skills as well as tangible resources such as finance.

However, there are several limitations of the research. The first limitation is that data were collected from 60 countries. As more countries will be included in the pandemic in the next time, the model can be retested with more countries. Second, different independent variables such as chronic/hereditary diseases can be included in the research model. However, it is difficult to obtain high-reliability data on these issues. This type of model test can only be done on local basis, not globally. Third, the research was conducted with data from a single time section. Therefore, the results obtained can be just interpreted for this time section. The longitudinal research method can be applied to re-analyze the model by periodically collecting data. Thus, stronger statistical evidence can be obtained by controlling the internal consistency of the model.

Ethics

Ethics Committee Approval: Data on death cases were taken from the Worldometer statistics website, and data on current health expenditure and median age were obtained from the World Bank's database.

Peer-review: Externally and internally peer reviewed.

Authorship Contributions

Concept: K.T., Design: K.T., Data Collection or Processing: Z.İ.G., Analysis or Interpretation: K.T., Literature Search: Z.İ.G., Writing: K.T., Z.İ.G.

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

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

References

1. Sun P, Xiaosheng L, Chao X, Wenjuan S, Bo P. Understanding of COVID-19 based on current evidence. J Med Virol 2020;92:548-51.
2. Saxena SK. (ed.). Coronavirus Disease 2019 (COVID - 19). Epidemiology, Pathogenesis, Diagnosis, and Therapeutics. Singapore:Springer;2020.
3. Ghinai I, McPherson TD, Hunter JC, Kirking HL, Christiansen D, Joshi K, et al. First known person-to-person transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in the USA. Lancet 2020;395:1137-44.
4. World Health Organization. Report of the WHO-China joint mission on Coronavirus Disease 2019 (COVID-19). Last Accessed Date: 12.04.2020 Avaialable from: https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19-final-report.pdf.
5. The United Nations. New measures of population ageing. Last Accessed Date: 12.04.2020 Available from: https://www.un.org/en/development/desa/population/events/pdf/expert/29/session1/EGM_25Feb2019_S1_SergeiScherbov.pdf
6. World Health Organization. Aging and health. Last Accessed Date: 14.04.2020. Available from: https://www.who.int/news-room/fact-sheets/detail/ageing-and-health Retrieved date:
7. Berlatsky N. Aging. 1st edition. Michigan:Greenhaven Publishing;2014.
8. Wu Z, McGoogan JM. Characteristics of and Important Lessons From the Coronavirus Disease 2019 (COVID-19) Outbreak in China: Summary of a Report of 72 314 Cases From the Chinese Center for Disease Control and Prevention. JAMA 2020;323:1239-42.
9. Onder G, Rezza G, Brusaferro S. Case-fatality rate and characteristics of patients dying in relation to COVID-19 in Italy. JAMA 2020;323:1775-6.
10. Sannigrahi S, Pilla F, Basu B, Basu AS. The overall mortality caused by COVID-19 in the European region is highly associated with demographic composition: A spatial regression-based approach. arXiv preprint arXiv:2005.04029. 2020:1-43.
11. World Health Organization. Public spending on health: A closer look at global trends Last Accessed Date: 13.04.2020. Avaialable from: https://www.who.int/health_financing/documents/health-expenditure-report-2018/en/
12. Kiross GT, Chojenta C, Barker D, Loxton D. The effects of health expenditure on infant mortality in sub-Saharan Africa: evidence from panel data analysis. Health Econ Rev 2020;10:1-9.
13. Bein MA, Unlucan D, Olowu G, Kalifa W. Healthcare spending, and health outcomes: evidence from selected East African countries. Afr Health Sci 2017;17:247-54.
14. Armocida B, Formenti B, Ussai S, Palestra F, Missoni E. The Italian health system and the COVID-19 challenge. Lancet Public Health 2020;5:e253.
15. Rezapour A, Mousavi A, Lotfi F, Movahed MS. Alipour S. The effects of health expenditure on health outcomes based on the classification of public health expenditure: A panel data approach. Shiraz E-Med J 2019;20:1-7.

16. Rana RH, Alam K, Gow J. Development of a richer measure of health outcomes incorporating the impacts of income inequality, ethnic diversity, and ICT development on health. Globalization Health 2018;14:1-12.
17. Worldometer. reported cases and deaths by country, territory, or conveyance. Last Accessed Date: 13.04.2020. Available from: https://www.worldometers.info/coronavirus/ ?utm_ campaign=homeAdvegas1?
18. The World Bank. World development indicators. 2020. Last Accessed Date: 13.04.2020. Available from: https://databank.worldbank.org/home
19. Schober P, Boer C, Schwarte LA. Correlation Coefficients: Appropriate Use and Interpretation. Anesth Analg 2018;126:1763-68.
20. Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. J Pers Soc Psychol 1986;51:1173-82.
21. Bave JJV ,Baicker K, Boggio PS, Capraro V, Cichocka A, Cikara M, et al. Using social and behavioural science to support COVID-19 pandemic response. Nat Hum Behav 2020;4:460-71.

Original Article

DOI: 10.14235/bas.galenos.2020.5085
Bezmialem Science 2020;8(Supplement 2):7-14

The Relationship of Hemogram and Inflammatory Biomarkers to Lenght of Stay in Hospital and Clinical Course in Patients with COVID-19

COVİD-19 Olgularında Hemogram ve Enflamasyon Biyobelirteçlerinin Hastane Yatış Süresi ve Klinik Seyirle Ilişkisi

Banu BÜYÜKAYDIN

Bezmialem Vakıf University, Department of Internal Medicine, İstanbul, Turkey

ABSTRACT

Objective: It was aimed to research the relationship between neutrophil-lymphocyte ratio (NLR), platelet-lymphocyte ratio (PLR), inflammatory markers and lenght of stay in hospital (LOS) with clinical results in hospitalized patients with Coronavirus disease-2019 (COVID-19).

Methods: Total leukocyte, neutrophil, lymphocyte and platelet counts (/mm^3), hemoglobin (g/dL), mean platelet volume, C-reactive protein (CRP) (mg/L), ferritin (ng/mL), lactate dehydrogenase (LDH) (U/L) creatine kinase (U/L), D-dimer (ng/mL), troponin-I (pg/mL), alanine aminotransferase (U/L), aspartate aminotransferase (U/L) and serum creatinine (mg/dL) measurements were recorded. NLR and PLR were calculated. Applied treatments, intensive care unit requirement, and mortality rates were determined. For LOS and mortality, the sensitivity of biochemical parameters was evaluated.

Results: One hundred seventy-one patients (87 females, 84 males) were evaluated. The mean age was 57.9±14.6 years, and the mean LOS was 8.83±6.4 days. There was a positive correlation between NLR and PLR ($p<0.05$). NLR was correlated with CRP, LDH, ferritin, D-dimer, and troponin-I ($p<0.05$). LOS was longer in patients with high serum creatinine, CRP, LDH, ferritin, and troponin-I ($p<0.05$). The need of intensive care unit was observed in 14.6% of the patients and mortality rate was 9.9%. The most used medications were Azithromycin and Hydroxychloroquine.

ÖZ

Amaç: Hospitalize Coronavirüs hastalığı-2019 (COVİD-19) olgularında nötrofil-lenfosit oranı (NLR), platelet-lenfosit oranı (PLR) ve enflamatuvar göstergelerin hastane yatış süresi (HYS) ve klinik seyirle olan ilişkisini araştırmaktır.

Yöntemler: Çalışmaya dahil edilen olguların total lökosit, nötrofil, lenfosit ve trombosit sayıları (/mm^3), hemoglobin düzeyi (g/dL), ortalama trombosit hacmi, C-reaktif protein (CRP) (mg/L), ferritin (ng/mL), laktat dehidrogenaz (LDH) (U/L), kreatin kinaz (U/L), D-dimer (ng/mL), troponin-I (pg/mL), alanin aminotransferaz (U/L), aspartat aminotransferaz (U/L) ve serum kreatinin (mg/dL) sonuçları kaydedildi. NLR ve PLR hesaplandı. Uygulanmış olan antiviral tedaviler kaydedildi. Yoğun bakım ünitesi takibi ve mortalite oranları belirlendi. Biyokimyasal parametrelerin kendi aralarındaki korelasyon analizleri yapıldı ve parametrelerin HYS ve mortalite öngörüsü için duyarlılıkları analiz edildi.

Bulgular: Toplam 171 hastanın (87 kadın, 84 erkek) verileri değerlendirildi. Ortalama yaş 57,9±14,6 yıl, ortalama HYS 8,83±6,4 gündü. NLR ile PLR pozitif yönde koreleydi ($p<0,05$). NLR ile CRP, LDH, ferritin, D-dimer ve troponin-I arasında pozitif yönde korelasyon vardı ($p<0,05$). HYS, artmış serum kreatinin, CRP, LDH, ferritin ve troponin-I olan olgularda daha uzundu ($p<0,05$). Yirmi beş olgu (%14,6) yoğun bakım ünitesinde takip edilmiş, 17 olgunun takibi (%9,9) mortalite ile sonuçlanmıştı. Tedavide Azitromisin ve Hidroksiklorokin kullanımı yüksek orandaydı.

Address for Correspondence: Banu BÜYÜKAYDIN, Bezmialem Vakıf University, Department of Internal Medicine, İstanbul, Turkey
E-mail: bbuyukaydin@hotmail.com **ORCID ID:** orcid.org/0000-0003-2843-4209

Cite this article as: Büyükaydın B. The Relationship of Hemogram and Inflammatory Biomarkers to Lenght of Stay in Hospital and Clinical Course in Patients with COVID-19. Bezmialem Science 2020;8(Supplement 2):7-14.

Received: 07.07.2020
Accepted: 04.08.2020

In patients with advanced age, prolonged LOS, and increased inflammation, the frequency of using Favipravir and Tociluzumab was higher.

Conclusion: In patients with COVID-19, inflammatory parameters are useful to predict LOS. Increased NLR and PLR seem to be related with poor prognosis.

Keywords: COVID-19, lenght of stay in hospital, neutrophil-lymphocyte ratio, platelet-lymphocyte ratio, intensive care unit follow up, mortality

Favipravir ve Tociluzumab tedavileri uygulanan olgularda ileri yaş, uzamış yatış süresi ve artmış enflamatuvar göstergeler mevcuttu.

Sonuç: COVİD-19 olgularında HYS'yi öngörmek için enflamatuvar parametreler kullanılabilir. Artmış NLR ve PLR kötü klinik seyirle ilişkili gözükmektedir.

Anahtar Sözcükler: COVİD-19, hastane yatış süresi, nötrofil-lenfosit oranı, platelet-lenfosit oranı, yoğun bakım takibi, mortalite

Introduction

At the end of 2019, a new Coronavirus was determined as a result of virus sequence analyses performed in cases of pneumonia of unknown cause in Wuhan, China. This infection, defined as Coronavirus disease-2019 (COVID-19), has become a serious threat to human health due to the rapid increase in its incidence, high contagiousness and high mortality. Although 81% of the cases have a mild course, a severe course is observed in 14% of cases and a critically severe course is observed in 5% (1). Prognosis is poor and mortality is high in critically severe cases (2). Fever, cough, dyspnea, fatigue, and myalgia are among the clinical symptoms, and the ground-glass appearance on computed tomography is accepted as the typical finding (3,4). Its pathogenesis includes the inflammatory process associated with vasculitis, the complement cascade and pro-inflammatory cytokines, and the process results in serious organ damage, particularly lung and cardiovascular damage (5,6).

Due to the high rates of infection-related mortality, early recognition of cases that will progress is very important, and biomarkers to be used for this purpose are among the research topics. Normal or decreased neutrophil and lymphocyte count, thrombocytopenia, increased transaminase, lactate dehydrogenase (LDH), creatine kinase (CK) and troponin levels, and changes in D-dimer and albumin have been shown as risk factors for referral to intensive care unit (ICU) in COVID-19 cases (3,7). Increased neutrophil-lymphocyte ratio (NLR) has been associated with poor prognosis, and platelet-lymphocyte ratio (PLR) and lymphocyte-monocyte ratio have been evaluated among inflammatory response indicators (8). The change in mean platelet volume (MPV) associated with this infection is among the research topics, although its prediction is low (9).

Clinical course and response rates to the treatment show unpredictable differences among cases. Length of stay (LOS) in hospital has been associated with patient age, current comorbidities, severity of symptoms and lymphopenia level (10-12). The prolongation of the hospitalization period increases the risk of complications, especially hospital infection. Clinical and laboratory tools to be used to predict this period are among the research topics.

There is not yet an approved treatment method and a vaccine with proven safety against COVID-19. The use of protective equipment, symptomatic supportive treatment, and advanced life support in serious disease and treatment of complications are the accepted approach models (13). It is recommended that uncomplicated mild cases are treated outside the hospital, whereas complicated cases with additional risk factors and severe respiratory failure are hospitalized (14).

In our study, we aimed to investigate the relationship between NLR,PLR, inflammatory indicators, medical treatments and LOS with clinical course in hospitalized patients with COVID-19.

Method

In our study, the files of the patients, who were clinically and radiologically diagnosed with COVID-19 between March 20 and May 20, 2020 hospitalized, were retrospectively evaluated with the permission of the institutional ethics committee, number with 54022451-050-05-04- 02/09/2020. The patients were included in the study according to the protocol number order. No additional intervention was made in patient selection. Patient age, gender and LOS period were recorded.

Cases with malignancy recorded were not included in the study. Related was the thought that the current diagnosis and the treatments might affect the parameters evaluated. Total leukocyte, neutrophil, lymphocyte and thrombocyte counts (/mm^3), hemoglobin level (g/dL) and MPV were recorded among the hemogram parameters measured on the day of hospitalization. NLR and PLR were calculated and included in the study. C-reactive protein (CRP) (mg/L) and ferritin (ng/mL) levels as acute phase indicators, together with LDH (U/L), CK (U/L), D-dimer (ng/mL), troponin-I (pg/mL), alanine aminotransferase (ALT) (U/L), aspartate aminotransferase (AST) (U/L) and serum creatinine, (mg/dL) were recorded.

Among the treatments applied, the presence of Azithromycin, Oseltamivir, Hydroxychloroquine, Favipravir and Tociluzumab was investigated. Anti-coagulant treatments, especially low molecular weight heparin, were determined. The numbers of patients followed up in the ICU and developing mortality were recorded. The possible relationships of the evaluated biochemical parameters with each other and their sensitivity in predicting the length of hospital stay and mortality were analyzed. In addition, the effects of the treatments used on the parameters evaluated were investigated.

Statistical Analysis

IBM 22.0 version was used for statistical analysis. The Mann-Whitney U test was used for non-parametric analysis. Descriptive analyses were presented as mean and standard deviation. The chi-square and Fisher's exact test were employed for categorical analyses. Non-parametric Spearman's test was used for the correlation between LOS and biochemical parameters, and Pearson correlation test was used for the correlation of biochemical parameters among themselves. P<0.05 was considered statistically significant for all data.

Results

Data of 171 patients (87 female, 84 male) were evaluated. The mean age was 57.9±14.6 years. The mean LOS was found to be 8.83±6.4 days. A very low statistically significant relationship was found between the age of the patient and LOS in the same direction (rs: 0.18, p=0.018). The mean values and statistical differences of biochemical parameters according to gender are presented in Table 1. When all cases were evaluated together, the NLR correlated negatively with the hemoglobin level and positively with the platelet count (r=-0.176, p=0.021, r=0.163, p=0.033). A statistically significant positive correlation was found between NLR and PLR (r=0.645, p<0.05). NLR was also significantly correlated in the same direction with CRP, LDH, ferritin, D-dimer, and troponin-I (r=0.341, r=0.216, r=0.226, r=0.4, r=0.264, p<0.05). PLR was positively correlated with neutrophil absolute count and d-dimer and negatively correlated with MPV (r=0.199, r=0.168, r=-0.305, p<0.05). There was a negative correlation between MPV and the absolute number of platelets (r=-0.425, p<0.05). Total leukocyte and neutrophil absolute counts were positively correlated with D-dimer, LDH, ferritin, and troponin-I (r=0.274, 0.329, r=0.213, 0.275, r=0.213, 0.271, r=0.274, 0.308, p<0.05).

LOS was longer for patients with higher serum creatinine, CRP, LDH, ferritin and troponin-I levels (p<0.05). Twenty-five cases (14.6%) (13 women, 12 men) were followed up in the ICU. Table 2 shows the changes of the parameters between cases with and without ICU follow-up. Azithromycin usage rate was 91.8% (157 cases), Hydroxychloroquine usage rate was 97.1% (166 cases). For oseltamivir, this rate was 30.4% (52 cases). 63.7% of the cases had received anticoagulant treatment, mostly (60.2%) low molecular weight heparin. Favipravir treatment for 60 cases (35.1%) and Tociluzumab treatment for 12 cases (7%) were added to the existing treatment. Favipravir rate was 84% and Tociluzumab usage rate was 32% in patients with ICU. While there was a positive correlation between the number of ICU admissions and Favipravir use, this number was negatively correlated with Tociluzumab (p<0.05). In 60 cases given Favipravir, age, LOS, CRP, ALT, AST, LDH, ferritin and troponin-I levels were statistically significantly higher, and the absolute number of lymphocytes was lower (p<0.05), compared to the patients who did not use it. In these cases, NLR was statistically significantly higher, while PLR was similar between the two groups (p<0.05, p=0.451). LOS, CRP, ALT, AST, LDH and ferritin levels were found to be statistically significantly

Table 1. The averages of evaluated biochemical parameters

	Female	Male	p
Age	59.7±14.1	56.01±17.98	0.1
LOS-day	8.34±5.82	9.33±6.36	0.265
Total leukocyte-mm^3	7.88±4.18	7.34±3.2	0.721
Neut-mm^3	5.44±3.74	5.27±2.98	0.506
Lymph-mm^3	1.59±0.79	1.27±0.57	<0.05
Hb-g/dL	12.68±1.64	13.94±2.09	<0.05
PLT-mm^3	244±86.4	201.9±69.2	<0.05
MPV	7.71±1.35	7.93±1.36	0.135
NLR	4.34±3.93	5.21±4.31	0.058
PLR	198.26±137.5	193.5±117	0.607
CRP-mg/L	57.42±56.01	64.04±55.5	0.349
D-dimer-ng/mL	498.83±574.42	416.42±798.04	0.03
ALT-U/L	28.38±25.16	35.68±36.91	0.057
AST-U/L	32.57±29.47	37.44±33.64	0.365
Creatinin-mg/dL	1.03±0.78	1.11±0.73	<0.05
LDH-U/L	287.48±124.43	294.18±133.4	0.888
CK-U/L	84.93±67.71	171.95±272	<0.05
Ferritine-ng/mL	371.04±830.03	418.45±520.26	<0.05
Troponin-I-pg/mL	34.10±170.27	15.51±34.09	0.257

LOS: Lenght of stay in hospital, Neut: Neutrophil count, Lymph: Lymphocyte count, Hb: Hemoglobin, PLT: Platelet count, MPV: Mean platelet volume, NLR: Neutrophil-lymphocyte ratio, PLR: Platelet-lymphocyte ratio, CRP: C-reactive protein, ALT: Alanine aminotransferase, AST: Aspartate aminotransferase, LDH: Lactate dehydrogenase, CK: Creatine kinase

Table 2. The changes of parameters between the patients in clinical service and intensive care unit

	Clinical service (n=146)	ICU (n=25)	p
Age	56.77±14.09	64.6±16.17	p<0.05
LOS-day	7.76±4.12	15.08±11.85	p<0.05
Total leukocyte-mm^3	7.11±3.41	10.59±3.93	p<0.05
Neut-mm^3	4.78±2.97	8.68±3.78	p<0.05
Lymph-mm^3	1.47±0.7	1.22±0.7	p=0.057
Hb-g/dL	13.37±1.97	12.89±1.96	p=0.208
PLT-mm^3	219.12±79.25	249.56±88.26	p=0.087
MPV	7.82±1.39	7.77±1.12	p=0.946
NLR	3.97±3.15	9.43±5.87	p<0.05
PLR	182.59±111.89	273.79±179.52	p<0.05
CRP-mg/L	53.07±52.79	104.47±52.87	p<0.05
D-dimer-ng/mL	346.11±285.17	1102.08±1530.38	p<0.05
ALT-U/L	29.9±29.11	44.08±42.23	p=0.068
AST-U/L	31.78±26.42	53.33±49.15	p<0.05
Creatinin-mg/dL	1.04±0.72	1.23±0.95	p=0.317
LDH-U/L	265.7±96.74	437.2±185.58	p<0.05
CK-U/L	106.58±130.94	258.92±412.49	p<0.05
Ferritine-ng/mL	290.6±396.36	985.35±1400.31	p<0.05
Troponin-I-pg/mL	10.52±18.09	108.38±310.1	p<0.05

ICU: Intensive care unit, LOS: Lenght of stay in hospital, Neut: Neutrophil count, Lymph: Lymphocyte count, Hb: Hemoglobin, PLT: Platelet count, MPV: Mean platelet volume, NLR: Neutrophil-lymphocyte ratio, PLR: Platelet-lymphocyte ratio, CRP: C-reactive protein, ALT: Alanine aminotransferase, AST: Aspartate aminotransferase, LDH: Lactate dehydrogenase, CK: Creatine kinase

higher, and the absolute count of lymphocytes was found to be lower in 12 patients who were given tociluzumab (p<0.05). In these cases, NLR and PLR were not different from those who did not use tociluzumab (p=0.063, p=0.127).

Mortality rate for our patient group was 17 cases (7 women, 10 men) (9.9%). The results of these cases with the remaining patient group are presented in Table 3. All cases with mortality were followed up in the ICU. In these cases, Favipravir usage rate was 82.4% and Tociluzumab usage rate was 29.4%.

Discussion

In our study, 171 hospitalized COVID-19 cases were evaluated and the mean LOS was found to be 8.83±6.4 days. LOS varies among countries. While an average of 19 and 21 days of LOS was reported in studies originating from China and Vietnam, this time is 7-8 days in those originating from Europe and the United States (15,16). This difference is thought to be due to differences in disease prevention and control approaches among countries. In our study, LOS was similar between male and female patient groups. Although a statistically very low relationship was found, it was observed that LOS increased as the age of the patients increased. This period is thought to be prolonged due to the higher rate of comorbid diseases and the risk of developing a more severe clinical picture in older patients.

In many studies, it has been observed that advanced age is the main factor in hospitalization risk (17,18). In our study, it was remarkable that the average age of the patients who were taken to the ICU and developed mortality was significantly higher. CRP, LDH, ferritin and troponin-I values at the time of hospitalization were among the other factors affecting LOS in our case group. High CRP and LDH levels have been previously associated with a severe clinical course and prolonged hospitalization (19). There are studies in which high ferritin level is associated with severe clinical course and high troponin-I level with mortality (20,21).

In our study, a positive correlation was found between NLR and PLR, which are among the parameters investigated in the prediction of clinical progression in the literature. NLR was also significantly positively correlated with platelet count, CRP, LDH, ferritin, D-dimer, and troponin-I. PLR was positively correlated with the absolute number of neutrophils and D-dimer. The absolute number of lymphocytes was lower in male patients but there was no significant difference between the two genders in terms of NLR and PLR. NLR and PLR are among for the prognostic indicators, especially cardiovascular diseases and malignancies (22). In studies and meta-analyses on NLR - related COVID-19, it has been reported that high neutrophil count and decreased lymphocyte count and NLR are useful in predicting disease severity (23). In a study in which 548 COVID-19 cases were analyzed, it was reported that increased neutrophil count and NLR were found in critically ill patients and cases with mortality, and low eosinophil, lymphocyte and platelet counts were observed during hospitalization of these cases (24). As a new systemic inflammation indicator, PLR is one of the factors

Table 3. The changes of parameters in cases with or without of mortality

	Non exitus (n=154)	Exitus (n=17)	p
Age	56.84±14.21	67.71±15.11	p<0.05
LOS-day	8.07±4.48	15.71±13.71	p<0.05
Total leukocyte-mm^3	7.25±3.50	10.92±3.9	p<0.05
Neut-mm^3	4.95±3.11	8.97±3.63	p<0.05
Lymph-mm^3	1.45±0.71	1.25±0.64	p=0.257
Hb-g/dL	13.36±1.94	12.79±2.24	p=0.319
PLT-mm^3	222.74±83.16	231±60.3	p=0.394
MPV	7.8±1.37	7.93±1.2	p=0.501
NLR	4.3±5.67	8.97±5.66	p<0.05
PLR	191.8±124.44	233.24±152.2	p=0.136
CRP-mg/L	55.9±54.17	103.89±51.88	p<0.05
D-dimer-ng/mL	376.14±395	1191.12±1702.3	p<0.05
ALT-U/L	29.99±28.53	50±49.54	p=0.146
AST-U/L	31.99±25.81	62.19±58.31	p=0.069
Creatinin-mg/dL	1.03±0.7	1.4±1.11	p=0.083
LDH-U/L	273.89±106.08	443.71±201.29	p<0.05
CK-U/L	106.53±128.9	335.5±488.18	p<0.05
Ferritine-ng/mL	299.79±401.28	1231.22±1624.65	p<0.05
Troponin I-pg/mL	11.33±20	147.15±372.17	p<0.05

LOS: Lenght of stay in hospital, Neut: Neutrophil count, Lymph: Lymphocyte count, Hb: Hemoglobin, PLT: Platelet count, MPV: Mean platelet volume, NLR: Neutrophil-lymphocyte ratio, PLR: Platelet-lymphocyte ratio, CRP: C-reactive protein, ALT: Alanine aminotransferase, AST: Aspartate aminotransferase, LDH: Lactate dehydrogenase, CK: Creatine kinase

that increase thrombosis development and responsible for the cytokine and chemokine cascade (25). In COVID-19 cases, high PLR has been reported to be associated with severe clinical course and prolonged LOS (26). In our case group, the total leukocyte and neutrophil absolute counts, as well as NLR and PLR levels were statistically significantly higher in the patients who were followed up in the ICU. It was also remarkable that NLR was higher in cases developing mortality, in line with the literature. The fact that PLR was not observed to be significant in mortality prediction. It can be explained by the relatively low number of patients.

In our study, it was striking that CK and ferritin levels were higher in male patients and acute phase-related CRP, LDH, D-dimer, ferritin, CK, troponin-I levels in case groups with ICU and mortality were apparently high. It was observed that acute phase response increased in patients developing renal dysfunction. However, the predictive effect of transaminase levels and renal functions on ICU admission and mortality was not observed. Our results related to acute phase parameters were consistent with the literature. In these cases, CRP, LDH, CK and troponin levels were associated with disease severity (27). In a cohort analysis performed with 799 patients, the presence of significantly high concentrations of ALT, AST, creatinine, CK, LDH, troponin-I, N-terminal pro-brain natriuretic peptide, and D-dimer was reported in patients with mortality (28). In clinical practice, evaluating D-dimer, LDH, transaminases together with interleukin-6 (IL-6) levels among routine tests is among the cases recommendations to predict high-risk patients and to identify cases that may benefit from anti-IL-6 and Tociluzumab treatment (29). Cytokine storm is thought to be responsible for acute lung injury and multiorgan failure in these cases. Other inflammatory markers that are being investigated in this process include IL-2, IL-7, tumor necrosis factor-alpha (α), interferon-c inducible protein-10, monocyte chemoattractant protein-1, macrophage inflammatory protein-1α, granulocyte-colony stimulating factor, procalcitonin and ferritin (30-32).

For our cases, the rate of follow-up in the ICU was 14.6%, and the mortality rate was 9.9%. ICU rates for our cases were consistent with the literature. We think that all hospitalized patients should be included in the analysis and re-evaluated in order to determine our hospital mortality rate. So far, it has not been determined what percent of infected people are hospitalized. ICU rate has been reported as 10-20% in hospitalized patients, with intubation 3-10%. Also the reported mortality risk was 5,5% for China and 6,5% for worldwide, this rate increases up to 49% in critical cases (33,34). However, the actual mortality rate of COVID-19 has not been determined yet. Risk factors for poor prognosis appear to be patient age and the presence of comorbidities (30). Therefore, the use of scoring systems and patient management according to the results is the recommended to predict disease severity (35). Apparatus and biomarkers that will rapidly and early identify the disease course are among the research topics (36).

Today, an effective treatment method against COVID-19 has not yet been defined. However, due to the similarity of this virus, which is a single-stranded RNA virus, to the Severe Acute Respiratory Syndrome-Coronavirus-2 (SARS-CoV-2) and Middle East Respiratory Syndrome, the current treatment is based on the experience gained from these two diseases (37). Chloroquine and Hydroxychloroquine have an important place among the treatments. Although the antiviral activity of these drugs is not known exactly, there is information in *in vitro* studies that they prevent the virus to bind and enter the cell (38). Favorable results have been reported in a study in which Azithromycin, a macrolide antibiotic, was used together with Hydroxychloroquine, and it was presented among the recommendations (39,40). The combination of Azithromycin and Hydroxychloroquine is also included in the first stage in the current treatment protocol of our country's Ministry of Health along with relevant literature. Therefore, the rate of using this combination quite high in our case group.

Favipravir treatment is among the recommendations for patients with tachypnea and SpO_2 level below 90% in room air, with bilateral diffuse involvement in imaging, and patients whose clinical condition and pneumonia symptoms progressed while receiving Hydroxychloroquine treatment. In our study, the patients who received Favipravir treatment were older, and the LOS duration was longer and the acute phase response was significantly higher in these cases. Favipravir acts by inhibiting viral RNA-dependent RNA polymerase and has been shown to have good clinical efficacy against COVID-19 (41). Favipravir appears to be a promising agent for treatment. Along with its clinical research, the studies continue in comparative and combination models with placebo and other antiviral agents (42).

Tocilizumab is a recombinant IL-6 receptor monoclonal antibody. In the development of severe alveolar damage and dysfunction in these cases, high IL-6 level among inflammatory mediators was observed as predictive of mortality (31). Clinical studies investigating its effectiveness are promising (43). Because it was a case-based medication, Tociluzumab was used at a rate of 7% for the entire patient group and 32% for the patients who were hospitalized in the ICU. Due to the low rate of use for this patient group, it was not possible to indicate a result on its clinical efficacy, but promising studies related to this treatment continues (44).

Treatment modalities with favorable results reported in the literature. Among these Oseltamivir, Baricinitib, Remdesivir, Ritonavir and Lopinavir, Ivermekin, Darunavir, Camostat Mesylate, Cepharanthie, Selamectin, Meflquine Hydrochloride, Losartan and Telmisartan, SARS-CoV - specific human monoclonal antibody, protease inhibitors, convalescent plasma and passive immunization. In these cases, supportive and symptomatic treatments, including anticoagulation, are applied on the basis case (45,46).

Study Limitations

Because of the retrospective nature of the study, analyses could only be made over the parameters registered in the system. There is no sufficient and reliable information about possible comorbidities of cases that are among the factors that may affect LOS duration. The fact that the relationship between LOS and inflammation and NLR and PLR was not investigated with multivariate analysis. The absence of objective data on the status of COVID-19-associated disease severity, respiratory support need, existing lung damage and the absence of risk scoring associated with inflammation and thrombosis are other limitations of the study.

Conclusion

The COVID-19 pandemic continues to affect the world with increasing case and mortality rates. In this study, the correlation of leukocyte count, neutrophil absolute count, NLR, and PLR with inflammatory markers was determined. NLR and PLR were observed to be predictive in cases with ICU hospitalization, and NLR in cases developing mortality. Future studies are needed regarding the role of these biomarkers in the pathogenesis of the disease.

Ethics

Ethics Committee Approval: Bezmialem Vakif University Clinical Research Ethics Committee Approval Number: 54022451-050-05-04- 02/09/2020.

Informed Consent: There is no informed consent because of retrospective manner.

Peer-review: Externally and internally peer reviewed.

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

References

1. Weifeng Shang, Junwu Dong, Yali Ren, Ming Tian, Wei Li, Jianwu Hu, Yuanyuan Li The Value of Clinical Parameters in Predicting the Severity of COVID-19 J Med Virol 2020; 21;10.1002/jmv.26031 Online ahead of print.
2. Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72314 cases from the Chinese Center for Disease Control and Prevention. JAMA. 2020; 323:1239.
3. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020; 395:497-506.
4. Guan WJ, Ni ZY, Hu Y, et al. Clinical characteristics of coronavirus disease 2019 in China. N Engl J Med. 2020; 82:1708-20.
5. Tang N, Li D, Wang X, et al. Abnormal coagulation parameters are associated with poor prognosis in patients with novel coronavirus pneumonia. J Thromb Haemost. 2020; 18:844–47.

6. Lin L, Lu L, Cao W, et al. Hypothesis for potential pathogenesis of SARS-CoV-2 infection—a review of immune changes in patients with viral pneumonia. Emerg Microbes Infect. 2020; 9:1–1.
7. Zhang G, Zhang J, Wang B, et al. Analysis of clinical characteristics and laboratory findings of 95 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a retrospective analysis. Respir Res. 2020; 21:74.
8. Ai-Ping Yang, Jian-Ping Liu, Wen-Qiang Tao, Hui-Ming Li. The Diagnostic and Predictive Role of NLR, d-NLR and PLR in COVID-19 Patients Int Immunopharmacol 2020; 84:106504.
9. 9. Yunbao Pan, Guangming Ye, Xiantao Zeng, et al. Can Routine Laboratory Tests Discriminate SARS-CoV-2-infected Pneumonia From Other Causes of Community-Acquired Pneumonia? Clin Transl Med2020; 10:161-8.
10. Dawei Wang, Bo Hu, Chang Hu et al. Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China JAMA 2020; 323:1061-69.
11. Vinayak Mishra, Ajit Deo Burma, Sumit Kumar Das, Mohana Balan Parivallal, Senthil Amudhan, Girish N Rao. COVID-19-Hospitalized Patients in Karnataka: Survival and Stay Characteristics Indian J Public Health 2020; 64: 221-24.
12. Xiaofan Liu, Hong Zhou Yilu Zhou et al. Risk Factors Associated With Disease Severity and Length of Hospital Stay in COVID-19 Patients J Infect 2020; 81:95-97.
13. Center for Disease Control and Prevention. Interim clinical guidance for management of patients with confirmed coronavirus disease COVID-19 2020.
14. World Health Organization. Clinical management of severe acute respiratory infection (SARI) when COVID-19 disease is suspected 2020.
15. Pham Quang Thai, Do Thi Thanh Toa, Dinh Thai Son, et al. Factors Associated With the Duration of Hospitalisation Among COVID-19 Patients in Vietnam: A Survival Analysis Epidemiol Infect 2020; 10:e114.
16. Wise J. A third of COVID-19 patients admitted to UK hospitals die. British Medical Journal 2020; 30: m1794.
17. Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72 314 cases from the Chinese Center for Disease Control and Prevention JAMA 2020: 323; 1239–42.
18. CDC (Centers for Disease Control and Prevention) Severe outcomes among patients with coronavirus disease 2019 (COVID-19) – United States, February 12–March 16, 2020. MMWR. Morbidity and Mortality Weekly Report 69, 343–346.
19. Xiaofan Liu, Hong Zhou, Yilu Zhou et al. Risk Factors Associated With Disease Severity and Length of Hospital Stay in COVID-19 Patients Comment J Infect 2020; ;81:95-97.
20. Ian Huang Raymond Pranata, Michael Anthonius Lim, Amaylia Oehadian, Bachti Alisjahbana C-reactive Protein, Procalcitonin, D-dimer, and Ferritin in Severe Coronavirus disease-2019: A Meta-Analysis Ther Adv Respir Dis 2020; 14:1753466620937175.
21. Alvaro Lorente-Ros, Juan Manuel Monteagudo Ruiz, Luis M Rincón,et al. Myocardial Injury Determination Improves Risk Stratification and Predicts Mortality in COVID-19 Patients Cardiol J 2020 Jun 26, Online ahead of print.
22. M.E. Afari, T. Bhat, Neutrophil to lymphocyte ratio (NLR) and cardiovascular diseases: an update, Expert Rev. Cardiovasc. Ther 2016;14: 573–77.
23. Furong Zeng, Linfeng Li, Jiling Zeng, Yuhao Deng, Huining Huang, Bin Chen, Guangtong Deng Can We Predict the Severity of Coronavirus Disease 2019 With a Routine Blood Test? Pol Arch Intern Med 2020;130:400-6.
24. Ruchong Chen, Ling Sang, Mei Jiang, J et al Longitudinal Hematologic and Immunologic Variations Associated With the Progression of COVID-19 Patients in China Medical Treatment Expert Group for COVID-19 Allergy Clin Immunol. 2020; 146:89-100.
25. Rayes J, Bourne JH, Brill A, Watson SP. The dual role of platelet innate immune cell interactions in thrombo-inflammation. Res Pract Thromb Haemost. 2019;4:23-35.
26. Rong Qu,Yun Ling, Yi-Hui-Zhi Zhang J et al. Platelet-to-lymphocyte Ratio Is Associated With Prognosis in Patients With Coronavirus disease-19 Med Virol. 2020;17:10.
27. Du R-H, Liang L-R, Yang C-Q, et al. Predictors of mortality for patients with COVID-19 pneumonia caused by SARS-CoV-2: a prospective cohort study. Eur Respir J. 2020; 55:2000524.
28. Chen T, Wu D, Chen H, et al. Clinical characteristics of 113 deceased patients with coronavirus disease2019: retrospective study. BMJ. 2020; 368:m1091.
29. Zhang C, Wu Z, Li J-W, et al. The cytokine release syndrome (CRS) of severe COVID-19 and interleukin-6 receptor (IL-6R) antagonist tocilizumab may be the key to reduce the mortality. Int J Antimicrob Agents. 2020. 55:105954.
30. Zhou F, Yu T, Du R, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. Lancet 2020;395:1054–62.
31. Mehta P, McAuley DF, Brown M, et al. COVID-19: consider cytokine storm syndromes and immunosuppression. Lancet. 2020;395:1033–34.
32. Wang D, Hu B, Hu C, et al. Clinical characteristics of138 hospitalized patients with 2019 novel coronavirus- infected pneumonia in Wuhan, China. JAMA. 2020;323:1061–69.
33. Guan W-j, Ni Z-y, Hu Y et al. Clinical characteristics of coronavirus disease 2019 in China. N Engl J Med 2020; 382: 1708–20.
34. World Health Organization. Coronavirus disease (COVID-19): situation report—125. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200524-covid-19-sitrep-125.pdf?sfvrsn=80e7d7f0-2.
35. Centers for Disease Control and Prevention, Interim Clinical Guidance for Management of Patients with Confirmed Coronavirus Disease (COVID-19), https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinical-guidance-management-patients.html.

36. Michael P McRae, Glennon W Simmons et al. Clinical Decision Support Tool and Rapid Point-of-Care Platform for Determining Disease Severity in Patients With COVID-19 medRxiv. 2020 22;04.16.20068411.

37. Morse JS, Lalonde T, Xu S, Liu WR. Learning from the past: possible urgent prevention and treatment options for severe acute respiratory infections caused by 2019-nCoV. Chembiochem2020;21:730-8.

38. Savarino A, Boelaert JR, Cassone A, Majori G, Cauda R. 2003. Effects of chloroquine on viral infections: an old drug against today's diseases? Lancet Infect Dis 3:722–7.

39. Gautret P, Lagier JP, Parola P, Hoang VT et al. Hydroxychloroquine and azithromycin as a treatment of COVID-19: results of an open-label non-randomized clinical trial. Int J Antimicrob Agents 2020; 20:105949.

40. Matthay MA, Aldrich JM, Gotts JE. Treatment for severe acute respiratory distress syndrome from COVID-19. Lancet Respir Med. 2020;2600: 30127-2.

41. Bryner J. 2020. Flu drug used in Japan shows promise in treating COVID-19. Live Science, New York, NY. https://www.livescience.com/flu-drug-could-treat-coronavirus.html.

42. Clinicaltrials.Gov. Clinical trials on Favipiravir role in SARS-COV-2 infection. 2020 https://clinicaltrials.gov/ct2/results?cond=covid+19&term= Favipiravir+&cntry=&state=&city=&dist

43. Xu X, Han M, Li T et al. Effective treatment of severe COVID-19 patients with tocilizumab. Proc. Natl Acad. Sci. U S A 2020;117:10970-10975.

44. Chctr.Org. Favipiravir Combined With Tocilizumab in the Treatment of novel coronavirus pneumonia (COVID-19) - A Multicenter, Randomized, Controlled Trial 2020 www.chictr.org.cn/showprojen.aspx?proj=51126

45. Chris R Triggle, Devendra Bansal, Elmoubasher Abu Baker Abd Farag, Hong Ding , Ali A Sultan COVID-19: Learning From Lessons To Guide Treatment and Prevention Interventions- Review mSphere2020;5:e00317-20.

46. Lo'ai Alanagreh, Foad Alzoughool, Manar Atoum. Review Pathogens The Human Coronavirus Disease COVID-19: Its Origin, Characteristics, and Insights Into Potential Drugs and Its Mechanisms Pathogens 2020; 29:331.

Original Article

DOI: 10.14235/bas.galenos.2020.4978
Bezmialem Science 2020;8(Supplement 2):15-21

Evaluation of Clinical Features and Prognosis in COVID-19 Patients with Hypertension: A Single-center Retrospective Observational Study

Hipertansiyonu Olan COVİD-19 Hastalarında Klinik Özelliklerin ve Prognozun Değerlendirilmesi: Tek Merkezli Retrospektif Gözlemsel Çalışma

Gülay OKAY[1], Bülent DURDU[1], Yasemin AKKOYUNLU[1], Sibel BÖLÜKÇÜ[1], Asiye Bahar KAÇMAZ[2], Bilge SÜMBÜL[3], Hatice Dilara KARAKUŞ[1], Meliha Meriç KOÇ[1]

[1]Bezmialem Vakıf University Faculty of Medicine, Department of Infectious Diseases and Clinical Microbiology, İstanbul, Türkiye
[2]Bezmialem Vakıf University Dragos Hospital, Department of Infectious Diseases and Clinical Microbiology, İstanbul, Türkiye
[3]Bezmialem Vakıf University Faculty of Medicine, Department of Medical Microbiology, İstanbul, Türkiye

ABSTRACT

Objective: The aim of this study is to investigate the effect of hypertension on the clinical severity and prognosis of Coronavirus disease-2019 (COVID-19) patients.

Methods: In this retrospective observational study, reverse transcription-polymerase chain reaction (RT-PCR) positive COVID-19 patients over the age of 18 years who were hospitalized in Bezmialem Vakıf University between March and May 2020 were included. The patients were divided into two groups as hypertensive and non-hypertensive and compared for clinical, laboratory and prognosis.

Results: Two hundred sixty COVID-19 patients were included in the study, 55.4% of them were male and the mean (± standard deviation) age was 54.1±15.5 years. Hypertensive patients were older (64.6±11.5 and 47.2±13.9) (p<0.001), had higher diabetes mellitus rates (41.7% and 11.5%, p<0.001) and more complicated with chronic renal failure (16.5% vs. 2.5%, p<0.001).While 56.1% of patients were desaturated in the hypertensive group ($SaPO_2$ <93%), this rate was 32.3% in the group without hypertension (p<0.001). While oxygen therapy was needed in 39.8% of hypertensive patients, this rate was 25.5% in non-hypertensive patients (p=0.001). The rate of transfer to intensive care unit (23.3%) and in-hospital mortality rate (17.5%) in hypertensive patients were higher than

ÖZ

Amaç: Bu çalışmada amacımız, hipertansiyonun Koronavirüs hastalığı-2019 (COVİD-19) hastalarının klinik ağırlığı ve prognozu üzerine etkisini araştırmaktır.

Yöntemler: Bu retrospektif gözlemsel çalışmaya Mart-Mayıs 2020 tarihleri arasında Bezmialem Vakıf Üniversitesi Hastanesi'nde yatarak izlenen 18 yaş üstü, ters transkripsiyon-polimeraz zincir reaksiyonu (RT-PCR) pozitif COVİD-19 hastalar dahil edildi. Hastalar hipertansif ve hipertansif olmayan olarak iki gruba ayrılarak klinik, laboratuvar ve prognoz açısından karşılaştırıldı.

Bulgular: Çalışmaya dahil edilen 260 COVİD-19 hastasının %55,4'ü erkek, yaş ortalamaları (± standart sapma) 54,1±15,5'tir. Hipertansif hastalar daha yaşlıydı (64,6±11,5 ve 47,2±13,9) (p<0,001), daha yüksek diabetes mellitus oranlarına sahipti (%41,7 ve %11,5, p<0,001) ve kronik böbrek yetmezliği ile daha fazla komplike idi (%16,5'e karşı %2,5, p<0,001). Hipertansiyon olan grupta hastaların %56,1'i desatüre olurken ($SaPO_2$<%93), hipertansiyon olmayan grupta bu oran %32,3 idi (p<0,001). Hipertansif hastaların %39,8'inde oksijen tedavisine ihtiyaç olmuşken, hipertansif olmayan hastalarda bu oran %25,5 idi (p=0,001). Hipertansif hastalarda yoğun bakım ünitesine yatış oranı (%23,3) ve hastane içi mortalite oranı (%17,5), hipertansif

Address for Correspondence: Gülay OKAY, Bezmialem Vakıf University Faculty of Medicine, Department of Infectious Diseases and Clinical Microbiology, İstanbul, Türkiye
E-mail: gulay.okay@hotmail.com **ORCID ID:** orcid.org/0000-0003-1616-2162

Cite this article as: Okay G, Durdu B, Akkoyunlu Y, Bölükçü S, Kaçmaz AB, Sümbül B, Karakuş HD, Koç MM. Evaluation of Clinical Features and Prognosis in COVID-19 Patients with Hypertension: A Single-center Retrospective Observational Study. Bezmialem Science 2020;8(Supplement 2):15-21.

Received: 25.06.2020
Accepted: 04.06.2020

those in non-hypertensive patients (11.5% and 8.8%, respectively) (p=0.01 and p=0.025).

Conclusion: Our study shows that additional attention should be paid to prevent poor prognosis in COVID-19 patients with hypertension.

Keywords: COVID-19, hypertension, Severe Acute Respiratory Syndrome Coronavirus-2, prognosis

olmayan hastalardaki oranlara göre yüksekti (sırasıyla %11,5 ve %8,8) (p=0,01 ve p=0,025).

Sonuç: Çalışmamız hipertansiyonu olan COVID-19 hastalarında kötü prognozu önlemek için ek dikkat göstermek gerektiğini göstermektedir.

Anahtar Sözcükler: COVİD-19, hipertansiyon, Şiddetli Akut Solunum Sendromu Coronavirus-2, prognoz

Introduction

As of December 2019, pneumonia patients infected by a new type of coronavirus were detected consecutively in Wuhan City, Hubei State of China. This new type of coronavirus was later named Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) by the International Virus Taxonomy Committee (1). And then, the disease was named Coronavirus disease-2019 (COVID-19) by the World Health Organization (WHO) (2).

It has been reported in epidemiological studies of COVID-19 patients that hypertension (HT) carries an increased risk for poor prognosis (1,3,4). Angiotensin-converting enzyme (ACE2) is considered as the receptor for the entry of SARS-CoV-2 into human cells. (5,6). The ACE2 receptor is widely found in various organ systems in the human body, including the respiratory system and cardiovascular system (7,8). In studies, HT has been reported as one of the most common comorbid diseases seen in patients with COVID-19 (9,10). In one study, it has been shown that SARS-CoV-2 binds to the host ACE2 receptor via the S protein (11). Due to the relationship between SARS-CoV-2 and ACE2 and the role of ACE2 in HT pathogenesis, the issue of whether HT plays a role in the pathogenesis of COVID-19 is controversial. In some studies, it has not been revealed that HT is related to disease severity (12). Therefore, it remains unclear whether HT is a risk factor for COVID-19.

In this study, our aim is to compare the clinical and laboratory characteristics of COVID-19 patients with and without HT in order to determine the effect of HT on the severity of COVID-19 and prognosis.

Method

Study Design and Patient Population

This retrospective observational study was approved by the Bezmialem Vakıf University Ethics Committee. Reverse transcription-polymerase chain reaction (RT-PCR) positive COVID-19 patients over the age of 18 years who were hospitalized in Bezmialem Vakıf University Hospital between March and May 2020 were included in the study. The diagnosis and treatment of the patients included in the study were made in accordance with the WHO, Ministry of Health, COVID-19 diagnosis and treatment guidelines. The patients were divided into two groups as those with and without HT according to their medical history and compared in terms of clinical, laboratory features, clinical results and mortality.

The diagnosis of COVID-19 was made by evaluating the following criteria: 1) History of contact with a COVID-19 patient, 2) Fever or other respiratory symptoms, 3) Typical viral pneumonia findings in computed tomography (CT) imaging 4) Positive SARS-CoV-2 RNA with RT-PCR. The patients were clinically divided into four groups as mild, moderate, severe and critical according to the classification of WHO (2). 1) Mild: Patients with symptoms but no signs of viral pneumonia and hypoxia, 2) Moderate: Those with clinical symptoms of pneumonia (fever, cough, shortness of breath, rapid breathing) but with $SpO_2 \geq 90\%$ in room temperature, without signs of severe pneumonia, 3) Severe: Clinical signs of pneumonia (fever, cough, dyspnea, rapid breathing) with either: respiratory rate >30/min; severe respiratory distress; or $SpO_2 < 90.4\%$ at room temperature, 4) Critical: Complicated by one of the following: Acute Respiratory Distress syndrome or life-threatening organ dysfunction, septic shock and admitted to the intensive care unit (ICU). In statistical analysis, mild and moderate groups were evaluated in a single group as mild-moderate group.

Pulmonary CT findings of the patients were divided into two groups according to the extent of involvement. 1. Mild: Pure ground glass density, number of lesions ≤3 and size of all ≤3 cm, 2. Moderate/severe: Pure ground glass density, number of lesions >3 and the size of all >3 cm, consolidation, structural distortion.

Data Collection

Clinical and laboratory data of the patients were collected from their electronic files. Collected data of patients included age, gender, complaints, comorbidities, laboratory findings, lung CT findings, COVID-19 RT-PCR results, length of stay, ICU hospitalization, clinical results.

Statistical Analysis

The distribution of data was analyzed using the Shapiro-Wilk test. T-test was used to compare two independent groups with normal distribution. The Mann-Whitney U test was employed to compare two groups that did not show normal distribution. The Fisher Exact test, Pearson chi-square test and Fisher Freeman Halon test were used to compare categorical data. Binary logistic regression analysis with backward stepwise method was used to evaluate the risk factors affecting clinical severity status. Descriptive statistics of the data are given as frequency (percentage), median (minimum-maximum) and mean [± standard deviation (SD)]. All statistical tests were analyzed and

reported in IBM SPSS Statistics 22.0 program at α=0.05 level and 95% confidence interval.

Results

55.4% of 260 patients included in the study were male (n=144), their mean age was 54.1±15.5 years. The three most common symptoms observed in the patients were cough (71.5%), fever (55%) and respiratory distress (35.4%). Other symptoms were muscle pain (19.2%), sore throat (13.8%), diarrhea (11.9%), and headache (11.5%). The three most common comorbidities were HT (39.6%), diabetes mellitus (DM) (23.6%) and cardiovascular disease (CVD) (13.1%), and these were followed by chronic renal failure (CRF) (8.1%), asthma (7.3%) and chronic obstructive pulmonary disease (COPD) (5%). 56.2% of the patients (n=46) were in the clinically severe and critical group. In-hospital mortality was 11.9% (n=31) (Table 1).

The patients were divided into hypertensive (n=103) and non-hypertensive (n=157) groups and their clinical and laboratory characteristics were compared (Table 1, 2). Hypertensive patients were older than non-hypertensive patients [mean (± SD) 64.6 (±11.5) and 47.2 (±13.9) years, respectively], rates of DM were higher (41.7% and 11.5%), they were more complicated with CRF (16.5% vs 2.5%). Sore throat was statistically significantly lower in the hypertensive group (6.8% and 16.5%, respectively,

Table 1. Clinical characteristics of hypertensive and non-hypertensive COVID-19 patients

	Total (n=260)	Hypertension (+) (n=103)	Hypertension (-) (n=157)	p
Age, mean (± SD)	54.1 (±15.5)	64.6 (±11.5)	47.2 (±13.9)	**<0.001**
Gender				
Male	144 (55.4)	52 (50.5)	92 (58.6)	0.198
Female	116 (44.6)	51 (49.5)	65 (41.4)	0.198
Symptoms				
Cough	186 (71.5)	75 (72.8)	111 (70.7)	0.712
Fever	143 (55)	54 (52.4)	89 (56.7)	0.499
Dyspnea	92 (35.4)	39 (37.9)	53 (33.8)	0.498
Phlegm	16 (6.2)	7 (6.8)	9 (5.7)	0.727
Muscle pain	50 (19.2)	16 (15.5)	34 (21.7)	0.221
Headache	30 (11.5)	12 (11.7)	18 (11,5)	0.963
Sore throat	36 (13.8)	7 (6.8)	29 (18.5)	**0.008**
Diarrhea	31 (11.9)	12 (11.7)	19 (12.1)	0.918
Comorbidities				
Diabetes mellitus	61 (23.5)	43 (41.7)	18 (11.5)	**<0.001**
Cardiovascular disease	34 (13.1)	31 (30.1)	3 (1.9)	**<0.001**
Chronic renal failure	21 (8.1)	17 (16.5)	4 (2.5)	**<0.001**
Asthma	19 (7.3)	9 (8.7)	10 (6.7)	0.473
Chronic obstructive pulmonary disease	13 (5)	9 (8.7)	4 (2.5)	**0.025**
Cerebrovascular disease	6 (2.3)	3 (2.9)	3 (1.9)	0.684
Cancer	15 (5.8)	8 (7.8)	7 (4.5)	0.263
Chronic liver disease	1 (0.4)	1 (1)	0 (0)	0.396
Treatment and prognosis				
$SaPO_2$<93	105 (41.5)	55 (56.1)	50 (32.3)	**<0.001**
Low and high flow oxygen therapy	81 (31.2)	41 (39.8)	40 (25.5)	**0.001**
Non-invasive mechanical ventilation	7 (2.7)	5 (4.9)	2 (1.3)	**0.001**
Invasive mechanical ventilation	21 (8.1)	12 (11.7)	9 (5.7)	**0.001**
ICU hospitalization	42 (16.2)	24 (23.3)	18 (11.5)	**0.01**
Disease severity				
Mild-moderate	114 (43.8)	23 (22.3)	91 (58)	**<0.001**
Severe	104 (40)	56 (54.4)	48 (30.6)	**<0.001**
Critical	42 (16.2)	24 (23.3)	18 (11.5)	**<0.001**
Mortality	31 (11.9)	18 (17.5)	13 (8.5)	**0.025**

Data are given as mean (± SD), %, $SaPO_2$: Hemoglobin oxygen saturation; ICU: İntensive care unit, SD: Standard deviation, COVID-19: Coronavirus disease-2019

p=0.008). Cough (72.8% and 70.7%) and dyspnea rates (37.9% and 33.8%) were higher in the hypertensive group compared to the non- hypertensive group (Table 1).

The $SaPO_2$ (hemoglobin oxygen saturation) value was <93% in 41.5% (n=105) of the patients during hospitalization. While $SaPO_2$ decreased below 93% in 56.1% (n=55) of the patients in the hypertensive group, this rate was 32.3% (n=50) in the non-hypertensive group (p<0.001). Considering the clinical severity status, while the rate of patients with severe and critical clinic in the hypertensive group was 77.7%, this rate was 42.1% in the non-hypertensive group (p<0.001). Oxygen therapy was required in 39.8% of hypertensive patients, while this rate was 25.5% in non-hypertensive patients (p=0.001). Non-invasive and invasive mechanical ventilation rates were 4.9% and 11.7% respectively in hypertensive patients, while these rates were 1.3% and 5.7% respectively in non-hypertensive patients, and these differences were statistically significant (p=0.001). The rate of admission to the ICU in hypertensive patients (23.3%) was statistically significantly higher than in the non-hypertensive group (11.5%) (p=0.01). In-hospital mortality rate was statistically significantly higher in hypertensive patients (17.5%) compared to non-hypertensive patients (8.5%) (p=0.025) (Table 1). While the median (minimum-maximum) value of the hospitalization length of hypertensive patients was 9 days (1-54), this value was 5 days (1-33) in patients without HT (p=0.004).

Laboratory and imaging results of hypertensive and non-hypertensive patients are shown in Table 2. The median (minimum-maximum) values of neutrophil count, aspartate aminotransferase (AST), lactate dehydrogenase (LDH), and creatinine were significantly higher in hypertensive patients than in non-hypertensive patients. (p=0.001; p=0.016; p=0.002; p<0.001, respectively). Albumin and GFR median values were significantly lower in hypertensive patients (p=0.002 and p<0.001, respectively). Severe CT involvement rate was 78% in hypertensive patients and 67.9% in the non-hypertensive group. Mild CT findings were detected in 22% of the hypertensive group and in 32.1% of the non-hypertensive group (p=0.095).

In order to determine the factors affecting the clinical severity status of the patients in our study population, the risk factors for ICU admission were determined by logistic regression analysis. Age, gender, fever, cough, dyspnea, HT, DM, coronary artery disease, COPD, asthma, CRF, saturation rate, and CT severity scoring, which might affect the ICU admission rate, were included in the analysis. As a result of the analysis, age> 65 years [odds ratio (OR), 1.061; 95% confidence interval (CI), 1.026-1.098; p=0.001), high fever (OR, 1.655; 95% CI, 1.034-2.649; p=0.036), presence of dyspnea (OR, 1.856 ; 95% CI, 1.148-3; p=0.012) and saturation <90% (OR, 3.379; 95% CI, 1.548-7.377; p=0.002) were determined as risk factors for clinical severity. For regression model significance, p<0.001 (Table 3).

Table 2. Comparison of laboratory and computed tomography findings of hypertensive and non-hypertensive COVID-19 patients

	Hypertension (+) (n=103) Med (min-max)	Hypertension (-) (n=157) Med (min-max)	p
Blood leukocyte count, ×10³/uL	6.1 (1.06-16.6)	5.3 (1.1-13.8)	**0.002**
Neutrophil count, ×10³/uL	4 (1.5-14.6)	3.4 (0.5-12.4)	**0.001**
Lymphocyte count, ×10³/uL	1.2 (0.2-5.4)	1.3 (0.1-3.4)	0.880
Platelet count, ×10³/uL	198 (±64)	193 (±66.5)	0.526
ALT, U/L	26 (8-165)	24 (7-171)	0.591
AST, U/L	30 (10-239)	25 (11-141)	**0.016**
Albumin, g/dL	3.7 (2-4.7)	4 (1.9-5)	**0.002**
LDH, U/L	255 (153-977)	242.5 (125-770)	**0.002**
Creatinine, mg/dL	0.9 (0.6-13)	0.8 (0.5-7.8)	**<0.001**
GFR,	74 (2-107)	98 (6-150)	**<0.001**
CRP, mg/L	54 (0.1-325)	21 (0.1-261)	**<0.001**
Procalcitonin, ng/mL	0.35 (0.01-77)	0.22 (0.01-31.2)	**0.007**
Serum ferritin, ng/mL	256 (11.6-11.472)	224 (2-21.130)	0.136
D-dimer, ng/mL	260 (100-3.940)	245 (30-2.195)	**0.029**
Fibrinogen, mg/dL	400 (145-547)	391 (98-832)	0.934
PT, s	15.8 (13.2-40)	15.6 (13.6-33.4)	0.248
aPTT, s	34.4 (24.2-80.6)	34.05 (24.5-48.9)	0.179
Computed tomography			
Mild , n (%)	20 (22)	44 (32.1)	0.09
Moderate/severe, n (%)	71 (78)	93 (67.9)	

COVID-19: Coronavirus disease-2019, SD: Standard deviation, ALT: Alanine aminotransferase, AST: Aspartate aminotransferase, LDH: Lactate dehydrogenase, GFR: Glomerular filtration rate, CRP: C-reactive protein, PT: Prothrombin time, aPTT: Activated partial thromboplastin time

Table 3. Logistic regression analysis of risk factors affecting severe clinical rates

Variables	Wald	OR (95% CI)	p
Age >65	11.663	1.061 (1.026-1.098)	0.001
Fever	4.404	1.655 (1.034-2.649)	0.036
Presence of dyspnea	6.366	1.856 (1.148-3)	0.012
Saturation <%90	9.339	3.379 (1.548-7.377)	0.002

CI: Confidence interval, OR: Odds ratio

Discussion

In our study in which hypertensive and non-hypertensive patients were compared, it was found that the rates of severe clinic, ICU hospitalization and mortality were significantly higher in the hypertensive group. In the logistic regression analysis performed in the study population, age >65 years, presence of dyspnea, high fever, saturation <90% were determined as risk factors for severe clinic. Previous clinical studies on SARS and Middle East respiratory syndrome patients have shown that HT is a risk factor for increased mortality in infected patients (13-15). Similar results were obtained in many studies conducted with COVID-19 patients (16,17). Cytokine storm seen in COVID-19 patients may be one of the reasons for the increase in disease severity in hypertensive patients. In studies, cytokine storm caused by the increase of cytokines such as IL-6, TNF-α, and IL-7 has been found to be associated with clinical worsening of COVID-19 patients (18,19). In some previous studies, it has been shown that the increase in cytokines causes HT to deteriorate (20).

In our study group, the mean age of COVID-19 patients was 54.1±15.5 years, and the frequency of HT was 39.6%. In the national cross-sectional epidemiological study in Turkey, HT prevalence in the adult population was determined to be 31.8% (21). In a study that included 320 COVID-19 patients with a median age of 62 years, HT was found to be at a rate of 36.5% (12). In another study including 1.099 COVID-19 patients with a median age of 47 years, the prevalence of HT was 15% (10). It was observed that the prevalence of HT in COVID-19 patients increased in parallel with the increase in the average age of patients. Among the comorbid diseases seen in COVID-19 patients in our study group, DM, CVD and CRF rates were found to be higher in hypertensive patients than in non-hypertensive patients. In previous studies, it was reported that other comorbidities were observed at a higher rate in COVID-19 patients with HT (12,22). It was thought that higher rates of comorbidities and higher average age in hypertensive COVID-19 patients had a negative effect on the prognosis of the disease. The determination of advanced age as a risk factor for severe clinic in the logistic regression analysis performed in the study population supports this.

As in many previous studies (22,23), fever, cough and dyspnea were found to be the most common symptoms in our study. In our study, no significant difference was found in the rates of symptoms between hypertensive patients and non-hypertensive patients. Only sore throat was found to be statistically significantly lower in hypertensive patients. It should be kept in mind that patients may also have gastrointestinal symptoms such as diarrhea, as well as respiratory tract symptoms. In a previous study, it was reported that diarrhea was detected at a higher rate in hypertensive patients compared to non-hypertensive patients (12). In another study conducted with 110 COVID-19 patients, the rate of dyspnea in hypertensive patients was found to be statistically significantly higher (22).

In our COVID-19 patients, the rates of those who were desaturated, those who received oxygen therapy, and those who received non-invasive and invasive mechanical ventilation were higher in hypertensive patients compared to non-hypertensive patients. In a previous study conducted with 310 COVID-19 patients, it was reported that both non-invasive and invasive mechanical ventilation were applied at a higher rate in hypertensive patients (12). In a study involving 2.877 COVID-19 patients, the rate of invasive ventilation in hypertensive patients was significantly higher than in non-hypertensive patients (16).

When we evaluated the laboratory findings of our hypertensive COVID-19 patients, it was found that neutrophil count, AST, LDH and creatinine levels of hypertensive patients were significantly higher than the levels in non-hypertensive patients. The median albumin and GFR values were statistically significantly lower in patients with HT. In a previous study conducted with 310 COVID-19 patients, a significant increase was detected in blood leukocyte and neutrophil count, neutrophil/lymphocyte ratio, alanine aminotransferase, AST and LDH levels in hypertensive patients compared to non-hypertensive patients (12). In another study, blood leukocyte count was found to be significantly higher in hypertensive patients, but lymphocyte was lower (22).

When we evaluated our patients according to lung CT findings, the rate of moderate/severe CT involvement was found to be higher in hypertensive COVID-19 patients than in non-hypertensive patients, although not significant. In a study in which previously performed lung CTs were evaluated with the scoring system, it was found that lung CT scores were higher in the HT group. Again, in this study, CT scores of the left upper lobe, right upper lobe, right middle lobe and right lower lobe were found to be significantly higher in patients with HT than in patients without HT (17).

Our study has some limitations. The most important limitation is that it is a single center, retrospective study. Other limitation is

that factors such as smoking and obesity, which might affect the clinical severity of the patients, were not taken into consideration.

Conclusion

Our study has shown that COVID-19 patients with HT have a more severe clinical course and a poor prognosis. Follow-up and treatment of hypertensive patients should be done more carefully in accordance with current guidelines, considering the risk of poor prognosis.

Ethics

Ethics Committee Approval: This retrospective observational study was approved by the Bezmialem Vakıf University Ethics Committee.

Informed Consent: Retrospective study.

Peer-review: Externally and internally peer reviewed.

Authorship Contributions

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

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

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

References

1. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. Lancet . 2020;395:1054-62.
2. World Health Organization. Coronavirus disease (COVID-19). Situation report 142. June 2020 [June 2020]. Available from: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200610-covid-19-sitrep-142.pdf?sfvrsn=180898cd_2.
3. Wu C, Chen X, Cai Y, Xia J, Zhou X, Xu S, et 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;180:934-43.
4. Wu JT, Leung K, Bushman M, Kishore N, Niehus R, de Salazar PM, et al. Estimating clinical severity of COVID-19 from the transmission dynamics in Wuhan, China. Nat Med 2020;26:506-10.
5. Zhou P, Yang XL, Wang XG, Hu B, Zhang L, Zhang W, et al. A pneumonia outbreak associated with a new coronavirus of probable bat origin. Nature 2020;579:270-3.
6. Lu R, Zhao X, Li J, Niu P, Yang B, Wu H, et al. Genomic characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding. Lancet 2020;395:565-74.
7. Hamming I, Timens W, Bulthuis ML, Lely AT, Navis G, van Goor H. Tissue distribution of ACE2 protein, the functional receptor for SARS coronavirus. A first step in understanding SARS pathogenesis. J Pathol 2004;203:631-7.
8. Jia HP, Look DC, Shi L, Hickey M, Pewe L, Netland J, et al. ACE2 receptor expression and severe acute respiratory syndrome coronavirus infection depend on differentiation of human airway epithelia. J Virol 2005;791:14614-21.
9. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-ınfected pneumonia in Wuhan, China. JAMA 2020;323:1061-9.
10. Guan WJ, Ni ZY, Hu Y, Liang WH, Ou CQ, He JX, et al. Clinical characteristics of coronavirus disease 2019 in China. N Engl J Med 2020;382:1708-20.
11. Yan R, Zhang Y, Li Y, Xia L, Guo Y, Zhou Q. Structural basis for the recognition of SARS-CoV-2 by full-length human ACE2. Science 2020;367:1444-8.
12. Altun B, Arici M, Nergizoglu G, Derici Ü, Karatan O, Turgan Ç, et al. Prevalence, awareness, treatment and control of hypertension in Turkey (the PatenT study) in 2003. J Hypertension 2005;23:1817-23.
13. Huang S, Wang J, Liu F, Liu J, Cao G, Yang C, et al. COVID-19 patients with hypertension have more severe disease: a multicenter retrospective observational study. Hypertens Res 2020:1-8.
14. Hui DS, Azhar EI, Madani TA, Ntoumi F, Kock R, Dar O, et al. The continuing 2019-nCoV epidemic threat of novel coronaviruses to global health - The latest 2019 novel coronavirus outbreak in Wuhan, China. Int J Infect Dis 2020;91:264-6.
15. Zhou X, Zhu J, Xu T. Clinical characteristics of coronavirus disease 2019 (COVID-19) patients with hypertension on renin-angiotensin system inhibitors. Clin Exp Hypertens 2020;42:656-60.
16. Gao C, Cai Y, Zhang K, Zhou L, Zhang Y, Zhang X, et al. Association of hypertension and antihypertensive treatment with COVID-19 mortality: a retrospective observational study. Eur Heart J 2020;41:2058-66.
17. Wang S, Chen Y, Wang L, Liu H, Han P. Are COVID-19 patients with hypertension at higher risk in China? J Hypertens 2020;38:1384-5.
18. Morra ME, Van Thanh L, Kamel MG, Ghazy AA, Altibi AMA, Dat LM, et al. Clinical outcomes of current medical approaches for Middle East respiratory syndrome: A systematic review and meta-analysis. Rev Med Virol 2018;28:e1977.
19. Matsuyama R, Nishiura H, Kutsuna S, Hayakawa K, Ohmagari N. Clinical determinants of the severity of Middle East respiratory syndrome (MERS): a systematic review and meta-analysis. BMC Public Health 2016;16:1203.
20. Kreutz R, Algharably EAE, Azizi M, Dobrowolski P, Guzik T, Januszewicz A, et al. Hypertension, the renin-angiotensin system, and the risk of lower respiratory tract infections and lung injury: implications for COVID-19. Cardiovasc Res 2020;116:1688-99.
21. Qin C, Zhou L, Hu Z, Zhang S, Yang S, Tao Y, et al. Dysregulation of immune response in patients with COVID-19 in Wuhan, China. Clin Infect Dis 2020;71:762-8.

22. Chen G, Wu D, Guo W, Cao Y, Huang D, Wang H, et al. Clinical and immunological features of severe and moderate coronavirus disease 2019. J Clin Invest 2020;130:2620-9.

23. Drummond GR, Vinh A, Guzik TJ, Sobey CG. Immune mechanisms of hypertension. Nat Rev Immunol 2019;19:517-32.

Original Article

DOI: 10.14235/bas.galenos.2020.5018
Bezmialem Science 2020;8(Supplement 2):22-26

Utility of Rapid Antibody Test for Screening COVID-19 Among Healthcare Professionals

Sağlık Çalışanı Taramasında COVİD-19 Hızlı Antikor Testlerinin Kullanımı ve Etkinliğinin Değerlendirilmesi

Asiye Bahar KAÇMAZ[1], Bilge SÜMBÜL[2], Sibel BOLUKÇU[1], Gülay OKAY[1], Bülent DURDU[1], Yasemin AKKOYUNLU[1], Meliha MERİÇ KOÇ[1]

[1]Bezmialem Vakıf University Faculty of Medicine, Department of Infectious Diseases and Clinical Microbiology, İstanbul, Turkey
[2]Bezmialem Vakıf University Faculty of Medicine, Department of Medical Microbiology, İstanbul, Turkey

ABSTRACT

Objective: This study aims to assess the effectivity of a rapid antibody test on detecting the occupational exposure in healthcare professionals who have been working in a pandemic hospital since the initial cases were seen in our country.

Methods: Prevention of Coronavirus disease 2019 (COVID-19) in our institution was managed according to the Republic of Turkey (T.C.) Ministry of Health recommendations. Between 20.04.2020 and 05.05.2020, 376 high-risk professionals (triage, emergency room, COVID-19 outpatient unit, COVID-19 clinic and intensive care unit) were screened by rapid antibody test for COVID-19. Positive cases were retrospectively examined in terms of COVID-19 diagnosis or potential symptoms of COVID-19 infection (fever, perspiration, debility, cough, myalgia, sour throat, nasal flow, diarrhea, loss of smell/taste sensation).

Results: The mean age was 32.7±8.9 years, 222 patients were female and 154 were male. Positive rapid antibody test was detected in 27 (7.2%) patients: 24 of those had COVID-19 diagnosis or potential symptoms of COVID-19 infection, where 3 patients had no signs or symptoms of the disease.

Conclusion: During pandemic, the reliability of rapid antibody tests has become under question due to validation issues. However, rapid antibody test may be feasible for COVID-19 screening among healthcare professionals in order to assess the precautions and prevent nosocomial infection.

ÖZ

Amaç: Çalışmamızda pandemi sürecinde yüksek riskli alanlarda görev yapan sağlık çalışanlarında hızlı antikor testleriyle Coronavirus hastalığı 2019 (COVİD-19) enfeksiyonuyla maruziyetlerini belirlemeyi ve kitin etkinliği hakkında fikir edinmeyi amaçladık.

Yöntemler: Sağlık çalışanlarında COVİD-19 enfeksiyonundan korunma önerileri Türkiye Cumhuriyeti (T.C.) Sağlık Bakanlığı COVİD-19 Rehberi doğrultusunda gerçekleştirildi. Yüksek riskli alanlarda görev yapan (triyaj alanları, acil servis, COVİD-19 polikliniği, COVİD-19 servisleri, yoğun bakım ünitesi) 376 sağlık çalışanı COVİD-19 ile maruziyetlerinin değerlendirilmesi amacıyla kesitsel olarak 20.04.2020-05.05.2020 tarihleri arasında hızlı antikor kitleri ile tarandı. Taramada antikor pozitif saptananlar geriye dönük olarak son 2 ay içinde kesin COVİD-19 enfeksiyonu tanısı veya başka bir sebeple açıklanmayan olası COVİD-19 semptomları (ateş yüksekliği, terleme, öksürük, nefes darlığı, halsizlik, kas ağrısı, baş ağrısı, boğaz ağrısı, burun akıntısı, ishal, tat ve koku kaybı) açısından sorgulandı ve verileri kaydedildi.

Bulgular: Çalışmamızda 222 kadın, 154 erkek olmak üzere 376 sağlık çalışanı tarandı. Yaş ortalaması 32,7±8,9 idi. Bunlardan 27'sinde (%7,2) hızlı antikor testleri pozitif saptanırken 349 (%92,8) çalışanda COVİD-19 hızlı antikor testleri negatif olarak sonuçlandı. Yirmi yedi sağlık çalışanının 24'ünde kesin COVİD-19 tanısı ya da son 2 ay içinde COVİD-19 enfeksiyonu düşündüren semptomlar olduğu değerlendirildi. Üç çalışan ise bu süreçte herhangi bir semptom tariflemedi.

Address for Correspondence: Asiye Bahar KAÇMAZ, Bezmialem Vakıf University Faculty of Medicine, Department of Infectious Diseases and Clinical Microbiology, İstanbul, Turkey
E-mail: asybaharkacmaz@hotmail.com **ORCID ID:** orcid.org/0000-0002-2707-0637

Cite this article as: Kaçmaz AB, Sümbül B, Bolukçu B, Okay G, Durdu B, Akkoyunlu Y, Meriç Koç M. Utility of Rapid Antibody Test for Screening COVID-19 Among Healthcare Professionals. Bezmialem Science 2020;8(Supplement 2):22-26.

Received: 29.06.2020
Accepted: 04.08.2020

Keywords: COVID-19, healthcare professionals, rapid antibody test

Sonuç: Pandemi sürecinde hızlı antikor testleriyle yaşanan validasyon sorunları nedeniyle test sonuçlarına güvenilirlik azalmaktadır. Literatürde benzer bir çalışmaya rastlanmazken COVİD-19 hastalarına hizmet sunan hastanelerde sağlık çalışanı taramalarının enfeksiyon kontrol önlemlerini değerlendirmek ve nozokomiyal bulaşı engellemek için akılcı bir yaklaşım olduğunu düşünmekteyiz.

Anahtar Sözcükler: COVİD-19, sağlık çalışanı, hızlı antikor testi

Introduction

Since the Severe Acute Respiratory Syndrome-Coronavirus-2 (SARS-CoV-2) infection was first reported in the city of China-Wuhan and the date of March 11, 2020 when World Health Organization declared it as a pandemic, its impact has been continuing all over the world. In our country, the disease is tried to be taken under control and the whole process is followed closely in the company of the Coronavirus Disease 2019 (COVID-19) Guide (1), which is updated periodically by the scientific committee established by the Republic of Turkey Ministry of Health. Since March 11, 2020, when the first case was reported in our country, the total number of cases confirmed on June 28, 2020 is 195,883, and the number of those who died is 5,082 (2).

In the last 20 years, global outbreaks have been experienced with SARS and Middle East Respiratory Syndrome (MERS)-CoV-2, which are members of the coronavirus family (3,4). The contagiousness of COVID-19 infection is higher than these infections, but mortality rates are lower (5). Due to the structural similarities with SARS and MERS-CoV-2, evaluations and recommendations regarding the diagnosis, treatment, prognosis and prevention methods of COVID-19 disease have been made, and many studies are ongoing in this area (6).

SARS-CoV-2 is thought to be a zoonotic infection (1). Although its source is not yet clear, the transition from the wholesale fish and livestock market to human was first identified in Wuhan, Hubei state of China, and it was shown to be transmitted from person to person through droplets and close contact (1,5). Therefore, healthcare professionals who have contact with and care for patients are at high risk of contamination. Compliance with hand hygiene while providing services to patients and proper use of personal protective equipment in line with the Republic of Turkey Ministry of Health's COVID-19 Guidelines minimizes this risk (1). Fever, cough, weakness and muscle pain are the most common complaints in the course of infection, while approximately 75% of the patients have a mild clinical course and 25% have a severe course. Mortality rates are evaluated as 2-3%, and the prognosis of the disease is seen to be poor, especially in patients with advanced age and underlying chronic diseases (7).

The gold standard in the diagnosis of the disease is the COVID-19 real-time polymerase chain reaction (RT-PCR) test (8). The sensitivity of the RT-PCR test is evaluated as 50-70%; when the sample is taken, it is seen that the duration of the infection, the technique of taking it and the appropriate transport methods affect this rate (8). In addition to the sensitivity problems experienced in the molecular method, the high cost and the inability to reach results in the early period also created the need for rapid serological tests (9). It is also very important to diagnose suspicious patients in as little as 15 minutes to prevent nosocomial infection and to protect healthcare workers (10). In addition, in epidemiological studies and in cases with negative RT-PCR, rapid antibody tests and enzyme-linked immunosorbent assays are used to confirm the diagnosis (10). In this process, many rapid antibody kits were used without validation, without knowledge of their specificity and sensitivity. This has also raised concerns about the effectiveness of rapid antibody tests. However, it has been shown in studies that the diagnostic efficiency of kits approved by Food and Drug Administration (FDA), Conformité Européenne (CE) and CE-European CE Marking for *In Vitro* Diagnostic (IVD) are high, and new studies are also needed (9-12).

In our study, we aimed to evaluate the exposure of our healthcare professionals working in high-risk units with COVID-19 infection and to evaluate the effectiveness of these tests.

Method

Our study was planned retrospectively using a cross-sectional study method. Recommendations for protection from COVID-19 infection in healthcare workers during the pandemic process in our hospital were provided in line with the Republic of Turkey Ministry of Health COVID-19 Guidelines. Three hundred seventy six healthcare staff working in high-risk areas (triage, emergency service, COVID-19 outpatient clinic, COVID-19 services, intensive care unit) were scanned with the COVID-19 rapid antibody test for evaluating their exposure to COVID-19 virus between April 20, 2020 and May 05, 2020.

For scanning, the COVID-19 immunoglobulin M (IgM)-IgG lateral flow test was used, which was supplied to our hospital as approved by the Ministry of Health. Blood samples were taken from the individuals and studied in the microbiology laboratory, and they were concluded within 15 minutes. The patients who were detected to have only IgM positive, only IgG positive or IgM and IgG positive were questioned about whether they were diagnozed with definite COVID-19 infection and whether they had at least two of non-explained symptoms (fever, sweating, cough, shortness of breath, weakness, muscle pain, headache, sore throat, runny nose, diarrhea, loss of taste and smell) suspected for COVID-19 in the last 2 months and their data were recorded.

Statistical Analysis

Parametric values will be expressed as mean ± standard deviation, categorical data will be expressed as percentages.

Results

In our study, 376 healthcare workers, including 222 women and 154 men, were screened. The mean age was 32.7±8.9 years. Rapid antibody tests were found to be positive in 27 of these (7.2%), while COVID-19 rapid antibody tests were negative in 349 (92.8%) workers.

It was evaluated that 24 of the 27 healthcare staff had at least 2 of the symptoms suggesting COVID-19 infection, which were not explained for any other reason, or diagnozed with COVID-19 in the last 2 months. 3 employees did not describe any symptoms during this period (Figure 1).

Of the 27 people whose rapid antibody tests were positive, only 2 were IgM positive, 4 of them were IgM and IgG positive, and 21 of them were only IgG positive. One of staff with only IgM positive described fever, weakness, and runny nose 10 days before the scan. Another health worker, who was IgM positive, stated that he had no active complaints in the last 2 months. One of the employees who were IgM and IgG positive was diagnosed with COVID-19 one month ago. Three other employees described symptoms suggesting possible COVID-19 infection in the past 2 months. In 21 healthcare workers who were only IgG positive; 3 received treatment within the last 2 months with the definitive diagnosis of COVID-19. One employee was followed up with a definite diagnosis of COVID-19 2 days after the screening test was found to be positive. Fifteen healthcare workers said they had symptoms that were not explained for any other reason during this process, suggesting a possible COVID-19 infection. Two employees had no symptoms (Figure 2).

Discussion

While the severity and effects of the COVID-19 pandemic differ among countries, we see that the isolation of infected individuals is a determinant in epidemic management, because the biggest obstacle in breaking the chain of transmission is that SARS-CoV-2 infection is often passed as asymptomatic or with mild symptoms (13). Those who are admitted to the hospital and hospitalized are generally the patients with severe clinical condition or expected progression. These patients have the most contagious disease and healthcare workers are at great risk worldwide (14). Early and rapid diagnosis of patients is critical to protect healthcare professionals.

At the diagnosis stage of SARS-CoV-2, the molecular method RT-PCR is used in naso-oropharyngeal swab samples and lower respiratory tract samples in people who meet the possible case definition of COVID-19 (10). The medical microbiology laboratory of our hospital also served as a reference laboratory for the COVID-19 RT-PCR test shortly after the announcement of the pandemic. The sensitivity of this method, which is the gold standard in diagnosis, is 50-70% (8). However, problems such as low sensitivity of the test, expensive molecular methods, and inability to obtain results immediately led to the development of serological methods (10). For this purpose, laboratory-based enzyme immunoassays and point-of-care rapid tests are used (10).

Both antigen and antibody presence can be evaluated with serological methods. Among serological methods, antibody tests have important advantages such as evaluating the presence of antibodies in patients who have recovered, detecting individuals who are asymptomatic and showing the prevalence of the disease in the society (10). Rapid antibody tests are performed on whole blood, serum or plasma samples. The methods used are lateral flow immunoassays, time-resolved fluorescence immunoassays, and colloidal gold immunoassays (10). As the COVID-19 pandemic continues, various serological tests have been allowed to be developed and it has been allowed to accelerate their availability regardless of the presence of emergency use authorization from the FDA. (10) However, all antibody tests need to be validated to ensure reliability, accuracy, consistency, and reproducibility (15). For this reason, different kits have been evaluated in many studies, especially in which rapid antibody tests were used, and it has been shown in studies that the diagnostic efficiency of kits approved by FDA, CE and CE-IVD is high (10-12). In the largest study conducted in this area, the sensitivity of

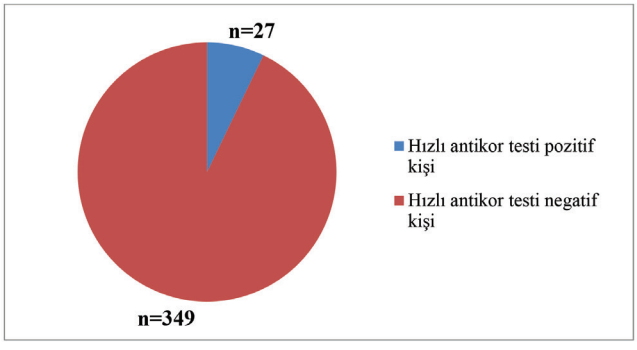


Figure 1. Rapid antibody test results of healthcare workers (n=number)

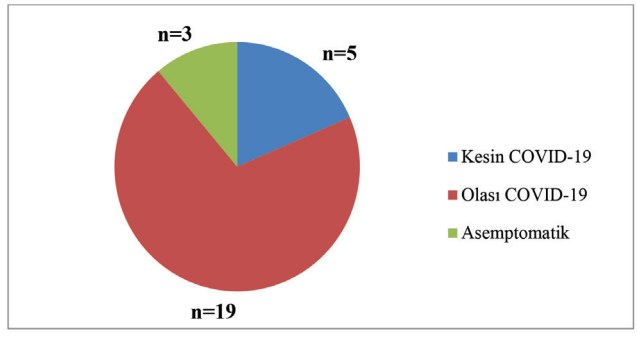


Figure 2. Distribution of healthcare professionals with positive rapid antibody test result (n=number)

BioMedomics IgM-IgG lateral flow rapid antibody tests in the sample including 525 patient was 89% and the specificity was 91% (9). The disadvantages of serological tests are the absence of IgM-IgG positivity in the early period of the disease, and test positivity that is expected at the earliest 3 days after the onset of symptoms and 7-10 days after the infection (16). In addition, it has been reported that there is no antibody response in people with mild COVID-19 infection (10). In another study in which antibody responses were evaluated, it was found that IgM positivity could extend up to 8 weeks, and IgG positivity was still high at the 8th week (17).

In our country, COVID-19 IgM-IgG lateral flow rapid antibody tests approved by the Republic of Turkey Ministry of Health were used for screening in our hospital due to the high risk of transmission in healthcare workers during the pandemic. The test is not approved by FDA, CE, and CE-IVD, which reduces the reliability of the test results. However, in clinical evaluations, it was seen that 89% of those with positive antibody tests were diagnosed with definite COVID-19 or had possible COVID-19 symptoms that could not be explained for any other reason in the last 2 months, only 3 (11%) employees did not describe any symptoms. However, approximately 20-80% of patients with SARS-CoV-2 infection are also thought to be asymptomatic (18). Considering that the pandemic strains are the dominant strain in the circulation, the average age of the screened group is 32.7 years and the COVID-19 infection has a mild course at the rate of 75%, it can be suggested that the results of those with positive antibody results are consistent. Studies have shown that antibody responses and the time when antibodies remain positive in individuals with COVID-19 infection vary (19). Therefore, with the use of validated rapid antibody tests, reliable results will be obtained in screening and evaluating the antibody responses of people who have had COVID-19 infection. Further studies in this area are needed.

Study Limitations

Our study's being single-centered and its cross-sectional and retrospective design are the limitations.

Conclusion

While the pandemic process continues, all healthcare professionals work under high risk. Use of protective equipment and compliance with recommendations for appropriate isolation minimize the possibility of transmission, but do not eliminate it. For this reason, screening of healthcare workers is a rational approach for both evaluating infection control measures and preventing nosocomial transmission, especially in hospitals giving care to COVID-19 patients, and no similar study has been found in the literature.

Ethics

Ethics Committee Approval: Permission was obtained from the Scientific Research Platform of the Ministry of Health.

Informed Consent: Consent was not obtained because the study was planned retrospectively.

Peer-review: İnternally peer reviewed.

Authorship Contributions

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

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

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

References

1. T.C. Sağlık Bakanlığı Bilim Kurulu.(2020,Haziran 1) COVID-19 (SARS-CoV-2 Enfeksiyonu) Rehberi. Ankara, Türkiye
2. T.C. Sağlık Bakanlığı. Last Accessed Date: 23.06.2020. Available from: https://covid19bilgi.saglik.gov.tr/tr/.
3. Peiris JS, Y Guan Y, Yuen KY. Severe acute respiratory syndrome. Nat Med 2004;10(Suppl 12):S88-97.
4. Zaki AM, Boheemen SV, Bestebroer TM, Osterhaus ADME, Fouchier RAM. Isolation of a novel coronavirus from a man with pneumonia in Saudi Arabia. N Engl J Med 2012;367:1814-20.
5. Wang L, Wang Y, Ye D, Liu Q. Review of the 2019 novel coronavirus (SARS-CoV-2) based on current evidence. Int J Antimicrob Agents 2020;55:105948.
6. Adhikari AP, Meng S, Wu YJ, Mao YP, Ye RX, Wang QZ, et al. Epidemiology, causes, clinical manifestation and diagnosis, prevention and control of coronavirus disease (COVID-19) during the early outbreak period: a scoping review. Infect Dis Poverty 2020;9:29.
7. Fu L, Wang B, Yuan T, Chen X, Ao Y, Fitzpatrick T,et al.Clinical characteristics of coronavirus disease 2019 (COVID-19) in China: A systematic review and meta-analysis. J Infect 2020;80:656-65.
8. Wang Y, Kang H, Liu X, Tong Z. .Combination of RT-qPCR testing and clinical features for diagnosis of COVID-19 facilitates management of SARS-CoV-2 outbreak. J Med Virol 2020;92:538-9.
9. Li Z, Yi Y, Luo X, Xiong N, Liu Y, Li S, et al. Development and clinical application of a rapid IgM-IgG combined antibody test for SARS-CoV-2 infection diagnosis. J Med Virol 2020;10.1002/jmv.25727.
10. Younes N, Al-Sadeq DW, Al-Jighefee H, Younes S, Al-Jamal O, Daas HI, et al. challenges in laboratory diagnosis of the novel Coronavirus SARS-CoV-2. Viruses 2020;12:E582.
11. Fu L, Wang B, Yuan T, Chen X, Ao Y, Fitzpatrick T, et al. Clinical characteristics of coronavirus disease 2019 (COVID-19) in China: A systematic review and meta-analysis. J Infect 2020;80:656-65.
12. Green K, Graziadio S, Turner P, Fanshawe T, Allen J. (2020). Molecular and antibody point-of-care tests to support the screening, diagnosis and monitoring of COVID-19. Available from: www.cebm.net/oxford-covid-19/.
13. Hoehl S, Berger A, Kortenbusch M, Cinatl J, Bojkova D, Rabenau H, et al. Evidence of SARS-CoV-2 Infection in Returning Travelers from Wuhan, China. N Engl J Med 2020; 382:1278-80.

14. Jin Y, Yang H, Ji W, Wu W, Chen S, Zhang W.et al. Virology, Epidemiology, Pathogenesis, and Control of COVID-19. Viruses 2020;12:372.

15. ARUP. Understanding the Role of Antibody Testing in Battling the Spread of COVID-19. Last Accessed Date: 13.04.2020. Available from:

16. https://www.aruplab.com/news/4-13-2020/Antibody-Testing-COVID-19

17. Lauer SA, Grantz KH, Bi Q, Jones FK, Zheng Q, Meredith HR, et al. The incubation period of coronavirus disease 2019 (COVID-19) from publicly reported confirmed cases: estimation and application. Ann Intern Med 2020;172:577-82.

18. Jin CC, Zhu L, Gao C, Zhang S.Correlation between viral RNA shedding and serum antibodies in individuals with coronavirus disease 2019. Clin Microbiol Infect 2020;23:S1198-743X(20)30299-8.

19. Li R, Pei S, Chen B, Song Y, Zhang T, Yang W, et al. Substantial undocumented infection facilitates the rapid dissemination of novel coronavirus (SARS-CoV-2). Science 2020;368:489-93.

20. Wölfel R, Corman VM, Guggemos W, Seilmaier M, Zange S, Müller MA, et al. Virological assessment of hospitalized patients with COVID-2019. Nature 2020;581:465-9.

Original Article

DOI: 10.14235/bas.galenos.2020.4935
Bezmialem Science 2020;8(Supplement 2):27-35

The Evaluation of the Health Care Professionals' Knowledge, Prevention and the Perceptions on the Treatment of New Coronavirus (COVID-19)

Sağlık Çalışanlarının Yeni Koronavirüs Enfeksiyonu (COVİD-19) Hakkındaki Bilgi, Korunma ve Tedavi Algılarının Değerlendirilmesi

Aydın BALCI, Şule ÇİLEKAR, İbrahim Güven COŞĞUN

University of Health Sciences Afyonkarahisar Faculty of Medicine, Department of Chest Diseases, Afyon, Turkey

ABSTRACT

Objective: The recent spread of new Coronavirus disease (COVID-19) pandemic which caused worldwide concern is a public health emergency situation. The risk of getting infected as well as the concern levels of the health professionals on this issue is very high due to their close contact with the infected patients. The aim of this study is to evaluate the concern level of being infected in the health professionals, as well as their view and perception of different applications used during the treatment of the COVID-19 cases together with their whole approach during this pandemic situation.

Methods: The study was conducted through an online survey that was sent to all the Health professionals of a pandemic hospital of a city in Turkey between 8 and 15 May 2020. This online survey was sent to all the professionals through social media platforms. The survey included both multiple-choice and true-false questions regarding COVID-19 diagnosis, clinical stage, treatment approach, concerns, knowledge, and awareness of the situation together with some social demographic characteristics of the health professionals. SPSS v20 program was used to evaluate the statistical analysis of the data collected. Data are shown through mean ± and the standard deviation is shown through percentage.

Results: The study consisted of 250 (59.9%) doctors and 169 (41.1%) assistant healthcare professionals and the average age

ÖZ

Amaç: Yeni Coronavirüs hastalığı (COVİD-19) salgını, uluslararası endişe duyulan bir halk sağlığı acil durumudur. Bu çalışma, mevcut salgın sırasında sağlık çalışanları arasında enfekte olma endişesini, tutumlarını, tedavi ve COVİD-19 ile mücadeledeki çeşitli uygulama modifikasyonları konusundaki görüş ve davranış tarzlarını değerlendirmek amacıyla yapılmıştır.

Yöntemler: Türkiye'de bir ilin pandemi hastanesindeki sağlık personeline 8-15 Mayıs 2020 tarihleri arasında bir çevrimiçi anket uygulayarak gerçekleştirilmiştir. Ankette sosyodemografik özelliklere dair sorular ile beraber COVİD-19 tanı, klinik, tedavi tutumu, kaygı, bilgi ve farkındalık ile ilgili çoktan seçmeli sorular ve doğru yanlış soruları soruldu.

Bulgular: Katılımcıların 250'si (%59,9) doktor, 169'u (%41,1) yardımcı sağlık personelinden oluşuyordu, yaş ortalamaları 33,21±6,88 yıl idi. Sağlık sektöründe çalıştığı için COVİD-19 bulaşma riskinin yüksek olduğunu düşünenlerin ve kaygı duyanların sayısı ise 390 (%93,1) kişidir. Yüz dokuz (%26,01) kişinin yakınlarında COVİD-19 testi pozitif çıktığı beyan edilmiştir. Altmış dört (%15,3) sağlık çalışanı polimeraz zincir reaksiyonu (PCR) testi yaptırdığını bildirmiştir ve 3 (%0,7) sağlık çalışanı da COVİD-19 PCR testin pozitif çıktığını bildirilmiştir.

Address for Correspondence: Aydın BALCI, University of Health Sciences Afyonkarahisar Faculty of Medicine, Department of Chest Diseases, Afyon, Turkey
E-mail: draydnbalc@gmail.com **ORCID ID:** orcid.org/0000-0002-6723-2418

Cite this article as: Balcı A, Çilekar Ş, Coşğun İG. The Evaluation of the Health Care Professionals' Knowledge, Prevention and the Perceptions on the Treatment of New Coronavirus (COVID-19).. Bezmialem Science 2020;8(Supplement 2):27-35.

Received: 09.07.2020
Accepted: 04.08.2020

of the participants was 33.21±6.88 years. Seventy-six (18.1%) of 128 people who smoked during the pandemic wanted to quit smoking. 390 (93.1%) of the participants thought that they were in a high-risk group of being infected and were concerned about this matter. One hundred nine (26.01%) of the participants had positive COVID-19 tests of their relatives or friends. Sixty-four (15.3%) participants claimed to have a polymerase chain reaction (PCR) test, and 3 (0.7%) of them reported that their COVID-19 PCR tests were positive. Eighty-four (20.04%) stated that they used Hydroxychloroquine for prophylaxis.

Conclusion: The healthcare professionals working in the pandemic hospital during the pandemic stated that they generally had sufficient knowledge about COVID-19 and believed that our country would be successful with its fight against this pandemic. Moreover, our study proved the importance of knowledge levels in fighting communicable diseases.

Keywords: Health care professionals, knowledge levels of COVID-19, hydroxychloroquine prophylaxis

Sonuç: Salgın sırasında pandemi hastanesinde çalışan sağlıkçılar COVİD-19 hakkında genel olarak yeterli bilgiye sahip olduklarını ve ülkemizin salgınla mücadelede başarılı olacağına inandıklarını ortaya koymuştur.

Anahtar Sözcükler: COVİD-19, sağlık çalışanları COVİD-19 bilgi düzeyi, hidroksiklorakin proflaksisi

Introduction

A new type of Coronavirus disease (COVID-19) that had negative effects in all parts of daily life emerged in China (1). The first cases of the pandemic started as a disease without any etiology at the end of December 2019 in the city of Wuhan, which is located in the Hubei province of China (2). The World Health Organization (WHO) declared the disease as a public health pandemic and an international state of emergency on 30 January 2020 when it already spread to 34 different districts of China up to that date (3).

Structurally COVID-19 is a positive polarity ss-RNA enveloped virus which is approximately 350-kilo base pair (kbp) in size (4). The droplet feature was identified as the primary cause of the spread of the COVID-19 virus (5).

Incubation period, which is the time until the symptoms develop after being exposed to the virus, is between 2 and 14 days with an average of 5 days (6). Upper respiratory tract infections, high fever, dry cough, difficulty in breathing, myalgia, pain in throat, nausea, vomiting, and diarrhea are some of the common symptoms of the infection (7). When the vital role of the immune system of the body is considered, the risk of elderly people and people with chronic diseases that weakens the immune system for being infected with the virus is much higher when compared to young and healthy people with stronger immune systems (8). The COVID-19 infection might result in acute coronary syndrome, acute respiratory failure, and fatality in serious cases (9). Even though the fatality rate associated with COVID-19 is quite low, it has the potential of spreading very quickly (10). It is strongly recommended to place the possibly infected individuals into quarantine and observation after real-time RT-PCR samples were taken until further investigations were carried out (11). Unfortunately, there is no antiviral vaccine that has been developed at the moment. Therefore, patients have to rely on supportive treatments like vitamins A, C, and D (12).

There are also different opinions from the current data on the use of certain antimalarial drugs, such as chloroquine (CQ) and hydroxychloroquine (HCQ) that have been tried for the treatment of COVID-19 for chemoprophylaxis as well as continuing to use the barrier system (13). Some of the authors decided on the use of CQ and HCQ for the prophylaxis against COVID-19 based on the results of In vitro studies. Moreover, in line with these results, the China's National Health Commission Guidelines for COVID-19 and U.S. Food and Drug Administration recommended the use of HCQ on the treatment of COVID-19 despite its indefinite benefits and opened the way for its use for prophylaxis purposes (14,15).

Due to COVID-19's fast-spreading and devastating attitude, a lot of countries shut down education institutions, social gatherings, sports events, airports, and even banks or brought flexible working hours for them to be able to prevent the spread of the virus. Besides most of the individuals played their parts in the society quarantining themselves by staying inside their homes to minimize the spread of the virus. Additionally, having all the hospitals functioning actively during these difficult times is vitally important and they are rarely shut down during pandemic conditions (16). The health care professionals are at high risk of contamination due to their close contact with the infected patients. Therefore, there is a high risk of health care professionals getting infected from their patients and potentially they can spread the virus to their friends, relatives, and even to other patients. Under these circumstances, the development of anxiety to get infected from the patients of health care professionals might be considered a natural behavior (16).

Even though the Ministry of Health issued guideline on prevention, most of the health care professionals are scared of conducting detailed examination and treatment for the patients with COVID-19 risk. Actually health care professionals might not be updated with the latest guidelines. Because of this, we conducted a survey-based study that aimed to evaluate the

knowledge levels of the health care professionals working actively during the COVID-19 pandemic on the infection as well as their behaviors and attitudes, knowledge level on the treatment process, and the methods they used personally for prophylaxis in our city.

Method

An online survey with 39 questions was used in this study between 8 and15 May 2020 with a group of doctors and nurses working in the units related to COVID-19 from a total of 965 health professionals of a pandemic hospital of a city in Turkey. For this purpose, we designed a comprehensive survey on https://docs.google.com/forms website. The survey was sent out through the Whatsapp application to the professionals whom we contacted through phone calls personally to brief them about the content of the survey and the responses to the questions were recorded after their consent was obtained. The survey was completed manually by the professionals that could not be contacted through social media. The health professionals involved in the diagnosis, treatment and the follow-up process of COVID-19 were included in the study.

Survey Design

Demographic parameters of the participants including age, gender, marital status, profession, and smoking habits were recorded. The professions and titles of the participants were categorized. We asked the participants to fill the survey with 39 questions that aimed to evaluate their knowledge of COVID-19 symptoms, diagnosis and treatment, blood table, risk groups, ways of transmission, precautions, and the prevention methods, level of contact with the infection, prophylaxis, and concerns. The answers to the questions were in the format of Present-not Present, Yes-No, True-False- Do not know, Agree-Disagree- Not sure, multiple choices, and open-ended answers.

SPSS v20 program was used for the statistical analysis of the data which were transferred to Microsoft Excel from the Google form format by adhering to the original states of surveys. Data were shown as mean ± standard deviation, number of individuals, and percentage. The suitability of the quantitative data for normal distribution was tested by the Kolmogorov–Smirnov, Shapiro–Wilk test and graphical evaluations. Student's t-test was used for comparison of two groups of quantitative data with normal distribution, and the Mann–Whitney U test was used for comparison of two groups of data with non-normal distribution. Pearson Chi-Square test and Fisher's Exact test were used to compare qualitative data. Significance was set at $p<0.05$.

Ethics Committee Approval

Afyonkarahisar Health Sciences University Ethical Committee approval with 2020/119 number and 2011-KAEK-2 code was obtained.

Results

Our study included 419(%43, 41) health professionals out of 965(300 doctors, 515 nurses, 150 health technicians) health care professionals of our hospital, who were involved in diagnosis, treatment, and follow up processes of the COVID-19.

When the demographic characteristics of the participants were evaluated, 232(%55, 4) of them were males and 187 (44.6%) of them were females with a mean age of 33.21±6.88 (20-57) years. The number of participants having at least one child or more was 276. There were slightly more 250 (59,9%) doctors than the 169 nurses (41.1%) (Table 1).

The number of the participants with chronic diseases was 67 (16%), of which 17 (4.05%) had asthma, 13 (3.1%) had a functional thyroid disorder, 8(%1,9) had diabetes mellitus and 8(%1,9) had high blood pressure. There was no statistically significant difference between the profession and gender respectively in the presence of chronic disease (p=0.354, 0.239).

There was no significant difference in smoking habits according to the professions (p=0.973). A total of 128 (30.5%) participants smoked with an average of 23.2 packets of cigarettes per year. The total number of smoking participants who either wanted to quit or made an attempt to quit during the COVID-19 was 76 (18.1%) and there was a statistical similarity between the profession groups.

Almost all the participants (94.7%) claimed to know the means of the transmission of COVID-19. Also, nearly all of them (98.1%) responded with the answer of "yes" to the question on if they knew the general symptoms of the disease and the necessary prevention methods towards the infection.

Total of 151 (36%) participants [(79 (18%) doctors, 79 (18%) nurses)] claimed sensitivity towards cold and flu-like illnesses; therefore, they stated that they were scared of being infected with the COVID-19 and it showed statistical significance among the nurses ($p<0.001$). There was a similar perception between both professions (p=0.209) as 151 nurses and 239 doctors considered

Table 1. Socio-demographic characteristics of the participants

		n	%
Mean age	33.21±6.88		
Gender	Male	232	55.4
	Female	187	44.6
	Total	419	100
Occupation	Research Assistant Doctor	124	29.6
	Assistant Professor	106	25.3
	Associate Professor	10	2.4
	Professor	10	2.4
	Assistant Health Personnel	169	40.3
	Total	419	100
Marital status	Married	280	66.8
	Single	128	30.5
	Divorced	11	2.6
	Total	419	100

themselves at high-risk groups for the transmission of the virus because they worked in the healthcare sector.

When the responses to the question on the knowledge level of them regarding the SARS-CoV-2 and its virus family were evaluated, 119 (42.2%) nurses and 163 (57.8%) doctors gave the correct answer of "a virus with positive polarity enveloped onto RNA". The correct response rate to this question showed statistical significance among the doctors (p=0.021). Almost all the participants, 418 (99.8%), selected "China" as the emerging country of the virus. Total of 397 (94.7%) participants, of which 148 (35.3%) were nurses and 249 (59.4%) were doctors, selected the correct answer of "droplet infection" choice as the primary means of transmission of COVID-19 infection and there was a statistical difference among the doctors (p=0.002).

Total of 227 (54.2%) participants, of which 39 (9.3%) were nurses and 188 (44.9%) were doctors, selected "polymerase chain reaction" as a mean of final diagnosis of the virus and this was statistically significant (p<0.001). On the other hand, a total of 105 (25%), of which 58 (13.9%) were nurses and 47 (11.1%) were doctors, selected "Thorax BT together with polymerase chain reaction" choice.

"Oropharyngeal sampling" was selected as an answer by 194 (46.3%) of them for the question on sampling method which had the highest value for the diagnosis of the COVID-19 while 183 (43.7%) of them selected correct answer of "bronchoscopy sampling" which was mainly from the doctors of 157 (37.5%) and it showed a statistical difference (p<0,001).

Total of 241 (57.5%) participants, of which 49 (11.7%) were nurses and 192 (45.8%) were doctors, gave the correct answer of "lymphopenia" to the question regarding the hemogram table inside the blood during COVID-19 and this showed statistical difference for the doctors (p<0.001). The answers of the participants to the question on procalcitonin levels when there was no accompanying bacterial infection were as followed; 168 (40.1%) of them "does not change', 114 (27.2%) of them "will increase", 109 (26%) of them "will decrease" and 28(%6, 7) of them did not answer at all. Most of the correct answer [129 (30.8)] of "does not change" came from the doctors and this showed a statistical difference with nurses (p<0.001).

Total of 149 (35.6%) participants gave the answer of "fever, dry cough, and fatigue"; on the other hand, 62 (14.8%) of them gave the answer of "fever, dry cough and loss of sense of taste and smell" to the question on the most common clinical sign and symptoms of COVID-19.

The answer of "75 mL/min" was chosen by 152 (36.3%) of the participants to the question on the threshold saturation value of the patients with respiratory difficulties for the intubation procedure and 141 (33.7%) of them gave the answer of "80 mL/min".

A total of 208 (82.5%) doctors answered "Yes" when they were asked if they changed their approach to the usage of non-steroid anti-inflammatory medicines towards paracetamol like medicines during COVID-19.

Table 2. Knowledge about COVID-19 among health care workers

Questions	True	False	Unknown
Headache, fever, cough, myalgia are symptoms of COVID-19	411 (98.1%)	4 (1%)	4 (1%)
Unlike the common cold, stuffy nose, runny nose, and sneezing are less common in persons infected with the COVID-19 virus.	333 (79.5%)	54 (12.9%)	32 (7.6%)
There currently is no effective cure for COVID-2019, but early symptomatic and supportive treatment can help most patients recover from the infection	380 (90.7%)	24 (5.7%)	15 (3.5%)
COVID-19 patients do not spread the disease when they do not have a fever	6 (1.4%)	386 (92%)	27 (6.4%)
COVID-19 is transmitted through air, contact, fecal-oral routes	403 (96.2%)	8 (1.9%)	8 (1.9%)
Ordinary residents can wear general medical masks to prevent the infection by the COVID-19 virus	385 (91.9%)	24 (5.7%)	10 (2.4%)
It is not necessary for children and young adults to take measures to prevent the infection by the COVID-19 virus	24 (5.7%)	379 (90%)	16 (3.8%)
To prevent the infection by COVID-19, individuals should avoid going to crowded places such as train stations and avoid taking public transportations	409 (97.6%)	2 (0.5%)	8 (1.9%)
Isolation of people who are infected with the COVID-19 virus are effective ways to reduce the spread of the virus	408 (97.4%)	2 (0.5%)	9 (2.1%)
People who have contact with someone infected with the COVID-19 virus should be immediately isolated in a proper place.	407 (97.1%)	2 (0.5%)	40 (2.4%)
In the presence of tuberculosis vaccine, the clinical symptoms of COVID-19 disease are mild.	125 (29.8%)	88 (21%)	206 (50.1%)
In the presence of measles rubella and mumps vaccine, the clinical symptoms of COVID-19 disease are mild.	76 (18.1%)	122 (29.1%)	221 (52.7%)

When the responses to 15 questions, which were designed in True-False- Do not Know format, on the means of transmission of the coronavirus and the anxiety towards the virus, 371 (88.5%) of the participants believed that the severity of the disease was correlated with obesity, chronic diseases, and the old age. Also, 409 (97.6%) of the participants believed in avoiding public transport and crowded places and the necessity of following the social distancing rules. Additionally, 164 (39.1%) of the participants believed that consuming wild animals would lead to the transmission of the virus. Responses to the other 12 questions of the 15-question parts were shown in Table 2.

Total of 122 (29.1%) participants stated that they did not have any contact with anyone with the COVID-19 infection and 96 (22.9%) of those with the contact stated that these patients were in their units they were working, when they were asked about the level of contact of the participants with the COVID-19 cases.

When asked if any of the relatives and friends were diagnosed with COVID-19, 121 (29.2%) participants, of which 82 (19.8%) were doctors and 39 (9.4%) were nurses, had friends and relatives who had their COVID-19 tests with a positive result and this showed statistical significance for the doctors (p=0.024).

When they were asked if they either had COVID-19 PCR or fast antigen-antibody tests, a total of 64(%15, 3) of them, of which 21 (5%)were nurses and 43(10.3%) were doctors, answered "yes" (p=0.267). 2 (0.4%) doctors and 1 (0.3%) nurse stated that their own COVID-19 PCR test results were positive.

When evaluating the precautions and the preventions against COVID-19 of the health care professionals, 387 (91.7%) of them stated that they washed their hands with soap for at least 20 seconds, followed the social distancing rules keeping the barrier measure. Table 3 shows the answers to the most common preventive measures taken by the health care professionals against the COVID-19.

A total of 158 (37.7%) participants believed that using hydroxychloroquine (plequanil) might be beneficial for prophylaxis; however, 151 (36%) of them believed that there was not enough evidence to support the usage of it. 90 (21.5%) of them stated that their doctor friends recommended, 85 (20.3%) of them stated that they used the literature as reference, 66 (15.8%) of them referred to the panels conducted by the specialists and 36 (8.6%) of them referred to media when they were asked about the source of information on the effect of hydroxychloroquine for prophylaxis.

Total of 84 (20.04%) participants, of which 28 (6.7%) were nurses and 56 (13.4%) were doctors, stated that they used hydroxychloroquine for prophylaxis to protect themselves from the COVID-19 (p=0.213). 3 of these 84 participants stated that they used hydroxychloroquine for prophylaxis in line with the Ministry of Health's high-risk contact criteria due to their contact with the COVID-19 infected patients. The dosage and the frequency of hydroxychloroquine usage for prophylaxis are shown in Table 4.

Table 3. Precautions against virus transmission

Questions	Answers n %
I don't leave the house unless it is necessary	379 (89.8%)
I wash my hands with soap for at least 20 seconds during the day	387 (91.7%)
I wear a mask if I have to go out	383 (90.8%)
I pay attention to social distance	385 (91.2%)
I do not approach people more than 1 meter in crowded environments	383 (90.8%)

Table 4. The use of hydroxychloracine in prophylaxis

How to use hydroxychloroquine	n	%
Twice a week, one	31	7.2
One in twenty-one days	25	6.0
One every day	10	2.4
Once every two weeks	6	1.4
Two days three times during my contact with patients	6	1.4
Once a week	2	0.5
I used a total of three doses	2	0.5
Once a week, two doses	1	0.2
I use it because of rheumatism	1	0.2
Total	84	20.04

Discussion

Our study shows that most of the health care professionals of a pandemic hospital in one of the cities of Turkey have comprehensive knowledge about the COVID-19 disease and they follow the relevant algorithms with necessary literature references. Almost all the participants (94.7%) are confident with their knowledge on the means of transmission of the virus and with their knowledge on the general symptoms (98.1%) as well as how to protect themselves from the virus. Similarly, 93.1% of the participants believe that they are in a high-risk group for the infection and 82.3% of them believe that our country will be successful with its fight against the infection.

Our study used a survey, which was developed by us, mainly focusing on closed-end questions to collect information on health care professionals' knowledge level of COVID-19, their behaviors and attitudes towards the treatment process, their concerns together with preventive measures taken during the COVID-19. It is proven that studies, which are based on surveys, collect information about preferences, attitudes, perceptions, and the experiences of the participants. However, careful data collection and interpretation are required [17].

The common symptoms of this COVID-19 disease include fever, dry cough, and difficulty in breathing. Myalgia, developing phlegm and sore throat are the other symptoms that are less common (7). Virus is transmitted among the humans through droplets which happen to be due to cough. Touching at its own face after touching a contaminated area is believed to be another means of transmission of the virus (18,19). The incubation period which is the time until the symptoms develop after exposure to the virus is between 2 and 14 days with an average of 5 days (6). The standard diagnostic method is to conduct real-time reverse transcriptase-polymerase chain reaction (rRT-PCR) tests with a nasopharyngeal swab taken from the individual (20). Diagnosis of the infection can be done by evaluating the symptoms, risk factors and computerized chest tomography scans pointing to pneumonia together (21). The answers which are similar to the literature regarding most of the basic knowledge about the COVID-19 were obtained in our study and nearly all the participants gave correct answers to the questions.

Due to long incubation (up to 14 days) period of SARS-CoV-2, it is nearly impossible to determine the individual's exposure to the virus during different stages like isolation, quarantine, and till the mortality stage. Because of this, very fast pace transmission of COVID-19, which impacted millions of people around the world, is causing severe physiological stress and fear among the people (22). Additionally, the non-availability of an approved treatment or prophylaxis vaccine treatment increases the anxiety of being infected. Therefore, health care professionals are at high risk of being exposed to the virus during this COVID-19 pandemic and this leads to a great level of fear and anxiety among them (23). Most of our participants had the fear factor and there were statistical similarities between the doctors and the nurses on this issue (p=0.209).

Primary transmission means of the COVID-19 infection happens through droplets (5). That is why the likelihood of health care professionals being infected and spreading the virus further increases. The current study shows that healthcare professionals' anxiety of getting infected through their colleagues is similar to the anxiety they have by getting infected in society which has a very fast pace of the spread of the virus among the people (24). One of the other concerns that the health professionals have is transmitting the virus to their family members after they have completed their work. Coronavirus may be alive on some surfaces from a few hours to few days and due to the long incubation period of the virus, people will not show any symptoms and healthcare professionals are scared of being infected from these people who are admitted to the hospital for other reasons than COVID-19 (25). During the outbreak of COVID-19, the importance of hand hygiene was emphasized repeatedly and this issue is even more important for health care professionals. The studies show that washing hands with soap and water or cleaning them with alcohol-based disinfectants is an important precaution to control the spread of respiratory diseases including SARS (26,27). Because of this, WHO suggests washing the hands or using alcohol-based disinfectants very frequently during the health care procedures? The use of a particulate respiratory device like an N-95 mask was recommended for the treatment of patients with the suspicion of COVID-19. Otherwise, when the distance is less than 1 meter between the professional and the patient, at least a surgical mask should be used to treat all the patients (5). Most of the participants (93.6%) of our study believe that they have a higher risk of getting infected than other people and they are worried about this. Besides, without any statistical difference between the doctors and the nurses, 385 (91.5%) of the participants were observed adhering to the preventive measures. Participants of our study were observed following the literature for the updates, adhering to social distance rules as well as paying attention to the usage of masks. They also stated that they adhere to the social distancing and hygiene rules among each other and at their homes. Statistically, doctors gave more correct answers to the questions on the means of transmission, how to make the diagnosis, and the best sampling method which had the highest value for the diagnosis of the COVID-19 ($p<0.001$). This might be related to the fact that doctors are in the front line of the first diagnosis and the treatment phase of the disease while the nurses are responsible for the follow-up and the treatment of the hospitalized patients.

The study of Ling Hu et al. (28) shows an increase of COVID-19 risk with the presence of chronic diseases and smoking. In parallel to that study, 76 (18.13%) of 128 smoking participants of our study tried to quit smoking because they were worried about getting infected with COVID-19. Also, %88. 5 of the participants stated that the elderly, obese, and people with chronic diseases have a higher possibility of severe cases of COVID-19.

How to provide the most effective ventilator support to the COVID-19 patients with respiratory insufficiency is still being investigated. Apart from intubation, high flow nasal cannula

and positive airway pressure methods can be used. These two methods provide similar benefits with intubation to the patients at critical stages of the disease; therefore, there is nothing certain about in which situation intubation should be done (29). A total of 170 (40.57%) participants of our study believe that intubation should be performed if the saturation that is measured from the finger falls below 75 mL/min. Additionally, 258 (61.6%) of the participants believe that providing non-invasive mechanical ventilation through a helmet mask with two hoses before the intubation might provide better results if there are suitable ICU conditions before the intubation process.

Because of the high fever symptoms of COVID-19, fever-reducing therapies should be conducted and non-steroid anti-inflammatory medicines and paracetamol like medicines are considered to be the primary resources. The study of Sridharan GT et al. (30) shows that the usage of Ibuprofen and other non-steroid anti-inflammatory medicines increased the risk of deterioration of COVID-19 infection. %82,5 of the doctors who follow this study and similar studies in the literature state in our study that they choose paracetamol like medicines.

The study of Schuetz at al. (31) determined that there was a correlation between the procalcitonin level elevation and the severity of the bacterial infections and it was blunted during the viral infections. In our study, 168 (40.1%) participants selected "does not change" where 114 (27.2%) of them selected "will increase" and 109 (26%) of them "will decrease" as an answer to the question on the procalcitonin level due to the fact that COVID-19 is a viral infection. Most of the correct answer, 129 (30.8%), of "does not change" came from the doctors and this shows a statistical difference with nurses ($p<0.001$) which might be related to the fact that the doctors are the ones dealing with the laboratory results to define the treatment process.

Although there is no definite treatment for COVID-19, hydroxychloroquine, and chloroquine which are antimalarial agents with immunomodulator and anti-inflamatuar activities are recommended for possible treatments of COVID-19 (32). Even though there is no evidence or data to support the use of these medicines as a preventive treatment, there is a lot of interest among the people who are not infected but with a high risk of being infected to use these medicines as prophylaxis (33). Some of the authors decided on the use of CQ and HCQ for the prophylaxis against COVID-19 based on the results of In vitro studies. Moreover, in line with these results, China's National Health Commission Guidelines for COVID-19 and U.S. Food and Drug Administration recommended the use of HCQ on the treatment of COVID-19 despite its indefinite benefits and opened the way for its use for prophylaxis purposes (14,15). Our study also shows that a total of 84 (20.04%) participants, of which 28 (6.7%) were nurses and 56 (13.4%)were doctors, stated that they believed in the benefits of hydroxychloroquine for prophylaxis and started taking at different doses based on their individual choices. ($p=0.213$). Our study also shows that the doctors were at least 8%0 aware of most of the current studies conducted as well as the experimental treatments.

Study Limitations

Some of the limitations of the study as follows: The data of the study were collected in a very short period due to the fast impact of the health care professional on the diagnosis, treatment, and the preventive measure of COVID-19. Also, the knowledge level of the health care professionals on COVID-19 treatment shows differences due to different studies emerging every day on the subject due to its dynamic status. Moreover, the study was conducted only in a pandemic hospital in a city. Even though the survey was applied to almost all the doctors and to nurses working inside the COVID-19 units or having interaction with the patients, lack of response to the surveys and the small sample size was another constrain. Further studies should be done with bigger sample sizes and the data of the studies should be interpreted carefully. Even though the survey was sent out to all the health care professionals, the target group of the study was the doctors.

Conclusion

There was not any study conducted in our country before this study evaluating the knowledge level, fear and anxiety, attitude to treatment, and the approach to prophylaxis to COVID-19 of the health care professionals. Even though health care professionals have a high level of knowledge and application standards, they have the responsibility to keep themselves up to date with all the new information and treatment procedures of COVID-19 emerging due to its pandemic status. Only a small number of doctors prefer to use hydroxychloroquine for prophylaxis as it only has hypothetical recommendations of its usage on COVID-19 which does not have an approved treatment method yet.

Health care professionals have a special role in the management of this crisis situation as a part of the Covid-19 pandemic. They keep up with the current literature updates related to COVID-19 which shows how much attention the health care professionals give to the current situation of the COVID-19 pandemic. They stated their sensitivity to preventive measures as they consider themselves in a high-risk group to get infected with the virus. It shows that more than %90 of the health care professionals in the pandemic hospital have a sufficient level of knowledge on COVID-19 and they believe that as a country, we will be successful against the fight with the COVID-19 pandemic. This study also proved the importance of knowledge level as a key factor in the management of communicable diseases. The fact that they know that they are in a high-risk group for the transmission of COVID-19 and that even more than half of them have the history of either direct or indirect contact with COVID-19 patients, the belief that this pandemic will be managed successfully might be related to the high level of education and the knowledge.

Ethics

Ethics Committee Approval: Afyonkarahisar University of Health Sciences, Faculty of Medicine, Department of Chest Diseases 05.05.2020.

Peer-review: Externally and internally peer reviewed.

Authorship Contributions

Concept: , Design: , Data Collection or Processing: , Analysis or Interpretation: , Literature Search: , Writing:

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

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

References

1. Gralinski LE, Menachery VD, Return of the cCoronavirus: 2019-nCoV. Viruses 2020;12:135
2. Nishiura, H. Transition Coverage of New Coronavirus in Wuhan. J Clin Med 2020;9:330.
3. Mahase, E. China coronavirus: WHO declares international emergency as death toll exceeds 200. BMJ Clin Res 2020;368:M408.
4. Chen Y, Liu Q, Guo D. Emerging coronaviruses: Genome structure, replication, and pathogenesis J Med Virol 2020;92:418-23.
5. Ge, Z .; Yang, L .; Xia, J .; Fu, X .; Zhang, Y. COVID-19'un olası aerosol iletimi ve diş hekimliğinde özel önlemler. J. Zhejiang Üniv. B 2020 , 1-8. [Google Akademik] [CrossRef]
6. Velavan TP, Meyer CG The COVID-19 epidemic. Trop Med Int Health 2020;25:278-80. doi:10.1111/tmi.13383.
7. Chen, N. Wuhan, Çin'de 2019 yeni koronavirüs pnömonisinin 99 vakasının epidemiyolojik ve klinik özellikleri: Tanımlayıcı bir çalışma. Lancet 2020 , 395 , 507-513. [Google Akademik] [CrossRef]
8. Wu, P .; Hao, X .; Lau, EHY; Wong, JY; Leung, KSM; Wu, JT; Cowling, BJ; Leung, GM 22 Ocak 2020'de Çin, Wuhan'da yeni koronavirüs enfeksiyonlarının epidemiyolojik özelliklerinin gerçek zamanlı geçici değerlendirmesi. Euro Surveill. 2020 , 25 , 1-6. [Google Akademik] [CrossRef] [PubMed]
9. Holshue, ML Amerika Birleşik Devletleri'nde 2019 Roman Coronavirüs'ün İlk Örneği. N. Engl. J. Med. 2020 . [Google Akademik] [CrossRef] [PubMed]
10. Chen, J. Pathogenicity and transmissibility of 2019-nCoV - a quick overview and comparison with other emerging viruses. Microb Infect 2020;22:69-71.
11. Corman VM, Landt O, Kaiser M, Molenkamp R, Meijer A, Chu DK, et al. Detection of 2019 novel coronavirus (2019-nCoV) by real-time RT-PCR . Euro Surveill 2020;25:1-8.
12. Zhang L, Liu Y. Potential interventions for novel coronavirus in China: A systematic review . J Med Virol 2020;92:479-90.
13. Gao J, Tian Z, Yang X. Breakthrough: chloroquine phosphate has shown apparent efficacy in treatment of COVID-19 associated pneumonia in clinical studies. Biosci Trends. 2020;14:72-3.
14. Department of Infectious Diseases, Central Hospital of Ezhou, Ezhou, Hubei, China
15. Department of Cardiovascular Medicine, Yunmeng People's Hospital, Xiaogan, Hubei, China
16. Ather A, Patel B, Ruparel NB, Diogenler A. Hargreaves KM. Coronavirus disease 19 (COVID-19): implications for clinical dental care. J Endod. 2020;46:584-95.
17. Lydeard, S. Bir araştırma aracı olarak anket. Dostum. Pract. 1991 , 8 , 84-91. [Google Akademik] [CrossRef]
18. Neher RA, Dyrdak R, Druelle V, Hodcroft EB, Albert J. Potential impact of seasonal forcing on a SARS-CoV-2 pandemic. Swiss Med Wkly 2020;150:w20224.
19. Peng X, Xu X, Li Y, Cheng, Zhou X, Ren,B. Transmission routes of 2019-nCoV and controls in dental practice. Int J Oral Sci 2020;12:1-6.
20. "2019 Novel Coronavirus (2019-nCoV) Situation Summary". Centers for Disease Control and Prevention
21. Jin YH, Cai L, Cheng ZS, Cheng H, Deng T, Fan YP, et al. A rapid advice guideline for the diagnosis and treatment of 2019 novel coronavirus (2019-nCoV) infected pneumonia (standard version) Mil Med Res 2020:7:4. https://doi.org/10.1186/s40779-020-0233-6
22. Moorthy, V .; Restrepo, AMH; Preziosi, MP; Swaminathan, S. Aktif karantina önlemleri COVID-19'un ölüm oranını azaltmanın başlıca yoludur. Boğa. Dünya Sağlık Organ. 2020 , 98 , 150. [Google Akademik] [CrossRef]
23. Lai J, Ma S, Wang Y, Cai Z, Hu J, Wei N, et al. Factors associated with mental health outcomes among health care workers exposed to coronavirus disease 2019 JAMA Netw Open 2020;3:e203976.
24. Person B, Sy F, Holton K, Govert B, Liang A, Garza B, et al. Fear and Stigma: The Epidemic within the SARS Outbreak . Emerg. Infect. Dis. 2004;10:358-63.
25. van Doremalen N, Bushmaker T, Morris DH, Holbrook MG, Kumar A, Williamson BN, et al. Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. N Engl J Med 2020; 382:1564-7.
26. Mantar IC-H, Cairncross S. Effectiveness of hand washing in preventing SARS: A review. Trop Med Int Health 2006:1749-58.
27. Jefferson T, Foxlee R, Mar CD, Dooley L, Ferroni E, Hewak B, et al. Physical interventions to interrupt or reduce the spread of respiratory viruses. Cochrane Database Syst Rev 2011:CD006207.
28. Hu L, Chen S, Fu Y, Gao Z, Long H, Wang JM, et al. Risk factors associated with clinical outcomes in 323 COVID-19 hospitalized patients in Wuhan, China. Clin Infect Dis ciaa539, https://doi.org/10.1093/cid/ciaa539.
29. Murthy S, Gomersall CD, Fowler RA . "Care for Critically Ill Patients With COVID-19". JAMA. doi:10.1001/jama.2020.3633. PMID 32159735.
30. Sridharan KG, Gurusaravanan K, Kotagiri R, Chandiramani HV, Mohan BP, Vegunta R, et al. COVID-19 and Avoiding Ibuprofen. How Good Is the Evidence? Am J Ther 2020;27:e400-2.

31. Schuetz P, Albrich W, Mueller B. Procalcitonin for diagnosis of infection and guide to antibiotic decisions: past, present and future. BMC Med 2011;9:107.

32. Baden LR , Rubin EJ. Covid-19 - the search for effective therapy N Engl J Med 2020;382:1851-2 10.1056 / NEJMe2005477.

Original Article

DOI: 10.14235/bas.galenos.2020.5000
Bezmialem Science 2020;8(Supplement 2):36-40

Relationship between ABO Blood Group and COVID-19: The Case of Siirt

ABO Kan Grubu ve COVID-19 Arasındaki İlişki: Siirt Örneği

Mehmet ÜYÜKLÜ[1], Osman ÖZÜDOĞRU[2]

[1]Siirt University Faculty of Medicine, Department of Physiology, Siirt, Turkey
[2]Siirt State Hospital, Clinic of Internal Medicine, Siirt, Turkey

ABSTRACT

Objective: Epidemiological and clinical studies have shown that age and chronic diseases are important risk factors in the mortality of patients infected by Coronavirus disease 2019 (COVID-19). However, there is no biomarker identified yet for susceptibility to the disease. Some studies have reported that ABO blood groups are associated with a predisposition to Covid-19. In this study, it was aimed to investigate the relationship between ABO blood groups and COVID-19 susceptibility in Siirt province scale.

Methods: In this study, the blood groups of 174 patients, all of whom were in Siirt, were confirmed retrospectively at the Siirt State Hospital, all confirmed by revers-transcriptase chain reaction. For comparison, data from 36394 patients whose blood group was detected in the Siirt State Hospital were used.

Results: In Siirt provincial normal population; while blood groups A, B, AB and O were 40%, 19.5%, 8.5% and 32% respectively, the blood groups of COVID-19 positive patients were 42.5%, 19.5%, 8%, and 30%. No statistically significant difference was found in blood group distribution rates between healthy and COVID-19 patient groups (>0.05). The distribution of blood group rates of patients hospitalized in the intensive care unit was not different from healthy individuals (>0.05). No significant difference could be calculated between the duration of hospitalization in the intensive care unit and blood groups.

Conclusion: As a result, unlike studies showing that the risk of COVID-19 infection was higher in the A blood group and lower in the O blood group, no relationship was found between the

ÖZ

Amaç: Epidemiyolojik ve klinik çalışmalar, Coronavirus hastalığı 2019 (COVID-19) ile enfekte olan hastaların mortalitesinde yaş ve kronik hastalıkların önemli risk faktörü olduğunu göstermiştir. Bununla birlikte hastalığa yatkınlık için henüz tanımlanmış bir biyolojik belirteç bulunmamaktadır. Yapılan bazı çalışmalar ABO kan gruplarının COVID-19'a yatkınlıkla ilişkili olduğu bildirmiştir. Bu çalışmada Siirt il ölçeğinde ABO kan grupları ile COVID-19 yatkınlığı arasındaki ilişkinin araştırılması amaçlanmıştır.

Yöntemler: Bu çalışmada Siirt Devlet Hastanesinde tümü gerçek zamanlı polimeraz zincir reaksiyonu ile doğrulanmış tamamı Siirt'li olan 174 hastanın kan grupları retrospektif olarak değerlendirilmiştir. Karşılaştırma için Siirt Devlet Hastanesinde kan grubu tespiti yapılan 36.394 hastaya ait veriler kullanılmıştır.

Bulgular: Siirt il geneli normal popülasyonda; A, B, AB ve O kan grupları sırasıyla %40, %19,5, %8,5 ve %32 iken COVID-19 pozitif hastaların kan grupları sırasıyla; %42,5, %19,5, %8, %30 bulunmuştur. Sağlıklı ve COVID-19 hasta grupları arasında kan grubu dağılım oranları arasında istatistiksel olarak anlamlı bir fark bulunmamıştır (>0.05). Yoğun bakım ünitesinde yatan hastaların kan grubu oranlarındaki dağılım da sağlıklı bireylerden farklı bulunmamıştır (>0.05). Yoğun bakımdaki yatış süresi ile kan grupları arasında da anlamlı bir fark hesaplanamamıştır.

Sonuç: Sonuç olarak, COVID-19 enfeksiyonu riskinin A kan grubunda daha yüksek, 0 kan grubunda daha düşük olduğunu gösteren çalışmaların aksine kan grubuyla COVID-19 enfeksiyon riski ve yoğun bakım tedavisi arasında bir ilişki bulunmamıştır. Bu

Address for Correspondence: Mehmet ÜYÜKLÜ, Siirt University Faculty of Medicine, Department of Physiology, Siirt, Turkey
E-mail: mmuyuklu@gmail.com **ORCID ID:** orcid.org/0000-0002-7100-9817

Received: 30.06.2020
Accepted: 04.08.2020

Cite this article as: Üyüklü M, Özüdoğru O. Relationship between ABO Blood Group and COVID-19: The Case of Siirt. Bezmialem Science 2020;8(Supplement 2):36-40.

blood group and the risk of COVID-19 infection and intensive care therapy. Combining the results of this study with data from other regions, it is thought that only if the relationship between blood group COVID-19 can be confirmed, it may be a guide for diagnosis, follow-up and treatment.

Keywords: COVID-19, blood group, corona virus, Siirt

çalışmadaki sonuçların, diğer bölgelerdeki verilerle birleştirilmesiyle kan grubu COVID-19 arasındaki ilişki doğrulanabildiği takdirde ancak tanı, takip ve tedaviye yol gösterici olabileceği düşünülmektedir.

Anahtar Sözcükler: COVID-19, kan grubu, korona virus, Siirt

Introduction

The new Coronavirus disease (COVID-19) infection appeared in Wuhan, China in December 2019. Cases of pneumonia associated with this virus have spread rapidly since then and affected many countries and regions with large epidemics (1,2). Clinical studies have shown that the most common symptoms of COVID-19 are fever, fatigue and dry cough. Other symptoms are myalgia, chest tightness, shortness of breath, nausea, vomiting, and diarrhea. In thoracic computed tomography scans, multiple bilateral ground glass opacities/consolidation are observed as typical viral pneumonia images (3). Common laboratory findings are lymphopenia and/or leukopenia. No specific therapeutic agent has been available for corona virus infections to date. However, various approaches are used for treatment but there is not yet a defined biomarker for susceptibility to the disease.

Blood type is used for antigens made by various gene alleles on red blood cells and it is reported that there are more than 400 antigens on the erythrocyte (4). In 1901, Karl Landsteiner discovered the ABO system, which contains 4 main blood groups A, B, AB and O (5). ABO antigens are carbohydrate moieties expressed on red blood cells as well as other cells and tissues and represent the main determinants of blood transfusion compatibility. ABO antigens are commonly expressed in epithelial cells, sensory neurons, body fluids, including platelets and endothelium of blood vessels, and cell surfaces in tissues in addition to erythrocytes (6). In connection with the widespread distribution of these antigens, it is said that some diseases may be associated with ABO blood types. It has been reported that plasma Willebrand factor, Factor VIII, total cholesterol, cardiovascular diseases and malaria (malaria) are observed more frequently in people other than those with 0 blood type (7-10). Some studies have reported that ABO blood types are also associated with susceptibility to COVID-19. In these studies, it was found that the risk of COVID-19 infection was higher in blood type A and lower in blood type 0 (11-13). In this study, it was aimed to investigate the relationship between ABO blood types and COVID-19 susceptibility in Siirt provincial scale.

Material and Method

Patient Population

The study group consisted of 174 patients from Siirt, who had a diagnosis of COVID-19 made in Siirt State Hospital, who were confirmed as positive with revers-transcriptase chain reaction, who were ≥18-year-old male and non-pregnant female. Patients' gender, age, intensive care and death, length of stay in intensive care, their average age and lymphocyte, D-dimer, C-reactive protein (CRP) and ferritin parameters of intensive care patients were evaluated. Again, the blood types of the same patients and the results of 36394 people, all of whom were from Siirt (including districts) and whose blood groups were evaluated in Siirt State Hospital between 2015 and 2020, as the control group were used. The whole study was conducted retrospectively. For the study, approval was obtained from The Chief Physician of Siirt State Hospital, Siirt University non-Invasive Clinical Research Ethics Board (2020/8:03) and the Republic of Turkey Ministry of Health, Health Services Directorate General, Scientific Research Platform on 5/28/2020 (2020-05-22-T21_49_16).

Statistical Analysis

Results are given as mean ± standard error. Statistical comparisons between the groups were evaluated by the "Chi-square (χ^2)" and "Student's t-test", and intergroup comparisons of the variables were performed with the one-way analysis of variance (ANOVA). P values less than 0.05 were considered statistically significant. (PRISM 6.0, GraphPad Software, Inc., La Jolla, CA, USA).

Results

According to the brochure prepared by the Red Crescent Society of Turkey, about 45% of people in Turkey have blood type A, 16% have blood type B, 6% have blood type AB and 33% have blood type O. The blood types A, B, AB, and O of normal population in the province of Siirt were found to be 40%, 19.5%, 8.5% and 32%, respectively. The blood types of COVID-19 patients in Siirt State Hospital were 42.5% (A), 19.5% (B), 8% (AB), and 30% (O) (Table 1). The comparison of the overall results of Siirt and Turkey revealed regional differences. It was observed that the blood type A was lower than the normal distribution in the province of Siirt, but the B and AB blood types were higher (Table 1).

79 of the patients from Siirt, who had a definite diagnosis of COVID-19 positive, were male (M: 45.4%), and 95 of them were female (F: 54.6%). The mean ages of the patients were calculated as 44.90 and 43.23, respectively, and no significant difference was found between them (p>0.05). 28 of the patients were hospitalized in intensive care unit (M: 16, F: 12) and 16 died (M: 8, F: 8). The average age of the patients hospitalized in intensive care unit was calculated as 60.94 years for males and 72.92 years for females, and the mean age of those who died was calculated as 62.50 years for males and 76.80 for females. It was

observed that the average age of both patients being hospitalized in the intensive care unit and those who died was lower in men than in women (p<0.05, Table 2). Almost all patients in the intensive care unit have a similar clinical Picture. In 27 patients, lymphocyte value was less than 800 (Lymphopenia), D-dimer value was higher than 1000 µg/L and CRP was higher than 40 mg/L. In 25 patients, ferritin value was measured to be higher than 500 µg/L.

Table 3 compares the blood groups of COVID-19 positive (n=174) and control groups (n=36394). The susceptibility of the A blood group to COVID-19 infection, compared to the other blood groups, changed 1,096 times (p>0.05); the susceptibility of the blood group O to COVID-19 infection changed 0.910 times (p>0.05). Blood groups of A, B, AB and O in patients receiving intensive care treatment were 43%, 17%, 7% and 33%, respectively. It was calculated that the intensive care risk in blood type A changed 1,133 times (p>0.05) and in blood group O, it changed 1.068 times (p>0.05).

No significant change was calculated in other blood types. As a result of the statistical analysis, no significant difference was found in the comparison of blood groups between the two groups (p>0.05). A similar comparison was made for patients hospitalized in the intensive care unit and again, no difference was observed in terms of blood types (p>0.05, Table 3). The relationship between the length of stay of the patients in the intensive care unit and their blood groups is shown in Table 3. The length of stay in the intensive care unit (days) is as follows, from the highest to the lowest, respectively: A (11.53±4.05), O (9.30±5.75), B (7.00±5.05) and AB (6.00±7.07). Although patients with blood type A had the longest length of stay in the intensive care unit, no statistically significant difference was found in the comparison of variables between the groups (p>0.05).

Discussion

In the early stage, the coronavirus primarily targets the respiratory system and reproduces. It uses the angiotensin converting enzyme receptor to enter the cell (14-16). These receptors are predominantly found in the lung, small intestine, and vascular endothelial cells. It has been shown that IL-2, IL-6, CRP, Ferritin, D-dimer and Troponin levels increase and lymphopenia is observed in patients with a severe course of COVID-19 (14-17). In the results of our study, an increase in CRP, Ferritin, and D-dimer levels and lymphopenia were observed in patients hospitalized in the intensive care unit (Table 2).

Apart from erythrocytes, ABO antigens are also found on the cell surfaces of many tissues, especially in epithelial cells, sensory neurons, platelets and endothelium of blood vessels (6). Many studies have evaluated that ABO blood groups may be associated

Table 1. Comparative distribution of Siirt, COVID-19 positive and Turkey's blood types (%).

Distribution of blood types				
	A	B	AB	O
Siirt (control)	**40,3%**	**19,34%**	**8,47%**	**31,88%**
(n=36394)	(14.666)	(7.038)	(3.086)	(11.604)
COVID-19	**42,53%**	**19,54%**	**8,05%**	**29,88%**
(n=174)	(74)	(34)	(14)	(52)
Turkey*	**45%**	**16%**	**6%**	**33%**

*Source: Red crescent, COVID: Coronavirus disease

Table 2. Comparison of the age, gender, intensive care and clinical pictures of COVID-19 positive patients

Patients (n=174)	Male (n=79) 45.4%	Female (n=95) 54.6%	p
Age (year)	44.90±19.9	43.23±20.51	0.05
Intensive care	16 (20%)	12 (12,6%)	
Mean age for intensive care	60.94±14.70	72.92±8.38*	**0.018**
Death	8 (10.1%)	8 (8.4%)	
Mean age for death	62.5±15.13	76.8±5.03*	**0.024**
Death/Intensive care	**50%**	**66.6%**	
Intensive care patients (n=28)			
Lymphocyte (<800)	15	12	
D-dimer (>1000 µg/L)	15	12	
CRP (>40 mg/L)	15	12	
Ferritine (>500 µg/L)	14	11	

CRP: C-reactive protein, COVID: Coronavirus disease, difference from male *: <0.05

with some diseases. It has been reported that plasma coagulation factors (Willebrand factor, Factor VIII), blood lipid levels, cardiovascular diseases and malaria are observed more frequently in people other than O blood group (7-10). Epidemiological and clinical studies have shown that age and chronic diseases (cardiovascular disease, diabetes, chronic obstructive pulmonary disease, etc.) are important risk factors in the mortality of patients infected by COVID-19. In recent studies, it has been evaluated that there is a relationship between ABO blood groups and being infected by COVID-19, and the risk of COVID-19 infection is higher in the A blood type and lower in the O blood type (11-13). People with blood type A have been said to have potential risk for COVID-19 infection. In this study we conducted throughout the province of Siirt, no relationship was found between blood groups and COVID-19 infection, hospitalization and length of hospitalization in intensive care unit (Table 3).

In studies stating that blood group A is a risk factor for COVID-19 infection, it is thought that the small number of control group samples used for comparison may not be sufficient to fully compare with the patient population or may not fully reflect the blood group distribution of that population. It is a known fact that the distribution of blood groups is not the same geographically among countries or in different regions of the same country. A similar situation was encountered for the comparison of Turkey with Siirt general population (Table 1). It was observed that the frequencies of B and AB blood types were higher in the region, and the frequency of blood type A was lower. It is believed that it was an advantage for our study that all of our COVID-19 positive patients (n=174) and control group samples (n=36394) were from Siirt and the number of control group samples used for comparison was high.

Conclusion

The ABO system is found on the surface of platelets, vascular epithelial cells, intestinal, cervical and mammary gland epithelial cells (6). Unlike the ABO system, the Rh system is not found in other tissues except erythrocytes. According to some studies, ABO blood groups may be associated with some diseases, and this relationship has been attributed to the widespread presence of this system in human body tissues and cells. It has been stated that the presence of Rh system only in erythrocytes is excluded from this relationship because approximately 85% of humans are Rh+. For this reason, only ABO system data are included in the results section of our study. As a result, unlike studies showing that the risk of COVID-19 infection is higher in blood group A and lower in blood group O, no relationship was found between blood type and the risk of COVID-19 infection and intensive care treatment. The small area of the study indirectly caused the number of patients to be low. It is necessary to investigate and support this relationship with studies involving larger patient series and / or to be confirmed by re-evaluating the results by adding other patients who were not included in this study after the pandemic.

Table 3. Comparison of blood groups in control, COVID-19 positive and intensive care patients

Blood types				
	A	**B**	**AB**	**O**
Control (n=36394)	14,666 **(40.3%)**	7038 **(19.34%)**	3086 **(8.47%)**	11,604 **(31.88%)**
COVID-19 (n=174)	74 **(42.53%)**	34 **(19.54%)**	14 **(8.05%)**	52 **(29.88%)**
x2	0.358	0.004	0.041	0.319
p	**0.549**	**0.946**	**0.837**	**0.572**
OR	1.096	1.013	0.944	0.910
95%Cl	0.811-1.482	0.695-1.475	0.546-1.633	0.657-1.261
	A	**B**	**AB**	**O**
Intensive care (n=28)	12 **(42.9%)**	5 **(17.9%)**	2 **(7.1%)**	9 **(32.1%)**
χ^2	0.115	0.137	0.127	0.029
p	**0.735**	**0.711**	**0.722**	**0.865**
OR	1.133	0.834	0.771	1.068
95%Cl	0.550-2.334	0.319-2.180	0.183-3.239	0.499-2.283
	A	**B**	**AB**	**O**
Length of stay in intensive care unit (day)	**11.53**±4.05	**7.00**±5.05	**6.00**±7.07	**9.30**±5.75

CI: Confidence interval, OR: Odds ratio, COVID: Coronavirus disease

Ethics

Ethics Committee Approval: The study, approval was obtained from The Chief Physician of Siirt State Hospital, Siirt University non-Invasive Clinical Research Ethics Board (2020/8:03) and the Republic of Turkey Ministry of Health, Health Services Directorate General, Scientific Research Platform on 5/28/2020 (2020-05-22-T21_49_16).

Informed Consent: Informed consent was obtained from all study participants.

Peer-review: Internally peer reviewed.

Authorship Contributions

Concept: M.Ü., O.Ö., Design: M.Ü., O.Ö., Data Collection or Processing: M.Ü., O.Ö., Analysis or Interpretation: M.Ü., O.Ö., Literature Search: M.Ü., O.Ö., Writing: M.Ü., O.Ö.

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

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

References

1. Wu F, Zhao S, Yu B, Chen YM, Wang W, Song ZG, et al. A new coronavirus associated with human respiratory disease in China. Nature 2020;579:265-9.
2. 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 2020;395:497-506.
3. Chan JF, Yuan S, Kok KH, To KKW, Chu H, Yang J. et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. Lancet 2020;395:514-23
4. Calhoun L, Petz LD. Erythrocyte antigens and antibodies. In: Williams Hematology. Beutler E, Lichtman MA, Coller BS and Kipps TJ (eds) Fifth edition, New York, McGraw-Hill, 1995:1595.
5. Lesky E. Viennese serological research about the year 1900: its contribution to the development of clinical medicine. Bull N Y Acad Med 1973;49:100-11.
6. Eastlund T. The histo-blood group ABO system and tissue transplantation. Transfusion 1998;38:975-88.
7. Jenkins PV, O'Donnell JS. ABO blood group determines plasma von Willebrand factor levels: a biologic function after all? Transfusion 2006;46:1836-44.
8. Folsom AR, Wu KK, Rosamond WD, Sharrett AR, Chambless LE. Prospective study of hemostatic factors and incidence of coronary heart disease: the Atherosclerosis Risk in Communities (ARIC) Study. Circulation 1997;96:1102-8.
9. Whincup PH, Danesh J, Walker M, Lennon L, Appleby P, Rumley A, et al. von Willebrand factor and coronary heart disease: prospective study and meta-analysis. Eur Heart J 2002;23:1764-70.
10. Chen Y, Chen C, Ke X, Xiong L, Shi Y, Li J, et al. Analysis of circulating cholesterol levels as a mediator of an association between ABO blood group and coronary heart disease. Circ Cardiovasc Genet 2014;7:43-8.
11. Li J, Wang X, Chen J, Cai Y, Deng A, Yang M. Association between ABO blood groups and risk of SARS-CoV-2 pneumonia. Br J Haematol 2020.
12. Zhao J, Yang Y, Huang H, Li D, Gu D, Lu X, et al. Relationship between the ABO Blood Group and the COVID-19 Susceptibility. MedRxiv 2020.
13. Goker H, Aladag KE, Demiroglu H, Ayaz CM, Buyukasik, Y, Inkaya AC, et al. The effects of blood group types on the risk of COVID-19 infection and its clinical outcome. Turk J Med Sci 2020;50:679-83.
14. Gao J, Tian Z, Yang X. Breakthrough: Chloroquine phosphate has shown apparent efficacy in treatment of COVID-19 associated pneumonia in clinical studies. BioScience Trends 2020;14-1:72-3.
15. Zhou D, Dai SM and Tong Q. COVID-19: a recommendation to examine the effect of hydroxychloroquine in preventing infection and progression. Journal of Antimicrobial Chemotheraphy 2020.
16. Timothy F. Simpson, Richard J. Eric C. Ventricular Arrhythmia Risk Due to Hydroxychloroquine-Azithromycin Treatment for COVID-19. ACC Cardiology Magazine. 2020.
17. Siddiqi HK, Mehra MR. COVID-19 Illness in Native and Immunosuppressed States: A Clinical Therapeutic Staging Proposal. J Heart Lung Transplant. 2020;39:405-7.

Original Article

DOI: 10.14235/bas.galenos.2020.4660
Bezmialem Science 2020;8(Supplement 2):41-47

Risk Communication in Public Health Practices and Coronavirus Disease 2019 (COVID -19): Social Media Analysis of Health Authorities

Halk Sağlığı Uygulamalarında Risk iletişimi ve Koronavirüs Hastalığı 2019 (COVID -19): Sağlık Otoritelerinin Sosyal Medya Analizi

Miraç Nevzat KARAKOÇ[1], Hüseyin KOÇAK[2], Cüneyt ÇALIŞKAN[2], Kerem KINIK[3]

[1]Çanakkale City Administrations, Investment and Construction Directorate, Çanakkale, Turkey
[2]Çanakkale Onsekiz Mart University, Emergency Aid and Disaster Management Department, Çanakkale, Turkey
[3]University of Health Science, Management and Organization Department, İstanbul, Turkey

ABSTRACT

Objective: This study aims to evaluate information on the website of the Ministry of Health about the COVID-19 pandemic, the social media accounts of health authorities, and the COVID-19 cases.

Methods: In this descriptive ecological research, the content analysis of the posts about COVID-19, which were shared for health professionals and the public on the official website of the Ministry of Health, was conducted. The content traffic of the social media accounts of the health authorities about the pandemic and the daily number of cases along with recovery and death rates related to the pandemic were analyzed.

Results: The first COVID-19 post was sent on 22 January 2020 through the official Twitter account of the Minister of Health. After the first tweet about COVID-19, the first positive case was seen in the 50th day, while the first death was seen in the 57th day and the first recovery case was seen in the 67th day. There is a significant positive correlation between the number of days passed and the number of cases, deaths, recoveries, comments, retweets and likes that the tweets of the Minister received; between the number of cases and the number of deaths and recovery cases; between fatal cases and recovery cases.

ÖZ

Amaç: Bu çalışma coronavirus hastalığı (COVİD-19) pandemisine karşı T.C. Sağlık Bakanlığı'nın web sitesinde yer alan bilgilerin ve sağlık otoritelerinin sosyal medya hesapları ve görülen olguların değerlendirilmesini amaçlamaktadır.

Yöntemler: Tanımlayıcı ekolojik tipteki araştırmada T.C. Sağlık Bakanlığı'nın resmi web sitesindeki COVİD-19 ile ilgili halka ve sağlık personeline yönelik paylaşımların içerik analizi ve sağlık otoritelerinin sosyal medya hesaplarındaki (twitter) salgınla ilgili trafiklerinin ve hastalığa ait günlük olgu, iyileşme ve ölüm sayıları analiz edilmiştir.

Bulgular: İlk COVİD-19 paylaşımı 22 Ocak 2020 tarihinde Sağlık Bakanı'nın resmi twitter hesabı üzerinden yapılmıştır. COVİD-19 hakkında atılan ilk tweettin 50. gününde ilk pozitif olgu, 57. gününde ilk ölüm ve 67. gününde ilk iyileşen olgular görülmüştür. Geçen gün sayısı ile olgu, ölüm, iyileşen ve bakan tweetinin aldığı beğenmeler arasında; olgu ve ölüm sayıları arasında; ölüm ve iyileşen olgular arasında kayda değer pozitif korelasyon vardır.

Sonuç: Sağlık otoritelerinin tweeter hesaplarına ait tweet trafiği ile COVİD-19 olguları, ölüm, iyileşme ve gün arasında bir korelasyon ilişkisi saptanmıştır. Bu nedenle, pandemi gibi afetlerde halkın

Address for Correspondence: Miraç Nevzat KARAKOÇ, Çanakkale City Administrations, Investment and Construction Directorate, Çanakkale, Turkey
E-mail: mnkarakoc@hotmail.com **ORCID ID:** orcid.org/0000-0001-7135-0858

Cite this article as: Karakoç MN, Koçak H, Çalışkan C, Kınık K. Risk Communication in Public Health Practices and Coronavirus Disease 2019 (COVID -19): Social Media Analysis of Health Authorities. Bezmialem Science 2020;8(Supplement 2):41-47.

Received: 21.05.2020
Accepted: 15.06.2020

Conclusion: A correlation was found between the tweet traffic of the health authorities' twitter accounts and the number of COVID-19 cases, deaths, recoveries and days passed. Therefore, social platforms can be an important risk communication tool for public health in informing and managing the community in disasters like pandemics.

Keywords: Risk communication, social media, pandemic, epidemic, COVID-19

bilgilendirilmesi ve yönetiminde sosyal platformlar halk sağlığı açısından önemli bir risk iletişim aracı olabilir.

Anahtar Sözcükler: Risk iletişimi, sosyal medya, pandemi, salgın, COVİD-19

Introduction

Pandemic is a global epidemic, and the new coronavirus type (COVID-19) is the first coronavirus pandemic known to cause an emergency. Over the past century, new influenza viruses have caused 4 known pandemics: Spanish flu (1918) (H1N1 virus), Asian flu (1957) (H2N2), Hong Kong flu (1968) (H3N2) and Swine flu (2009) (H1N1) pdm09. Since most of the research on pandemics are specific to flues, information gained from those pandemics can be adapted to COVID-19 and the new outbreak can be overcome in the mildest way (1). Accordingly, the guides prepared by countries against influenza outbreaks and their risk communication strategies for informing the public come into prominence.

Risk communication can be carried out with well-thought-out messaging and program contents developed by newer social media organizations (i.e., social networks, smartphones, instant messaging) along with traditional mass media. However, despite the improvement in communication tools, government officials generally state that people are unprepared for disasters (2). The best example of this can be seen in the process of epidemic diseases turning into pandemics as a result of society's failure to take necessary measures despite all the measures that have been taken by the states.

The Ministry of Health of Turkey published the Pandemic Influenza National Readiness Plan study in 2019 in coordination with public health units and private sector partners in order to provide an effective and coordinated response to flu epidemics (3). In this plan, how to conduct risk communication during the delivery of the instructions required to protect the public from pandemics is explained. However, since disasters do not affect everyone in the same way due to social injustice (4), it may be necessary to reach the public through different communication channels. For this reason, web-based content and social media applications that almost everyone can access today are seen as tools that can provide direct communication with the public as they have a great potential in increasing the resistance of the society against disasters (5-7). However, although social media is used as a platform where emergency alerts are shared by public health institutions, false information and rumors spread in the public are a disadvantage for public health control (8-10). In this study, it is aimed to evaluate COVID-19 cases as well as content of information about the COVID-19 pandemic on the website of the Ministry of Health and the twitter traffic of health authorities.

Methods

The website of the Ministry of Health of Turkey about COVID-19 and the official twitter accounts of the Ministry of Health, General Directorate of Public Health and the Health Minister (@saglikbakanlig, @halksagligigm and @drfahrettinko, respectively) constitute the population of the descriptive ecological type of epidemiological study. The general introduction of the COVID-19 website of the Ministry of Health and the contents of the guides, presentations, algorithms, forms, publications, and billboard buttons, in which various tools for healthcare staff and the public were collected, were examined. Frequency distributions of daily like, comment and retweet traffic on the official twitter accounts of the Ministry of Health, General Directorate of Public Health, and the Health Minister were determined from 22.01.2020, when the COVID-19-related posts were started to be shared directly, until 17.05.2020. However, the data traffic was given started from 10.03.2020, the date when the COVID-19 pandemic was observed in Turkey for the first time (the first positive case). The time trend relationship in Turkey between 10.03.2020 and 17.05.2020 was observed: Since the official Twitter account of the Minister of Health did not contain missing data, the traffic of (1) comments, (2) retweets, (3) likes, and (4) the time that passed since the first tweet (day), COVID-19 (4) cases and (5) deaths in Turkey. The relationship between variables (day, case, death, recovered, received comments, retweets and likes for Minister's tweets) was analyzed by the Spearman rank-correlation ($p<0.05$). The analyses were carried out with SPSS 19.0 statistical software package (IBM; Armonk, New York USA).

Results

Findings about the COVID-19 website

The Ministry of Health has an online website with the extension of https://Covid19bilgi.saglik.gov.tr/tr/ to inform healthcare staff and the public. Upon entering the website, a guiding banner welcomes the user with new information about COVID-19. In the upper left corner of the website, there are links to various social network accounts belonging to the Ministry of Health and there is a search option in the upper right corner. Again, at the top right, there are tabs for decisions made for institutions, news and frequently asked questions related to COVID-19. There are various informative items under the buttons of what is COVID-19?, what are the symptoms?, how is it transmitted?,

who are at risk?, how the diagnosis is made? and ways of protection? in the middle line of the website. There are also Daily Coronavirus table of Turkey and General Coronavirus table of Turkey in the middle line of the website. These tables are updated daily. Below them are videos with famous actors describing protective measures for COVID-19, a welcome announcement, and radio spots. At the bottom of the website, there are buttons for various documents and treatment, protective equipment usage suggestions, case inquiry guide and list of provinces to send samples for healthcare staff. Below are the contents of the buttons with various documents presented to the public and healthcare staff:

COVID-19 Guidebook

The renewed edition was published by the Ministry of Health, General Directorate of Public Health on 25 March 2020 under the name of COVID-19 (SARS-CoV2 Infection) Guidebook. The content of this guide includes information on COVID-19 under the main topics of epidemiology, sources and transmission routes, clinical features, laboratory tests, case definition and case management, sampling, storage and transportation of the sample, contact tracking, infection control and isolation, patient management and treatment, and the things that people going to a country where a case has been seen should do.

COVID-19 Presentations

There is one presentation that offers information about the general features of COVID-19 and protection measures.

COVID-19 Algorithms

There are four algorithms under the headings of the case management flow chart in 2nd and 3rd level health institutions; tracking algorithm for passengers and flight attendants; polyclinic / emergency patient management chart; evaluation of healthcare professionals with COVID-19 contact.

COVID-19 Forms

It contains a case information form, a follow-up form and a possible COVID-19 case inquiry guide for outpatients.

COVID-19 Publications

For public use, it contains the new coronavirus disease (COVID-19) booklet, "14 rules against the risk of new coronavirus" poster, "home monitoring (quarantine)" rule/"14-Day Rules" poster, "wash your hands frequently" poster, "protect your health while traveling" poster, "how should we wash our hands" poster, "virus protection is in our hands" poster, "when and how should we wash our hands" poster, "let's wash our hands and protect our health" poster, leaflet about suggestions for our citizens returning from UMRE worship, medical mask use brochure.

For healthcare personnel, it contains a standard measures poster, contact isolation poster, droplet isolation poster, respiratory insulation poster, appropriate use of personal protective equipment poster.

COVID-19 Billboard

There are billboards prepared for COVID-19 with the titles of "virus protection is in our hands", "let's wash our hands and protect our health", "how should we wash our hands", and "coronavirus is not stronger than the measures we will take".

COVID-19 Results About Twitter Posts

The first COVID-19 post was shared on 22 January 2020 by the official twitter account of the Minister of Health, @drfahrettinkoca. Most tweet traffic belongs to this account. It is successively followed by @saglikbakanligi and @halksagligigm in terms of the density of tweet traffic. It seems that the General Directorate of Public Health has almost no sharing of COVID-19 on its official twitter account, @halksagligigm. After the sharing of the first tweet, the first positive case was detected on the 50th day, the first death on the 57th day and the first recovery case on the 67th day. A total of 149435 positive cases, 4140 deaths, and 109962 recoveries were observed on 17.05.2020, 118 days after the first tweet (Table 1). The daily case, death and recovery trend of COVID-19 is given in Figure 1.

There is a strong and significant and positive correlation between the number of days passed and the number of recoveries ($r=0.804$, $p<0.01$). There is a moderate and significant and positive correlation between the number of days passed and the number of deaths ($r=0.549$, $p<0.01$). There is a strong and significant and positive correlation between the number of COVID-19 cases and the number of deaths ($r=0.904$, $p<0.01$). There is a moderate and significant positive correlation between the COVID-19 fatal cases and the number of comments that the tweets of the Minister received ($r=0.549$, $p<0.01$) (Table 2).

Discussion

The World Health Organization (WHO) declared a global public health emergency for COVID-19 on 20 January 2020, and today the number of positive cases has globally exceeded two million (11). Before the declaration of the pandemic by WHO, Turkey began to take some early measures by placing thermal cameras at the international airports. One of these measures is the effective management of risk communication

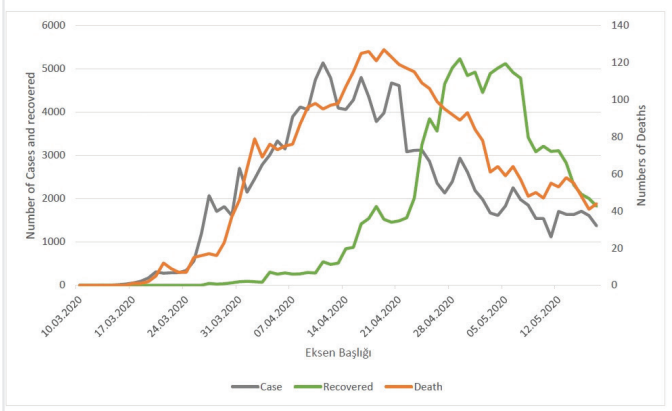


Figure 1. COVİD-19 distribution of daily case, death and recovery numbers

Table 1. Traffic of Covid-19 posts from health authorities' twitter accounts and the number of Covid-19 cases, deaths and recoveries

Date	Number of days passed since the first tweet	Number of Tweets	@halksagligigm Followers: 22 500 Following: 600			@saglikbakanligi Followers: 1 500 00 Following: 16 000			@drfahrettinkoca Followers: 4 700 000 Following: 26 000			Cases	Deaths	Recoveries
			Comment	Retweet	Like	Comment	Retweet	Like	Comment	Retweet	Like			
22.01.2020	1	1	0	0	0	87	240	958	87	240	957	0	0	0
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
10.03.2020	50	7	0	0	0	21	149	529	6792	29800	169300	1	0	0
11.03.2020	51	9	0	0	0	639	27500	54600	6367	36300	254700	0	0	0
12.03.2020	52	2	0	0	0	31	191	812	2740	11800	74600	0	0	0
13.03.2020	53	8	0	0	0	0	0	0	12286	162100	599000	4	0	0
14.03.2020	54	5	0	0	0	364	9900	19600	22700	222500	556200	1	0	0
15.03.2020	55	4	0	0	0	0	0	0	20900	70800	495300	12	0	0
16.03.2020	56	6	0	0	0	172	2300	6500	24000	339700	972100	29	0	0
17.03.2020	57	4	0	0	0	194	7500	17400	16700	96700	639700	51	1	0
18.03.2020	58	4	0	0	0	137	2600	6800	30800	111500	628600	93	1	0
19.03.2020	59	8	0	0	0	0	0	0	44800	188200	1492300	168	2	0
20.03.2020	60	6	0	0	0	242	4867	11600	50900	174500	1349700	311	5	0
21.03.2020	61	10	0	0	0	377	3300	7900	51189	214700	1729800	277	12	0
22.03.2020	62	7	0	0	0	170	1400	6700	46900	251700	1584100	289	9	0
23.03.2020	63	7	0	0	0	183	2000	6000	51500	159400	1141800	293	7	0
24.03.2020	64	8	0	0	78	347	2300	23058	74700	721000	859300	343	7	0
25.03.2020	65	4	0	0	0	570	1936	8400	29500	66600	561700	561	15	0
26.03.2020	66	5	0	0	0	162	1100	3900	39500	177400	774400	1196	16	0
27.03.2020	67	4	0	0	0	545	4876	18300	19300	38200	341000	2069	17	42
28.03.2020	68	6	0	0	0	638	5400	20400	16200	67400	447400	1704	16	28
29.03.2020	69	2	0	0	0	509	3786	15300	12300	53900	302500	1815	23	35
30.03.2020	70	2	0	0	0	196	2037	8300	12100	44400	297700	1610	37	57
31.03.2020	71	2	0	0	0	199	2756	8000	14500	38000	194300	2704	46	81
01.04.2020	72	3	0	0	0	170	2666	9300	9800	38200	283500	2148	63	90
02.04.2020	73	10	0	0	0	423	3403	12700	17290	93900	705800	2456	79	82
03.04.2020	74	2	0	0	0	79	981	3400	3619	23400	122100	2786	69	69

Table 1 contiuned

04.04.2020	75	5	0	0	0	306	4535	11900	4469	28100	162300	3013	76	302
05.04.2020	76	3	0	0	0	109	2515	6800	12676	58800	549600	3335	73	256
06.04.2020	77	3	0	0	0	248	3463	10400	5400	28400	201400	3148	75	284
07.04.2020	78	5	0	0	0	239	3835	10400	7726	51800	340600	3892	76	256
08.04.2020	79	5	0	0	0	43	781	2100	6823	47600	343000	4117	87	264
09.04.2020	80	3	0	0	0	126	1592	5600	7600	34300	253800	4056	96	296
10.04.2020	81	3	0	0	0	408	4300	12800	12100	29900	302100	4747	98	281
11.04.2020	82	5	0	0	0	0	0	0	11477	49900	416800	5138	95	542
12.04.2020	83	3	0	0	0	0	0	0	7700	35600	285200	4789	97	481
13.04.2020	84	2	0	0	0	90	606	2700	6000	29800	305800	4093	98	511
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…
15.05.2020	116	3	0	0	0	25	201	1200	5000	18300	213900	1708	48	2103
16.05.2020	117	6	0	49	51	30	747	2426	2833	16200	136500	1610	41	2004
17.05.2020	118	3	0	61	77	0	0	0	2822	15900	137900	1368	44	1825
												149435	4140	109962

Table 2. Correlation relationship between Covid-19 case characteristics and tweets

Correlation test results	1.	2.	3.	4.	5.	6.	7.
1. Day	..	..	..	..	..	..	..
2. Case	0.366**	..	..	..	..	..	..
3. Death	0.549**	0.904**	..	..	..	..	..
4. Recovered	0.804**	0.124	0.399**	..	..	..	..
5. Received comments for Minister's tweet	0.164	-0.497**	-0.549**	-0.386**	..	..	..
6. Received retweets for Minister's tweet	0.119	-0.434**	-0·453**	-0.307*	0.855**	..	..
7. Received likes for Minister's tweet	0.318**	-0.432**	-0.404**	-0.206	0.876**	0.688**	..

*p<0.05, **p<0.01

that comes into play in disaster situations. In this study, both the website established for COVID-19 and the twitter accounts of the health authorities were examined in order to evaluate risk communication through COVID-19 because interactive social media platforms can deliver an enormous amount of voluntary content when used properly (5).

In a study evaluating the national pandemic influenza plans of 28 European Union member countries, one of the themes with the highest score is risk communication (12). In the same direction, with the risk communication included in the Pandemic Influenza National Preparation Plan published in 2019 in Turkey, it started a preventive or mitigating preparatory work against future epidemic threats. The ways in which people can be reached and what kind of messages can be given during a pandemic are outlined in it. In line with the plan, a website was established by the Ministry of Health for COVID-19, which started in China and turned into a pandemic. It has been determined that there were a lot of written and visual materials for the public and healthcare personnel for COVID-19 and that this information is constantly updated. However, it has been determined that there was no written and visual material about children and pets.

As in natural disasters (7), social media can be useful in public administration during pandemics. Citizens can be directed to take necessary measures by being warned about the characteristics of a disaster and things to do (6). At this point, emergency managers use various platforms today in order to reach the public. One of these platforms is twitter which includes the features of user ID, timestamp, text, coordinates and retweet. In this social platform, comment, retweet and like interactions made specific to tweets also ensure that the same content is delivered to the followers of the interacting account. In this regard, it has been observed that the Turkish health authorities started to inform the public before COVID-19 became a global problem through twitter accounts. The health authorities regularly share messages to inform the public about COVID-19 every day. However, the first case in Turkey was seen on the 50th day after the first tweet. A positive correlation was found between the number of cases, recoveries and deaths with each passing day, and the traffic of the Minister's tweets. The increase in tweet traffic with the passage of days indicates that it is important for health authorities to use their twitter accounts to reach the public directly and to inform them. For this reason, it can be said that social media platforms are one of the various mass media apparatuses that can be used to inform the public directly in the cases of threats and dangers.

The number of COVID-19 cases, deaths and recoveries also has a positive correlation in itself. However, although there was a middle correlation between the number of cases and deaths and the Minister's tweets, a negative low correlation was found between the number of recovery cases and the tweets of the Minister. The negative correlation between the number of recovery cases and the tweet traffic can be attributed to the lack of data since the data on recoveries appeared in later days.

Study Limitations

This study has several limitations. Firstly, due to the descriptive ecological design of the study, the cause-effect relationship should be interpreted carefully. Secondly, the hit rate of the website and the amount of time spent on the website are not known. Thirdly, there are no data about the number of people who saw these accounts but did not interact with the Twitter accounts of the health authorities. In addition, according to the We Are Social 2020 report, there are 62 million (74%) internet users and 11.8 million (18%) twitter users in Turkey which has a population of 84 million (13). Fourthly, although COVID-19 arrived late in Turkey thanks to the measures taken and the authorities attempted to prevent its spread across the country, the detected cases may not reflect the actual number.

Conclusion

It was found that the twitter accounts of the health authorities shared posts for protection from the COVID-19 pandemic even before it started to appear in Turkey. Among these accounts, a positive correlation was found between the tweet traffic of the Minister of Health and the COVID-19 cases, deaths and days. In addition, written and visual materials containing various information about COVID-19 were presented on a website by the Ministry of Health. Social platforms can be important risk communication tools in terms of informing and managing the public during disasters like pandemics. The utility of such platforms and the determination of the factors affecting them can be better demonstrated by various simulation models that can be made in the future.

Ethics

Peer-review: Externally and internally peer reviewed.

Authorship Contributions

Concept: M.N.K., H.K., C.Ç., K.K., Design: M.N.K., H.K., C.Ç., K.K., Data Collection or Processing: M.N.K., H.K., C.Ç., K.K., Analysis or Interpretation: M.N.K., H.K., C.Ç., K.K., Literature Search: M.N.K., H.K., C.Ç., K.K., Writing: M.N.K., H.K., C.Ç., K.K.

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

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

References

1. Past Pandemics | Pandemic Influenza (Flu) | CDC [Internet]. Last Accessed Date:23.03.2020. Available from: https://www.cdc.gov/flu/pandemic-resources/basics/past-pandemics.html
2. Veil SR, Littlefield RS, Rowan KE. Dissemination as success: Local emergency management communication practices. Public Relat Rev [Internet]. 2009;35:449-51. Available from: http://linkinghub.elsevier.com/retrieve/pii/S0363811109000897

3. T.C.Health Ministry. National preparedness plan for pandemic influenza [Internet]. Ankara; 2019. Available from: https://www.grip.gov.tr/depo/saglik-calisanlari/ulusal_pandemi_plani.pdf
4. Kayman H, Ablorh-Odjidja A. Revisiting Public Health Preparedness: Incorporating Social Justice Principles Into Pandemic Preparedness Planning for Influenza Harvey. J Public Heal Manag Pract [Internet].2006;12:373-80. Available from: http://content.wkhealth.com/linkback/openurl?sid=WKPTLP:landingpage&an=00124784-200607000-00011
5. Steiger E, de Albuquerque JP, Zipf A. An advanced systematic literature review on spatiotemporal analyses of twitter data. Trans GIS 2015;19:809-34. Available from: http://doi.wiley.com/10.1111/tgis.12132
6. Latonero M, Shklovski I. Emergency management, twitter, and social media Evangelism. Int J Inf Syst Cris Response Manag 2011;3:1-16. Available from: http://services.igi-global.com/resolvedoi/resolve.aspx?doi=10.4018/jiscrm.2011100101
7. Wang Z, Ye X. Social media analytics for natural disaster management. Int J Geogr Inf Sci 2018 ;32:49–72. Available from: https://doi.org/10.1080/13658816.2017.1367003
8. Muniz-Rodriguez K, Ofori SK, Bayliss LC, Schwind JS, Diallo K, Liu M, et al. Social Media Use in Emergency Response to Natural Disasters: A Systematic Review With a Public Health Perspective. Disaster Med Public Health Prep 2020;14:139-49. Available from: https://www.cambridge.org/core/product/identifier/S1935789320000038 /type/journal_article
9. The Lancet. COVID-19: fighting panic with information. Lancet [Internet]. 2020;39:537. Available from: http://dx.doi.org/10.1016/S0140-6736(20)30379-2
10. Leung GM, Leung K. Crowdsourcing data to mitigate epidemics. Lancet Digit Heal 2020;2:e156-7. Available from: http://dx.doi.org/10.1016/S2589-7500(20)30055-8
11. WHO. Coronavirus disease 2019 [Internet]. Last Accessed Dare: 30.03.2020. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019
12. Droogers M, Ciotti M, Kreidl P, Melidou A, Penttinen P, Sellwood C, et al. European Pandemic Influenza Preparedness Planning: A Review of National Plans, July 2016. Disaster Med Public Health Prep 2019;13:582-92. Available from: https://www.cambridge.org/core/product/identifier/S1935789318000605/ type/journal_article
13. Digital 2020 - We Are Social Last Accessed Date: 30.03.2020. Available from: https://wearesocial.com/digital-2020

Review

DOI: 10.14235/bas.galenos.2020.4657
Bezmialem Science 2020;8(Supplement 2):48-57

COVID-19 Pandemic and Surge Capacity

COVID-19 Pandemisi ve Taşma Kapasitesi

Miraç Nevzat KARAKOÇ[1], Özcan ERDOĞAN[2]

[1]Çanakkale Special Provincial Administration, Investment and Construction Directorate, Çanakkale, Turkey

[2]Bezmialem Vakıf University Faculty of Medicine, Department of Disaster Management, İstanbul, Turkey

ABSTRACT

Disasters and pandemics experienced in recent years have shown the importance of emergency preparedness. Effectively responding to events leading to a large influx of patients that disrupt daily operations requires increased capacity. Not much resources may be available to recover losses in the current healthcare system. Therefore, plans should be made for the overflow capacity to accommodate a large number of patients before the disaster. In the face of a complex emergency epidemic, it is very important to identify and verify resources from the beginning of the outbreak in order to scale and use efficiently. It is necessary to make alternative plans and produce solutions against the worst possible scenario. In Coronavirus disease-2019 pandemics, as in all disasters and pandemics, trying to reduce the number of cases for overflow capacity, establishing alternative health facilities, minimizing the resource consumption of patients and increasing the bed capacity should be basic strategies. The need for excess resources arising in the overflow capacity experienced in a pandemic should be evaluated correctly and planning should be done accordingly. Therefore, it is necessary to create alternative areas. Projecting the underground car parks of the hospitals as underground hospitals in case of a nature-related disaster, and evaluating other closed areas within this scope; Again, the parks and reserve areas in the cities should be planned for the establishment of field hospitals against different scenarios against each natural disaster situation. With these plans, physical area demands that will occur in response to the overflow capacity can be supplied.

Keywords: COVID-19, pandemic, surge capacity, underground hospital

ÖZ

Son yıllarda yaşanan afetler ve pandemiler, acil durum hazırlığının önemini göstermiştir. Günlük operasyonları bozan büyük bir hasta akınına yol açan olaylara etkili bir şekilde yanıt verebilmek, kapasite artışı gerektirir. Mevcut sağlık sisteminde kayıpları gidermek için çok fazla kaynak bulunmayabilir. Bu nedenle afet öncesi, çok sayıda hastayı barındıracak taşma kapasitesi için planlar yapılmalıdır. Karmaşık bir acil salgın durumu karşısında kaynakların doğru ölçeklendirilmesi ve verimli bir biçimde kullanılabilmesi için salgının başlangıcından itibaren tespit edilmesi ve doğrulanması çok önemlidir. Ortaya çıkabilecek en kötü senaryoya karşı alternatif planlamalar yapmak ve çözüm üretmek gerekmektedir. Coronavirüs hastalığı-2019 pandemisinde de tüm afetlerde ve pandemilerdeki gibi taşma kapasitesine yönelik olarak olgu sayısını azaltmaya çalışmak, alternatif sağlık tesisleri kurmak, hastaların kaynak tüketimini en aza indirmek ve yatak kapasitesini arttırmak temel stratejiler olmalıdır. Bir pandemide yaşanan taşma kapasitesinde ortaya çıkan aşırı kaynak ihtiyacı doğru değerlendirilmelidir ve planlamalar buna göre yapılmalıdır. Bu sebeple alternatif alanlar yaratmak gerekmektedir. Hastanelerin yeraltında bulunan otoparklarının bir doğa kaynaklı afet durumunda yeraltı hastanesi olarak projelendirilmesi, diğer kapalı alanların da bu kapsamda değerlendirilmesi; yine şehirlerde yer alan park ve rezerv alanlarının da her bir afet durumuna karşı sahra hastaneleri kurulumu için planlanması gerekmektedir. Bu planlamalar ile taşma kapasitesine karşılık ortaya çıkacak fiziksel alan talepleri karşılanabilecektir.

Anahtar Sözcükler: COVİD-19, pandemi, taşma kapasitesi, yeraltı hastanesi

Address for Correspondence: Miraç Nevzat KARAKOÇ, Çanakkale Special Provincial Administration, Investment and Construction Directorate, Çanakkale, Turkey
E-mail: mnkarakoc@hotmail.com **ORCID ID:** orcid.org/0000-0001-7105-0858

Received: 21.05.2020
Accepted: 04.08.2020

Cite this article as: Karakoç MN, Erdoğan Ö. COVID-19 Pandemic and Surge Capacity. Bezmialem Science 2020;8(Supplement 2):48-57.

Introduction

Disasters cause physical, economic or social losses by leading to many damages in the places where they occur. As a result of disasters, for hospitals and the general public, when an event that causes a large number of acute injuries and/or patients occurs, it is important to evaluate and plan the number of available beds according to the need. The ability of a hospital to adapt to the sudden influx of patients who need to be hospitalized due to disasters or any other reason is called the 'surge capacity of hospitals' (1). Plans for surge capacity should allow the activation of more than one capacity from the routine level to the highest level of the healthcare facility. Therefore, before the disaster, plans for the surge capacity to accommodate a large number of patients should be made for each level.

Correct assessment of the surge capacity is also important when faced with outbreaks of infectious diseases that occur naturally or as a result of bioterrorism (2). In fact, surge capacity is not a new concept, as auxiliary hospitals were used in past smallpox and pandemic influenza events (3). Infectious disease outbreaks such as Severe Acute Respiratory Syndrome (SARS) or pandemic bird flu can potentially be considered as other examples of large-scale events (4).

Hospital Surge Capacity in Disasters

Outbreaks of infectious diseases in recent years have demonstrated the importance of emergency preparedness for major events affecting many people. To be able to respond effectively to events that generate a large influx of patients disrupting daily operations requires an increase in capacity. The main components of the surge capacity can be considered as "personnel, materials, structures and systems". In addition, a critical component of responding to large-scale disasters is the surge stress capacity (4). Effective health emergency preparedness requires planning of large-scale events that affect many people.

Emergencies and disasters can cause disorganization in social and organizational activities. On the other hand, effective management of these destructive and damaging events depends on anticipating the problems associated with these events and making plans to effectively respond to them. The first and foremost demand of people in these events is their health and well-being; Health systems should therefore play a key role in reducing deaths and injuries. All preparations and planning made by the hospital to cope with disasters constitute an important part of the health system programs used to reduce the loss and disability that may occur (5).

Hospital surge capacity is defined as the ability to provide acute care to both critical and non-critical mass events at the same time, and is an indicator of the ability to provide emergency care in the event of a disaster. The best international practice models for mass patient care state that the number of available operating rooms and the ability to take simple X-rays are the measures of the capacity to care for both critical and non-critical patients. The number of intensive care unit (ICU) beds is also one of the physical indicators of the capacity to provide care to critically hospitalized patients, but there is no internationally accepted criterion for this (6).

Many studies consider the ability to increase capacity in addition to using available resources to manage the sudden flow of injured people or patients with respect to surge capacity. Hospital surge capacity has 3 main components:

1. Human resources,

2. Specific/non-specific equipment,

3. Physical area.

The hospital surge capacity program is dynamic and needs to be constantly reviewed and updated when necessary. Excessive surge capacity programs should be developed and implemented on the basis of assessment and risk analysis. Therefore, before developing this program, risks or hazards threatening hospitals must be identified and hospital's security gap must be evaluated (5).

Surge capacity is an essential element of hospital disaster management plans and organizational endurance plans. However, the lack of a coherent and integrated approach has consequences that can leave some health facilities and surrounding communities vulnerable. Therefore, fluctuations that may occur in the scenarios created in hospital disaster plans drills may create a problem for hospital managers. For this reason, there is a need for fluctuation capacity protocols based on comprehensive plans that can be implemented in emergency situations (7).

Hospitals may not have sufficient space to accommodate patients in need of emergency medical care. Managers can take action for the sudden provision of additional medical services to meet the increased demand in response to surge capacity. Operational strategies that increase the surge capacity should be studied and how these can be implemented in the most effective way according to the characteristics of the hospitals should be determined (8).

1. Components of Surge Capacity

Surge capacity is defined as a significant increase in resource demand compared to basic demand. Regarding healthcare, surge represents a significant increase in demand for medical or public health resources. In addition to mass influx (volume ratio), surge also consists of event (type, scale and duration) and resource demand (consumption and deterioration) components. Figure 1 shows the surge response capacity as a function of surge capacity (resource availability) and surge (resource demand) components (9).

For natural disaster events, the components of the surge capacity are only defined broadly and many subcomponents are not defined. Also, the relative effect of the various components under different event scenarios is largely unknown. Nevertheless, surge response capacity, which is a new concept, can be expressed as a function of surge capacity and surge characteristics (9).

1. Use of Capacity in Hospitals

To interpret the relationship between the concepts of daily patient capacity and surge capacity; both concepts are similar in terms of struggling a large increase in both medical and public health resource demand and questioning system capacity. However, surge capacity, which is a term used for disaster events, is larger in scale, more complex, and has nonlinear multicomponent interactions incremental with capacity, compared to the simpler daily patient capacity (9).

In an event with a large number of patients, hospital surge capacity is the core of the hospital medical intervention and is an integral part of the total medical capacity of the affected community (10). Hospitals are the first structures that come to mind in health care, but expanded care facilities, community health centers, laboratories and public health departments also constitute the structural component of the surge capacity (4).

Operational decisions involved in managing surge capacity can be evaluated within a broader conceptual framework consisting of four stages: preparedness, response, recovery and mitigation (Figure 2).

Hospitals establish the hospital capacity during the preparation phase and determine the resources that can be used in emergency situations. During the response phase, the hospital responds to the emergency and controls its negative effects. During the recovery phase, the hospital continues its normal operations. In the mitigation phase, the hospital takes measures to reduce the severity and impact of an emergency on its operations (11).

Pandemic

Pandemics are disease outbreaks that are widespread, mostly as a result of the spread of infection from person to person and are declared by the World Health Organization (WHO) (12). The impact of the pandemic at the community level varies depending on the contagiousness of the microorganism, its virulence, the immune status of the individuals in the society, the contact among the individuals and transportation characteristics among societies, the presence of risk factors, the health services provided

$$\text{Taşma Yanıt Kapasitesi} = \text{Planlama} * \frac{\text{Azami Kullanılabilir Kaynaklar}}{\text{Kaynak Talebi}}$$

$$= \text{Planlama} * \frac{\text{Taşma Kapasitesi}}{\text{Taşma}}$$

$$= \text{Planlama} * \frac{\text{Sistem (Bütünlük)} * \text{Alan (Boyut * Nitelik)} * \text{Personel (Sayı * Yetenek)} * \text{Malzemeler (Miktar * Nitelik)}}{\text{Olay (Tür * Ölçek * Süre)} * \text{Kitlesel Akın} * \text{Kaynak Talebi (Tüketim * Bozulma)}}$$

Figure 1. The fluctuation capacity of the surge response capacity and its functional relationship with the fluctuation

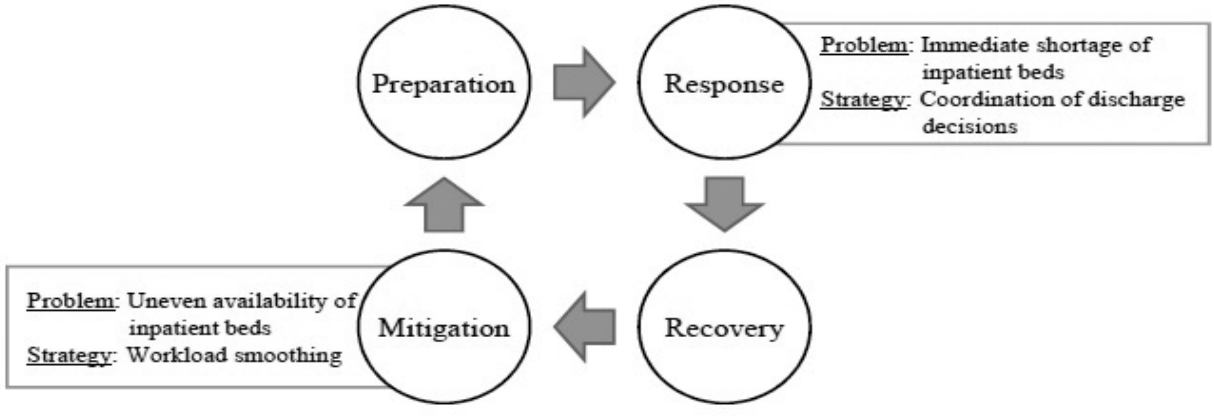


Figure 2. Problems-strategies in the framework of emergency response (4)

and the climate. Throughout human history, many important pandemics such as smallpox, cholera, plague, dengue, AIDS, influenza, SARS have been recorded (13).

1. COVID-19

The first coronavirus case was reported as a common cold in 1960. In a study conducted in Canada in 2001, a flu-like disease was observed in approximately 500 patients. It was confirmed by polymerase chain reaction method that 17-18 cases were infected by coronavirus during this pandemic. Corona was considered a simple non-fatal virus until 2002. In 2003, various reports were published with evidence that the coronavirus spread to many countries such as the United States of America, Hong Kong, Singapore, Thailand, Vietnam and Taiwan. In 2003, more than 1,000 cases of SARS were reported in coronavirus-infected patients who experienced the fatal syndrome (14).

The acute respiratory infection pandemic that we are currently experiencing, caused by COVID-19, occurred on December 12, 2019 in Wuhan, China, possibly caused by bats in a seafood market. Studies have suggested that the bat may be a potential reservoir of SARS-Coronavirus-2 (15). On January 7, 2020, it was announced that the causative virus was a new coronavirus (2019-nCoV) that was not previously detected in humans. Then, the name of the 2019-nCoV disease was accepted as COVID-19 (16). It is the seventh coronavirus causing disease in humans. The virus is named this way because of its crown-shaped (corona) protrusions (17).

Surge Capacity in Pandemics

Planning an unpredictable, effective, long-term and widespread health emergency is difficult, but imperative. It requires a "social integration" and a coordinated effort in which all public stakeholders collaborate (18). Significant assessments should be made when public health decisions are needed to be useful. For this purpose, a serious risk assessment should provide as much information as possible about an emerging outbreak to answer the following key questions.

- How fast do new cases occur?

- What types of diseases and complications are observed?

- Which groups of people (eg. age groups or groups at risk of serious consequences) will become severely ill and die?

- Is the microorganism sensitive to antimicrobial agents?

- How many people will get sick?

- How will it th affect the health sector, including factors such as healthcare use and impact on the health workforce?

Operationally, these questions will help guide decisions regarding vaccine production and strategy for its use, antimicrobial use, mobilization of health resources, school closures, and other social distancing strategies (19).

In the occurrence of a complex emergency pandemic, it is very important to detect and verify the outbreak from the beginning so that resources can be scaled correctly and used efficiently. In addition to all factors, patient surveillance in a hospital and communication infrastructure against risks are vital for controlling and struggling epidemics (7). It is recommended that hospital management move to a team that can provide clinical surge capacity and deploy quickly during the outbreak (20).

In pandemics, the primary care system is always needed to be sensitive and high-capacity. Pre-hospital screening and pre-hospital and post-hospital care are crucial to patient survival. Since there will be an intense increase in patients in the event of an epidemic, it is unthinkable for the emergency department to provide healthcare services to all patients or for hospitals to accept patients and provide care without evaluating the status of alternative facilities (21).

Epidemic and pandemic planning offers the opportunity to integrate the primary, secondary and tertiary levels by using the rules of public health and the public administrative resource infrastructure in increasing the health capacity in primary care and in the care service. With this planning, patients are helped to receive health care services at home with primary care under the supervision of a doctor (21).

It is difficult to respond to the need for healthcare services that will arise with the occurrence of excessive capacity increase in infectious disease epidemics and similar emergency health situations. There may be problems in meeting the need for extra bed (2).

Healthcare professionals have a responsibility to treat as many patients as possible to survive in a disaster or emergency. Responsible personnel evaluate patients under limited conditions and resources in the field of triage and rank them for treatment priority. Correct triage management is achieved by ensuring medical success with scarce resources. Triage is valid for all disasters regardless of their size (2).

In the event of a pandemic, home care may not be provided for pandemic influenza patients with complex respiratory management needs. Instead, some patients who need hospital-level care but do not need 24-hour supervision are provided care at home. By providing home care for these patients, hospital beds can be used for severe pandemic patients (22).

1. COVID-19 Surge Capacity Strategies

When designing health systems, the study is done according to the average patient load, not the number of patients that will arise in the presence of the epidemic. With the occurrence of COVID-19, it is seen that countries with a high number of patients are faced with a patient burden far above the capacity of health centers. For example, a study by Imperial College suggested an 8 to 30-fold increase in health system capacities for the UK and the USA (23).

The high rates of serious and critical cases in the development of the evolution of the epidemic in some countries have shown that the surge capacity must be increased rapidly in order to prevent the rapid depletion of medical supplies and the shortage of health personnel. It has been observed that the increase in cases has doubled or become more in three days in some countries. According to the largest cohort of COVID-19 patients, it has been observed that this disease is a mild disease that is symptomatic but does not require inpatient care in 40% of patients; a moderate disease that will require inpatient care in 40% of them; a disease requiring oxygen therapy or serious patient intervention in 15% of the patients; and a critical disease requiring mechanical ventilation in 5% of cases (24). This shows that 55% of patients need inpatient treatment. Considering the number of cases here, the available hospitalization areas may not be sufficient for the number of patients that will arise as a result of the surge capacity. A 4-item strategy has been considered to increase capacity (25).

a. Trying to reduce the number of COVID-19 cases in order to increase capacity: Explaining the ways of protection against the virus to the society, directing non-emergency patients to alternative health centers instead of emergency services, urgently discharging patients who need to be discharged, and postponing all unnecessary health services.

b. Establishment of alternative health facilities: Foundation of alternative medical centers (underground hospitals, field hospitals, activation of non-used/closed hospitals, use of nursing homes as health centers). Using places that do not provide medical services as health centers (public spaces, hotels, dormitories).

c. Minimizing the resource consumption of admitted patients: Giving patients only the health care they need. Patients should not be admitted to the isolation room except when necessary.

d. Increasing bed capacity: Taking low-risk patients into non-used areas for regular health care provides more space for high-risk patients who need ICU. Any area that provides a room standard and isolated environment can be used.

The Monroe State Administrator of the United States, Adam Bello, and health officials, which has been most affected by the COVID-19 virus, explained the stages of the plan for the surge capacity as follows (26);

Stage one: Make existing beds available and delay any non-emergency surgery.

Stage two: Transform the busy or outpatient clinics of the hospital into areas that can provide patient care.

Stage three: Expand into unconventional physical spaces, transform spaces such as corridors into patient care rooms, double the number of non-COVID-19 patients in private rooms.

Stage four: Create a field hospital.

2. Surge Capacity Strategies Against COVID-19 Pandemic in Turkey

With the occurrence of the COVID-19 crisis, countries have taken some measures to reduce the effects of the emerging crises. Forty-six of the 214 world countries (21.5%) announced at least 97 measures in response to the COVID-19 outbreak in the first periods of the pandemic (between February 1 and March 22, 2020). Thirteen countries (28.9% of the countries in the region) in the Asia and Pacific region, where the epidemic originated, announced the measures they took against the crisis. Later, 11 countries in Europe and Central Asia (36.2%), 11 countries in the American continents (24.4%) and 1 country in Arab countries (8.3%) explained the measures they took (Figure 3) (27).

The first COVID-19 case in Turkey was a patient who was detected to catch the virus as a result of a contact in Europe on March 11, 2020. In order to minimize the negative effects of the virus after the occurrence of the first case, the government of the Republic of Turkey started to work urgently for taking precautions with the guidance of the WHO and the Republic of Turkey Ministry of Health. The measures emerging as a result of these studies were put under a heading and published by the Ministry of Health (28);

1. Precautions to be Taken in Blood Centers

2. Measures to be Taken for Protection from COVID-19 in the Provinces where Seasonal Agricultural Workers will Go to Work

3. Measures to be Taken for Morgue and Burial Services

4. Precautions to be Taken at Airports

5. Recommendations for Security Control and Passport Officers at Airports

6. Precautions to be Taken in Accommodation Facilities

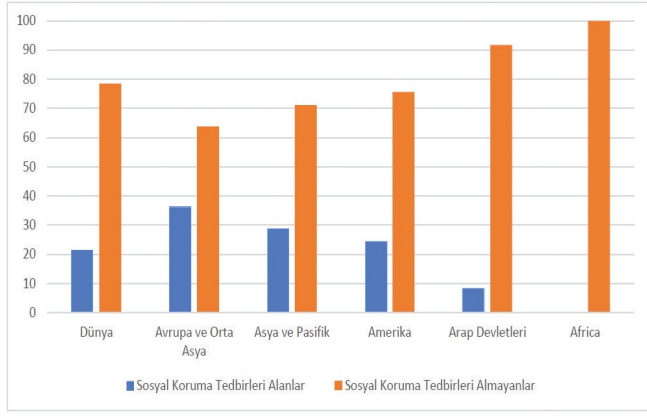


Figure 3. Percentage of countries to take social measures according to regions in the world

7. Cleaning Measures for Public Transportation Vehicles

8. Protection and Control Measures in Bank Branches

9. Measures to be Taken in Food Markets

10. Precautions to be Taken in Restaurants

11. Precautions to be Taken in Nursing Homes and Elderly Care Centers

12. Precautions to be Taken in Traditional and Complementary Medicine Units & Centers and Beauty & Medical Aesthetic Centers

13. Measures to be Taken in Penal Institutions of the Republic of Turkey Ministry of Justice.

Turkey has brought some rules for social measures in the context of determined struggle with COVID-19 pandemic;

- Airway transportation to 20 countries was stopped.

- A 14-day home quarantine obligation was imposed for citizens from abroad.

- Primary schools, high schools and universities were closed, and education activities were initiated on the internet from home.

- Administrative leave was given to pregnant women working in the public sector, those on breastfeeding leave, the disabled, those with chronic illnesses and personnel over 60 years of age until a second decision.

- A decision was made to work in turns for personnel in public sector.

- In order to raise the awareness of the public, public service announcements were started in all social media areas on the issues of virus protection and providing social distance.

- In all metropolitan cities (31 provinces) in the country, a curfew was imposed on weekends.

- The permissions of the soldiers in the barracks were stopped.

- Visits and transfers in penal institutions were suspended.

- Non-urgent trials and other judicial proceedings were postponed.

- Cultural and artistic activities were postponed.

- Mosques and masjids were closed to worship.

- Restrictions for going out were imposed first for citizens over the age of 65 years and then for those under the age of 20 years in Turkey.

- All scheduled national and international scientific activities, open and closed meetings, congresses, conferences, military exercises, paid military service calls were postponed.

- Activities where people come together, such as general assemblies and training activities, were postponed.

- Football, basketball, handball and volleyball competitions were postponed due to the COVID-19 outbreak until a new decision.

- The activities of places such as coffee houses, cafes, cinemas, theaters, concert halls, wedding halls, Turkish baths, sports halls, internet cafes, indoor children's playgrounds, condolence houses were temporarily suspended.

- Activities of entertainment places such as bars, casinos, and nightclubs, anf of museums and libraries were stopped.

- Production of protective equipment was increased in the public and private sector. Support was provided to many textile companies for the production of protective equipment. The sale and export of all protective equipment produced was prohibited.

- A local ventilator was designed and its production was started.

- Free masks were distributed to all citizens by the state.

- The number of laboratories for the detection of COVID-19 cases was increased to 36 within the country.

In addition, in order to prevent surge capacity in hospitals;

- At the hospital entrances, the pre-triage area was determined and the patients with suspected covid were identified.

- Non-urgent surgeries were stopped in order to minimize the density in health institutions and alleviate the burden on health personnel.

- All public and private hospitals were accepted as pandemic hospitals and started to serve free of charge for epidemic treatment.

- The number of hospital ICU beds was increased.

- Planning and preparations were made to transform normal patient rooms and operating rooms into ICU beds in case of need.

- In order to use the existing beds for COVID-19 infected patients, inpatients who did not have an emergency situation were discharged and followed up at their homes.

- When the symptoms of COVID-19 positive patients were improved, their treatment was planned and their quarantine processes were completed at their homes.

The COVID-19 pandemic has shown that the world may face an epidemic that will be devastating at any moment. As can be seen from the number of cases and deaths around the world, the health system in the world is not prepared for such big epidemic risks. Turkey has revealed a health care system that will be an example to the world in terms of the rates of cases and mortality, with the measures taken after the occurrence of the first case and strong infrastructure of the health system.

According to the COVID-19 Status Report published by the Ministry of Health on 30.06.2020, the total number of hospitalizations due to COVID-19 in Turkey is 105,416 (29). Currently, hospital capacities are sufficient; however, against

future epidemic risks that may arise at any time, the construction of two pandemic hospitals with a capacity of 1000 beds has been started in the district of Sancaktepe in Istanbul and in the Atatürk Airport area, which is closed to use, in Yeşilköy district. While each room of the hospitals is prepared for a single person, each room can be converted into an ICU room if needed, and both will have a fully-fledged hospital infrastructure.

Investigation of Surge Capacity in the COVID-19 Pandemic with SWOT Analysis Matrix

By conducting a SWOT analysis of the surge capacity in the COVID-19 pandemic, the strengths, weaknesses, opportunities and threats to be encountered were evaluated.

1. SWOT Analysis

The SWOT analysis applied is shown in the table below (Table 1).

For *strengths*, the strongest part emerging in the pandemic is the database on viruses. Knowing the viruses that have been seen before, their sources and treatment methods have created an important source of information in the fight against COVID-19. Despite the speed of the virus spreading, the ability to instantly share scientific studies on treatment in various parts of the world with the technological infrastructure is another strength, even if they are not approved. It is very important to use the press and social media correctly in order to slow the spread of the virus and to raise the awareness of the society. The rapid adaptation of the society to the pandemic process is effective in reducing the rate of spread of the virus.

For *weaknesses,* first of all, we can accept that the components of the virus are unknown and there is no vaccine to be used in treatment and prevention, as they negatively affect the treatment process. This not only delays the application of treatment methods against the virus, but also negatively affects the process of finding a vaccine that will be effective against the virus. The late detection of the source of the virus is one of the most important weaknesses for this process, because it directly affects the treatment process. Insufficient number of patient beds during the treatment process may prevent patients to access treatment. It can prevent the treatment of patients who need to be kept under surveillance at the hospital. Another important weakness is the insufficient number of health personnel to take part in the pandemic. A small number of personnel working at a busy pace can negatively affect the treatment process, and may cause transmission by reducing the resistance of the personnel to the virus. Also, the insufficient stocking of the drugs used in the treatment process is another important weakness. In case of pandemic risks that may arise at any time, not having enough medicine stock may negatively affect the treatment process. One of the most important weaknesses that directly affect the spread of the virus is the insensitivity and misconsciousness of the society to protection methods against the virus.

For *opportunities*, it is important to obtain new data in order to take precaution in advance against new types of viruses that may emerge. Making new plans for increasing the number of healthcare personnel in the occurrence of the pandemic, designing alternative physical places for hospitalization, facilitating the supply of drugs to be used in the treatment process, and providing protection materials (such as respirator, mask, gloves) can be considered as important opportunities.

For *threats*, the lack of information about the virus is a major threat that delays the availability of the vaccine. The insufficient number of healthcare professionals involved in the treatment process is an important factor that negatively affects patient treatment. Insufficient treatment areas and patient beds are among the biggest threats to patients' access to treatment. Incomplete or incorrect stocking of drugs to be used in the treatment process will negatively affect the treatment. Failure to raise the awareness of the society correctly and in time poses a serious threat to the rapid spread of the disease.

2. SWOT Matrix

The SWOT Matrix was applied to make a decision by focusing on strategically important elements with the data obtained through SWOT analysis. The SWOT Matrix applied is shown in the table below (Table 2).

Conclusion

The occurrence of pandemics is not limited to the winter season, and unlike seasonal flu, they can occur at any time of the year. In addition, they are not limited to a specific time and place, unlike an epidemic. Planning and measures to be taken before the epidemic occurs determine the level of economic and social impacts of the epidemic. The course of a pandemic can be reduced by effective infection control measures. The first of these control methods is to be prepared. Rapidly increasing urbanization also increases the patient burden in the health system. In parallel with this increase, in addition to strengthening the health system, planning should be made against possible outbreaks. Experiences have shown that no matter how advanced the health systems and technology in the countries are, there may be an epidemic situation beyond predictions. At this point, the resistance of existing health systems and technology cannot be a savior. It is necessary to make alternative plans and produce solutions against the worst scenario that may arise. The excessive resource need arising in the surge capacity experienced in a pandemic should be evaluated correctly and planning should be done accordingly. The pandemics that caused great losses have shown that one of the biggest resource demands is in physical areas. For this reason, it is necessary to create alternative areas. It is necessary to design underground parking lots of hospitals as underground hospitals and evaluate other closed areas within this scope, and to plan parks and reserve areas in cities for the establishment of field hospitals in case of any disaster. With these plannings, the physical space demands that will arise in response to the surge capacity can be met.

Table 1. SWOT analysis table for surge capacity during Coronavirus disease-2019 pandemic

SWOT analysis	
Strenghts in SWOT analysis	**Weaknesses in SWOT analysis**
1. Database infrastructure for viruses. 2. Technological infrastructure that allows data (even if not approved) to be shared quickly. 3. Rapid awareness raising of the society through press and social media. 4. Society's rapid adaptation to the pandemic process.	1. Unknown components of the virus 2. Inability to identify the sourse of the virus rapidly 3. Fast spreading capacity of the virus. 4. Despite the spreading speed, insufficient number of beds. 5. Insufficient number of health personnel compared to the number of patients. 6. Insufficient drugs used in the therapy process. 7. The society's insensitivity to protection methods from the virus. 8. The absence of any vaccine against the virus.
Opportunities in SWOT analysis	**Threats in SWOT analysis**
1. Obtaining new data against new types of viruses. 2. Evaluating alternatives to increase capacity in response to the pandemic. 3. Increasing the number of pandemic treatment areas. 4. Starting to produce new respirators. 5. Public and private sector's manufacturing for the supply of materials such as masks, gowns, gloves.	1. The long duration of finding the vaccine that will be effective against the virus. 2. Insufficient number of trained health personnel to take part in combating pandemic. 3. Lack of adequate hospitalization area for the patients. 4. Depletion of drugs used in the treatment process. 5. Inadequate respiratory equipment used in treatment. 6. Difficulties in supplying materials such as masks, gowns, gloves. 7. Not raising the right awareness of the public during the pandemic process.
SWOT Matrix	
Strengths	**Weaknesses**
SO strategy Using the data obtained through the pandemic process, studies can be conducted against new virus types that may emerge in the future. In this way, the diagnosis and treatment time can be shortened and the disease can be intervened quickly. Alternative projects and additional treatment centers should be opened to increase capacity in response to the pandemic. Designing the underground parking lots of hospitals as underground hospitals in case of a disaster, and evaluating other closed areas within this scope are important; Again, parks and reserve areas in cities should be planned for the establishment of field hospitals in case of any disaster. With these plans, the physical space demands that will arise in response to the surge capacity can be met. During the pandemic, the most needed materials (such as respirators, masks, gloves, gowns) are produced and the possibility of using them without disruption in healthcare services becomes possible. The production and export of these materials will also contribute to the national economy.	WO strategy Today, the communication infrastructure strong enough to provide information flow allows data and information about emerging diseases to be shared quickly. In this way, the information that can be used in the treatment process reaches the places that need to be reached quickly and contributes positively to the treatment period. In response to the spread of the virus, the capacities of health centers may not be sufficient. In this case, preparation should be made for the worst possible disasters and new projects should be produced to increase capacity. The number of existing health personnel can be considered to be planned and sufficient in response to predictable disaster situations. However, alternative planning can be made in case of unforeseen situations. For example; Health personnel working in different branches can also receive the necessary training in case of an extraordinary disaster and can take part as an additional health team in case of unforeseen situations. Care should be taken to stocking and following drugs that can be used in the treatment process. The drugs that may be needed most urgently should be determined and stock planning should be made according to the risks. In order to increase the knowledge and awareness of the society, planning should be made not only in the pandemic time but also in the normal process. Training programs should be prepared and included in our education system for all extraordinary disasters that may occur.
ST strategy	**WT strategy**
The rapidity of the communication system nowadays positively affects the duration of treatment in a pandemic that will arise. Quick sharing of information and data makes a significant contribution to finding the treatment. is actively used in the pandemic. It is also possible to use this communication opportunity in the training of health personnel who will actively work in the pandemic. With the correct use of press and social media, among these communication methods, the society can be made aware of the individual protection of people against the virus.	In order to reduce the spreading rate of the viruses that may arise, the society must first be informed correctly and in time. Trainings that will raise awareness can be given in for these risks in daily life. These trainings can be done not only in pandemic time but also in the usual time period for preparation and planning. In this way, the awareness of the society can be increased and it can be made more sensitive in case of disaster.
SO: Strengths-Opportunities, ST: Strengths-Threats, WT: Weakness-Threat, WO: Weaknesses-Opportunities	

Table 2. SWOT Matrix table of surge capacity during the Coronavirus disease-2019 pandemic process

$$\text{Surge Response Capacity} = \text{Planning} * \frac{\text{Maximum available resources}}{\text{Source demand}}$$

$$= \text{Planning} * \frac{\text{Surge Capacity}}{\text{Surge}}$$

$$= \text{Planning} * \frac{\text{system} * \text{Space} * \text{Personnel} * \text{Equipment}}{\text{Event} * \text{Massive influx} * \text{source demand}}$$

(Integrity) (size*quality) (number*ability) (amount*quality)

(Type*Extent*Time) (consumption*deterioration)

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Concept: M.N.K., Ö.E., Design: M.N.K., Ö.E., Data Collection or Processing: M.N.K., Ö.E., Analysis or Interpretation: M.N.K., Ö.E., Literature Search: M.N.K., Ö.E., Writing: M.N.K., Ö.E.

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

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

References

1. Davis D, Poste J, Hicks T, Polk D, Rymer T, Jacoby I. hospital bed surge capacity in the event of a mass-casualty incident. Prehosp Disaster Med 2005;20:169-76.
2. Jr Burkle FM. Mass casualty management of a large-scale bioterrorist event: An epidemiological approach that shapes triage decisions. Emerg Med Clin North Am 2002;20:409-36.
3. Hick JL, Hanfling D, Burstein JL, DeAtley C, Barbisch D, Bogdan GM, et al. Health care facility and community strategies for patient care surge capacity. Ann Emerg Med 2004;44:253-61.
4. Adams L. Exploring the concept of surge capacity. OJIN 2009;14:1-8.
5. Sheikhbardsiri H, Raeisi AR, Nekoei-Moghadam M, Rezaei F. Surge capacity of hospitals in emergencies and disasters with a preparedness approach: a systematic review. Disaster Med Public Health Prep 2017;11:612-20.
6. Traub M, Bradt DA, Joseph AP. The Surge Capacity for People in Emergencies (SCOPE) study in Australasian hospitals. Med JAust 2007;186:394-8.
7. Rathnayake, D., Clarke, M. ve Jayasooriya, L. Hospital surge capacity: The importance of better hospital pre-planning to cope with patient surge during dengue epidemics-A systematic review. Int J Health Manag 2009:1-8.
8. Mills A, Helm J Wang Y. Surge Capacity Deployment In Hospitals: Effectiveness Of Response And Mitigation Strategies. Kelley School of Business Research Paper 17-35.
9. Kelen GD, McCarthy M L. The science of surge. Acad Emerg Med 2006;13:1089-94.
10. Jamil J, Zuabi S, Subbarao I. Disaster metrics quantitative benchmarking of hospital surge capacity trauma-related multiple casualty events. Disaster Med Public Health Prep 2011;5:117-24.
11. Mills A, Helm J, Wang Yu. (2017). Surge Capacity Deployment In Hospitals: Effectiveness Of Response And Mitigation Strategies. SSRN Electronic J 2017:1-32.
12. WHO. WHO Pandemic Influenza Preparedness And Response. Switzerland; 2010.
13. Morens DM, Folkers GK, Fauci AS. What is a pandemic? J Infect Dis 2009;200:1018-21.
14. Lina B. Paleomicrobiology-Past Human Infections. In; Rault D, Drancourt M, editors. Berlin:Springer; 2008.p.199-211.
15. Tognotti E. Influenza pandemics: a historical retrospect. J Infect Dev Ctries 2009;3:331-4.
16. Taubenberger JK, Morens DM. 1918 Influenza: the mother of all pandemics. Emerg Infect Dis 2006;12:15-22.
17. Canadian Pandemic Influenza Plan. (2004). Available from: http://www.phac-aspc.gc.ca/cpip-pclcpi/
18. WHO. WHO Pandemic Influenza Risk Management. 2017. Available from: https://www.who.int/influenza/preparedness/pandemic/influenza_risk_management_update2017/en/
19. Kumar D, Malviya R, Sharma P. Corona virus: A review of COVID-19. EJMO 2020;4:8-25.
20. Guo YR, Cao QD, Hong ZS, Tan YY, Chen SD, Jin HJ, et al. The origin, transmission and clinical therapies on coronavirus disease 2019 (COVID-19) outbreak - an update on the status. Mil Med Res 2020;7:11.
21. Karakoç Y. New Corona Virus (COVID-19) Latest Status and Information Note. (2020). Public Health Professionals Association. Last Accessed Date: 01.04.2020. Available from: https://hasuder.org.tr/yeni-corona-virus-covid-19-son-durum-ve-bilgi-notu/
22. TYBD. Management Of Critical Patients Infected With Covid-19 And Management Of Covid 19 Critical Patients. Türk Yoğun Bakım Derneği; 2020.
23. Connolly MA, Gayer M, Ryan MJ, Salama P, Spiegel P, Heymann DL. Communicable diseases in complex emergencies: impact and challenges. The Lancet 2004;364:1974-83.
24. Mazowita, G. role for primary care. Can Fam Physician 2006;52:951.

25. Hogg W, Lemelin J, Huston P, Dahrouge H. Increasing epidemic surge capacity with home-based hospitalcare. Can Fam Physician 2006;52:563-4.

26. Izmirlieva M. COVID-19 Pandemic: health system surge capacity. Last Accessed Date: 20.03.2020. Available from: https://ihsmarkit.com/research-analysis/covid19-pandemic-health-system-surge-capacity.html

27. WHO. Operational Considerations For Case Management Of COVID-19 In Health Facility And Community. 2020. Available from: https://apps.who.int/iris/handle/10665/331492

28. Helman A, Helman R, Kollek D. ED Surge Capacity Strategies in the COVID-19 Pandemic. Last Accessed Date: 01.04.2020. Available from: https://emergencymedicinecases.com/surge-capacity-strategies-covid-19/

29. Green, K. Bello Announces 4-Part Surge Capacity Plan For Local hospitals COVID-19 Efforts. Last Accessed Date: 30.03.2020. Available from: https://www.rochesterfirst.com/coronavirus/watch-live-bello-to-announce-surge-capacity-plan-for-local-hospitals-covid-19-efforts/

30. ILO. (2020). Social protection measures against the COVID-19 crisis in the world. ILO Social Protection Monitoring System. Available from: https://www.ilo.org/ankara/publications/WCMS_741444/lang--tr/index.htm

31. Covid-19'a Yönelik Kamu, Kurum ve Kuruluşların Alacağı Önlemler. (2020). T.C. Sağlık Bakanlığı. Last Accessed Date: 30.04.2020. Available from: https://covid19bilgi.saglik.gov.tr/tr/diger-kamu-kurumlari

Review

DOI: 10.14235/bas.galenos.2020.4798
Bezmialem Science 2020;8(Supplement 2):58-62

Perioperative Precautions for Novel Coronavirus Outbreak

Yeni Coronavirüs Salgınında Perioperatif Dönem Korunma Önlemleri

Mahmut DAĞCI[1], Hatice Merve ALPTEKİN[2]

[1]Bezmialem Vakıf University Faculty of Health Sciences, Division of Nursing, İstanbul, Turkey

[2]İstanbul University Cerrahpaşa Florence Nightingale Faculty of Nursing, İstanbul, Turkey

ABSTRACT

Coronavirus disease 2019 (COVID-19) virus, a sub-member of the coronavirus family, that first appeared in China, has been declared a pandemic in the world due to its rapid spread and spread by airborne transmission. Since all patients diagnosed with COVID-19 do not have symptoms, it is difficult to recognize people with or without disease. When patients with suspected or diagnosed COVID-19 surgery need to be operated in urgent or emergent situations, measures must be taken to protect the patient and the operating room staff. The operating room team should know the procedures to be applied if fixtures and surgical instruments in the operating room are used in cases of suspected COVID-19. In these cases, training should be provided on the effective use of personal protective equipment, precautions to be taken, and health institutions should be able to manage the preoperative, perioperative and postoperative process of patients with suspected COVID-19 or diagnosis. Health institutions should prepare an emergency plan to be applied in pandemic situations. The aim of this was study to present how to manage the perioperative process of surgical patients in COVID-19 pandemic.

Keywords: Coronavirus, COVID-19, operating room, surgery, perioperative management

ÖZ

İlk olarak Çin'de ortaya çıkan coronavirüs ailesinin alt üyesi Coronavirüs hastalığı 2019 (COVİD-19) virüsü, damlacık yoluyla hızlıca bulaşıp yayılması nedeniyle Dünya'da pandemi ilan edilmesine neden olmuştur. COVİD-19 tanısı konan hastaların hepsinde semptomlar görülmediğinden hastalığa yakalanmış veya yakalanmamış kişilerin ayrımının yapılması zordur. COVİD-19 şüpheli/tanısı doğrulanmış hastaların acil veya ertelenmeyecek durumlarda ameliyat edilmesi gerektiğinde hastayı ve ameliyathane ekibini koruyacak önlemler alınması gerekmektedir. Ameliyathane ekibi ameliyathane odasındaki demirbaşların ve cerrahi aletlerin COVİD-19 şüphesi barındıran olgularda kullanılması halinde uygulanacak prosedürleri bilmelidir. Ameliyathane ekibine bu olgular için kişisel koruyucu ekipmanların etkin kullanımı ve alınması gereken önlemler ile ilgili eğitim verilmelidir. Sağlık kurumları da pandemi durumlarında uygulanacak acil durum planını hazırlayarak COVİD-19 şüpheli/tanısı doğrulanmış hastaların preoperatif, perioperatif ve postoperatif sürecini yönetebilmelidir. Bu çalışmada COVİD-19 pandemisinde cerrahi tedavi gereksinimi olan hastaların periopertatif sürecinin nasıl yönetileceğinin anlatılması amaçlanmaktadır.

Anahtar Sözcükler: Coronavirüs, COVİD-19, ameliyathane, cerrahi, perioperatif yönetim

Address for Correspondence: Mahmut DAĞCI, Bezmialem Vakıf University Faculty of Health Sciences, Division of Nursing, İstanbul, Turkey
Phone: +90 554 761 89 39 **E-mail:** mdagci@bezmialem.edu.tr **ORCID ID:** orcid.org/0000-0003-0883-9129

Received: 08.06.2020
Accepted: 04.08.2020

Cite this article as: Dağcı M, Alptekin HM. Perioperative Precautions for Novel Coronavirus Outbreak. Bezmialem Science 2020;8(Supplement 2):58-62.

Introduction

The first case of the COVID-19 [Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2)] pandemic, which has surrounded the whole world today and in which 11,669,259 cases have occurred in the world as of July 8, 2020, and 539,906 of these cases died, emerged in Wuhan city of Hubei state in China at the end of December, 2019 (1-4).

With the occurrence of the cases in the UK at the end of January 2020, the epidemic spread to Europe and the number of cases increased rapidly, resulting in devastating effects on the society (1,5). In Turkey, the first case of COVID-19 was seen on March 11, 2020 (6). The World Health Organization (WHO) declared the COVID-19 pandemic on March 11, 2020, due to the rapid spread of the virus and the rapid increase in pneumonia cases and patients in need of intensive care in parallel with the cases (7,8).

It is known that most of the deaths caused by the COVID-19 virus are seen in individuals with suppressed immune system for any reason, hypertension, diabetes mellitus and comorbid diseases and in the elderly and male populations (9). COVID-19 mortality rates (0.25-3%) are not as high as in SARS-CoV-1, but when the transmission rate is compared, SARS-CoV-1 spreads faster (10). No symptoms or mild symptoms in 80% of infected patients make it difficult to diagnose the disease. It is stated that 15% of the patients show severe symptoms and only 5% of them are in critical condition (11). Fever, cough and mild pneumonia are observed in mild cases. In severe cases, in addition to fever and cough, dyspnea and hypoxia requiring supplementary oxygen therapy are observed. In critical cases, intensive care support is required due to respiratory failure, shock or multi-organ failure (5,12,13). The rapid spread of COVID-19 made it necessary to take measures to manage the epidemic, so it was decided to postpone all elective surgeries (8,14,15). However, it is stated that infected patients should be operated in emergency situations or in cases that cannot be postponed, by taking protective measures (14).

In the studies, it is reported that guides containing the precautions to be taken during the perioperative process to be used in cases with COVID-19 have been prepared for the operating room team (OR head nurses, operating room nurses, surgeons, anesthesiologists, anesthesia technicians, and operating room technicians) (14,16).

In emergency or non-postponed surgical interventions, the preoperative, perioperative and postoperative process management of patients who are suspected for/diagnosed with COVID-19 should be known in detail by the operating room team (14).

In this study, it is aimed to explain how to manage the periopertative process of patients who need surgical treatment in the COVID-19 pandemic.

Measures Taken by Health Institutions

Considering that COVID-19 infection can spread in hospitals, it is recommended to take general measures to prevent transmission. The main reason for the measures taken is to keep the capacity of the existing health system sufficient against COVID-19 cases, which are expected to increase. In this context, in parallel with the nation-states in the world, non-emergency surgeries have been primarily postponed in Turkey. Later, the Ministry of Health has defined a "pandemic hospital" (6). In order to manage the pandemic process effectively, consumption of medical consumables and surgical applications should be minimized and attention should be paid to the distribution of personnel. It has been reported that operating rooms other than emergency operating rooms can be converted into intensive care units, as the bed capacity is limited for patients in need of intensive care (17). In addition, it is recommended to re-plan shift hours, break times, social distances during meals and rest in order to prevent the spread of COVID-19 among the operating room team (6,18).

Within the scope of COVID-19 measures, a decision tree algorithm has been created in order for the operating room team to evaluate the risk status of the patients (1,19). According to this algorithm, every patient must be considered to be carrying the COVID-19 virus until proven otherwise. In order to prevent the spread of the disease, emergency action plans previously developed by health institutions should be implemented (20). In order to minimize the spread of COVID-19 and protect healthcare personnel, training on personal protective equipment (PPE) is recommended (18). In the study of Forrester et al. (1), they reported that a decision was made to delay the surgical intervention for patients who had a positive COVID-19 test and who had symptoms such as fever, cough and sore throat. In cases where surgical intervention cannot be delayed, reverse transcription-polymerase chain reaction test is performed. While surgical team members perform standard procedures for patients with negative test results, it is reported that all operating room team uses N95 or N99 masks, face guards, surgical gloves, surgical gowns and protective overalls required for droplet isolation for patients with positive test results (1,21).

Preoperative Precautions

It is recommended that patients with suspected/confirmed COVID-19 infection be transferred to the operating room via a predetermined and isolated path, and the paths and corridors passed by the patient, including elevators, should be disinfected after the transfer is completed (18).

The team transferring the patient should receive special training on "transfer of the patient with risk of transmission through droplets" (6,18). In addition, the use of negative pressure stretchers and ventilators is recommended for patients coming from the intensive care unit (whether intubated or not), and it is reported that the endotracheal tube should be clamped to prevent aerosolization when the gas flow is turned off and the ventilators are changed (2,16).

In order to reduce and control the personnel entry and exit to the operating room, the instruments (intubation tools, anesthetics, peripheral artery/central venous cannulas, injectors, gauze, surgical instruments and sutures) to be used during the operation

of the patient with COVID-19 should be ready before surgery in line with the recommendations of Association of periOperative Registered Nurses (AORN) (22). In addition, it is recommended to check the devices and anesthetic equipment to be used during surgery beforehand. In the study of Lerardi et al. (23) (2020), it is stated to be important to cover inventory stock, such as the pendants, anesthesia devices, cabinets, tables etc. used in the operating room, with a clear drape for infection control.

Another recommendation is to remove out the equipment such as cabinets and tables that are not needed in the operating room during the preoperative period in order to reduce the surface area where the virus will be transmitted (24). The surgery of the COVID-19 suspected/diagnosed patient includes some different prevention measures, apart from standard infection prevention measures (Figure 1).

PPE used in standard surgical procedures includes surgical mask, surgical shirt, surgical cap, surgical gloves and protective glasses (18). It is recommended to use N95 or N99 masks, protective overalls, shoe covers and face shield in addition to standard prevention measures when performing surgical intervention in patients with suspected/confirmed diagnosis of COVID-19 (18,21). In the study conducted by Tan et al. (3) (2020), the importance of wearing the equipment in front of the mirror is emphasized so that the operating room team can see that the PPE is worn correctly and completely. It is reported that mirrors can be placed in operating rooms to facilitate this application. In addition to all these prevention methods, it is recommended to use

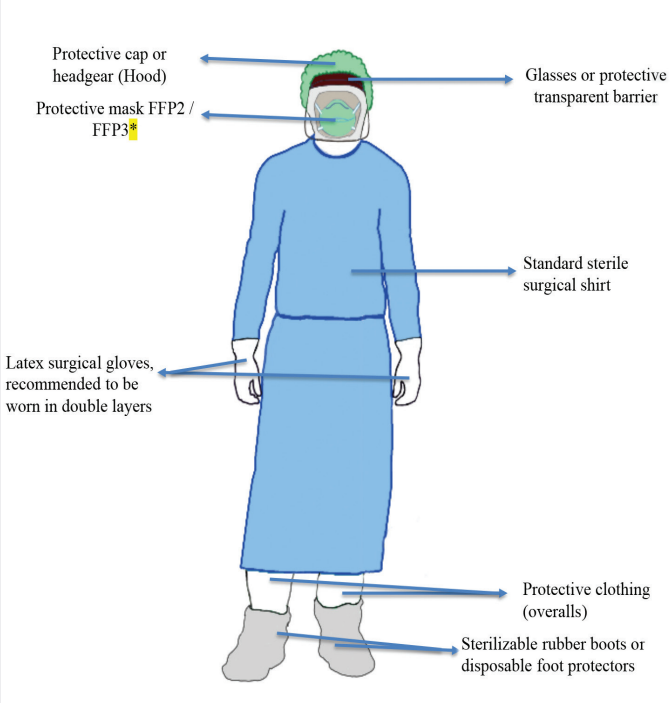


Figure 1. Use of personal protective equipment in the surgery of the patient with suspected/diagnosed COVID-19 *It is recommended to use powered air-purifying respirator in the surgical treatment of patients with suspected/confirmed COVID-19.

devices with active air filtering [(powered air-purifying respirator (PAPR)] in patients with suspected/confirmed COVID-19 (21). It is known that there is water vapor and granular structures in the surgical smoke that occurs when using devices that generate heat energy such as electrocautery (25). Although it is seen as a low possibility, it has been reported that the COVID-19 virus may rise to the water vapor contained in the surgical smoke and contact the healthcare staff (26). PAPR ensures the safety of the operating room team by providing both droplet filtration and filtering electrocautery smoke (21). Although PPE is necessary for the safety of operating room staff, there are difficulties and limitations in working with these equipment. Tan et al. (3) reported in their study that the operating room team had difficulties in wearing PAPR and had problems with battery life, and the face shields they used caused reflection and communication problems. It is recommended to use paper and pencil for written communication to facilitate communication among team members using PPE.

Intraoperative Precautions

In AORN recommendations, it is recommended to have as few personnel and equipment in the operating room during surgery as possible. There should be a maximum of five health personnel in the room, and entry and exit should be restricted as much as possible (27). In addition, it is recommended that the operating room team perform surgical hand washing in specially reserved areas for the surgery of patients with COVID-19 infection (18). The operating room nurse is responsible for the readiness of the operating room, for him/her and his/her teammates to wear protective equipment (PPE or PAPR), and for taking the patient to the operating table safely (16). Therefore, it is important for the operating room nurse to make the necessary checks before the operation starts. The protection measures to be taken in the operating room are given in Table 1. During the surgery, it is recommended that the healthcare team take precautions for the focus of infection as well as using PPE. WHO reports that there are difficulties in accessing protective equipment during the pandemic period and draws attention to this issue (28). Similarly, in the study conducted by Lai and Chang (29) (2020) in Taiwan, it is seen that researchers try to produce different solutions due to the lack of protective equipment. It is reported that a disposable intubation shield made of cardboard was designed by researchers to be used during the intubation of patients with suspected/confirmed COVID-19. It has been suggested that this face shield can reduce the transmission of infection via droplet during intubation or extubation.

Postoperative Precautions

In the COVID-19 pandemic, the management of postoperative period includes the transfer of patients to the units and planning for the treatment to be applied. Since postoperative respiratory problems are more common in COVID-19 patients, an interdisciplinary team including anesthesiologists and pulmonologists should decide on the treatment. Post operative planning includes the cleaning of both the operating room and the equipment used in surgery, and the disposal of used consumables. (19).

Table 1. General protection measures to be taken in the operating room in the COVID-19 pandemic

- Patients with suspected or confirmed disease should be paid more attention (14).
- All personnel who will come into contact with patients should use personal protective equipment (16).
- Infected patients should be moved as little as possible (6).
- Transfer routes should be planned precisely and a short route should be used as much as possible (6).
- During the perioperative process, a safe surgical checklist should be applied and supervised, and if possible, it should be done electronically with touch screen devices to facilitate decontamination (19).
- Surgery of patients with suspected/confirmed COVID-19 should be performed in a separate operating room with isolation precautions. This room should be as close to the patient transfer area as possible (18).
- Since it has been determined that the COVID-19 virus can remain on materials such as stainless steel and plastic in operating rooms for 3 days, disposable materials should be preferred if possible (19).
- After the patient enters the operating room, the doors of the room should be closed and kept closed until the end of the surgery (18).
- There should be as few medical personnel as possible in the operating room (20).
- The operating team should come to the operating room on time and should not leave the room during surgery (18,27)
- It is recommended that the number of air changes is >25 changes/hour in the operation of the patient with suspected/confirmed COVID-19 (3).
- Patient files and nurse records should be kept outside the operating room (19).
- At the end of each intervention, all surfaces and electromedical devices should be properly disinfected (14).
- The operating room team should remove their personal protective equipment in a specially reserved area outside the room after surgery (14).
- The operating room team should take a shower, if possible, after each operation (18).

The operating room and dressing areas should be disinfected as soon as possible after the operation of patients with suspected/confirmed COVID-19. 1000 mg/L sodium hypochlorite solution should be used for cleaning operating rooms and patient contact areas. In addition, it is recommended to use hydrogen peroxide vaporizer or ultraviolet-C irradiation for disinfection (2,19). Reusable surgical instruments should be washed, dried, and decontaminated by disinfection or sterilization process after surgery. It is recommended that electromedical devices (ventilator, electrocautery, etc.) be cleaned with a chloro-derivative solution and then allowed to dry. It is recommended that the devices whose cleaning process is completed are then disinfected with chloro-derivative at a concentration of ≥0.1% or 1000 ppm (18). If there is no visible contamination on devices such as surgical optics or cameras used in the surgery of patients with suspected/confirmed COVID-19, it is recommended to be kept in 1000 mg/L chlorine-containing disinfectant for 30 minutes. If there is visible contamination on these instruments, they should be kept in 5000 mg/L chlorine-containing disinfectant for 30 minutes and then packaged and sterilized after drying (14).

Disposable materials used in the surgery of the patient with a suspected/confirmed COVID-19 should be disposed of at the end of the surgery. It is recommended to have a separate medical waste container in front of the operating room for medical waste generated during the operation of the patient with suspected/confirmed COVID-19. Other suggestions include having this medical waste box with a cover, constantly keeping the cover closed, throwing the sharp objects into sharp object container, and replacing the visibly damaged waste containers (18).

Conclusion

Emergency surgical interventions can be performed even when elective surgeries are postponed during the COVID-19 pandemic. In order for healthcare professionals serving the community to be protected from the virus, health institutions must take the necessary precautions, provide protective equipment and prepare their own pandemic plans.

During the COVID-19 pandemic, it is recommended to conduct more studies with high evidence level on operating room management.

Peer-review: Externally and internally peer reviewed.

Authorship Contributions

Concept: M.D., H.M.A., Design: M.D., H.M.A., Data Collection or Processing: M.D., H.M.A., Analysis or Interpretation: M.D., H.M.A., Literature Search: M.D., H.M.A., Writing: M.D., H.M.A.

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

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

References

1. Forrester JD, Nassar AK, Maggio PM, Hawn MT. Precautions for operating room team members during the COVID-19 pandemic. J Am Coll Surg 2020;230:1098-101
2. Karaca AS, Özmen MM, Uçar AD, Yastı AÇ, Demirer S. General surgery operating room applications in patients with COVID-19 .

Turk J Surg, 2020;36:6-10.

3. Tan Z, Phoon PHY, Jing F, Ting LX. Response and operating room preparation for the COVID-19 outbreak: a perspective from the National Heart Centre Singapore. J Cardiothorac Vasc Anesth 2020;34:2331-3
4. WHO, Coronavirus Disease (COVID-19) Dashboard, Last Accessed Date: 25.05.2020. Available from: https://covid19.who.int/
5. Brücher BL, Nigri G, Tinelli A, Lapeña JFF, Espin-Basany E, Macri P, et al. COVID-19: Pandemic surgery guidance. 4open 2020;3:19.
6. Mavioğlu HL, Ertekin UÜ, Aşkın G, Küçüker ŞA, Özatik MA. Perioperative planning for cardiovascular operations in the COVID-19 pandemic. Turkish J Thorac Cardiovasc Surg 2020;28:236-43.
7. Al-Balas M, Al-Balas HI, Al-Balas H. Surgery during the COVID-19 pandemic: a comprehensive overview and perioperative care. Am J Surg 2020;219:903-6
8. Çakmak G, Cömert M. The Reality of Sars-CoV-2 (COVID-19) and Zonguldak Bülent Ecevit University Faculty of Medicine Department of General Surgery current surgical approach recommendations in the pandemic Process. Batı Karadeniz Tıp Derg 2020;4:1-6.
9. Applegate WB, Ouslander JG. COVID-19 presents high risk to older persons. J Am Geriatr Soc 2020;68:681
10. Aktoz M, Altay H, Aslanger E, Atalar E, Atar İ, Aytekin V. ve ark. Türk Kardiyoloji Derneği Uzlaşı Raporu: COVID-19 Pandemisi ve Kardiyovasküler Hastalıklar Konusunda Bilinmesi Gerekenler. Turk Kardiyol Dern Ars 2020;48:1-87.
11. Abdelrahman T, Beamish AJ, Brown C, Egan RJ, Evans T, Ryan Harper E. et al. Surgery during the COVID-19 pandemic: operating room suggestions from an international Delphi process. Br J Surg 2020:10.1002/bjs.11747.
12. Steward J, Kitley WR, Schmidt CM, Sundaram CP. Urologic surgery and COVID-19: How the pandemic is changing the way we operate. J Endourol 2020;34:541-9.
13. Sohrabia C, Alsafi Z, O'Neilla N, Khan M, Kerwan A, Al-Jabir A. World Health Organization declares global emergency: Are view of the 2019 novel coronavirus (COVID-19). Int J Surg 2020;76:71-6.
14. Kamer E, Çolak T. What to do when a patient infected with COVID-19 needs operation: pre-surgery, during surgery, and post-surgery guide. Turk J Colorectal Dis 2020;30:1-8.
15. Flemming S, Hankir M, Ernestus RI, Seyfried F, Germer CT, Meybohm P. et al. Surgery in times of COVID-19-recommendations for hospital and patient management. Langenbecks Arch Surg 2020; 405:359-64.
16. Ti LK, Ang LS, Foong TW, Ng BSW. What we do when a COVID-19 patient needs an operation: operating room preparation and guidance. Can J Anesth 2020;67:756-8..
17. Peters AW, Chawla KS, Turnbull ZA. Transforming ORs into ICUs. New England J Med 2020;382:e52.
18. Coccolini F, Perrone G, Chiarugi M, Di Marzo F, Ansaloni L, Scandroglio I. et al. Surgery in COVID-19 patients: operational directives. World J Emerg Surg 2020;15:25
19. Türk Cerrahi ve Ameliyathane Hemşireliği Derneği. COVID-19 Salgını İçin Ameliyathanede Alınması Gereken Önlemler. 2020. https://www.tcahd.org/gorseller/ files/covid-19/ COV%C4%B0D-19%20Ameliyat%20Y%C3%B6netimi%20 Rehberi.pdf.
20. Collaborative C. Global guidance for surgical care during the COVID-19 pandemic. The British Journal of Surgery 2020.
21. Brat GA, Hersey S, Chhabra K, Gupta A, Scott J. Protecting surgical teams during the COVID-19 outbreak: a narrative review and clinical considerations. Ann Surg 2020;17:10.
22. AORN. AORN Position Statement on Perioperative Safe Staffing and On-Call Practices, 2014.
23. Lerardi AM, Wood BJ, Gaudino C, Angileri SA, Jones EC, Hausegger K, Carrafiello G. How to handle a COVID-19 patient in the angiographic suite. Cardiovascular and Interventional Radiology, 2020;1.
24. Moletta L, Pierobon ES, Capovilla G, Costantini M, Salvador R. ve ark. International Guidelines And Recommendations For Surgery During Covid-19 Pandemic: A Systematic Review. International Journal of Surgery,2020;79:180-188. https://doi.org/10.1016/j.ijsu.2020.05.061.
25. Choi SH, Kwon TG, Chung SK, Kim TH. Surgical smoke may be a biohazard to surgeons performing laparoscopic surgery. Surgical Endoscopy,2014; 28(8):2374-2380.
26. Sookaromdee P, Wiwanitkit V. COVID-19 Among Medical Personnel İn The Operating Room. Infection Control & Hospital Epidemiology, 2020.
27. AORN. AORN Position Statement on Perioperative Safe Staffing and On-Call Practices, 2014.
28. WHO. Shortage of personal protective equipment endangering health workers worldwide. Newsroom, March, 3, 2020.
29. Lai YY, Chang CM. A carton-made protective shield for suspicious/ confirmed COVID-19 intubation and extubation during surgery. Anesthesia and Analgesia, 2020.

Letter to Editor

DOI: 10.14235/bas.galenos.2020.5049
Bezmialem Science 2020;8(Supplement 2):63-66

Effective implementation of unprecedented measures for the protection from COVID-19 syndrome

COVİD-19 Sendromuna Karşı Alınan Olağanüstü Önlemlerin Etkin Uygulaması

Adem ÖZKARA[1], Katrina LAMBERT[2], Duygu AYHAN BAŞER[3], Bircan ERBAS[2]

[1]University of Health Sciences Turkey, Department of Family Medicine, Ankara, Turkey
[2]La Trobe University, Public Health Department, School of Psychology and Public Health, Australia
[3]Hacettepe University Faculty of Medicine, Department of Family Medicine, Ankara, Turkey

ABSTRACT

Despite 82 million populations, Turkey is one of the countries with the lowest mortality rates in the world as a result of successful crisis management and public compliance. Turkey's public health response to the COVID-19 pandemic has been rapid and continually evolving as described here. In this short communication we offer insight into the preparedness and response by Turkey of this continued global health threat posed by COVID-19. Turkey implemented multiple containment strategies prior to the first reported case within its borders- to reduce the burden and deadly risk of the virus. In the absence of a specific vaccine, governments, health care professionals and communities in general are continually working together to reduce exposure, infection, clinical severity and community transmission of COVID-19.

Keywords: Republic of Turkey, COVID-19, measures, public health

ÖZ

Türkiye, 82 milyon nüfusa rağmen, başarılı kriz yönetimi ve kamu uyumuna bağlı olarak dünyada COVİD-19'a bağlı en düşük ölüm oranına sahip ülkelerden biridir. Türkiye'nin COVİD-19 salgınına karşı toplum sağlığı olarak cevabı bu yazıda da açıklandığı gibi hızlı ve sürekli olarak gelişmektedir. Bu kısa derlemede, COVİD-19'un sürdürdüğü bu küresel sağlık tehdidine karşı Türkiye'nin hazırlık ve müdahale uygulamalarını sunuyoruz. Türkiye, virüsün yükünü ve ölümcül riskini azaltmak için sınırlarında bildirilen ilk olgudan önce birden çok sınırlama stratejisi uygulamıştır. Belirli bir aşının bulunamaması durumunda, COVİD-19'un maruziyetini, enfeksiyon ve klinik şiddetini ve toplum bulaşını azaltmak için genel olarak hükumet, sağlık uzmanları ve toplum birlikte çalışmak durumundadır.

Anahtar Sözcükler: Türkiye Cumhuriyeti, COVİD-19, önlemler, toplum sağlığı

The global nightmare of a new strain of the coronavirus -COVID-19- is unprecedented and has not been seen since the 1918 influenza pandemic, placing extraordinary strains on health institutions, governments and communities. Currently, there are 14.562.550 confirmed cases worldwide, with 607.781 deaths reported (as of Jul 21). World Health Organization (WHO) declared COVID-19 a pandemic on March 11, 2020 as many countries grappled with the danger of the disease as it rapidly spread and reported deaths quickly rose (1). An urgent public health dilemma was emerging, and governments needed to take extraordinary steps to control and reduce community transmission to gain time and reduce the rapidly unfolding burden of COVID-19 while weighing up the foreseeable economic challenges likely to occur.

Address for Correspondence: Duygu AYHAN BAŞER, Hacettepe University Faculty of Medicine, Department of Family Medicine, Ankara, Turkey
E-mail: duyguayhan@outlook.com **ORCID ID:** orcid.org/0000-0002-5153-2184

Received: 01.07.2020
Accepted: 04.08.2020

Cite this article as: Özkara A, Lambert K, Ayhan Başer D, Erbas B. Effective implementation of unprecedented measures for the protection from COVID-19 syndrome. Bezmialem Science 2020;8(Supplement 2):63-66.

The Republic of Turkey which is a bridge between Europe and Asia geographically was one of the first countries which implemented urgent and robust measures to slow the spread. The first case observed in Turkey was on March 10, 2020 approximately three months after the spreading of COVID-19 from the Wuhan city of China. The public health message and policies implemented from the Ministry of Health began well in advance of the first confirmed case. An operation centre was established on January 6, 2020, a Science Committee was established on January 10, 2020 and government initiated public health interventions were followed immediately. On January 14, the "COVID-19 Disease Guideline" was prepared by the Ministry of Health and the public was informed about all processes (2). Also COVID-19 Disease Guideline has been updated in line with the developments. Leadership was demonstrated with the communication of important information via social media and news coverage of the then epidemic. COVID-19 was at the forefront of every news item with effective statements made by experts and others famous names and celebrities pleading with the public not be complacent with the emerging crisis the country was facing, and the role of each citizen to ensure precautionary measures were implemented in the pre- first case period. Another step pre-first case was screening movement of incoming and outgoing of all persons within Turkey airports. Since January 20, all travellers from China's Wuhan city, Myanmar, Singapore, Thailand, America, Russia were screened and all passengers in all flights to risky areas were scanned with thermal cameras prior to departure. Citizens of the Republic of Turkey working/living in Wuhan, China were brought into Turkey and quarantined with no virus detected in any of these passengers at the end of quarantine period. After March 11, all flights were banned to China, South Korea, Iran, Iraq and Italy, and then flights to Germany, France, Spain, Norway, Denmark, Belgium, Austria, Sweden and the Netherlands were mutually stopped. Finally, this number increased to 359. All of this occurred well in advance to the spread. Field Hospitals were established on February 27 at eight border crossings with Iran, Iraq and Georgia. All travellers were required to comply with the 14-day quarantine rule to protect their fellow citizens. All state student dormitories were emptied for the quarantine process and healthcare personnel were provided for those in quarantine. Before the first case, all key health institutions in Turkey implemented urgent policies to adapt to surge in demand and the possibility of cases. In primary institutions all elective case reception ceased and as the number of cases emerged this practice was applied to all secondary and tertiary health intuitions which also developed emergency response and interventions. For example, to reduce the possibility of public contact with risky persons, elderly people with chronic illnesses and those with chronic diseases were provided alternative forms of care without the need to visit health institutions. As the first cases emerged, the government working closely with experts implemented drastic public health measures to ensure transmission reduction processes. These included early self-isolation, the closure of schools and the beginning of distance education learning, visitor restriction in prisons and hospitals, postponing overseas travel of public employees and continuing sporting events without spectators. Social distancing interventions were implemented immediately and mass gathering and activities of places where people congregated ceased. A donation campaign was launched to fight the disease. The Republic of Turkey, a predominately Muslim country made the key decision to forbid prayer collectively in mosques and places of worship and banned to Pilgrimage and Umrah visits to Saudi Arabia in 2020. Although, this was seen as a drastic measure by other countries early in the outbreak, the government and health experts were determined to reduce exposure and infection early. Government public health infrastructure increased immediately. As demand of personal protective measures during the pandemic peaked (3) the Vocational and Technical Anatolian High Schools with appropriate infrastructure began the production of disinfectant and surgical masks. Under the coordination of the Ministry of Health and the Ministry of Transport and Infrastructure, free mask distribution was initiated to all citizens aged 20-65. Even now, the Ministry of Health continues to distribute personal protective equipment to healthcare workers. Respiratory devices were produced and donated to hospitals by large companies. Applicable algorithms have been created in all health systems, including primary care, for COVID-19 and forwarded to all healthcare professionals for implementation (4). As cases began to emerge, all possible case definitions have been based on the WHO clinical and epidemiology profile of COVID-19. Respiratory tract samples have been studied in reference laboratories serving all 16 provinces. In addition, a new diagnostic screening kit was developed to give reliable and rapid results in the diagnosis of the disease (2). All provinces were provided with these kits and plans were implemented for immediate information transfer to the reference laboratories when new possible positive cases emerged. Curfews have been imposed on citizens over 65 years old, citizens with chronic illnesses without age restrictions and persons under 20 years of age. As of April 1, curfews began to be implemented on all citizens on weekends as part of the fight against the pandemic. As numbers began to decline, restrictions started to be removed significantly, as of Jun 1,on the condition of not neglecting the mask wearing, social distancing, cleaning rules; it has been decided to remove the travel restriction between cities, and to open social places within certain rules. Within the scope of coronavirus measures, the use of masks has been made compulsory in some provinces and substantial penalties are enforced, if not complied.

The Republic of Turkey was instrumental in implementing measures to assess risk and all departments within the ministry of health were actively engaged in Turkey's response. Critical information and expert opinion were communicated to the public in a transparent and timely manner to reduce the initial and subsequent peaks. There is no treatment for COVID-19 as vaccinations are currently been developed. As precautionary measures, strict measures need to be adopted to reduce the intensity and spread of the disease. The Ministry of Health, decision makers at all levels of government have undertaken strategies and worked collectively with health experts to provide transparent evidence of this rapidly evolving pandemic through social media, television channels and healthcare professionals

at every opportunity (3). Systems, policy and procedures are constantly revised. With almost all countries affected, implementing strict broad scale social distancing and isolation measures may contribute to minimizing transmission and substantial burden on the hospital systems at which the rapid spread of the virus occurs.

At present over 4,359,627 tests for the novel coronavirus are being carried out daily in the Republic of Turkey, with 221.500 confirmed cases and 5,526 deaths as of Jul 21 (1). Although the second wave of the outbreak is imminent, effective interventions put in place by the Republic of Turkey may have slowed the speed of transmission and clinical severity of the infection, thereby slowing down this peak of the infection curve (5). To date, Turkey has a 2.5% mortality rate and is one of the countries with low rates due to the COVID-19 pandemic, which caused the death of six hundred and seventy thousand people worldwide (Table 1) (7).

The cautionary tale of countries with a higher burden of COVID-19 at an earlier date than ours (6) will enable the Republic of Turkey to continue to develop mitigation and containment strategies to be better prepared for the additional expected surge in cases COVID-19 threatens our world as we know it. To reduce this burden and deadly risk of the novel coronavirus, governments, health care professionals and communities in general need to work together to reduce exposure, infection, clinical severity and community transmission of COVID-19 for much longer than first anticipated.

Table 1. Cases/fatality rate and mortality by country of the COVID-19 pandemic (7)

Country	Case-fatality (%)	Confirmed cases	Deaths
Yemen	27.6	1.619	447
Belgium	15.3	64.094	9.805
United Kingdom	15.3	296.944	45.397
Italy	14.3	244.624	35.058
France	14.1	214.023	30.180
Netherlands	11.8	52.142	6.155
Mexico	11.3	349.396	39.485
Spain	10.7	264.836	28.422
Canada	7.9	112.938	8.902
Sweden	7.2	78.048	5.639
Switzerland	5.9	33.634	1.971
China	5.4	85.314	4.644
Iran	5.2	276.202	14.405
Algeria	4.6	23.691	1.087
Denmark	4.5	13.466	611
Germany	4.5	203.325	9.094
US	3.7	3.830.010	140.906
Tunisia	3.6	1.381	50
Turkey	2.5	220.572	5.508
India	2.4	1.155.338	28.082
Pakistan	2.1	266.096	5.639
Argentina	1.8	130.774	2.373
Russia	1.6	776.212	12.408
Australia	1.0	12.428	126
Israel	0.8	52.003	415
Singapore	0.1	48.035	27

Peer-review: Externally and internally peer reviewed.

References

1. WHO 2020, Coronavirus disease (COVID-19) Pandemic Last Accessed Date :23.06.2020. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019
2. T. C. Ministry of Health General Directorate of Public Health 2020. COVID-19 (SARS-CoV2 Infection) Guideline. Last Accessed Date: 23.06.2020. Available from: https://hsgm.saglik.gov.tr/depo/covid19/Ingilizce/Rehber/COVID-19_Rehberi__Genel_bilgiler_epidemiyoloji_ve_tani_8.06.2020_eng.pdf
3. Xu K, Cai H, Shen Y, Ni Q, Chen Y, Hu S, et al. Management of corona virus disease-19 (COVID-19): the Zhejiang experience. Zhejiang Da Xue Xue Bao Yi Xue Ban 2020;49:147-57.
4. Minister of Health of the Republic of Turkey, 2019 Yeni koronavirus enfeksiyonu vaka bilgi, sorgulama ve izlem formları Last Accessed Date: 23.06.2020
5. Anderson RM, Heesterbeek H, Klinkenberg D, Hollingsworth TD. How will country based mitigation measures influence the course of the COVID-19 epidemic? Lancet 2020;395:931-4. doi:https://doi.org/10.1016/S0140-6736(20)30567-5
6. Legido-Quigley H, Mateos-García JT, Campos VR, Gea-Sánchez M, Muntaner C, McKee M. The resilience of the Spanish health system against the COVID-19 pandemic. Lancet Public Health 2020;5:e251-2. pii: S2468-2667(20)30060-8. doi: 10.1016/S2468-2667(20)30060-8.
7. Mortalıty Analyses. Last Accessed Date: 26.06.2020. Available from: https://coronavirus.jhu.edu/data/mortality