ISSUE 2
YEAR: 2022 VOLUME: 3

ARCHIVES OF CURRENT MEDICAL RESEARCH

ARCHIVES OF CURRENT MEDICAL RESEARCH

https://dergipark.org.tr/tr/pub/acmr

ARCHIVES OF CURRENT MEDICAL RESEARCH (ACMR)

Volume: 3

Number: 2

May 2022

Publishing Language
English

E-ISSN
2717-9788

Type of Publication
Peer Reviewed Academic Journal

Publishing Period
Three Times a Year (January, May, September)

Journal Name
Archives of Current Medical Research
Arch Curr Med Res

Owner
14th March Medical Association

General Publication Director
Mehmet Ali Tokgöz

Management Location - Content Advisor
Alban Tanıtım Ltd. Şti.
Tunalı Hilmi Cad. Büklüm Sokak No: 45/3
Kavaklıdere/Ankara Tel: 0.312 430 13 15
E-mail: info@acmronline.org
editor@albantanitim.com.tr

Graphic Design
Alban Tanıtım Ltd. Şti.

Proofreading
S. Bahar Alban

Prepress
Alban Tanıtım Ltd. Şti.

ARCHIVES OF CURRENT MEDICAL RESEARCH

EDITORIAL TEAM

TABLE OF CONTENTS

TABLE OF CONTENTS

Archives of Current Medical Research
Arch Curr Med Res 2022;3(2):68-73

Received: 19 November 2021
Revised: 22 December 2022
Acccepted: 27 April 2022
DOI: 10.47482/acmr.2022.50

ORIGINAL ARTICLE

Physical activity level of medical students: Is there a family effect?

Asiye Uğraş Dikmen[1], Mustafa Altunsoy[2], Ali Kadir Koç[1], Eda Koç[1], Seçil Özkan[1],

1 Gazi University Faculty of Medicine, Department of Public Health, Ankara, Turkey
2 Gazi University Faculty of Sports Sciences, Department of Physical Education and Sports Teaching, Ankara, Turkey

Abstract

Background: Sedentary lifestyle is common in various age groups all over the world and it is an important public health issue because of its adverse effects on health. Taking actions against inactivity among medical students is important because they will become role models for their patients as future doctors. In this research, physical activity (PA) frequency and factors affecting participation in PA among medical students were studied.

Methods: Six hundred sixty-eight medical students from Gazi University Medical Faculty took part in the study. The students answered sociodemographic questions in addition to completing the Global Physical Activity Questionnaire (GPAQ).

Results: One-quarter (24.9%) of the participants did no physical activity. Logistic regression indicated that being female (OR: 1.7), father's inactivity (OR: 2.2), and family income less than 4500 TL (OR: 1.5) were significant factors in not doing PA among the medical students.

Conclusions: As medical students will play a critical role in improving public health as future doctors, intervention programs should be encouraged in order to increase the PA level of medical students to create a healthy lifestyle habit.

Keywords: Youth, Physical Activity Level, Medical Students, Turkey.

Cite this article as: *Uğraş Dikmen A, Altunsoy M, Koç AK, Koç E, Özkan S. Physical activity level of medical students: Is there a family effect? Arch Curr Med Res. 2022;3(2):68-73*

Corresponding Author:
Asiye Uğraş Dikmen, Gazi University Medical Faculty of Medicine, Department of Public Health, Ankara, Turkey
E-mail: asiyeud@gmail.com

INTRODUCTION

Physical inactivity is a significant global public health problem because of its adverse effects on health. Physical activity (PA) improves physiological, metabolic and psychological parameters, reduces risks of chronic diseases and early mortality rates, and preserves bone, muscle and joint health and functionality (1). Physical inactivity is the fourth leading risk factor of mortality globally (2).

The World Health Organization (WHO) states in its 2018-2030 Physical Activity Action Plan that globally, 25% of adults and 75% of adolescents do not meet the PA levels recommended by the WHO (3). In the same report, the WHO calculated the global direct healthcare cost of physical inactivity as 54 billon dollars in 2013, and an additional $14 billion as loss of productivity. In a previous study by Samuel et al., which covered 76 countries, the overall physical inactivity prevalence was 21.4%. (4) In the WHO's previous 2010 statistics, 23% of people over the age of 18; 19% of the youngest adults, and 55% of the oldest adults did not meet the WHO-suggested physical activity goals. Comparing the WHO's two reports from 2010 and 2018, global physical inactivity is on the rise.

The PA level, or rather the lack of PA, of young people is a determining factor in the occurrence of preventable health problems in adulthood. Thus, measuring PA levels in young people, and those in early adulthood, and developing appropriate interventions to encourage PA and an active lifestyle is important in these age groups (5). The studying age at university corresponds to late adolescence and the early adulthood phase of life, and for some students these periods are stressful times affected by extrinsic factors (6,7).

In a 2010 Turkey Nutrition and health Survey (TBSA), 44.6% of 15-18–year-old and 69.5% of 19-30–year-old males reported that they did not exercise, and an even higher 72.5% of 15-18–year-old and 76.6% of 19-30–year-old females reported they did not exercise either (8).

In the current study, a quarter of the medical students did not have enough PA. Although the remainder performed an adequate amount of PA, a feeling of competence is important when it comes to prescribing exercise to patients in counselling practices. In a 2017 study on fifth-year Australian medical students, after a 4.5-week geriatric medicine and exercise course, students had the greatest score improvements in referring older people to exercise programs and designing exercise prescriptions (9). In a 2004 study on 1906 freshman medical students from 17 medical schools in the United States of America, the authors found that the medical students who did strenuous exercise believed that their exercise habits were highly relevant (79%) for counselling patients about physical activity in the future (10).

Although, studies about PA are abundant in our country and globally, those covering medical students about PA and use of the Global Physical Activity Questionnaire (GPAQ) on them are limited and nearly nonexistent nationally. Medical students have strategic importance for improving health through PA because of being a part of the healthcare services and their age group, both for themselves and their patients. Thus, more studies are needed to evaluate the PA level of medical students and factors that affect their ability to do the recommended amount of PA. In addition, previous studies generally used questionnaires evaluating PA in the previous week, rather than general PA behaviors. The GPAQ used in this research was used for the first time in our country on medical students since its validity was checked (11). The GPAQ was developed by the WHO for PA surveillance.

MATERIALS AND METHODS

Research Design and Participants

Permission for the study was granted by the ethics committee of Gazi University (Date: 12.02.2018 / No:85). The participants were students of a medical faculty in Ankara province. Clustered sampling was used for choosing the participants, considering each year of study as a cluster. Using Epi-Info, the 2017 Turkey physical inactivity prevalence was 43% (12), alfa (Type I error) 5%, power 80% and at 95% confidence level, thus 668 participants were chosen. The required number of samples was calculated by the weight of the cluster, i.e. using the number of students in each year of study and the total number of medical students. All candidates accepted to take part in the research and completed the questionnaire. The number of participants in each year is given in Table 1.

Table 1. Research sample group and grade distribution

Year	Total Number of Students	Sample Group	Completed Responses
1st	474	114	114
2nd	522	126	126
3rd	443	106	106
4th	515	124	124
5th	439	106	106
6th	385	92	92
Total	2778	668	668

This study was approved by the clinical research ethics committee of the Gazi University (Date: 12.02.2018 number: 85).

Data Source and Calculation of Physical Activity Level

The data source in the study was the answers of sociodemographic questions and the GPAQ. The survey was conducted through face-to-face interviews. The GPAQ collects information on PA participation in three domains, and also sedentary behaviors: activity at work, travel to and from places, recreational activities. A population's physical activity (or inactivity) with GPAQ can be described in different ways. The two most common ways are; to estimate a population's mean or median physical activity using a continuous indicator such as MET-minutes per week or time spent in physical activity, or to classify a certain percentage of a population as 'inactive' or 'insufficiently active' by setting up a cut-point for a specific amount of physical activity. The WHO considers a PA level of 600 MET / min / week as the threshold; anything below this is considered inadequate PA, above is adequate. The validity of the Turkish version of GPAQ was assessed by Adiguzel et al. in 2017 on a group of medical faculty students of Ege University; the validity score was found as strong-very strong (Kappa 0.74-0.87, $p<0.0005$) (11)

Statistical Analysis

The research data were evaluated using the SPSS 21 (Armonk, NY) statistics software. The distribution of variables was evaluated using observational (histograms and possibility graphics) and analytical methods (Kolmogorov-Smirnov test). Descriptive data are given as mean and standard deviation (SD), frequency, percentage…etc. The Independent T-test (Student T-test) was used when the data follow normal distribution and Mann Whitney-U test was used when the data did not follow normal distribution. Logistic regression was used for multivariate analysis. Prior to logistic regression, MET values of variables affecting PA level were evaluated using univariate analysis. In the backward model, variables were included if they were significant between 0.05 - 0.20 level. This study was approved by the clinical research ethics committee of the Gazi University (Date: 12.02.2018 number: 85).

RESULTS

There were 668 participants, comprising of an equal number of males and females. The mean age of the students was 21.3±2.1 years. Fifty-four (8.1%) students reported having chronic diseases, 13.2% were regular smokers, and 2.4% consumed alcohol regularly. Of the participants, 44.3% were from families whose family income was over 4500 TL. Sixteen percent of each grade was represented in the research population. Almost three-quarters (73.1%) of the participants described themselves as being overweight or obese.

The metabolic scores of the participants and their distribution is given in Table 2. Five hundred two (75.1%) participants, had adequate MET scores of 2501.97+121.97, and 166 (24.9%) participants had inadequate MET scores of 209.39+201.66.

Table 2. Participants' Metabolic Equivalent Scores

MET Score	Number / (Percentage)	Mean Score ± SD	Median (min-max)
Adequate	502 (75.1%)	2501.97 ± 121.97	1680 (600-28560)
Inadequate	166 (24.9%)	209.39 ± 201.66	200 (0-580)
Total	668 (100.0%)	1932.26 ± 256.69	1130 (0-28560)

The MET scores of the medical students according to characteristics of their mothers and fathers are presented in Table 3. The median MET scores of students whose mothers had chronic diseases, were high school graduates or full-time employed, and performed regular PA were 1020, 1200, and 1680, respectively. The median MET scores of students whose fathers had chronic diseases, were night school graduates, in full-time employment, and performed regular PA were 1540, 1200, 1120, and 1540, respectively. Having fathers who were high school graduates and either fathers or mothers engaging in PA significantly affected the median MET scores of the medical students ($p<0.05$).

Table 3. Mean MET scores of medical students according to characteristics of their mothers and fathers

MET scores	Mother		Father	
	Mean (± SD)	Median (min-max)	Mean (± SD)	Median (min-max)
Chronic disease	1020.00 (± 1774.04)	1589 (0-12160)	1540.00 (± 2710.97)	1200 (0-12160)
High school graduation	1200.00 (± 2005.52)	1200 (0-14280)	1200.00 (±1952.93)	1865 (0-14280) *
Full time employment	1200.00 (± 2075.97)	1858(0-14280)	1120.00 (± 2368.55)	1936 (0-19920)
Doing physical activity	1680.00 (±2892.47)	2424 (0-19920) *	1540.00 (± 2710.97)	2366 (0-19920) *

* Mann Whitney-U Test is statistically significant, $p<0.05$

The factors affecting activity among the medical students are shown in Table 4. As family income dropped, so did the PA of students (OR: 1.5), similarly the fathers' being physically active increased PA among medical students (OR: 2.2). Male medical students performed more PA than their female peers (OR: 1.7).

Table 4. Distribution of factors affecting the physical activity of medical students

Factors		OR*	95% CI	P
Sex	Male	**1.7**	1.2-2.5	**0.004**
	Female	1		
Grade	Clinic level	1.1	0.8-1.6	0.57
	Pre-clinic level	1		
Self-perception	Under weight-normal	1.1	0.7 -1.6	0.59
	Overweight-obese	1		
Level of income (Median value)	4501 TL and over	**1.5**	1.1-2.3	**0.017**
	4500 TL and under	1		
PA status of mother	Performed PA	1.3	0.8 -2.2	0.24
	No PA	1		
PA status of father	Performed PA	**2.2**	1.3 -3.7	**0.002**
	No PA	1		

*OR odds relative risk factor

DISCUSSION

There is no doubt that PA is important in promoting health for people of all ages. There have been many studies looking at the various aspects of PA among the youth and medical students and the effect of physical activity on them. In a study by Ucok et al. (2011), 18% of medical students did not meet the WHO PA goals, and Savci et al. (2006) found that 16% of medical students did not have enough PA (13,14). The same GPAQ used by Savci et al. was used by Wattanapisit et al. (2015) on Thai medical students, reporting that 25.9% of the students did not perform enough PA (15). The physical inactivity prevalence of our medical students is in line with the literature.

Two hundred sixteen third-year medical students in New Zealand completed a voluntary PA learning module, consisting of three tutorials and one lecture. After completing the module, although students perceived themselves as moderately competent in counselling on PA, taking the module increased their awareness and knowledge about PA and their self-perceived confidence in providing PA advice increased (16). In both Australian and New Zealand studies, medical students were physically active and exercising.

The effect of sex on PA in the general population has been well studied. Research on the PA levels of medical faculty students (15,17,18) and university students (14,19) showed that more females than males did not meet the WHO-defined PA goals. Likewise, in the current study, females were more physically inactive than their male peers. This may be a cultural issue because of the gender bias in public. Males doing regular physical activity may seem natural but women doing the same is frowned upon.

Looking at the literature on the connection between income and PA, a Brazilian study conducted on adolescents found that adolescents, especially males from low income backgrounds, performed less PA (20). In another study on the Finnish adult population, PA levels increased as income increased (21). Although culturally and economically different, these two examples present that better income allows people to do more PA. This suggests that income is one of the determinants of PA levels.

The children of physically active parents tend to be physically active. In a study on Brazilian adolescents, females were less physically inactive if their parents were doing PA (20). In a Canadian study, parents doing PA made their children more physically active than children whose parents were not (21). Fathers doing PA has the highest determinant effect in doing PA both on sons and daughters in a family (22). In our study, the PA level of the mother and father was designed as a separate variable; and medical students' PA level decreases if their parents PA level is lower than the recommended level. According to the results of the logistic regression, the fathers being physically active was an important factor in the PA levels of medical students. This could be attributed to the father being taken as a role model during childhood and adolescence more than any other family member.

In the literature, it is emphasized that parents have a significant effect in taking up PA (22, 23). Thus, parents should be involved when devising intervention programs for increasing PA levels. Even though it may be late for current medical student's PA levels, today's medical students will set an example for their patients as future doctors and parents.

Studies in the relevant literature indicate that as the education level of parents decreases so do the PA level of their children (19, 24). In our study, although there was no significant relationship between the mothers' education level and the PA level of the medical students, the father's education level had a significant effect. The significant effect of taking the father as a role model and his education on the PA levels of the medical students could be attributed to the dominant effect of the father in patriarchal cultures.

Comparing our findings with the WHO data, the PA levels of the medical students were similar to the general population. Since today's medical students will play a significant role as future doctors in improving public health, their role in shaping the health of future generations is huge. Their understanding of the place of PA in health promotion and setting an example for their patients is important. When designing intervention programs for developing healthy living habits through PA among medical students, it should be kept in mind that they will set an example as PA practicing doctors (prescribing PA,setting PA plans for patients etc.).

Parents, especially fathers are important figures that determine their children's PA levels. When designing health promotion programs focusing on PA, parents should also be involved in these activities.

In several places on its website, in its reports and action plans, the WHO clearly emphasizes that PA is an effective intervention method for preventing noncommunicable diseases. Creating healthy living behaviors through increasing PA levels is not possible just with individual initiatives, lack of inactivity is a societal problem, thus it requires population-based, culturally appropriate, multi-sectoral and milti-disciplinary action plans. As leading members of the healthcare provision team, doctors should digest the importance of PA during their practice by actively participating in PA.

Declarations

The authors received no financial support for the research and/or authorship of this article. There is no conflict of interest.

This study was approved by the clinical research ethics committee of the Gazi University (Date: 12.02.2018 number: 85).

REFERENCES

1. Whaley MH, Brubaker PH, Otto RM, Armstrong LE. ACSM's guidelines for exercise testing and prescription. (7th ed.). Philadelphia: Lippincott, 2006.
2. Lee IM, Shiroma EJ, Lobelo F, Puska P, Blair SN, Katzmarzyk PT; Lancet Physical Activity Series Working Group. Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. Lancet. 2012;380(9838):219-29.
3. World Health Organization (WHO). Prevalence of insufficient physical activity. 2018. Available at https://www.who.int/data/gho/data/indicators/indicator-details/GHO/prevalence-of-insufficient-physical-activity-among-adults-aged-18-years-(age-standardized-estimate)-(-) Accessed September 20, 2021
4. Dumith SC, Hallal PC, Reis RS, Kohl HW 3rd. Worldwide prevalence of physical inactivity and its association with human development index in 76 countries. Prev Med. 2011;53(1-2):24-8.
5. von Bothmer MI, Fridlund B. Gender differences in health habits and in motivation for a healthy lifestyle among Swedish university students. Nurs Health Sci. 2005;7(2):107-18.
6. Dyson R, Renk K. Freshmen adaptation to university life: depressive symptoms, stress, and coping. J Clin Psychol. 2006;62(10):1231-44.
7. Neumark-Sztainer D, Story M, Perry C, Casey MA. Factors influencing food choices of adolescents: findings from focus-group discussions with adolescents. J Am Diet Assoc. 1999;99(8):929-37.
8. Turkish Ministry of Health. Türkiye Beslenme ve Sağlık Araştırması 2010: Beslenme Durumu ve Alışkanlıklarının Değerlendirilmesi Sonuç Raporu. Ankara: 2014
9. Jadczak AD, Tam KL, Yu S, Visvanathan R. Medical students' perceptions of the importance of exercise and their perceived competence in prescribing exercise to older people. Australas J Ageing. 2017;36(3):E7-E13.
10. Frank E, Galuska DA, Elon LK, Wright EH. Personal and clinical exercise-related attitudes and behaviors of freshmen U.S. medical students. Res Q Exerc Sport. 2004;75(2):112-21.
11. Adıgüzel İ, Durusoy R, Mandıracıoğlu A, Öcek Z. Küresel fiziksel aktivite anketinin (GPAQ) Türkçe'ye uyarlanması, güvenilirlik ve geçerliliğinin Bornova Belediyesi çalışanlarında değerlendirilmesi. Proceedings of 19th National Public Health Congress; 2017 March 15-19; Antalya, Turkey. Ankara: HASUDER; 2017.
12. Türkiye Hanehalkı Sağlık Araştırması: Bulaşıcı Olmayan Hastalıkların Risk Faktörleri Prevalansı 2017 (STEPS). Editörler: Üner S, Balcılar M, Ergüder T. Dünya Sağlık Örgütü Türkiye Ofisi, Ankara, 2018.
13. Üçok K, Genç A, Şener Ü, Akkaya M, Mollaoglu H. Tıp Fakültesi Öğrencilerinde Fiziksel Aktivite Düzeyinin Araştırılması. Eur J Basic Med Sci 2011;1 (1):33-38.
14. Savcı S, Öztürk M, Arıkan H, İnal İnce D, Tokgözoğlu L. Physical activity levels of university students. Arch Turk Soc Cardiol 2006;34(3):166-172.
15. Wattanapisit A, Gaensan T, Anothaisintawee T. Prevalence of physical activity and associated factors of medium and high activity among medical students at Ramathibodi Hospital. Proceedings of the 6th International Conference on Sport and Exercise Science; 2021 June 9-11; Chonburi, Thailand.
16. Mandic S, Wilson H, Clark-Grill M, O'Neill, D. A physical activity learning module improves medical students' skills and confidence for advising patients about physical activity. Monten J Sports Sci Med. 2018;7(1): 31-38.
17. Naim Z, Anwar K, Rahman A, Zuliani N. Physical Inactivity Among Medical and Non-Medical Students: A Cross Sectional Study. Int J Public Health Clin Sci. 2016;3(5): 48-58.
18. Wattanapisit A, Fungthongcharoen K, Saengow U, Vijitpongjinda S. Physical activity among medical students in Southern Thailand: a mixed methods study. BMJ Open. 2016;6(9):e013479.
19. El-Gilany AH, Badawi K, El-Khawaga G, Awadalla N. Physical activity profile of students in Mansoura University, Egypt. East Mediterr Health J. 2011;17(8):694-702.
20. Bastos JP, Araujo CL, Hallal PC. Prevalence of insufficient physical activity and associated factors in Brazilian adolescents. J Phys Act Health. 2008;5(6):777-94.
21. Garriguet D, Colley R, Bushnik T. Parent-Child association in physical activity and sedentary behaviour. Health Rep. 2017;28(6):3-11.
22. Ornelas IJ, Perreira KM, Ayala GX. Parental influences on adolescent physical activity: a longitudinal study. Int J Behav Nutr Phys Act. 2007;4:3.
23. Manganello JA. Health literacy and adolescents: a framework and agenda for future research. Health Educ Res. 2008;23(5):840-7.
24. Abdel-Hady EG, Ragaa EM. Physical inactivity among Egyptian and Saudi medical students. TAF Prev Med Bull 2011; 10(1): 35-44

Archives of Current Medical Research
Arch Curr Med Res 2022;3(2):74-85

Received: 21 October 2021
Revised: 13 November 2021
Acccepted: 12 January 2022
DOI: 10.47482/acmr.2022.51

ORIGINAL ARTICLE

Evaluation of SMS-intervention in patients with diabetes on disease perception and treatment compliance

Hasan Nadir Rana[1], **Kadriye Avcı**[1],

1 Afyonkarahisar Health Sciences University Faculty of Medicine, Department of Public Health, Afyonkarahisar, Turkey

Abstract

Background: Nowadays, as in all health branches, health communication technologies are used in diabetes to develop positive health behaviors and the self-efficacy of patients. The aim of this study was to evaluate the effect of SMS-intervention on disease perception, health behavior, and improvement initiatives for treatment compliance in diabetic patients.

Methods: This intervention type study was conducted at Afyon Kocatepe University, Ahmet Necdet Sezer Research and Application Hospital in Turkey. Diabetic patients (n=136) were randomly assigned to three groups. These were "Control", "Reminder", "Information and Motivation". The "Reminder" and "Information and Motivation" groups received regular SMS for one year.

Results: In our study, there was a significant increase for health beliefs and treatment compliance in "Reminder" and "Information and Motivation" groups after the intervention. However, there was no significant difference in "Control" group. The SMS sent to diabetes patients positively affected their health belief and treatment compliance. Especially in the "Information and Motivation" group, differences were found in all parameters of the Health Belief Model Scale.

Conclusions: SMS interventions are easy and effective interventions that can be used to improve positive health behaviors and positive health perception in individuals. Such interventions, especially for common diseases such as diabetes, will make a significant contribution to the control and treatment of the disease.

Keywords: Health Communication, Diabetes Mellitus, Treatment Compliance, Cell Phone, Health Behavior.

Cite this article as: *Rana HN, Avcı K. Evaluation of SMS-intervention in patients with diabetes on disease perception and treatment compliance. Arch Curr Med Res. 2022;3(2):74-85*

Corresponding Author:
Kadriye Avcı, Afyonkarahisar Health Sciences University Faculty of Medicine,Department of Public Health, Afyonkarahisar, Turkey
E-mail: drkavci@yahoo.com

INTRODUCTION

Although non-infectious diseases were seen as the problem of developed countries and elderly populations in the past, today, independent of socio-economic situation, people of every country and age group are affected. Non-communicable diseases are the most important cause of death worldwide (1). Diabetes is one of the non-communicable diseases that cause the most deaths throughout the world. There has been a stable increase in the prevalence of diabetes in the last few decades and projections show that this increase will continue. Thus, it is a priority public health issue worldwide (2,3).

Patients with diabetes may develop many acute and chronic complications during the course of the disease. To prevent diabetes complications and to better the course of the disease, it is important to comply with the clinical treatment. Studies show that lifestyle changes such as physical activity, a proper diet, and regular blood sugar control can delay or prevent complications (3–5). Non-compliance with treatment is directly connected to bad treatment outcomes (5,6). Behavior changes in individuals are an important step in the treatment of chronic diseases because of its direct effect on treatment results.

In the past, it was thought that a behavioral change could only be achieved by giving information. Today, it is accepted that information does affect attitude and behavior, but this relationship is a multi-factored pattern rather than a direct effect (7,8). Therefore, various models have been developed to explain the health behaviors of individuals. One of the models that is thought to fit patients with diabetes is the Health Belief Model (8,9). According to the Health Belief Model, the beliefs that the individual is sensitive to the disease, the emergence of the disease will affect his/her life, the severity of the disease will decrease when he/she takes action, and he/she will not encounter negativities such as cost, shame, and pain affects the health behavior of the individual (10).

Although the Health Belief Model is concerned with explaining health habits, it does not declare how to change health behavior. But Albert Bandura's Social Cognitive Theory identifies factors that explain health behaviors and how to inform, lead, and motivate people to ensure this change was understood. According to Bandura, the expectations of the individual about physical health, acceptance of the behavioral change to be developed in the social environment, and setting of goals that are based on the individual are effective in the development of positive health behavior (11). These positive health behaviors are of great importance in the prevention and treatment of diseases such as diabetes, directly related to lifestyle and health rituals.

Nowadays, as in all health branches, health communication technologies are used in diabetes to develop positive health behaviors. With health communication technologies such as Short Messaging Services (SMS), phone calls, voice mail systems, and e-mail; it is possible to carry out broad and promising interventions to develop the self-efficacy of patients with diabetes (12–14). In addition, previous studies show that SMS, mobile applications, or phone calls are effective in terms of blood sugar monitoring, continuing education, diet, exercise, and regulation of treatment and that the interventions contributed to blood sugar control (15,16).

Based on the positive results of these previous interventions, we aimed to evaluate the effect of SMS-intervention on disease perception, health behavior, and improvement initiatives for treatment compliance.

MATERIALS AND METHODS

This intervention type study was carried out from 01.12.2016 to 01.03.2018 at Afyon Kocatepe University Ahmet Necdet Sezer Research and Application Hospital.

Identification of Patients

All 143 patients who visited the Endocrinology Clinic of Afyon Kocatepe University Ahmet Necdet Sezer Research and Application Hospital in Turkey, between 01.12.2016 and 28.02.2017, met the inclusion criteria, and agreed to participate in the study were included in the study without determining the sample. Inclusion criteria were being over the age of 18, having diabetes, using oral antidiabetic medication or insulin, being literate, being able to use a mobile phone, and being able to read SMS. Being under the age of 18 or pregnant were exclusion criteria.

Participants in the study were divided into three groups by method of simple random sampling (groups were determined by drawing lots after the sequence number was given to the patients): The included patients were randomly divided into three groups: "Control" (n=48), "Information and Motivation" (n=48), and "Reminder" (n=47). During the study, one patient died and one patient voluntarily left the study. Four people were excluded because they could not be reached at the end of the study and one person did not have laboratory measurements. A

total of 7 patients, 1 patient from the "Control" Group, 2 patients from the "Information and Motivation" Group, and 4 patients from the "Reminder" Group were excluded from the study and the evaluations took place with 136 patients.

Content of the intervention

The first interview with the patients was carried out after their first visit to the clinic. The patients were interviewed face-to-face in a quiet room where privacy conditions were met. The study plan and the possible advantages and disadvantages of the study were explained in detail to the patients and verbal and written consent was obtained. Data were collected by a face-to-face interview during the first visit to the clinic with the patients and by phone at the end of the study.

No interventions were carried out with the patients in the "Control" group. The "Reminder" and "Information and Motivation" groups received regular SMS for one year, between the first and last interviews, as intervention. The "Reminder" group received a daily message saying, "Don't forget your diabetes medication today. Please apply your treatment as directed by your doctor."

The patients in the "Information and Motivation" group received a weekly phone message for one year. A total of 52 different messages were used. The content of the messages were designed according to the "Social Cognitive/ Learning Theory" by Bandura (11). Messages that create a social support idea (e.g. Tell your family and friends how they can help you, they will support you.), create positive expectations (e.g. Proper blood sugar control will prevent the occurrence of secondary diseases related to diabetes), and determine reachable goals (e.g. Moderate exercise at least 2.5 hours per week will help balance your blood sugar level) were sent.

Data Collection Tools

At the beginning of the study, we used the face-to-face interview method with the patients. To collect the data, we used the First Interview Survey Form, developed by us, and the Health Belief Model in Diabetes Scale, consisting of 33 questions (the scale developed by Schwab et al. was the foundation, which was modified by Tan with 5 dimensions, Cronbach α=0.72) (17). The Turkish validity and reliability study of the Health Belief Model in Diabetes Scale was carried out by Kartal and Özsoy in 2005. The subdimension Cronbach α-values of the Turkish scale varied from 0.73 to 0.89 and the total Cronbach α-value of the scale was 0.86 (18).

The first interview survey form questioned the patients' sociodemographic characteristics, diabetic diagnosis, treatment, course (when was the diagnosis, type of diabetes, treatment received, physical exercise, and compliance with medication treatment (0=worst compliance, 10=full compliance)), and health status (0=I am very unhealthy, 10=I am very healthy).

The fasting blood glucose (FBS), glycosylated hemoglobin (HbA1c), total cholesterol, high density lipoprotein (HDL), low density lipoprotein (LDL), triglyceride, blood urea nitrogen (BUN), and creatinine levels, measured during their hospital visits throughout the year, were obtained from the hospital information system.

To evaluate the effectiveness of the intervention, the patients included in the study were contacted by phone and the Last Interview Survey and the Health Belief Model in Diabetes Scale, which consisted of 33 questions, were filled out. The subjects in the First Interview Survey that were expected to change were questioned again in the Last Interview Survey (diet, physical exercise, medical treatment compliance, and health status). In addition, questions about the phone messages and their content were added.

Ethical Compliance of the Study

The necessary permissions were received from the local Clinic Research Ethics Committee (dated 02.12.2016 and numbered 2016/60).

Statistical Evaluation

The obtained data were evaluated with descriptive statistics (arithmetic mean, median, standard deviation, and percentage distributions). First, the suitability of normal distribution was evaluated using Kolmogorov-Smirnov and Shapiro-Wilk tests when comparing mean values between groups. The means of more than two independent groups were compared using ANOVA in cases where parametric assumptions were met and the Kruskal-Wallis test in cases where it was not met. When parametric assumptions were met, the T-test was used in the comparison of repetitive measurements of dependent groups and the Wilcoxon test if they were not met. Percentage distribution of categorical data between groups was compared with the Chi-Square test. SPSS v18 program was used for data analysis and $p<0.05$ was accepted as significant.

RESULTS

It was determined that of the patients, 90.4% (n=123) had Type 2 diabetes and 9.6% (n=13) Type 1 diabetes. It was observed that 80.9% used oral antidiabetics, 42.6% used insulin, and 5.2% used an insulin pump. The age of the 136 diabetes patients in our study varied from 20-82, the mean age was 51.76±12.50, and 54.4% of the patients were female. While there was a significant difference in mean age between the groups (p=0.008), there was no significant difference regarding the other sociodemographic indicators (sex, place of residence, income status, and educational status) (Table 1).

Table 1. Sociodemographic characteristics of the groups

	Control Group		Reminder Group		Information and Motivation Group		KW	p
	Min-Max	Mean±SD	Min-Max	Mean±SD	Min-Max	Mean±SD		
Age	20-82	54.6±14.8	22-77	50.2±10.2	20-70	50.2±11.2	9.703	0.008
	n	%	**n**	%	**n**	%	**X^2**	**p**
Sex								
Male	21	44.7	18	41.9	23	50.0	0.617	0.734
Female	26	55.3	25	58.1	23	50.0		
Place of Residence								
Village-small town	15	319	7	163	11	239	2.992	0.224
Province-district	32	581	36	837	35	561		
Income Status								
Low	11	234	12	279	7	152	2.157	0.340
Middle-High	36	766	31	711	39	848		
Educational Status								
Primary School graduate	24	510	28	651	27	587	9.377	0.153
Middle School graduate	6	128	4	93	5	109		
High School graduate	6	128	9	209	10	217		
University / College graduate	11	234	2	47	4	87		

There was no significant difference between the groups at the beginning of the study regarding diet, physical exercise, medical treatment compliance, and health status of the patients (p=0.256, p=0.911, p=0.600, and p=0.644, respectively).

According to the subjective evaluation of the patients, the beginning and end scores regarding diet (p=0.763), physical exercise (p=0.458), compliance with medical treatment recommendations (p=0.083), and subjective health status (p=0.405) of the "Control" group did not show any significant differences.

When comparing the compliance with the diet recommendations of the patients, there was a significant increase in the "Reminder" (p=0.001) and "Information and Motivation" (p=0.034) groups after the intervention. The comparison of the compliance with physical exercise and medical treatment recommendations after the intervention only increased in the "Reminder" group (p=0,001, p=0.003, respectively). According to the self-evaluation of the patients, those in the "Information and Motivation" group gave themselves higher scores regarding their health status (p=0.030) (Table 2).

Table 2. Treatment compliance and subjective evaluation of health status of the groups before and after the intervention

	Before Intervention	After Intervention		
	Mean±SD	Mean±SD	t-Z	p
Compliance with diet recommendations				
Control Group	6.05±2.37	5.47±2.00	-0.302**	0.763
Reminder Group	4.69±2.76	5.98±2.06	-3.467*	**0.001**
Information and Motivation Group	6.02±2.34	6.50±2.16	-2.197*	**0.034**
Compliance with physical exercise recommendations				
Control Group	6.39±2.75	5.88±2.67	-0.741**	0.458
Reminder Group	5.69±2.95	6.93±2.56	-3.565*	**0.001**
Information and Motivation Group	6.78±2.66	6.86±2.64	-0.328*	0.747
Compliance with medical treatment				
Control Group	8.46±2.12	8.17±1.51	-1.732**	0.083
Reminder Group	7.22±3.07	8.49±1.79	-3.003**	**0.003**
Information and Motivation Group	8.36±2.47	8.70±2.00	-1.578**	0.115
Subjective health status				
Control Group	7.24±1.81	7.28±1.41	-0.832**	0.405
Reminder Group	7.26±2.10	7.69±1.88	-1.393*	0.172
Information and Motivation Group	7.45±2.24	7.89±1.92	-2.242*	**0.030**

*= Dependent Group T Test was used

** =Wilcoxon Test was used

The examination of the patients' health beliefs showed no significant differences between the groups with respect to perceived susceptibility (p=0.693), perceived severity (p=0.529), perceived benefits (p=0.914), perceived barriers (p=0.804), recommended health-related activities (p=0.075), and Belief Model in Diabetes Scale total score (p=0.703) before the intervention.

The evaluation of the Belief Model Scale of the patients with diabetes before and after the intervention is shown in Table 3. No significant change was determined over time regarding health belief in the "Control" group. The comparison of the Health Belief Model Scale subheadings in the "Control" group before and after the study showed a significant increase in perceived severity (p=0.046) but no significant changes regarding perceived susceptibility (p=0.583), perceived benefits (p=0.070), perceived barriers (p=0.169), and recommended health related activities (p=0.085).

Table 3. The groups' health beliefs before and after intervention

	Before Intervention	After Intervention	t-Z	P
	Mean±SD	Mean±SD		
Perceived susceptibility				
Control Group	3.03±0.46	3.26±0.58	-0.549**	0.583
Reminder Group	3.06±0.50	3.10±0.48	-0.983*	0.331
Information and Motivation Group	2.97±0.49	3.18±0.52	-3.887*	**<0.001**
Perceived severity				
Control Group	3.80±0.63	4.11±0.60	-1.992**	**0.046**
Reminder Group	3.66±0.47	4.15±0.53	-4.067**	**<0.001**
Information and Motivation Group	3.74±0.61	4.25±0.56	-4.661**	**<0.001**
Perceived benefits				
Control Group	4.02±0.54	4.19±0.50	-1.810**	0.070
Reminder Group	4.05±0.44	4.16±0.45	-2.453*	**0.019**
Information and Motivation Group	4.05±0.39	4.44±0.37	-9.508*	**<0.001**
Perceived barriers				
Control Group	3.77±0.42	3.75±0.52	-1.376**	0.169
Reminder Group	3.72±0.32	3.75±0.35	-0.920*	0.363
Information and Motivation Group	3.74±0.40	3.90±0.31	-3.470*	**0.001**
Recommended health related activities				
Control Group	4.22±0.46	4.32±0.45	-1.724**	0.085
Reminder Group	4.13±0.33	4.21±0.34	-3.075*	**0.004**
Information and Motivation Group	4.31±0.35	4.52±0.32	-5.875*	**<0.001**
Total scale score				
Control Group	3.86±0.37	3.99±0.39	-1.494**	0.134
Reminder Group	3.83±0.25	3.93±0.27	-4.375*	**<0.001**
Information and Motivation Group	3.89±0.31	4.15±0.27	-8.395*	**<0.001**

*= Dependent Group T Test was used

** =Wilcoxon Test was used

Health belief ($p<0.001$) significantly increased in the "Reminder" group after the intervention. The comparison of the Health Belief Model Scale subheadings in the "Reminder" group before and after the intervention showed no significant change in perceived sensitivity ($p=0.331$) and perceived barriers ($p=0.363$) but significant increases regarding perceived severity ($p<0.001$), perceived benefits ($p=0.019$), and recommended health related behaviors ($p=0.004$).

Health belief ($p<0.001$) significantly increased in the "Information and Motivation" group after the intervention. The comparison of the Health Belief Model Scale subheadings in the "Information and Motivation" group before and after the intervention showed significant increases in all subheadings, which were perceived susceptibility ($p<0.001$), perceived severity ($p<0.001$), perceived benefits ($p<0.001$), perceived barriers ($p=0.001$), and recommended health related activities ($p<0.001$).

The evaluation of the biochemical parameters of the patients with diabetes showed no significant difference between the groups regarding FBS (p=0.213), total cholesterol (p=0.487), LDL (p=0.848), triglycerides (p=0.115), BUN (p=0.988), and creatinine (p=0.550) values.

In Table 4, the measured biochemical parameters of the patients before and after the intervention were evaluated. A significant increase in HDL (p=0.008) and significant decrease in triglyceride levels (p=0.034) were determined in the "Information and Motivation" group after the intervention, but no significant changes were seen regarding FBS (p=0.722), HbA1c (p=0.739), total cholesterol (p=0.131), LDL (p=0.204), BUN (p=0.722), and creatinine (p=0.722). There was no significant difference between the measured biochemical parameters before and after intervention in the "Control" and "Reminder" groups.

Table 4. Measured biochemical parameters of the groups before and after intervention

	Before Intervention	After Intervention		
	Mean±SD	Mean±SD	t- Z	p
FBS				
Control Group	166.73±77.80	161.31±83.81	-0.105**	0.916
Reminder Group	193.01±84.06	157.47±72.09	0.947*	0.354
Information and Motivation Group	176.51±76.14	162.40±59.11	-0.356**	0.722
HbA1c				
Control Group	7.51±1.84	7.51±1.55	-1.290**	0.197
Reminder Group	8.17±2.05	7.58±1.85	1.406*	0.174
Information and Motivation Group	7.88±1.48	7.48±1.54	0.337*	0.739
T. cholesterol				
Control Group	194.14±37.26	183.53±34.80	-0.148*	0.884
Reminder Group	189.65±48.58	184.94±43.69	1.386*	0.182
Information and Motivation Group	195.13±38.98	180.30±49.17	1.575*	0,131
HDL				
Control Group	50.74±17.17	48.77±13.54	1.806*	0.084
Reminder Group	44.09±13.78	42.98±10.93	1.619*	0.122
Information and Motivation Group	41.60±10.89	44.61±9.04	-2.663**	**0.008**
LDL				
Control Group	127.81±39.00	121.57±35.95	0.001*	0.999
Reminder Group	131.22±40.94	124.06±36.39	1.034*	0.314
Information and Motivation Group	132.89±36.08	128.11±40.47	1.314*	0.204
Triglycerides				
Control Group	152.04±69.04	146.63±67.45	-1.909*	0.069
Reminder Group	165.51±125.58	180.64±125.29	0.972*	0.343
Information and Motivation Group	213.83±154.43	160.54±75.46	-2.120**	**0.034**
BUN				
Control Group	15.43±9.09	16.77±7.23	-0.169*	0.867
Reminder Group	14.37±6.16	14.47±5.65	1.029*	0.315
Information and Motivation Group	14.01±3.87	14.10±4.06	-0.494*	0.624
Creatinine				
Control Group	0.86±0.31	0.91±0.28	-1.350*	0.184
Reminder Group	0.83±0.34	0.89±0.42	-1.914**	0.056
Information and Motivation Group	0.76±0.15	0.79±0.18	-2.472*	**0.018**

*= Dependent Group T Test was used

** =Wilcoxon Test was used

Upon questioning the opinion of the patients about the messages sent, 76.7% of the "Reminder" group said the SMS helped them take their medicine and 7.0% said they were annoyed by the phone messages. However, 81.4% of the patients with diabetes recommended SMS-service for medicine Reminder purposes (Table 5).

Table 5. Opinions of the diabetic patients regarding the SMS-service

Opinions of the "Reminder" group regarding the SMS-service	n	%
The SMS helped me to regularly take my medicine	33	76.7
I was annoyed by receiving the SMS	3	7.0
I recommend sending diabetes patients reminder SMS	35	81.4
Opinions of the "Information and Motivation" group regarding the SMS-service	**n**	**%**
It increased my treatment compliance	32	69.6
It should contain more detailed information	33	71.7
It should contain more motivational content	28	60.9
I recommend sending diabetes patients messages with information	39	84.8
I recommend sending diabetes patients motivational messages	35	76.1

Upon questioning the opinions of the patients in the "Information and Motivation" group regarding the SMS-service, 69.6% said that the SMS helped them to comply with the treatment, 71.7% stated that the phone messages should contain more information, and 60.9% said that the messages should contain more motivational content. While 84.8% of the patients in the "Information and Motivation" group recommended sending informational messages to diabetes patients, 76.1% said that motivational messages should be sent (Table 5).

Table 6. Effect of SMS intervention on biochemical parameters in the present study and other studies

	Reminder Group	Information and Motivation Group	Sezgin et al. (31)	Zolfaghari et al. (24)	Yoon et al. (32)	Shetty et al. (23)n = 110
FBS	0	0	-		0	-
HbA1c	0	0	-	-	-	0
Total cholesterol	0	0	0		0	-
HDL	0	+	+		0	0
LDL	0	0	0			-
Triglycerides	0	-	0		0	-
BUN	0	0				
Creatinine	0	+				

(0)= No significant difference before and after the intervention.

(-)= Significant decrease after the intervention

(+)= Significant increase after the intervention

DISCUSSION

In this study, we aimed to improve the lifestyle, health belief, treatment compliance, and biochemical measurement results of diabetes patients by sending SMS.

Evaluation of the effect of the SMS intervention on lifestyle changes

This study concentrated on diet and physical exercise as lifestyle changes. Previous studies showed weight loss and an increase in physical exercise due to SMS intervention in groups with and without diabetes. A study conducted in Korea with 927 patients showed that they lost a significant amount of weight with the help of weekly supporting SMS (19). Another study with 125 overweight individuals showed that the group with phone intervention lost a significant amount of weight in comparison to the control group (20). A study conducted with women after they gave birth stated that those women in the SMS intervention group showed a significant increase in physical exercise time (21).

In studies conducted with diabetes patients, Yoo et al. (22) determined that the SMS-intervention group showed a significant weight loss. A study carried out in India showed that SMS intervention for informational and motivational purposes did not create a significant difference in terms of physical exercise and diet recommendation compliance (23). The present study determined that the patients in the "Reminder" group showed an increase in both diet and physical exercise compliance and the patients in the "Information and Motivation" group showed an increase in diet recommendation compliance. A similar study conducted in Iran (24) asked the patients to self-evaluate their compliance to diet and physical exercise recommendations and the patients in the SMS intervention group showed an increase in compliance.

While the intervention in the "Information and Motivation" group consisted of informational and motivational content, the SMS in the "Reminder" group was designed to remind the patients to take their medicine. However, although it was expected in the "Information and Motivation" group, no increase in compliance regarding physical exercise was observed. Interestingly, in addition to treatment compliance, diet and physical exercise compliance increased in the "Reminder" group. This is thought to be because the number of messages sent to the "Reminder" group was higher and the messages had a general effect to remind the patients to comply with treatment.

Evaluation of the SMS intervention on Health Belief

Health belief is an important element in the development of health behaviors and this study evaluated the Health Belief Model in Diabetes Scale. A study by Kartal et al. conducted in Turkey with the same scale showed that a planned educational program increased the total score of the Health Belief Model in Diabetes Scale and all subdimensions in patients with type 2 diabetes (18). A study by Bayat et al. in 2013 showed that the perceived barriers score decreased after planned education and that all other subdimension scores and the health belief increased (25). These studies show that planned education based on the Health Belief Model affect health belief. In the present study, in contrast to these studies, the intervention within the framework of the Health Belief Model and Social Cognitive Theory was done by SMS and not by a training program. A significant increase in health belief and all subheadings, including perceived barriers, was observed in the "Information and Motivation" group that received SMS content regarding information and motivation, similar to those studies conducted with educational programs. Even though no significant increases were observed in a study where health beliefs of patients with diabetes was evaluated with SMS intervention, there was a rising trend regarding health belief and subheadings in the intervention group (26).

The perceived severity score in all three groups showed a significant increase in the present study. Although the contents of the messages sent to the "Information and Motivation" group are motivating and supportive, the increase in perceived severity score suggests that health belief is influenced not only by the content of the message, but also by the reminder stimulus.

The present study showed a significant increase in perceived benefits and recommended health related activities scores in the "Reminder" group after the intervention. Although the messages sent to the "Reminder" group were only meant to remind the patients to take their medicine, this observed increase suggests that the intervention content was effective in changing the health belief. Because health belief is a dynamic process, changing the health belief through SMS causes the individual to reassess his health belief by changing his perspective on his illness. We believe that the dynamic process here also caused health belief changes independent of the intervention content.

According to Bandura, technological developments increase the scope and effect of health development programs, but this does not mean that this communication

guarantees better health results. To achieve effective results, it is necessary to intervene with social cognitive factors known to affect health behavior (11). While all parameters of the Health Belief Model in Diabetes Scale were affected in the "Information and Motivation" group of the present study, not all parameters showed changes in the "Reminder" group. This is thought to be due to the messages about positive health perception, based on Social Cognitive Learning Theory, sent to the "Information and Motivation" group.

Evaluation of the effect of the SMS intervention on medical treatment compliance

The medical treatment compliance increased in the "Reminder" group, but there was no statistical difference in the other groups. When examining studies where diabetes patients were reminded with SMS regarding their medicine, Vervolet et al. observed that 42.9% of the patients showed an increase in medication awareness (27). Zolfaghari et al. (24) also reported that SMS contributed to the medical treatment compliance of individuals.

The present study did not show a statistical increase in the "Information and Motivation" group, but there was a rising trend. A meta-analysis conducted by Thakkar et al. in 2016 showed that SMS intervention not only increases treatment compliance, but also that the message content does not create a difference (28). The present study similarly showed that the treatment compliance was affected independently from the message content.

In the present study, 76.7% of the patients in the "Reminder" group stated that the phone messages helped them to comply with the medical treatment and 81.4% recommended sending SMS to diabetes patients for Reminder purposes. While 69.6% of the "Information and Motivation" group said that their treatment compliance increased, a significant number of patients stated that they recommend sending information and motivation messages to people with diabetes. The study of Hussein et al. (29) similarly stated that all patients said that the SMS service helped them.

Evaluation of the SMS intervention on metabolic values

With the widespread and easy use of mobile technologies, various studies have been conducted using mobile devices in order to evaluate their effect on biochemical parameters in people with diabetes (28,30). Although the biochemical parameters measured in the studies differ, HbA1c was measured in all studies. HbA1c, which increases in parallel to blood sugar, is associated with diabetes complications because of its lack of oxygen transport function and is considered an important indicator of treatment compliance (4). Some studies evaluating the effect of SMS intervention on biochemical parameters in diabetes patients and the effect of intervention are shown in Table 6.

Hussein et al. (29), Yoo et al. (22), Zolfaghari et al. (24), Yoon et al. (31), and Sezgin et al. (32) determined a decrease in HbA1c value after the intervention. Hanauer et al. (33) did not observe any difference in HbA1c value after the intervention. In the present study, the HbA1c value was, although not statistically significant, lower in the "Reminder" and "Information and Motivation" groups after the intervention. Shetty et al. (23) observed, similar to the present study, a clinical decrease in HbA1c in the intervention group, although it was not statistically significant.

No significant differences regarding the FBS values before and after the intervention were determined in the present study. There are studies showing that FBS decreased in mobile phone intervention studies (23,32,34), but there are also studies in which no significant difference was found (31,35). FBS is a short-term indicator and can be affected by food consumed 8-10 hours prior to measurement (4). Therefore, the differences observed between the studies in FBS are short-term changes originating from the patients.

When examining the lipid profiles of the SMS intervention groups, there was no significant difference before and after treatment in the "Reminder" group but there was a significant increase in HDL value and a significant decrease in triglycerides value after the intervention in the "Information and Motivation" group. Sezgin et al. (32) observed, similar to the present study, an increase in HDL value and Shetty et al. (23) observed a decrease in triglycerides value.

In the present study, HbA1c and FBS values of the individuals in the "Information and Motivation" and "Reminder" groups decreased, although it was not statistically significant, but no difference was observed in the "Control" group. This decrease observed in FBS and HbA1c can be considered not only because of increased compliance with drug treatment, but also because of the changed health perception of the patients.

Patients make sense of their symptoms and medical conditions from the perceptions they form of the disease (36). After the patients were asked to evaluate their own health status, no significant difference could be

determined in the "Control" and "Reminder" groups before and after the study, but a higher score was observed in the "Information and Motivation" group after the intervention. We think that this is because motivating messages sent to the "Information and Motivation" group caused a change in the perception of disease and a decrease in the symptom burden they perceived.

The SMS sent to diabetes patients positively affected their health belief and treatment compliance. Using all parameters of the Health Belief Model Scale in the "Information and Motivation" group showed that this effect was due to the messages that aimed at a positive health perception. In addition, because some parameters changed in the "Reminder" group, the effect also could be independent from the contents of the SMS. In conclusion, SMS interventions are easy and effective interventions that can be used to improve positive health behaviors and positive health perception in patients. Such interventions, especially for common diseases such as diabetes, will make a significant contribution to the control and treatment of the disease because of the continuity of education, decreased burden on health personnel, and access to all segments of society.

Limitations of the study

In this intervention type study, the expected participant loss for prospective studies was observed. After calling the patients who were excluded from the study because they did not come to their follow-up appointments, we learned they had their check-ups at other health institutions outside the hospital where our study was conducted. Accessing the laboratory results of the patients through an online system, independent of the health institution, will help to reduce data loss in future studies.

Declarations

The authors received no financial support for the research and/or authorship of this article. There is no conflict of interest.

This study was approved by the clinical research ethics committee of the Afyon Kocatepe University (Date: 02.12.2016 number: 60).

REFERENCES

1. World Health Organization. Noncommunicable Diseases Country Profiles 2018. Available at: https://apps.who.int/iris/handle/10665/274512 Accessed February 17, 2022
2. World Health Organization. Global Report on Diabetes 2016. Available at: https://www.who.int/publications/i/item/9789241565257 Accessed February 17, 2022)
3. International Diabetes Federation. IDF Diabetes Atlas. 8. edition. 2017. Available at: Abhttps://diabetesatlas.org/upload/resources/previous/files/8/IDF_ DA_8e-EN-final.pdf Accessed February 17, 2022)
4. Şazi İ. Diabetes Mellitus Multidisipliner Yaklaşımla Tanı, Tedavi ve İzlem. 2nd ed. Deomed Medikal Yayıncılık, İstanbul, 2009.
5. World Health Organization. Adherence to Long-Term Therapies: Evidence for Action. 2003. Available at: https://apps.who.int/iris/handle/10665/42682 Accessed February 17, 2022)
6. Lin J, Sklar GE, Oh VM Sen, Li SC. Factors affecting therapeutic compliance: A review from the patient's perspective. Ther Clin Risk Manag 2008;4:269–86.
7. Güler Ç, Akın L. Halk Sağlığı Temel Bilgiler. 3rd ed. Hacettepe Üniversitesi Yayınları. Ankara. 2015.
8. Peyrot M. Behavior Change in Diabetes Education. Diabetes Educ 1999;25:62–73.
9. Petersen S, A. van den Berg R, Janssens T, Van den Bergh O. Illness and symptom perception: A theoretical approach towards an integrative measurement model. Clin Psychol Rev 2011;31:428–39.
10. Rosenstock IM. Historical Origins of the Health Belief Model. Health Educ Monogr 1974;2:328–35.
11. Bandura A. Health Promotion by Social Cognitive Means. Heal Educ Behav 2004;31:143–64.
12. Farmer AJ, Mcsharry J, Rowbotham S, Mcgowan L, Ricci-Cabello I, French DP. Effects of interventions promoting monitoring of medication use and brief messaging on medication adherence for people with Type 2 diabetes: A systematic review of randomized trials. Diabet Med 2016;33:565–79.
13. Krishna S, Boren SA. Diabetes Self-Management Care via Cell Phone: A Systematic Review. J Diabetes Sci Technol 2008;2:509–17.
14. Mulvaney SA, Ritterband LM, Bosslet L. Mobile intervention design in diabetes: Review and recommendations. Curr Diab Rep 2011;11:486–93.
15. Zolfaghari M, Mousavifar SA, Haghani H. Mobile phone text messaging and Telephone follow-up in type 2 diabetic patients for 3 months: A comparative study. J Diabetes Metab Disord 2012;11.
16. Liang X, Wang Q, Yang X, Cao J, Chen J, Mo X, vd. Effect of mobile phone intervention for diabetes on glycaemic control: a meta-analysis. Diabet Med 2011;28:455–63.
17. Tan MY. The relationship of health beliefs and complication prevention behaviors of Chinese individuals with Type 2 Diabetes Mellitus. Diabetes Res Clin Pract 2004;66:71–7.
18. Kartal A, Özsoy SA. Effect of Planned Diabetes Education on Health Beliefs and Metabolic Control in Type 2 Diabetes Patients. Hacettepe Üniversitesi Hemşirelik Fakültesi Derg 2014;1:1–15.
19. Joo N-S, Kim B-T. Mobile phone short message service messaging for behaviour modification in a community-based weight control programme in Korea. J Telemed Telecare 2007;13:416–20.

20. Haapala I, Barengo NC, Biggs S, Surakka L, Manninen P. Weight loss by mobile phone: a 1-year effectiveness study. Public Health Nutr 2009;12:2382–91.
21. Fjeldsoe BS, Miller YD, Marshall AL. MobileMums: A Randomized Controlled Trial of an SMS-Based Physical Activity Intervention. Ann Behav Med 2010;39:101–11.
22. Yoo HJ, Park MS, Kim TN, Yang SJ, Cho GJ, Hwang TG, vd. A Ubiquitous Chronic Disease Care system using cellular phones and the internet. Diabet Med 2009;26:628–35.
23. Shetty AS, Chamukuttan S, Nanditha A, Raj RKC, Ramachandran A. Reinforcement of adherence to prescription recommendations in Asian Indian diabetes patients using short message service (SMS)--a pilot study. J Assoc Physicians India 2011;59:711–4.
24. Zolfaghari M, Mousavifar SA, Pedram S, Haghani H. Retracted: The impact of nurse short message services and telephone follow-ups on diabetic adherence: which one is more effective? J Clin Nurs 2012;21:1922–31.
25. Bayat F, Shojaeezadeh D, Baikpour M, Heshmat R, Baikpour M, Hosseini M. The effects of education based on extended health belief model in type 2 diabetic patients: a randomized controlled trial. J Diabetes Metab Disord 2013;12:45.
26. Gatwood J, Balkrishnan R, Erickson SR, An LC, Piette JD, Farris KB. The impact of tailored text messages on health beliefs and medication adherence in adults with diabetes: A randomized pilot study. Res Soc Adm Pharm 2016;12:130–40.
27. Vervloet M, van Dijk L, Santen-Reestman J, van Vlijmen B, van Wingerden P, Bouvy ML, vd. SMS reminders improve adherence to oral medication in type 2 diabetes patients who are real time electronically monitored. Int J Med Inform 2012;81:594–604.
28. Thakkar J, Kurup R, Laba T-L, Santo K, Thiagalingam A, Rodgers A, vd. Mobile Telephone Text Messaging for Medication Adherence in Chronic Disease. JAMA Intern Med 2016;176:340.
29. Hussein WI, Hasan K, Jaradat AA. Effectiveness of mobile phone short message service on diabetes mellitus management; the SMS-DM study. Diabetes Res Clin Pract 2011;94:e24–6.
30. Riley WT, Rivera DE, Atienza AA, Nilsen W, Allison SM, Mermelstein R. Health behavior models in the age of mobile interventions: are our theories up to the task? Transl Behav Med 2011;1:53–71.
31. Yoon K-H, Kim H-S. A short message service by cellular phone in type 2 diabetic patients for 12 months. Diabetes Res Clin Pract 2008;79:256–61.
32. Sezgin H, Çınar S. Follow-up of Patients with Type 2 Diabetes via Cell Phone: Randomized Controlled Trial. J Marmara Univ Inst Heal Sci 2013;3:1.
33. Hanauer DA, Wentzell K, Laffel N, Laffel LM. Computerized Automated Reminder Diabetes System (CARDS): E-Mail and SMS Cell Phone Text Messaging Reminders to Support Diabetes Management. Diabetes Technol Ther 2009;11:99–106.
34. Piette JD, Weinberger M, Kraemer FB, McPhee SJ. Impact of automated calls with nurse follow-up on diabetes treatment outcomes in a Department of Veterans Affairs Health Care System: a randomized controlled trial. Diabetes Care 2001;24:202–8.
35. Kim HJH-S. A nurse short message service by cellular phone in type-2 diabetic patients for six months. J Clin Nurs 2007;16:1082–7.
36. Petrie KJ, Weinman J. Patients' Perceptions of Their Illness. Curr Dir Psychol Sci 2012;21:60–5.

Archives of Current Medical Research
Arch Curr Med Res 2022;3(2):86-96

Received: 03 January 2022
Revised: 12 January 2022
Acccepted: 18 January 2022
DOI: 10.47482/acmr.2022.52

ORIGINAL ARTICLE

Prevalence of COVID-19 vaccine hesitancy among dentists in Turkey

Nevra Karamüftüoğlu[1], Fatma Semanur Korkmaz Öner[1], Asiye Uğraş Dikmen[1], Seçil Özkan[1],

1 Gazi University Faculty of Medicine, Department of Public Health, Ankara, Turkey

Abstract

Background: Although dentists are among high-risk groups for COVID-19 due to their practice requiring to be in close proximity to patients's oral cavities, there is a clear lack of studies on the frequency of hesitancy towards COVID-19 vaccines and the factors that influence the said hesitancy. This study aims to determine the factors causing hesitancy to receive COVID-19 vaccines in dentists and the frequency of the hesitancy.

Methods: The universe of this online cross-sectional survey was 23,664. Participants were then selected from the association's member list using the numbers table. Dentists were selected by random sampling method and the sample size was 458. SPSS 22.0 for Windows was used for the data analysis. Chi-square test was used in the comparison analysis of categorical variables, and the statistical significance level was set as $p<0.05$.

Results: Of the 458 dentists participating in the study, the mean age was 38±10.5, 133 (29.0%) were male and 325 (71.0%) were female. 59 (12.9%) dentists stated that they have not been vaccinated with the COVID-19 vaccine, 399 (87.1%) participants stated that they have.

Conclusions: In this study, 87.1% of dentists in Turkey stated that they have been vaccinated with the COVID-19 vaccine; proving that there is no vaccine hesitation among dentists in Turkey.

Keywords: COVID- 19, Vaccine Hesitancy, Dentist, Turkey

Cite this article as: *Karamüftüoğlu M, Korkmaz Öner FS, Uğraş Dikmen A, Özkan S. Prevalence of COVID-19 vaccine hesitancy among dentists in Turkey. Arch Curr Med Res. 2022;3(2):86-96*

Corresponding Author:
Nevra Karamüftüoğlu, Gazi University Faculty of Medicine,
Department of Public Health, Ankara, Turkey
E-mail: nvrserbest@hotmail.com

INTRODUCTION

Coronavirus disease 2019 (COVID-19) is a new disease caused by the pathogen "Severe Acute Respiratory Syndrome Coronavirus 2" (SARS-CoV- 2) (1). The World Health Organization (WHO) declared the status of COVID-19 to have risen to a pandemic on 11 March 2020 (2). The pandemic has created a heavy burden of disease worldwide, and there is currently no specific antiviral treatment for COVID-19 (3,4). In view of Benjamin Franklin's words, "One gram of prevention is better than one kilogram of cure", standart restriction measures were introduced to prevent contamination (mask mandates, social distancing, hygiene and ventilation). However, they were found to be not sufficient to control the progression of the COVID-19 pandemic (5,6). In line with this, vaccines are considered to be the most successful and cost-effective health interventions in preventing the spread of a pandemic, with vaccine development and mass immunization playing the most important role in preventive health services. In the midst of a pandemic that has been on the agenda for more than a year globally, the hesitation towards vaccination and different hesitancy trends in different countries require careful considerations to be made in order to ensure effective prevention of the spread of the disease.

Vaccine hesitancy, as defined by WHO; vaccine delays, acceptance or rejection of vaccination despite the availability of vaccination services, is observed in more than 90% of countries around the world (4).

According to the Turkish Medical Association (TMA), the rate of those who are willing to receive a COVID-19 vaccine in Turkey has been in the range of 40 – 45% for a period of time (5). In Turkey, studies were carried out on the hesitation of the society and healthcare workers that were against the COVID-19 vaccine. Although some studies on the COVID-19 vaccine hesitation of dentists and dentistry students around the world are being published, a study focusing on dentists regarding their hesitation, hesitation frequency and contributing factors towards COVID-19 vaccines was yet to be conducted in Turkey. Considering that dentists are continuously exposed to SARS CoV–2 infection due to aerosol released during dental treatment and are in a high-risk group, the importance of administering COVID–19 vaccines to dentists rises (6-8).

The aim of this study is to evaluate the frequency of COVID-19 vaccine hesitation among dentists and the factors affecting dentists in Turkey.

MATERIALS AND METHODS

An online cross-sectional survey consisting of 19 questions for dentists working in private practice, clinics, universities, and state hospitals was conducted in April 2021 via "Google Forms". The study was carried out in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of Gazi University (Date: 23.03.2021 number: 05), with all participants giving their informed consent to participate. The survey included questions on socio-demographic characteristics, the impact of COVID-19, risk perception for COVID-19 vaccines, attitudes, acceptance and hesitation preferences during the pandemic. Of the total 32,859 dentists working in the public and private sectors throughout Turkey; 23,644 dentists are members of the Turkish Dental Association. Accordingly, the sample size was calculated by taking the frequency of vaccine hesitation as 50% (the unknown frequency that extracted the maximum sample size) with a confidence interval of 95%, deviation 5%; resulting in a sample size of 458. Participants were then selected by random sampling method from the members list of the association.

The Statistical Package for Social Sciences (SPSS), version 22.0 for Windows (SPSS Inc. Chicago, USA) computer package program was used for statistical analysis of the data. In the descriptive statistics section, categorical variables are presented by giving number and percentage, while continuous variables are presented with mean ± standard deviation and median (min-max) value. Yates Continuity Correction Test, Pearson Chi-Square Test, and Likelihood Ratio Test were used in the evaluation of categorical variables. Statistical significance was accepted as $p<0.05$. Descriptive statistics, chi-square and logistic regression analysis were used to evaluate the data. A P value of <0.05 was considered significant. Variables with $p<0.20$ in the chi-square analysis were included in the logistic regression model.

RESULTS

The average age of the participants was 38±10.5. Distribution of some descriptive characteristics of dentists participating in the research are shown in Table 1. A total of 72.5% (n=332) of them had doctorate, specialty or master's degrees. 94.8% (n=434) of participants were still working, 3.5% (n=16) were not working and 1.7% (n=8) stated that they were retired. In terms of chronic disease and/or disability, it was found that 16.6% (n=76) of the participants had such, while 83.4% (n=382) did not.

Table 1. Distribution of some descriptive characteristics of dentists participating in the study, Turkey, 2021

	Number	(%)*
Gender (n=458)		
Female	325	71.0
Male	133	29.0
Marital Status (n=456)		
Single	306	67.1
Married	150	32.9
Education Status (n=458)		
Post graduate	126	27.5
Doctorate, speciality, masters degree	332	72.5
Working Status (n=458)		
Still working	434	94.8
Not working	16	3.5
Retired	8	1.7
Employed Institution (n=444)		
Own clinic	129	29.1
Private hospital	104	23.4
Public hospital	93	20.9
Faculty of dentistry	99	22.3
Other	19	4.3
Chronic Disease and / or Disability Status (n=458)		
No	382	83.4
Yes	76	16.6
Living with others (n=456)		
Alone	70	15.4
With friends	8	1.8
with family members	374	82.0
Other	4	0.9
Living with People Over 65 (n=450)		
Yes	76	16.9
No	374	81.7

*percentage column

Distribution of professional working conditions of dentists participating in the research is shown in Table 2. Considering the frequency of working with aerosols during the study, 56.6% (n=249) of the participants stated that they have regularly performed procedures causing aerosol production, 27.0% (n=119) stated that they have occasionally performed such procedures, and 16.4% (n=72) stated that they did not perform any aerosol-producing procedures.

Table 2. Distribution of professional working conditions of dentists participating in the study, Turkey, 2021

	Number	(%)*
Active Work Throughout the Pandemic (n=455)		
Yes	368	80.9
No	87	19.1
Work Intensity in the Pandemic (n=441)		
Similarly	130	29.5
Less	236	53.5
More	75	17.0
Aerosol-producing Applications in the Pandemic (n=440)		
Occasionally doing the operations that create aerosol	119	27.0
Regularly doing the operations that create aerosol	249	56.6
Never doing the operations that create aerosol	72	16.4
Taking Part in Filiation (n=458)		
Yes, I worked in filiation for a while	47	10.3
Yes, I'm still in filiation	50	10.9
No	361	78.8

*percentage column

Distribution of dentists participating in the study regarding the diagnosis of COVID-19 and other vaccines are shown in Table 3. When evaluated for having been diagnosed with COVID-19 during the pandemic, it was found that 88.0% (n=403) of the participants were not diagnosed.

Table 3. Distribution of dentists participating in the study regarding the diagnosis of COVID- 19 and vaccination history of participants, Turkey, 2021

	Number	(%)*
COVID- 19 Diagnosis During the Pandemic (n=456)		
Yes, treated at the hospital	1	0.2
Yes, treated using medicines at home	44	9.6
Other	8	1.7
No	403	88.4
Being Diagnosed with COVID- 19 in the Same Household (n=453)		
No diagnosis	379	83.7
Have a diagnosis	74	16.3
Being Diagnosed with COVID- 19 in People Nearby (n=458)		
No diagnosis	288	62.9
Have a diagnosis	170	37.1
Getting Pneumococcal Vaccination in the Pandemic (n=456)		
Yes	69	15.1
No	387	84.9
Getting Influenza Vaccination in the Pandemic (n=458)		
Yes	67	14.6
No	391	85.4
Getting COVID-19 Vaccination (n=458)		
Yes	399	87.1
No	59	12.9

*percentage column

Of the dentists participating, 16.3% (n=74) stated that one of the people that they were living in the same household were diagnosed with COVID-19, 83.7% (n=379) stated that the people they lived with were undiagnosed. When questioned whether they have had an influenza vaccine since September 2020; it was found that 14.6% (n=67) participants have received the influenza vaccine during the pandemic, and 85.4% (n=391) did not receive the vaccine. 12.9% (n=59) of the 87.1% (n=399) participants stated that they were vaccinated with the COVID-19 vaccine, which is given free of charge by the state, once it was their turn.

The evaluation of COVID-19 vaccination status of the dentists participating in the study is presented in Table 4 in line with some descriptive characteristics. In terms of gender, male participants were observed to be vaccinated more (93.2%) (p=0.019). In terms of marital status, being married was associated with more frequent vaccination (89.9%) (p=0.011). In terms of the place of employment, all dentists working in their own clinic, private hospitals, public hospitals and dentistry faculties were vaccinated (p<0.001). A significant relationship was found between dentists living in different residences in isolation since the beginning of the pandemic and vaccination status (p<0.001), and dentists who did not follow such isolation measures were vaccinated more (99.3%). A significant relationship was found in vaccination status of dentists who lived with somebody who was diagnosed with COVID-19 (p=0.007). Dentists living with people who had not been diagnosed with COVID-19 received more vaccinations (92.9%). There was a significant difference between being vaccinated against influenza and being vaccinated against COVID-19 during the pandemic (p=0.007). Dentists who were not vaccinated against influenza were found to have received the COVID-19 vaccines more (89.0%). Dentists who did not think that the 60% of the population being vaccinated in order to ensure mass vaccination would be effective against the pandemic were vaccinated on a higher frequency (98.8%). This difference was statistically significant (p<0.001).

Table 4. Evaluation of COVID- 19 vaccination status of the dentists participating in the study according to some descriptive characteristics, Turkey, 2021

	COVID- 19 Vaccination Status			
	Yes		No	
	Number	(%)*	Number	(%)*
Gender (n= 458)				
Female	275	84.6	50	15.4
Male	124	93.2	9	6.8
χ 2 = 5.501 p= 0.019**				
Marital Status (n= 456)				
Married	122	89.9	31	10.1
Single	275	81.3	21	18.7
χ 2 = 6.511 p= 0.011***				
Employed Institution (n= 425)				
Own clinic	118	91.5	11	8.5
Private hospital	91	87.5	13	12.5
Public hospital	70	75.3	23	24.7
Faculty of dentistry	95	96.0	4	4.0
χ 2 = 21.712 p< 0.001***				
Chronic Disease and / or Disability Status (n= 458)				
Yes	68	89.5	8	10.5
No	331	86.6	51	13.4
χ 2 =0.234 p=0.629****				
Living with others (n= 456)				
Alone	63	90.0	7	10.0
With friends	7	87.5	1	12.5
With family members	324	86.6	50	13.4
Other	3	75.0	1	25.0
χ 2 =1.116 p=0.773***				
Living with People Over 65 (n= 450)				
Yes	62	81.6	14	18.4
No	332	88.8	42	11.2
χ 2 = 2.374 p= 0.123**				
Work Intensity in the Pandemic (n= 441)				
Similarly	120	92.3	10	7.7
Less	202	85.6	34	14.4
More	62	82.7	13	17.3
χ 2 = 4.918 p= 0.086***				
Aerosol-producing Applications in the Pandemic (n= 440)				
Occasionally doing the operations that create aerosol	95	79.8	24	20.2
Regularly doing the operations that create aerosol	230	92.4	19	7.6
Never doing the operations that create aerosol	59	81.9	13	18.1
χ 2 = 13.595 p= 0.001***				

Table 4. (continued) Evaluation of COVID- 19 vaccination status of the dentists participating in the study according to some descriptive characteristics, Turkey, 2021.

	COVID- 19 Vaccination Status			
	Yes		No	
	Number	(%)*	Number	(%)*
Taking Part in Filiation (n= 458)				
Yes, I worked in filiation for a while	34	72.3	13	27.7
Yes, I'm still working in filiation	37	74.0	13	26.0
No	328	90.9	33	9.1
χ 2 = 21.313 p< 0.001***				
Self-isolation from Household Members in the Pandemic (n= 405)				
Yes	95	65.1	51	34.9
No	304	99.3	2	0.7
χ 2 = 113.688 p< 0.001****				
COVID-19 Diagnosis During the Pandemic (n= 458)				
Yes	46	86.8	7	13.2
No	353	87.2	52	12.8
χ 2 = 0.006 p= 0.940****				
Being Diagnosed with COVID-19 in the Same Household (n= 453)				
Yes	65	87.8	9	12.2
No	332	87.6	47	12.4
χ 2 = 0.003 p= 0.954****				
Being Diagnosed with COVID-19 in People Nearby (n= 458)				
Yes	241	83.7	47	16.3
No	158	92.9	12	7.1
χ 2 = 7.365 p= 0.007****				
Getting Pneumococcal Vaccination in the Pandemic (n= 456)				
Yes	55	79.7	14	20.3
No	342	88.4	45	11.6
χ 2 = 3.169 p= 0.075**				
Getting Influenza Vaccination in the Pandemic				
Yes	51	76.1	16	23.9
No	348	89.0	43	11.0
χ 2 = 7.350 p= 0.007**				
60% Vaccination will be Effective in COVID- 19				
Yes	237	80.6	57	19.4
No	162	98.8	2	1.2
χ 2 = 41.093 p< 0.001****				

* Percentage column

** Yates Continuity Correction Test

*** Pearson Chi-Square Test

**** Likelihood Ratio Test

The evaluation of the COVID-19 vaccination status of the dentists participating in the study is presented in Table 5. Married dentists were 4.229 times more likely to receive the COVID-19 vaccine than the unmarried dentists. Dentists working in dentistry faculties were 11.264 times more likely to be vaccinated than those working in private clinics. Those who occasionally apply aerosol-producing treatments were 9.416 times, and those who perform aerosol-producing treatments on a regular basis were 11.568 times more likely to receive the COVID-19 vaccine than those who do not use aerosols at all. Dentists currently working in filiation units were 13.174 times more likely to receive the COVID-19 vaccine than those who have never worked in filiation units.

Table 5. Analysis of Factors Affecting Dentists' Vaccination for COVID-19 (Multivariate logistic regression)

		P	OR*	%95 Confidence Interval	
			Min	Max	
Marital Status					
	Single	Reference	1		
	Married	0.015	4.229	1.320	13.544
Employed Institution					
	Own clinic	Reference	1		
	Private hospital	0.657			
	Public hospital	0.411			
	Faculty of dentistry	0.010	11.263	1.793	70.768
Aerosol-containing Applications in the Pandemic					
	Never doing the operations that create aerosol	Reference	1		
	Occasionally doing the operations that create aerosol	0.017	9.416	1.490	59.506
	Regularly doing the operations that create aerosol	0.006	11.568	2.005	66.731
Taking Part in Filiation					
	No	Reference	1		
	Yes, I worked in filiation for a while	0.254			
	Yes, I'm still working in filiation	0.032	13.174	1.248	139.096

*OR: Estimated relative risk as indicated by odds ratio

DISCUSSION

The main purposes of health services are to protect the health of the society, to improve the existing health and to restore the deteriorated health. In view of these purposes, the first stage of health services is preventive health services. Practices within the boundaries of preventive health services have social characteristics as well as individual characteristics. The first application that comes to mind when talking about preventive services is vaccination. Vaccination is one of the most successful public health interventions in human history (9). The success of immunization is directly related to vaccination rates and the factors that reduce vaccination rates, such as vaccine instability or adversity that negatively affects the control of vaccine preventable diseases (10,11). Vaccination provides individual immunity; and mass vaccination provides social immunity. In line with this, as the number of vaccinated individuals in a community increases, the possibility of contact for the unvaccinated individuals with the disease agent, therefore the frequency of the disease in said society decreases.

In view of the benefits vaccination provides under public health interventions, the need to identify factors that may contribute to the adoption of COVID-19 vaccination, especially among healthcare professionals that are at high risk of becoming infected with COVID-19 such as dentists increases.

Development in COVID-19 vaccines is advancing at an unprecedented pace, and countries around the world are accelerating research and development. As of 18 February 2021, at least seven different vaccines have been launched across three platforms in countries, and more than 200 additional vaccine candidates are under development, more than 60 of which are in clinical development (4,12). However, there is still uncertainty in the acceptance of the vaccine by the society (13,14).

"Vaccine Hesitancy Working Group" defined the term vaccine hesitation or vaccine instability as "delay in accepting or not allowing some vaccines to be administered despite the availability of vaccine services". In 2019, WHO identified one of the 10 global health problems before the COVID-19 pandemic as the anti-vaccine movement (15). In many studies on vaccine hesitation, factors affecting hesitation are found to be behaviors such as health belief model or protection motivation theory, risk perception, vaccine safety and effectiveness perception, general vaccination attitude, past vaccination, date, advice from doctors, price, vaccination convenience and socio-demographic characteristics (16-19).

Vaccine hesitancy and rejection cases, which were previously very few in Turkey, have increased rapidly with the winning of a lawsuit related to "obtaining parental consent for vaccination application" in 2015 and the frequent coverage of anti-vaccine statements in the media (17). The scientific literature around the world indicates that the hesitation to receive the COVID-19 vaccine in society is a major health problem. A study conducted on attitudes towards vaccination and awareness of health behaviors in adult Israelis showed that attitudes towards COVID-19 vaccines were more negative than attitudes towards general vaccines (18). Another study published in The Lancet Public Health Journal provided a new perspective on determinants of acceptance or rejection of the COVID-19 vaccine (19). Another survey concluded that a high degree of hesitation is present in society rather than direct opposition to vaccines, with the hesitation being mostly due to the fear of the side effects related to the COVID-19 vaccine (20).

In a review of more than 100 surveys examining the acceptance of the COVID-19 vaccine, it shows that many participants will decide whether to accept the vaccine based on the findings obtained by waiting for other people to receive the COVID-19 vaccine. This situation reveals the urgent need for active campaigns to build confidence in the vaccine (21).

There also are studies on vaccine hesitation in different groups at the national level. The behaviors of healthcare professionals not to be vaccinated directly affect the society's approach to the vaccination in general. In some studies conducted in Turkey, the behaviors of healthcare workers regarding vaccination have been discussed. In an evaluation of the attitudes of physicians in a university hospital towards vaccination, it was found that 10.5% of the participants were hesitant to vaccinate themselves or their children, and 2.6% did not want to vaccinate for religious and philosophical reasons (22). In another study aiming to determine the general vaccination status, knowledge and attitudes of healthcare professionals working and studying in a university hospital, it was found that 10.1% of healthcare workers completely refused vaccines and 89.6% were vaccinated against influenza viruses. Also, healthcare workers tending to young age groups showed more hesitation when vaccinating their children (23).

Vaccination of healthcare professionals is important as they set a precedent for their patients and their immediate environment. Vaccination hesitation in healthcare professionals should be heeded, details of this issue should be investigated and interventions to reduce vaccination hesitancy should be planned. In a study investigating the hesitations and acceptance of COVID-19 vaccine among dentistry and medical students, the need for a profession-specific curriculum designed to increase the knowledge of dental students about vaccination and vaccine counseling skills was highlighted (24). In another study investigating the attitudes and hesitations of dentistry students against the COVID-19 vaccine, almost all participants had a generally positive attitude towards vaccines, agreeing that they would be exposed to COVID-19 during their practice, and they personally knew someone who had been infected with COVID-19. However, it has been found that only 56% are willing to get the COVID-19 vaccine as soon as an

FDA-approved vaccine is available. 63% of those who do not want to receive the vaccine stated that they will receive the vaccine if it is mandated by the health systems or the dental school; 16.3% of the respondents stated that they would not receive the COVID-19 vaccine even if it were made mandatory. There are several factors associated with vaccine acceptance and the likelihood of recommending the vaccine, such as relying on public health professionals, concerns about side effects, and accepting vaccine instructions. These studies display a clear need for an education curriculum on vaccine safety and effectiveness to promote the adoption of the COVID-19 vaccine (25).

In this study, it was found that dentists did not hesitate on receiving the COVID-19 vaccine. The reason for the different results from other studies is thought to be that the group in which the study was conducted consisted of dentists who were at high risk of being infected with the current virus, and that the vaccine studies had positive findings regarding reliability across countries.

This cross-sectional study also aimed to explore the perspectives of dentists in Turkey regarding the COVID-19 vaccine and the dynamics of vaccine hesitations. According to the results of this study, dentists with higher leniency to be vaccinated are those who are male, married, working in the dentistry faculties, regularly performing the operations that involve aerosols, not employed in filiation units, diagnosed with COVID-19, have somebody in proximity who is diagnosed with COVID-19, did not receive an influenza vaccine during the pandemic, and those who do not think that 60% of the population being vaccinated against COVID-19 will be effective against the virus.

A study investigating the vaccine hesitation trends of healthcare professionals towards COVID-19, conducted after the second dose of the COVID-19 vaccines were administered found that 68.6% of the professionals were open to vaccination, and no prior hesitation before or after the vaccination were present in healthcare professionals; revealing that vaccination is more frequent and there is no hesitation in this regard (26).

All over the world, hesitation towards vaccines is increasing with different variables between countries, and vaccines are being associated with conspiratorial worldviews (27). Vaccine hesitation is an imminent threat to the fight against COVID-19 as it threatens achieving herd immunity, vaccine efficacy and population impact. It is important to devise an evidence-based strategy to promote vaccine acceptance by dentists who are at high risk of infection and to reduce vaccine hesitancy. These precautions would protect dentists against the virus and also reduce the transmission of the disease to their families, patients and society. When developing vaccination strategies for dentists, evidence-based planning should be considered prior to the administration of vaccines. Vaccination acceptance should be encouraged by the authorities within the scope of new developments in legislation and freedom of information and health guarantee. Maintaining the health of healthcare professionals through vaccination is an important component of pandemic preparedness as acceptance of vaccines is crucial to its success. Our findings add to the growing research on vaccination among oral health professionals.

When we look at the past, the pandemics ended in 2- 3 years. The SARS-CoV-2 virus will also be eradicated; however, it is still important to keep the rate of infection low as it does. Vaccines may not be effective against mutated viruses, so education comes to the fore and dentists' health literacy on vaccination needs to be increased.

Vaccination of healthcare professionals is important in terms of setting a precedent for their patients and their immediate environment. In this study, 87.1% of dentists in Turkey stated that they had the COVID-19 vaccine provided by the government. This result shows us that there is no vaccine hesitation in dentists in Turkey.

There are very few studies on the frequency of hesitancy and the factors affecting the COVID-19 vaccine among dentists in Turkey. This study is one of the first studies on this subject and more work needs to be done in this area. As a result, 87.1% of dentists in Turkey stated that they had the COVID-19 vaccine; proving that there is no vaccine hesitation in dentists in Turkey.

Declarations

The authors received no financial support for the research and/or authorship of this article. There is no conflict of interest.

This study was approved by the clinical research ethics committee of the Gazi University (Date: 23.03.2021 number: 2021/05).

REFERENCES

1. Guan W, Ni Z, Hu Y, Liang W, Ou C-Q, He J-X et al. Clinical characteristics of coronavirus disease 2019 in China. New Engl J Med. 2020;382:1708–20.
2. WHO Director-General's opening remarks at the Member States information session on COVID-19 - 11 March 2021. 2021. Available at https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-member-states-information-session-on-covid-19---11-march-2021 Accessed March 20, 2022
3. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020;395:497–506.
4. World Health Organization. WHO coronavirus disease (COVID-19) Dashboard. 2021. Available at https://covid19.who.int/?gclid=EAIaIQobChMI2_CM6eDZ6gIVghh9Ch3nDQm1EAAYASAAEgLqwPD_BwE Accessed March 24, 2022
5. TMA COVID-19 Pandemic 10th Month Evaluation Report. Vaccine Hesitation and Confidence. 2021. Available at https://www.ttb.org.tr/haber_goster.php?Guid=5b50dd24-5993-11eb-a234-396657807ef8 Accessed March 12, 2022
6. FDI council statement on COVID-19 vaccination. 2021. Available at https://www.fdiworlddental.org/vaccines Accessed March 10, 2022
7. Journal of the Turkish Dental Association. COVID-19 continues to take lives. 2021. Available at http://www.tdb.org.tr Accessed March 13, 2022. Turkish.
8. Gür E. Vaccine hesitancy - Vaccine refusal. Turk Pediatri Ar. 2019;54:1–2.
9. Kutlu R. Childhood vaccines. J Fam Med-Special Topic. 2017;8:311-8.
10. Health topics. Immunization. 2021. Available at https://www.who.int/immunization/monitoring_surveillance/data/tur.pdf Accessed March 14, 2022
11. Global Vaccine Action Plan. 2021. Available at https://www.who.int/teams/immunization-vaccines-and-biologicals/strategies/global-vaccine-action-plan Accessed March 13, 2022
12. COVID-19, Different COVID-19 Vaccines. 2021. Available at https://www.cdc.gov/coronavirus/2019-ncov/vaccines/different-vaccines.html Accessed March 13, 2022
13. Filiz M, Kaya M. Systematic review of studies to determine factors affecting vaccine rejection / instability / contrast. Turk Res J Academ Soc Sc. 2019;2:1-7.
14. Report of the Sage Working Group on Vaccine Hesitancy. 2021. Available at https://www.thecompassforsbc.org/sbcc-tools/report-sage-working-group-vaccine-hesitancy Accessed March 20, 2022
15. World Health Organization. Ten threats to global health in 2019. 2019. Available at https://www.who.int/news-room/spotlight/ten-threats-to-global-health-in-2019 Accessed March 20, 2022
16. Determann D, Korfage IJ, Lambooij MS, Bliemer M, Richardus JH, Steyerberg E.W. et al. Acceptance of vaccinations in pandemic outbreaks: A discrete choice experiment. PLoS ONE. 2014;9:e102505.
17. T.R. Ministry of Health, General Directorate of Health Information Systems. Health statistics annuals. 2021. Available at https://sbsgm.saglik.gov.tr/TR-73387/saglik-istatistikleri-yilliklari.html Accessed March 14, 2022. Turkish.
18. Shacham M, Greenblatt-Kimron L, Hamama-Raz Y, Martin LR, Peleg O, Ben-Ezra M et al. Increased COVID- 19 vaccination hesitancy and health awareness amid COVID- 19 vaccinations programs in Israel. Int J Environ Res Public Health. 2021;1:3804.
19. Schwarzinger M, Flicoteaux R, Cortarenoda S, Obadia Y, Moatti J-P. Low acceptability of A/H1N1 pandemic vaccination in french adult population: Did public health policy fuel public dissonance? PLoS ONE. 2010; 5: e10199.
20. Marco-Franco JE, Pita-Barros P, Vivas-Orts D, González-de-Julián S, Vivas-Consuelo D. COVID- 19, fake news, and vaccines: should regulation be implemented? Int J Environ Res Public Health. 2021;1:744.
21. Lin C, Tu P, Beitsch LM. Confidence and receptivity for Covid- 19 vaccines: a rapid systematic Review. Vaccine. 2021;9:16.
22. Arıcan MD. Overview of vaccination among healthcare professionals, factors affecting vaccine acceptance and rejection. Master thesis, Health Sciences University İzmir Tepecik Training and Research Hospital Family Medicine Clinic. İzmir, Turkey, 2019. Turkish.
23. Alben AF. Vaccine awareness and thoughts of healthcare professionals in a university hospital on vaccine rejection. Master thesis, Gaziantep University, Faculty of Medicine, Department of Public Health. Gaziantep, Turkey, 2019. Turkish
24. Kelekar AK, Doktora VCL, Afonso NM, Mascarenhas AK. COVID- 19 Vaccine acceptance and hesitancy among dental and medical students. J Am Dent Assoc. 2021;152:596-603.
25. Mascarenhas AK, Lucia VC, Kelekar A, Afonso NM. Dental students' attitudes and hesitancy toward COVID- 19 vaccine. J Dent Educ. 2021:1-7.
26. Kose S, Mandiracioglu A, Sahin S, Kaynar T, Karbus O, Ozbel Y et al. Vaccine hesitancy of the COVID- 19 by health care personnel. Int J Clin Pract. 2020;00:e13917.
27. Salali GM, Uysal MS. COVID- 19 vaccine hesitancy is associated with beliefs on the origin of the novel coronavirus in the UK and Turkey. Psychol Med. 2020;19;1-3.

Archives of Current Medical Research
Arch Curr Med Res 2022;3(2):97-104

Received: 21 October 2021
Revised: 13 November 2021
Acccepted: 12 January 2022
DOI: 10.47482/acmr.2022.53

ORIGINAL ARTICLE

An analysis of emergency department-boarded patients awaiting inpatient beds

Şule Yakar[1], **Levent Avşaroğulları**[2],

1 University of Health Sciences Kayseri City Training and Research Hospital, Department of Emergency Medicine, Kayseri, Turkey
2 Erciyes University Faculty of Medicine, Department of Emergency Medicine, Kayseri, Turkey

Abstract

Background: Emergency department (ED) overcrowding and boarding are the most important factors that affect health services and quality of care all over the world. The objective of this study is to evaluate the length of stay of patients boarded in the ED and to analyze patients' data in respect to the length of stay.

Methods: This prospective study was carried out in a one-year period. The study included patients older than 18 years old who stayed in the ED more than 3 hours after the decision to transfer the patient to the relevant department due to unavailability of vacant inpatient beds. The mode of arrival to the ED, demographic features, the length of stay, clinical course, and outcomes were recorded and statistically analyzed.

Results: A total of 1750 patients were included in the study. Thirty-five percent of patients stayed more than 24 hours in the ED. Department of Infectious Diseases admitted the highest number of the patients (22.5%). Patients' need for Intensive Care Unit, departments awaited to admit patients, and patients' Emergency Severity Index were compared to patients' length of stay and Charlson Comorbidity Index. Differences between groups were statistically significant ($p<0.05$).

Conclusions: Insufficient number of inpatient beds is a major factor contributing to the ED boarding and overcrowding, which may have various unfavorable effects on both patient safety and functionality of EDs. Multidisciplinary solutions are required to overcome the problem.

Keywords: Boarding, Emergency Department, Overcrowding, Prolonged Wait Times.

Cite this article as: *Yakar Ş, Avşaroğulları L. An analysis of emergency department-boarded patients awaiting inpatient beds. Arch Curr Med Res. 2022;3(2):97-104*

Corresponding Author:
Şule Yakar, University of Health Sciences Turkey Kayseri City Training and Research Hospital, Department of Emergency Medicine, Kayseri, Turkey
E-mail: suleeee85@hotmail.com

INTRODUCTION

Emergency departments (ED) admit patients without any restrictions of social security or policies (1). Insufficient number of inpatient beds and inability for hospitalization is the leading factor among numerous factors affecting ED crowding (2,3). Some other factors are increasing number of patients, increasing number of the elderly and critically ill population, insufficient ancillary staff, delayed responses to consultations, insufficient number of ED beds, delayed laboratory and radiological results, and social security problems (4,5). Inpatient bed insufficiencies may be caused by the low ratio of number of nurses to those of patients, isolation measures, delayed cleaning services after patient discharge, inadequate examination and care services in bedridden patients, and delayed discharges after acute health care (6).

The term "*boarding* – i.e. awaiting transfer to an inpatient bed" is used for patients who remain in the ED after the patient has been admitted or placed into observation status at the facility, but has not been transferred to an inpatient or observation unit (7). Extended stays in EDs cause serious problems such as increased workload, delays in diagnostic and treatment processes, and decreased quality of healthcare (5,8). Furthermore, providing care to patients in critical conditions who cannot be transferred to inpatient beds and have to await in the ED has transformed EDs into so-called "pseudo-Intensive Care Units (ICU)" (9). ED crowding is known to cause dispatching ambulances to other hospitals, delayed transport of patients with acute cardiac conditions, and patients leaving the hospital without being evaluated (10). Moreover, overcrowded EDs lead to burnout, demoralization, and eventually workforce loss of ancillary staff (2,5,11). Recently, ED crowding has led to several studies analyzing features and length of stay of patients in ED (8,12).

This study focuses on boarding time of patients admitted to the ED and analyses the patients' data in respect to the length of stay. Additionally, possible solutions for boarding and its effects are discussed.

MATERIALS AND METHODS

This study was approved by the clinical research ethics committee of the Erciyes University Faculty od Medicine (Date: 24.01.2014 number: 2014/43).

This prospective study was performed in the Department of Emergency Medicine, Faculty of Medicine, Erciyes University in a one-year period between April 2014 and March 2015 after approval of the ethical committee. The patient group consisted of 1750 patients with a boarding time in ED more than three hours due to unavailability of vacant inpatient beds. Data on demographical features, mode of admittance (i.e. via ambulance, referral from another clinic, or direct admittance), date and hour of admittance, complaints, comorbidities, diagnoses, boarding time, Glasgow Coma Scale, Emergency Severity Index (ESI), Charlson Comorbidity Index (CCI), and outcome of the patients were collected and recorded using standard forms. Additionally, the department of consultant physician, procedures performed in the ED, undesired events that would occur in the ED, and patients needing isolation and indications for isolation were also recorded on the forms.

ESI is a triage algorithm which stratifies patients from the most to the least urgent medical condition by leveling them from 1 to 5 based on acuity of patients and resources needed (13). CCI is a comorbidity score based on additional diseases and age groups of patients (14). Statistical analyses were performed with SPSS 16.0 and SPSS 22.0 statistical packages for Windows.

Patients' boarding durations were grouped into specific time intervals, which were compared to CCI, ESI, department to be transferred, and need for ICU. Nonparametric tests (Kruskal-Wallis Test and Mann-Whitney U Test) were used to analyze differences between median values of groups, which were not normally distributed.

RESULTS

Of 1750 patients, 959 (54.8%) were male. The median age was 66±17.5 years. Age and gender differences were not statistically significant. Ambulance was the most frequent mode of admittance (56.3%). Of these patients, 967 were transferred to our ED via state-based ambulance service. Complaints or symptoms such as fever, loss of appetite, chills, malaise, etc. were categorized as "general symptoms". Respiratory system complaints were the most common chief complaint with a rate of 28.5% and the most common comorbid disease was hypertension with a rate of 29.7%. Demographic data, clinical features, ESI, and CCI scores of the patients are listed in Table 1.

Table 1. Demographic and clinical characteristics of the patients

	n: 1750	%
Mode of arrival		
Direct	1186	67.8
Referrals from polyclinics or outpatient facilities	57	3.3
Intra-city referral	416	23.8
Out-of-city referral	91	5.2
Chief complain		
Trauma	37	2.1
Eyes/Ears	13	0.7
Cardiovascular	34	1.9
Mental	321	18.3
Respiratory	498	28.5
Genitourinary	92	5.3
Digestive	428	24.5
Skin	66	3.8
Musculoskeletal	100	5.7
General symptoms	377	21.5
Other	39	2.2
Comorbidities		
Congestive heart failure	66	3.8
Valvular disease	32	1.8
Coronary artery disease	214	12.2
Peripheral vascular disease	13	0.7
Hypertension	519	29.7
Diabetes mellitus (DM)	299	17.1
Anemia	72	4.1
Neurological diseases	196	11.2
Chronic pulmonary disease	316	18.1
DM with complications	17	1
Cancer	378	21.6
Renal failure	107	6.1
Liver failure	80	4.6
Coagulation deficiency	13	0.7
Obesity	18	1
Weight loss	35	2
Fluid-electrolyte disorders	26	1.5
Alcohol abuse	8	0.5
Drug abuse	27	1.5
Depression / Psychosis	23	1.4
Emergency severity index score		
1	125	7.1
2	1027	58.7
3	598	34.2
Charlson score		
0	175	10
1	77	4.4
2	256	8.9
≥3	1342	76.7

In our study, 70.3% of the patients were hospitalized. ICU was indicated in 500 cases (28.6%), and more than one department decided for hospitalization in 386 cases (22.1%). The most common diagnosis of the patients was pneumonia with a rate of 26.9%, and the department of infectious diseases (22.5%) was the department that admitted the highest numbers of patients. Diagnoses, primary departments for transfer, and outcomes are listed in Table 2. Conditions such as diabetic ketoacidosis, urolithiasis, renal infarcts, traumatic causes, oncological conditions, and hematological disorders were categorized as "other conditions".

Table 2. Diagnosis, primary indicated department for hospitalization and final status of patients

	n	%
Diagnosis		
Cerebrovascular disease	261	14.9
Pneumonia	471	26.9
Pulmonary thromboembolism	100	5.7
Urinary system infections	166	9.5
Cellulitis	38	2.2
Gastrointestinal system bleeding	107	6.1
Choledocholithiasis	149	8.5
Acute renal failure	84	4.8
Pyelonephritis	13	0.7
Angioedema	8	0.5
Pneumothorax	14	0.8
Diabetic foot	11	0.6
Sepsis	136	7.8
Hepatic encephalopathy	31	1.8
Pancreatitis	61	3.5
Drug intoxication	29	1.7
Schizophrenia	6	0.3
Heart failure	5	0.3
Fluid-electrolyte disorders	12	0.7
Peritonitis	12	0.7
Other conditions	442	25.3
Primarily indicated department for hospitalization		
Internal Medicine ICU*	178	10.2
Anesthesia ICU	24	1.4
Neurology	272	15.5
Chest Diseases	362	20.7
Infectious Diseases	394	22.5
Cardiology / Endocrinology	14	0.8
Gastroenterology	265	15.1
Nephrology	59	3.4
Hematology	51	2.9
Oncology	20	1.1
General surgery	24	1.4
Thoracic Surgery	24	1.4
Neurosurgery	22	1.3
Psychiatry	18	1
Other(Orthopedics, Urology, Plastic Surgery)	23	1.3
Outcome		
Discharge from ED	125	7.1
Left from own request (consent)	58	3.3
Exitus in the ED	4	0.2
Referral to another hospital	333	19
Hospitalization	1230	70.3

The most common consulting departments were infectious diseases (39.1%), pulmonary diseases (25%), gastroenterology (20.5%), and neurology (17.9%). Cardiovascular surgery was the least common consulting department with 13 patients (0.7%). After boarding, the patients were hospitalized most commonly at departments of gastroenterology (12.5%), infectious diseases (12.4%), and pulmonary diseases (10.5%).

The number of boarding patients increased in spring months with 224 patients (12.7%) in March, 217 (12.4%) in April, and 186 (10.6%) in May. In October, there were only 70 boarding patients (4%), which was the lowest number. It was thought that the number of inpatients increased in the spring months, because of the most common complaint of the patients was from the respiratory system and the rate of concomitant chronic pulmonary disease was high (18.1%) in our study.

Additionally, procedures performed in the ED, undesired events that occurred during boarding, and need for isolation were evaluated. The most common indication for isolation was febrile neutropenia with a rate of 4.6%, and inadequate nursing care services were determined as the most common undesired event with a rate of 27.9%. The most common procedure performed in ED was blood product transfusion with a rate of 9.6%. Inserting an urethral catheter or nasogastric or orogastric tube, abscess drainage, dialysis, apheresis, and cardiopulmonary resuscitation were categorized in "others group" (Table 3).

Table 3. Isolation indications, procedures performed in the ED and complications

	n	%
Isolation indications		
VRE-positivity*	44	2.5
Febrile neutropenia	80	4.6
Tuberculosis	2	0.1
Viral infection	15	0.9
Immunosuppression	22	1.3
Agitation	10	0.6
Procedures performed in ED		
Intubation	54	3.1
Central venous catheter	102	5.8
Dialysis catheter	56	3.2
Nephrostomy catheter	7	0.4
Endoscopy	69	3.9
Endoscopic Retrograde Cholangiopancreatoduodenography	34	1.9
Percutaneous Transhepatic Cholangiography	4	0.2
Tube thoracostomy	19	1.1
Thoracentesis	33	1.9
Paracentesis	23	1.3
Transient pacemaker	1	0.1
Non-invasive mechanical ventilation	84	4.8
Tissue plasminogen activator use	5	0.3
Central venous pressure measurement	44	2.5
Blood product transfusion	168	9.6
Bronchoscopy	5	0.3
Lumbar puncture	15	0.9
Cystostomy	4	0.2
Other	342	19.5
Undesired events		
Missed home medication	104	5.9
Treatment delays	167	9.5
Delay/lack of interventional procedures to be performed in the inpatient departments	281	16.1
Inadequate nursing care services	489	27.9
Inappropriate regimen-diet	151	8.6
Not being able to be monitorized	48	2.7
Others group	257	14.7

*Vancomycin-resistant enterococci

Date and time of admittance, indications of hospitalization, boarding time, and total length of stay in the ED were summarized in Table 4. It was determined that 23.5% of the patients admitted to the hospital most frequently between 16:00-20:00 hours, and 37% of the patients' length of stay in the emergency department was 12-24 hours after hospitalization decision.

Table 4. ED arrival time and length of stay in the ED

	n	%
Arrival times		
08:00-12:00	308	17.6
12:00-16:00	382	21.8
16:00-20:00	412	23.5
20:00-24:00	367	20.9
00:00-04:00	188	10.7
04:00-08:00	93	5.3
Length of stay after hospitalization decision		
3-12 hours	490	28
12-24 hours	649	37
24-48 hours	414	23.6
48-72 hours	122	7.5
72-96 hours	40	2.2
More than 96 hours	25	1.4
Total length of stay		
3-12 hours	286	16.3
12-24 hours	664	37.9
24-48 hours	510	29.1
48-72 hours	195	11.1
72-96 hours	56	3.1
More than 96 hours	39	2.2

The patients were divided into two groups as (*i*) patients needing ICU (28.6%) and (*ii*) patients not needing ICU (71.4%). Median CCI of patients needing ICU was 4.3±2.2 and their median length of stay in the ED was 26.5±22.3 hours; median CCI of patients not needing ICU was 3.9±2.2 and their median length of stay in the ED was 31.2±23.3 hours. Comparison of the two groups regarding CCI of the patients and their length of stay in the ED showed statistically significant results ($p<0.05$). Neither ESI score 4 nor 5 was obtained in our patients. Consequently, the patients were divided into three groups regarding their ESI level (Table 1). Median CCI of patients with ESI level-1 was 5 and length of stay in the ED was 17.9 hours, median CCI of patients with ESI level-2 was 4 and length of stay in the ED was 23.2 hours, median CCI of patients with ESI

level-3 was 4, and length of stay in the ED was 22.1 hours. Comparison of the three groups regarding the length of stay in the ED and CCI was statistically significant ($p<0.001$).

DISCUSSION

A leading factor for ED overcrowding is patients' extended length of stay in the ED due to insufficient inpatient beds, which increases the number of boarding patients (2). Moreover, overcrowding causes medical errors, delayed care services, and decreased quality of medical care (9,15,16). To our knowledge, there is no study evaluating boarding patients in particular. Therefore, we discussed our findings with studies focusing on ED admittances of various categories. The main complaint at the time of admission in our study was mostly related to the respiratory system (28.5%) and gastrointestinal system (24.5%). On the other hand, chest pain was the most common complaint in another study focusing on the patient population of another university hospital ED in Turkey (12). McCarthy et al. (17) examined patients' charts of four trauma center-qualified hospitals to evaluate the impact of ED crowding and found that patients were admitted mostly due to trauma. Since patients of traumatic origin or with chest pain have a very short boarding time in our hospital, these patients form only a small part of our study group (2.1% and 1.9%, respectively).

Singer et al. (18) evaluated the relationship between boarding time in the ED and mortality and found that hypertension was the most common comorbidity (41.5%). Hypertension was also the most common comorbid condition in our study (29.7%). Mahsanlar et al. (4) also determined hypertension as one of the most common comorbidities in their study focusing on patients in the monitored care (monitored observation) unit in the ED.

Pneumonia was the most common disease requiring hospitalization. Consistently, the departments of infectious diseases (22.5%) and pulmonary diseases (20.7%) were the departments which admitted the highest numbers of patients. Satar et al determined that cardiology was the most common department to hospitalize the patients since cardiac conditions were the most common form of admission in their study focusing on patients older than 65 years old (19). Kekec et al. (20) found a high incidence of hospitalization into surgical ICUs in their study evaluating older patients admitted to the ED. In our study, boarding times for surgical departments and cardiology department were found rather short. This may be due to that a separate ICU for each surgical department has been established in our hospital and the ICU in the cardiology department contains sufficient beds, which ensures rapid hospitalization to these departments.

In a study on admittance of whole patients to the ED, Kilicaslan et al. (12) reported that consultations were mostly obtained from departments of cardiology, orthopedics and traumatology, and internal medicine. In our study, pneumonia was the most common diagnosis in boarding patients (26.9%). Therefore, infectious diseases (39.1%) and pulmonary diseases (25%) were the most common departments, from which consultations were obtained. There was a low rate of consultations obtained from surgical departments because of the low number of surgical cases in the boarding patient group in our study (12.6%).

Literature data suggest that delayed transfer to the ICU causes performing acute medical care to stabilize the patient and follow-up procedures in EDs instead of ICUs (21). In our study, rates of blood transfusion and introducing a central venous catheter were higher, 9.6% and 5.8%, respectively, and one patient received a temporary pacemaker in the ED. Svenson et al. (21) described a high incidence of introducing a central venous catheter (36.2%). Moreover, low incidence of temporary pacemaker placement in our patient group is probably due to the short transfer time to the cardiology ICU. Green et al. (22) described orotracheal intubation as the most common invasive procedure in their study evaluating patients transferred from the ED to the ICU (64%). Our study included patients transferred to not only ICUs but also regular wards, this may explain why intubation rate was found to be lower (3.1%) among all the invasive procedures.

Ramlakhan et al. (23) reported that most of the undesirable events occurring in EDs were avoidable (55-82%). We found out that the most common undesired events in our patient population were inadequate nursing care services and lack or delay of timely performance of in some invasive procedures to be performed in the inpatient departments (27.9% and 16.1%, respectively). High rate

of inadequate nursing care services in our study may be due to insufficient number of ancillary staff, continuing patient admissions to ED, necessity to provide care to new patients with the same team, and focusing on the acute condition of the patients. Liu et al. (24) reported a higher incidence of missing out home treatment compared to our study (17.9% vs. 5.9%). Length of stay in the ED is a factor considered in evaluating the quality of medical care. As it extends, quality of care was found to decrease (9). In our study, average boarding time was 24.6 hours. However, 2005 report of Centers for Disease Control and Prevention suggested an average boarding time of 210 minutes (4). Also, National Health Service strategized and advocated that >90% of the patients visiting the ED should be seen, evaluated, investigated, diagnosed, and disposed (admitted/discharged) within 4 hours of arrival to the ED (25). In our study, 35% of patients had a boarding time of more than 24 hours, which occurred due to the insufficient number of beds in inpatient wards as reported before in some studies (6).

This present study also evaluated ESI and CCI scores of patients. To our knowledge, there is no study in the literature focusing on the relationship between boarding time in the ED and these two indexes. Our results revealed an ESI level-2 in 59.2% of patients and CCI score of 5 in 21.1%. ESI is an algorithm based on resource needs (12, 26). This study does not contain patients with ESI level-4 or 5 because our study group mainly consists of patients needing hospitalization and a wide number of resources.

Liu et al. (24) stated that most of the patients in their study had a CCI of 0. CCI index of our patient population was mainly high (Table 1). This may be explained due to the fact that vacant inpatients beds were not available even for our critical or comorbid patients. Similarly, McCarthy et al. (17) suggested that a high ESI may be related to longer boarding time. They reported a lower rate of patients with ESI level-1 (7%) in their study and stated that these patients had a shorter length of stay in ED. We obtained a similar ratio in our patients with an ESI level-1 (7.1%). The simulation study of Hoot et al. (27) revealed that patients with ESI level-1 have an increased chance of hospitalization. This finding is consistent with our finding in the patients with an ESI level-1. The study of Lauks et al. (28) showed patients with ESI level-2 to 4 had mildly extended boarding time. In our study the percentages of the patients with ESI level-2 and 3 were 58.7% and 34.2% respectively. No patients with ESI level-4 or 5 were detected.

To prevent intense workload of ED, solutions such as changing the timing of elective surgeries, transferring boarding patients to hallways with beds to clear out primary intervention and treatment areas, increasing number and capacity of inpatient wards, and balancing ratio of patient hospitalization vs. discharge have been proposed (5,29). Studies confirmed that elective surgeries are one of the factors in extended ED stays (7). Accordingly, in our hospital, reserving ICU beds for elective surgeries has been found to be a considerable cause for insufficient ICU beds for emergency patients. Postponing elective surgeries and prioritizing emergency cases by regulations may be recommended. Another factor is accepting patients from other departments or outpatient services instead of patients awaiting in ED. Oray et al. (30) found a statistically significant decrease in the number of boarding patients in the ED after the use of "Electronic Blockage System" (EBS) compared to the period before the use of EBS (p=0.0001). EBS appoints empty inpatient beds, reserves these beds for boarding ED patients, and prevents the hospitalization of patients from outpatient services. EBS seems to be an effective solution for ED crowding. Furthermore, additional ICUs or wards outside the ED which would not be administratively connected to the ED may be designed particularly for keeping boarding patients until transfer. Health care staff and consulting physicians may follow and treat boarding patients in these units (9,31).

In conclusion, there is no simple solution for ED boarding. Instead of focusing only on the insufficient number of beds, a multidisciplinary and broad-scoped solution should be proposed. Hospital and city administrations should be included to address these problems.

Declarations

The authors received no financial support for the research and/or authorship of this article. There is no conflict of interest.

This study was approved by the clinical research ethics committee of the Erciyes University Faculty od Medicine (Date: 24.01.2014 number: 2014/43).

REFERENCES

1. Weiss SJ, Derlet R, Arndahl J, Ernst AA, Richards J, Fernández-Frackelton M, et al. Estimating the Degree of Emergency Department Overcrowding in Academic Medical Centers: Results of the National Emergency Medicine Department Overcrowding Study (NEDOCS). Acad Emerg Med. 2004;11:38-50.
2. Richardson DB, Mountain D. Myths versus facts in emegency department overcrowding and hospital access block. Med J Aust. 2009;190:369-74.
3. Erenler AK, Akbulut S, Guzel M, Cetinkaya H, Karaca A, Turkoz B, et al. Reasons for Overcrowding in the Emergency Department: Experiences and Suggestions of an Education and Research Hospital. Turk J Emerg Med. 2016;14:59-63.
4. Mahsanlar Y, Parlak I, Yolcu S, Akay S, Demirtas Y, Eryigit V. Factors Affecting the Length of Stay of Patients in Emergency Department Obsevation Units at Teaching and Research Hospitals in Turkey. Turk J Emerg Med. 2016;14:3-8.
5. Olshaker JS, Rathlev NK. Emergency department overcrowding and ambulance diversion: The impact and potential solutions of extended boarding of admitted patients in the emergency department. J Emerg Med. 2006;30:351-6.
6. Asplin BR, Magid DJ, Rhodes KV, Solberg LI, Lurie N, Camargo CA. A conceptual model of emergency department crowding. Ann Emerg Med. 2003;42:173-80.
7. Laam LA, Wary AA, Strony RS, Fitzpatrick MH, Kraus CK. Quantifying the impact of patient boarding on emergency department length of stay: All admitted patients are negatively affected by boarding. J Am Coll Emerg Physicians Open. 2021;2:e12401.
8. Veen D, Remeijer C, Fogteloo AJ, Heringhaus J, Groot B. Independent determinants of prolonged emergency department length of stay in a tertiary care centre: a prospective cohort study. Scand J Trauma Resusc Emerg Med. 2018;26:81.
9. Trzeciak S, Rivers EP. Emergency department overcrowding in the United States: an emerging threat to patient safety and public health. Emerg Med J. 2003;20:402-5.
10. Cowan RM, Trezeciak S. Clinical review: Emergency department overcrowding and the potential impact on the critically ill. Crit Care. 2005;9:291-5.
11. Farahmand S, Karimialavijeh E, Vahedi HS, Jahanshir A. Emergency medicine as a growing career in Iran: an Internet-based survey. World J Emerg Med. 2016;7:196-202.
12. Kilicaslan I, Bozan H, Oktay C, Goksu E. Demographic properties of patients presenting to the emergency department in Turkey. Turk J Emerg Med 2005;55-13.
13. Mirhaghi A, Kooshiar H, Esmaeili H, Ebrahimi M. Outcomes for Emergency Severity Index Triage Implementation in the Emergency Department. Journal of Clinical and Diagnostic Research. 2015;9:4-7.
14. Charlson score [accessed June 13th, 2013]. Available from: URL: http://touchcalc.com/calculators/cci_js - on line calculator (Date of access: 05/02/2014).
15. Hsu CM, Liang LL, Chang YT, Juang WC. Emergency department overcrowding: Quality improvement in a Taiwan Medical Center. J Formos Med Assoc 2019;118:86-93.
16. Hoot NR, Banuelos RC, Chathampally Y, Robinson DJ, Voronin BW, Chambers KA. Does crowding influence emergency department treatment time and disposition? J Am Coll Emerg Physicians Open. 2020;2:e12324.
17. McCarthy ML, Zeger SL, Ding R, Levin SR, Desmond JS, Lee J, et al. Crowding delays treatment and lengthens emergency department length of stay, even among high-acuity patients. Ann Emerg Med. 2009;54:492-503.
18. Singer AJ, Thode HC, Viccellio P, Pines JM. The association between length of emergency department boarding and mortality. Acad Emerg Med. 2011;18:1324-9.
19. Baz U, Satar S, Kozacı N, Acikalin A, Gulen M, Karakurt U. Geriatric patient admissions to emergency service. JAEM 2014;13:53-7.
20. Kekec Z, Koc F, Buyuk S. Review of Geriatric Patients Hospitalization in Emergency Department. Turk J Emerg Med. 2009;8: 21-4.
21. Svenson J, Besinger B, Stapczynski JS. Critical care of medical and surgical patients in the ED: Length of stay and initation of intensive care procedures. Am J Emerg Med. 1997;15:654-7.
22. Green RS, Macintyre JK. Critical care in the emergency department: An assessment of the length of stay and invasive procedures performed on citically ill ED patients. Scand J Trauma Resusc Emerg Med. 2009;17:47.
23. Ramlakhan S, Qayyum H, Burke D, Brown R. The safety of emergency medicine. Emerg Med J. 2016;33:293-9.
24. Liu SW, Thomas SH, Gordon JA, Hamedani AG, Weissman JS. A pilot study examining undesirable events among emergency department-boarded patients awaiting inpatient beds. Ann Emerg Med. 2009;54:381-5.
25. Verma A, Shishodia S, Jaiswal S, Sheikh WR, Haldar M, Vishen A, et al. Increased Length of Stay of Critically Ill Patients in the Emergency Department Associated with Higher In-hospital Mortality. Indian J Crit Care Med. 2021; 25:1221-5.
26. Maleki M, Fallah R, Riahi L, Delavari S, Rezaei S. Effectiveness of Five-Level Emergency Severity Index Triage System Compared With Three-Level Spot Check: An Iranian Experience. Arch Trauma Res. 2015;4:e29214.
27. Hoot NR, LeBlanc LJ, Jones I, Levin SR, Zhou C, Gadd CS, et al. Forecasting Emergency Department Crowding: A Discrete Event Simulation. Ann Emerg Med. 2008;52:116-25.
28. Lauks J, Mramor B, Baumgartl K, Maier H, Nickel CH, Bingisser R. Medical Team Evaluation: Effect on Emergency Department Waiting Time and Length of Stay. PLOS ONE. 2016;11:e0154372.
29. Yarmohammadian MH, Rezaei F, Haghshenas A, Tavakoli N. Overcrowding in emergency departments: A review of strategies to decrease future challenges. J Res Med Sci 2017;22:23.
30. Oray NC, Yanturalli S, Atilla R, Ersoy G, Topacoglu H. A New Model in Reducing Emergency Department Crowding: The Electronic Blockage System. Turk J Emerg Med. 2016;14:64-70.
31. Di Somma S, Paladino L, Vaughan L, Lalle I, Magrini L, Magnanti M. Overcrowding in emergency department: an international issue. Intern Emerg Med. 2015;10:171-5.

Archives of Current Medical Research
Arch Curr Med Res 2022;3(2):105-112

Received: 12 January 2022
Revised: 14 March 2022
Acccepted: 30 March 2022
DOI: 10.47482/acmr.2022.54

ORIGINAL ARTICLE

Comparison of the clinical results of mobile-bearing and fixed-bearing prostheses used for total knee arthroplasty in patients with osteoarthritis

Numan Atılgan[1], **Mehmet Türker**[2], **Özlem Orhan**[3], **Recep Memik**[4],

1 University of Health Sciences Mehmet Akif Inan Training and Research Hospital, Department of Orthopedics and Traumatology, Şanlıurfa, Turkey
2 University of Health Sciences Konya City Hospital, Department of Orthopedics and Traumatology, Konya, Turkey
3 Harran University Faculty of Medicine, Department of Orthopedics and Traumatology, Şanlıurfa, Turkey
4 Necmettin Erbakan University Meram Faculty of Medicine, Department of Orthopedics and Traumatology, Konya, Turkey

Abstract

Background: The aim of this study was to investigate the changes in pain, function, stiffness and complications over time in patients with osteoarthritis who underwent total knee arthroplasty (TKA) with fixed or mobile-bearing.

Methods: This study is a prospective cohort type study performed with gonarthrosis patients that underwent TKA. Western Ontario and McMaster Universities Arthritis Index (WOMAC) and American Knee Society Score (AKSS) were used for clinical evaluation (pain, function and stiffness). The post-treatment measurements of patients were performed at the one-year follow-up.

Results: The study group consisted of 63 patients with a mean age of 63.57 ± 8.13 years. WOMAC and AKSS scores of the patients improved significantly in both groups over time. WOMAC pain score was found to be lower in the fixed-bearing group in the postoperative first year. The WOMAC function score was lower in the mobile-bearing group at 6 months and 1 year postoperatively. The AKSS pain score was significantly lower in the mobile-bearing group in the preoperative period and in the fixed-bearing group at postoperative third month. The AKSS function score was significantly lower in the fixed-bearing group in the third and sixth postoperative months. In the postoperative period, no significant difference was found between groups in terms of radiolucent area size, infection and complication development.

Conclusions: Significant clinical improvements were observed in both types of prostheses during the follow-up of patients. While there were differences in clinical outcomes between the groups during the follow-up period, the two groups were similar in terms of complications.

Keywords: Osteoarthritis, Knee, Arthroplasty, Replacement, Prostheses and Implants.

Cite this article as: *Atılgan N, Türker M, Orhan Ö, Memik R. Comparison of the clinical results of mobile-bearing and fixed-bearing prostheses used for total knee arthroplasty in patients with osteoarthritis. Arch Curr Med Res. 2022;3(2):105-112*

Corresponding Author:
Özlem Orhan, Harran University, Faculty of Medicine,
Department of Orthopedics and Traumatology, Şanlıurfa, Turkey
E-mail: droorhan@gmail.com

INTRODUCTION

Osteoarthritis (OA) is the most common type of arthritis and is the main cause of chronic musculoskeletal pain and loss of mobility in the elderly (1). OA is particularly common in weight bearing joints such as the knee and the hip (2). Knee OA is a common degenerative condition caused by mechanical and chemical stress in the knee joint. Functional impairment inevitably occurs in affected joints, causing pain and reduced range of motion (3). Degenerative changes in the articular cartilage, muscles, bones, synovia and subchondral bone often progress during the development of the disease and include various abnormalities: osteophyte formation, synovial inflammation, degeneration of ligaments, dysfunctions in periarticular muscles and nerves, and bursitis (4,5).

Because of the continuous aging of the population and the increase in obesity levels, OA is becoming increasingly common worldwide (6). In population-based studies, the incidence of the disease has been reported to be 2-10 times higher in the population aged 65 years and older compared to the third decade of life (7). The estimated lifetime risk of developing symptomatic knee OA is approximately 40% in men and 47% in women, and this risk is higher in obese patients (8). In the Framingham OA survey; the prevalence of osteoarthritis has been reported to be 11% in women and 7% in men (9). In a study performed to evaluate the prevalence of osteoarthritis in Turkey, the prevalence of symptomatic knee OA was 14.8% in patients over 50 years of age (women: 22.5%, men: 8%) (10). Thus, it is evident that OA and OA-related knee pain has arguably become the most common cause of movement dependence and physical disability in the elderly (11,12).

In the advanced stages of the OA, surgical treatment options such as joint debridement, synovectomy, distal femoral/high tibial osteotomy are available (13). However, total knee arthroplasty (TKA) is the gold standard treatment for patients with severe end-stage symptomatic osteoarthritis that is unresponsive to conservative treatment, especially when OA leads to considerably impaired quality of life (14). TKA contributes significantly to pain control and functional recovery in patients with severe OA (15,16). Over the past 30 years, different prostheses have been designed with advances in biomedical engineering and surgical techniques (17). Nowadays, TKA is performed with knee prostheses that have mobile-bearing or fixed-bearing characteristics as both types seem to provide similarly successful clinical results (15,17). However, problems such as abrasion, osteolysis and loosening are known to affect some of the patients during long-term follow-up after TKA with fixed-bearing prostheses. This fact has caused further development and interest for the use of mobile-bearing knee prostheses. Mobile-bearing prostheses are reported to reduce the risk of loosening by reducing stress as a result of having a larger area and also its even distribution of weight to the surrounding soft tissues. They are also suggested to decrease risk for osteolysis by causing less microparticle formation than fixed bearing prostheses (18,19).

The aim of this study was to investigate the changes in pain, function, stiffness and complications over time in patients who underwent TKA with fixed or mobile-bearing prostheses for the treatment of OA.

MATERIALS AND METHODS

This study is a prospective cohort type study performed with gonarthrosis patients who underwent TKA at Necmettin Erbakan University, Meram Medical Faculty Orthopedics and Traumatology Department between 2017-2018.

In order to conduct the study, ethical committee approval (Date-no:16.06.2017- 2017/972) was obtained from the Ethics Committee of Meram Faculty of Medicine, and the study was conducted in accordance with the Helsinki Declaration (20).

Study group

The study group consisted of patients who applied to the orthopedics and traumatology department and were scheduled for TKA due to being diagnosed with OA that did not respond to conservative treatments.

Revision knee arthroplasty, bilateral knee arthroplasty in the same session, a constant varus of more than 20 degrees, skeletal development problems, rheumatic disease, secondary osteoarthritis, and Charcot's neuroarthropathy patients were excluded from the study.

Randomization

Each patient was assigned a number according to the order of admission to the hospital. The groups were determined by randomized selection. Patients were divided into two groups as fixed bearing and mobile bearing.

Evaluation of patients

TKA of OA patients who applied to the orthopedics and traumatology outpatient clinic were evaluated by an experienced specialist physician. Patients who were diagnosed with OA were informed about the aim and subject of the study. Informed consent was obtained from the patients who agreed to participate in the study. Afterwards, TKA operations were performed by the same group of specialists according to patient randomization.

Pain, function and stiffness of the knee joint were measured in the third postoperative month, sixth month and first year. Western Ontario and McMaster Universities Arthritis Index (WOMAC) and American Knee Society Score (AKSS) were used as clinical evaluation instruments. During the follow-up, radiographs of the patients were evaluated. In addition, complications such as superficial skin infection, serious discharge and anterior knee pain were evaluated and recorded in both groups.

WOMAC Index

The WOMAC index is a valid and reliable scale frequently used in the clinical evaluation of patients with hip and knee OA (21). The validity and reliability study of the Turkish version was conducted by Tüzün et al. (22). The WOMAC index consists of three different sections and 24 questions that assess pain (five questions), stiffness (two questions), and physical function (17 questions). The increase in the total score is associated with increased pain and stiffness and impairment of physical function (21,22).

AKSS

In addition to the WOMAC index, clinical evaluation of the patients was performed using the scoring system established by the American Knee Society. With this scoring system, pain, function, range of motion, flexion deformity and instability are evaluated. As the score obtained from the scale increases, pain and functional limitation decrease (23).

Statistical analysis

All data were evaluated by IBM SPSS (Version 15.0) statistical package program on a Windows OS computer. The variables were tested for normal distribution with the Shapiro Wilk and the Kolmogorov Smirnov (with Lilliefors correction) tests and normal distribution assumptions for the respective tests were not met in any analysis. The number, percentage, mean, standard deviation, median, minimum and maximum values of variables were used for the depiction of descriptive data. The Mann Whitney U, Kruskal Wallis and Chi Square tests were used to compare groups. Statistical significance level was accepted as $p \leq 0.05$.

RESULTS

The study group consisted of 63 patients (15 (23.8%) males and 48 (76.2%) females). The ages of the patients ranged from 47 to 87, with a mean of 63.57 ± 8.13 years. There was no statistically significant difference between the groups in terms of age, gender and affected extremity (localization). The comparison of groups in terms of descriptive characteristics is given in Table 1.

Table 1. Comparison of groups according to descriptive characteristics

	Fixed-bearing	Mobile-bearing	Overall	p
	Mean ± SD (Min–Max)	Mean ± SD (Min–Max)		
Age (years)	63.1±9.0 (47.0-87)	64.0±7.3 (51.0.-81.0)	63.57±8.13 (47.0-87.0)	0.65
	n (%)	**n (%)**		
Gender				
Male	9 (60.0)	6 (40.0)	15 (23.8)	0.41
Female	23 (47.9)	25 (52.1)	48 (76.2)	
Localization				
Right	11 (34.4)	10 (32.3)	21 (33.3)	0.86
Left	21 (65.6)	21 (67.7)	42 (66.7)	
Total	32 (50.8)	31 (49.2)	63 (100.0)	

WOMAC pain, function and stiffness scores of the patients decreased significantly over time. WOMAC pain score was found to be lower in the fixed-bearing group in the postoperative first year. The WOMAC function score was lower in the mobile-bearing group at 6 months and at 1 years postoperatively. The preoperative value of WOMAC stiffness score was lower in the mobile-bearing group, whereas the postoperative 1st year value was lower in the fixed-bearing group. The comparison of the WOMAC scores of the groups is given in Table 2.

Table 2. Comparison of the scores of the groups from the WOMAC Index

	Fixed-bearing	Mobile-bearing	p
	Mean±Sd (Min-Max)	Mean±Sd (Min-Max)	
WOMAC Pain			
Preoperative	17.7±1.8 (12-20)	17.1±2.2 (12-20)	0.37
Postoperative 6th month	3.2±0.9 (2-5)	3±0.7 (2-4)	0.32
Postoperative 1st year	2.3±0.7 (1-4)	2.6±0.7 (1-4)	**0.07**
p	**<0.01**	**<0.01**	
WOMAC Function			
Preoperative	53.1±5.2 (40-62)	54.8±5.6 (49-62)	0.18
Postoperative 6th month	15.2±3.6 (9-25)	11.4±2.7 (2-17)	**<0.01**
Postoperative 1st year	11±3.2 (5-18)	7.9±2.6 (4-18)	**<0.01**
p	**<0.01**	**<0.01**	
WOMAC Stiffness			
Preoperative	6.8±0.7 (6-8)	6.4±0.9 (5-8)	**0.03**
Postoperative 6th month	3.5±0.9 (2-6)	3.2±0.7 (2-4)	0.27
Postoperative 1st year	2±0.6 (1-3)	2.7±0.8 (1-4)	**<0.01**
p	**<0.01**	**<0.01**	

When the changes in the AKSS scores of the patients were examined, it was seen that there was a significant increase in the postoperative period in both groups compared to preoperative measurements. The AKSS pain score was significantly lower in the mobile-bearing group in the preoperative period, while in the fixed-bearing group it was lower in the postoperative third month. The AKSS function score was significantly lower in the fixed-bearing group in the third and sixth postoperative months. The comparison of groups in terms of AKSS scores is given in Table 3.

Table 3. Comparison of American Knee Society Scores (AKSS) of groups

	Fixed-bearing	Mobile-bearing	p
	Mean±Sd (Min-Max)	Mean±Sd (Min-Max)	
AKSS Pain Score			
Preoperative	51.8±6.7 (30-62)	48.0±5.7 (37-61)	**<0.01**
Postoperative 3th month	63.6±6.0 (51-76)	67.2±9.6 (45-83)	**0.02**
Postoperative 6th month	72.1±4.8 (62-86)	74.9±10.3 (54-93)	0.16
Postoperative 1st year	76.1±6.1 (65-98.9)	77.7±10.4 (56-98)	0.39
p	**<0,01**	**<0,01**	
AKSS Function Score			
Preoperative	30.3±8.6 (14-50)	28.0±6.7 (17-37)	0.33
Postoperative 3th month	59.3±7.0 (47-72)	62.6±6.7 (51-73)	**0.06**
Postoperative 6th month	63.4±10.2 (44-82)	69.7±5.2 (57-78)	**0.01**
Postoperative 1st year	70.3±7.8 (54-83)	73.3±4.4 (64-81)	0.11
p	**<0.01**	**<0.01**	

In the postoperative period, no significant difference was found between the fixed-bearing and mobile-bearing groups in terms of radiolucent area size, infection and complication development. The comparison of postoperative follow-up values of groups was given in Table 4.

Table 4. Comparison of postoperative follow-up values of groups

	Fixed-bearing n (%)	Mobile-bearing n (%)	p
Radiolucent area size			
<4 mm	30 (93.8)	29 (93.5)	0.97
5-6 mm	2 (6.3)	2 (6.5)	
Development of infection			
No	26 (81.3)	30 (96.8)	0.10
Serous discharge	4 (12.5)	0 (0.0)	
Superficial infection	2 (6.3)	1 (3.2)	
Development of complication			
No	29 (90.6)	29 (93.5)	0.67
Anterior knee pain	3 (9.4)	2 (6.5)	

DISCUSSION

In this study, we evaluated the clinical outcomes and complications of patients undergoing TKA with fixed-bearing and mobile-bearing prostheses. In both the fixed-bearing and mobile-bearing groups, it was found that pain, function and stiffness improved significantly. The clinical results showed variability between the two groups in the postoperative period, but the two groups were similar in terms of complications.

Knee pain

According to WOMAC index, pain was lower in the fixed-bearing group in the first postoperative year. According to AKSS, knee pain was significantly lower in fixed-bearing group at the preoperative period, while the mobile-bearing group had significantly lower values at postoperative third month. In a systematic review of 127 studies evaluating clinical outcomes with fixed and mobile-bearing prostheses in TKA, no significant difference was reported between the groups in terms of pain (24). In another systematic review, this time including 19 studies, no significant differences were found between the groups in terms of pain which was assessed via the AKSS and also visual analog scales (26). Furthermore, in a study from Turkey, by Atay et al., it was reported that there was no significant difference in postoperative pain scores between fixed and mobile-bearing groups (17). Despite finding various significant differences between groups, we are aware that there may be other parameters that influenced pain levels in patients, including baseline differences between patients (which are evident with preoperative measurements) and the lack of evaluation of the patients' daily life practices after surgery. However, the significant differences between pain levels at especially the postoperative third month may warrant further studies in order to assess whether the two procedures have different short-term pain outcomes.

Functional capacity and stiffness

Both groups showed significant improvement in function and stiffness over time, as measured by the WOMAC index. According to the WOMAC index, functional status of the patients was significantly better in the mobile-bearing group at 6 months and 1 year postoperatively. Further, stiffness of the knee joint was better in the fixed-bearing group at postoperative first year. When changes in the AKSS function score of the patients were examined, it was seen that there was a significant improvement in the postoperative period in both groups compared to preoperative measurements. AKSS function score was found to be significantly better in the mobile-bearing group in the third and sixth postoperative months. In a systematic review by Fransen et al., no significant difference was found between fixed and mobile bearing groups in terms of range of motion and function (24). In a study by Xu et al., the postoperative 1, 3, and 10 years of range of motion and functional scores (measured by AKSS and WOMAC) of both the fixed and mobile-bearing groups were found to have improved significantly (they were similar at baseline). In addition, range of motion and functional status were reported to be better in the fixed-bearing group compared to mobile-bearing in the sixth week (25). In another study, no significant difference was found between fixed and mobile-bearing in terms of AKSS and WOMAC functional scores (26). Returning to the study from Turkey by Atay et al., it was reported that there was no significant difference between the fixed and mobile-bearing groups in terms of function scores at 50 months of follow-up (17). In the study of Abdel et al., no significant difference was found between the fixed and mobile-bearing prosthesis groups observed for 10 years with tests of range of motion and AKSS (27). In their study, Emerson et al. reported that they did not find a significant difference in knee functional scores at 8-year follow-up between fixed and mobile-bearing (28).

In the study of Kim et al., fixed-bearing knee prostheses were applied to one knee and mobile-bearing knee prostheses to the other knees of the same patients due to concerns that factors related to patient characteristics might be effective on postoperative clinical changes. In this study, no difference was found between the groups in terms of WOMAC index, AKSS pain and function scores (27). Chiu et al., in a similarly designed study, reported that there was no significant difference between the two types of prostheses in terms of clinical results when the early results of the cases were compared (30). In contrast, we found some differences between groups; however, as mentioned before, some of these differences in pain, function and stiffness may be due to various factors. Even so, despite the overwhelming evidence in the literature and the fact that our results confirm prior findings at

longer duration of follow-up, we believe the short-term differences may again point to a short-term difference between the two prosthesis types. Therefore, our belief is that further studies are warranted to elucidate whether such a difference truly exists.

Complications in fixed-bearing and mobile-bearing groups

In the postoperative period, no significant difference was found between fixed-bearing and mobile-bearing groups in terms of radiolucent area size, infection and complication development. In the study of Hofstede et al., it was reported that there was no significant difference between two groups (fixed-bearing and mobile-bearing) when revision surgery, mortality and complication rates were examined (26). In another study, no difference was found between fixed and mobile-bearing groups in terms of patellar tilt and prosthesis survival (27). In the study by Kim et al., it was reported that osteolysis was not seen in both groups at 7.4 years of follow-up, and no significant difference was found between the groups in terms of complications (29). In a previous systematic review, no significant difference was found between the fixed and mobile-bearing groups in terms of complications such as insert wear, osteolysis and radiolucency (24). The results of this study support the literature in this regard.

Limitations

One of the limitations of the study is the relatively low sample size. In a larger sample, we could have obtained different results, especially with a multicenter study that may have contributed to the determination of actual differences in the short term. Another limitation is that the follow-up period of the patients was set at one year. In the long term, there may be other differences between groups, or the differences could diminish over time. Finally, the characteristics of the surgical team, postoperative care, and factors related to patient and treatment adherence are also likely to affect clinical outcomes. However, we could not control the effects of these factors during or after treatment.

Significant clinical improvements were observed with both types of prosthesis during the follow-up period. There were differences in clinical outcomes between the two groups, especially at short-term comparisons; but the two groups were similar with regard to complications. In the light of these results, both fixed-bearing and mobile-bearing type prostheses can be said to be beneficial in the treatment of OA. However, we further studies are necessary to evaluate the clinical effects of both types of prosthesis, particularly to compare short-term results.

Declarations

The authors received no financial support for the research and/or authorship of this article. There is no conflict of interest.

This study was approved by the clinical research ethics committee of the Necmettin Erbakan University Meram Faculty of Medicine (Date: 16.06.2017 number: 2017/972).

REFERENCES

1. Zhang W, Moskowitz RW, Nuki G, Abramson S, Altman RD, Arden N, et al. OARSI recommendations for the management of hip and knee osteoarthritis, Part II: OARSI evidence-based, expert consensus guidelines. Osteoarthritis Cartilage. 2008;16(2):137-62.
2. Mabey T, Honsawek S. Cytokines as biochemical markers for knee osteoarthritis. World J Orthop. 2015;6(1):95-105.
3. Raeissadat SA, Tabibian E, Rayegani SM, Rahimi-Dehgolan S, Babaei-Ghazani A. An investigation into the efficacy of intra-articular ozone (O2-O3) injection in patients with knee osteoarthritis: a systematic review and meta-analysis. J Pain Res. 2018;11:2537-2550.
4. Blanco FJ. Osteoarthritis: something is moving. Reumatol Clin. 2014;10(1):4-5.
5. Roos EM, Arden NK. Strategies for the prevention of knee osteoarthritis. Nat Rev Rheumatol. 2016;12(2):92-101.
6. Calunga JL, Menéndez S, León R, Chang S, Guanche D, Balbín A, et al. Application of ozone therapy in patients with knee osteoarthritis. Ozone Sci Eng. 2012;34(6):469-75.
7. Felson DT, Lawrence RC, Dieppe PA, Hirsch R, Helmick CG, Jordan JM, et al. Osteoarthritis: new insights. Part 1: the disease and its risk factors. Ann Intern Med. 2000;133(8):635-46.
8. Murphy L, Schwartz TA, Helmick CG, Renner JB, Tudor G, Koch G, et al.. Lifetime risk of symptomatic knee osteoarthritis. Arthritis Rheum. 2008;59(9):1207-13.
9. Felson DT, Naimark A, Anderson J, Kazis L, Castelli W, Meenan RF. The prevalence of knee osteoarthritis in the elderly. The Framingham Osteoarthritis Study. Arthritis Rheum. 1987;30(8):914-8.
10. Kaçar C, Gilgil E, Urhan S, Arikan V, Dündar U, Oksüz MC, et al. The prevalence of symptomatic knee and distal interphalangeal joint osteoarthritis in the urban population of Antalya, Turkey. Rheumatol Int. 2005;25(3):201-4.
11. Peat G, McCarney R, Croft P. Knee pain and osteoarthritis in older adults: a review of community burden and current use of primary health care. Ann Rheum Dis. 2001;60(2):91-7.
12. Yüce A, İğde N, Bayraktar TO, Yerli M, Tekin AÇ, Bayraktar MK, Gürbüz H. Intra-articular Methylprednisolone Injection for Advanced Knee Osteoarthritis in Geriatric Patient Population. Arch Curr Med Res 2021;2(1):19-24

13. Ulucaköy C, Yapar A, Vural A, Özer H. Is iliac autogenous graft augmentation in medial open wedge high tibial osteotomies superior to no augmentation in terms of bone healing?. Jt Dis Relat Surg 2020;31(2):360-366.
14. Mandl LA. Determining who should be referred for total hip and knee replacements. Nat Rev Rheumatol. 2013;9(6):351-7.
15. Skou ST, Roos EM, Laursen MB, Rathleff MS, Arendt-Nielsen L, Simonsen O, et al. A Randomized, Controlled Trial of Total Knee Replacement. N Engl J Med. 2016;374(7):692
16. Hochberg MC, Altman RD, Brandt KD, Clark BM, Dieppe PA, Griffin MR, et al. Guidelines for the medical management of osteoarthritis. Part II. Osteoarthritis of the knee. American College of Rheumatology. Arthritis Rheum. 1995;38(11):1541-6.
17. Atay T, Aksoy O, Aydoğan N. The evaluation of the midterm results of the patients applied knee prosthesis with polyethylene mobile bearing and fixed bearing insert. S.D.Ü. Tıp Fak. Derg. 2007;14(4):1-6
18. Buechel FF Sr, Buechel FF Jr, Pappas MJ, D'Alessio J. Twenty-year evaluation of meniscal bearing and rotating platform knee replacements. Clin Orthop Relat Res. 2001;388:41-50.
19. Sorrells RB. The rotating platform mobile bearing total knee arthroplasty. Surg Technol Int, 2000; 9:245-51.
20. World Medical Association Declaration of Helsinki. Ethical principles for medical research involving human subjects. Bull World Health Organ. 2001;79(4):373-4.
21. Bellamy N, Buchanan WW, Goldsmith CH, Campbell J, Stitt LW. Validation study of WOMAC: a health status instrument for measuring clinically important patient relevant outcomes to antirheumatic drug therapy in patients with osteoarthritis of the hip or knee. J Rheumatol. 1988;15(12):1833-40.
22. Tüzün EH, Eker L, Aytar A, Daşkapan A, Bayramoğlu M. Acceptability, reliability, validity and responsiveness of the Turkish version of WOMAC osteoarthritis index. Osteoarthritis Cartilage. 2005;13(1):28-33.
23. Insall JN, Dorr LD, Scott RD, Scott WN. Rationale of the Knee Society clinical rating system. Clin Orthop Relat Res. 1989;248: 13-4.
24. Fransen BL, van Duijvenbode DC, Hoozemans MJM, Burger BJ. No differences between fixed- and mobile-bearing total knee arthroplasty. Knee Surg Sports Traumatol Arthrosc. 2017;25(6):1757-77.
25. Xu H, Wang C, Zhang H, Wang Y. [Effectiveness comparison of mobile-bearing and fixed-bearing prostheses in total knee arthroplasty for ten years follow-up]. Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi. 2017;31(3):271-7.
26. Hofstede SN, Nouta KA, Jacobs W, van Hooff ML, Wymenga AB, Pijls BG, et al.. Mobile bearing vs fixed bearing prostheses for posterior cruciate retaining total knee arthroplasty for postoperative functional status in patients with osteoarthritis and rheumatoid arthritis. Cochrane Database Syst Rev. 2015;(2):CD003130.
27. Abdel MP, Tibbo ME, Stuart MJ, Trousdale RT, Hanssen AD, Pagnano MW. A randomized controlled trial of fixed- versus mobile-bearing total knee arthroplasty: a follow-up at a mean of ten years. Bone Joint J. 2018;100-B(7):925-929.
28. Emerson RH Jr, Hansborough T, Reitman RD, Rosenfeldt W, Higgins LL. Comparison of a mobile with a fixed-bearing unicompartmental knee implant. Clin Orthop Relat Res. 2002;404:62-70.
29. Kim YH, Park JW, Kim JS. The Long-Term Results of Simultaneous High-Flexion Mobile-Bearing and Fixed-Bearing Total Knee Arthroplasties Performed in the Same Patients. J Arthroplasty. 2019;34(3):501-7.
30. Chiu KY, Ng TP, Tang WM, Lam P. Bilateral total knee arthroplasty: One mobile-bearing and one fixed-bearing. J Orthop Surg (Hong Kong). 2001;9(1):45-50.
31. Stukenborg-Colsman C, Ostermeier S, Hurschler C, Wirth CJ. Tibiofemoral contact stress after total knee arthroplasty: comparison of fixed and mobile-bearing inlay designs. Acta Orthop Scand. 2002;73(6):638-46.
32. Callaghan JJ. Mobile-bearing knee replacement: clinical results: a review of the literature. Clin Orthop Relat Res. 2001;392:221-5.

Archives of Current Medical Research
Arch Curr Med Res 2022;3(2):113-119

Received: 26 January 2022
Revised: 04 March 2022
Acccepted: 05 April 2022
DOI: 10.47482/acmr.2022.55

ORIGINAL ARTICLE

Which glomerular filtration rate estimation formula should be used for nephrological evaluation in patients with common variable immune deficiency?

Gökhan Aytekin[1], İsmail Baloğlu[2], Fatih Çölkesen[3], Eray Yıldız[3], Hakan Özer[4], Sevket Arslan[3], Ahmet Zafer Çalışkaner[3], Kültigin Türkmen[4],

1 Konya City Hospital, Department of Allergy and Clinical Immunology, Konya, Turkey
2 Nigde Omer Halisdemir University Education and Research Hospital Department of Internal Medicine, Division of Nephrology Nigde, Turkey
3 Necmettin Erbakan University Meram Faculty of Medicine, Department of Internal Medicine, Division of Allergy and Clinical Immunology, Konya, Turkey
4 Necmettin Erbakan University Meram Faculty of Medicine, Department of Internal Medicine, Division of Nephrology, Konya, Turkey

Abstract

Background: Common variable immunodeficiency (CVID) is the most common primary immunodeficiency in adults. In addition to renal complications of the disease, there may be an increased likelihood of renal dysfunction due to sucrose in immunoglobulin replacement therapies or other drugs used in treatment. In CVID patients, it is important to monitor patients for renal complications at routine intervals. We compared creatinine-based calculation methods for estimated glomerular filtration rate (eGFR) such as Modification of Diet in Renal Disease (MDRD), Cockcroft-Gault (CG), and Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) with 24-hour urine creatinine clearance measurement. We aimed to investigate which calculation method was more reliable and consistent in this patient population.

Methods: The records of 14 patients who had clinical follow-up at our hospital were retrospectively reviewed. Patients' eGFR values were measured by three different methods (CKD-EPI, MDRD , and CG formulas). The 24-hour urinary creatinine clearance of all patients and e-GFR calculated by the formula were compared.

Results: The eGFR calculated using the MDRD formula was 122.99±41.22 mL/min/1.73 m2, whereas the eGFR measured using the 24-hour urinary creatinine clearance was 99.64(83.35-156.58) mL/min/1.73 m2. Moreover, eGFR calculated by CKD-EPI formula was 113.83±26.46 mL/min/1.73 m2, while eGFR calculated by CG formula was 133.52±45.35 mL/min/1.73 m2. 24-hour urinary creatinine clearance was positively correlated with MDRD, CKD-EPI and CG formulas (r=0.726, p=0.003, r=0.634, p=0.015, r=0.806, p=0.001, respectively).

Conclusions: We found that all creatinine-based formulas used in clinical practice for eGFR measurement correlate with 24-hour urine creatinine clearance in patients with CVID. In addition, we have shown that eGFR calculated with the formula CKD-EPI is more closely related to 24-hour urinary creatinine clearance. Therefore, we believe that the eGFR measurement calculated with CKD-EPI is more useful for nephrological follow-up of patients with CVID. It should be noted that our study has some limitations due to the small number of patients.

Keywords: Common Variable Immune Deficiency, Chronic Kidney Disease Epidemiology Collaboration, Cockcroft-Gault, Glomerular Filtration Rate, Modification of Diet in Renal Disease.

Cite this article as: *Aytekin G, Baloğlu İ, Çölkesen F, Yıldız E, Özer H, Arslan Ş, Çalışkaner AZ, Türkmen K. Which glomerular filtration rate estimation formula should be used for nephrological evaluation in patients with common variable immune deficiency? Arch Curr Med Res. 2022;3(2):113-119*

Corresponding Author:
Hakan Özer, Necmettin Erbakan University, Meram Faculty of Medicine, Department of Internal Medicine, Division of Nephrology, Konya, Turkey
E-mail: hakanozer724@gmail.com

INTRODUCTION

In the adult population, common variable immunodeficiency (CVID) is the most common primary immunodeficiency. It is characterized by recurrent upper respiratory tract infections and chronic lung diseases such as bronchiectasis and interstitial lung disease, inflammatory bowel disease, granulomatous disease, autoimmunity, immune dysregulation, and a predisposition to lymphomalignancies (1,2). Although many diseases such as renal granulomas, focal segmental glomerulosclerosis (FSGS), membranous glomerulonephritis (MGN), membranoproliferative glomerulonephritis (MPGN), renal amyloidosis, nephrotic syndrome, various tubulopathies, and end-stage renal disease have been described in CVID patients, there are no comprehensive prospective studies investigating renal complications in this patient population (3-6). Data are generally based on case reports and brief literature reviews. In addition to renal complications of the disease, there may be an increased likelihood of renal dysfunction due to sucrose in immunoglobulin replacement therapies or other drugs used in treatment (7, 8). With advances in treatment and increasing life expectancy in these patients, issues such as management of disease-related complications and quality of life have become more important. For this reason, it is important to monitor patients for renal complications at regular intervals. The most commonly used parameter in monitoring renal functions is creatinine, while the gold standard parameters are inulin clearance, 51Cr-EDTA, 99mTC-DTPA, 125I-thalamate, and iohexol clearance, but they are expensive and impractical to use (9). Although measurement of renal function with 24-hour urine is the most widely used method, creatinine-based glomerular filtration rate (GFR) calculation methods such as Modification of Diet in Renal Disease (MDRD), Cockcroft-Gault (CG), and Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) are practical methods that can be used instead of measuring urea creatinine clearance in 24-hour urine. The serious limitations of the 24-hour urine creatinine clearance method, such as urine collection in one day and erroneous urine collection, necessitate alternative measurement methods. In this study, we compared creatinine-based estimated glomerular filtration rate (e-GFR) calculation methods such as Modification of Diet in Renal Disease (MDRD), Cockcroft-Gault (CG), and Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) with 24-hour urine creatinine clearance measurement. We aimed to determine which calculation method was more reliable and consistent in this patient population.

MATERIALS AND METHODS

This study was approved by the clinical research ethics committee of the Necmettin Erbakan University Meram Faculty of Medicine (Date: 21.02.2020 number: 2020/2322), and all participants signed a written informed consent form. The records of 14 patients who were followed-up in our hospital were retrospectively analyzed. Patients were diagnosed with CVID according to the European Society for Immunodeficiency (ESID) criteria (10). Inclusion criteria for the study: 1) CVID patients according to ESID criteria. 2) Patients over 18 years old 3) Patients not taking medications that affect 24-hour urinary creatinine excretion or serum creatinine level measurement. As exclusion criteria: 1) Patients under 18 years old 2) Patients taking medications that may affect 24-hour urinary creatinine excretion or serum creatinine level measurement. 3) Presence of urinary tract infection. All of our patients received intravenous immunolobulin (IVIG) treatment, but none of them received sucrose-containing IVIG.

Data on age, height, and current body weight were recorded, and their body mass index (BMI) was calculated using this equation: BMI (kg/m^2) = weight (kg)/height (m). Blood samples were obtained from all patients by venipuncture. All creatinine measurements were performed in the same laboratory using the method of Jaffe.

The e-GFR values of the patients were measured by three different methods (Table 1). In addition, 24-hour urinary proteinuria values were recorded for all patients in the system.

Table 1. e-GFR Calculation Formulas

MDRD	186 × Serum $Cr^{-1.154}$ × $age^{-0.203}$ × 1.212 (if the patient is black) × 0.742 (if female)
Cockcroft-Gault	CrCl ml/min = (140 – age) × (weight, kg) × (0.85 if female) / (72 × Cr)
CKD-EPI	141 × min (Scr **/κ (0.7 for females and 0.9 for males))** $^{\alpha}$ **(-0.329 for females and -0.411 for males)** × max(Scr **/κ)**$^{-1.209}$ × 0.993^{Age} × 1.018 (if female) × 1.159 (if black)

eGFR: Estimated glomerular filtration rate, MDRD: The Modification of Diet in Renal Disease, CKD-EPI: Chronic Kidney Disease Epidemiology Collaboration

Statistical analysis was performed using the software package IBM SPSS Statistics version 22. Normally distributed parameters were presented as mean ± standard deviation, and skewed parameters were expressed as median (interquartile range [minimum/maximum]). Descriptive data were presented as frequencies and percentages and compared with the chi-square test. Baseline characteristics were compared with an independent Student's t test, Mann-Whitney rank sum test, Fisher's exact test, or chi-square test where appropriate.

RESULTS

Demographic, clinical characteristics, and biochemical parameters of 14 patients with CVID were depicted in Table 2. We studied 14 patients with CVID, 8 (57.1%) females and 6 (42.9%) males. The mean age of the patients was 40.61 ± 13.73 years. As shown in Table 2, the mean serum creatinine level was 0.72 ± 0.20.

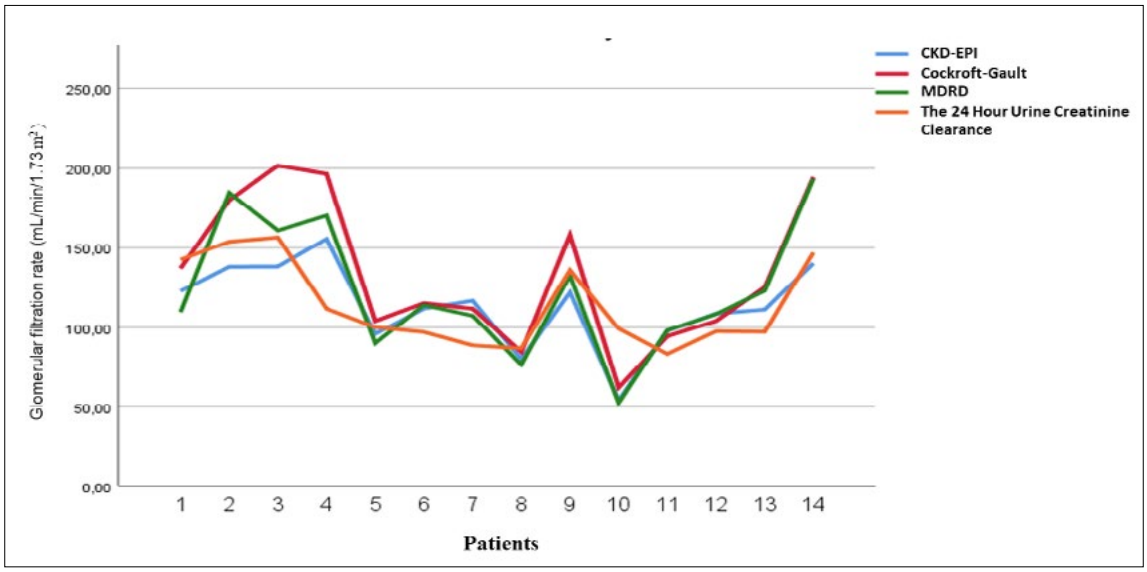
Table 2. Demographic, clinical characteristics, and biochemical parameters of 14 patients

Parameters	
Gender (F/M)	8/6
Currrent age, years	40.61 ± 13.73
Height (cm)	166.07 ± 8.34
Body weight, kg	72.14 ± 12.95
Age at diagnosis, years	32.64 ± 15.92
Diagnostic delay, months	81 (0-294)
Body surface area, (m^2)	1.82 ± 0.20
Creatinine, (mg/dl)	0.72 ± 0.20
Urea (mg/dl)	28.43 ± 22.38
24-Hour Creatinine Clearance (ml/min)	99.64 (83.35-156.58)
CKD-EPI, ml/min/1.73 m^2	113.83 ± 26.46
Cockcroft-Gault, ml/min	133.52 ± 45.35
MDRD, ml/min/1.73 m^2	122.99 ± 41.22
Serum Albumin, (g/dL)	4.26 ±0.45
>150 mg/day 24-hour urine Proteinuria, n (%)	6 (42.8)
Mean proteinuria of all patients (mg/dL)	130.14 (223.98)

MDRD: The Modification of Diet in Renal Disease, CKD-EPI: Chronic Kidney Disease Epidemiology Collaboration F/M: Female/Male,

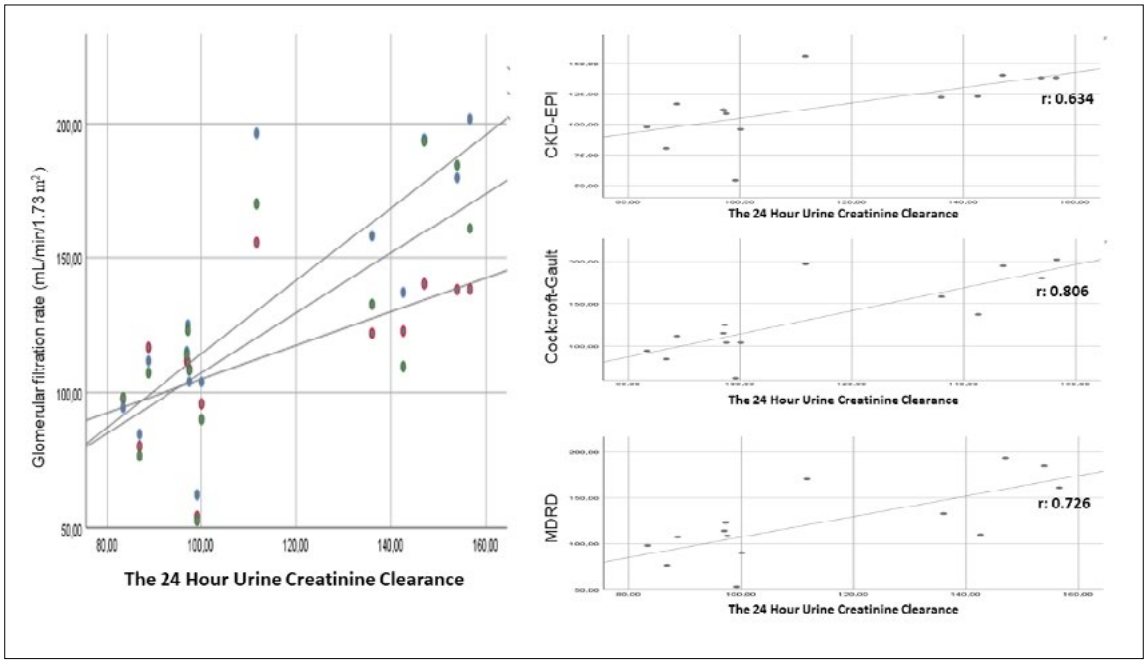
e-GFR calculated by the MDRD formula was 122.99 ± 41.22 mL/min/1.73 m^2, while e-GFR measured by 24-hour urinary creatinine clearance was 99.64 (83.35-156.58) mL/min/1.73 m^2. In addition, e-GFR calculated by the CKD-EPI formula was 113.83 ± 26.46 mL/min/1.73 m^2, while e-GFR calculated by the CG formula was 133.52 ± 45.35 mL/min/1.73 m^2. On average, there were differences of 23.9, 43.5, and 14.8 mL/min/1.73 m^2 in e-GFR calculated by the MDRD, CG, and CKD-EPI formulas, respectively, when compared with the 24-hour urine creatinine clearance (Figure 1).

Figure 1. eGFR calculated with the formulas MDRD, CG, and CKD-EPI compared with 24-hour urinary creatinine clearance.



We also performed correlation analysis between 24-hour urinary creatinine clearance and other formulas. 24-hour urinary creatinine clearance was positively correlated with MDRD, CKD-EPI and CG formulas (r = 0.726, p = 0.003, r = 0.634, p = 0.015, r = 0.806, p = 0.001, respectively) (Figure 2).

Figure 2. Correlation analysis of 24-hour urinary creatinine clearance and e-GFR calculated with MDRD, CKD-EPI and CG formulas.



DISCUSSION

Although CVID is estimated to affect 1 in 25,000 people, it is the most common form of severe antibody deficiency in both children and adults (11). As life expectancy increases due to improved medical care for CVID patients, the number of patients presenting to nephrology clinics for renal complications is also increasing. Small changes in serum creatinine in CVID patients with progressively decreasing muscle mass, both as a result of chronic inflammation and as a result of gastrointestinal involvement, may indicate serious alterations in renal function. In other words, serum creatinine levels alone are not sufficient to assess the incidence and stage of renal disease in immunocompromised patients. At this point, evaluation and monitoring of renal function estimation with e-GFR is of great importance for early diagnosis and follow-up (12). To date, the optimal formula for calculating glomerular filtration rate in patients with common variable immunodeficiency is not known, but an indication of chronic renal impairment based on creatinine elevation alone is insufficient to detect renal impairment, especially in lean patients or patients with low muscle mass. Moreover, even minor increases in creatinine levels can lead to a serious decrease in e-GFR. Therefore, it is not appropriate to diagnose chronic kidney disease based on creatinine levels alone. In our study, glomerular filtration rate calculated from 24-hour urinary creatinine clearance in patients with common variable immunodeficiency correlated with all three formulas, but there were large differences among the three formulas in terms of calculated mean e-GFR values. The e-GFR value that was closest to 24-hour urine creatinine clearance was obtained using the CKD-EPI formula.

The prevalence of acute kidney injury, which is one of the side effects of IVIG replacement therapy commonly used in CVID patients, is approximately 1%. The addition of sugar components such as sucrose to IVIG formulas has also increased the incidence of acute kidney injury (13). Patient age and the presence of renal impairment before treatment are the most important risk factors for IVIG-induced renal injury. Identification of these risks allow early diagnosis of possible renal injury and early precautions to be taken, thereby reducing morbidity and mortality (14). CVID patients have tubular dysfunction, which is mainly related to impaired urine acidification and decreased concentration capacity. In CVID patients, the decreased urine concentrating ability in particular can lead to hypovolemia and dehydration under stress conditions (8).

The MDRD (expressed as mL/min/1.73m^2) was developed primarily for hospitalized patients with chronic kidney disease. It is a formula calculated using 4 variables such as age, sex, serum creatinine, and race. It provides more accurate results in patients with a GFR < 60 mL/min. The GFR > 60 mL/min/1.73m^2 leads to an overestimation of glomerular filtration rate in individuals. The current formula underestimates the GFR value much lower than it actually is, especially in young women and patients with severe nutritional problems (15-17). Because none of the patients in our study had chronic kidney disease and all had a GFR greater than 60 mL/min, we believe that there is a significant difference between clearance calculated by the MDRD formula and creatinine clearance.

The CG formula (expressed in mL/min) determines approximate GFR by formulating ideal weight and serum creatinine. It reduces the variability of serum creatinine in estimating GFR due to sex and age-related differences in muscle mass. Because the formula does not account for differences in creatinine production due to variations in muscle mass, it overestimates the GFR when there is an imbalance between muscle mass and weight (in people with low muscle mass, obesity, edematous disease, chronic disease) (16,18). Absorption disorders due to gastrointestinal effects in patients with immunodeficiency and decrease in muscle mass due to chronic diseases may mask the decrease in GFR. Despite the decrease in GFR, serum creatinine remains at normal levels, or because creatinine remains low as a result of the decrease in muscle mass, very high GFR values can occur in calculation methods that formulate body mass, such as CG. We consider this to be one of the reasons why the formula CG has such a large difference compared to the other two formulas when compared to 24-hour urine creatinine clearance.

The CKD-EPI equation was developed because of the limitations of the MDRD and CG equations. It is a recognized calculation method that provides more accurate and precise results than the MDRD equation, particularly for estimating GFR in individuals with GFR greater than 60 mL/min/1.73m^2 (16,19). The sensitivity of

the CKD-EPI equation for detecting a glomerular filtration rate of less than 60 mL/min/1.73 m^2 is 91% and the specificity is 87%; the sensitivity of the MDRD equation is 95% and the specificity is 82% (20). The GFR of our entire study patient group was greater than 60 mL/min, and the results closest to 24-hour urine creatinine clearance were found with the CKD-EPI equation. The only study in the literature with a similar patient group states that the e-GFR formulation that contains the results closest to the patients' expected renal clearance is the CKD-EPI equation (21). This was said by the authors to be more appropriate because the CKD-EPI formula relatively accounts for differences in creatinine production due to changes in muscle mass in CVID patients who often suffer from gastrointestinal disease and protein malnutrition and does not overestimate the GFR relative to weight in individuals with low muscle mass. Another feature that makes the CKD-EPI formula more useful is that it accounts for variations due to extrarenal creatinine clearance and tubular secretion and is designed for use with standard serum creatinine concentrations. For all these reasons, there is a strong argument not to use the CG formula (21). The main limitations of our study are that methods such as inulin clearance or scintigraphic methods, which are considered the gold standard in calculating renal function, were not used and the entire patient group consisted of patients with GFR greater than 60 mL/min and were of the same ethnicity.

In summary, we found that all creatinine-based formulas used in clinical practice for e-GFR measurement correlate with 24-hour urine creatinine clearance in patients with CVID. In addition, we have shown that e-GFR calculated with the formula CKD-EPI is more closely related to 24-hour urine creatinine clearance. Therefore, we believe that e-GFR measurement calculated using CKD-EPI is more useful for nephrological follow-up of patients with CVID.

The limited number of patients in our study group was one of the most important limitations. Another significant limitation was that only six patients had 24-hour urinary protein excretion above the physiological limit, so statistics were impossible. The last limitation of our study was that the history of acute kidney injury was not known in the patients included in the study.

Declarations

The authors received no financial support for the research and/or authorship of this article. There is no conflict of interest.

This study was approved by the clinical research ethics committee of the Necmettin Erbakan University Meram Faculty of Medicine (Date: 21.02.2020 number: 2020/2322).

REFERENCES

1. Bonilla FA, Barlan I, Chapel H, Costa-Carvalho BT, Cunningham-Rundles C, de la Morena MT, et al. International Consensus Document (ICON): Common Variable Immunodeficiency Disorders. J Allergy Clin Immunol Pract. 2016;4(1):38-59.
2. Picard C, Bobby Gaspar H, Al-Herz W, Bousfiha A, Casanova JL, Chatila T, et al. International Union of Immunological Societies: 2017 Primary Immunodeficiency Diseases Committee Report on Inborn Errors of Immunity. J Clin Immunol. 2018;38(1):96-128.
3. Endo LM, Giannobile JV, Dobbs AK, Foote JB, Szymanska E, Warnock DG, et al. Membranous glomerulopathy in an adult patient with X-linked agammaglobulinemia receiving intravenous gammaglobulin. J Investig Allergol Clin Immunol. 2011;21(5):405-9.
4. Fakhouri F, Robino C, Lemaire M, Droz D, Noel LH, Knebelmann B, et al. Granulomatous renal disease in a patient with common variable immunodeficiency. Am J Kidney Dis. 2001;38(2):E7.
5. Meyer A, Lachmann HJ, Webster AD, Burns A, Thway K. Hypercalcemia in a patient with common variable immunodeficiency and renal granulomas. Am J Kidney Dis. 2005;45(5):e90-3.
6. Tsuji K, Uchida HA, Ono T, Inoue T, Shinagawa K, Kitamura S, et al. A case of focal segmental glomerulosclerosis in an adult patient with hypogammaglobulinemia superimposed on membranoproliferative glomerulonephritis in childhood. BMC Nephrol. 2012;13:46.
7. Aydin Z, Gursu M, Ozturk S, Kilicaslan I, Kazancioglu R. A case of primary immune deficiency presenting with nephrotic syndrome. NDT Plus. 2010;3(5):456-8.
8. Capistrano GG, Meneses GC, de Oliveira Neves FM, de Almeida Leitao R, Martins AMC, Liborio AB. Renal Evaluation in Common Variable Immunodeficiency. J Immunol Res. 2018;2018:5841031.
9. Toto RD. Conventional measurement of renal function utilizing serum creatinine, creatinine clearance, inulin and para-aminohippuric acid clearance. Curr Opin Nephrol Hypertens. 1995;4(6):505-9; discussion 3-4.
10. Conley ME, Notarangelo LD, Etzioni A. Diagnostic criteria for primary immunodeficiencies. Representing PAGID (Pan-American Group for Immunodeficiency) and ESID (European Society for Immunodeficiencies). Clin Immunol. 1999;93(3):190-7.
11. Gathmann B, Mahlaoui N, Ceredih, Gerard L, Oksenhendler E, Warnatz K, et al. Clinical picture and treatment of 2212 patients with common variable immunodeficiency. J Allergy Clin Immunol. 2014;134(1):116-26.
12. Aytekin G, Baloglu I, Colkesen F, Yildiz E, Arslan S, Turkmen K. Nephrological factors may cause kidney dysfunction in patients with common variable immunodeficiency. Turk J Med Sci. 2021;51(4):1924-31.

13. Itkin YM, Trujillo TC. Intravenous immunoglobulin-associated acute renal failure: case series and literature review. Pharmacotherapy. 2005;25(6):886-92.

14. Sati HI, Ahya R, Watson HG. Incidence and associations of acute renal failure complicating high-dose intravenous immunoglobulin therapy. Br J Haematol. 2001;113(2):556-7.

15. Coresh J, Stevens LA. Kidney function estimating equations: where do we stand? Curr Opin Nephrol Hypertens. 2006;15(3):276-84.

16. Levey AS, Stevens LA. Estimating GFR using the CKD Epidemiology Collaboration (CKD-EPI) creatinine equation: more accurate GFR estimates, lower CKD prevalence estimates, and better risk predictions. Am J Kidney Dis. 2010;55(4):622-7.

17. Stevens LA, Coresh J, Feldman HI, Greene T, Lash JP, Nelson RG, et al. Evaluation of the modification of diet in renal disease study equation in a large diverse population. J Am Soc Nephrol. 2007;18(10):2749-57.

18. Stevens LA, Li S, Kurella Tamura M, Chen SC, Vassalotti JA, Norris KC, et al. Comparison of the CKD Epidemiology Collaboration (CKD-EPI) and Modification of Diet in Renal Disease (MDRD) study equations: risk factors for and complications of CKD and mortality in the Kidney Early Evaluation Program (KEEP). Am J Kidney Dis. 2011;57(3 Suppl 2):S9-16.

19. Levey AS, Stevens LA, Schmid CH, Zhang YL, Castro AF, 3rd, Feldman HI, et al. A new equation to estimate glomerular filtration rate. Ann Intern Med. 2009;150(9):604-12.

20. Matsushita K, Tonelli M, Lloyd A, Levey AS, Coresh J, Hemmelgarn BR, et al. Clinical risk implications of the CKD Epidemiology Collaboration (CKD-EPI) equation compared with the Modification of Diet in Renal Disease (MDRD) Study equation for estimated GFR. Am J Kidney Dis. 2012;60(2):241-9.

21. Gaspar A, Miranda G, Lopez E, Rodriguez K, Segura N. [Estimation of glomerular filtration rate in adults with common variable immunodeficiency treated with intravenous immunoglobulin. What formula should we use?]. Rev Alerg Mex. 2014;61(2):45-51.

Archives of Current Medical Research
Arch Curr Med Res 2022;3(2):120-125

Received: 16 February 2022
Revised: 21 April 2022
Acccepted: 19 May 2022
DOI: 10.47482/acmr.2022.56

ORIGINAL ARTICLE

Outpatient use of tPA to recanalize thrombosed native fistulas a case series and discussion of literature

Işıl Yıldız[1], **Demet Ünal**[2], **Can Çalışkan**[1],

1 Acibadem University Atakent Hospital, Department of Radiology, İstanbul, Turkey
2 Süleyman Demirel University Faculty of Medicine, Department of Radiology, Isparta, Turkey

Abstract

Background: The present study aims to evaluate the effectiveness of ultrasound-guided percutaneous alteplase (t-PA) injection for the treatment of long segment (≥14cm) thrombi in the efferent veins of native arteriovenous fistulas in hemodialysis patients.

Methods: A total of 9 patients who underwent t-PA application under ultrasound guidance in the interventional radiology clinic between 2019 and 2021 were included in the study. During the intervention, information such as thrombosed segment length, t-PA dose, number of sessions, presence of aneurysmal segment, bleeding after the intervention and the need for percutaneous transluminal angioplasty (PTA) were recorded. Restoring the flow in the fistula was considered the successful outcome. All statistical evaluations were performed with the IBM SPSS Statistics 21 software (version 21.0; SPSS Inc, Chicago, Illinois) for Windows.

Results: Mean age of the patients was 48.7±14 years, the fistula age was 28.7±11 months, the thrombosis age was 3.5±2 days, and the thrombosed segment length was 17.7±2.9 cm. Post-intervention bleeding that did not require treatment was encountered in 2 patients, and stenosis in the proximal fistula was encountered in 6 patients. PTA was applied to 7 patients after t-PA. After the interventions, effective flow was provided in all patients.

Conclusion: Ultrasound-guided percutaneous t-PA injection should be considered as an effective intervention which is less invasive, can be performed as an outpatient intervention and has fewer complications, even if the thrombi segments are long (>10 cm). This technique avoids the potential endothelial damage and saves the cost of the mechanical devices.

Keywords: Hemodialysis, Thrombosis, Tissue Plasminogen Activator.

Cite this article as: *Yıldız I, Ünal D, Çalışkan C. Outpatient use of tPA to recanalize thrombosed native fistulas a case series and discussion of literature Arch Curr Med Res. 2022;3(2):120-125*

Corresponding Author:
Işıl Yıldız, Acibadem University Atakent Hospital,
Department of Radiology, İstanbul, Turkey
E-mail: drisilyildiz@gmail.com

INTRODUCTION

Arteriovenous (AV) fistula, AV graft and tunneled hemodialysis catheters are used for hemodialysis applications (1,2). Complications such as venous aneurysm, infection, skin necrosis, steal syndrome, thrombosis and stenosis are encountered in patients who undergo arteriovenous fistula applications (3). The National Kidney Foundation Disease Outcomes Quality Initiative recommends that fistulas be preferred over grafts, as they have lower complication rates (4). However, thrombosis is a common complication of AV fistulas. Intimal rupture in the fistula triggers thrombocyte aggregation and causes thrombosis (5). Methods such as surgical thrombectomy, thromboaspiration and thrombolytic agents like t-PA are used in treatment (6, 7).

Plasmin is an enzyme that has a thrombolytic effect by breaking the cross-links between fibrin molecules in thrombus content. t-PA is involved in the formation of plasmin from plasminogen. It is used as a thrombolytic agent in the treatment of various diseases (8-10). Ischemic stroke, myocardial infarction, pulmonary embolism, and deep vein thrombosis are the main indications for these drugs (8, 9, 11). The main types of t-PA are alteplase, reteplase and tenecteplase. Nowadays, recombinant tissue plasminogen activator(rt-PA) can be produced in the laboratory. It has been approved by the US Food and Drug Administration (FDA) for use in cases of thrombosis, especially in alteplase central venous access catheters (12). Each vial of alteplase contains 10, 20 or 50 mg rt-PA. The reconstituted solution contains 1 mg alteplase per mL.

There are studies in the literature regarding the use of t-PA for thrombosis in both AV fistula and grafts in patients, who underwent hemodialysis due to chronic renal failure. As it is minimally invasive, t-PA is administered as a bolus from catheters placed in the fistula vein, by slow infusion via infusion catheters or by percutaneous injection directly into the graft (13-16). In this study, we aimed to evaluate the results of ultrasound-guided percutaneous t-PA injection in thrombosed native veins for the treatment of long segment thrombi in the efferent vein of the arteriovenous fistula.

MATERIALS AND METHODS

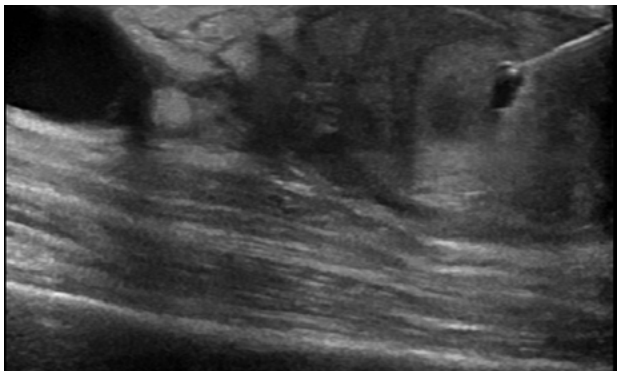
Patients who were treated with the diagnosis of dysfunction due to long segment thrombosis in hemodialysis fistula and who were admitted to our hospital's interventional radiology clinic between 2019 and 2021 were retrospectively reviewed. All patients who received percutaneous t-PA injections were included in the study. In our clinic, the diagnosis of thrombosis is made with ultrasonography (USG) by observing the thrombus in the fistula. Those with short segment thrombosis are treated with for thromboaspiration and if necessary balloon angioplasty is performed. We did not include these patients to our study.

Patients with t-PA contraindications, such as head trauma or stroke suffered in the previous three months, subarachnoid hemorrhage symptoms, a history of intracranial hemorrhage, a history of arterial interference in the previous seven days and intracranial neoplasia were not included in the study. Apart from these, the patients who did not attend the control appointments (n = 2) were excluded from the study. The remaining 9 patients (6 men and 3 women) were included in the study. Demographic data and clinical examination findings of the patients were obtained from the patient registry system. In addition, information on fistula duration, thrombosis duration, thrombosed segment length, fistula type, applied t-PA dose, number of sessions, presence of aneurysmal segment, bleeding after the intervention and the need for percutaneous transluminal angioplasty (PTA) after thrombolysis were obtained from the hospital records (Table 1). Informed consent forms were obtained from all patients before treatment.

Technique: In the study, alteplase injections to efferent veins in AV fistulas were performed percutaneously with USG guidance. All AV fistulas had dysfunction due to occlusion. This intervention was applied in the outpatient clinic of interventional radiology department. For the intervention sterile field preparation in the supine position was done; 27-gauge (G) needle and a 20cc syringes were used (Fig 1). No local anesthetic or prophylactic antibiotics were administered. 5-8 mg alteplase was completed up to 20 cc with physiological saline was used per session. 1-2 cc of the alteplase-saline mixture was injected into the thrombus with 2-2.5cm intervals with USG (Logic S8, GE (New York, USA)) guidance. The sessions were repeated until no thrombus remained in the vein. Low molecular weight heparin (enoxaparin sodium) was prescribed at therapeutic dose. First dose was administered at the

hospital after the intervention Patients were followed up in the hospital for 2 hours after the intervention for observation. During discharge, patients were warned about not using their upper extremity with the AV fistula to prevent bleeding.

Figure 1: Injection of TPA into the thrombus



On the second day after the intervention, patients were called out to outpatient clinic. If residual thrombus was detected with US the intervention was repeated in the same fashion. After the second intervention fistulas were checked with USG on the day after. PTA was performed on the day when no thrombus found on USG examination. During the period from first injection until PTA, enoxaparin sodium was administered at the therapeutic dose. Flow volume of >600 ml/min, and a full dialysis session through reopened fistula considered to be successful treatment.

Statistical method writing : Quantitative variables are presented as mean ± SD (standard deviation) in tables and median (minimum / maximum), while categorical variables are shown as n (%).

This study was approved by the clinical research ethics committee of the Acıbadem University (Date: 28.01.2022 number: 2022-02/08).

RESULTS

9 patients with a mean age of 48.7 ± 14 (min: 32- max: 72) were included in the study. The mean age of fistula was 28.7 ± 11 months, that of thrombosis was 3.5 ± 2 days, and the length of the thrombosed segment was 17.7 ± 2.9 cm. Fistula types, t-PA dosage, and number of applications are shown in Table 1.

Aneurysmal segment was observed in three patients. In two patients, bleeding occurred at the needle insertion sites within the first 24 hours after the intervention which is controlled with compression. Hospitalization, additional intervention or erythrocyte replacement was not required for these patients.

Six of the patients included in the study had stenosis (4 subclavian, 1 brachiocephalic, and 1 vena cava superior). Two patients did not have any stenotic segment. Severe hypotension caused thrombosis in these patients. If present, stenoses were treated with PTA which is a very short procedure after thrombus disappeared (2nd or 3rd day of the treatment). All patients were able to have hemodialysis via AVFs at maximum 3 days after the first injection of t-PA. The therapeutic dose of enoxaparin sodium was continued until PTA was administered. Patients, who underwent PTA, continued to receive therapeutic dose of enoxaparin sodium for one more week and maintenance dose for the next 3 weeks. One patient who underwent percutaneous t-PA injection and PTA due to central vein stenosis presented with recurrence of fistula dysfunction in the 3rd month after the treatment. There were no thrombi that's why PTA was performed due to restenosis of the central vein. Another patient who did not use enoxaparin sodium regularly was admitted to the outpatient clinic with occlusion due to rethrombosis 17 days after the treatment. t-PA was applied by using the same protocol but this time intervention was not successful. The fistula was recanalized with endovascular thrombectomy and PTA. We assume that our technique was unsuccessful because of the old age of the thrombi.

DISCUSSION

Surgical thrombectomy and endovascular interventions are used in the treatment of thrombosis. In the study published by Marston *et al*. in 1997, surgical thrombectomy was shown to be superior to endovascular interventions, but urokinase was used as a thrombolytic agent in this study (10). After recombinant t-PA (r-tPA) is produced in the laboratories, urokinase was not the preferred thrombolytic agent anymore because studies showed that thrombolysis with r-tPA is more successful than surgical thrombectomy. (7,18,19,20,21).

In a systematic review conducted in 2011, three different r-tPA agents were compared with each other and it was

shown that the success rate was 88% with reteplase, 81% with alteplase, and 41% with tenecteplase (22). In our study, we used alteplase, which has been proven to be effective.

In addition, an advantage of endovascular interventions is that the underlying stenosis can also be treated in the same session (23). In our study, successful results were obtained as a result of USG-guided t-PA injection. Effective hemodialysis was possible after treatment in all patients. PTA was applied for stenoses (n = 7) after t-PA. Because no treatment for thrombus is needed during the angiographic intervention, only PTA is performed in the angiography room.

Thrombi older than two weeks are considered chronic (24,25). Because fibrin crosslinks change after two weeks and tPA actively degrades fibrin crosslinks, chronic thrombi are resistant to thrombolytic therapies and anticoagulation (26-28). We assume that this was the reason of the failed procedure of the patient with rethrombosis. The thrombus was chronic (17 days old).

Acute thrombi age and infusion time of t-PA are other issues. In a study in which 42 thrombosed fistulas were included, no significant correlation was found between the younger thrombus age and the success of the treatment. In our study, patients applied to us after the fistula was occluded. We considered the time elapsed from the time the fistula stopped to the time we performed the intervention as the age of thrombus. Based on this assumption the thrombi age in our study is younger than 7 days. However, even if thrombus fragments of different ages are considered in such a long segment thrombus, it was thought that no fragment was older than 15 days, based on the effectiveness of t-PA (29).

In the study conducted by Regus et al. (30) in 2017, patients were divided into two groups as short (<3 hours) and long (≥3 hours) infusion times. It has been shown that a longer infusion time provides a more effective thrombolysis and causes fewer complications in the long term. In this study r-TPA dose ranges 2-6mg which is lower than ours. But the success rates are 85.7% and 89.7% . Unlike these studies short-term application was found to be effective in our study. However, there was no comparison group who received infusion over a longer period. In addition, we think that the factor that makes it effective, despite its short duration, may be the method of administration. In this study, thrombolytic injection was performed directly into the thrombus accompanied by USG without using infusion catheter or angiography guidance. Similarly, in the study of Durmaz et al. (13), 5-10 mg t-PA was administered as a single injection directly into the thrombus and 100% success was achieved. According to that study, successful results were obtained although the lengths of thrombosed segments of the patients included in our study were longer. In the aforementioned studies, a total dose of 2-2.5 mg was administered. In our study, a total dose of 5-8 mg t-PA was administered directly into the thrombus within approximately five minutes. It is not possible to compare the studies with each other due to different application techniques.

Dose of the t-PA administered for AVF thrombosis is variable. Schon et al. (14) studied on reducing the t-PA dose the reduced dose found successful ranged between 0.5-7.5mg for thrombus length of 0.5cm to more than 10cm. Our doses range is 5-8 mg for thrombus longer than 10cm meaning r-tPA doses for long thrombus is similar.

In their study in 2011, Chang et al. (31) showed that low-dose t-PA administered directly into the thrombus once a day was at least as effective as thrombolytic infusion treatment with a catheter in deep vein thrombosis the application that corresponds most closely to the method employed in our study was made in a retrospective study of Durmaz et al. (13) in 2019. Nearly complete success was achieved in the study in which 17 patients were included and t-PA injection was performed in the native hemodialysis fistula under the guidance of USG. Unlike this study, the duration of thrombosis was less than 2 weeks in all patients included in our study, and the thrombosed segment length was over 10 cm in all patients. When compared with the study of Durmaz et al. (13), we conclude that success can be achieved in acute thrombi, even if the thrombosed segment is over 10 cm. The most important difference in the method used in this study from other studies in the literature is that successful results were obtained in long segment thrombi.

There is a need for a large series of prospective randomized studies consisting of standard groups on this subject. We think that it is a more economical method

compared to the methods used in other studies because it is not an angiographic intervention and it is a method that is more adaptable for the patient because it does not require hospitalization.

This study has some limitations. The method employed was applied to patients who were not suitable for surgical thrombectomy and who did not want to be hospitalized and therefore could not have an infusion catheter, and it was observed that a successful result was obtained. The study was designed retrospectively based on this observation. Due to the retrospective study design, patient selection, standard patient groups and randomization could not be made. The limited number of samples was also a limitation in the interpretation of the data obtained. Although patient age and fistula age spread over a wide range create limitations in evaluating the results, the presence of acute thrombus in all patients, similar thrombosed segment length and standard dose and duration of t-PA are strengths of the study. The most important difference in this study is that the method was applied in long segment (>10 cm) thrombi and achieved successful results, especially when compared with studies in the literature. This is the first study done on such long segment thrombi.

In conclusion, ultrasound-guided t-PA injection should be considered as it is a less invasive, effective intervention that can be performed without hospitalization and has fewer complications, even if the thrombi are long segments (>10 cm) that develop in patients with native AV hemodialysis fistula. This technique avoids the potential endothelial damage and cost of the mechanical devices. Moreover, it is a time saving intervention for the interventional radiologists, helps to reduce the x-ray exposure by shortening the time spend in the angiography unit.

Declarations

The authors received no financial support for the research and/or authorship of this article. There is no conflict of interest.

This study was approved by the clinical research ethics committee of the Acıbadem University (Date: 28.01.2022 number: 2022-02/08).

REFERENCES

1. Agarwal AK, Haddad N, Boubes K. Avoiding problems in tunneled dialysis catheter placement. Semin Dial 2019; 32(6):535-40.
2. Murea M, Geary RL, Davis RP, Moossavi S. Vascular access for hemodialysis: A perpetual challenge. Semin Dial 2019; 32(6):527-34.
3. Al-Jaishi AA, Liu AR, Lok CE, Zhang JC, Moist LM. Complications of the Arteriovenous Fistula: A Systematic Review. J Am Soc Nephrol 2017; 28(6):1839-50.
4. Coleman CI, Tuttle LA, Teevan C, Baker WL, White CM, Reinhart KM. Antiplatelet agents for the prevention of arteriovenous fistula and graft thrombosis: a meta analysis. Int J Clin Pract 2010; 64(9): 1239-44.
5. Swedberg SH, Brown BG, Sigley R, Wight TN, Gordon D, Nicholls SC. Intimal fibromuscular hyperplasia at the venous anastomosis of PTFE grafts in hemodialysis patients. Clinical, immunocytochemical, light and electron microscopic assessment. Circulation 1989; 80(6): 1726-36.
6. Dougherty MJ, Calligaro KD, Schindler N, Raviola CA, Ntoso A. Endovascular versus surgical treatment for thrombosed hemodialysis grafts: A prospective, randomized study. J Vasc Surg 1999; 30(6):1016-23.
7. Marston WA, Criado E, Jaques PF, Mauro MA, Burnham SJ, Keagy BA. Prospective randomized comparison of surgical versus endovascular management of thrombosed dialysis access grafts. J Vasc Surg 1997; 26(3):373-80; discussion 80-1.
8. Gravanis I, Tsirka SE. Tissue-type plasminogen activator as a therapeutic target in stroke. Expert Opin Ther Targets 2008; 12(2):159-70.
9. Heiferman DM, Li DD, Pecoraro NC, Smolenski AM, Tsimpas A, Ashley WW Jr. Intra-Arterial Alteplase Thrombolysis during Mechanical Thrombectomy for Acute Ischemic Stroke. J Stroke Cerebrovasc Dis 2017; 26(12):3004-8.
10. Islam MS. Thrombolytic Therapy by Tissue Plasminogen Activator for Pulmonary Embolism. Adv Exp Med Biol 2017; 906:67-74.
11. Sharifi M, Bay C, Nowroozi S, Bentz S, Valeros G, Memari S. Catheter-directed thrombolysis with argatroban and tPA for massive iliac and femoropopliteal vein thrombosis. Cardiovasc Intervent Radiol 2013; 36(6):1586-90.
12. Demaerschalk BM, Kleindorfer DO, Adeoye OM, Demchuk AM, Fugate JE, Grotta J et al. American Heart Association Stroke Council and Council on Epidemiology and Prevention. Scientific Rationale for the Inclusion and Exclusion Criteria for Intravenous Alteplase in Acute Ischemic Stroke: A Statement for Healthcare Professionals From the American Heart Association/American Stroke Association. Stroke. 2016;47(2):581-641.
13. Durmaz H, Birgi E. A promising method for the salvage of thrombosed native hemodialysis fistulas: percutaneous ultrasound-guided thrombolytic injection. Turk J Med Sci 2019; 49(4):1179-84.
14. Schon D, Mischler R. Salvage of occluded autologous arteriovenous fistulae. Am J Kidney Dis. 2000; 36(4):804-10.
15. Falk A, Mitty H, Guller J, Teodorescu V, Uribarri J, Vassalotti J. Thrombolysis of clotted hemodialysis grafts with tissue-type plasminogen activator. J Vasc Interv Radiol 2001; 12(3):305-11.
16. Vogel PM, Bansal V, Marshall MW. Thrombosed hemodialysis grafts: lyse and wait with tissue plasminogen activator or urokinase compared to mechanical thrombolysis with the Arrow-Trerotola Percutaneous Thrombolytic Device. J Vasc Interv Radiol 2001;12(10):1157-65.
17. Inston N, Al Shakarchi J, Khawaja A, Jones R. Maintaining Patency of Vascular Access for Haemodialysis. Cardiovasc Eng Technol 2017; 8(3):240-3.

18. Koraen-Smith L, Krasun M, Bottai M, Hedin U, Wahlgren CM, Gillgren P. Haemodialysis access thrombosis: Outcomes after surgical thrombectomy versus catheter-directed thrombolytic infusion. J Vasc Access. 2018;19(6):535-41.
19. Tseke P, Kalyveza E, Politis E, Giapraka N, Andriopoulos C, Balitsari A et.al. Thrombolysis with alteplase: a non-invasive treatment for occluded arteriovenous fistulas and grafts. Artif Organs. 2011 Jan;35(1):58-62.
20. Aydin E, Bademci MS, Kocaaslan C. Comparison of pharmacomechanical and surgical interventions for thrombosed native arteriovenous fistulas. Turk Gogus Kalp Damar Cerrahisi Derg 2020; 28(4):609-14.
21. Koraen-Smith L, Krasun M, Bottai M, Hedin U, Wahlgren CM, Gillgren P. Haemodialysis access thrombosis: Outcomes after surgical thrombectomy versus catheter-directed thrombolytic infusion. J Vasc Access. 2018;19(6):535-541.
22. Hilleman D, Campbell J. Efficacy, safety, and cost of thrombolytic agents for the management of dysfunctional hemodialysis catheters: a systematic review. Pharmacotherapy 2011; 31(10):1031-40.
23. Wan Z, Xiang R, Wang H, Zhong Q, Tu B. Comparative efficacy and safety of local and peripheral venous thrombolytic therapy with urokinase for thrombosed hemodialysis arteriovenous fistulas. Exp Ther Med 2019;17(5):4279-84.
24. Xie H, Kim K, Aglyamov SR, Emelianov SE, Xunchang C, O'Donnell M et al. Staging deep venous thrombosis using ultrasound elasticity imaging: animal model. Ultrasound Med Biol 2004;30:1385-96.
25. Fineschi V, Turillazzi E, Neri M, Pomara C, Riezzo I. Histological age determination of venous thrombosis: a neglected forensic task in fatal pulmonary thrombo-embolism. Forensic Sci Int. 2009;186(1-3):22-8.
26. Stanford SN, Sabra A, D'Silva L, Lawrence M, Morris RHK, Storton S. The changes in clot microstructure in patients with ischaemic stroke and the effects of therapeutic intervention: a prospective observational study. BMC Neurol 2015;15:35.
27. Oklu R, Wicky S. Catheter-directed thrombolysis of deep venous thrombosis. Semin Thromb Hemost 2013;39:446-51.
28. Goktay AY, Senturk C. Endovascular Treatment of Thrombosis and Embolism. Adv Exp Med Biol 2017;906:195-213.
29. Andriani M, Drago G, Bernardi AM, Da Porto A, De Luca M, Riegler P et al. Recombinant tissue plasminogen activator (rt-PA) as first-line therapy for declotting of haemodialysis access. Nephrol Dial Transplant. 1995;10(9):1714-9.
30. Regus S, Lang W, Heinz M, Uder M, Schmid A. Benefits of Long Versus Short Thrombolysis Times for Acutely Thrombosed Hemodialysis Native Fistulas. Vasc Endovascular Surg 2017; 51(5): 233-9.
31. Chang R, Horne MK, 3rd, Shawker TH et al. Low-dose, once-daily, intraclot injections of alteplase for treatment of acute deep venous thrombosis. J Vasc Interv Radiol 2011;22(8): 1107-16.

Archives of Current Medical Research
Arch Curr Med Res 2022;3(2):126-132

Received: 28 February 2022
Revised: 20 March 2022
Acccepted: 14 April 2022
DOI: 10.47482/acmr.2022.57

ORIGINAL ARTICLE

A new cystatin C based model for predicting COVID-19- associated mortality

Sumeyra Koyuncu[1], Serhat Koyuncu[2], Halil İbrahim Akdoğan[3], Mehmet Kara[4], Göksel Güven[5], Didem Barlak Keti[6], Hilal Sipahioğlu[7], Gözde Ertürk Zararsız[8], İsmail Koçyiğit[1], Bülent Tokgöz[1],

1 Erciyes University Faculty of Medicine, Department of Internal Medicine, Division of Nephrology, Kayseri, Turkey
2 Kayseri City Training and Research Hospital, Department of Emergency, Kayseri, Turkey
3 Tokat State Hospital, Department of Emergency, Tokat, Turkey
4 Tokat Erbaa State Hospital, Department of Infection Disease, Tokat, Turkey
5 Hacettepe University Faculty of Medicine, Department of Internal Medicine, Division of Intensive Care, Ankara, Turkey
6 Erciyes University Faculty of Medicine, Department of Biochemistry, Kayseri, Turkey
7 Kayseri City Hospital, Department of Intensive Care, Kayseri, Turkey
8 Erciyes University Faculty of Medicine Department of Biochemistry, Kayseri, Turkey

Abstract

Background: This study aimed to investigate the effect of the Cystatin C based model on kidney function and the value of this model on predicting mortality in patients with the recent novel coronavirus disease (COVID-19).

Methods: Demographic characteristics, clinical manifestations, and laboratory measurements were measured in critically ill patients with COVID-19 infection. Patients were monitored until they were discharged from the hospital or died.

Results: 105 patients participated in this study. 29 of 105 patients were treated in the intensive care unit. Acute kidney injury developed in nearly all of these patients and developed in 6 other non-intensive care unit patients. 21 of the patients in the intensive care unit had exitus.

Conclusion: The cystatin C (sCys C)based model may be used to predict mortality in severe COVID-19 infections.

Keywords: Acute Kidney Injury, Cystatin-C, Mortality.

Cite this article as: *Koyuncu S, Koyuncu S, Akdoğan Hİ, Kara M, Güven G, Barlak Keti D, Sipahioglu H, Ertürk Zararsiz G, Koçyiğit İ, Tokgöz B. A new cystatin C based model for predicting COVID-19- associated mortality. Arch Curr Med Res. 2022;3(2):126-132*

Corresponding Author:
Sümeyra Koyuncu, Erciyes University School of Medicine, Department of Internal Medicine, Division of Nephrology, Kayseri, Turkey
E-mail: sumeyraozberk@hotmail.com

INTRODUCTION

The kidney is one of the most frequently affected organs, as are the respiratory and immune systems, in coronavirus disease-2019 (COVID-19) infection. It is critical to diagnose whether COVID-19 patients develop acute kidney injury (AKI), affecting their prognosis by increasing morbidity, mortality and healthcare costs (1). Several direct and indirect factors that cause kidney damage have been identified in COVID-19. However, difficulties remain in recognizing kidney damage since creatinine and urine output are not enough to diagnose AKI timely (2). Consequently, researchers are in search of new biomarkers for early diagnosis of AKI.

sCys C is a valuable biomarker for detecting AKI and has been shown to include advantages over creatinine, notably in patients with a critical illness. It is a low molecular weight (13.3 kDa) proteinase inhibitor present in all extracellular fluids and is produced continuously by nucleated cells (3). Serum sCys C is a biochemical marker with high sensitivity and specificity to estimate kidney functions and is unaffected by age, gender, weight and inflammation. Several clinical and experimental studies have shown that this biomarker is a better indicator than creatinine of glomerular filtration rate (GFR) measured (4,5). Moreover, the level of circulating sCys C has shown to be strongly associated with critical illness such as increased risk of coronary heart disease, ischemic stroke, and heart failure. Additionally, it has been reported that sCys C a good parameter for evaluating the survival rates of patients with sepsis in the intensive care unit (6,7).

No previous study has been conducted on serum cystatin levels in intensive care patients with COVID-19 infection. The purpose of this study was to investigate the effect of COVID-19 on kidney function and to evaluate the predictive value of sCys C for mortality risk in critically ill patients with COVID-19.

MATERIALS AND METHODS

This is a prospective study performed at Medical Faculty Department of Intensive Care and State Hospital. After the study was approved by the local ethics committee, data collection was carried out between November 2020 and March 2021. Those found to have COVID-19 infection were included. Only COVID-19 infected patients identified by throat swab samples were included in the current study. Patients with chronic kidney diseases (G4–G5 according to Kidney Disease: Improving Global Outcomes (KDIGO) criteria) and history of renal transplant were excluded. 105 hospitalized COVID-19 patients, aged ≥ 18 years were enrolled in the study.

Demographic characteristics (age, gender), comorbid disease, clinical manifestations (fever, cough, sore throat, dyspnea), laboratory parameters (white blood cell, platelet, hemoglobin, C-reactive protein, procalcitonin, sCys C, blood urea nitrogen, creatinine, albumin, fibrinogen, D-dimer, lactate dehydrogenase, ferritin) were recorded. All data were obtained from the first admission to the hospital. Patients were monitored until hospital discharge or death.

COVID-19 was diagnosed based on World Health Organization guidance (8). The real-time reverse transcription-polymerase chain reaction was used to confirm COVID-19 infection in accordance with the manufacturer's protocol (Beijing Genomics Institution and Geneodx Biotechnology Co., Ltd.). The diagnosis of COVID-19 infection was confirmed by polymerase chain reaction (PCR) from nasopharyngeal and oropharyngeal swab samples. Daily biochemical parameters of the patients were recorded. AKI was defined as per KDIGO criteria: a change in the serum creatinine of 0.3 mg/dL over a 48-hour period or 50% increase in baseline creatinine. AKI stages were defined using KDIGO. Description of AKI stages based on creatinine levels were as follows:

Stage 1 is an increase of ≥ 0.3 mg/dL in serum creatinine or an increase to ≥ 1.5–1.9 times the baseline serum creatinine,

Stage 2 is an increase to > 2–2.9 times from the baseline serum creatinine,

Stage 3 is an increase to > 3 times baseline serum creatinine or a peak serum creatinine ≥ 4.0 mg/dL or if the patient received renal replacement therapy during admission (9,10).

This study was approved by the clinical research ethics committee of the Erciyes University, (no:2020/252), and written consent was obtained from all patients participating in the study.

Statistical Analysis

Histogram and q-q plots were plotted and Shapiro-Wilk's test was used to assess the data normality. Continuous variables were summarized as mean and standard deviation or median and interquartile ranges, depending on the data distribution. Categorical variables were summarized as numbers and percentages. The sCys C variable was dichotomized, and then survival probabilities were estimated with the Kaplan–Meier method and compared between groups using the log-rank test. The optimal cut-off value was determined by maximizing the Log-rank chi-square statistic after a grid search of all sCys C values. Furthermore, univariate Cox regression analysis was used to assess the risk of clinical variables on the overall survival of the Covid-19 patients. Significant variables at $p < 0.25$ were included into the multiple model and forward elimination was performed using likelihood ratio statistics to identify the independent risk factors. Two separate multiple models were built for continuous (Model-1) and binary variables of sCys C (Model-2). Hazard ratios were calculated with 95% confidence intervals. p values less than 5% were considered as statistically significant. All analyses were conducted using R 3.6.0 (www.r-project.org) and TURCOSA (Turcosa Analytics Ltd. Co., Turkey, www.turcosa.com.tr) software.

RESULTS

Patients demographic and biochemical parameters are shown in Table 1. 105 patients participated in this study and 54 were male. The mean age of the patients was 53.04 ± 19.83 years. 25 (25.3%) of the patients were diabetic and 24 (24.3%) were hypertensive patients. 29 of 105 patients were treated in the intensive care unit. AKI developed in nearly all of these patients and in 6 non-intensive care unit patients. 21 of the patients treated in the intensive care unit had exitus.

Table 1. The distribution of clinical variables in Covid-19 patients

Variables	Statistics
Age (years)	53.04 ± 19.83
Gender (male)	54 (52.4%)
Diabetes mellitus (present)	25 (24.3%)
Hypertension (present)	24 (23.3%)
CRP	11.25 (3.83-76.75)
Sodium	136±3.2
Potassium	4.2±0.7
Calcium	8.9±1.3
Creatinine	1.17 (0.60-2.23)
Procalcitonin	0.19 (0.08-0.37)
Fibrinogen	367.62±141.89
D-dimer	350.0 (197.50-822.50)
Albumin	3.71±0.73
LDH	214.0 (174.75-317.50)
Ferritin	190.0 (93.00-440.00)
Cystatin C	1.00 (0.88-2.16)

Values are expressed as n(%), mean±SD or median(1^{st}-3^{rd} quartiles).

In univariate analysis of all patients (Table 2) sCys C was positively correlated with ferritin, procalcitonin, hs-CRP, and D-dimer. However, sCys C negatively correlated with albumin. Univariate and multiple Cox regression results in predicting survival in COVID-19 patients are shown in Table 3.

Table 2. Univariate correlates of selected markers in all 105 study participants

	Cystatin		Ferritin		Procalcitonin		Crp		D-dimer		Fibrinojen		Albumin	
	p	r	p	r	p	r	p	r	p	r	p	r	p	r
Cystatin	----		0.06	0.223	0.001	0.371	0.001	0.515	0.008	0.401	0.51	0.060	0.03	-0.329
Ferritin	0.06	0 .223	-----		0.001	0.387	0.001	0.366	0.09	0.179	0.078	0.190	0.001	-0.447
Procalsitonin	0.001	0.371	0.001	0.387	-----		0.020	0.248	0.07	0.185	0.848	0.020	0.001	-0.424
Crp	0.001	0.515	0.001	0.366	0.020	0.248	----		0.001	0.665	0.042	0.208	0.001	-0.651
D-dimer	0.008	0.401	0.09	0.179	0.07	0.185	0.001	0.665	----		0.034	0.214	0.07	-0.188
Fibrinojen	0.514	0.060	0.078	0.190	0.848	0.020	0.042	0.208	0.034	0.214	----		0.501	-0.068
Albumin	0.03	-0.329	0.001	-0.447	0.001	-0.424	0.001	-0.651	0.07	-0.188	0.501	-0.068	----	

Table 3. Univariate and multiple Cox regression results in predicting survival in Covid-19 patients

Variables	Univariate		Multiple-1		Multiple-2	
	HR(95% CI)	p	HR(95% CI)	p	HR(95% CI)	p
Age (years)	1.05(1.01-1.09)	0.008	1.04(1.01-1.08)	0.048	1.05(1.01-1.09)	**0.043**
Gender (male)	2.13(0.72-6.33)	0.175	-	-	-	-
Diabetes mellitus (present)	1.33(0.62-2.84)	0.468	-	-	-	-
Hypertension (present)	1.30(0.60-2.79)	0.503	-	-	-	-
CRP	1.00(0.99-1.01)	0.534	-	-	-	-
Creatinine	1.72(1.20-2.47)	0.003	-	-	-	-
Prokalsitonin	1.59(1.01-2.48)	0.043	-	-	1.98(1.08-3.60)	**0.026**
Fibrinojen	1.00(0.99-1.01)	0.896	-	-	-	-
D-dimer (1/100 ng/mL)	1.00(0.99-1.01)	0.217	-	-	1.04(1.01-1.08)	**0.027**
Albumin	0.76(0.43-1.35)	0.351	-	-	-	-
LDH	1.01(1.00-1.01)	0.041	-	-	-	-
Ferritin	1.00(0.99-1.01)	0.437	-	-	-	-
Cystatin C	1.46(1.18-1.82)	<0.001	1.34(1.04-1.71)	**0.022**	-	-
Cystatin C (>2.715 mg/l)	4.39(1.94-9.94)	<0.001	-	-	4.93(1.87-12.98)	**<0.001**

HR: Hazard ratio, CI: Confidence interval

Two separate Cox proportional hazard regression models were built for continuous (Model-1) and binary variables of sCys C (Model-2). In these formulae, is called the baseline hazard function, while is the hazard at time *t* for a given set of independent variables, ***X***. With a given specification of age, sCys C, D-dimer, and procalcitonin variables; the hazard at time *t* for an individual can be predicted using these models (Table 3). Procalcitonin levels [HR (95% CI): 1.98 (1.08 - 3.60), p: 0.026], and D-dimer [HR (95% CI): 1.04 (1.01 - 1.08) p: 0.027] predicted mortality in these patients. Moreover, sCys C [HR (95% CI): 4.93 (1.87 - 12.98) p: < 0.001] predicted mortality in patients with severe COVID-19 infection.

Model 1: $\hat{h}(t, \boldsymbol{X}) = \hat{h}_0(t) * e^{0.036 x age \ + 0.289 x Cystatin\ C}$

Model 2: $\hat{h}(t, \boldsymbol{X}) = \hat{h}_0(t) *$

$e^{0.046 x age + 0.681 x Procalcitonin + 0.000416 x Ddimer + 1.594 x Cystatin\ C\ group}$

In model 2, the sCys C group, was coded as "1" if the numerical value of sCys C is greater than 2.715. Otherwise, the sCys C group was coded as "0".

DISCUSSION

In this study, we firstly evaluated the factors affecting COVID-19-related mortality. Secondly, we performed a new model for predicting survival and showed the relationship between several factors including sCys C, procalcitonin, D-dimer, and survival rate.

sCys C has been claimed to be more strongly associated with cardiovascular events and death compared to creatinine. Additionally, it has been reported that the sCys C-based GFR is associated with all-cause mortality and cardiovascular events, regardless of both the measured and creatinine-based GFR (11-13).

Critical patients are at risk of decline in GFR due to several causes such as nephrotoxicity and sepsis, partly related to individual initial risk. In a prospective study of 442 critically ill patients, Nejat et al. (14) showed sCys C and creatinine at admission and daily series sustains AKI. They observed an earlier increase of sCys C levels than in creatinine. Similarly, this trend was found in subgroups with chronic kidney failure cardiac surgery, and sepsis. sCys C levels also rise earlier than serum creatinine levels in Intensive care unit (ICU) patients (15). In one study, a similar relationship was found between sCys C levels and COVID-19 associated AKI. According to the results, in patients with normal serum creatinine values at the time of hospitalization, AKI could be predicted by using a cutoff value of 1 mg / L and sCys C levels in the early period (16).

Generally, the COVID-19 process involves overactivation of inflammatory and immune responses in severe cases of the disease, which ultimately result in high mortality for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infected patients (17,18). Several studies have been conducted on COVID-19 patients that evaluated their prognosis. Previous studies revealed that non-survivors from the disease had obvious increase trends in D-dimer, IL-6, serum ferritin, high-sensitivity cardiac troponin, lactate dehydrogenase (LDH), white blood cell (WBC), neutrophil count, blood urea nitrogen, and creatinine, procalcitonin levels, and noticeable lymphopenia when compared with survivors (19-21). In a systematic review and meta-analysis of laboratory test findings of COVID-19, Ghahramani et al. and Akbari et al. reported that cytokine storm might be one of the main causes of COVID-19-related death (22,23) and these studies have shown inflammation, coagulopathy, anemia, and kidney failure as the main causes of COVID-19-related mortality.

It has been reported that sCys C, which is confirmed to predict AKI and death risk in critically ill patients, can also be predictive of the prognosis in COVID-19 patients (24). Circulating sCys C could serve as a potential inflammatory target for preventing COVID-19 from the likely progression of critical illness and in-hospital death. sCys C may also have a role as a potential biomarker of systemic inflammation during the exacerbation of COVID-19, rather than only reflecting renal function in patients infected by SARS-CoV-2. Higher sCys C levels at admission can predict significantly worse outcomes for adult patients with COVID-19 (25).

In another prospective study of 845 critically ill patients, sCys C levels were shown to be independently associated with death in hospital for those with and without AKI; however, the relationship was stronger for those with AKI (26).

Some studies have revealed that patients with COVID-19 associated with renal deterioration and clinical signs include hematuria, albuminuria, and decreased GFR (27,28). Xiang et al. (29) also showed that blood urea nitrogen (BUN), creatinine, and sCys C were increased significantly in severe COVID-19 patients. It has been reported that the incidence of AKI in COVID-19 patients ranges from 0.9% to 29% (30,31). The incidence of AKI is significantly higher in patients, who need intensive care (32). Pei et al. (33) showed that the total mortality rate of patients with renal involvement was 11.2%, while the mortality rate of patients without renal involvement was 1.2%. They also showed that sCys C levels were positively correlated with inflammatory markers, such as IL-1β, IL-6, tumor necrosis factor-α, and hs-CRP (34). Therefore, in the pathological state of COVID-19 invading lung tissue, sCys C is synthesized and released in large quantities, and the level of sCys C is increased, which regulates the cathepsin activity released from necrotic or inflammatory cells. It has been suggested that clinicians should pay close attention to sCys C's level and its changes (35).

In another study, it was concluded that albuminuria, serum sCys C, and D-dimer levels in COVID-19 patients with normal serum creatinine levels at hospitalization might be an early predictor of AKI associated with COVID-19 (16, 36). In a multicenter cohort study of critically ill adults with COVID-19 in the United States, it was found that more than one in five patients developed AKI requiring renal replacement therapy (RRT), of which more than 60% died within 28 days. Approximately one-third of those with AKI-RRT, who survived until discharge from the hospital, remained dependent on RRT (37). Chen et al. showed that elevated sCys C levels were associated with increased inflammatory index levels, including white blood cell count, C-reactive protein, procalcitonin, neutrophil/lymphocyte ratio, and D-dimer, as well as increased lactate levels, and decreased PaO2: FiO2 ratio. In the study, a positive correlation was found between higher sCys C level and increased blood creatinine level and acute physiology and chronic health evaluation II (APACHE II) score. They also revealed that sCys C levels are independently associated with critical illness and death risks in COVID-19. Thus, it has been thought that sCys C could function as a potential biomarker of systemic inflammation during an exacerbation of COVID-19, rather than simply reflecting kidney function in SARS-CoV-2 infected patients (25, 38).

Limitations of our study were: in critically ill patients, since renal failure often develops during intensive care follow-up, its correlation with creatinine should be considered. In addition, the number of patients should be increased.

In conclusion, we performed the new sCys C based model for predicting mortality in severe COVID-19 infection and we think that new algorithms may be used while determining the risk ratios of these patients and making a treatment plan. Further studies are needed to predict the prognosis of COVID-19, since the infection still has significant morbidity and mortality rates.

Declarations

The authors received no financial support for the research and/or authorship of this article. There is no conflict of interest.

This study was approved by the clinical research ethics committee of the Erciyes University, (no:2020/252), and written consent was obtained from all patients participating in the study.

REFERENCES

1. Hirsch JS, Ng JH, Ross DW, Sharma P, Shah HH, Barnett RL, et al. Acute kidney injury in patients hospitalized with COVID-19. Kidney Int. 2020;98(1):209-218.
2. Guven G, Ince C, Topeli A, Caliskan K. Cardio-Pulmonary-Renal Consequences of Severe COVID-19. Cardiorenal Med. 2021;11(3):133-139.
3. Laterza OF, Price CP, Scott MG. Cystatin C: an improved estimator of glomerular filtration rate? Clin Chem. 2002;48(5):699-707.
4. Dharnidharka VR, Kwon C, Stevens G. Serum cystatin C is superior to serum creatinine as a marker of kidney function: a meta-analysis. Am J Kidney Dis. 2002;40(2):221-6.
5. Roos JF, Doust J, Tett SE, Kirkpatrick CM. Diagnostic accuracy of cystatin C compared to serum creatinine for the estimation of renal dysfunction in adults and children--a meta-analysis. Clin Biochem. 2007;40(5-6):383-91.
6. Shlipak MG, Sarnak MJ, Katz R, Fried LF, Seliger SL, Newman AB, et al. Cystatin C and the risk of death and cardiovascular events among elderly persons. N Engl J Med. 2005;352(20):2049-60.
7. Ni L, Lü J, Hou LB, Yan JT, Fan Q, Hui R, et al. Cystatin C, associated with hemorrhagic and ischemic stroke, is a strong predictor of the risk of cardiovascular events and death in Chinese. Stroke. 2007;38(12):3287-8.
8. World Health Organization. (2020). Clinical management of severe acute respiratory infection when novel coronavirus (2019-nCoV) infection is suspected: interim guidance. 2020. Available at https://apps.who.int/iris/handle/10665/330893 Accessed December 20, 2021
9. Pei G, Zhang Z, Peng J, Liu L, Zhang C, Yu C, et al. Renal Involvement and Early Prognosis in Patients with COVID-19 Pneumonia. J Am Soc Nephrol. 2020;31(6):1157-1165.

10. Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. KDIGO 2012 clinical practice guideline for the evaluation and management of chronic kidney disease. Kidney Int Suppl 2013; 3: 1–150.
11. Mathisen UD, Melsom T, Ingebretsen OC, Jenssen T, Njølstad I, Solbu MD, et al. Estimated GFR associates with cardiovascular risk factors independently of measured GFR. J Am Soc Nephrol. 2011;22(5):927-37.
12. Wu CK, Lin JW, Caffrey JL, Chang MH, Hwang JJ, Lin YS. Cystatin C and long-term mortality among subjects with normal creatinine-based estimated glomerular filtration rates: NHANES III (Third National Health and Nutrition Examination Survey). J Am Coll Cardiol. 2010;56(23):1930-6.
13. Schöttker B, Herder C, Müller H, Brenner H, Rothenbacher D. Clinical utility of creatinine- and cystatin C-based definition of renal function for risk prediction of primary cardiovascular events in patients with diabetes. Diabetes Care. 2012;35(4):879-86.
14. Nejat M, Pickering JW, Walker RJ, Endre ZH. Rapid detection of acute kidney injury by plasma cystatin C in the intensive care unit. Nephrol Dial Transplant. 2010;25(10):3283-9.
15. Roos JF, Doust J, Tett SE, Kirkpatrick CM. Diagnostic accuracy of cystatin C compared to serum creatinine for the estimation of renal dysfunction in adults and children--a meta-analysis. Clin Biochem. 2007;40(5-6):383-91.
16. Yildirim C, Ozger HS, Yasar E, Tombul N, Gulbahar O, Yildiz M, et al. Early predictors of acute kidney injury in COVID-19 patients. Nephrology (Carlton). 2021;26(6):513-521.
17. Tay MZ, Poh CM, Rénia L, MacAry PA, Ng LFP. The trinity of COVID-19: immunity, inflammation and intervention. Nat Rev Immunol. 2020;20(6):363-374.
18. Conti P, Ronconi G, Caraffa A, Gallenga CE, Ross R, Frydas I, et al. Induction of pro-inflammatory cytokines (IL-1 and IL-6) and lung inflammation by Coronavirus-19 (COVI-19 or SARS-CoV-2): anti-inflammatory strategies. J Biol Regul Homeost Agents. 2020;34(2):327-331.
19. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. JAMA. 2020;323(11):1061-1069. Erratum in: JAMA. 2021;325(11):1113.
20. 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(10229):1054-1062. Erratum in: Lancet. 2020;395(10229):1038. Erratum in: Lancet. 2020;395(10229):1038.
21. Ouyang SM, Zhu HQ, Xie YN, Zou ZS, Zuo HM, Rao YW, et al. Temporal changes in laboratory markers of survivors and non-survivors of adult inpatients with COVID-19. BMC Infect Dis. 2020;20(1):952.
22. Akbari H, Tabrizi R, Lankarani KB, Aria H, Vakili S, Asadian F, et al. The role of cytokine profile and lymphocyte subsets in the severity of coronavirus disease 2019 (COVID-19): A systematic review and meta-analysis. Life Sci. 2020;258:118167.
23. Ghahramani S, Tabrizi R, Lankarani KB, Kashani SMA, Rezaei S, Zeidi N, et al. Laboratory features of severe vs. non-severe COVID-19 patients in Asian populations: a systematic review and meta-analysis. Eur J Med Res. 2020;25(1):30.
24. Li Y, Yang S, Peng D, Zhu HM, Li BY, Yang X, et al. Predictive value of serum cystatin C for risk of mortality in severe and critically ill patients with COVID-19. World J Clin Cases. 2020;8(20):4726-4734.
25. Chen D, Sun W, Li J, Wei B, Liu W, Wang X, et al. Serum Cystatin C and Coronavirus Disease 2019: A Potential Inflammatory Biomarker in Predicting Critical Illness and Mortality for Adult Patients. Mediators Inflamm. 2020;2020:3764515.
26. Bell M, Granath F, Mårtensson J, Löfberg E, Ekbom A, Martling CR; et al. Cystatin C is correlated with mortality in patients with and without acute kidney injury. Nephrol Dial Transplant. 2009;24(10):3096-102.
27. Henry BM, de Oliveira MHS, Benoit S, Plebani M, Lippi G. Hematologic, biochemical and immune biomarker abnormalities associated with severe illness and mortality in coronavirus disease 2019 (COVID-19): a meta-analysis. Clin Chem Lab Med. 2020;58(7):1021-1028.
28. Su H, Yang M, Wan C, Yi LX, Tang F, Zhu HY, et al. Renal histopathological analysis of 26 postmortem findings of patients with COVID-19 in China. Kidney Int. 2020;98(1):219-227.
29. Xiang J, Wen J, Yuan X, Xiong S, Zhou X, Liu C, et al. Potential biochemical markers to identify severe cases among COVID-19 patients. 2020 Preprint. Available at: https://doi.org/10.1101/2020.03.19.20034447 Accessed December 21, 2020
30. 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(10223):497-506.
31. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet. 2020;395(10223):507-513.
32. Delanaye P, Cavalier E, Morel J, Mehdi M, Maillard N, Claisse G, et al. Detection of decreased glomerular filtration rate in intensive care units: serum cystatin C versus serum creatinine. BMC Nephrol. 2014;15:9.
33. Pei G, Zhang Z, Peng J, Liu L, Zhang C, Yu C, et al. Renal Involvement and Early Prognosis in Patients with COVID-19 Pneumonia. J Am Soc Nephrol. 2020;31(6):1157-1165.
34. Akerfeldt T, Helmersson J, Larsson A. Postsurgical inflammatory response is not associated with increased serum cystatin C values. Clin Biochem. 2010;43(13-14):1138-40.
35. Li Y, Yang S, Peng D, Zhu HM, Li BY, Yang X, et al. Predictive value of serum cystatin C for risk of mortality in severe and critically ill patients with COVID-19. World J Clin Cases. 2020;8(20):4726-4734.
36. Erganiş S, Bozdayı G. Virology, Immunity and Vaccine Development of SARS-CoV-2. Arch Curr Med Res 2021;2(1):05-13
37. Gupta S, Coca SG, Chan L, Melamed ML, Brenner SK, Hayek SS, et al. AKI Treated with Renal Replacement Therapy in Critically Ill Patients with COVID-19. J Am Soc Nephrol. 2021;32(1):161-176.
38. Ceyhan MA, Tümer M, Gürü S, Kadı S, Demir GG. Mean platelet volume and red cell distribution width values in patients with COVID-19 admitted to intensive care units or wards from emergency department. Arch Curr Med Res. 2021;2(2):88-92

Archives of Current Medical Research
Arch Curr Med Res 2022;3(2):133-141

Received: 29 March 2022
Revised: 29 March 2022
Acccepted: 14 April 2022
DOI: 10.47482/acmr.2022.58

ORIGINAL ARTICLE

Determining the knowledge, attitude and practice about the environment and recycling of individuals living in a public housing compound: A quantitative, qualitative mixed method study

Hülya Şirin[1], **Ahmet Arslan**[1], **Gamze Ketrez**[1],

1 University of Health Sciences Gülhane Faculty of Medicine, Department of Public Health Ankara, Turkey

Abstract

Background: The environment is the physical, biological, social, economic and cultural environment in which people and other living things maintain their relationships and interact throughout their lives. In this study, it was aimed to determine the knowledge, attitudes and behaviors of individuals residing in a public housing estate towards the environment and recycling.

Methods: The research was designed as cross-sectional and conducted with a mixed method including both quantitative and qualitative methods. 330 of 437 residents participated in the qualitative part of the study (participation rate 75.5%) in January 2021. The quantitative part of the study was attended by 10 apartment workers.

Results: 51.5% of the participants (n=170) believe that they have sufficient knowledge about recycling. However, only 38.8% of the participants (n=128) stated that they collect recyclable waste separately. The environment-emotion level of men was found to be higher (Z=-2.242, p=0.025). A statistically significant difference was found between the general level average scores in terms of marital status. In terms of "knowledge sub-levels", the mean environmental knowledge level scores of health workers were found to be significantly higher than other occupational groups (Z=-2,460, p=0.014). Apartment workers stated 202 flats (46.2%) collect recyclable waste separately.

Conclusion: To prevent the climate crisis, it is important to recycle domestic waste to protect the environment. Individuals' recycling behavior levels can be increased with practices that aim to inform, direct and encourage recycling. In parallel with all these practices, it is important for governments to be politically determined and implement legal regulations on waste recycling.

Keywords: Recycling, Environment, Public housing, Knowledge, Attitude, Practice.

Cite this article as: *Şirin H, Arslan A, Ketrez G. Determining the knowledge, attitude and practice about the environment and recycling of individuals living in a public housing compound: A quantitative, qualitative mixed method study. Arch Curr Med Res. 2022;3(2):133-141*

Corresponding Author:
Hülya Şirin, University of Health Sciences, Gülhane School of Medicine, Department of Public Health Ankara, Turkey
E-mail: hulya.sirin@sbu.edu.tr

INTRODUCTION

The environment is the physical, biological, social, economic and cultural environment in which people and other living things maintain their relationships and interact throughout their lives. John M. Last, on the other hand, defines the environment as everything other than human. It can be understood from these definitions that people and the environment are in constant interaction. As a result of this interaction, human and public health are "directly and indirectly" affected "positively or negatively" (1).

Mankind has produced waste in every period of history. While this situation did not cause a big issue in the periods when the population was less and nomadic life existed, it became a serious issue with population growth, intense urbanization and the growth of cities (2). Wastes threaten the survival of humans and other living things and all natural resources necessary for human existence. Inadequate waste management causes soil, water and air pollution. This significantly affects public health (3).

The management of wastes within the recycling and recovery processes ensure that both serious material and energy resource losses and major environmental problems are prevented. Recovery, which includes the concepts of reuse and recycling, is defined as the collection and grouping of recyclable wastes at the source, and their conversion into other products or energy via physical and chemical methods (1).

To protect and improve the environment, both national and international legal regulations have been prepared. With these legal regulations, individuals and the state are given the task of actively participating. The studies carried out to date have shown that the fight against environmental problems is not possible only with the measures taken or the strategies developed by the administrative offices and official institutions. Initiatives should be made to increase social consciousness, awareness and participation. (4,5). As emphasized by many scientists, the aim of the concept of environmental awareness is environmental knowledge, attitude towards the environment and behaviors that impact the environment positively (6).

In the detailed literature review, it was found that the research on this subject were mostly done in children and young people and studies on environmental and recycling awareness of adults are limited. It is clear that environmental and recycling awareness should also be evaluated in adults who both carry the role of practitioner and teacher.

In this study, the researchers tried to determine the knowledge, attitudes and behaviors of individuals residing in a public housing estate towards the environment and recycling. In addition, the opinions of the apartment workers working in the same residence on this subject were also evaluated.

MATERIALS AND METHODS

The research was conducted with a mixed method including both quantitative and qualitative methods in January 2022. The quantitative part is a cross-sectional study and a questionnaire (77 questions in total) was applied. In the qualitative part, face-to-face individual in-depth interviews were conducted. The population of the study consists of the people residing in the 437 occupied flats (one person from each flat) in the Health Sciences University Gülhane Lodgings, which is a public housing site. Since the aim was to reach the entire universe, no sample selection was made. 330 residents, one from each flat, participated in the qualitative part of the study (participation rate 75.5%). The quantitative part of the study was attended by 10 apartment workers working in the lodging.

In the first stage, the sociodemographic section created by the researchers and the section consisting of 18 questions about recycling practices and environmental problems in the public housing unit, and the questionnaire containing the 59 questions on "Environment, Recycling, Plastic and Plastic Waste Attitude Scale" were distributed to all flats on recycled papers and in closed envelopes. The questionnaires were filled by one person from each flat and collected under observation. In the second stage, face-to-face in-depth interviews were conducted with the apartment workers using the information collection form for recycling created by the researchers.

In the study, a refined form of questionnaires titled "Environment, Recycling, Plastic and Plastic Waste Attitude Scale" was used (7,8). Scale usage permissions were obtained. Ethics Committee approval was received from SBU Gülhane Scientific Research Ethics Committee (No. 2020/520).

SPSS 25.00 package program was used in the analysis of the collected data. Descriptive statistical analyzes were made in the evaluation of the data; Kolmogrov-Smirnov tests were used for normality tests, and Mann Whitney U and Kruskal Wallis tests were used to compare the scale score averages of the groups. Statistical significance value was accepted as $p<0.05$. The qualitative part was analyzed and reported.

This study was approved by the clinical research ethics committee of the University of Health Sciences, Gulhane School of Medicine (Date: 29.12.2020 number: 2020/520).

RESULTS

Quantitative Study Findings

The mean age of the individuals participating in the study was 40.5±8.88, 50% (n=165) were women and 79.4% (n=262) were married. 53.3% (n=176) of the participants had university and 40% (n=132) had postgraduate degrees. When the professions of the participants were examined, it was seen that 36.4% (n=115) were doctors and 24.7% (n=78) were from other health professions (nurse, health officer, etc.) (Table 1).

Table 1. Sociodemographic Characteristics of the Participants

Sociodemographic Characteristics	Number	%*
Age (n=317)		
Mean ± SD (min, max)	40.58±8.88 (min=18, max=64)	
Gender (n=330)		
Women	165	50.0
Men	165	50.0
Marital Status (n=330)		
Married	262	79.4
Single	58	17.6
Other (Separated/Divorced/Widowed)	10	3.0
Child Status (n=330)		
Yes	256	77.6
No	74	22.4
Number of Children (n=256) those without children?		
1	75	29.3
2	153	59.8
3	24	9.4
4	3	1.2
5	1	0.4
Educational Status (n=330)		
Literate	1	0.3
Primary Education	6	1.8
High School	15	4.5
University	176	53.3
Postgraduate	132	40.0
Occupation (n=316)		
Doctor	115	36.4
Other Health Professionals (nurse, health officer, etc.)	78	24.7
Other (engineer, teacher, banker, psychologist, housewife, etc.)	123	38.9
Number of people living in the household (n=329)		
1 or 2 people	92	28.0
3 or 4 people	205	62.3
5 people or more	32	9.7

*Column percentage.

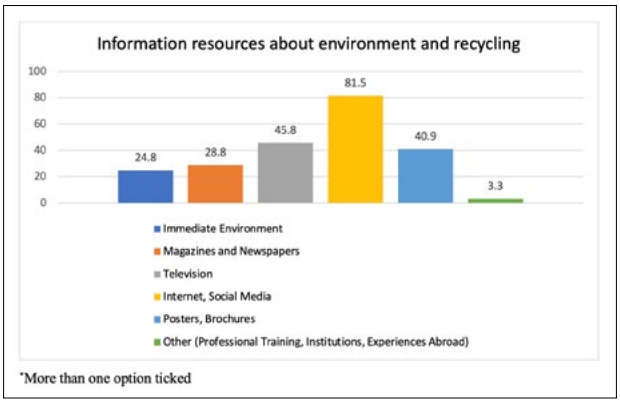
97% of the participants (n=320) stated that they have future concerns about environmental problems. The rate of respondents stating that there are recycling bins or collection points in the residential area they live in is 57.3% (n=189). 49.2% (n=96) of the lodging residents stated that they were not satisfied with the recycling practices in the lodging area. 66.7% (n=220) of the participants stated that the information signs in shopping malls, workplaces, etc. were drawing attention. However, 82.1% (n=271) stated that there are not enough warning and information signs about recycling in public places. 51.5% of the participants (n=170) believe that they have sufficient knowledge about recycling, 83.6% (n=276) believe that the effects of global warming will decrease with the use of recyclable products. 50.0% (n=165) stated that they consider the products purchased in terms of recycling while shopping. However, only 38.8% (n=128) of the participants stated that they collect recyclable waste separately (Figure 1).

Figure 1. Participant's separate collection of recyclable waste

The areas of concern about environmental problems are as follows; 94.5% of the participants (n=312) are concerned about water pollution, 76.4% (n=252) are concerned about air pollution, 71.2% (n=235) are concerned about soil pollution, 84.2% (n=278) are concerned about healthy food supply, 84.5%, (n=279) are concerned about global climate change and related conditions (flood, hurricane, storm, forest fires etc.), 87.6% (n=289) is concerned about other problems such as infectious diseases, terrorism, war, radiation pollution and technology.

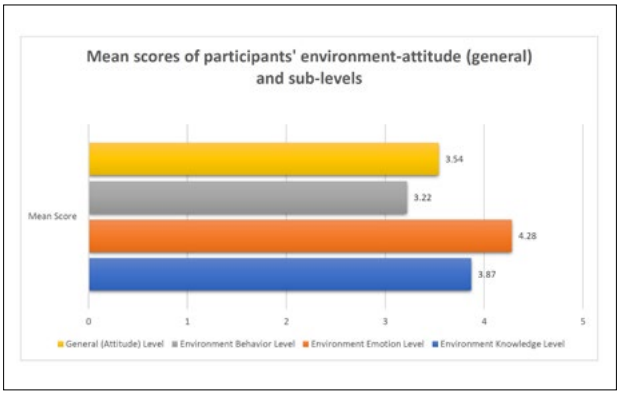
It has been observed that the highest rate of 81.5% (n= 269) information about environment and recycling is accessed via internet and social media. This information source was followed by television with a rate of 45.8% (n=151) (Figure 2).

Figure 2. Resources for participants to access information about the environment and recycling



The mean environmental-attitude (general) score of the participants from the scale was 3.54 (±0.36). Considering the lower-level mean scores, the mean environmental-knowledge level score is 3.87 (±0.46), the environment-level mean score is 4.28 (±0.58), and the environment-behavior mean score is 3.22 (±0.54) (Figure 3).

Figure 3. The mean scores of the participants' environment-attitude (general) and sub-levels



When the average scores of some sociodemographic characteristics and environmental-attitude (general) levels of the participants were examined, no significant difference was found in terms of gender and age (Table 2). However, when the sub-dimensions were examined, the environment-emotion level of men was found to be higher, and this difference was statistically significant (Z=-2.242, p=0.025). There was also a significant difference between age groups in terms of behavioral sub-dimensions (F=3.217, p=0.013). The groups that made the difference were the 26-35 and 46-55 age groups, and the average behavioral score of the 26-35 age group was found to be the lowest.

Table 2. Comparison of the average scores of the participants' environmental attitude (general) levels in terms of some variables

Features	N	Average rank	Test, p
Sex			
Women	165	163.67	Z=-0.348*
Men	165	167.33	p= 0.728
Age			
16-25 years old	9	166.50	
26-35 years	87	138.58	X^2 =6.495**
36-45 years	123	164.89	p =0.165
46-55 years	87	166.89	
56-65 years	11	186.09	
Marital status			
Married***	262	170.38	X^2 =7.169**
Single	58	156.11	**p = 0.028**
Divorced***	10	92.10	
Have a Child			
Yes	256	170.76	Z=-1.862*
No	74	147.32	p= 0.063
Education Status			
Literate	1	6.00	
Primary Education	6	190.00	X^2 =7.396**
High School	15	141.13	p =0.116
University	176	158.34	
Graduate	132	177.91	
Profession			
Health workers (doctor, nurse, health officer, health technician, etc.)	193	165.71	Z=-1.757*
Other professions (engineer, teacher, banker, psychologist, housewife, etc.)	123	147.19	p = 0.079
Number of people living in the household			
Up to 2***	92	139.87	X^2 =9.688**
3-4	205	172.61	**p =0.008**
5 and above***	32	188.47	
Future concern about environmental problems			
Yes	320	167.51	Z=-2.168*
No	10	101.10	**p= 0.030**
Attracting attention of information signs about recycling in places such as shopping malls and workplaces			
Yes	220	179.37	Z=-3.736*
No	110	137.76	**p<0.001**
The state of believing that they have enough information about recycling			
Yes	170	184.84	Z=-3.797*
No	160	144.95	**p< 0.001**
Believes that the effects of global warming will decrease with the use of recyclable products.			
Yes***	276	174.01	X^2 = 13.906**
No	25	131.66	**p =0.001**
No idea***	29	113.67	
Considers the products bought while shopping in terms of recycling			
Yes	165	196.19	Z=-5.845*
No	165	134.81	**p<0.001**
Separate collection of recyclable waste			
Yes***	128	198.79	X^2 =28.821**
No	76	128.60	**p<0.001**
Sometimes	126	153.94	

*Mann Whitney U Test, **Kruskal Wallis Test, ***Groups that make a difference

A statistically significant difference was found between the general level average scores in terms of marital status. The groups that make the difference are those who are married and divorced. No statistically significant difference was found between the mean scores of environmental attitudes in terms of having children, educational status and occupation (Table 2).

There was no significant difference between the mean scores of the general environmental levels of the health care workers and other occupational groups in terms of the professions of the participants (Table 2). However, in terms of "knowledge sub-levels", the mean environmental knowledge level scores of health workers were found to be significantly higher than other occupational groups (Z=-2.460, p=0.014).

The mean scores of environmental-attitude (general) level of those who are concerned about the future about environmental problems, those who state that information signs about recycling in places such as shopping centers and workplaces draw attention, those who believe that they have enough information about recycling, those who believe that the effects of global warming will decrease with the use of recyclable products, those who pay attention to recyclability of products they buy and those who collect recyclable waste separately were found to be statistically significantly higher (Table 2).

Qualitative Study Findings

All apartment workers were included through face-to-face individual in-depth interviews. Of the apartment workers serving in 14 buildings; 5 were women, 5 were men, with an average age of 44 (min=36, max=51). Considering the education levels, 7 were primary school graduates, 2 were secondary school graduates and one had an associate degree. The average time of employment in this job was 9.5 years (median: 9.0; min=2, max=18).

In the interview, they stated that all apartment officials have information about recycling and that they obtained this information mostly from their own children (n=5), from media (newspaper, television, internet, etc.) (n=4) and from apartment management (n=1).

Apartment officials serve 437 flats in total, and they stated that 202 of these flats (46.2%) collect recyclable waste separately.

6 of the apartment officials stated that they believe that the recyclable wastes left at the recycling points are collected and recycled with appropriate methods. 8 workers stated that if all flats were to collect their recyclables separately, it wouldn't impose them an additional workload. All of the apartment workers stated that they leave the recycling wastes collected separately at the recycling points. In addition, 9 of them stated that they separate the unsorted packaging wastes (cardboard boxes, plastic and glass bottles, etc. if not contaminated with household waste) in the garbage of the apartments they served and leave them at the recycling point.

When asked whether there is a waste oil collection point, only one apartment worker stated that there is a waste oil collection point in a building they serve, and only 2 flats in this building collect waste oil.

When the participants were asked about the existence of environmental concerns about the future, 8 of them said they had concerns, and some of their statements about their concerns about the future are presented below.

AW-1 and AW-2: More trees should be planted, there should be more green areas, nature should be allowed to renew itself.

AW-3, 4 and 7: Environmental pollution is increasing and we are all causing it. AW-7 also said that "children who do not care about this situation are growing up" and stated that he is worried that the children won't care about the environment in the future.

AW-9: Water scarcity, deforestation and desertification are big problems in the world.

To the question '***Do you have any ideas or suggestions about recycling? What is it, if any?***', participants stated that recycling points are insufficient. Some of the answers given by the apartment staff are as follows:

AW-1: If everyone collects their recyclable waste separately, we can also transport it to the recycling point.

AW-3: This issue should be explained to all apartment officials. Waste bins are insufficient, they should be increased. It would be better if there is a separate recycling collection point in each apartment.

AW-7: All wastes are collected in the same place at the recycling points. It has to be separated.

AW-10: The recycling points are insufficient.

DISCUSSION

In our study, we tried to determine the knowledge, attitudes and behaviors of individuals living in a public housing unit about the environment, recycling and plastic waste. In accordance with the literature, although the participants' environmental-knowledge and attitude level average score was high, their behavior level average score was low (8,9,10). This situation draws attention to the need to increase the number of studies on the underlying reasons why knowledge does not turn into behavior.

Considering whether the participants had concerns about the environment, it was determined that they have a very high rate of anxiety (97%). Although the area of greatest concern was water pollution, participants have also stated that they have concerns about other issues such as air and soil pollution, the problem of healthy food supply, global climate change and related conditions (flood, hurricane, storm, forest fires, etc.), infectious diseases, terrorism, war, radioactive pollution and technology. In the study conducted in İzmir, 69% of the participants stated that air, soil and water pollution cause them anxiety (11).

Many studies show that environmental concerns have a positive effect on consumer behavior. It was determined that the state of being concerned about the environment affects being informed about the environment, i.e. paying attention to the selection of recyclable products, and positive behaviors towards recycling (12,13). A recent study conducted in Israel states that COVID-19 increased anxiety about climate change and positive behaviors related to recycling and decreased consumption (14). In our study, in accordance with the literature, environmental general score averages were found to be higher in those who have concerns about the future about the environment.

It was also observed that the highest rate (81.5%) of information about the environment and recycling was accessed from the internet and social media. Some other studies, in accordance with our study, show television and internet on a higher frequency among other sources related to recycling (15,16). Accordingly, the necessity to provide more information about recycling and environmental problems through public service ads and advertisements on television and the internet becomes clearer.

Studies have shown that single participants are more indifferent to environmental pollution, recycling and buying recyclable products. On the other hand, it was determined that the participants who have children associate environmental pollution with their future anxiety (17,18). Although there is no significant difference, the mean of the environment-general score of those who have children is also higher. At the same time, in the interviews made in the qualitative part of our study, it was determined that the apartment workers learned the information about recycling mostly from their own children. A study conducted in Australia also shows that students' environmental knowledge can improve their parents' knowledge (19). According to these studies, increasing the knowledge and awareness of children on environmental problems and recycling aid adults' awareness greatly.

In our study, although the environmental-knowledge level of health workers was found to be significantly higher than other occupational groups, no difference was found between the levels of environment-behavior. In a study conducted on medical faculty students in Istanbul, students' recycling habits were found to be low, and it was seen that the sensitivity of future doctors to environmental issues is not different from other university students (20). In a study conducted on medical school and nursing students in Iran, it was stated that the students' knowledge about recycling was high, but this knowledge does not translate into behavior (21). Although some studies show that there is a relationship between the increase in environmental knowledge and the increase in environmental awareness and environmental behavior, education alone may be insufficient in creating positive environmental behaviors (22,23). In addition to education, the application of legal sanctions can also be an important intervention in developing positive behavior on environmental issues. In a study conducted in Sakarya, the participants who said 'I do not separate for recycling because there is no legal sanction' were found to be substantial (24). This shows that the necessity of legal sanctions and incentives is important.

Most of the participants (57.3%) stated that there is not enough warning and information signs about recycling in public areas. In a study conducted on university students, more than half of the students stated that there are not

enough advertisements, signs, etc. to remind them to recycle. It has also been stated that university recycling facilities (boxes, containers, etc.) are not sufficient (24). In our study, the apartment officials stated that the recycling points in the public housing area are insufficient.

In our study, the rate of those who say 'sometimes I collect them separately' and 'I do not collect them separately' is 61.2%. In a study conducted in Trabzon, 50.4% of the participants stated that they do not separate their household wastes (10). Another study in İzmir reveals that 72.5% of the participants do not separate their wastes (11). As can be seen, the rates of not separating the wastes are quite high. In addition, the statements of apartment officials in the qualitative part of our study also support this finding.

In our study, although the participants who believe that the effects of global warming will decrease with the use of recyclable products are in the high majority that it is also seen that this information cannot translate into behavior. While the rate of consideration of the products purchased in our study in terms of recycling is 50%, in a study conducted on preschool teachers, the percentage of those who purchase products bearing environmental signs is 13.5% (6).

In our study, it can be seen that those who say that information signs about recycling in places such as shopping centers and workplaces attract attention have higher environmental general scores. This shows that sufficient recycling points and practices can guide and encourage individuals to transform their knowledge and attitudes into behavior. In addition, some encouraging practices for the collection of recyclable waste, which have various examples in the world, can also contribute to the development of positive environmental behaviors. For example, in Sweden, recycling machines in food shops provide receipts for all kinds of plastic and metal cans recovered, which then can be used in said shops. Thanks to this incentive, discarded bottles or boxes in the environment are recycled (25).

The most important limitation of our study is that the individuals living in public housing units and participating in our study have a high level of education and most of them are healthcare professionals, which may create deficiencies in representing the society.

To prevent the climate crisis, which is one of the biggest problems of our time, it is also important to recycle domestic waste to protect the environment and ecological balance. Since the source separation method is the basis of recycling practices, it is understood from this research that individuals' recycling behavior levels can be increased with practices that aim to inform, direct and encourage recycling. It is important to plan the activities to be done in a way that increases the behavioral dimension as well as knowledge. Adequate recycling points, providing adequate information boards and providing information from time to time especially via social media or public service ads, motivating individuals to separate wastes by enabling them to make profits through various applications, site managements' reminders on recycling in their area of responsibility, distributing different colored separation bags made of recycled materials, providing detailed training to apartment workers are considered as what needs to be done in creating positive behavior for recycling. In parallel with all these practices, it is important for governments to be politically determined and implement legal regulations on waste recycling.

Declarations

The authors received no financial support for the research and/or authorship of this article. There is no conflict of interest.

This study was approved by the clinical research ethics committee of the University of Health Sciences, Gulhane School of Medicine (Date: 29.12.2020 number: 2020/520).

REFERENCES

1. Güler Ç. Çevre Sağlığı, Çevre ve Ekoloji Bağlantılarıyla, 1. Baskı. Ankara, Yazıt Yayıncılık. 2012.
2. Giusti L. A review of waste management practices and their impact on human health. Waste Manag. 2009; 29(8): 2227-2239.
3. Oweis R, Al-Widyan M, Al-Limoon O. Medical waste management in Jordan: a study at the King Hussein Medical Center. Waste Manag. 2005; 25(6): 622-5.
4. Gunduzalp AA, Güven, S. Waste and waste types, waste management, recycling and consumer: Çankaya Municipality and Instance of Neighborhood Consumers. Hacettepe Üniversitesi Sosyolojik Araştırmalar E-Dergisi. 2016; 9: 1-19.
5. Koçak YC, Oran NT, Ceber Turfan E. Waste separation, social responsibility and environmental awareness education. JAREN. 2016; 2(2): 97-102.

6. Erten, S. Çevre Eğitimi Ve Çevre Bilinci Nedir, Çevre Eğitimi Nasıl Olmalıdır? Çevre ve İnsan Dergisi, Çevre ve Orman Bakanlığı Yayın Organı. 2004; 65(66): 1-13.
7. Avan C, Aydınlı B, Bakar F, Alboga Y. Preparing attitude scale to define students' attitudes about environment, recycling, plastic and plastic waste. IEJEE-Green. 2011; 1(3): 179-191.
8. Karakas H, Divrik MT, Divrik B. Vocational School Students' Attitude for Plastic Wastes and Recycling. Selçuk Üniversitesi Sosyal Bilimler Meslek Yüksekokulu Dergisi. 2018; 21(2): 448-470.
9. Kanbak, A. Environmental attitudes and behaviors of university students: Kocaeli University example in terms of different variables. KOSBED. 2015; 30: 77-90.
10. Demirbag BC, Gungormus Z. The knowledge and behaviors of individuals regarding the management of domestic solid waste. Gümüşhane University Journal of Health Sciences. 2012; 1(3): 127-137.
11. Aracioglu B, Tatlidil R. Effects of environmental consciousness over consumers' purchasing behavior. Ege Acad Rev. 2009; 9(2): 435-461.
12. Tanrikulu C. An examination of the role of environmental concern, perceived consumer effectiveness, and collectivism in green purchase behavior of consumers. Atatürk Üniversitesi İktisadi ve İdari Bilimler Dergisi. 2015; 29(1): 121-136.
13. Lee YK, Kim S, Kim MS, Choi JG. Antecedents and Interrelationships of Three Types of Pro-Environmental Behavior. J Bus Res. 2014; 67(10): 2097-2105.
14. Tchetchik A, Kaplan S, Blass V. Recycling and consumption reduction following the COVID-19 lockdown: The effect of threat and coping appraisal, past behavior and information. J Res Cons Rec. 2021; 167: 105370.
15. Gürer A, Sakız G. Adults' level of knowledge about global warming and recycling awareness. Journal of the Human & Social Science Researches. 2018; 7 (2): 1364-1391. (In Turkish)
16. Çimen O, Yılmaz M. Recycling knowledge, behaviors, and attitudes of primary school students. UEFAD. 2012; 25(1): 63-67.
17. Özbakır Umut M, Topuz Y, Nurtanış Velioğlu M. The sustainable consumers on the way from waste to recycling. CBÜ Sosyal Bilimler Dergisi. 2015; 13(2): 263-288.
18. Cabuk S, Nakiboglu B, Keles C. Tüketicilerin Yeşil ürün Satın Alma Davranışlarının Sosyo demografik Değişkenler Açısından incelenmesi. ÇÜSBED. 2008; 17(1): 85-102.
19. Grodzinska-Jurczak M, Bartosiewicz A, Twardowska A, Ballantyne R. Evaluating the impact of a school waste education program upon students', parents' and teachers' environmental knowledge, attitudes and behavior. Int. Res. Geogr. Environ. Educ. 2003; 12(2): 106-122.
20. Ikiisik H, Ari A, Cakir M, Ileri Y, Aslan E, Sabreden BE, et al. Evaluation of The Recycling Habits of Medical Faculty Students. Abant Med J. 2020; 9(3): 108-115.
21. Ehrampoush MH, Moghadam MB. Survey of knowledge, attitude and practice of Yazd University of Medical Sciences students about solid wastes disposal and recycling. Iranian J Env Health Sci Eng. 2005; 2(2): 26-30.
22. Kazazoglu TI, Erkal S. Investigation of environmental awareness levels of university students and their behaviours towards environmental problems. ESOSDER. 2022; 21(81): 21-42.
23. Güşta Sahin H, Dogu S. Pre-service preschool teachers' attitudes and behaviors related to environmental problems. IOO. 2018; 17(3): 1402-1416.
24. Oznur AK, Genc AT. A research on the recycling awareness of university students: The case of Sakarya University. UEAD. 2018; 4(2): 19-39.
25. Tezel O, Yıldız E. Comparison of world and turkey in sustainable waste management applications: Edikab Case. SSRJ. 2020; 9(2): 35-48.

Archives of Current Medical Research
Arch Curr Med Res 2022;3(2):142-146

Received: 29 March 2022
Revised: 29 March 2022
Acccepted: 14 April 2022
DOI: 10.47482/acmr.2022.59

ORIGINAL ARTICLE

Vascular surgery experiences and the results in the first two years of a newly-established neurosurgery clinic

Mehmet Ziya Çetiner[1], **Duygu Baykal**[1], **Fatih Aydemir**[1],

1 University of Health Sciences Bursa Faculty of Medicine, Bursa City Hospital, Department of Neurosurgery, Bursa, Turkey

Abstract

Background: Aneurysmal hemorrhages have been the mostly seen cause of spontaneous subarachnoid hemorrhages. Aneurysmal hemorrhages are situations with a high rate of mortality and morbidity. It is really crucial that the treatment of an aneurysm should be operated by experienced tertiary clinics. Newly established clinics need experienced doctors and clinic reflexes in which patient follow-up is conducted properly in order to manage the treatment process ideally.

Methods: In this study, the 6-month clinical results of patients with aneurysmal subarachnoid hemorrhage who have been operated in our newly established hospital have been evaluated. Moreover, the results are compared with other clinics and literature.

Results: The study included 27 (57%) female patients and 20 (43%) male patients. It is determined that the average age of all patients is 55.42 (+- 1.68). 6 months mortality rate was 19.14%. The patients were operated within 24 hours after admission to the clinic

Conclusion: It is determined that the treatment unit for aneurysmal subarachnoid hemorrhage in our hospital is similar to the ones in other clinics and the ones mentioned in the literature. It is also seen that the early surgical planning in our hospital positively affects patient survival in keeping with the literature.

Keywords: Subarachnoid Hemorrhage, Cerebral Aneurysms, Stroke, Brain Aneurysms.

Cite this article as: *Çetiner MZ. Vascular surgery experiences and the results in the first two years of a newly-established neurosurgery clinic. Arch Curr Med Res. 2022;3(2):142-146*

Corresponding Author:
Mehmet Ziya Çetiner, Health Sciences University, Bursa Faculty of Medicine, Bursa City Hospital, Clinic of Neurosurgery, Bursa,Turkey
E-mail: m.ziya.cetiner@gmail.com

INTRODUCTION

The most common cause of a nontraumatic subarachnoid hemorrhage (SAH) is aneurysmal subarachnoid hemorrhage. The global incidence of aneurysmal SAH is seen as 7.9/100000. The incidence of aneurysmal SAH differs according to countries and regions (1). The average age for the rupture of an aneurysm is 50-55. Also, it is mostly seen between the ages of 40 and 60 (2-4). Hypertension, smoking and family history are the most important risk factors (5, 6).

After the aneurysm is ruptured, the blood flows in cerebrospinal fluid (CSF) and diffuses in CSF. Generally, it diffuses in cistern and ventricles. However, it also diffuses in parenchyma and rarely to a subdural distance. Within that period, intracranial pressure increases. Although aneurysmal hemorrhages usually end in a few seconds, they frequently reoccur in the first 24 hours (7, 8). Beyond the re-bleeding, other two most important complications of aneurysmal SAH are hydrocephalus and vasospasm (9, 10).

Grading aneurysmal SAH is vital in terms of the management of the treatment process. Glasgow Coma Scale, Hunt Hess classification, WFNS and Fisher Grading Scale have been used to grade aneurysmal SAH. These graders directly affect the prognosis and the treatment process. It is seen that the treatment modalities and algorithms of ruptured aneurysms have been changing and improving since the first aneurysm clip was done by Dandy in 1938 and endovascular coiling procedure was done by Gugliemi in 1990 (11, 12).

In this study, it is aimed to evaluate aneurysm surgeries that have been conducted by our team, started in 2020, in the newly-established University of Health Sciences, Bursa City Hospital. Although both surgical and endovascular treatments have been performed in our hospital, in this study, it is aimed to compare the results of the surgically treated patients with the literature and to evaluate their prognosis.

MATERIALS AND METHODS

University of Health Sciences in Bursa City Hospital was put into service in July, 2019. Neurovascular Surgery department was opened in January, 2020. There are 40 beds in our neurosurgery service. Intensive care patients are being followed-up in surgical intensive care unit and/or anesthesia intensive care unit. When the need for intensive care of these patients ends, they are particularly moved to neurosurgery service to be followed-up. There are 2 neurosurgery operating rooms and the aneurysm operations are conducted by the helps of experienced staff and nurses. Once the decision to operate is made for a patient, routine CT angiography is done and based upon the clinical condition of the patient, digital subtraction angiography (DSA) is also done. In case of re-bleeding, the surgical operations are emergently conducted within 24 hours. Before and after clipping, vascular flow is checked by intraoperative doppler. The images that belong to the patients are stored in the databases of our hospital and City Health Administrative.

The patients admitted to our clinic have had a neurological examination first. After being diagnosed as SAH via CT, the patients have been examined for etiology search via CT angiography and digital subtraction angiography (DSA), if needed. During this process, routinely, the patients have started using dexamethasone, antiepileptic therapy and nimodipine. The WFNS values and Fisher scales of the patients have been recorded. Hypertensive and hypervolemia have been followed-up among patients postoperatively. Hyperglycemia and hyperthermia have been avoided and laboratory support has been given. In any case of need, sedation is given, and the patients have been followed. For the patients who have had vasospasm, control DSAs have been conducted and they are given selective intraarterial nimodipine. For the patients who have had vasospasm and communicating hydrocephalus, it has been tried to decrease the burden of blood elements in cerebrospinal fluid via lumbar punctures. In order to make an evaluation about the WFNS scores, mortality and morbidity values of the patients in admission and modified Rankin Scales (mRS) in the 6th month have been evaluated. The locations of aneurysms have been observed and the results have been compared with the literature. For the patients, mRS scores are grouped as good for 0-2, mortality and dependent patient for 3-6.

Statistical analyses were performed using IBM SPSS Statistics for Windows, version 22.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were presented as numbers and percentages for categorical variables and as mean ± standard deviation for continuous variables.

This study was approved by the clinical research ethics committee of the Health Sciences University, Bursa Faculty of Medicine, Bursa City Hospital (Date: 28.05.2022 number: 2022-08/08).

RESULTS

In our clinic, aneurysm surgery is started to be applied in January 2020. Since then, to November 2021, 47 patients, who admitted to our hospital with aneurysmal SAH, have been operated in a 13-month active working period because of the intensive care unit restrictions that lasted 10 months in which we were not able to conduct surgeries during Covid-19 pandemic. 27 of them (57%) are female patients. It is seen that the age distribution of the patients is normal for both genders according to the Shapiro-Wilk test. It is determined that the average age of all patients is 55.42 (+- 1.68), the average age of female patients is 57.96 (+- 2.14), and the average age of male patients is 52 (+- 2.57) (Table 1).

Table 1. Clinical results according to GCS scores

Patients' treatment results of 6-month period according to their admission scores.			mRS (0-6)		Total
			Good (0-2)	Dependent patient and mortality (3-6)	
GCS scores in admission	Good (15-14)	Number	18	4	22
		Percentage	81.8%	18.2%	100.0%
	Medium (13-9)	Number	9	2	11
		Percentage	81.8%	18.2%	100.0%
	Bad (8-3)	Number	5	9	14
		Percentage	35.7%	64.3%	100.0%
Total		Number	32	15	47
Percentage		68.1%	31.9%	100.0%	

Note: Admission scores of the patients have been evaluated by GCS and they are grouped as good between 14-15, medium between 13-9 and bad between 8-3. At the end of 6-month period, the patients have been re-evaluated. The results of the treatment and mRS scores are grouped as good clinical results between 0-2 and dependent and lost patients between 3-6.

The mortality rate is 19.1% among all patients while this rate increases up to 35.7% among surgically treated patients with low GCS scores. Although they have been admitted to our hospital with high GCS scores, only 4 of our patients, one of whom was post op 10, died. During the day, two patients had re-bleeding aneurysm after the diagnostic angiography and before the surgery. Due to this re-bleeding, they had low GCS scores and were taken into emergent surgical operation, but the patients died in the following process because of acute myocardial infarction. It is seen that, the better admission GCS scores the patients have, the better clinical results they reach. This situation is seen to be statistically significant with Pearson Chi-Square test (Table 2).

Table 2. Mortality rates of patients in coma or not

			Patients' final status for six months period		
			Good	Dependent/ Dead	Total
Patients' status in admission	Not in coma	Number	27	6	33
		Percentage	81.8%	18.2%	100.0%
	In coma	Number	5	9	14
		Percentage	35.7%	64.3%	100.0%
Total		Number	32	15	47
Percentage			68.1%	31.9%	100.0%

Note: When the patients' status in admission and patients' final clinical status for six-month period are compared, it is seen that poor conscious is directly related to mortality and morbidity. (Fischer's exact test $p<0.05$)

When the locations of aneurysm have been examined, it is seen that middle cerebral artery (MCA) is mostly operated. The other locations are anterior communicating artery (ACOM), posterior communicating artery (PCOM), distal anterior cerebral artery (DACA) and internal carotid artery (ICA) in order (Table 3).

Table 3. Aneurysm locations

		Number	Percentage
Aneurysm locations	MCA	21	44.7
	ACOM	17	36.2
	PCOM	6	12.8
	ICA	1	2.1
	DACA	2	4.3
	Total	47	100.0

Note: Considering the aneurysm location distributions, it is seen that the most operated aneurysms are MCA aneurysms.

DISCUSSION

Although our clinic is a newly-established one, neurovascular cases have been gradually increasing. It is seen that the rate of female patients to male patients is 1.35. It is also determined that when we compare the demographic values such as the average age of our patients with other data from both our country and abroad, the results are roughly similar (13-16).

When the locations of aneurysms are examined among older clinics which have been conducting such operations longer than us, it is seen that the most common ones are similar in order, MCA (44.7%), and ACOM (36.2%) (15). It is also detected that the discharge and good clinical result rate in the 6th month of other clinics is 67.2% (15). When we have evaluated our clinic results, it is seen that the rate is 68.1%, similarly. When the surgery rates of the patients with low GCS values (GCS values 8-3) increase, the mortality and morbidity rates relatively increase, but it is seen that the recovery rates of the patients in coma are substantial. The meta-analysis study of Yao et. al. demonstrates that early surgery decreases the mortality and morbidity rates of the patients with SAH either operated or not (17). Therefore, patients with aneurysmal SAH are being operated as soon as possible in our clinic. Although it has been the early stages of aneurysmal surgery in our clinic, we believe that early surgery is one of the reasons of our success which has similar rates with other clinics.

It is obvious that, even the patients are operated without wasting time, one of the most important factors is the GCS values of the patients in admission to the hospital. In our study, similar to the ones in literature, it is seen that the patients with low GCS values have significantly high mortality and morbidity rates.

It is apparent that operating the patients at early stages has positive effects on the success of the treatment. In newly-established clinics, planning these kinds of operations is significant in terms of clinical routines which can improve staff training. It is known that the clinical results of the patients with low GCS scores in admission are worse. However, it is estimated that early surgery would be more promising for these patients, too. Although we are a new clinic, bleeding aneurysm treatments performed by following the current literature have provided acceptable values according to the literature.

Declarations

The authors received no financial support for the research and/or authorship of this article. There is no conflict of interest.

This study was approved by the clinical research ethics committee of the Health Sciences University, Bursa Faculty of Medicine, Bursa City Hospital (Date: 28.05.2022 number: 2022-08/08).

REFERENCES

1. Etminan N, Chang HS, Hackenberg K, de Rooij NK, Vergouwen MDI, Rinkel GJE, et al. Worldwide Incidence of Aneurysmal Subarachnoid Hemorrhage According to Region, Time Period, Blood Pressure, and Smoking Prevalence in the Population: A Systematic Review and Meta-analysis. JAMA Neurol. 2019;76(5):588-597.
2. Rinkel GJ, Djibuti M, Algra A, van Gijn J. Prevalence and risk of rupture of intracranial aneurysms: a systematic review. Stroke. 1998;29(1):251-6.
3. Jordan LC, Johnston SC, Wu YW, Sidney S, Fullerton HJ. The importance of cerebral aneurysms in childhood hemorrhagic stroke: a population-based study. Stroke. 2009;40(2):400-5.
4. Shea AM, Reed SD, Curtis LH, Alexander MJ, Villani JJ, Schulman KA. Characteristics of nontraumatic subarachnoid hemorrhage in the United States in 2003. Neurosurgery. 2007;61(6):1131-7; discussion 1137-8.
5. Vlak MH, Rinkel GJ, Greebe P, Greving JP, Algra A. Lifetime risks for aneurysmal subarachnoid haemorrhage: multivariable risk stratification. J Neurol Neurosurg Psychiatry. 2013;84(6):619-23.
6. Müller TB, Vik A, Romundstad PR, Sandvei MS. Risk Factors for Unruptured Intracranial Aneurysms and Subarachnoid Hemorrhage in a Prospective Population-Based Study. Stroke. 2019;50(10):2952-2955.
7. Biesbroek JM, van der Sprenkel JW, Algra A, Rinkel GJ. Prognosis of acute subdural haematoma from intracranial aneurysm rupture. J Neurol Neurosurg Psychiatry. 2013;84(3):254-7.
8. Schuss P, Konczalla J, Platz J, Vatter H, Seifert V, Güresir E. Aneurysm-related subarachnoid hemorrhage and acute subdural hematoma: single-center series and systematic review. J Neurosurg. 2013;118(5):984-90.
9. Zimmermann M, Seifert V. Endothelin and subarachnoid hemorrhage: an overview. Neurosurgery. 1998;43(4):863-75; discussion 875-6.
10. Douglas MR, Daniel M, Lagord C, Akinwunmi J, Jackowski A, Cooper C, Berry M, Logan A. High CSF transforming growth factor beta levels after subarachnoid haemorrhage: association with chronic communicating hydrocephalus. J Neurol Neurosurg Psychiatry. 2009;80(5):545-50.
11. Symon L. Perspectives in aneurysm surgery. Acta Neurochir (Wien). 1982;63(1-4):5-13.
12. Molyneux A, Kerr R, Stratton I, Sandercock P, Clarke M, Shrimpton J, Holman R; International Subarachnoid Aneurysm Trial (ISAT) Collaborative Group. International Subarachnoid Aneurysm Trial (ISAT) of neurosurgical clipping versus endovascular coiling in 2143 patients with ruptured intracranial aneurysms: a randomised trial. Lancet. 2002;360(9342):1267-74.
13. Muehlschlegel S. Subarachnoid Hemorrhage. Continuum (Minneap Minn). 2018;24(6):1623-1657.
14. Sarı RO. Son on yılda opere edilen serebral anevrizmalı hastaların retrospektif analizi [dissertation]. Ankara: Dışkapı Yıldırım Beyazıt Education and Research Hospital; 2009
15. Çetiner MZ. Clinical Evaluation Of Microneurosurgery And Endovascular Aneurysm Treatments Between 2013-2018 [dissertation]. Ankara: Health Sciences University; 2018
16. Ulutaş M. Outcome of intracranial aneurysm surgery : single center experience. Cukurova Med J 2016;41(4):732-743.
17. Yao Z, Hu X, Ma L, You C, He M. Timing of surgery for aneurysmal subarachnoid hemorrhage: A systematic review and meta-analysis. Int J Surg. 2017;48:266-274.

Archives of Current Medical Research
Arch Curr Med Res 2022;3(2):147-153

Received: 07 May 2022
Revised: 11 May 2022
Acccepted: 19 May 2022
DOI: 10.47482/acmr.2022.60

ORIGINAL ARTICLE

Comparison of the Laparoscopic Appendicitis (LAPP) score with the Alvarado and Appendicitis Inflammatory Response(AIR) scores and computed tomography and pathology results

Hüseyin Fahri Martlı[1], **Hacı Bolat**[2],

1 Ankara Atatürk Sanatoryum Training and Research Hospital, Department of General Surgery, Ankara, Turkey
2 Niğde Ömer Halisdemir Training and Research Hospital, Department of General Surgery, Niğde, Turkey

Abstract

Background: Acute appendicitis is the most commonly encountered and operated group among general surgery emergency patients. Various scoring and algorithms are used in diagnosis and treatment. This study aimed to compare the Laparoscopic Appendicitis (LAPP) score, which is used to reduce negative appendectomy, according to the pathology and preoperative computed tomography results and investigate its correlation with other clinical scoring systems.

Methods: Patients who underwent appendectomy in our clinic between June 2020 and March 2021 were retrospectively reviewed. The obtained LAPP scores were compared with the preoperative imaging results, Alvarado score, appendicitis inflammatory response (AIR) score, and pathology results.

Results: The study included a total of 109 patients, of whom 22 (20.18%) had a pathology result that was not consistent with appendicitis. The LAPP score was determined as 1.41 for this 22 patients who underwent negative appendectomy ($p<0.001$), 2.45 for 74 patients with suppurative appendicitis ($p<0.001$), and 3.54 for 13 patients with gangrenous or perforated appendicitis ($p<0.001$).

Conclusions: The purpose of the LAPP score is to reduce the rate of negative appendectomy. Appendectomy is also performed in some patients who may have spontaneous resolution if they present to the hospital in the early period. We also consider that the frequency of familial Mediterranean fever in Turkey may be another reason for the high rate of negative appendectomy. In addition, the correlation of high Alvarado and AIR scores with a high LAPP score indicates that it is more reliable in the diagnosis of complicated appendicitis.

Keywords: Acute Appendicitis, Lapp Score, Alvarado Score

Cite this article as: *Martlı HF, Bolat H. Comparison of the Laparoscopic Appendicitis (LAPP) score with the Alvarado and Appendicitis Inflammatory Response(AIR) scores and computed tomography and pathology results. Arch Curr Med Res. 2022;3(2):147-153*

Corresponding Author:
Hüseyin Fahri Martlı, Ankara Atatürk Sanatoryum Training and Research Hospital, General Surgery Department, Ankara, Turkey
E-mail: fahri_martli@hotmail.com

INTRODUCTION

Acute appendicitis is one of the most common causes of acute abdomen in the world. Its prevalence in developed countries is 90-100 per 100,000(1). Appendectomy still constitutes the most common treatment method and gold standard for acute appendicitis(2). However, especially with the COVID-19 pandemic, the rate of non-operative treatment preference has increased, and it has become an important alternative in this area(3-5). Non-operative treatment is reported to fail in 8% of patients, while 20% present with recurrence within the first year, but it has been determined that antibiotic treatment does not increase morbidity and mortality, especially in uncomplicated appendicitis cases(6, 7). It can be predicted that organ-preserving treatment methods will be increasingly preferred due to the important role of the appendix in the preservation of the intestinal microbiota(7-9).

Negative appendectomy detects an important misdiagnosis. While this rate is approximately 9% in the Netherlands and European countries where the pilot Laparoscopic Appendicitis (Lapp) Score study was conducted(10), it is around 3-4% in the USA and South Korea, where computed tomography is used frequently for diagnostic purposes(11, 12). Hamminga et al. published a pilot study in 2012 using the perioperative LAPP score to prevent negative appendectomy in patients undergoing diagnostic laparoscopy for acute abdomen(13). The LAPP score was prepared based on findings suggesting inflammation in the perioperative appendix examination, both for the preliminary diagnosis of appendicitis and for operations performed for diagnostic purposes, and indicates appendectomy in patients with a score of at least 1(13, 14). The LAPP score questions the following: 1-) Is there necrosis or perforation in the appendix?, 2-) Is there any thickening of the appendix?, 3-) Is there any thickening in the appendix mesentery?, 4-) Is there vascular prominence in the appendix serosa?, and 5-) Is the appendix adhered to any organ or tissue? Each 'yes' answer is scored 1 point, and appendectomy is performed in patients with a total score of 1 and above. According to original study on the LAPP score study, the positive predictive value of the LAPP score was 99%, and the negative predictive value was 100%. In the validation study of the LAPP score conducted by Golpke et al., it was found that the rate of negative appendectomy was lower in patients evaluated with the LAPP score than in cases where this score was not used(14). Therefore, the parameters in the LAPP score are also checked in open operations. Thus, it is clear that the validation of the LAPP score can also be performed in patients who have undergone open appendectomy. In this study, we aimed to compare the LAPP score according computed tomography (CT) and pathology results of patients who underwent appendectomy, and determine its correlation with the preoperative Alvarado and appendicitis inflammatory response (AIR) scores.

MATERIALS AND METHODS

In the study, 337 patients who underwent appendectomy at Nigde Omer Halisdemir University Training and Research Hospital between June 2020 and March 2021 were screened. The study was approved by the Ethics Committee of the university in December 2021 with the number 2021-105. From the retrospectively screened patient files, a total of 108 patients with known preoperative Alvarado and AIR scores, complete anamnesis, and detailed perioperative findings were included in the sample. The patients' Alvarado, AIR and LAPP scores of the patients were compared with the preoperative radiological examination and pathology results of the appendectomy material. In addition, the correlation of LAPP score with the Alvarado and AIR scores was examined.

The exclusion criteria were determined as an age below 18 years and lack of informative operation notes, anamnesis or epicrisis. The patients' whole blood count, c-reactive protein, liver function, and kidney function were studied preoperatively. Preoperative ultrasonography or CT was performed in all patients. CT was performed in patients who could not be diagnosed or had suspected acute abdomen despite normal ultrasonographic findings. Patients with any intra-abdominal pathology other than perioperative appendicitis were not included in the study.

SPSS v. 25 was used for statistical analyses. While analyzing the study data, in addition to descriptive statistical methods (mean, standard deviation, median, frequency, ratio, minimum and maximum values), the distribution of the data was evaluated with the Shapiro-Wilk test. Student's t-test was used to compare two groups with normally distributed quantitative data. One-way analysis of variance was used conducted for the

comparison of three or more groups in terms of normally distributed quantitative data. The significance level was accepted as $p < 0.05$.

RESULTS

The pathology result of 22 patients (20.18%) with a retrospective LAPP score of at least 1 or higher was not consistent with appendicitis. In the remaining 87 (79.82%) patients, the pathology result was reported as appendicitis. When evaluated according to the pathology results, the mean LAPP score was 1.41 ± 0.67 for the 22 patients without appendicitis, 2.45 ± 1.07 for the 74 patients with appendicitis , and 3.54 ± 1.27 for the 13 patients with perforated-gangrene-plastron ($p < 0.001$) (Table 1). In Tukey's post hoc analysis test, there was a significant difference between the non-appendicitis group and the suppurative appendicitis group ($p<0.001$), and between the non-appendicitis group and the complicated appendicitis group ($p<0.001$), but no difference was found between complicated appendicitis and suppurative appendicitis $p>0.05$. Accordingly, the patients that underwent negative appendectomy had a lower LAPP score, those with appendicitis had a higher LAPP score, and those with complicated appendicitis had a higher Lapp score, which were all at statistically significant levels.

Table 1. Comparison of the Laparascopic Appendicitis (LAPP)score according to the pathology results

Pathology Result	n	LAPP Score	Min-Max	P
		(Mean ± SD)	(LAPP Score)	
Not appendicitis	22	1.41 ± 0.67	1-3	
Acute appendicitis	74	2.45 ± 1.07	1-5	0.001
Gangrenous-perforate appendicitis	13	3.54 ± 1.27	1-5	

One-way analysis of variance, *p < 0.05, **p < 0.01

When compared according to the preoperative CT results, the mean LAPP score was 2.46 ± 1.18 for the 88 patients with CT findings consistent with appendicitis and 1.59 ± 0.71 ($p < 0.001$) for the 21 patients with non-appendicitis or normal findings (Table 2).

Table 2. Comparison of the LAPP score according to the preoperative tomography results

CT Result	n	LAPP Score	Min-Max	P
Consistent with appendicitis	88	2.46 ± 1.18	1-5	0.001
Inconsistent with appendicitis	21	1.59 ± 0.71	1-3	

One-way analysis of variance, *p < 0.05, **p < 0.01

The comparison of the Alvarado and AIR scores according to the patients' pathology results revealed that the mean Alvarado and AIR scores were 5.43 ± 1.44 and 5.82 ± 1.97 respectively for the 22 patients who underwent negative appendectomy; 6.8 ± 1.52 ($p < 0.05$), and 6.82 ± 2.16 , for the 74 patients with appendicitis; and 6.85 ± 1.57 ($p < 0.05$) and 8.08 ± 1.85 respectively for the 13 patients with advanced infection. After Tukey's test; While the Alvarado score was significantly different between complicated appendicitis and nonapendicitis, and between suppurative appendicitis and nonapendicitis ($p<0.001$ and $p<0.05$, respectively), it did not make a significant difference between complicated appendicitis and supurative appendicitis ($p>0.05$). A significant difference was found between suppurative appendicitis groups ($p<0.05$), between non-appendicitis and complicated appendicitis groups ($p<0.05$), and between complicated appendicitis and non-appendicitis groups ($p<0.05$) (Tables 3 and 4). For the 88 patients with appendicitis-consistent preoperative CT findings, the mean Alvarado and AIR scores were determined as 6.66 ±

1.52 ($p < 0.05$) and 6.76 ± 2.11 ($p > 0.05$), respectively. The mean Alvarado score was 5.65 ± 2.41 ($p < 0.05$) and the mean AIR score was 6.35 ± 2.34 ($p > 0.05$) for the 21 patients without appendicitis findings on CT. While a statistical relationship was defined between the Alvarado score and CT results, no significant relationship was found between the AIR score and CT results. Lastly, a highly significant positive correlation was observed between the high LAPP, high Alvarado and AIR scores (Tables 5 and 6).

Table 3. Comparison of the preoperative Alvarado score according to the pathology results

Pathology Result	n	Alvarado Score	Min-Max	P
Not appendicitis	22	5.45 ± 1.44	3-8	
Acute appendicitis	74	6.8 ± 1.52	4-9	0.001
Gangrenous-perforated appendicitis	13	6.85 ± 1.57	4-9	

One-way analysis of variance, *p < 0.05, **p < 0.01

Table 4. Comparison of the preoperative Appendicitis Inflamatory Response (AIR) Score according to the pathology results

Pathology Result	n	AIR Score	Min-Max	P
Not appendicitis	22	5.82 ± 1.97	2-9	
Acute appendicitis	74	6.82 ± 2.16	2-12	0.001
Gangrenous-perforated appendicitis	13	8.08 ± 1.85	4-10	

One-way analysis of variance, *p < 0.05, **p < 0.01

Table 5: Correlation analysis for the relationship between the LAPP score and the preoperative Alvarado score

		LAPP Score	Preoperative Alvarado Score
LAPP Score	r	1	0.363**
	p		0.000
Preoperative Alvarado Score	r	0.363**	1
	p		

Spearman's correlation test, *p < 0.05, **p < 0.01

Table 6: Correlation analysis for the relationship between the LAPP score and the preoperative AIR score

		LAPP Score	Preoperative Alvarado Score
LAPP Score	r	1	0.363**
	p		0.000
Preoperative Alvarado Score	r	0.363**	1
	p	0.000	

Spearman's correlation test, *p < 0.05, **p < 0.01

DISCUSSION

The most important goal of using the LAPP score is to reduce the rate of negative appendectomy(14). Parameters included in the LAPP score are findings in favor of inflammation in the perioperative examination of the appendix, which surgeons expect to see when diagnosing preoperative appendicitis. The use of the LAPP score can be considered as a method for systematizing the perioperative appendix examination. However, there are two important questions in this process: First, is the LAPP score is compatible with other preoperative scoring systems and preoperative CT and postoperative pathology results? Second, are the parameters included in the LAPP score sufficient to make an operation decision?

In this study, the pathology result of the 22 patients with at least one LAPP score point was not consistent with appendicitis. The preoperative CT findings were consistent with appendicitis in 12 of these patients and indicated suspicion in the remaining 10. The mean LAPP score of these 22 patients was 1.41 (min-max: 1-3), and the indication for surgery was determined according to the parameters in the LAPP score. In a multicenter validation study by Gelpke et al., 300 patients underwent appendectomy, and the pathology result of 14 was a normal appendix. All these 14 cases presented with appendicitis findings on preoperative CT. Gelpke et al. reported that the use of the LAPP score reduced the rate of negative appendectomy to 4.7%(14). In our study, despite the use of the parameters in the LAPP score, the rate of negative appendectomy was 20%. The mean Alvarado and AIR scores of these patients were 5.45 (min-max: 3-8) and 5.82 (min-max: 2-9), which did not favor a diagnosis of appendicitis. Similarly, in the study of Gelpke et al., the Alvarado score was found to be low and evaluated as an important limitation of the study by Niu et al.(14, 15). The patients who underwent surgery due to both CT findings and severe clinical condition during the follow-up were operated on because they had at least 1 point or more in the LAPP score, but the pathology result of these patients was not consistent with appendicitis. It is suggested that in the pathophysiology of appendicitis, first lumen obstruction and subsequently inflammation develop, and inflammation starts primarily from the lumen, with mucosal inflammation being an early sign of appendicitis(16). As a treatment method, the endoscopic opening of obstruction provides a similar improvement to appendectomy and causes less morbidity(17). The development of diagnostic methods and easier access to healthcare facilities can explain negative appendectomy since surgery is also performed in cases of spontaneously resorbed appendicitis. Another reason for the high rate of negative appendectomy despite the use of the LAPP score in Turkey may be the common occurrence of familial Mediterranean fever (FMF) in the general population(18-20). Since diffuse peritonitis occurs in FMF, the vascularity of the appendix and the wall thickness of the appendix and its meso may appear to be increased, thus mimicking appendicitis in the perioperative examination. The low Alvarado and AIR scores of the patients may also be a supporting finding.

With the current pandemic, non-operative appendicitis treatment has become increasingly preferred(21-23). Non-operative treatment can be undertaken with antibiotics, and spontaneous resolution may be observed with supportive treatment(7). Studies showing spontaneous resolution without antibiotics have obtained similar results with patient groups treated with antibiotics in uncomplicated appendicitis, although the level of evidence is low(24, 25). Patients with appendicitis who do not present to hospital and do not undergo radiological imaging are also likely to have spontaneous resolution. In Turkey, access to health services is much easier than in many other countries. According to the data of the Turkish Ministry of Health shared in Twitter account, there were 2.9 million emergency or elective outpatient clinic presentations in Turkey on December 21, 2021, which, in 30 days, would reach 90 million, the total population of the country. The patients with a negative appendectomy despite at least one LAPP score point can be explained by the admission of patients that would have spontaneous resolution to the hospital. In addition, Mock et al. reported that the rate of negative appendectomy was higher in groups with a low socioeconomic status(26). This is supported by the patient profile of Turkey and Nigde region.

When the LAPP score was compared with the Alvarado and AIR scores, a positive and significant correlation was found between them. In a validation study conducted by Gelpke et al. using the Alvarado score, the mean LAPP score was reported to be 6 in the patient group(14). In our study, both the Alvarado and AIR scores were found to be low in

patients who underwent negative appendectomy, which would have excluded the diagnosis of appendicitis. In complicated appendicitis cases, the Alvarado, AIR and LAPP scores were all found to be high, supporting the significant relationship between these scores.

Gomes et al. conducted a similar study and performed perioperative grading(27); however, they reported that although the LAPP score identified advanced infection, it was not detailed enough for non-complicated appendicitis, and therefore it was considered to be more useful in the evaluation of uncomplicated appendicitis.

The current study was conducted retrospectively, which may have resulted in incomplete information in surgical notes and patient anamnesis and epicrisis in some cases, resulting in limitations. Since the LAPP scores had not been determined based on perioperative findings, scoring was performed retrospectively by examining the operation notes. Most operations were performed with the open technique. Although this contradicts the name of the score, the diagnosis of perioperative appendicitis was made using the same parameters in open surgery. Other limitations can be considered as the small number of patients and single-center design.

CONCLUSION

The LAPP score parameters represent the systematic version of the perioperative appendix examination. Despite the LAPP score point in the perioperative examination, the pathology result not being consistent with appendicitis can be explained by conditions specific to Turkey or appendectomy being also performed in patients that would have had spontaneous resolution. The use of the LAPP score does not reduce the rate of negative appendectomy in patients with a low score, and therefore these patients should be further evaluated with clinical and laboratory findings, while surgery can be safely performed in patients with a high LAPP score. The use of the LAPP score will be beneficial in the systematization of the perioperative examination and the decision-making of the surgeon as a rational parameter. It may be useful to validate the LAPP score parameters separately and increase or decrease the scores of the parameters.

Declarations

The authors received no financial support for the research and/or authorship of this article. There is no conflict of interest.

This study was approved by the clinical research ethics committee of the Niğde Ömer Halis Demir University (Date: 23.12.2021 number: 2021/105).

REFERENCES

1. Bhangu A, Søreide K, Di Saverio S, Assarsson JH, Drake FT. Acute appendicitis: modern understanding of pathogenesis, diagnosis, and management. Lancet. 2015 Sep 26;386(10000):1278-1287.
2. Song MY, Ullah S, Yang HY, Ahmed MR, Saleh AA, Liu BR. Long-term effects of appendectomy in humans: is it the optimal management of appendicitis? Expert Rev Gastroenterol Hepatol. 2021 Jun;15(6):657-664.
3. Köhler F, Hendricks A, Kastner C, Müller S, Boerner K, Wagner JC, Lock JF, Wiegering A. Laparoscopic appendectomy versus antibiotic treatment for acute appendicitis-a systematic review. Int J Colorectal Dis. 2021 Oct;36(10):2283-2286.
4. O'Leary DP, Walsh SM, Bolger J, Baban C, Humphreys H, O'Grady S et al. A Randomized Clinical Trial Evaluating the Efficacy and Quality of Life of Antibiotic-only Treatment of Acute Uncomplicated Appendicitis: Results of the COMMA Trial. Ann Surg. 2021 Aug 1;274(2):240-247.
5. Sippola S, Haijanen J, Grönroos J, Rautio T, Nordström P, Rantanen T et al. Effect of Oral Moxifloxacin vs Intravenous Ertapenem Plus Oral Levofloxacin for Treatment of Uncomplicated Acute Appendicitis: The APPAC II Randomized Clinical Trial. JAMA. 2021 Jan 26;325(4):353-362.
6. Podda M, Gerardi C, Cillara N, Fearnhead N, Gomes CA, Birindelli A et al. Antibiotic Treatment and Appendectomy for Uncomplicated Acute Appendicitis in Adults and Children: A Systematic Review and Meta-analysis. Ann Surg. 2019 Dec;270(6):1028-1040.
7. Di Saverio S, Podda M, De Simone B, Ceresoli M, Augustin G, Gori A, et al. Diagnosis and treatment of acute appendicitis: 2020 update of the WSES Jerusalem guidelines. World J Emerg Surg. 2020 Apr 15;15(1):27.
8. Babakhanov AT, Dzhumabekov AT, Zhao AV, Kuandykov YK, Tanabayeva SB, Fakhradiyev IR et al. Impact of Appendectomy on Gut Microbiota. Surg Infect (Larchmt). 2021 Sep;22(7):651-661.
9. Vanhatalo S, Munukka E, Sippola S, Jalkanen S, Grönroos J, Marttila H et al. Prospective multicentre cohort trial on acute appendicitis and microbiota, aetiology and effects of antimicrobial treatment: study protocol for the MAPPAC (Microbiology APPendicitis ACuta) trial. BMJ Open. 2019 Sep 6;9(9):e031137. doi: 10.1136/bmjopen-2019-031137.
10. Slotboom T, Hamminga JT, Hofker HS, Heineman E, Haveman JW; Apple Study Group Appendicitis and Laparoscopic Evaluation. Intraoperative motive for performing a laparoscopic appendectomy on a postoperative histological proven normal appendix. Scand J Surg. 2014 Dec;103(4):245-8.
11. Drake FT, Mottey NE, Castelli AA, Florence MG, Johnson MG, Steele SR et al. Time-of-day and appendicitis: Impact on management and outcomes. Surgery. 2017 Feb;161(2):405-414.

12. Jeon BG. Predictive factors and outcomes of negative appendectomy. Am J Surg. 2017 Apr;213(4):731-738.
13. Hamminga JT, Hofker HS, Broens PM, Kluin PM, Heineman E, Haveman JW. Evaluation of the appendix during diagnostic laparoscopy, the laparoscopic appendicitis score: a pilot study. Surg Endosc. 2013 May;27(5):1594-600.
14. Gelpke K, Hamminga JTH, van Bastelaar JJ, de Vos B, Bodegom ME, Heineman E et al. Reducing the negative appendectomy rate with the laparoscopic appendicitis score; a multicenter prospective cohort and validation study. Int J Surg. 2020 Jul;79:257-264.
15. Niu R, Mei Z. The value of LAPP score: strengths and limitations. An Invited Commentary on "reducing the negative appendectomy rate with the laparoscopic appendicitis score: A multicenter prospective cohort and validation study". Int J Surg. 2020 Jul;79:269-270.
16. Carr NJ. The pathology of acute appendicitis. Ann Diagn Pathol. 2000 Feb;4(1):46-58.
17. Ding W, Du Z, Zhou X. Endoscopic retrograde appendicitis therapy for management of acute appendicitis. Surg Endosc. 2022 Apr;36(4):2480-2487.
18. Ozen S, Karaaslan Y, Ozdemir O, Saatci U, Bakkaloglu A, Koroglu E et al. Prevalence of juvenile chronic arthritis and familial Mediterranean fever in Turkey: a field study. J Rheumatol. 1998 Dec;25(12):2445-9.
19. Ozdogan H, Ugurlu S, Hatemi G, Ozgun E, Can G, Ozgon G et al. Is Familial Mediterranean Fever a clinical diagnosis? Results of a field survey. Pediatr Rheumatol 13, P126 (2015). https://doi.org/10.1186/1546-0096-13-S1-P126 20.
20. Onen F, Sumer H, Turkay S, Akyurek O, Tunca M, Ozdogan H. Increased frequency of familial Mediterranean fever in Central Anatolia, Turkey. Clin Exp Rheumatol. 2004 Jul-Aug;22(4 Suppl 34):S31-3.
21. Barie PS. Non-Operative Management of Appendicitis: Evolution, not Revolution. Surg Infect (Larchmt). 2021 Dec;22(10):991-1003.
22. Patel VK, Ye K, In H, Scheinfeld MH. Non-operative Management for Acute Appendicitis During the COVID-19 Pandemic Does Not Increase the Rate of Complications. J Gastrointest Surg. 2021 May;25(5):1327-1329. doi: 10.1007/s11605-020-04844-8. Epub 2020 Nov 2. PMID: 33140319; PMCID: PMC7605731.
23. Emile SH, Hamid HKS, Khan SM, Davis GN. Rate of Application and Outcome of Non-operative Management of Acute Appendicitis in the Setting of COVID-19: Systematic Review and Meta-analysis. J Gastrointest Surg. 2021 Jul;25(7):1905-1915.
24. Park HC, Kim MJ, Lee BH. Randomized clinical trial of antibiotic therapy for uncomplicated appendicitis. Br J Surg. 2017 Dec;104(13):1785-1790.
25. Sippola S, Grönroos J, Sallinen V, Rautio T, Nordström P, Rantanen T, et al. A randomised placebo-controlled double-blind multicentre trial comparing antibiotic therapy with placebo in the treatment of uncomplicated acute appendicitis: APPAC III trial study protocol. BMJ Open. 2018 Nov 3;8(11):e023623.
26. Mock K, Lu Y, Friedlander S, Kim DY, Lee SL. Misdiagnosing adult appendicitis: clinical, cost, and socioeconomic implications of negative appendectomy. Am J Surg. 2016 Dec;212(6):1076-1082.
27. Gomes CA, Nunes TA, Fonseca Chebli JM, Junior CS, Gomes CC. Laparoscopy grading system of acute appendicitis: new insight for future trials. Surg Laparosc Endosc Percutan Tech. 2012 Oct;22(5):463-6.

Archives of Current Medical Research
Arch Curr Med Res 2022;3(2):154-157

Received: 03 January 2022
Revised: 12 January 2022
Acccepted: 18 January 2022
DOI: 10.47482/acmr.2022.61

CASE REPORT

A rare chest wall tumor: A case report of angiomatosis

Mehmet Çetin[1], İlteriş Türk[2], Yetkin Ağaçkıran[3], Ebru Sayılır Güven[2], Pınar Bıçakçıoğlu[2],

1 Ömer Halisdemir University Training and Research Hospital, Department of Thoracic Surgery, Niğde, Turkey
2 Ankara Atatürk Sanatoryum Training and Research Hospital, Department of Thoracic Surgery, Ankara, Turkey
3 Ankara Atatürk Sanatoryum Training and Research Hospital, Department of Pathology, Ankara, Turkey

Abstract

Angiomatosis, a pathology that may occur in any soft tissue, is typically characterized by vascular proliferation and invasion of adjacent tissues. Although it is described as a benign lesion, it can be as challenging as malignancy in treatment and follow-up due to its vascular rich structure and frequent recurrence. Here, we present a rare case of chest wall angiomatosis in a 46-year-old female patient treated with surgical excision.

Keywords: Angiomatosis, Mediastinum, Thoracic Wall.

Cite this article as: *Çetin M, Türk İ, Ağaçkıran Y, Sayılır Güven E, Bıçakçıoğlu P. A Rare Chest Wall Tumor: A Case Report of Angiomatosis. Arch Curr Med Res. 2022;3(2):154-157*

Corresponding Author:
Mehmet Çetin, Omer Halisdemir University Training and Research Hospital, Department of Thoracic Surgery, Niğde, Turkey
E-mail: mehmetcetn@gmail.com

INTRODUCTION

Angiomatosis, a benign vascular pathology commonly seen in the first two decades of life, can involve any soft tissue, such as breast, bone, and retina (1). It is a very rare type of tumor and, although benign, recurrence rate after surgery is reported at approximately 90%. The standard surgical approach is resection with wide margins, which requires diligent preoperative planning (2). Here, we report an angiomatosis case treated with complete chest wall resection.

CASE REPORT

A 46-year-old female patient with abdominal pain for one month had a chest X-ray in another health facility (Figure 1A). He was referred to our clinic after abdominal computed tomography (CT) scan revealed vascular branches extending from the aorta to the tumor suggesting sequestration (Figure 1B). Moreover, chest-wall soft-tissue density in the left paravertebral region in the cross-sectional area was observed on thorax CT (Figure 1C).On the CT scan, vascular branches extending from the aorta to the tumor were observed,suggesting sequestration (Figure 1C). A positron emission tomography (PET) scanshowed a 70X27 mm tumor on the left lateral of the T9-T11 vertebrae, extending from the 10th and 11th intercostal spaces to the paraspinal musculature with a maximum standart uptake value of 4.02.Transthoracic fine-needle aspiration biopsy yielded a fibroadipose tissue sample containing very few spindle cells, which was non-diagnostic.Due to its rich vascular structure, it was consulted for preoperative embolization, but the procedure was not considered appropriate by interventional radiology. Then after forced expiratory volume in 1 secondvalue (1.93, 89%) in pulmonary function test was deemed suitable for surgical resection, an exploratory left thoracotomy uncovered a tumor,extending from the paravertebral region to the ribs,that was highly hemorrhagic even in frozen sectionbiopsy. However, the frozen section examination did not establish whether the tumor was benign or malignant. Therefore, the decision was made to proceed with chest wall resection. We observed many collateral branches from the aorta to the tumor and ligated these during the excision. The 9th, 10th, and 11th ribs were disarticulated posteriorly and they were resected anteriorly at a distance of 4 cm from the tumor, followed byen bloc resection of the tumor (Figure 2). Afterwards chest wall reconstruction using a Gore-Tex patch was performed since the soft tissue is also resected together with the ribs, in order to avoid chest wall instability. On pathological examination, the tumor was invading the surrounding fibroadipose tissue without evident mitosis or necrosiswas positive for CD31 and CD34. No invasion of the ribs wasdetected. In light of these findings, we confirmed the diagnosis of angiomatosis (Figure 3). The patient, who had no postoperative chemotherapy (CT) and radiotherapy (RT), is currently in the 3rd year of follow-up without recurrence.

Figure 1. A. Preoperative chest X-ray, B. Abdominal CT Scan (Vascular structures originating from the aorta), C. Abdominal CT Scan (Soft tissue invasion), D. Postoperative chest X-ray

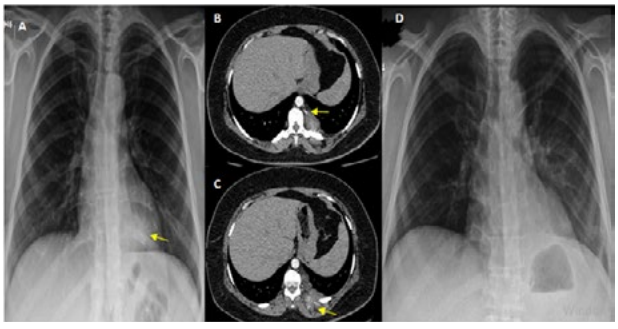
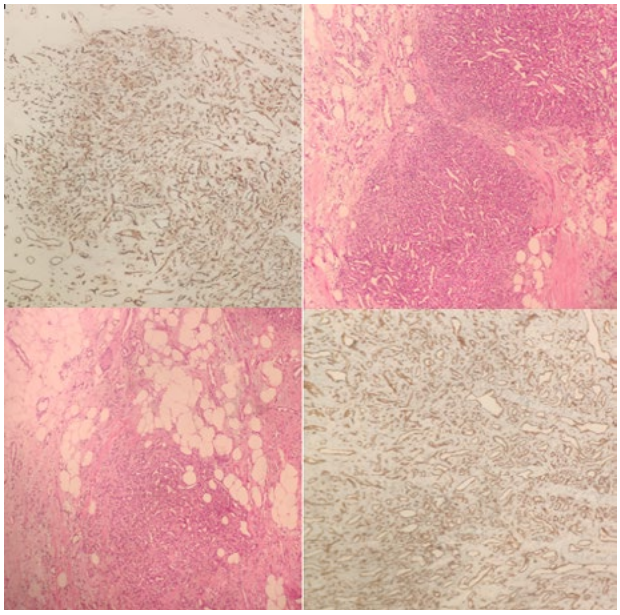


Figure 2. Macroscopic view of the tumor

Figure 3. Microscopic view of the tumor



DISCUSSION

Angiomatosis is a benign tumor histologically characterized by vascular proliferation and invasion of adjacent fibroadipose tissue. The first reported case of angiomatosis in 1927 was retinal, and the disease was later shown to involve almost any soft tissue. These scarce types of tumors most commonly occur in the lower extremity, followed by the chest wall, abdomen, and upper extremity (4).

The main limitation in the preoperative diagnosis of angiomatosis lies in the fact that the pathology includes extensive fibroadipose tissue and dilated vascular structures, as well as necrosis. Typically, percutaneous biopsy does not yield a precise diagnosis, as seen in our case and others in the literature (1,5). When the studies in the literature were examined, it was seen that the biopsy result was not diagnostic and was not associated with malignancy in two separate thoracic wall case reports (3,4). Due to the presence of abnormal vascular structures and the likelihood of hemorrhage in angiomatosis, an imaging-guided biopsy is particularly recommended for large tumors that appear irresectable. The definitive diagnosis is based on evident vascular proliferation in gross pathology specimens (5). In our case, neither the frozen section examination nor preoperative interventions proved diagnostic.

Although angiomatosis is defined as a vascular proliferation with asymptomatic bone destruction,we observed no bone tissue invasion in our casedespite the presence of bone tissues within the tumor region. The standard treatment in angiomatosis is wide surgical resection. Due to fibroadipose tissue invasion, which was also present in our case, high recurrence rates are reported for the tumor, necessitating wide surgical margins (6). Besides, preoperative embolization can reduce the tumor size before surgery since the tumor is vascular and may involve considerable proliferation. We also believe that preoperative tumor embolization could contributeto facilitate the operation in our case since we observed many collateral branches originating from the aorta, and the tumor was hemorrhagic. However, radiotherapy and chemotherapy are among the treatment approaches in cases unsuitable for surgery (7).

To conclude, angiomatosis is a scarce type of tumor that cannot be diagnosed preoperatively and,albeit benign, is frequently recurrent and invasive. Therefore, surgical en bloc resection and close follow-up can be recommended as the standard treatment approach.

Declarations

The authors received no financial support for the research and/or authorship of this article. There is no conflict of interest.

Ethical Committee approval was not required. Informed consent was obtained from all participants.

REFERENCES

1. Rao VK, Weiss SW. Angiomatosis of soft tissue. An analysis of the histologic features and clinical outcome in 51 cases. Am J Surg Pathol. 1992 Aug;16(8):764-71.
2. Pak MG, Choi PJ, Choi WS, Kang EJ, Roh MS. Mediastinal angiomatosis: a rare case report. J Thorac Dis. 2015 Dec;7(12):E662-6.
3. Garza-Serna U, Mohan N, Miller CR, Qiu S, Okereke IC. Chest wall resection for a giant angiomatosis lesion: A case report. Int J Surg Case Rep. 2018;51:117-119.
4. Stojsic J, Markovic J, Subotic D, Kontic M, Jovanovic J. Angiomatosis of the thoracic wall. J Orthop Sci. 2013 Jan;18(1):186-9.
5. Howat AJ, Campbell PE. Angiomatosis: a vascular malformation of infancy and childhood. Report of 17 cases. Pathology. 1987 Oct;19(4):377-82.

6. Đaković Bacalja I, Nikolić I, Pavić P, Krpina K, Diklić D, Šola I, Hudorovic N, Bacalja J. Solitary mediastinal angiomatosis: report of two cases and review of the literature. Neth J Med. 2017 Dec;75(10):455-457.

7. Adam Z, Pour L, Krejcí M, Pourová E, Synek O, Zahradová L et al. Uspesná lécba angiomatózy thalidomidem a interferonem alpha. Popis peti pripadů a prehled lécby angiomatózy a proliferujícich hemangiomů [Successful treatment of angiomatosis with thalidomide and interferon alpha. A description of five cases and overview of treatment of angiomatosis and proliferating hemangiomas]. Vnitr Lek. 2010 Aug;56(8):810-23. Czech.

Archives of Current Medical Research
Arch Curr Med Res 2022;3(2):158-162

Received: 07 May 2022
Revised: 24 May 2022
Acccepted: 25 May 2022
DOI: 10.47482/acmr.2022.62

CASE REPORT

Tuberculosis mimicking Rhabdomyosarcoma Metastasis in a pediatric patient

İlteriş Türk[1], **Mehmet Çetin**[2], **Nesrin Gürçay**[3], **Neriman Sarı**[4], **Şeref Özkara**[5], **Pınar Bıçakçıoğlu**[1],

1 Ankara Atatürk Sanatoryum Training and Research Hospital, Department of Thoracic Surgery, Ankara, Turkey
2 Niğde Ömer Halisdemir University Training and Research Hospital, Department of Thoracic Surgery, Niğde, Turkey
3 Ankara Atatürk Sanatoryum Training and Research Hospital, Department of Pathology, Ankara, Turkey
4 Ankara City Hospital, Department of Pediatric Hematology Oncology, Ankara, Turkey
5 Ankara Atatürk Sanatoryum Training and Research Hospital, Department of Chest Diseases and Tuberculosis, Ankara, Turkey

Abstract

In childhood sarcomas, the lung is one of the most common organs where metastasis occurs. Immunosuppression caused by antineoplastic treatments for primary cancer may facilitate the reactivation of latent tuberculosis (TB) infection, which can mimic cancer metastasis. The thought of lung metastasis is an important entity that changes the follow-up and treatment approach. Evaluating TB in initial differential diagnosis can prevent unjustifiable chemoradiotherapy and surgery. In this case report, we submit a 2-years-old boy under follow up of alveolar type rhabdomyosarcoma in masseter muscle also received chemoradiotherapy with a pre-diagnosis of lung metastasis patient who underwent surgical resection when the treatment didn't produce any benefit and all of the 34 excised nodules from the right lung were reported as "granulomatous inflammation suggestive of TB."

Keywords: Chemotherapy, Pulmonary Metastasectomy, Tuberculosis

Cite this article as: *Türk İ, Çetin M, Gürçay N, Sarı N, Özkara Ş, Bıçakçıoğlu P. Tuberculosis mimicking rhabdomyosarcoma metastasis in a pediatric patient. Arch Curr Med Res. 2022;3(2):158-162*

Corresponding Author:
İlteriş Türk, Atatürk Sanatoryum Training and Research Hospital, Department of Thoracic Surgery, Ankara, Turkey
E-mail: turkilteris@gmail.com

INTRODUCTION

Rhabdomyosarcoma is the most widespread soft tissue sarcoma and the fourth most common solid tumor in childhood (1,2). The survival was noticed 64,5% in the Yang's report (3). Treatment is often a multimodal approach, including surgery, chemotherapy, and radiotherapy (2). Metastasis is seen in 16% of the patients, and almost one-third of them occurs in the lung (1).

In children, intrathoracic tuberculosis manifests as a primary Ghon focus, Ranke complex, lymph node disease, pleural and pericardial involvement, miliary disease, and adult-type disease forms. Multiple primary foci and diffuse parenchymal involvement are uncommon (4). Because these rare conditions may incline the clinicians to the unneedful chemotherapy and surgery with the indications mimicking malignancy metastasis, TB should be considered in the differential diagnosis (5).

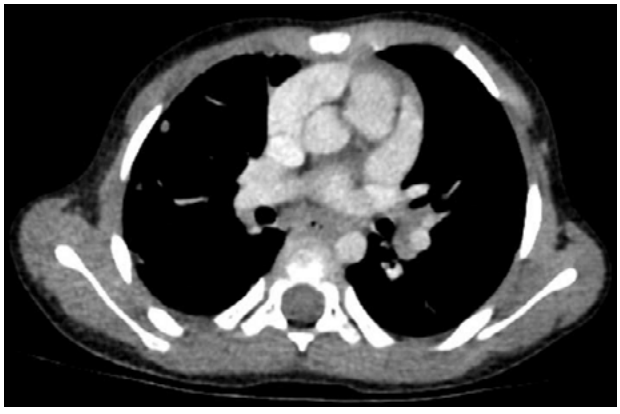
In light of the literature, we present an atypical case in terms of TB and primarily considered lung metastasis in an asymptomatic patient with peripheral and widespread nodules (6).

CASE REPORT

A 2-year-old boy was diagnosed with "alveolar type rhabdomyosarcoma" after an incisional biopsy of the masseter muscle was performed at the hospital. He received treatment for a sudden swelling in the cheek. After the diagnosis, the mass was totally excised, and 11 cures of chemotherapy and radiotherapy were implemented. On follow-up after completing multimodal treatment, which took about one year, thorax computed tomography (CT) showed bilateral, multiple, sub-centimetric, and subsolid nodules (Figure 1,2). When the unresponsiveness occurred to 4-week antibiotherapy for the nodules that were evaluated as pneumonia, long-term medication for fungal infection was handled. Under this treatment, nodules progressed, and the patient's condition deteriorated. The pediatric oncology council referred the patient with the pre-diagnosis of "lung metastasis of rhabdomyosarcoma" for pulmonary metastasectomy because the primary tumor was under control, and there were no other suspicious factors foci for metastasis in the body scan.

Figure 1. Lung nodules in mediastinum sections on thorax CT

Figure 2. Lung nodules in parenchyma sections on thorax CT



Following a preoperative evaluation, a muscle-sparing mini-thoracotomy in the lateral decubitus position was performed under general anesthesia. Following the surgical principles, 22 nodules from the lower lobe, eight from the middle lobe, and four from the upper lobe (34 in total) were found and excised with precision cautery excision (Perelman Technique). The intraoperative frozen examination was not implemented for nodules, for why returning for any nodule with a subsolid character as benign couldn't exclude the possibility of malignancy of the others. The operation was brought to completion when any additional nodules were detected after the palpation of the other surgeon. The patient was discharged following lung expansion without any complication on the postoperative 3rd day. During the postoperative pathology examination, all excised nodules were diagnosed with "Necrotizing granulomatous inflammation suggesting TB," and no malignant cells were found (Figure 3,4,5).

No specific microorganisms and bacilli were observed in the tissues stained with EZN and PAS. Thus, the patient was referred to the tuberculosis clinic with the reversal of left lung exploration for multiple nodules. In retrograde interrogation, the sputum ATB was negative, and the patient didn't have any history of contiguity with anyone diagnosed with tuberculosis. With the diagnosis of bacillus negative TB, he was given 150 mg isoniazid, 200 mg rifampin, and 500 mg pyrazinamide for two months under the supervision of healthcare professionals, followed by four months of isoniazid and rifampin maintenance therapy. At the end of the TB chemotherapy, the TB specialists requested a repetition of surgical intervention because of the progression of the nodules in actual CT. Still, we proffered follow-up for a while with the thought of the late radiological response. Six months after the end of the therapy, radiological response occurred as supposed, and the nodules dissolved completely. In the one-year follow-up, the patient is in complete remission and gained 12% of the weight.

Figure 3. H&E, X40. Assemblages of granulomas organized as nodular structures in the lung parenchyma

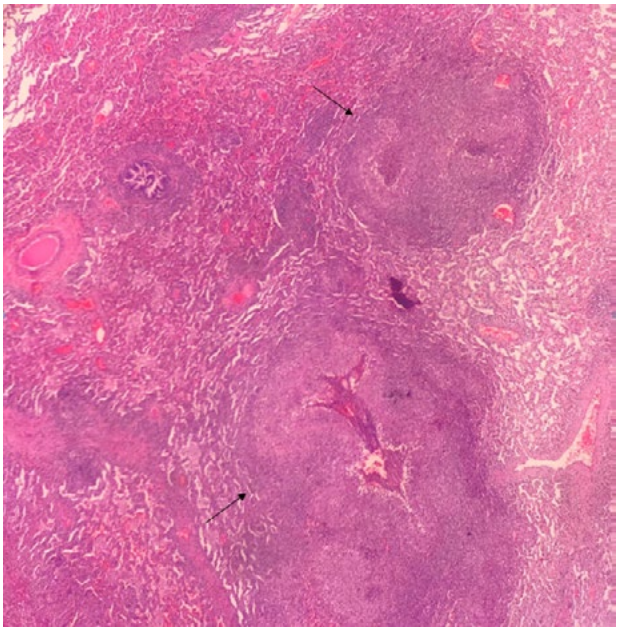


Figure 4.H&E, X200. Granuloma structure consisting of epithelioid histiocytes and lymphocytes

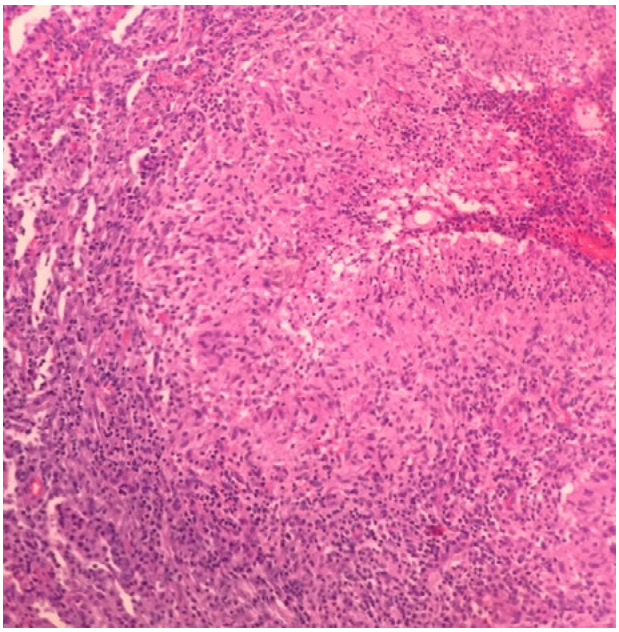
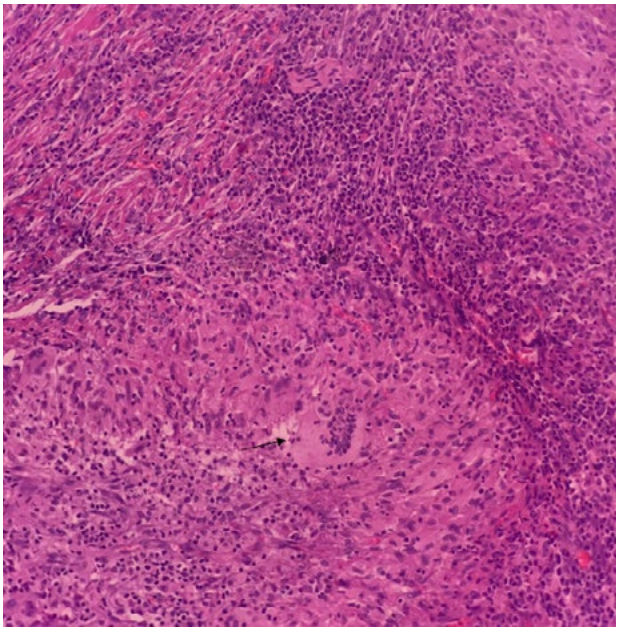


Figure 5.H&E, X200. Multinuclear giant cell in granuloma structure



DISCUSSION

In pediatric solid tumors, surgery has a substantial role in both diagnosis and multimodal treatment of lung metastasis. Pulmonary metastasectomy contributes to survival if the primary tumor is under control and there is no organ metastasis (7). There isn't any contraindication even if there are umpteen metastases and the patient is in childhood. Primary tumor type, complete resection of metastatic nodules, and disease-free survival rate are good prognostic indicators (8). In our case, surgery was performed for both diagnosis and cure for parenchymal nodules detected in the follow up after chemotherapy and primarily assessed as metastasis

TB can occur either attending to the malignancy or due to the immunosuppression resulting from antineoplastic therapy (5, 9). Patients initially taken chemotherapy and then diagnosed with TB with the lymph node biopsy following the regression of their condition are noticed in the literature. Because there is no TB-specific imaging modality, microbiological and histopathological examinations can be used to diagnose TB (5). In our case, preoperative research on TB wasn't performed because there was no typical imaging evidence as lymph nodes with a pathological increase in size, primary Ghon focus, or cavitation.

The incidence of TB in children with malignancy is 22 times higher than in the normal population. In Stefan's study, 47% of active TB infection in malignancy patients occurred in the first five months of chemotherapy and was more common in boys aged 0-4 years. Fifty-seven children were included in the study, and while there wasn't any case that evolved after rhabdomyosarcoma, mainly TB infection was detected in the children with hematological malignancies (10). Even if our case parallels this study in terms of age group, dissimilarities were the primary malignancy (rhabdomyosarcoma) and time to arise (1 year) in our case.

Dobler's meta-analysis, including Stefan's study, also noticed that the most often diagnosis of TB was defined in hematological or solid malignancies in children. According to this meta-analysis, the most increased risk of TB was at the time of diagnosis, and with time, it reduced with the strict follow-up. Nevertheless, whether tuberculosis causes cancer or cancer tuberculosis dilemma has not been resolved (9). Besides, TB mortality occurring after antineoplastic therapy was defined as higher in an old study, and additionally, they submitted that mortality directly due to TB was 17% (11).

TB screening, anamnesis, and physical examination, tuberculin skin test in the initial evaluation and on the 6th month of the malignancy treatment, a repeated tuberculin skin test with clinical and radiological assessment are suggested to decrease the risk of TB in the children with malignancy (7,9). In the meta-analysis of Dobler mentioned earlier, latent TB infection screening is also proffered for hematologic and solid malignancies with the ultimate risk of TB. Protective isoniazid therapy is being carried out for the patient, tuberculin skin test and interferon-gamma releasing assay positive depending to the TB Diagnosis and Treatment Guidelines in our country (12).

Children in Stefan's sample received an average of 5,6 months of tuberculosis treatment (10). In Cruz's study, five of 6 children infected with TB after bone marrow transplantation due to malignancy received a nine-month anti-TB therapy containing isoniazid, rifampin, ethambutol, and pyrazinamide Cruz's study (13). However, there is a lack of consensus about the anti-TB treatment in the literature, and the patient-based approach takes attention. We provide treatment to our patient for six months depending on the TB Guide in our country, and the patient has taken to follow up.

In conclusion, the surgical approach to the pulmonary metastasis of sarcomas in childhood significantly benefits survival. Yet, infectious diseases have to be kept in mind while assessing new findings on follow-up for these patients. Misdiagnosis based on delayed radiological response and sole oncological perspective may result in unnecessary medical treatment, chemotherapy, and surgical intervention. With patience, these patients should be considered in a multidisciplinary approach and follow-up response to the treatment.

Declarations

The authors received no financial support for the research and/or authorship of this article. There is no conflict of interest.

Ethical Committee approval was not required. Informed consent was obtained from all participants.

REFERENCES

1. Weiss AR, Lyden ER, Anderson JR, Hawkins DS, Spunt SL, Walterhouse DO et al. Histologic and clinical characteristics can guide staging evaluations for children and adolescents with rhabdomyosarcoma: a report from the Children's Oncology Group Soft Tissue Sarcoma Committee. J Clin Oncol. 2013 Sep 10;31(26):3226-32.
2. Hiniker SM, Donaldson SS. Recent advances in understanding and managing rhabdomyosarcoma. F1000Prime Rep. 2015 May 12;7:59.
3. Yang L, Takimoto T, Fujimoto J. Prognostic model for predicting overall survival in children and adolescents with rhabdomyosarcoma. BMC Cancer. 2014 Sep 5;14:654.
4. Marais BJ, Schaaf HS. Tuberculosis in children. Cold Spring Harb Perspect Med. 2014 Jul 18;4(9):a017855.
5. Sümbül AT, Sezer A, Abali H, Gültepe B, Koçer E, Reyhan M et al. An old enemy not to be forgotten during PET CT scanning of cancer patients: tuberculosis. Contemp Oncol (Pozn). 2016;20(2):188-91.
6. Rodeberg D, Arndt C, Breneman J, Lyden E, Donaldson S, Paidas C et al. Characteristics and outcomes of rhabdomyosarcoma patients with isolated lung metastases from IRS-IV. J Pediatr Surg. 2005 Jan;40(1):256-62.
7. Scanagatta P, Girelli L. Metastasectomy in pediatric patients: indications, technical tips and outcomes. J Thorac Dis. 2017 Oct;9(Suppl 12):S1299-S1304.
8. Kayton ML. Pulmonary metastasectomy in pediatric patients. Thoracic Surgery Clinics. 2006;16(2):167–83.
9. Dobler CC, Cheung K, Nguyen J, Martin A. Risk of tuberculosis in patients with solid cancers and haematological malignancies: a systematic review and meta-analysis. Eur Respir J. 2017 Aug 24;50(2):1700157.
10. Stefan DC, Kruis AL, Schaaf HS, Wessels G. Tuberculosis in oncology patients. Ann Trop Paediatr. 2008 Jun;28(2):111-6.
11. Kaplan MH, Armstrong D, Rosen P. Tuberculosis complicating neoplastic disease. A review of 201 cases. Cancer. 1974 Mar;33(3):850-8.
12. Tuberculosis Diagnosis and Treatment Guideline, Ministry of Health, Publication Number:1129, Ankara, May 2019.
13. Cruz AT, Airewele G, Starke JR. Tuberculosis in pediatric oncology and bone marrow transplantation patients. Pediatr Blood Cancer. 2014 Aug;61(8):1484-5.

ARCHIVES OF
CURRENT MEDICAL
RESEARCH

www.acmronline.org

https://dergipark.org.tr/tr/pub/acmr