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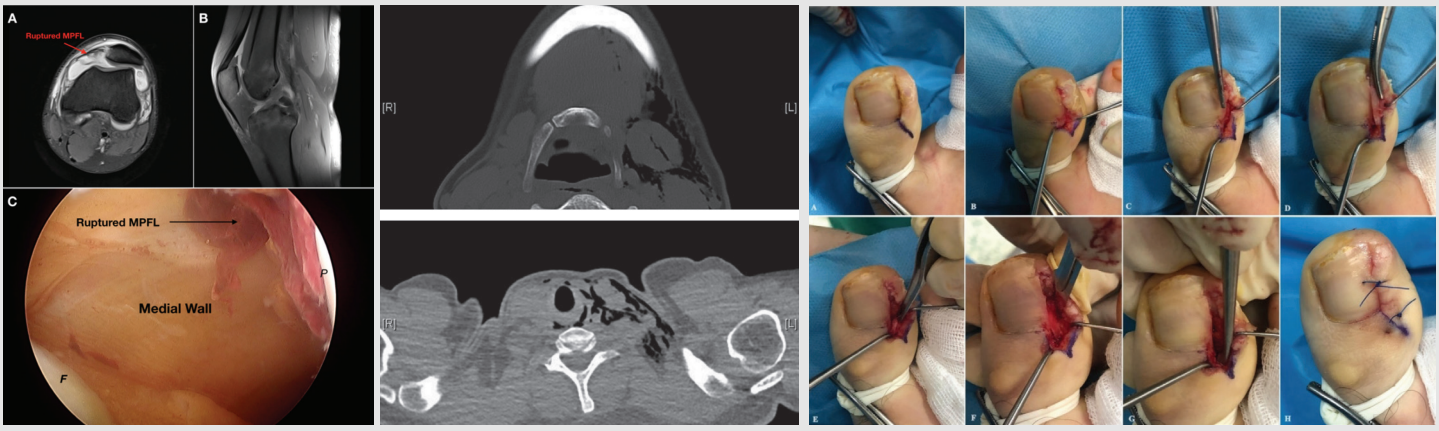

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Case Report	1000	200	15	No tables	10 or total of 20 images
Letter to the Editor	500	No abstract	5	No tables	No media

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Books with a Single Author: Sweetman SC. Martindale the Complete Drug Reference. 34th ed. London: Pharmaceutical Press;2005.

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Scientific or Technical Report: Cusick M, Chew EY, Hoogwerf B, Agrón E, Wu L, Lindley A, et al. Early Treatment Diabetic Retinopathy Study Research Group. Risk factors for renal replacement therapy in the Early Treatment Diabetic Retinopathy Study (ETDRS), Early Treatment Diabetic Retinopathy Study Kidney Int: 2004. Report No: 26.

Thesis: Yılmaz B. Ankara Üniversitesindeki Öğrencilerin Beslenme Durumları, Fiziksel Aktiviteleri ve Beden Kitle İndeksleri Kan Lipidleri Arasındaki Ilişkiler. H.Ü. Sağlık Bilimleri Enstitüsü, Doktora Tezi. 2007.

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Address: Department of Nuclear Medicine, University of Health Sciences Turkey, Prof. Dr. Cemil Taşcıoğlu City Hospital, İstanbul, Turkey

Phone: +90 212 314 63 24

E-mail: tozulker@gmail.com

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REVIEW

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A Vital Part of Creating a Safe and Healthy Society: Adolescent Friendly Health Services

Hüseyin Dağ[1,2], Hasan Dursun[1]

[1]*University of Health Sciences Turkey, Prof. Dr. Cemil Taşcıoğlu City Hospital, Clinic of Pediatrics, İstanbul, Turkey*
[2]*İstanbul University, Institute of Child Health, Adolesance Health, Department of Pediatric Basic Sciences, İstanbul, Turkey*

Abstract

Adolescence, which the World Health Organization defines as the period between the ages of 10 and 19, is characterized by several physiological, psychological, and emotional changes. Adolescents might experience some specific issues during this time. Supporting adolescents during this time helps them deal with these issues more successfully. Adolescents may continue to lack strong problem-solving skills since they cannot locate appropriate health facilities despite some of the health issues they encounter on a global scale. Thus, the idea of "adolescent friendly health services" becomes more significant. With the aid of adolescent health services, we hope to accomplish our three key objectives. With the help of these services, investments are made in today's teenagers, tomorrow's adults, and consequently the future generations. Adolescent-friendly healthcare services should be regarded as acceptable, equitable, accessible, appropriate, and effective. However, to anticipate mortality and morbidity risks, psychosocial evaluation, a crucial part of adolescent-friendly health services, must be carried out using the acronym home, education/employment, eating, activities, drugs, sexuality, suicidal ideation and safety.

Keywords: Adolescent friendly health services, adolescent, HEEADSSS, psychosocial assessment

INTRODUCTION

Adolescence is a transitional stage that encompasses the transition from childhood to adulthood. The World Health Organization (WHO) specifies this age range as 10 to 19. The preparation for maturity happens throughout this time on a physical, emotional, and psychological level. As a result, these periods have their own issues. This period is also defined as the storm and stress period (1,2).

Over 3 billion of the 7.2 billion people around the world, or 42% of the total population, are under the age of 25. Between the ages of 10 and 19, 1.2 billion of these young individuals are adolescents (3). The Turkish Statistical Institute reports that children make up 27.5% of Turkey's population, and young people make up 15.1% of the country's population (4). Adolescents make up approximately 1 in 6 of the world's population. Among the major causes of death for teenagers are car accidents, suicide, STDs, and maternity issues. Disability-adjusted life years (DALYs), sometimes referred to as the reduction in healthy life years lost to illness, disability, and early death, dropped by 17% globally but only by approximately 8% among teenagers. Although iron deficiency and traffic accidents are the main causes of DALYs in our country, depression and anxiety are also among the most frequent causes (5). In China and around the world, more research on adolescents is needed in this area.

Although they require health services, adolescents with several issues may be slightly cautious when receiving them. They believe that the healthcare options presently available are insufficient for them. It has been discovered that adolescents receive care considerably more readily when health services are set up with adolescent perspectives and needs in mind (6).

Address for Correspondence: Hüseyin Dağ, University of Health Sciences Turkey, Prof. Dr. Cemil Taşcıoğlu City Hospital, Clinic of Pediatrics; İstanbul University, Institute of Child Health, Adolesance Health, Department of Pediatric Basic Sciences, İstanbul, Turkey
Phone: +90 553 393 34 98 **E-mail:** huseyindag2003@gmail.com **ORCID ID:** orcid.org/0000-0001-7596-7687

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Adolescent friendly health services (AFHS) were created as a result of this circumstance.

Features and Importance of AFHS

AFHS are a concept and an endeavor to improve health practices to better meet the needs of young people, according to the World Health Organization. The World Health for Adolescents report, released in 2014, demonstrated that without parallel expenditures in adolescent health, significant gains from investments in mother and child health programs are at risk of being lost. According to the most recent data, approximately 5,000 teenagers pass away every day from conditions that can usually be avoided. Teenagers should therefore unwaveringly and consistently be given attention. The sustainable development targets for the period of 2016 to 2030 are centered on investments in adolescents. It is well established that several important risk factors for future adult diseases start during youth. As a result, investing in adolescent health helps current and future generations of adults as well as adolescents (7,8).

A consensus was reached in Geneva in 2002, and it defined adolescent-friendly health services. Countries are free to modify this as they see fit. These services should be accessible, equitable, acceptable, appropriate, and effective (9-16).

Accessible: Adolescent-friendly clinics should be built where young people can go without feeling uncomfortable. It should not be near any locations where teenagers would be frightened, including delivery rooms. Centers for integrated counseling and therapy should coexist. The duration of the workday has to be appropriate. Waiting periods need to be reduced.

Equitable: All adolescents in need should receive assistance. These services should be provided without discrimination against immigrants, the homeless, homeless children, individuals of different sexual orientations, people with chronic illnesses, and people with disabilities. It is vital to reevaluate health inequality indicators.

Acceptable: Healthcare practitioners should meet the needs of young patients. Confidentiality and respect are the two key criteria. It is the fundamental tenet of both professional ethics and human rights legislation. Expectations should be taken into account when creating guidelines.

Appropriate: Harmful practices must be avoided, and necessary attention should be given. Teenagers should have waiting rooms prepared with age-appropriate banners and posters. Additionally, adolescents should be included in choosing the times for check-ups and examinations.

Effective: Care services should include stimulating, preventive, and healing components. Adolescent-related concerns should be approached on all fronts. A multidisciplinary team should offer appropriate consultation and assistance. Accurately rendered services must be offered. Adolescents' opinions should be sought. The locations where these services can be offered are crucial factors. For these services, hospitals on their own are insufficient. Every location where teenagers can go should be viewed as a potential chance to offer services. The locations where AFHS can be offered are summarized in Table 1.

AFHS must offer the proper protocols and have medical personnel who are educated in this area. Adolescent-friendly health policies are required to provide these services. Without the necessary legal support, sustainability cannot be achieved by healthcare practitioners alone. However, in addition to sound health policy, non-governmental group help is crucial. For the fundamental aims of adolescent health, many elements must cooperate. The departments of adolescent health at Hacettepe University and Istanbul University have PhD programs in place to train medical professionals who will provide AFHS in our nation. They are significant although there are not enough skilled specialists in the field of adolescent health. The facilities that will offer this service need to play a therapeutic role as well as one in preserving and enhancing the adolescent's health. Unfortunately, we were unable to locate any research on whether the facilities in our nation are adolescent-friendly in the literature. AFHS are not being provided at the level that is expected, according to research conducted in several countries where they are being implemented. Therefore, it is crucial to prioritize adolescent-friendly health services for young people to accomplish sustainable development goals (17,18).

To meet international targets for adolescent health, investment in adolescent health is crucial. To meet its 2030 goals for adolescent health, the WHO has developed the Global Accelerated Action for the Health of Adolescents (2016-2030). This guide offers a wealth of knowledge, including the most recent statistics on the primary costs of teenage diseases and injuries, to policymakers,

Table 1. Locations where adolescent friendly health services can be offered
• Adolescent services in hospitals
• Community and family health centers
• School-based health centers
• Youth centers (information, education, health)
• Pharmacies
• Counseling services established in locations where teenagers congregate

practitioners, researchers, educators, donors, and non-governmental organizations. It signifies a paradigm shift in how we consider and prepare for adolescent health (19,20).

The WHO-coordinated guide was created with the active involvement of governments, academic institutions, non-governmental organizations, United Nations agencies, and -most importantly- adolescents. In the past, attention was drawn to STDs so that the necessary investments in adolescents could be made. While emphasizing the adolescent health approach in all policies, this guide contends that there are good enough logical grounds to focus just on adolescent health. This manual has a few fundamental sections, which are listed in Table 2.

Adolescent psychosocial assessment following fundamental methods is a crucial part of adolescent-friendly health services. Adolescents are assessed psychosocially using the HEADSSS acronym, which is outlined in Table 3. In this interview, there are certain fundamental questions that should be raised. The family can participate in the interview for the first five minutes to get to know them and observe their dynamics. The interviews lasted approximately 45 to 60 minutes. The adolescent should then be interviewed after the family has received the relevant explanations. Adolescents place a high value on privacy in regard to personal topics; as a result, secrecy should be given to the adolescent and upheld, "saved in life-threatening situations and judicial scenarios", so that the adolescent can speak freely during the interview. It is crucial that the doctors conducting this interview possess the fundamental skills for effective communication. There should be calm and two-way communication. The patients needed to be given the chance to explain themselves. Approaching the patient with respect is important. Open-ended questions should be used when taking a history. They can be asked questions such as, "Can you tell me a little about your home life?" "Who do you live with?" and "Can you tell me about your friends?" Using the abbreviation HEADSSS, the questions should be put in sequence from broad to specific. However, it would be best to save some inquiries for last because we believe they will make the adolescent feel quite uncomfortable. More precise inquiries are simple to make once the crucial connection of trust has been built. If we first build a trusting relationship, the patient will be more likely to disclose any hidden agendas they may have (21-30). The infant and child follow-up protocols of the Turkish public health institution were modified as "infant, child, and adolescent follow-up protocols" in our nation with the awareness that adolescent health is the most crucial step of sustainable development on a worldwide scale (30). A psychosocial assessment using the HEADSSS at least three times during adolescence is one of these follow-up strategies. Although this is a significant breakthrough, it is still problematic in practice to give teenagers a 45-60 minute psychosocial evaluation. The inclusion of this issue in the health

Table 2. Global accelerated action for the health of adolescents
• Understanding what matters to adolescents and why it pays off, in the long run, to invest in them
• Understanding adolescent health characteristics globally and locally
• Knowing what works from important interventions
• Examining the health characteristics of adolescents in various nations and creating priorities accordingly
• The significance of developing and carrying out national initiatives
• The significance of programs for monitoring and assessing adolescent health

Table 3. "HEEADSSS" psychosocial assessment
• **Home environment**: The home and family settings are often sources of issues for adolescents. Because of this, a thorough investigation into their environment should be conducted.
• **Education/employment:** After their homes, schools are typically where adolescents spend the second most time. Performance at work or in school is a parameter that must be assessed because it provides crucial hints.
• **Eating disorders:** Eating disorders are a problem that is increasingly prevalent among young people today. In particular, adolescent-specific illnesses including obesity, anorexia nervosa, and bulimia nervosa should be examined, and dietary practices should be thoroughly questioned.
• **Activities:** Adolescent people's social activities change rapidly over time. Learning about young people's activities during this time of change and offering them advice can help them improve their social interactions as well as their physical and mental health.
• **Drugs:** Substance abuse is a serious problem among adolescents, and it needs to be properly investigated. Cigarettes are the first thing to be questioned since they are a transitory substance.
• **Sexuality**: For adolescents, discussing issues connected to sexuality, sexual behavior, and sexual life with a doctor can be particularly challenging. Counseling about this issue is a crucial component of preventative medicine. When posing sexuality-related issues to adolescents, it is important to take into account their pubertal stage.
• **Suicide/depression:** It is well-known that roughly half of adult mental problems start during adolescence. It is crucial to do a psychological evaluation of the youth and to offer the required counseling, psychological, social work, and psychiatric treatments.
• **Safety:** Risky activities are on the rise, particularly in middle adolescence. It is well known that accidents account for a significant share of adolescent mortality. Reducing adolescent mortality may be achieved by identifying hazards and offering to counsel.

Table 4. Some fundamental suggestions for promoting adolescent health in our country
• Establishment of suitable healthcare facilities with adolescent-friendly practices under the purview of these policies, training of adolescent-friendly healthcare professionals who will serve in these facilities, and the adoption of policies for adolescent friendly health services (AFHS) throughout the nation in coordination with current national and international guidelines
• Ensuring that adolescents are included in decisions on how to deliver health care to them
• The introduction of AFHS in all medical facilities
• Establishing adolescent-friendly teams in various institutions, such as youth centers, hospitals, and colleges
• Providing educational opportunities in every setting where teenagers congregate (schools, workplaces, prisons)
• Increasing funding for adolescent health services in the national budget, while also placing a high priority on both curative and preventive health care.
• Developing adolescent health literacy and promoting family participation during these pieces of training
• Organizing appropriate training modules and courses across the country and updating these pieces of training with relevant feedback
• Establishing doctoral and minor programs in adolescent health to educate the specialists in adolescent health that our nation needs

practice communique and the resulting establishment of a legal basis will be a significant step in preserving and enhancing teenage health.

Some risk factors associated with adolescents can be discovered using the psychosocial assessment outlined in Table 3, and an opportunity to offer required counseling and preventative health services is also captured. Adolescents can easily access standard pediatric outpatient clinics and basic healthcare services through our health system. Even if these services are crucial, they might not be enough in actuality. Because of this, it is critical to offer these treatments while promoting "AFHS". The advice provided in Table 4 below is crucial to achieve this.

CONCLUSION

Therefore, without adolescent health services, it will be impossible to achieve the 2030 sustainable development goals set forth by the WHO and to create a healthy society concurrently. For the triple advantage (adolescents, adults, future generations) to be realized, these services must be properly provided, supported by child-friendly health policies and current guidelines, and made available across the nation.

Ethics

Peer-review: Internally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: H.D., Ha.D., Concept: H.D., Ha.D., Design: H.D., Ha.D., Data Collection or Processing: H.D., Analysis or Interpretation: H.D., Ha.D., Literature Search: H.D., Writing: H.D., Ha.D.

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ORIGINAL ARTICLE

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The Relationship Between Vitamin D Level and Ambulatory Blood Pressure Parameters and Cardiovascular Risk Factors

Ayşe Sülü[1], Emine Altay[2], Pelin Köşger[1], Hikmet Kıztanır[1], Birsen Uçar[1]

[1]Eskişehir Osmangazi University Faculty of Medicine, Department of Pediatric Cardiology, Eskişehir, Turkey
[2]Eskişehir Osmangazi University Faculty of Medicine, Department of Pediatrics, Eskişehir, Turkey

Abstract

Objective: It has been reported that the level of vitamin D in obese children is lower and that the low level of vitamin D creates a predisposition to hypertension. In this study, it was aimed to evaluate the relationship between vitamin D level, ambulatory blood pressure parameters, and cardiovascular risk factors in obese children.

Methods: Age, gender, and anthropometric measurements, fasting serum glucose, insulin, transaminase levels, lipid profile, 25(OH) vitamin D levels, 24-hour ambulatory blood pressure monitoring data, electrocardiography and echocardiography data of the patients were retrospectively obtained from hospital records.

Results: A total of 57 patients between the ages of 8-17 years, 26 females and 31 males, were included in the study. Patients were divided into two groups based on their vitamin D levels below and above 20 ng/mL. A total of 40 patients (70%) were hypertensive, and no correlation was found between blood pressure values and serum vitamin D levels in obese children in the correlation analysis. In the group with a vitamin D level lower than 20 ng/mL, the insulin level and homeostatic model assessment for insulin resistance (HOMA-IR) score were found to be significantly higher than in the other group (p=0.01, p=0.016, respectively). Furthermore, there was a positive correlation between the HOMA-IR score and systolic blood pressure load (r=0.280, p=0.03).

Conclusion: Increased insulin resistance in obese children is associated with high blood pressure values. However, no direct relationship could be found between vitamin D levels and blood pressure profile.

Keywords: Obesity, cardiovascular risk factor, hypertension, vitamin D

INTRODUCTION

Obesity is an increasing public health problem in children. The prevalence and mortality rate of hypertension secondary to obesity, hyperinsulinemia, increased insulin resistance, type 2 diabetes mellitus, hyperlipidemia, atherosclerosis, and as a result, cardiovascular diseases also increase especially in developed and developing countries (1,2).

Many studies have demonstrated that obese children have lower vitamin D levels than the lean ones (3-9). In addition to the classical physiological function of vitamin D in the regulation of calcium and bone metabolism, it is also known that it has other functions, such as modulating the immune system, enabling anti-inflammatory activity, suppressing the renin-angiotensin system and decreasing insulin resistance (10-13). Vitamin D deficiency has been proved to contribute to increased blood pressure due to the activation of the renin angiotensin-aldosterone system, the production of reactive oxygen species, and endothelial dysfunction caused by impaired nitric oxide secretion (14). As per the data obtained from the NHANES 2001-2006 study, low serum 25(OH) vitamin D level was associated with increased waist circumference, systolic blood pressure, homeostatic model

Address for Correspondence: Ayşe Sülü, Eskişehir Osmangazi University Faculty of Medicine, Department of Pediatric Cardiology, Eskişehir, Turkey
Phone: +90 554 120 49 78 **E-mail:** suluayse@windowslive.com **ORCID ID:** orcid.org/0000-0001-6384-3935

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assessment for insulin resistance (HOMA-IR) index and low HDL-cholesterol (15).

A twenty-four-hour ambulatory blood pressure monitoring provides an earlier detection of abnormal blood pressure. It supplies an evaluation of the circadian variability of blood pressure. It provides to separate hypertension from white coat hypertension and in revealing masked hypertension observed particularly in young people (16,17). In a few studies evaluating the correlation between vitamin D level and hypertension in children, a closer correlation was found particularly between the blood pressure load at night and vitamin D level (18-20). In many studies carried out in obese children, different results have been reported with regard to the correlation between serum cholesterol levels, insulin resistance, fasting blood glucose, insulin levels and vitamin D (5,7,21-23). Similarly, different results were obtained in the studies evaluating the changes in these parameters through a vitamin D replacement therapy. However, the role of vitamin D treatment in preventing the development of cardiovascular diseases is controversial (6,24-26).

There are very few studies have evaluating the relationship between hypertension and vitamin D in children with ambulatory blood pressure parameters. In these studies, there are non-homogeneous patient groups such as obese and non-obese patients and patients receiving antihypertensive treatment. At the same time, the number of patients was limited and the results were different. Therefore, our aim in this study is to evaluate patients who do not use drugs in homogeneous patient group together with cardiovascular risk factors using ambulatory blood pressure parameters, dyslipidemia, and insulin resistance.

METHODS

This is a retrospective review of 618 patients who underwent ambulatory blood pressure monitoring between January 2016 and January 2020 at the pediatric cardiology clinic of the Eskişehir Osmangazi University Hospital. The inclusion criteria were being obese, being aged between 8 and 17 years, and the measurement of vitamin D levels. Ninety-six patients with a body mass index above the 95th percentile (obese) was identified. The patient whose vitamin D level and ambulatory blood pressure monitoring were performed at the same visit were included in the study. Thirty-nine patients were excluded from the study due to the existence of accompanying renal, cardiovascular, and endocrinological diseases, and the remaining 57 patients were included. The present study was approved by the Non-Interventional Research Ethics Committee of Eskisehir Osmangazi University (12 May 2020-25403353-050.99-E.52038). This study was conducted per the principles of the Declaration of Helsinki.

The age, gender, and anthropometric measurements [height, body weight, body mass index (BMI)], lipid profile [low-density lipoprotein (LDL)-cholesterol, high density lipoprotein (HDL)-cholesterol, triglycerides], fasting serum glucose, calcium, phosphor, creatinine, alanine aminotransferase (ALT), insulin, 25(OH) vitamin D levels and 24-hour ambulatory blood pressure monitoring data (systolic/diastolic load during 25 hour, systolic/diastolic dipping, daytime/night-time mean systolic/diastolic pressure) of the patients were collected from the hospital records retrospectively. Blood pressure indices were calculated by dividing them to the 95th percentile of blood pressure. Examinations for hypertension etiology of hypertensive patients, as well as the data on transthoracic echocardiography and fundus examination evaluated in terms of target organ damage were obtained from hospital records for all patients. The patients were weighed on an electronic scale (SECA digital scale, sensitive to 0.1 kg measurement) in thin clothes and without shoes. Using a Harpenden stadiometer, height measurements were made in a standing upright position with bare feet and feet brought together in a parallel position, and with the shoulder and gluteal region touching the wall (sensitive to 0.1 cm measurement). Body mass indexes (BMI) [weight (kg)/height^2 (m^2)] of patients were calculated using height and weight measurements. Those having a BMI over the 95th percentile was considered obese. Percentile curves determined by the World Health Organization were used.

A 24-hour ambulatory blood pressure measurement was done using a Medset scanlight 2 recorder (Medset Scanlight II ABPM recorder, Germany). Systolic, diastolic, and mean arterial blood pressures were measured for 24 hours. Hypertension was defined as a case, in which measurements over the 95th percentile made based on age, gender and height yielded a rate over 25%. The blood pressure index was calculated by dividing the measured blood pressure value by the 95th percentile value as per gender and height (22). Patients who had a decrease in blood pressure by 10% or more in the night-time blood pressure data compared to daytime were considered dipper, and those who did not were considered non-dipper.

Glucose, insulin, HDL-cholesterol, LDL-cholesterol, triglyceride, 25(OH) vitamin D level, creatinine, and ALT were studied from the venous blood samples taken after 12 hours of fasting. Insulin resistance was calculated through the HOMA-IR formula [fasting glucose (mg/dL) x fasting insulin (uIU/mL)/405].

The cut-off value of 25(OH) vitamin D was accepted as 20 ng/mL in children and adolescents (27,28). Cases were divided into two groups as per their 25(OH) vitamin D levels based on 25(OH) vitamin D concentrations below or above 20 ng/mL.

Statistical Analyis

The data were analyzed through the SPSS package program. The values of qualitative variables were shown as frequency and percentage, and quantitative variables as mean ± standard deviation. The suitability of quantitative variables for normal distribution as per the groups was evaluated with the Shapiro-Wilk test. The comparison of the two groups was carried out through the t-test for normally distributed variables, and through the Mann-Whitney U for those not distributed normally. The correlation between the qualitative variables was examined through the chi-square analysis. Cases with an analysis result of $p<0.05$ were considered significant.

RESULTS

A total of 57 patients between the ages of 8 and 17 years, consisting of 26 females (45.6%) and 31 males (54.4%), were included in the study. There were 43 cases (75.4%) with a 25(OH) vitamin D level of <20 ng/mL, and 14 cases with a 25(OH) vitamin D level of ≥20 ng/mL. Demographic data of the patients and the comparison of the groups are given in Table 1. Age, body weight, BMI and gender distribution were similar between the two groups. In the group with vitamin D level below 20 ng/mL, the insulin levels and HOMA-IR score were significantly higher than the other group (p=0.012, p=0.016, respectively).

The comparison of ambulatory blood pressure monitoring data between the groups is given in Table 2. There was no statistically significant difference between the systolic and diastolic hypertension load (p=0.107, p=0.059, respectively). The night-time and daytime mean systolic blood pressure values were found to be significantly higher in the group having 25(OH) vitamin D level of <20 ng/mL (p=0.046, p=0.025, respectively).

Office blood pressure measurements of all patients were over the 95th percentile as per the age and height percentiles (29). In 70% (40/57) of the patients with high office measurements, systolic blood pressure load as per the ambulatory blood pressure monitoring was >25%, and that was compatible with hypertension. Vitamin D levels of 32 (80%) patients diagnosed with hypertension were below 20 ng/mL, and those of 8 (20%)

Table 1. Comparison of demographic and biochemical parameters between groups according to vitamin D level (mean ± SD)

	D vit <20 ng/mL	D vit ≥20 ng/mL	p
	n=43	n=14	
Age (year)	13.86±2.14	13.16±2.16	0.294
Gender (girls/boys)	22/21	4/10	0.244
Height (cm)	162.37±12.21	157.57±10.63	0.136
Weight (kg)	84.97±19.18	75.97±16.45	0.191
BMI (kg/m^2)	32.00±5.68	30.17±3.94	0.267
Systolic blood pressure (mmHg)	145.30±15.49	137.38±13.5	0.106
Diastolic blood pressure (mmHg)	88.02±14.44	85.07±16.98	0.577
Fasting blood glucose	86.18±8.23	89.07±11.41	0.307
Insulin (uIU/mL)	22.48±12.99	13.32±5.43	**0.012**
HOMA-IR	4.86±3.01	2.82±1.59	**0.016**
LDL-cholesterol (mg/dL)	116.30±34.59	108.80±21.92	0.559
HDL-cholesterol (mg/dL)	45.28±10.54	44.61±9.47	0.968
Triglycerides (mg/dL)	108±36.04	97.36±37.7	0.347
Creatinin (mg/dL)	0.57±0.13	0.56±0.11	0.955
ALT (IU/L)	26.21±21.32	23.92±14.08	0.902
Calcium (mg/dL)	9.77±0.34	9.94±0.33	0.238
Phosphor (mg/dL)	4.27±0.68	4.90±0.69	0.73
25(OH) vitamin D (ng/mL)	12.76±3.16	25.61±7.01	<0.001
Hypertension (yes/no)	32/11	8/6	0.314

BMI: Body mass index, HOMA-IR: Homeostasis model assessment of fasting insulin resistance, ALT: Alanine aminotransferase, LDL: Low density lipoprotein, HDL: High-density lipoprotein

patients were above 20 ng/mL. There were no significant differences with regard to the prevalence of hypertension. Six out of seven patients diagnosed with grade 1-3 hepatosteatosis were in the group with 25(OH) vitamin D levels below 20 ng/mL. In both groups, there was a case with grade 2 retinopathy; while the group with vitamin D deficiency had 4 patients with grade 1 retinopathy, there was one patient with grade 1 retinopathy in the group with a vitamin D level of >20 ng/mL. As per the electrocardiography and echocardiography findings, there were not any cases with left ventricular hypertrophy. As a result of the correlation analysis, a positive correlation was found between the HOMA-IR score and office diastolic blood pressure and systolic blood pressure load (r=0.372, p=0.007) (r=0.280, p=0.037). Correlation analyses of the HOMA-IR score and blood pressure parameters are given in Table 3.

DISCUSSION

According to our results of our study, insulin resistance increased in obese children with low vitamin D levels, and it was found to be associated particularly with high night-time systolic blood pressure levels.

In this study, 80% of these cases who had hypertension the vitamin D level was below the cut-off value. In a meta-analysis evaluating the correlation between vitamin D and cardiometabolic risk factors in children, it was reported that there was a negative correlation between the vitamin D level and systolic blood pressure in 11 studies, in addition to the diastolic blood pressure in 5 studies, while no correlation was found in a randomized controlled study (19). Similarly, in three different studies, no correlation could be found between vitamin D levels and hypertension and hypertensive organ damage, although a correlation was found between the fat tissue rate and insulin resistance (8,18,30). Similar to our study, Gul et al. (8) found a higher rate of vitamin D deficiency in the hypertensive group. In another comprehensive study involving 2.908 children, which investigated the correlation between hypertension and vitamin D, the prevalence of prehypertension and hypertension was 1.7% in patients with a vitamin D level of <10 ng/mL, while it was reported as 0.6% in those with a vitamin D level of >30 ng/mL as per the office measurements. In the same study, it was also emphasized that the effect of vitamin D level on systolic blood pressure was not independent of BMI and that the determining effect of vitamin D on systolic blood pressure did not continue when BMI was taken as a covariant (31). In our study, in which all our cases had BMI >95 p, we found that vitamin D level was not a determining factor for hypertension. In addition, in a comprehensive study involving adolescent children, it was stated that low vitamin D level was strongly correlated with excess weight, abdominal obesity, and an inverse correlation was found with high systolic blood pressure and increased fasting glucose (32). In our study, the higher systolic blood pressures and HOMA-

Table 2. Comparison of ambulatory blood pressure monitoring data between groups (mean ± SD)

	D vit <20 ng/mL	D vit >20 ng/mL	p
	n=43	n=14	
Systolic load during 24 h (%)	38.22±25.92	25.47±19.44	0.107
Diastolic load during 24 h (%)	21.20±21.20	9.31±8.74	0.059
Systolic blood pressure dipping	26.8	21.5	0.736
Diastolic blood pressure dipping	35	29	0,508
Daytime mean systolic blood pressure (mmHg)	125.38±10.48	118.92±6.88	0.39
Daytime systolic index	0.981±0.077	0.955±0.073	0.290
Daytime mean diastolic blood pressure (mmHg)	71.75±7.19	68.07±5.18	0.088
Daytime diastolic index	0.885±0.082	0.856±0.070	0.244
Night-time mean systolic blood pressure (mmHg)	115.03±9.33	109.14±8.01	0.046
Night-time systolic index	0.901±0.074	0.875±0.066	0.416
Night-time mean diastolic blood pressure (mmHg)	60.75±5.73	69.21±5.79	0.409
Night-time diastolic index	0.752±0.065	0.744±0.080	0.717
Systolic blood pressure during 24 h (mmHg)	122.95±10.02	116.42±5.57	0.025
Systolic index during 24 h	0.966±0.072	0.931±0.062	0.329
Diastolic blood pressure during 24 h (mmHg)	69.52±7.18	66.02±5.49	0.106
Diastolic index during 24 h	0.863±0.084	0.830±0.078	0.196

SD: Standard deviation

IR values that we detected in obese children with low vitamin D levels support the results of Reis et al. (32).

In our study, no significant difference was found in office systolic and diastolic blood pressures, ambulatory blood pressure load and blood pressure indexes between the two groups in the comparison of office and ambulatory blood pressure data. Although the number of studies on office blood pressure measurements in children is relatively high, there are few studies in the literature where the correlation between ambulatory blood pressure data and vitamin D deficiency is evaluated. Different results were reported in the aforementioned studies (4,14,22). The study, in which patients with primary hypertension were included, yielded no correlation between vitamin D level and ambulatory and office blood pressure measurements. Although the results in this study are similar, 30% of the patients are obese and 28% are overweight, unlike our study. Moreover, half of the patients receive antihypertensive treatment (14). In our study, all patients were either obese, with no antihypertensive treatment. Banzato et al. (22), investigated the correlation between vitamin D levels and ambulatory blood pressure data of 32 obese children and found negative correlations particularly with regard to night-time blood pressure load and blood pressure index. They also found a negative correlation between the daily blood pressure index, triglyceride level and HOMA-IR and vitamin D levels in this study. In this study, unlike our study, patients were divided into 3 groups as <10 ng/mL, 10-20 ng/mL, >20 ng/mL based on vitamin D level. The group with <10 ng/mL was determined to be the group with a significant difference, while the study was made with a total of 32 patients, which was quite a low number. In our study, it was thought that grouping in this manner would not be appropriate since the number of patients below <10 ng/mL was Colak et al. (4), the data of obese and normal-weight children were compared, and when another comparison was made among obese children based on the level of vitamin D, no significant difference could be found in terms of ambulatory blood pressure load. However, negative correlation was found between vitamin D level and age, BMI, fat rate, night-time blood pressure load and carotids intima media thickness. Similarly, in our study, daytime and night-time systolic blood pressures were found to be higher in the group with vitamin D deficiency, but no significant difference could be found in the comparison of blood pressure load and index.

In our study, insulin level and HOMA-IR scores were found to be significantly higher in the group with vitamin D deficiency. There are studies in the literature showing that an increased fasting blood glucose and insulin resistance are inversely correlated with vitamin D level (5,22,23). Distinctively, there are also studies that do not find a correlation between HOMA-IR and vitamin D level (7,21). In most of these studies, the

Table 3. Office, ambulatory blood pressure parameters and HOMA-IR correlation analysis

	r	p
Office systolic blood pressure (mmHg)	0.256	0.067
Office diastolic blood pressure (mmHg)	0.372	0.007[s]
Systolic load (%)	0.280	0.037
Diastolic load (%)	0.086	0.526
Systolic dipping (>10%)	-0.05	0.716
Diastolic dipping (>10%)	0.032	0.815
Daytime mean systolic blood pressure (mmHg)	0.122	0.405
Daytime systolic index	0.096	0.512
Daytime mean diastolic blood pressure (mmHg)	0.189	0.194
Daytime diastolic index	0.180	0.215
Night-time mean systolic blood pressure (mmHg)	0.246	0.103
Night-time systolic index	0.242	0.109
Night-time mean diastolic blood pressure (mmHg)	0.222	0.143
Night-time diastolic index	0.200	0.188
Mean systolic blood pressure during 24 h (mmHg)	0.139	0.313
Systolik index during 24 h	0.140	0.310
Mean diastolic blood pressure during 24 h (mmHg)	0.136	0.324
Diastolic index during 24 h	0.132	0.336

[s]Spearman's, HOMA-IR: Homeostatic model assessment for insulin resistance

correlation between low vitamin D level and BMI, adipose tissue rate and metabolic syndrome were emphasized. In a study carried out in Korea on 1.504 children, where this correlation could not be demonstrated, an inverse correlation was found between vitamin D level and diastolic blood pressure, waist circumference and BMI, yet no significant correlation could be found between hypertension, insulin resistance, hyperglycaemia, hypertriglyceridemia, and low HDL-cholesterol. However, the presence of a significant correlation between low vitamin D level and BMI was found to be of significance with regard to metabolic syndrome and cardiovascular diseases (33). In our study, triglyceride, LDL and HDL-cholesterol levels were similar between the two groups. Many studies have shown that increased triglyceride, total and LDL-cholesterol levels, and decreased HDL-cholesterol levels are associated with low vitamin D levels (7,21,23). In some studies, it was not possible to show any significant differences that are to our study (6,32,33). It is considered that the difference in the manner the results are reported is related to the differences in study group characteristics and vitamin D levels. In our study, although there was no significant correlation between vitamin D level and blood pressure load and indexes, a strong correlation was determinated between HOMA-IR and vitamin D level. In the correlation analysis, there was positive correlation between HOMA-IR score and office diastolic blood pressure value and systolic blood pressure load ($r=0.280$, $p=0.03$). Although vitamin D deficiency is not directly effective in blood pressure, it has been indirectly associated with hypertension due to its contribution to insulin resistance and obesity.

In a study evaluating insulin resistance and hepatosteatosis in obese children, insulin resistance and hepatosteatosis were found to be significantly high in patients with low vitamin D levels (5). Similarly, in our study, 6 (85%) out of 7 patients with hepatosteatosis were in the group with vitamin D deficiency. Five (71%) of the patients with hypertensive retinopathy were in the group with vitamin D deficiency. Although it is not possible to show a direct correlation between blood pressure parameters and vitamin D level, hypertensive organ damage was found to be higher.

Study Limitations

No evaluations were made regarding the post-vitamin D treatment process in our study, which is one of its limitations. At the same time, its retrospective design, the fact that a relatively small number of patients were included, accompanied by a quite limited number of patients with vitamin D levels below <10 ng/mL and above >30 ng/mL, and the absence of a comparison made with patients having a level of >30 ng/mL, which is considered an optimal level, as well as a lack of seasonal evaluations are the limitations of our study.

CONCLUSION

As a result, night-time systolic blood pressure and HOMA-IR score were found to be higher in obese children with low vitamin D levels. In addition, obese children with high insulin resistance have higher blood pressure values. Therefore, it can be said that an increased insulin resistance contributed by vitamin D deficiency in obese children is associated with high blood pressure values. In order to explain the correlation between vitamin D level and blood pressure in obese children, there is a need for prospective, randomized controlled studies involving more patients.

Ethics

Ethics Committee Approval: The present study was approved by the Non-Interventional Research Ethics Committee of Eskisehir Osmangazi University (12 May 2020- 25403353-050.99-E.52038). This study was conducted per the principles of the Declaration of Helsinki.

Informed Consent: Retrospective study.

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Authorship Contributions

Surgical and Medical Practices: A.S., E.A., P.K., H.K., B.U., Concept: A.S., P.K., B.U., Design: A.S., P.K., B.U., Data Collection or Processing: A.S., E.A., H.K., Analysis or Interpretation: A.S., P.K., H.K., Literature Search: A.S., E.A., H.K., Writing: A.S., E.A., P.K., B.U.

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ORIGINAL ARTICLE

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Pressure Ulcers in COVID-19 Patients in the Intensive Care Unit

Esra Akdaş Tekin[1], Hakan Küçükkepeci[1], Sinan Mutlu[1], Fethi Gültop[1], Hüseyin Sevgi[2], Necla Köse[2], Namigar Turgut[1]

[1]University of Health Sciences Turkey, Prof. Dr. Cemil Taşcıoğlu City Hospital, Clinic of Anesthesiology and Reanimation, İstanbul, Turkey
[2]University of Health Sciences Turkey, Prof. Dr. Cemil Taşcıoğlu City Hospital, Clinic of Intensive Care, İstanbul, Turkey

Abstract

Objective: Pressure ulcer (PU) in Coronavirus disease-2019 (COVID-19) patients will be an important health and cost factor for all countries. Risk factors for the development of PU in patients admitted to intensive care unit (ICU) during the COVID-19 pandemic were evaluated in terms of treatment and outcomes.

Methods: Patients were divided into two groups (group I= developing PU, group II= did not develop PU).

Results: A total of 105 patients were included in the study. PU developed in 20 patients (19%). The mean age was 58.45±13.35, days of PU development was 6. The duration of uninterrupted prone positioning was 23.55±4.38 hours among the study patients. The duration of ICU stay and mechanical ventilation duration of group I cases were longer than the durations of group II cases. There was no significant difference between the groups in terms of gender percentages, age, albumin, hemoglobin and C-reactive protein values ($p>0.05$).

Conclusion: Prolonged prone position are independent risk factors for the development of PU in COVID-19 patients.

Keywords: Pressure ulcers, prone position, COVID-19

INTRODUCTION

Pressure ulcers (PU) can occur in any area of the body that is subjected to pressure. Pain, length of intensive care unit (ICU) stay, diabetes, time of MAP <60-70 mmHg, length of mechanical ventilation (MV), haemodialysis or CRRT, vasopressor support, sedation, decreased consciousness level, hypoalbuminemia, anemia, malnutrition, obesity, dehydration, smoking, advanced age, excessive humidity are known risk factors for PU (1,2).

Severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) was identified in China in December 2019 and became a pandemic in a short period of time (3). In Coronavirus disease-2019 (COVID-19) cases, pneumonia caused by the SARS-CoV-2 may be decompensated due to hypoxemia respiratory failure compatible with acute respiratory distress syndrome (ARDS) (4). In patients with ARDS, the need for the prone position (PP) is increasing gradually as it allows gathering dorsal lung regions, increased end expiratory lung volume, and reduced alveolar shunt (4,5). It has been known for many years that in patients with moderate and severe ARDS, PP for 12 hours or longer together with lung protective ventilation improves the PaO_2/FiO_2 ratio and leads to lower mortality (6,7). However, prone positioning has been associated with higher rates of PU (6). It is clear that PU will be an important health and cost factor for all countries, despite the positive effect of PP on survival during the pandemic.

In this study, the risk factors for the development of PU in patients with ARDS who were admitted to the ICU of the study hospital during the COVID-19 pandemic were evaluated in terms of treatment and results.

Address for Correspondence: Namigar Turgut, University of Health Sciences Turkey, Prof. Dr. Cemil Taşcıoğlu City Hospital, Clinic of Intensive Care, İstanbul, Turkey
Phone: +90 212 221 77 77 **E-mail:** namigarturgut@gmail.com **ORCID ID:** orcid.org/0000-0003-0252-3377

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METHODS

Ethical Considerations

In the study, the patients who developed PU due to PP between patients who were admitted to the COVID-19 ICU between March 1, 2021 and May 31, 2021 were analyzed retrospectively with the approval of University of University of Health Sciences Turkey, Prof. Dr. Cemil Tascioglu City Hospital Local Ethics Committee (date: 24.05.2021, protocol number: 213) and was conducted in accordance with the Helsinki Declaration.

Study Design and Patient Selection

Written informed consent was obtained from the patients for their anonymized information to be published in this article. Patients over the age of 18 who stayed in ICU for more than 48 hours were included in the study, and those under the age of 18 were excluded from the study.

Patients were divided into two groups (group I= developing PU, and group II= did not develop PU). Demographic data, duration of the ICU stay, time in PP, comorbid conditions, days with PU, duration with MV, albumin (Alb) level (reference range 3.5-5.2 g/dL), the hemoglobin (Hb) level (reference range 12-16 g/L), and C-reactive protein (CRP) (mg/L, reference range 0-5 mg/L) level were analyzed. The approach to PU and wound infection were examined.

Definitions

PU risk scale: Braden scale is the most widely employed risk assessment tool. It is considered the gold standard PU risk assessment scales (8).

Statistical Analysis

All the statistical analyses were performed in the 1.15.3 program [R Core Team (2017) R Faundation for Statistical Computing, Vienna, Austria]. Minimum, maximum, mean, standard deviation, median, first quartile, third quartile, frequency, and percentage were used in reporting study data. The conformity of the quantitative data to the normal distribution was evaluated with the Shapiro-Wilk test and graphical examinations. Independent groups t-test was used for the evaluation of the normally distributed variables between two groups. The Mann-Whitney U test was used for the evaluation of the non-normally distributed variables between two groups. Chi-square test was used for comparison of qualitative data and the Pearson correlation test was used to evaluate the association between certain variables. Significance was assessed at $p<0.05$ level.

RESULTS

A total of 105 patients with moderate to severe COVID-19 ARDS were admitted to the COVID-19 ICU during the three-month period. All of the patients were under invasive MV support and they received enteral and parenteral nutrition and sedoanalgesia. PU developed in 20 patients in the follow-ups performed using the Braden PU risk assessment scale. In group I (n=20), the mean age was 58.45±13.35 and 11 were men (55%) while 9 patients were women (45%). In group II (n=85) the mean age was 62.58±15.31, 43 patients were female and 42 patients were male.

The incidence of PU (number of PU developing in the ICU/total number of days of hospitalization in the ICU x100) was 19%. It was found that the day of PU development was 6/days following the hospitalization, the durations of hospitalized in the ICU was 15.05/days, and the mean duration of MV was 12.15/days.

In group I, the duration of ICU hospitalization was 13.5/day, and the mean duration of MV was 11.5/day. In group II, the duration of ICU hospitalization was 6/day, and the mean duration of MV was 0 (0, 16) day.

It was determined that the duration of ICU stay and MV of group I cases were longer than the durations of group II cases (p=0.009, p=0.002, respectively).

The duration of uninterrupted prone positioning was 23.55±4.38 hours among the study patients. The patients were positioned prone for an average of 5.75 times (2-12) and at least 16 hours during the care unit stay. In group II, it was under 12 hours.

There was no significant difference between the groups in terms of Alb, Hb and CRP values ($p>0.05$) (Table 1).

While there was no comorbid condition in 5 patients in group I (25%), hypertension + diabetes mellitus (HT+DM) (25%) in 5 patients, DM in 4 patients (20%), HT in 3 patients (15%) were observed. In group II patients, there was no comorbid condition in 13 patients (15.29%); however, DM+HT in 13 patients (15.29%), DM in 22 patients (25.88%), HT in 20 patients (23.52%), asthma bronsiale (5.8%) in 5 patients, and COPD (5.8%) in 5 patients were observed.

While 2° and necrotic PU occurred in 7 patients in group I, the main areas were forehead and nose in all patients. *Klebsiella* was observed in the trachea culture of 3 patients with PU, Carbapenem resistant *Klebsiella* + *Enterococcus* was observed in one patient, *Klebsiella* + *Candida* was observed in blood culture of one patient. One patient had *Candida*.

Forehead (80%), thorax and anterior abdomen (40%), nose (25%), knee (25%) were the most common areas of PU development (Table 2), (Figures 1, 2). The approach to PS in patients was the application of wet dressing (stage I-II, Figure 3).

DISCUSSION

During the COVID-19 pandemic, a disproportionate level of prone ventilation was required to improve prognosis in patients with respiratory distress compared to the general intensive care population. However, making patients prone leads to important complications such as PU (8-10).

Metaanalyses of randomized controlled trials showed that survival increased when patients with severe ARDS (PaO_2/FIO_2 <150mm Hg) were treated with lower tidal volume (≤8 mL/kg), higher PEEP (10-13 cm H_2O), and longer PP duration (>0-12 hours/session) (11). Intubated patients may stay in PP for up to 12-16 hours (12). In COVID-19 ICU, few complications were observed when the PP duration of 8±5 hours in the first 24 hours was continued for an average of 10±5 days, and the conscious use of PP was emphasized (13). It has been suggested that hypoxemia, microvascular injury, and thrombosis may increase the risk of PU in COVID-19 pneumonia. Hypoxemia results in a decrease in peripheral perfusion, including skin perfusion, and this leads to the developments of ischemic skin lesions. Anatomopathological analyses of purpuric skin lesions also showed the presence of pauci-inflammatory thrombogenic vasculopathies (14). In the present study, the uninterrupted duration in the PP was 24 hours/session (16-32). Although all patients were placed in the left and right PP every 6 hours, PU developed. These patients required continued prone positioning to improve respiratory mechanics and oxygenation due to increased hypoxemia.

As the PP needs to be maintained for 10 to 12 hours to become effective, prolonged pressure may cause potential ischemic lesions at pressure points on the face. These facial ulcers most often occur around bony structures, including the forehead, cheekbones, and chin (2,4).

The face was shown as the most affected area (69%) in patients who developed PU due to the PPn. The most common stage II ulcer was observed (9). In our study, the forehead (80%) and thorax and anterior abdomen (40%) were the most common areas of PU in our patients. Stage II ulcers were detected in 35% of the cases.

Five potential causes have been identified that may have contributed to the increase in pressure-related tissue damage in COVID-19 patients. Physiological changes were associated with COVID-19 due to increased use of medical devices needed to support therapy (nasal cannulas, oxygen masks, high-flow oxygen devices, chest drains, tracheostomy tubes, endotracheal tubes, bi-level positive airway pressure or continuous positive air tract pressure masks, malnutrition, reduced mobility, and labor difficulties (15).

In addition to long-term invasive MV and immobility required for PP, friction/shear, use of vasopressors such as norepinephrine, advanced age, anemia, low risk scale score, fecal and urinary incontinence, dehydrated skin, and the presence of chronic diseases are additional risk factors (8,13,16,17). MV longer than 72 hours has been associated with a 23-fold higher risk of developing PU (6). Long-term invasive MV was applied to all of the patients [group I, 12.15 (6-23)/day; group II, 12.09 (2-108)/day]. However, PU developed in 20 patients (19%). Maintaining PP for more than 16 hours was the common point of the patients

Table 1. Demographic and clinical characteristics of patients

	Group I (n=20)	Group II (n=85)	p
Gender n (%)			[a]**0.804**
Male	11 (55)	42 (49.4)	
Female	9 (45)	43 (50.6)	
Age (years) mean ± SD	58.45±13.35	62.58±15.31	[b]**0.270**
Length of ICU stay (days), median (Q1, Q3)	13.5 (10, 18)	6 (2, 19)	[c]**0.009***
MV (days), median (Q1, Q3)	11.5 (6.5, 16.5)	0 (0, 16)	[c]**0.002***
Pressure ulcer (day) median (Q1, Q3)	6 (3.5, 8.5)	-	
Time in prone position (hours) mean ± SD	23.55±4.38	-	
Albumin (g/dL) mean ± SD	2.75±0.74	2.86±0.70	[b]**0.524**
Hemoglobin (g/L) mean ± SD	11.33±2.16	10.99±2.08	[b]**0.525**
CRP (mg/L) median (Q1, Q3)	45.4 (14.8, 114)	42.4 (13, 132.1)	[c]**0.948**

[a]Pearson chi-square test test, [b]Independent groups t-test, [c]Mann-Whitney U test, *p<0.05, SD: Standard deviation, ICU: Intensive care unit, CRP: C-reactive protein, MV: Mechanical ventilation

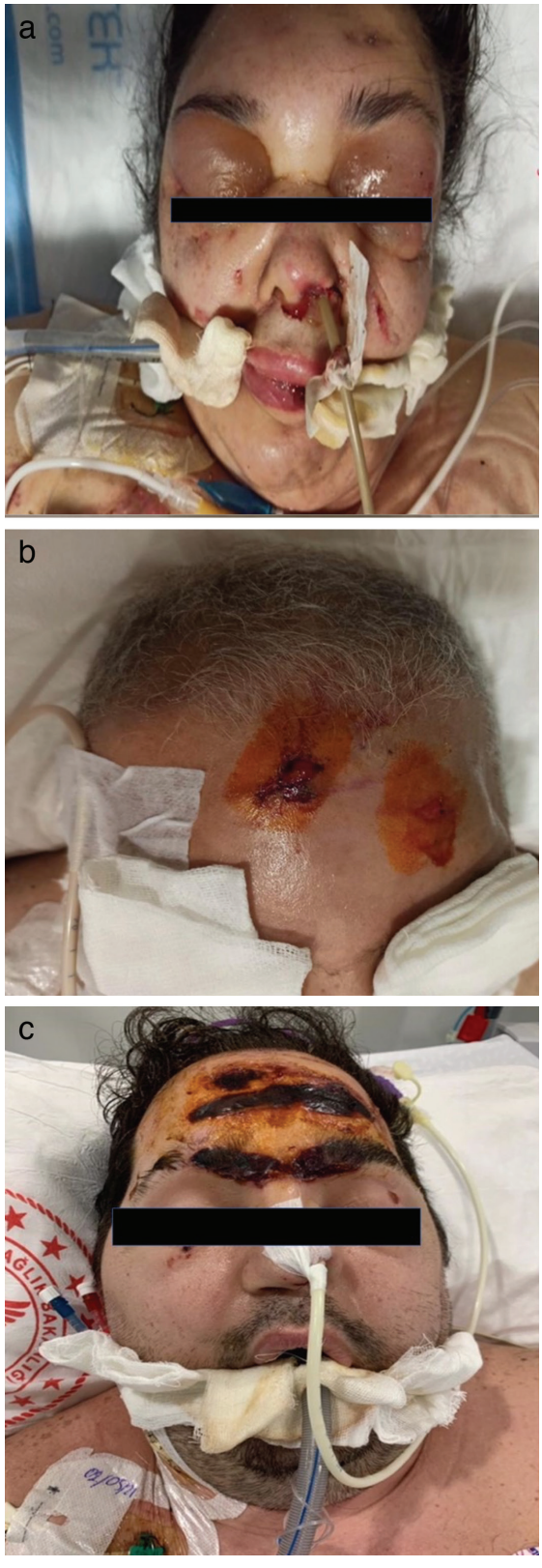

Figure 1. Pressure ulcers on the forehead in patients. (a) Stage 1 pressure ulcers on forehead and nose, severe eyelid edema due to prone position. (b) Unilateral stage 2 pressure ulcers. (c) Bilateral widely disseminated stage 3 (the area has a crater-like appearance due to damage below the skin's surface) pressure ulcers

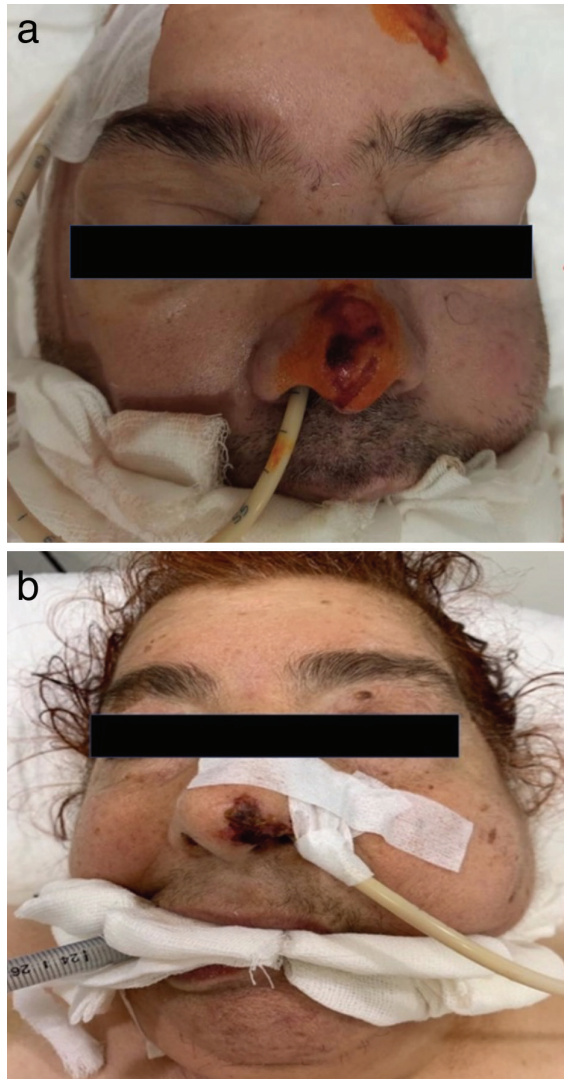

Figure 2. Pressure ulcers on the nose and forehead in patients. (a) Unilateral stage 1. Pressure ulcer on forehead (the area looks red and feels warm to the touch. With darker skin, the area may have a blue or purple tint. The person may also complain that it burns, hurts, or itches) and stage 2 pressure ulcer on forehead. (b) unilateral stage 3 pressure ulcers on the nose

Table 2. Pressure ulcer areas in patients

Variable	%	n
Forehead	80%	16
Nose	25%	5
Eye	10%	2
Chin	15%	3
Cheek	10%	2
Knee	25%	5
Thorax and anterior abdomen	40%	8
Lip edge	10%	2
Shoulder	5%	1
Sacrum	5%	1

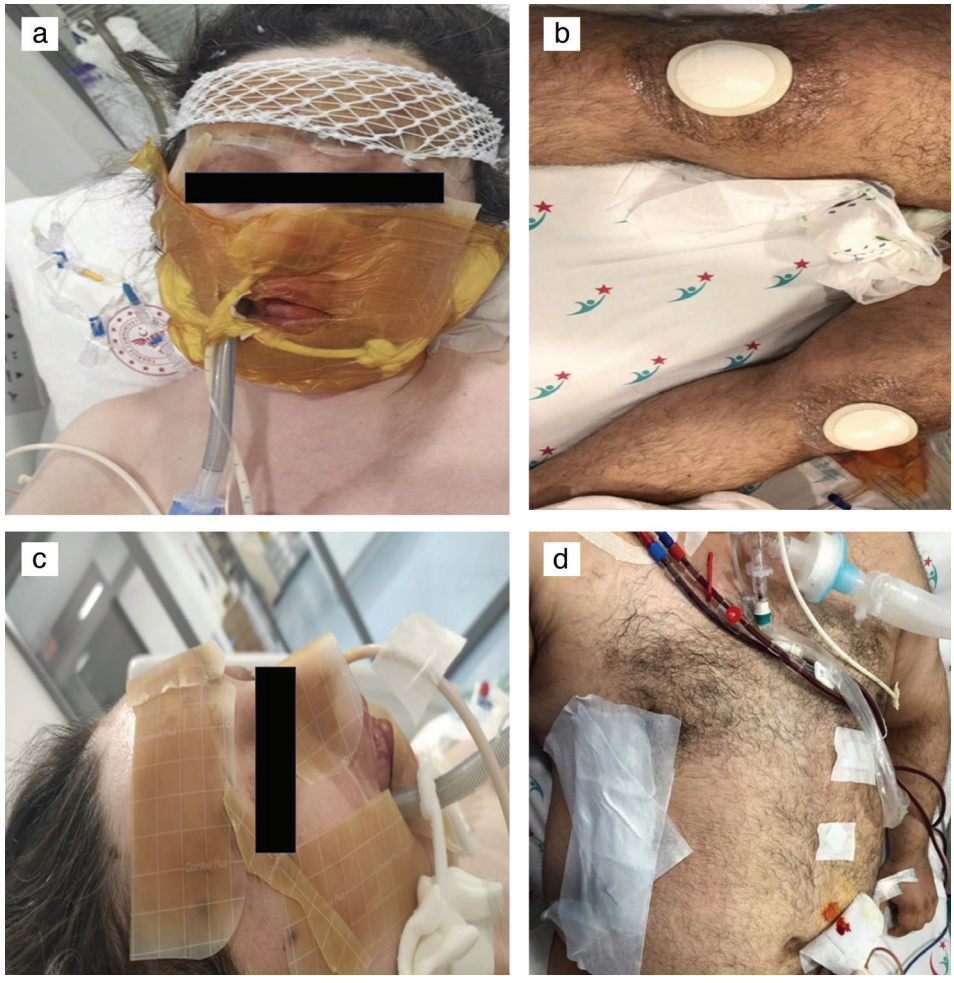

Figure 3. Approach to pressure ulcers; wound care and protective barriers in patients. (a) The pressure on the affected areas (forehead, cheek, nose and chin) is removed, and the wound is protected with gauze and special dressings. (b) Knees protected with dressing and gauze. (c) Areas that are expected to be affected (forehead, cheek, nose and chin) are protected with special protective dressings of different sizes. (d) Anterior abdomen is protected with gauze

in the present study and this requires us to consider the long-term PP as a possible risk factor over MV in the development of PU in this patient group. In group II, it was under 12 hours.

In a prospective multicentre randomized controlled study including patients with severe ARDS by Girard et al. (18) prone positioning was associated with higher PU than supine position, while invasive MV, number of hospital stay, age >60 years, female gender, a body mass index of >28.4 kg/m^2, and a simplified acute physiology score II of >46 at inclusion were shown as covariates independently associated with the development of PU. It was emphasized that these patients would need active protection.

These ulcers are painful and significantly reduce a person's quality of life. Management of ulcers is expensive and negatively impacts the success of cost-effective, efficient care delivery (10). In our patient group, all ulcers were treated with dressings. The use of dressings such as hydrocolloids, clear film and silicone has been beneficial in reducing facial skin deterioration. The use of multi-layered silicone foam dressings as tissue protectors on the forehead and chin. Similarly, chin dressing has been shown to reduce the stress exposure of soft tissues and strain energy densities by 78% and 92%, respectively (19).

Pain, hypotension, hyperthermia, decreased consciousness level, hypoalbuminemia, low Hb levels, malnutrition, dehydration, smoking, advanced age, excessive humidity are other known risk factors (16,20,21).

Comorbidities such as asthma, COPD, diabetes, and obesity cause patients to become bedridden and live a sedentary life for longer, which increases their risk of developing PU (15). While DM and HT was the most common comorbid conditions in our patients, 25% of the patients who developed PU had no comorbidities. However, the Hb levels of these patients were lower than those in the other group (9.82 g/L vs. 11.15 g/L). Similarly, Alb levels

of the patients in group I was low (26.3 g/dL vs. 29.05 g/dL) and CRP, one of the acute phase reactants, was high (109.8 mg/L vs. 80.19 mg/L).

It has been emphasized that the risk of PU increases when the duration of hospital stay in the ICU is extended (22). However, in the present study, there was no difference between the groups in the number of the days of hospital stay [group I, 15.05 (6-26)/day; group II, 15.67 (2-114)/day]. All of these patients generally required long-term high-level intensive care due to COVID-19-related ARDS. Prolonged stay in the PP, low Alb and Hb levels were the factors distinguishing patients with PU from other patients. Insufficient oxygen delivery to the tissues leads to ischemia and this may cause the development of PU (23). Anemia should be treated in these patients.

A pressure of 60-70 mmHg against the skin is sufficient to develop a pressure sore within one to six hours. Decreased blood flow due to decreased capillary blood pressure may cause ischemia, hypoxia, and necrosis in tissues (20). With a set of equipment and devices required for the treatment of COVID-19 (antiembolic stockings, nasogastric tubes, endotracheal tube and mask, central venous catheters, CRRT therapy catheters) which may cause an increased risk of tissue damage, it is obvious that this results in increased facial PS (6). In the Montgomery et al. (24) study, in patients diagnosed with COVID-19; age, male gender, risk of mortality, severity of illness, and long hospital stay were found to be risk factors. The effects of PP were not studied in this study.

When a patient is in the PP, it is recommended to position the patient in the swimmer position, reposition him/her every 2 hours, and keep the skin clean. When the patient is positioned supine, the evaluation of pressure points and early mobilization should be encouraged (12).

Study Limitations

There are some limitations to the present study. First, this study was done in a single centre with a limited number of patients. The duration of uninterrupted prone positioning was 24 hours (16-32) among the study patients. The patients were positioned prone for an average of 5.75 times (2-12) and at least 16 hours during the care unit stay. Statistical analysis of PP time and other risk factors associated with PU is difficult in this study. Because the number of cases is limited to 20. A larger number of patients are necessary for a more accurate analysis, the exclusion of observational biases and a deeper analysis of the risk factors most related to PU.

CONCLUSION

Particular attention should be paid to patient groups with a Braden score ≤13. PU are a preventable condition. The measures to be taken to prevent these wounds are easier and less costly. It is essential that risk factors relevant to clinical practice be identified. Although the risk factors that play a role in the development of PU such as anemia, hypoalbuminemia, long-term MV and prolonged ICU stay are known, situations that require prolonged prone positioning, such as in COVID-19 related ARDS patients, are independent risk factors for the development of PU.

In order to prevent PU in these patients, it is important to observe early symptoms and make appropriate interventions, and to change positions frequently.

Ethics

Ethics Committee Approval: In the study, the patients who developed PU due to PP between patients who were admitted to the COVID-19 ICU between March 1, 2021 and May 31, 2021 were analyzed retrospectively with the approval of University of University of Health Sciences Turkey, Prof. Dr. Cemil Tascioglu City Hospital Local Ethics Committee (date: 24.05.2021, protocol number: 213) and was conducted in accordance with the Helsinki Declaration.

Informed Consent: Written informed consent was obtained from the patients for their anonymized information to be published in this article.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

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

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ORIGINAL ARTICLE

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Comparison of Open Versus Closed Partial Nail Plate Excision with Partial Matrixectomy in Ingrown Toenail

Remzi Çaylak

Private Ortopedia Hospital, Clinic of Orthopedics and Traumatology, Adana, Turkey

Abstract

Objective: Ingrown toenail (Onychocryptosis); caused by the nail plate growing into the lateral/medial nail fold is a common health problem characterized by pain, exudation, and granulation tissue formation. In advanced cases, partial/total nail plate excision and matrixectomy were performed. This study aimed to compare the clinical results of open versus closed partial nail plate excision and surgical partial matrixectomy in ingrown toenails.

Methods: We compared the results of patients who underwent open (n=51) or closed (n=44) partial nail plate excision and surgical partial matrixectomy by two surgeons with the diagnosis of ingrown toenails in our hospital between 2016-2021 and had at least a 1-year follow-up. The recurrence, wound problems, time to return to work/school, general and cosmetic satisfaction of the cases were examined.

Results: No recurrence was observed in either group. Wound problem/superficial infection was observed in 3 cases in the open matrixectomy group. Return to work/school was 17.8±2.7 days in the open surgery group, while it was 14.4±1.4 days in the closed group ($p<0.001$). While the general satisfaction of the patients was the same in both groups, their cosmetic satisfaction was higher in the closed group (4.8±04 vs. 4.2±0.7) ($p<0.001$).

Conclusion: Partial nail plate excision and surgical partial matrixectomy are effective and safe methods in ingrown nails. A closed procedure might increase cosmetic satisfaction as well as reduce the time to return daily activities.

Keywords: Ingrown toenail, partial nail plate excision, partial matrixectomy

INTRODUCTION

The ingrown toenail (Onychocryptosis) is a common condition characterized by pain, exudation and swelling in the nail fold (1,2). It is frequently encountered in young adults, and its frequency is increasing (3). A study conducted in Australia showed that more than 20% of surgeries for the feet were performed for ingrown toenails (4). Excessive perspiration, improper nail trimming, trauma, tight shoes, and socks play a role in the etiology (5). The growth of the nail plate into the adjacent nail fold damages the soft tissue and causes an inflammatory reaction characterized by excessive granulation tissue formation (1,2). Exudation and pain caused by the disease can cause obstacles in the use of shoes, and as a result, problems in social and work life (1,2).

In the treatment of ingrown toenails, while conservative approaches are sufficient in the early stages, surgical approaches may be necessary in advanced stages and in recurrent cases (1,2,6-10). Conservative treatments aim to protect the nail fold from the nail plate, thus preventing secondary infections and relieving pain. Various measures, such as the use of appropriate shoes, cutting nails straight instead of round, and the treatment of concomitant hyperhidrosis and onychomycosis, must be applied at the beginning (1,2). Various non-surgical methods

Address for Correspondence: Remzi Çaylak, Private Ortopedia Hospital, Clinic of Orthopedics and Traumatology, Adana, Turkey
Phone: +90 322 432 77 77 **E-mail:** rcaylak@gmail.com **ORCID ID:** orcid.org/0000-0002-2926-4590

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such as placing cotton or dental floss under the nail plate, placing a gutter splint on the ingrown part of the nail plate, and wire applications can be used in patients who cannot achieve adequate recovery with these methods (1,2,7,8,11). Surgical treatment methods are used in advanced and/or recurrent cases.

Although many surgical techniques have been reported for ingrown toenails, a generally accepted method could not be established. The methods in the literature have advantages and disadvantages in terms of ease of application, complications, recurrence and cosmetic appearance. The ideal method should be easy to apply, have low complications and recurrence risk, as well as provide an acceptable cosmetic appearance. Partial nail plate excision with/without partial matrixectomy (surgical or chemical), total nail plate excision with/without total matrixectomy, which can be applied in stubborn cases, are the surgical alternatives that can be preferred (9,12,13).

In our hospital, the preferred surgical method for ingrown toenails is partial nail plate excision and surgical partial matrixectomy. This can be done with open or closed methods. In the open method, germinal matrix excision is made via an incision in the proximal nail fold. In the closed method, germinal matrix excision is made through the space formed by the excised nail plate. Potentially less wound problems but more recurrences can be expected with the closed method.

The aim of our study was to compare the results of open versus closed partial nail plate excision and surgical partial matrixectomy.

METHODS

Patients and Study Design

Ethics Committee approval was obtained before the study (Cukurova University, 08.04.2022, no: 121).

Patients who were treated by two different orthopedics and traumatology specialists (RÇ and ÇÖ) with the diagnosis of ingrown toenails in our hospital between January 2016 and January 2021 and had at least one year of follow-up were evaluated retrospectively. Patients who had previously undergone surgical treatment for ingrown toenails and patients with a diagnosis of diabetic foot were excluded from the study. All patients were treated with surgical partial nail plate excision and partial matrixectomy. One of the surgeons preferred the open and the other closed methods.

According to the information obtained from the hospital records, ingrown toenails were classified according to the Mozena classification (14) (Table 1). Information on whether a wound problem developed during the follow-ups, wound healing time, time to return to work/school, recurrence and/or re-intervention was obtained from the hospital records. In addition, the patients were contacted by phone and their satisfaction with the appearance of the toe and nail after recovery and their general satisfaction were questioned. Their satisfaction was grouped between 1 to 5. It was classified as; very satisfied as 5, satisfied as 4, moderate satisfied as 3, dissatisfied as 2, and not satisfied at all as 1.

Surgical Methods

Partial nail plate excision and closed surgical partial matrixectomy method

After the sterile preparation of the foot, the procedure was performed under digital block anesthesia with 4-6 mL of 2% prilocaine. Bleeding control was achieved by circular placement of a Penrose drain on the proximal phalanx. The nail plate and nail bed were excised with a lancet 2-3 mm from the medial/lateral to the nail fold by cutting straight up to the distal phalanx longitudinally (Figure 1A-E). The germinal matrix of the nail was excised with a scalpel and curette from the space formed by the excision of the nail plate and nail bed (Figure 1F). Excision of the nail fold was not performed unless there was excessive granulation tissue. The gap between the nail fold and the remaining nail plate was approximated with 3.0 monofilament sutures (Figure 1H). The tourniquet was opened and the toe was wrapped with a non-tight dressing. Infection prophylaxis was administered with oral antibiotics for 72 hours after the procedure. The first dressing change was done 48 hours after the procedure. The dressing was renewed at 72-hour intervals until the 12th day when the sutures were removed in patients without wound problems.

Partial nail plate excision and open surgical partial matrixectomy method

After the sterile preparation of the foot, the procedure was performed under digital block anesthesia with 4-6 mL of 2% prilocaine. Bleeding control was achieved by circular placement

Table 1. The Mozena classification system of ingrown toenails

Stage	Signs and symptoms
1	Erythema, slight edema, and pain when pressure is applied to the lateral fold
2a	Increased stage I symptoms, drainage and infection, nail fold less than 3 mm
2b	Increased stage I symptoms, drainage and infection, nail fold 3 mm or greater
3	Magnified stage II symptoms, presence of granulation tissue and nail fold hypertrophy

of a Penrose drain on the proximal phalanx. The proximal nail plate was reached by making an incision at an angle of approximately 45 degrees to the proximal nail fold (Figure 2A, B). The ingrown lateral/medial part of the nail plate was excised by cutting it longitudinally with scissors (Figure 2C, D). The germinal matrix and proximal nail bed were excised up to the bone with a scalpel (Figure 2E, F). The area was curetted to ensure that the germinal matrix was completely excised (Figure 2G). Excision of the nail fold was not performed unless there was excessive granulation tissue. The incision in the proximal nail fold was sutured with 3.0 monofilament sutures. The gap between the nail fold and the remaining nail plate was approximated with 3.0 monofilament sutures (Figure 2H). The tourniquet was opened and the toe was wrapped with a non-tight dressing. Infection prophylaxis was administered with oral antibiotics for 72 hours after the procedure. The first dressing change was done 48 hours after the procedure. The dressing was renewed at 72 hour intervals until the 12th day when the sutures were removed in patients without wound problems.

Statistical Analysis

Categorical variables were expressed as numbers and percentages, whereas continuous variables were summarized as mean and standard deviation and as the median and interquartile range (IQR) where appropriate. The chi-square test was used to compare the categorical variables between the groups. The normality of distribution for continuous variables was confirmed with the Shapiro-Wilk test. To compare continuous variables between two groups, the Student's t-test or Mann-Whitney U test was used depending on whether the statistical hypotheses were fulfilled. All analyses were performed using the IBM SPSS Statistics Version 20.0 statistical software package. The statistical level of significance for all tests was considered 0.05.

RESULTS

While 44 toes of 36 patients (15 females, 21 males) were treated with the closed method, 51 toes of 39 patients (11

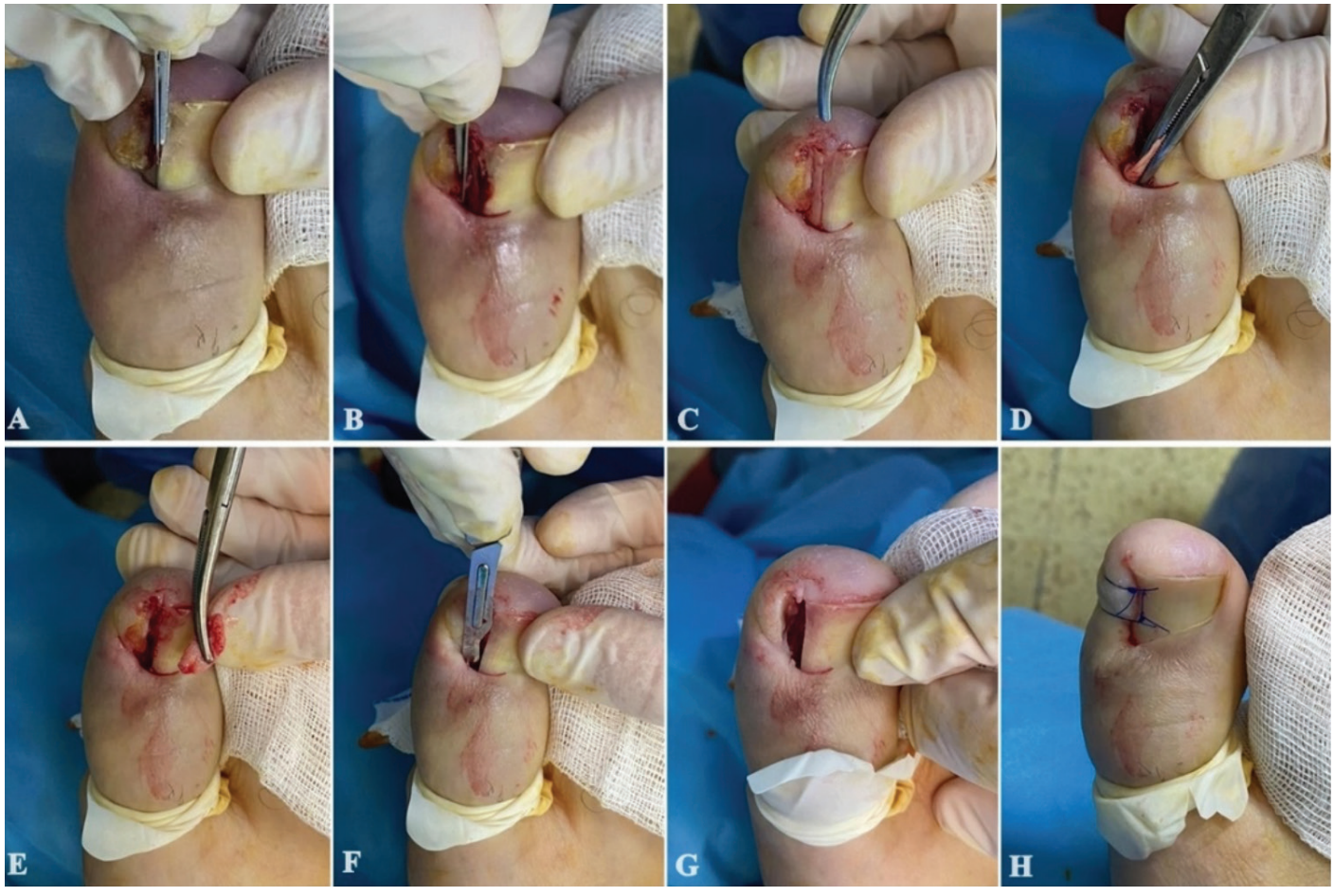

Figure 1. Partial nail plate excision and closed partial surgical matrixectomy steps. Partial excision of the ingrown part of the nail plate with the nail bed (A-E), debridement of the germinal matrix with the aid of a scalpel and curette (F-G), approximation of the nail fold to the nail plate with 3.0 monofilament sutures (H)

females, 28 males) were treated with the open method (Table 2). Eight patients in the closed method and 12 patients in the open method received bilateral ingrown toenails treatment in the same session. The median follow-up time was 29 (IQR: 36) months in the closed method and 44 (IQR: 25) months in the open method. The follow-up time was longer in the open method (p=0.036). The median age was 19 (IQR: 17.5) years in the closed method and 22 (IQR: 20) years in the open method (p=0.147). There was no difference in the pre-treatment Mozena class between the groups. In the closed group, 6 (14%) ingrown toenails were 2a, 19 (43%) ingrown toenails were 2b and 19 (43%) ingrown toenails were 3, while in the open group 10 (20%) ingrown toenails were 2a, 16 (31%) ingrown toenails were 2b, and 25 (%49) ingrown toenails were 3 according to the Mozena classification (p=0.457).

Table 2. Patients and Mozena class of toes

	Groups		p
	Closed (n=44)	Open (n=51)	
Age, mean ± SD	23.1±13.6	24.8±10.2	0.508
Gender, Female (%) Male (%)	 18 (41%) 26 (59%)	 16 (31%) 35 (69%)	0.334
Follow-up, months, median (IQR)	29 (36)	44 (25)	**0.036**
Mozena class, n (%) 2a 2b 3	 6 (14%) 19 (43%) 19 (43%)	 10 (20%) 16 (31%) 25 (49%)	0.457

SD: Standard deviation, IQR: Interquartile range

In the follow-ups, no wound problem/infection was observed in the closed treatment group, whereas wound problem/superficial infection was observed in 3 toes in the open group (p=0.024). All of these cases were treated with dressing and oral antibiotics, no new surgical procedure was needed. While the patients in the closed method returned to work/school in an average of 14.4±1.4 days, the patients in the open method were able to return to work/school in 17.8±2.7 days (p<0.001).

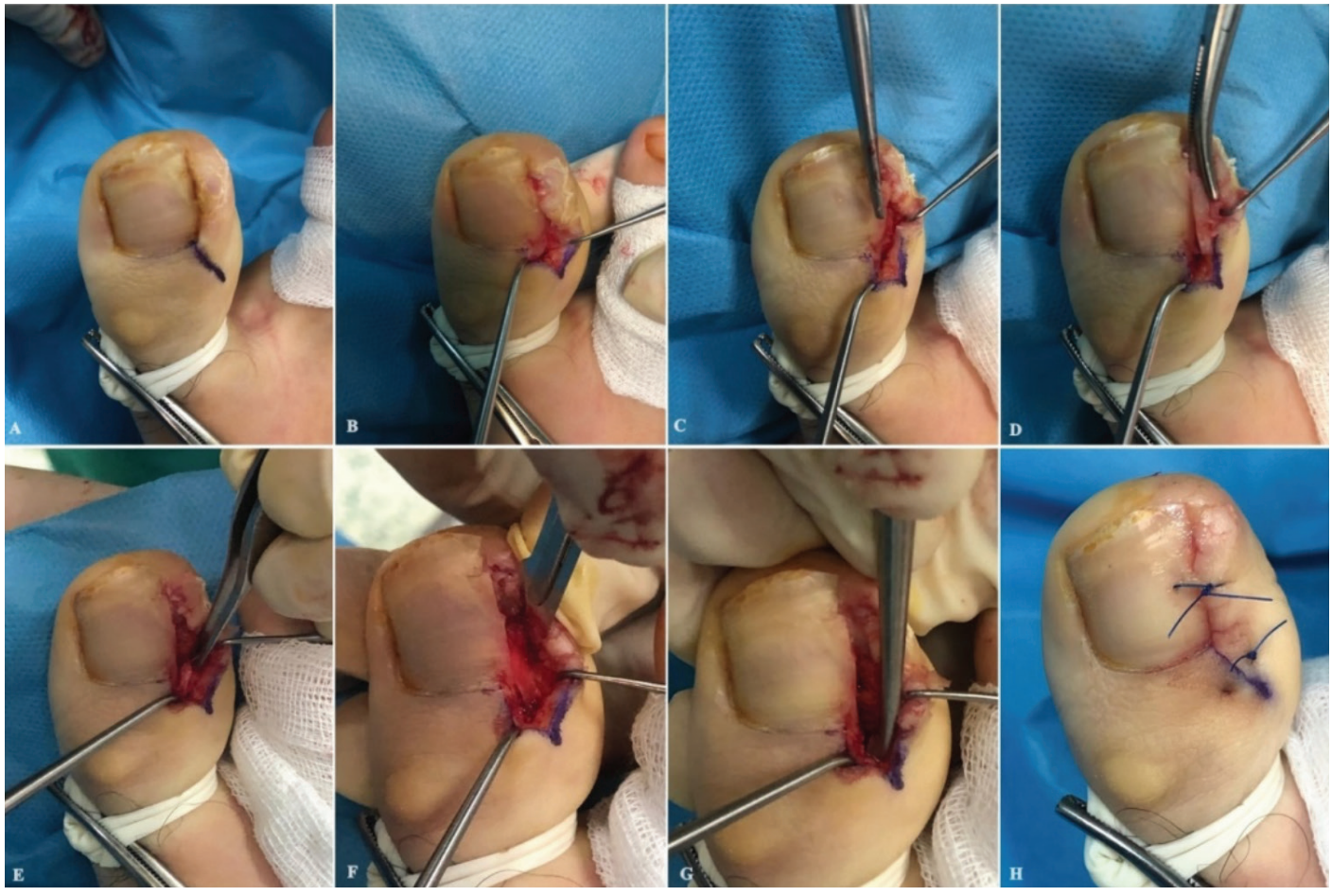

Figure 2. Partial nail plate excision and open partial surgical matrixectomy steps. Reaching the proximal nail plate and germinal matrix with an incision made at a 45 degree angle to the proximal nail fold **(A, B)**, excision of the lateral/medial ingrown part of the nail plate with scissors **(C, D)**, excision of the germinal matrix forming the ingrown nail plate together with the nail bed **(E, F)**, curette debridement of the germinal matrix **(G)**, suturing of the incision in the proximal nail fold, and approximation of the lateral/medial nail fold to the nail plate (H)

When the final cosmetic satisfaction of the toes was examined, it was 4.8±0.4 in the closed group and 4.2±0.7 in the open group (p<0.001). Overall satisfaction was 4.7±0.5 and 4.5±0.6 in closed and open groups, respectively (p=0.145). While there was a significant difference between the groups in terms of cosmetic appearance satisfaction, there was no difference in overall satisfaction (Table 3).

DISCUSSION

In our study, no recurrence was observed in either open or closed matrixectomy groups. However, a wound problem was observed in 3 cases who underwent open surgery. Although all 3 cases were treated with dressings and antibiotics, soft tissue infection also had the potential to develop osteomyelitis and total loss of the nail. In addition, the mean return to daily activities after wound healing in the closed method was shorter.

One of the complications of ingrown toenails is the deterioration of the cosmetic appearance of toes due to granulation tissue formation. In addition, open partial matrixectomy may cause scar tissue formation. In our study, satisfaction with the cosmetic appearance was higher in the group with closed matrixectomy. In both groups, patients were equally satisfied with overall satisfaction. However, cosmetic satisfaction was higher in the closed surgery group. Based on these advantages, a closed method might be recommended for ingrown toenail.

The ingrown toenail, also known as onychocryptosis, is a common health problem that can seriously affect the activities of daily living. While exudation and pain may limit the use of shoes, granulation tissue that develops in advanced cases may cause cosmetic dissatisfaction (1,2). In the early stages, treatment can be provided by methods such as placing cotton or dental floss under the ingrown nail plate, a hot water bath, and a gutter splint (1,2,7,8,11). In advanced stages, surgical treatment methods are preferable. The aim of surgical methods is to prevent the nail fold from disturbing the nail plate permanently. For this purpose, total/partial nail plate excision with/without matrixectomy can be performed together (9,12,13). Matrixectomy can also be performed surgically, chemically (phenol), and by cryotherapy (10-13). The ideal treatment method should be simple, provide permanent healing, have a low complication rate, provide fast recovery, and create a good cosmetic appearance at the end of the treatment.

Table 3. Results

	Groups		p
	Closed (n=44)	Open (n=51)	
Wound problems, n (%)	0 (0%)	3 (6%)	0.246
Cosmetic satisfactions, mean ± SD	4.8±0.4	4.2±0.7	**<0.001**
General satisfactions, mean ± SD	4.7±0.5	4.5±0.6	0.145
Back to work/school time, mean ± SD	14.4±1.4	17.8±2.7	**<0.001**

SD: Standard deviation

Partial nail plate excision with partial surgical matrixectomy has been a successful treatment method for a long time. It is frequently preferred due to the fact that the procedure can be performed with local anesthesia and the complication and recurrence rates are low (10-13). Misiak et al. (13) compared the cases that underwent phenol matrixectomy and electrocautery matrixectomy with partial nail plate excision and found 21.6% recurrence. Recurrence was more common in electrocautery matrixectomy (26.6% vs. 16.6%). Muriel-Sánchez et al. (15) reported that recurrence in patients who underwent phenol matrixectomy varied with the duration of phenol, and that increasing the duration of application reduced recurrence. However, Kim et al. (10) stated that chemical matrixectomy may cause uncontrolled damage to the soft tissue surrounding the germinal matrix, which may lead to infection, drainage and prolongation of healing (10). Bostancı et al. (16) stated that agents applied during chemical matrixectomy may cause nail dystrophy and discoloration. Barreiro et al. (17) recommended hydrogel application to protect the soft tissues around the germinal matrix from the caustic effect of phenol in cases that underwent phenol matrixectomy. Partial nail plate excision with partial matrixectomy can also be performed surgically. The aim of partial nail plate excision in surgery is to remove the ingrown nail plate from the nail fold. Regeneration of the nail plate causing the ingrowing is permanently prevented owing to excise the germinal matrix. Matrixectomy can be performed via open or closed methods. Performing it open theoretically makes it possible to completely remove the part of the germinal matrix that is desired to be excised. However, poor blood circulation of the proximal nail fold where the skin incision is made increased the likelihood of wound complications. In the literature, recurrence rates of partial nail plate excision with partial matrixectomy range from 0% to 15% (11,18-20). In the publication of Unal and Yuksekdag (21) with the highest number of cases in the literature (2.118 cases), the recurrence rate was reported at 1.7%. The risk of recurrence in surgical matrixectomy increases in elderly patients and relapsed cases (13,21). In our study, no recurrence was observed in either group. However, no wound complications were observed in the closed surgery group, whereas those were observed in three patients in the open surgery group. In addition, cosmetic satisfaction after the

treatment was higher in the closed surgery group. Therefore, closed surgery may be preferred, especially in patients with high cosmetic expectations.

The weaknesses of our study are that it was retrospective, the patients were not randomly selected, and the procedures were performed by different surgeons. In addition, the relatively small number of patients and the fact that it has not been compared with other treatment methods prevents it from forming a general opinion about the success of the method. Large, prospective studies are needed on the adequacy of the method.

CONCLUSION

Partial nail plate excision and surgical closed partial matrixectomy is a method that can be preferred with low complication and low recurrence rates in the treatment of patients in advanced-stage ingrown toenails. In addition, other advantages are that the cosmetic appearance does not deteriorate after the treatment and that it provides a quick return to normal daily activities.

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Ethics

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Selection of the Appropriate Population for Education to Prevent Pediatric Head Trauma

Haydar Gök, Gökhan Perçinoğlu

University of Health Sciences Turkey, Prof. Dr. Cemil Taşcıoğlu City Hospital, Clinic of Neurosurgery, İstanbul, Turkey

Abstract

Objective: Pediatric head trauma is one of the leading causes of childhood death. However, it is possible to reduce deaths with measures to be taken. Since it is important to educate the person(s) responsible for the care of the child and for whom the education should be applied first, we aimed to conduct a study to shed light on this situation.

Methods: 14,243 patients aged 0-6 years admitted to the emergency department with head trauma were included in the study. Apart from the routine parameters, who was responsible for the care of the patient during the trauma was questioned. It was investigated whether there was a correlation between the person(s) who took care of the patient and the severity of the trauma.

Results: It was determined that patients in all age groups were predominantly under maternal supervision. For the remaining patients, older siblings and fathers in younger age groups; in older age groups, grandmother, grandmother and grandfather played the role of caregiver. Non-family persons, who constitute a very small group in caregiving, show an equal distribution for age groups. The incidence of moderate head trauma was found to be higher in patients who were cared for by third parties, compared to other caregiver groups ($p<0.05$). No relationship was found between the mild and severe head trauma and caregiver groups.

Conclusion: Mortality and morbidity rates due to pediatric head trauma are high. It is possible to prevent traumas with the education of caregivers. Clinical experiences can provide guidance on what kind of training programs will be prepared and which groups of caregivers will receive these training primarily.

Keywords: Pediatric head trauma, community education, trauma preventive training

INTRODUCTION

Head trauma is one of the leading causes of mortality amongst the pediatric population in developed countries (1,2). Most of the childhood head traumas are preventable injuries; therefore, precautions can decrease the incidence rates and devastating consequences that may be attributed to trauma (3). Especially when preschool ages are examined, the importance of people who take care of the children increases. Moreover, educational level of the caregiver and the intensity of affection towards the child can affect the mechanism and severity of trauma. Children who are looked after by caregivers with male gender, low-income, teenage parenting or impulse control disorders have a higher risk of trauma (4). There are studies that demonstrate positive outcomes after parental training on preventing trauma (5). When examining pre-school pediatric head traumas in our society, identification of an individual that is responsible for the child's care is crucial for targeted solutions and educational planning. We aim to help in the quality and content of trauma education, along with decreasing trauma incidences.

METHODS

In the study, 14,243 pediatric patients were analyzed who were aged between 0-6 years and admitted with head trauma to the emergency department of our city hospital between 2016-2022.

Address for Correspondence: Haydar Gök, University of Health Sciences Turkey, Prof. Dr. Cemil Taşcıoğlu City Hospital, Clinic of Neurosurgery, İstanbul, Turkey
Phone: +90 506 309 29 65 **E-mail:** haydarctf@hotmail.com **ORCID ID:** orcid.org/0000-0002-5211-7388

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Patients were either evaluated by neurosurgeons primarily or consulted to neurosurgery department by other departments. Age, gender, and mechanism of trauma of the patients were recorded. The relationship between the caregiver and the patient was also noted. Mechanism of trauma was categorized as fall, traffic accident, assault and other causes (explosion, gunshot, etc.). The Glasgow Coma scale (GCS) was used in the evaluation of trauma severity and neurological status of the patients. Patients with a GCS of 13-15 were categorized as mild, GCS of 9-12 as moderate and GCS of 3-8 as severe trauma.

Along with other routine examinations, brain computed tomography (CT) was obtained from patients with moderate and severe head trauma. In patients with mild trauma, CT scans were performed only if there were signs of headache, vomiting, amnesia, drowsiness or mental/motor changes. Patients without these complaints were observed closely.

This study, the University of Health Sciences Turkey, Prof. Dr. Cemil Tascioglu City Hospital (04.04.2022, 89) approved.

Statistical Analysis

Statistical analysis was performed using Excel and the SPSS 22.0 statistical package software. Continuous variables were summarized as medians or means and standard deviations. The influence of all the categorical variables was tested using the chi-square test. A two-sided p value of <0.05 was considered to be statistically significant. A multivariate analysis was then carried out using a forward stepwise logistic regression analysis.

RESULTS

The mean age of 14,243 patients was 3.17 (±1.58). Five thousand four hundred twelve were female (38%) and 8.831 were male (62%). Falls were encountered in 12,391 (87%) patients, traffic accident was the cause of trauma in 1.709 (12%) and assault was noted in 143 (<2%) of patients. Majority of falls occurred from a cradle, parent's lap, seat or chair or from the ground height while playing or attempting to walk especially in toddlers. In addition, falls outside the home occurred while playing in the park or in the day-care center. Most of the traffic accident cases were in-vehicle and involved hitting the heads of children who were usually in their mother's embrace. Assaults were mainly caused by blunt trauma with toys or other objects that were thrown by a sibling or a playmate.

Fourteen thousand two hundred two patients had mild, 34 patients had moderate and seven patients had severe head trauma (Table 1). Sixty-seven patients were operated on epidural hematoma, subdural hematoma and displaced cranial fracture or open compression fracture (Table 2). Six hundred ninety-eight patients were hospitalized and monitored due to cranial fracture (linear, non-displaced), traumatic contusion or non-operative epidural/subdural hematoma (Table 3).

During the trauma of these patients, mothers in 12,027 patients, fathers or siblings in 767 patients, grandfathers or grandmothers in 1.292 patients and non-family members in 157 patients were responsible for caregiving. In all age groups, the mother was clearly the major attendee. Fathers and siblings were found to be more common in the first age groups and in older age groups, grandparents, who assumed the role of caregivers, came to the fore. Non-family persons were equal in all age groups (Table 4).

Statistically; moderate head trauma was more common in patients who were in the care of non-family individuals compared to other caregiver groups ($p<0.05$). No significant relationship was found between the caregiver groups in mild and severe traumas.

Table 1. Number of patients according to trauma severity

Trauma severity	Number of patients
Mild (GCS 13-15)	14,202
Moderate (GCS 9-12)	34
Severe (GCS 3-8)	7

GCS: Glasgow Coma scale

Table 2. Data of operated patients

Reason for operation	Number of patients
Compression fracture	37
Epidural hematoma	25
Subdural hematoma	5

Table 3. Patients hospitalized and followed up

Follow-up	Number of patients
Fracture	352
Contusion	243
Thin epidural/subdural hematoma	103

Table 4. Distribution of the number of patients according to the people who caregiver at the time of trauma and the severity of the trauma

Caregiver at the time of trauma	Trauma severity		
	Mild	Moderate	Severe
Mother	12,003	20	4
Father or sibling	762	3	2
Grandmother/father	1.290	1	1
Third person	147	10	0

DISCUSSION

Although ethnic and cultural differences can lead to demographic changes, the mother is the main person who takes care of the children because of the traditions of our society. In our study rate of the mother is 85%. In recent years, women are more involved in business life and their roles in socio-economic life have increased, thus caregiver support was desired for childcare. Because of our strong family relationships, family elders volunteered on the role of caregiving and salaried caregivers are very rare in our country unlike classical notions. In our study group, family members are favored to other third person caretakers. When the mother care-giving group is omitted, only in 6% a third person is giving the care, 94% a family member is taking care of the child.

The most common age range in childhood traumas has been determined as 3-7 years and in many studies, the rate of boys was found to be significantly higher than girls (3,6-9). However, between zero and three ages, no significant difference was observed between genders (10). Depending on the child's growth, the time spent outside the home increases, constant movement, and the desire to play makes the child more vulnerable to trauma. This situation is more evident in the male gender, and our study confirms this. Before the age 3, the incidence of trauma is same between genders but after age 3 male gender is more prone to trauma. After age 3, 62% of the patients were boys.

Shaken child syndrome has been reported more recently because of studies on awareness of the issue; however, there was no child with this diagnosis in our study. This can be caused by the inability to examine the trauma history in depth in emergency conditions or concealment of the truth by those responsible for the child's care. In our study, we think, having no information about the shaken baby syndrome in the records is also important information.

According to studies, anamnesis after autopsy could be obtained from the family in 40% of patients with a diagnosis of shaken child syndrome. Other families reported different causes of trauma (11). Even this situation indicates the importance of targeted education to family and other caregivers. Durkin et al. (5) showed that education on traffic rules and providing secure playgrounds had an essential role in decreasing trauma rates. However, in our study, caregiver education is of paramount importance due to the challenges in providing such a training for pre-school children.

CONCLUSION

In conclusion, pediatric head traumas cause many deaths and high expenditure in our country as well as all over the world. Education plays an important role in preventing undesirable consequences of trauma along with the training of the caregiver especially in pre-school era. Demographic structures of countries cause variation in the distribution of caregivers. In our study, according to our finding we suggest that if we are to choose a group of people to educate for child trauma that group must definitely include mothers. 85% of trauma takes place under maternal witness. If our resources are limited, we can omit the babysitters, because when the mother is not involved, %94 of the time a family member is giving the care at the time of trauma. Increasing the number of studies on this topic in our country will help in the quality and content of education, along with decreasing trauma incidences.

Ethics

Ethics Committee Approval: University of Health Sciences Turkey, Prof. Dr. Cemil Tascioglu City Hospital (04.04.2022, 89).

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Authorship Contributions

Surgical and Medical Practices: H.G., G.P., Concept: H.G., Design: H.G., Data Collection or Processing: G.P., Analysis or Interpretation: H.G., G.P., Literature Search: H.G., Writing: H.G., G.P.

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The Effect of Personality Traits on COVID-19 Stress Level During the COVID-19 Pandemic in Turkey

Fadime Bayrı Bingöl[1], Melike Dişsiz[2], Meltem Demirgöz Bal[1]

[1]Marmara University Faculty of Health Sciences, Department of Gynecology and Obstetrics, İstanbul, Turkey
[2]University of Health Sciences Turkey, Hamidiye Faculty of Nursing, Department of Gynecology and Obstetrics İstanbul, Turkey

Abstract

Objective: This study aimed to examine the relationship between personality traits and Coronavirus disease-2019 (COVID-19) stress level.

Methods: This descriptive correlational study was conducted between December 2020-January 2021 using an online survey of 360 participants. Data were collected using information form, COVID-19 stress scale, and the International Personality Item Pool-Big-Five inventory.

Results: The participants had a mean age of 28.43±6.88 years and their mean years of education was 15.0±2.24 years. The mean total score on the COVID-19 stress scale was 53.87±10.78 (17-73), indicating moderate stress. Evaluation of the relationship between personality traits and COVID-19 stress revealed a positive correlation between scores on the extroversion subscale of the personality inventory and the compulsive checking subscale of the COVID-19 stress scale. Agreeableness and conscientiousness scores were also positively correlated with the compulsive checking and danger/contamination subscales of the COVID-19 stress scale.

Conclusion: This study identified relationships between scores on the COVID-19 stress scale and the IPIP Big-Five factor markers. As high stress level is a risk factor for the development of psychiatric disorders, the early identification of stressed individuals is important improve public mental health.

Keywords: COVID-19, stress, personality traits

INTRODUCTION

The novel Coronavirus disease-2019 (COVID-19) is highly contagious and was declared a pandemic by the World Health Organization (WHO) just over three months after first appearing in China (1). Characterized by high morbidity and mortality rates, COVID-19 has negatively affected not only the physical health of infected individuals, but also the mental health of people worldwide by causing constant, high levels of stress (2-4). This extreme stress is a result of various factors such as the rapid spread of the virus, high mortality rates, fear of transmission, change in routines due to quarantine measures, helplessness, and inability to cope (5).

Initial findings from China indicated that more than a quarter of the general population experienced moderate to severe stress or anxiety-related symptoms in response to COVID-19 (4,5). Other studies have identified problems such as anxiety, depression, and somatization (4-6). These findings are similar to those previously reported during a 2003 quarantine in Toronto due to an outbreak of severe acute respiratory syndrome, in a 2014 quarantine in West Africa due to Ebola, and a Korean quarantine due to Middle East respiratory syndrome (7-10). Since March 11, 2020, the COVID-19 pandemic has dominated global current events, created major crises, and led to fear and stress, anxiety, and an anxiety syndrome characterized by avoidance, excessive checking, and anxiety in many people (1,11-13).

Address for Correspondence: Melike Dişsiz, University of Health Sciences Turkey, Hamidiye Faculty of Nursing, Department of Gynecology and Obstetrics İstanbul, Turkey
Phone: +90 543 799 51 43 **E-mail:** melekd78@gmail.com **ORCID ID:** orcid.org/0000-0002-2947-3915

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Stressors induced by the COVID-19 pandemic include quarantining, changes in routine, uncertainty and fear of the unknown, fear of infection, poor concentration, reduced physical activity and exposure to sunlight, sleep disturbances, changes in eating habits, and increased following of news and media about COVID-19 (2,14-18). Stress is actually an adaptive response by living organisms to internal and external threats, and is an extremely complex defense mechanism. Stress is not simply a response to a stimulus, but an interaction between the individual and the environment that involves subjective perception and evaluation of stressors, thus creating a highly personalized process. Therefore, stress and personality traits are interrelated (19,20).

Personality, which is determined largely by our genetic traits (60%) and the rest by environmental factors, makes us vulnerable or resistant to stressors. In other words, we respond to stress with our personality traits (20). Known worldwide as the most valid and reliable personality model, the Big-Five personality factors are a basic and comprehensive framework that classifies personality traits into five dimensions: extroversion, agreeableness, conscientiousness, neuroticism, and openness. Recent studies have indicated that personality traits are associated with certain behaviors and attitudes toward the COVID-19 pandemic (21-23). Although the relationship between the Big-Five personality traits, neuroticism, and depression and the mechanisms underlying these relationships are not completely clear, it is reported that positive coping styles (such as expressing negative emotions), avoidance, and seeking support may partially mediate the relationship between personality traits and mental health (19,24).

The serious problems caused by COVID-19 are also ongoing in our country. According to the WHO data, our country has the sixth highest number of cases in the world. Over 61,000 deaths have been attributed to COVID-19 since the start of the pandemic, and vaccination rates are still not at desired levels (25). Due to the weak and fragile nature of the country's economy, dozens of people lost their jobs due to the pandemic, and the frequency of suicide has been higher than ever before our history. All of these factors have increased stress levels among the Turkish population. Therefore, we believe it is important to examine the relationship between socio-demographic variables and personality traits. In this context, this study was conducted to examine the relationship between personality traits and level of COVID-19-related stress during the COVID-19 pandemic. Accordingly, the research questions are;

• What is the COVID-19 stress level of individuals?

• What is the relationship between personality traits of individuals and COVID-19 stress level?

• What is the effect of individuals' personality traits on COVID-19 stress level?

METHODS

Study Design and Sample

A descriptive correlational study was carried out using an internet-based data collection technique (Google Forms survey) between December 2020 and January 2021. The study population consisted of students enrolled in any department within the faculty of health sciences of a public university and their families. The improbable random sampling method was used in the sampling of the study. The sample of the study consisted of individuals between the ages of 18-60, who can understand and communicate in Turkish, who have access to the online data form (e.g., via smartphone, computer), who do not have any physical disability to participate in the study, between December 2020 and January 2021. First of all, in the research; 415 participants were reached with an online questionnaire form, but 55 participants who did not complete the questionnaire were excluded from the study and the study was terminated with 360 individuals.

Data Collection

Data were collected for this study using a personal information form, the COVID-19 stress scale, and the 50-item International Personality Item Pool (IPIP) Big-Five factor markers inventory.

Personal information form: This form consists of about the participants' individual characteristics age, education level, income level, chronic diseases, body mass index, smoking, place of residence, considers self at a high risk for COVID-19, face economic loss during the pandemic, family history of COVID-19 infection, feeling of defenseless against changes caused by the COVID-19 pandemic, fear of dying during the pandemic, and lost a relative due to the pandemic and history of COVID-19 contact.

COVID-19 stress scale: Taylor et al. (1) developed this scale to evaluate the stress experienced during the COVID-19 pandemic. Validity and reliability studies of the Turkish version were conducted by Demirgöz Bal et al. (25). The scale is a 36-item self-report scale designed to assess the severity of symptoms. As in the original form, the Turkish version has five subscales: COVID danger and contamination (items 1, 2, 3, 4, 5, 6, 19, 20, 21, 22, 23, and 24), COVID socio-economic consequences (items 7, 8, 9, 10, 11, and 12), COVID xenophobia (items 13, 14, 15, 16, 17, and 18), COVID traumatic stress (items 25, 26, 28, 29, and 30), and

COVID compulsive checking (31, 32, 33, 34, 35, and 36). There are no reverse-coded items in the scale. For each item, respondents choose the response option that most accurately describes their experience during the COVID-19 pandemic. Respondents rate to what degree and at what frequency they have experienced the feelings described in the items over the last 7 days on a 5-point scale from 0 (not at all/never) to 4 (extremely/almost always). Higher scores indicate a higher level of stress associated with the COVID-19 pandemic. In this study, the Cronbach's alpha value of the scale was determined as 0.94.

IPIP Big-Five factor markers: The IPIP Big-Five factor scale is 50- and 100 items. The validity and reliability study for the Turkish version of the 50-item inventory (B5KT-50-Tr) was conducted by Tatar (26). It is a self-report instrument with a 5-point Likert scale from 1 (disagree) to 5 (agree) and has five subscales that correspond to the Big-Five personality traits (extroversion, agreeableness, conscientiousness, emotional stability, and intelligence/imagination). In this study, it was determined that Cronbach's alpha values for the five sub-dimensions of the scale ranged from 0.81 to 0.90.

Ethics Statement

Before the study, permission to conduct scientific research related to COVID-19 was obtained from the Ministry of Health (2020-11-12T13_31_40). Approval for the study was then obtained from the Marmara University Faculty of Health Sciences Ethics Committee (26 November 2020/69). The study was conducted in accordance with the Declaration of Helsinki and the participants' consent was obtained at the beginning of the survey.

Statistical Analysis

The data were analyzed using SPSS version 21.0 software. Descriptive statistics were given as mean, standard deviation (±), and range for continuous variables and as frequency and percentage for categorical variables. The results of Kolmogorov-Smirnov test to evaluate the distribution of the data indicated that the data were normally distributed. Student's t-test or analysis of variance was used to compare the participants' socio-demographic and COVID-19 pandemic-related characteristics with their COVID-19 stress scale and B5KT-50-Tr scores. Pearson's correlation analysis was used to test the relationship between COVID-19 stress scale and B5KT-50-Tr scores. Multiple linear regression analysis was performed to determine the effect of personality traits on COVID-19 stress level. In this study, the statistical significance level was determined as $p<0.05$.

RESULTS

The mean age of the participants in the study was 28.43±6.88 years (range, 18-55), mean years of education was 15.03±2.24 years (range, 5-22), the majority of them (91.4%) were women, 8.6% were men, and mean number of people in the household was 3.73±1.80 (range, 1-11). Nearly a quarter (24.2%) of the participants reported having regular employment outside the home during the pandemic, 7.2% of the participants had seen a psychiatrist during the pandemic, and 6.9% had received a psychiatric diagnosis (Table 1).

The participants' mean total score on the COVID-19 stress scale was 53.87±10.78 (range, 17-73), indicating moderate stress. Mean subscale scores were 22.13±4.74 (range, 12-30) for danger and contamination, 6.90±1.36 (range, 4-10) for socio-economic consequences, 6.99±1.68 (range, 4-10) for xenophobia, 10.66±2.27 (range, 6-15) for traumatic stress, and 7.18±1.79 (range, 2-10) for compulsive checking.

On the COVID-19 stress scale, single participants had higher total and traumatic stress subscale scores than married participants, while participants with more than 15 years of education had higher scores in the compulsive checking subscale and lower scores in the xenophobia subscale compared to participants with 15 years of education or less ($p<0.05$). In addition, participants with any chronic disease (e.g., hypertension, diabetes) and those with children had significantly higher total scores and traumatic stress and xenophobia subscale scores ($p<0.05$) (Table 2).

When we examined the relationship between personality and COVID-19 stress, we determined that B5KT-50-Tr extroversion subscale score was positively correlated with compulsive checking subscale score on the COVID-19 stress scale. B5KT-50-Tr agreeableness and conscientiousness scores were positively correlated with scores in the compulsive checking and danger/contamination subscales of the COVID-19 stress scale. In addition, higher emotional stability scores on the B5KT-50-Tr were associated with lower total COVID-19 stress score and lower danger/contamination, xenophobia, and traumatic stress subscale scores. However, higher intelligence and imagination scores on the B5KT-50-Tr were associated with higher danger/contamination, compulsive checking, and total scores on the COVID-19 stress scale (Table 3).

According to our multiple linear regression analysis to determine the predictive value of the extroversion, emotional stability, and intelligence/imagination personality traits for COVID-19 stress level, these variables explained 23% of the total variance in COVID-19 stress level. It was determined that a 1-point increase

in emotional stability score on the B5KT-50-Tr was associated with a 0.628-point decrease in total COVID-19 stress score, while each 1-point increase in intelligence/imagination score was associated with a 0.606-point increase in total COVID-19 stress score (Table 4).

DISCUSSION

This study was conducted to determine the relationship between personality and socio-demographic characteristics and COVID-19 stress level. Our finding that single participants had higher mean traumatic stress subscale and total scores on the COVID-19 stress scale is similar to the results of other studies (27,28). Consistent with our findings, Tee et al. (29) also reported higher levels of stress, anxiety, and depression in single people. Participants in this study who had more than 15 years of education had higher scores in the compulsive checking subscale of the COVID-19 stress scale, while less educated participants had higher scores on the xenophobia subscale. As an individual's level of education increases, their awareness is higher and thus we expect their stress levels to be lower. However, although the highly educated participants in our study had a slightly lower mean total score on the COVID-19 stress scale, their higher score for compulsive checking may be a result of their efforts to cope effectively with the intense anxiety experienced during the pandemic. Similar to our study, participants with a high education level were reported to have fewer symptoms of anxiety, depression, and PTSD in a study by Liang et al. (30) and lower levels of stress in a study by Zager Kocjan et al. (31).

In this study, we observed that participants with children had higher COVID-19 stress scale total score and xenophobia and

Table 1. Socio-economic characteristics of the participants

		Number (n)	Percentage (%)
Economic status	Income less than expenses	101	28.1
	Income equivalent to expenses	225	62.5
	Income greater than expenses	34	9.4
Body mass index	<18.5 (underweight)	26	7.2
	18.5-24.9 (normal weight)	250	69.4
	>25.0 (overweight)	84	23.3
Comorbidity	Yes	30	8.3
	No	330	91.7
Smoking	Yes	61	16.9
	No	299	83.1
Place of residence	Rural area	31	8.6
	Suburban area	85	23.6
	Urban area	244	67.8
Considers self at high risk for COVID-19	Yes	46	12.8
	No	314	87.2
Faces economic loss during the pandemic	Yes	189	52.5
	No	171	47.5
Family history of COVID-19 infection	Yes	129	35.8
	No	231	64.2
Feeling of defenseless against changes caused by the COVID-19 pandemic	Yes	289	80.3
	No	71	19.7
Fear of dying during the pandemic	Yes	194	53.9
	No	166	46.1
Lost a relative due to the pandemic	Yes	65	18.1
	No	295	81.9
History of COVID-19 contact	Yes	127	35.3
	No	233	64.7

COVID-19: Coronavirus disease-2019

Table 2. COVID-19 stress scale total and subscale scores

Variable		Danger and contamination	Socio-economic consequences	Xenophobia	Traumatic stress	Compulsive checking	Total
		Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	
Marital status	Married (n=311)	30.56±10.21	5.38±6.04	11.44±6.94	7.16±5.91	11.65±5.55	66.22±21.54
	Single (n=49)	33.26±8.69	5.24±5.76	13.51±8.67	10.85±7.51	12.51±5.44	75.38±24.54
	t/p	-1.765/0.078	0.156/0.876	-1.867/0.063	**-3.920/0.000**	-0.987/0.324	**-2.429/0.016**
Education level	≤15 years (n=130)	31.59±9.44	5.58±6.34	12.72±6.90	8.03±6.54	10.43±5.20	68.36±24.43
	>15 years (n=230)	30.56±10.24	5.24±5.80	11.16±7.35	7.45±6.11	12.53±5.42	66.76±24.91
	t/p	0.939/0.348	0.511/0.680	**1.978/0.049**	0.834/0.405	**-3.469/0.001**	0.514/0.607
BMI	<18.5 (underweight) (n=26)[a]	30.19±8.99	3.69±4.88	12.11±5.55	8.84±5.46	10.50±4.98	65.34±16.68
	18.5-24.9 (normal) (n=250)[b]	31.05±9.80	4.98±5.59	11.62±6.91	7.12±5.76	11.92±5.34	66.70±23.16
	>25.0 (overweight) (n=84)[c]	30.82±10.79	7.04±7.11	11.89±8.55	8.89±7.65	11.73±6.50	70.39±30.61
	F/p	0.094/0.910	**4.935/0.008 c>a.b**	0.083/0.921	**3.021/.050 c>a.b**	0.755/0.471	0.801/0.450
Economic status	Income less than expenses (n=101)[a]	32.52±10.67	7.03±6.76	13.01±6.71	8.92±6.24	12.12±5.37	74.22±25.71
	Income equivalent to expenses (n=225)[b]	30.21±9.63	4.33±5.24	11.25±7.13	7.13±6.05	11.55±5.84	64.40±23.37
	Income greater than expenses (n=34)[c]	31.64±9.61	5.47±6.57	10.97±8.18	7.41±7.36	12.20±4.72	67.70±26.97
	F/p	2.146/0.118	**11.117/0.000 a>b**	2.293/0.102	2.877/0.058	0.479/0.620	**5.656/0.004 a>b**
Has children	Yes (n=38)	33.39±9.18	6.73±5.84	15.44±7.61	11.71±7.29	12.47±6.05	79.76±24.13
	No (n=322)	30.64±10.02	5.20±6.00	11.28±7.06	7.18±5.94	11.69±5.56	66.01±24.41
	t/p	1.265/0.207	-0.0142/0.887	**3.406/0.001**	**4.307/0.000**	0.811/0.418	**3.286/0.001**
Chronic health problem	Yes (n=30)	33.83±10.35	6.20±6.34	15.33±7.03	10.66±7.84	13.06±6.76	79.10±26.08
	No (n=330)	30.67±9.90	5.29±5.97	11.39±7.16	7.39±6.04	11.65±5.49	66.41±24.85
	t/p	1.667/0.096	0.792/0.429	**2.885/0.004**	**2.764/.006**	1.318/0.188	**2.716/0.007**
Family history of COVID-19	Yes (n=129)	32.42±9.52	6.04±6.35	11.86±7.03	7.99±6.74	11.84±5.71	70.16±25.51
	No (n=231)	29.29±10.20	4.62±5.50	11.57±7.45	11.84±5.71	11.69±5.50	64.48±23.51
	t/p	**3.010/0.003**	**3.350/0.025**	0.379/0.705	1.052/0.293	0.254/0.800	**2.190/0.029**
Economic loss due to pandemic	Yes (n=189)	30.55±10.22	4.85±6.59	10.45±7.62	7.05±6.54	11.69±5.30	65.21±26.05
	No (n=171)	31.14±9.83	5.65±5.63	12.43±6.91	7.67±6.12	11.81±5.56	68.72±23.89
	t/p	-0.537/0.591	-1.222/0.222	-2.505/0.013	-0.029/0.977	-0.195/0.845	-1.293/0.197
Fear of dying due to pandemic	Yes (n 194)	34.14±9.41	6.36±6.56	12.39±7.42	9.26±6.52	13.10±5.69	75.27±24.56
	No (n=166)	27.18±9.28	4.21±5.03	10.94±6.93	5.78±5.40	10.21±5.10	58.34±21.63
	t/p	**7.035/0.000**	**3.440/0.001**	1.899/0.058	**5.452/0.000**	**5.036/0.000**	**6.882/0.000**

F: One-Way ANOVA, t: Student's t-test, COVID-19: Coronavirus disease-2019, BMI: Body mass index, SD: Standard deviation

traumatic stress subscale scores than those without children. This finding supports the results of Brown et al. (32), who reported that COVID-19-related stressors and high anxiety and depressive symptoms were associated with higher perceived stress in parents. In contrast, Elbay et al. (33) reported that people who were married and had one or more children had lower scores on the depression anxiety and stress scale-21. This difference in results between studies may be due to differences in the populations studied, the measurement tools used, and cultural structure.

We also observed that participants with low income had higher xenophobia and total COVID-19 stress scores. Similarly, Brooks et al. (2) reported in their study that financial losses experienced during the pandemic had negative psychological effects on individuals, while Khan et al. (34) reported that people facing economic uncertainty exhibited common stress, anxiety, and depressive symptoms. Although the countries differ, the finding that people with low income experience higher anxiety and stress during the pandemic is a constant. A recent systematic review on the subject showed that unemployment was an important risk factor for mental health problems (35).

In this study, we determined that participants with chronic health problems scored high on the COVID-19 stress scale overall and in the xenophobia and traumatic stress subscales. This is consistent with previous studies indicating that psychological distress is higher among people with chronic diseases or poor health (5,36,37). In addition, we observed that participants who stated that they were afraid of dying due to the pandemic experienced intense COVID-19-related stress. The recent systematic review mentioned above also identified the presence of chronic disease as a risk factor for mental health disorders (35).

In addition, we observed higher COVID-19 stress scale scores among participants who knew someone who had COVID-19 infection. Similarly, Duan et al. (38) reported that having an infected friend or family member was associated with higher anxiety levels, and Wang et al. (5) reported that participants with family had high anxiety about the spread of COVID-19 among family members. This relationship between fear of loss of life and stress during the pandemic is likely due to the unavoidable interconnection of physical, psychological, social, and financial health.

In our study, we determined that participants exhibiting the personality trait of conscientiousness had high scores in the danger and contamination and compulsive checking domains of the COVID-19 stress scale. Individuals with high levels of responsibility tend to use active problem-focused solutions and usually avoid maladaptive emotion-focused coping strategies (39). This finding suggests that individuals with high scores on

Table 3. Comparison of COVID-19 stress scale and IPIP Big-Five factor markers 50-item inventory scores

COVID-19 stress scale and subscales	Big-Five 50-item personality test (B5KT-50-Tr) subscales									
	Extroversion		Agreeableness		Conscientiousness		Emotional stability		Intelligence/ imagination	
	r	p	r	p	r	p	r	p	r	p
Danger and contamination	0.021	0.698	0.182	**0.001***	0.136	**0.010***	-0.184	**0.000***	0.173	**0.001***
Socio-economic consequences	0.030	0.577	-0.046	0.389	0.024	0.654	-0.037	0.480	0.079	0.134
Xenophobia	-0.028	0.593	-0.037	0.489	0.008	0.874	-0.109	**0.038***	-0.070	0.188
Traumatic stress	-0.011	0.840	-0.069	0.189	-0.021	0.693	-0.108	**0.038***	0.062	0.239
Compulsive checking	0.161	**0.002***	0.145	**0.006***	0.159	**0.002***	0.049	0.351	0.202	**0.000***
Total	0.041	0.438	0.067	0.204	0.094	0.075	-0.132	**0.012***	0.120	**0.010***

r: Pearson correlation test, *p<0.05, COVID-19: Coronavirus disease-2019

Table 4. Multiple regression analysis of the effect of personality traits on COVID stress scale score

Variables personality trait	B	Standard error	Beta (β)	t	p
(Contrast)	51.211	8.604		5.952	0.000
Extroversion	0.373	0.263	0.105	1.421	0.156
Emotional stability	-0.628	0.170	-0.238	-3.695	**0.000**
Intelligence/imagination	0.606	0.258	0.145	2.349	**0.019**

R: 0.397, adjusted R2: 0.234, F: 6.854, p=0.000 Durbin Watson: 1.753, COVID: Coronavirus

the conscientiousness subscale may be more worried about careful planning and rational decision-making, especially when faced with a stressor.

It has been reported in the literature that personality traits are strongly associated with a wide range of important life outcomes, general well-being, physical and mental health, and stress (40). Similarly, in this study we found that lower scores for the personality trait of emotional stability were associated with higher stress levels. A similar study by Nikčević et al. (13) showed that individuals with neurotic personality traits had higher levels of COVID-19 anxiety.

In other studies, it was reported that depression, PTSD somatic symptoms, and anxiety were significantly higher in patients who had a history of COVID-19 infection (39,40). On the other hand, our results showed that participants with an extroverted personality tended to have compulsive behaviors. In other similar studies, extroversion was reported to be negatively related to emotion-focused coping, whereas another study suggested that individuals who scored high on the extroversion scale used active coping strategies and positive re-evaluation (38-40). This may be due to these individuals' efforts to cope with stress in order to minimize the negative effects of the stressor and the problem they are experiencing.

Studies have indicated that agreeableness, which is another dimension of the Big-Five personality model, is negatively associated with emotion-focused coping (39,40). In this study, we observed that participants who scored high on the agreeableness subscale also had high compulsive checking and danger/contamination scores. Although agreeableness is considered a positive feature that is especially helpful in times of crisis, the significant changes induced by the pandemic may have resulted in higher compulsive checking and danger/contamination scores due to the intensity of the stress experienced during the pandemic. All of these findings demonstrate that the five major personality traits are strongly related to levels of stress during the COVID-19 pandemic. Therefore, these results may facilitate the development of necessary interventions, treatments, and preventive measures.

We believe that during the pandemic, taking into account the role of personality in stress management, monitoring at-risk groups more closely, and providing early intervention when necessary are important to protect against other mental illnesses. In addition to the measures being implemented to fight the pandemic, increasing social support as much as possible, ensuring that people receive professional help when they feel unwell, and promoting a healthy diet, regular exercise, adequate sleep, and activities and hobbies that help manage stress are recommended to reduce stress levels during this period (40). As with many other diseases, it is essential to recognize psychiatric problems early and intervene before these problems progress and become chronic. As high stress level is a risk factor for the development of psychiatric disorders, the early identification of stressed individuals and provision of qualified care are important in order to protect their mental health and improve public mental health. Psychiatric personal play an important role in the early recognition, prevention, and when necessary, treatment referral of individuals with high levels of stress. Understanding the impact of the COVID-19 pandemic on people's stress levels is key in determining what precautions can be taken.

Study Limitations

Research data were collected through an online questionnaire. In addition, it is an important limitation that it is based on participants' self-report.

CONCLUSION

In accordance with the findings of this study, it is reasonable to argue that with, relationships between scores on the COVID-19 stress scale and the personality traits markers. Health professionals are pioneers in epidemics. We believe that during the pandemic, taking into account the role of personality in stress management, monitoring at-risk groups more closely, and providing early intervention when necessary are important to protect against other mental illnesses. As with many other diseases, it is essential to recognize psychiatric problems early and intervene before these problems progress and become chronic. As high stress level is a risk factor for the development of psychiatric disorders, the early identification of stressed individuals and provision of qualified care are important in order to protect their mental health and improve public mental health. Health professionals role in the early recognition, prevention, and when necessary, treatment referral of individuals with high levels of stress. Health professionals will contribute to the development of interventions to reduce their difficulties to protect and improve the psychosocial health of individuals and society in the possibility of encountering new pandemics in the future.

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Ethics

Ethics Committee Approval: Before the study, permission to conduct scientific research related to COVID-19 was obtained from the Ministry of Health (2020-11-12T13_31_40). Approval for the study was then obtained from the Marmara University Faculty of Health Sciences Ethics Committee (26 November 2020/69).

Informed Consent: The study was conducted in accordance with the Declaration of Helsinki and the participants' consent was obtained at the beginning of the survey.

Peer-review: Externally peer-reviewed.

Authorship Contributions

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

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Evaluation of COVID-19 Patients with the Assessment of Self-reported Olfactory Functioning and Olfaction-related Quality of Life Questionnaire

Doğan Çakan[1], Semih Uşaklıoğlu[2]

[1]İstanbul University-Cerrahpaşa, Cerrahpaşa Faculty of Medicine, Department of Otorhinolaryngology, İstanbul, Turkey
[2]University of Health Sciences Turkey, İstanbul Haseki Training and Research Hospital, Clinic of Otorhinolaryngology, İstanbul, Turkey

Abstract

Objective: This study aims to investigate the olfactory and taste disorders (OTD) in Coronavirus disease-2019 (COVID-19) and their effects on the quality of life (QoL).

Methods: This study was conducted between December 2021 and January 2022. The study group consisted of 30 COVID-19 patients, and the control group consisted of 30 healthy volunteers. The assessment of self-reported olfactory functioning and olfaction-related quality of life (ASOF) questionnaire was administered to all subjects. ASOF consists of 3 sections: The subjective olfactory capability scale (SOC), the self-reported capability of perceiving specific odors scale (SRP), and the olfactory-related quality of life scale (ORQ). The ASOF questionnaires, frequency, and type of OTD were examined.

Results: Twelve (30%) patients had olfaction disorders (OD). Five patients (16.66%) had anosmia, and 7 (23.33%) had hyposmia. Ten (33.33%) patients had taste disorders (TD). Seven (23.33%) patients had hypogeusia and 3 (10%) had ageusia. Nine (30%) patients defined the most disordered taste as salty taste and 1 (3.3%) described it as sweet. In the ASOF results, the number of subjects with abnormal olfactory abilities was 0 in the control group, and 12 in the study group the number of subjects with problems in odor perception was 0 in the control group, and 8 in the study group, the number of subjects with odor-related problems in QoL was 0 in the control group, and 12 in the study group. ASOF-SOC, ASOF-SRP, and ASOF-QRQ scores were significantly higher in the study group (p=0.001, p=0.001, p=0.001, respectively).

Conclusion: OTD is common in COVID-19 and may affect QoL.

Keywords: COVID-19, olfaction disorders, SARS-CoV-2, surveys and questionnaires, taste

INTRODUCTION

Coronavirus disease-2019 (COVID-19) has devastated the world order in all areas for about 3 years (1). COVID-19, caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), is the biggest global contagious disease that humanity has faced since the 1918 influenza pandemic (Spanish flu) (2,3).

The clinic of the disease is very variable. COVID-19 can be asymptomatic or can lead to death by causing complications (1-4). Symptoms of COVID-19 appear between 2 days and 2 weeks after exposure to the virus (5,6). In addition to symptoms such as fever, fatigue, muscle pain, nasal congestion, nasal discharge, cough, and shortness of breath seen in typical respiratory tract infections, high rates of smell and taste disorders are observed in COVID-19 (5,7). Olfactory disorders can be classed into two: Smell detection and smell identification disorders. Hyperosmia, hyposmia, and anosmia are defined as odor detection disorders, parosmia, phantosmia, and cacosmia are odor identification disorders (7).

Address for Correspondence: Doğan Çakan, İstanbul University-Cerrahpaşa, Cerrahpaşa Faculty of Medicine, Department of Otorhinolaryngology, İstanbul, Turkey
E-mail: drdgnckn@gmail.com **ORCID ID:** orcid.org/0000-0002-6283-2916

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Olfaction and taste are complex processes that have many components and affect the quality of life. There are assessment tools that examine the effect of olfactory disorders on quality of life (8). The assessment of self-reported olfactory functioning and olfaction-related quality of life (ASOF) survey, which is validated on the Turkish population, is one of them (8,9). This questionnaire, which evaluates the psychometric properties of patients with olfactory disorders, is used to distinguish between people with normal olfactory function and patients with hyposmia, as well as to evaluate the subjective symptom severity of patients (8).

The aim of this study was to determine the effect of smell and taste disorders on the quality of life in COVID-19 patients.

METHODS

This present cross-sectional study was conducted at Istanbul University-Cerrahpasa Cerrahpasa School of Medicine and Eyupsultan State Hospital between December 2021 and January 2022. This study, which complies with the World Medical Association Declaration of Helsinki, was approved by the Istanbul University-Cerrahpasa, Cerrahpasa Faculty of Medicine Clinical Research Ethics Committee (date-decision no: 03.08.2021-152409). Informed consents were obtained from all subjects.

Thirty subjects were selected randomly among the patients who applied to Eyupsultan State Hospital Emergency Service with at least one of the symptoms of COVID-19 on the first day of symptoms and were diagnosed with COVID-19 by reverse transcription-polymerase chain reaction. The study group was formed with these patients. Patients with chronic diseases, neurological and psychiatric diseases; patients with a history of head or facial trauma, upper respiratory tract surgery, regular drug use in the last 3 months, and smokers were excluded from the study. The control group consisted of 30 healthy individuals.

Data Collection

The contact informations of the subjects were obtained from the hospital records. Patients were called on day 7 of their COVID-19 diagnosis. The presence of smell and taste disorder symptoms was questioned in the patients. The patients were given a description of olfactory and taste disorders. Hyposmia was defined as decreased sense of smell, anosmia as the inability to perceive odors completely, parosmia as the perception of odors different from what they are, and phantosmia as the perception of the smell of something that is not (10). Hypogeusia was defined as a decrease in the sense of taste, while ageusia was defined as the absence of the sense of taste (11). The patients were asked which taste (sweet, salty, bitter, sour) perception problems they had the most. The ASOF questionnaire was applied to all the subjects. All questionnaires were administered by the same person via telephone.

Assessment of Self-reported Olfactory Functioning and Olfaction-related Quality of Life Survey

The assessment of self-reported olfactory functioning and olfaction-related quality of life (ASOF) questionnaire was developed by Pusswald et al. (8). This survey consists of 3 scales: The subjective olfactory capability scale (SOC), the self-reported capability of perceiving specific odors scale (SRP), and the olfactory-related quality of life scale (ORQ). The SOC consists of one item, SRP consists of 5 items, and ORQ consists of 6 items. The SOC scores olfactory performance between 0 (unable to smell) and 10 (best possible smell), and scores of 3 and below indicate abnormal smell capacity. The SRP measures the ability to perceive specific odors and a score of 2.9 or less indicates an odor disorder. The ORQ measures the olfactory quality of life, and scores of 3.7 and below indicate an impaired quality of life associated with an olfactory disorder (8,9).

Statistical Analysis

SPSS 22.0 program (IBM, USA) was used for statistical analysis. The normal distribution and homogeneity of data were evaluated with the Kolmogorov-Smirnov and Levene's tests, respectively. The comparisons were made with the Pearson chi-square test, and the Mann-Whitney U test. The significance level was accepted as $p<0.05$

RESULTS

Demographic data of the patients are presented in Table 1. There was no significant difference between the groups in terms of patient gender and age (p=0.791, p=0.188, respectively).

Smell disorders were detected in 12 (40%) patients. Five patients (41.66% of those with olfactory disorders and 16.66% of COVID-19 patients) stated that their symptoms were compatible

Table 1. The demographic characteristics of patients

Parameters		Control (n=30)	COVID-19 (n=30)	p
Gender	Male, n (%)	18 (60)	19 (63.33)	0.791*
	Female, n (%)	12 (40)	11 (33.67)	
Age (years)	Mean ± SD (median, min-max)	42.1±14.295 (47, 19-60)	37.33±9.932 (36.5, 24-60)	0.188**

*Pearson chi-square test, value: 0.071; df: 1, p>0.05, **Mann-Whitney U test p>0.05, SD: Standard deviation, COVID-19: Coronavirus disease-2019, min-max: Minimum-maximum

with anosmia and 7 (58.34% of those with olfactory disorders and 23.33% of COVID-19 patients) patients stated that their symptoms were compatible with hyposmia (Figure 1).

In the evaluation of ASOF questionnaires, while the number of subjects with abnormal olfactory abilities according to the SOC score was 0 in the control group, it was 12 in the study group. According to the SRP score, the number of subjects with problems in their odor perception capacity was 0 in the control group, while it was 8 in the study group. According to the QRQ score, the number of subjects with odor-related problems in their quality of life was 0 in the control group, while it was 12 in the study group. The statistical data of ASOF questionnaires are given in Table 2. In the examination of ASOF scores, ASOF-SOC, ASOF-SRP, and ASOF-QRQ scores were significantly higher in the study group (p=0.001, p=0.001, p=0.001, respectively).

Ten (33.33%) of the COVID-19 patients stated that they had taste disorders. Five of these patients had anosmia and 5 of them had hyposmia. Hypogeusia was found in 7 (23.33%) patients and ageusia in 3 (10%) patients. All patients with ageusia also had anosmia. Nine (30%) of the patients defined the most disordered taste as salty taste and one patient (3.3%) described it as sweet. The patient who had trouble perceiving the sweet taste had anosmia.

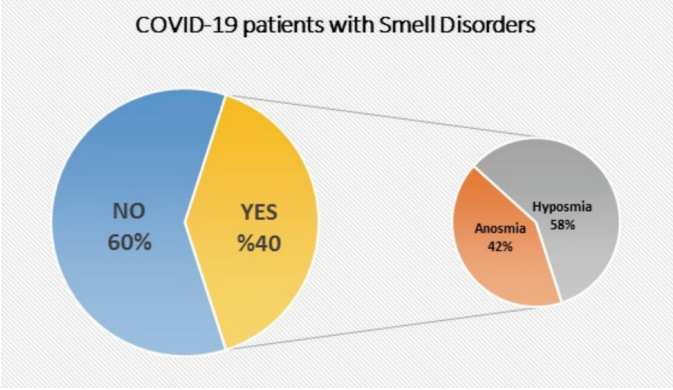

Figure 1. The evaluation of smell disorders in COVID-19 patients
COVID-19: Coronavirus disease-2019

Table 2. Statistical analysis of the assessment of self-reported olfactory functioning and olfaction-related quality of life (ASOF) questionnaires

Test domains	Control Mean ± SD (Median, min-max) (n=30)	COVID-19 Mean ± SD (Median, min-max) (n=30)	p
ASOF-SOC[a]	7.2±1.788 (7.4-10)	4.866±2.474 (4.5, 1-9)	**0.001***
ASOF-SRP[b]	4.9±0.305 (5.4-5)	3.867±1.332 (5.2-5)	**0.001***
ASOF-ORQ[c]	4.867±0.346 (5.2-6)	3.8±1.399 (5.2-6)	**0.001***

[a]The subjective olfactory capability scale, [b]The self-reported capability of perceiving specific odors scale, [c]The olfactory-related quality of life scale, *Mann-Whitney U test p<0.05, SD: Standard deviation, COVID-19: Coronavirus disease-2019, min-max: Minimum-maximum, SOC: Subjective olfactory capability scale, ASOF: Self-reported olfactory functioning and olfaction-related quality of life, ORQ: Olfactory-related quality of life scale, SRP: Self-reported capability of perceiving specific odors scale

DISCUSSION

Olfaction and taste disorders are on the COVID-19 symptom list of different associations (5,12). This study has shown that 40% of COVID-19 patients have olfactory disorders, 33% taste disorders, and 33% smell and taste disorders. The most common taste disorder is hypogeusia, while hyposmia is the most common olfactory disorder with a rate of 58%. The most common taste disorders are in salty taste. In the ASOF questionnaire, the ability to smell, perceive to smell, and odor-related problems in the quality of life are significantly higher in the COVID-19 patient group than in the control group.

Although COVID-19 has flu-like symptoms associated with rhinology, loss of smell and taste are the most specific symptoms (13). The rate of smell and taste disorders seen in COVID-19 has been determined as 41-62% (14,15). Smell disorders, which are more common in mildly symptomatic patients and females, are the good prognostic indicator for COVID-19 (14,15). Although the Sniffin' Sticks test, which is a semi-objective test, is used in studies examining the relationship between COVID-19 and smell and taste disorders, there are many self-reported survey based studies (14-16).

In this study, the ASOF questionnaire, which was shown to be highly correlated with the sniff sticks test, was used to examine the smell disorders in COVID-19 patients instead of the sniff sticks test with the thought that the sniff sticks test would increase the risk of COVID-19 transmission (8,9). COVID-19 is divided into 3 periods (17). In this study, smell and taste disorders, which have been shown to be the initial symptom in previous studies, were examined in the acute phase of the disease (14,15). Since smell and taste disorders due to COVID-19 are affected by patient gender and age, and smoking, the study groups were created statistically similar according to patient age and gender, and smokers were excluded (14,15). In addition, the rate of smell disorders in COVID-19 is different in inpatients and outpatients (18,19). Therefore only outpatients were included in this study.

Although the relationship between smell and taste disorder and COVID-19 is definitely known, the pathophysiology of these symptoms is not known precisely (14-20). There are limited studies on the pathophysiological mechanism of taste disorders in COVID-19. The expression of the ACE-2 receptor, to

which SARS-CoV-2 is attached, is quite high in the tongue (21). This expression is in epithelial cells in the basal region of the filiform papillae rather than in the taste buds (22). Therefore, it is thought that the local inflammation that occurs after the infection of tongue epithelial cells by the virus causes damage to the taste receptors and causes taste disorders (23). In the pathophysiology of the olfactory disorders, SARS-CoV-2 binds to ACE-2 and transmembrane serine protease 2 receptors in the nasal mucosa and causes an inflammation that damages nasal support cells and olfactory cells (24,25). In addition, the transmission of the sense of smell and taste may also be affected due to the direct neuroinvasive properties of SARS-CoV-2 (11).

In this study, smell disorders were detected in 40% of the patients. In the evaluation of smell disorders type, 41.66% of the detected smell disorders are anosmia and 58.34% of the smell disorders are hyposmia. Taste disorders were found in 33.3% of the patients. In the evaluation of taste disorders type 70% of the detected taste disorders are hypogeusia and 30% of the taste disorders are ageusia. Half of the patients with taste disorders have anosmia and the other half have hyposmia. All patients with ageusia also have anosmia. The most frequently spoiled taste is salty at the rate of 90%. These results of the present study are compatible with the literature (11,20). In the evaluation of the ASOF questionnaire, it was shown that the ability to smell and perceiving odors are affected in COVID-19 patients, and this effect affects the quality of life.

Study Limitations

Some factors limit the value of this study. The first limitation is that the data of the study was obtained by questionnaires. This method was chosen in order to prevent the transmission of the disease. Another limitation is that all patients included in the study were receiving Favipiravir treatment. Favipiravir is known to have neurological effects (26). Some of the smell and taste disorders in the patient group may have been seen due to this effect. The last limitation is the limited number of patients. Despite all these limitations, this study is a valuable study that examines the smell and taste disorders seen in COVID-19 patients with numerical statistical data and it is the first in the literature with the used evaluation method

CONCLUSION

Smell and taste disorders are one of the most common symptoms of COVID-19. These symptoms, which are often seen together, may affect the quality of life. The data we obtained need to be supported by larger studies.

Ethics

Ethics Committee Approval: This study, which complies with the World Medical Association Declaration of Helsinki, was approved by the Istanbul University-Cerrahpasa, Cerrahpasa Faculty of Medicine Clinical Research Ethics Committee (date-decision no: 03.08.2021-152409).

Informed Consent: Informed consents were obtained from all subjects.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: D.Ç., S.U., Concept: D.Ç., S.U., Design: D.Ç., S.U., Data Collection or Processing: D.Ç., S.U., Analysis or Interpretation: D.Ç., Literature Search: S.U., Writing: D.Ç., S.U.

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

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ORIGINAL ARTICLE

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Demographic and Clinical Findings of Refugee COVID-19 Patients Admitted to the Emergency Department

Mehmet Esat Ferhatlar[1], Edip Burak Karaaslan[1], Mücahit Şentürk[1], Yavuzselim Koca[2], Ahmet Demirel[3], Asım Kalkan[1]

[1]University of Health Sciences Turkey, Prof. Dr. Cemil Taşcıoğlu City Hospital, Clinic of Emergency Medicine, İstanbul, Turkey
[2]University of Health Sciences Turkey, Kanuni Sultan Süleyman Training and Research Hospital, Clinic of Emergency Medicine, İstanbul, Turkey
[3]University of Health Sciences Turkey, Basakşehir Çam and Sakura City Hospital, Clinic of Emergency Medicine, İstanbul, Turkey

Abstract

Objective: Turkey is one of the countries hosting the highest number of refugees in the world. The aim of this study was to examine the demographic and clinical data and the hospital costs of refugees who presented at the emergency department (ED).

Methods: The study included 1004 patients aged >18 years who presented at the hospital ED between 1 April 2020 and 31 December 2020. The Mann-Whitney U test was applied to comparisons of two groups and the Kruskal-Wallis test to more than two groups. Categorical variables were compared using the Pearson chi-square, Fisher's Exact chi-square test, or the Fisher-Freeman-Halton test.

Results: The rates of chronic obstructive pulmonary disease (COPD) and cerebrovascular disease (CVD) (40%) were seen to be higher in patients in the intensive care units than in those in the wards. It was observed that the costs of the group hospitalized from the ward to the intensive care unit were higher ($p<0.001$).

Conclusion: Patients with COPD and CVD were seen to have a more severe disease course. There is a need for further studies to be able to better understand how refugees are affected by Coronavirus disease-2019.

Keywords: COVID-19, refugee, SARS-CoV-2, emergency department

INTRODUCTION

In the city of Wuhan in Hubei province, China, a new coronavirus causing Coronavirus disease-2019 (COVID-19) was identified in December 2019 (1). As of 15 September 2021, COVID-19 has infected 225,024,781 people worldwide and caused 4,636,153 deaths (2). In Turkey, as of the same date, 6,710,666 people have been infected, and 60,393 deaths have been recorded (3). For various reasons such as war, violence, oppression, and violation of human rights, approximately 26,400,000 refugees worldwide have had to abandon their homes and journey to other countries (4). The COVID-19 pandemic has negatively affected refugees because of problems experienced in various areas, such as health, education, economic, mental health, and language barriers (5). The ability of states to provide a free, fair, and accessible healthcare service significantly prevents the spread of COVID-19 (6). As the health status of refugees is affected considerably more than that of the average population, the emergency healthcare services presented during the COVID-19 pandemic should not exclude any individuals and should include refugees in addition to all vulnerable groups (7).

Since 2014, Turkey has accepted many refugees, of which approximately 3.7 million are of Syrian origin, and 532,726 live in Istanbul (8). Refugee rights in Turkey are protected by a comprehensive legal infrastructure such as the Law on Foreigners

Address for Correspondence: Mehmet Esat Ferhatlar, University of Health Sciences Turkey, Prof. Dr. Cemil Taşcıoğlu City Hospital, Clinic of Emergency Medicine, İstanbul, Turkey
Phone: +90 506 805 25 33 **E-mail:** dresatferhatlar@gmail.com **ORCID ID:** orcid.org/0000-0002-3497-8547

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and International Protection (2013) and the Temporary Protection Regulation (2014) (9). All refugees in Turkey have free access to health services and have the same rights as Turkish citizens (10). There is no study in the literature examining the clinical data of refugees diagnosed with COVID-19.

The study aimed to examine the demographic and clinical data and the hospital costs of refugees who presented at the emergency department (ED) and were diagnosed with COVID-19 to evaluate the clinical effects and outcomes on refugees of the healthcare policies applied during the COVID-19 pandemic.

METHODS

Study Design

This retrospective study was conducted in the ED of the University of Health Sciences Turkey, Prof. Dr. Cemil Tascioglu City Hospital. Approval for the study was granted by the Local Ethics Committee of University of Health Sciences Turkey, Prof. Dr. Cemil Tascioglu City Hospital in January 2021 (decision no: E-48670771-514.10). The first refugee patient diagnosed with COVID-19 applied to our hospital in April 2020. The electronic health record system of refugee patients who presented at the ED between 1 April 2020 and 1 January 2021 was examined. Our hospital is a training and research hospital with emergency medicine specialists and residents working in the ED pandemic area. Although case numbers have varied from time to time in Turkey, the daily average of patients examined is 500.

Participants

The study included patients aged >18 years with refugee status, who presented at the ED pandemic area of our hospital and had COVID-19 infection confirmed with real-time reverse transcriptase-polymerase chain reaction (rt-PCR) test. Patients under the age of 18, negative rt-PCR test, missing data in their electronic health records, and exposure to trauma (traffic accident, fall, assault, etc.) were not included.

Collection of Data

Data were retrieved from the hospital's electronic health records in respect of demographic and clinical data including age, gender, nationality, complaints on admission, history of chronic diseases, laboratory test results, thorax computed tomography reports, and the length of stay in the ward, length of stay in ICU, treatment results, and costs. The data were evaluated by two emergency medicine specialists. The calculation of costs included laboratory tests, radiological imaging, drug and bed costs. Costs were obtained from the hospital's information management system. The exchange rate used was fixed as 1 USD =8.50 TL.

Statistical Analysis

Data obtained in the study were analyzed statistically using SPSS for Windows vn. 21.0 software (IBM Corp., Armonk, NY, USA). The conformity of the data to a normal distribution was assessed using the Shapiro-Wilk test. According to the normality test results, continuous variables were presented as median (minimum: maximum) values and categorical variables as number (n) and percentage (%). The Mann-Whitney U test was applied to the comparisons between two groups, and the Kruskal-Wallis test to comparisons of more than two groups. Multiple comparison procedures were performed using the Dunn-Bonferroni approach to identify different group or groups after the Kruskal-Wallis test. The Pearson chi-square, Fisher's Exact chi-square, or the Fisher-Freeman-Halton test was used in the comparisons of categorical variables. A value of $p<0.05$ was considered statistically significant.

RESULTS

Within the defined study period, a total of 133,289 patients presented at the ED pandemic area. Three thousand four hundred eighty-six patients were in refugee status. Of these, 2096 had a negative rt-PCR test result, 114 had been exposed to trauma, and the electronic health records of 272 were incomplete. One thousand-four patients were included in the study. The patients included in the study were separated into two groups those treated as outpatients with the recommendation for home quarantine and hospitalized patients. The in-patients were divided into three groups those admitted to wards, those transferred to the ICU from wards, and those admitted directly to the ICU (Figure 1).

The patients included in the study comprised 47.41% females and 52.59% males with a median age of 33 years (range, 18-86 years). The median age of hospitalized patients [48 years (range, 22-85 years)] was seen to be statistically significantly higher than that of discharged patients [31 years (range, 18-86 years)] ($p<0.001$). The discharged patients comprised 44.81% females and 55.19% males, and the hospitalized patients comprised 61.54% females and 38.46% males. The difference between discharged and hospitalized patients in respect of gender was statistically significant ($p<0.001$) (Table 1).

In the examination of the symptoms of patients, the complaint of fever was determined in 45.52%. The rate of fever in hospitalized patients (58.97%) was found to be statistically and significantly higher than in discharged patients (42.92%) ($p<0.001$). Shortness of breath was determined in 27.29% of all the patients, at a statistically significantly higher rate in

hospitalized patients than in discharged patients (64.10% vs. 20.52%) (p<0.001) (Table 1).

The median cost of the patients was 128 TL (range, 75-126,908 TL). These costs were found to be statistically significantly higher for hospitalized patients (median 5690 TL; range, 170-126,908 TL) than for discharged patients (median 120 TL; range,75-1608 TL) (p<0.001) (Table 1).

In comparing the groups of patients admitted to wards, those transferred to ICU from wards, and those admitted directly to ICU, a statistically significant difference was determined regarding age (p=0.001). The median age of patients transferred to the ICU from the ward (58 years; range, 24-80 years) was statistically significantly higher than that of patients on the ward (41 years; range, 22-85 years). No significant difference was determined between the groups regarding gender or the rate of hospitalized pregnant patients (p=0.738, p=0.756, respectively) (Table 2).

A statistically significant difference was determined between the hospitalized patient groups in respect of the presence of chronic obstructive pulmonary disease (COPD) and cerebrovascular disease (CVD) (p=0.016, p=0.002, respectively). The rates of COPD and CVD were higher in the patients in ICU than in those on the wards (Table 2).

Statistically significant differences were determined between the groups regarding leukocyte and neutrophil values (p=0.018, p=0.008, respectively). The median leukocyte and neutrophil values of the ICU patients were higher than those of the patients in the wards. The hemoglobin and lymphocyte values were determined to be statistically significantly higher in the ICU patients compared to the patients in the wards (p=0.010, p<0.001, respectively) (Table 2).

The C-reactive protein (CRP), urea, Hs troponin I, and ferritin values were statistically significantly lower in the patients in the wards compared to the patients transferred to ICU and those admitted directly to ICU (p<0.001). The median procalcitonin and D-dimer values were statistically significantly higher in the ICU patients than in the patients in the wards and those transferred to ICU from the wards (p<0.001) (Table 2).

The difference between the groups regarding costs was statistically significant (p<0.001). The median costs of the patients in the wards were lower than those of patients transferred to the ICU and those admitted directly to ICU. The

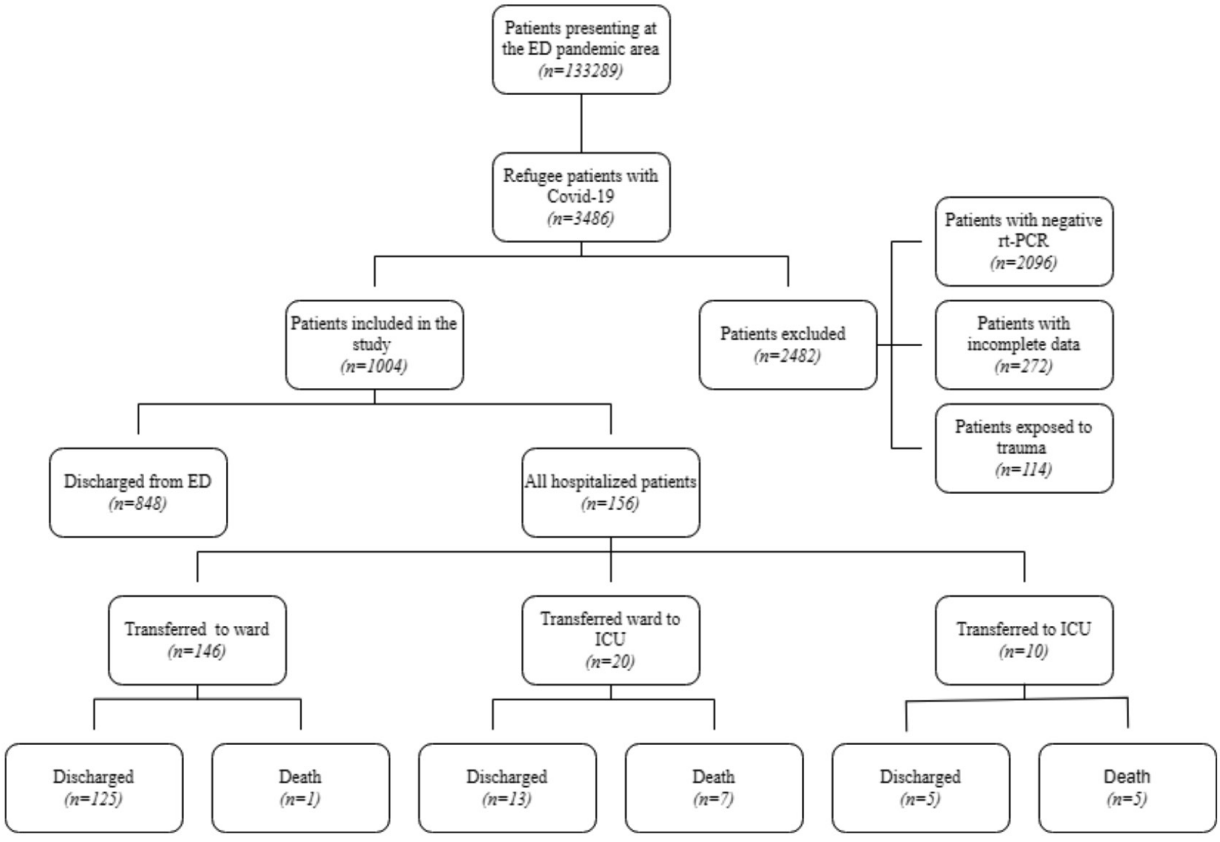

Figure 1. Patient selection flow chart

ED: Emergency department, ICU: Intensive care unit, COVID-19: Coronavirus disease-2019, rt-PCR: Reverse transcriptase-polymerase chain reaction

median total length of stay in the hospital was statistically significantly longer in the patients transferred from the ward to ICU than for patients on the ward and those admitted directly to ICU (p<0.001) (Table 2).

A statistically significant difference was determined between the groups regarding prognosis (p<0.001). The mortality rate of patients in the ICU and transferred to the ICU was higher than those of patients in the wards. In the comparisons of the other data presented in the table, there was no statistically significant difference (p>0.05) (Table 2).

DISCUSSION

In this study, the demographic and clinical data of refugee patients with COVID-19 were examined, and it was determined that as age increased, so the probability of admission to the hospital increased. This finding supported a study by Verity et al. (11) in which increased age was determined to increase hospital admission. This was attributed to more comorbidities and underlying health conditions in patients of an older age. In the current study, there was also seen to be an increase in comorbidities as age increased. In the study of Elmoheen et al. (12) patients who died were more

Table 1. Characteristics of the patients included in the study

	All patients (n=1004)	**Home quarantine (n=848)**	**Hospitalised (n=156)**	**p value**
Age (years)	33 (18:86)	31 (18:86)	48 (22:85)	**<0.001***
Gender				
Female	476 (47.41%)	380 (44.81%)	96 (61.54%)	**<0.001****
Male	528 (52.59%)	468 (55.19%)	60 (38.46%)	
Nationality				
Syria	724 (72.11%)	618 (72.88%)	106 (67.95%)	**0.006****
Iraq	90 (8.96%)	74 (8.73%)	16 (10.26%)	
Iran	40 (3.98%)	28 (3.30%)	12 (7.69%)	
Afghanistan	98 (9.76%)	78 (9.20%)	20 (12.82%)	
Other	52 (5.18%)	50 (5.90%)	2 (1.28%)	
Symptoms				
Fever	456 (45.42%)	364 (42.92%)	92 (58.97%)	**<0.001****
Cough	580 (57.77%)	490 (57.78%)	90 (57.69%)	0.983**
Shortness of breath	274 (27.29%)	174 (20.52%)	100 (64.10%)	**<0.001****
Loss of sense of taste	98 (9.76%)	86 (10.14%)	12 (7.69%)	0.344**
Nausea	42 (4.18%)	26 (3.07%)	16 (10.26%)	**<0.001****
Vomiting	38 (3.78%)	28 (3.30%)	10 (6.41%)	0.062**
Abdominal pain	34 (3.39%)	28 (3.30%)	6 (3.85%)	0.730**
Diarrhea	32 (3.19%)	16 (1.89%)	16 (10.26%)	**<0.001*****
Myalgia	74 (7.37%)	48 (5.66%)	26 (16.67%)	**<0.001****
Headache	42 (4.18%)	28 (3.30%)	14 (8.97%)	**0.001****
Sore throat	36 (3.59%)	28 (3.30%)	8 (5.13%)	0.260**
Listlessness	148 (14.74%)	110 (12.97%)	38 (24.36%)	**<0.001****
Syncope	20 (1.99%)	18 (2.12%)	2 (1.28%)	0.755***
Hemoptysis	10 (1.00%)	6 (0.71%)	4 (2.56%)	0.055***
Pregnancy	34 (3.39%)	20 (2.36%)	14 (8.97%)	**<0.001****
Costs	128 (75:126908)	120 (75:1608)	5690 (170:126908)	**<0.001***
Thorax CT				
Not taken	614 (61.16%)	574 (67.69%)	40 (25.64%)	**<0.001****
Findings present	288 (28.69%)	174 (20.52%)	114 (73.08%)	
Findings absent	102 (10.16%)	100 (11.79%)	2 (1.28%)	

Data are expressed as n (%), median (minimum: maximum), *Mann-Whitney U test, **Pearson chi-square test, ***Fisher's Exact test, CT: Computed tomography

Table 2. Findings of hospitalised patients according to the unit where they were treated					
	Total hospitalized (n=156)	**Ward (n=126)**	**From ward to ICU (n=20)**	**ICU (n=10)**	**p value**
Age (years)	47.50 (22:85)	41 (22:85)[a]	58 (24:80)[b]	57 (44:64)[a,b]	**0.001*****
Gender					
Female	96 (61.54%)	76 (60.32%)	14 (70%)	6 (60%)	0.738**
Male	60 (38.46%)	50 (39.68%)	6 (30%)	4 (40%)	
Pregnancy	14 (8.97%)	12 (9.52%)	2 (10.00%)	0	0.756**
Hypertension	36 (23.08%)	26 (20.63%)	6 (30%)	4 (40%)	0.244**
Diabetes mellitus	38 (24.36%)	28 (22.22%)	8 (40%)	2 (20%)	0.239**
Chronic obstructive lung disease	16 (10.26%)	10 (7.94%)[a]	2 (10%)[a,b]	4 (40%)[b]	**0.016****
Coronary artery disease	21 (14.10%)	18 (14.29%)	2 (10%)	2 (20%)	0.814**
Cerebrovascular disease	10 (6.41%)	6 (4.76%)a	0a	4 (40%)[b]	**0.002****
Chronic kidney disease	10 (6.41%)	6 (4.76%)	2 (10%)	2 (20%)	0.074**
Malignancy	8 (5.13%)	6 (4.76%)	2 (10%)	0	0.458**
Leukocyte (10^3/µL)	7.26 (0.97:24.99)	7.15 (0.97:23.12)[a]	7.31 (3.91:22.23)[a,b]	11.71 (2.35:24.99)[b]	**0.018*****
Hemoglobin (g/L)	128 (63:164)	131 (63:164)[a]	119.5 (92:146)[b]	120 (104:142)[b]	**0.010*****
Neutrophil count (10^3/µL)	5.46 (0.81:24.05)	5.04 (0.81:19.82)[a]	6.19 (2.34:20.45)[a,b]	10.74 (1.48:24.05)[b]	**0.008*****
Lymphocyte count (10^3/µL)	1.13 (0.47:3.44)	1.22 (0.47:3.44)[a]	0.96 (0.54:2.20)[b]	0.69 (0.48:1.28)b	**<0.001*****
Platelet count (10^3/µL)	212 (19:623)	206 (19:623)	225 (72359)	272 (60:354)	0.780***
C-reactive protein (mg/L)	45.97 (0.05:294.23)	26.65 (0.05:259.33)[a]	103.88 (33.81:230)[b]	188.57 (125.05:294.23)[b]	**<0.001*****
Alanine aminotransferase (U/L)	20 (6:202)	21 (6:157)[a,b]	15 (6:39)[a]	27 (8:202)[b]	**0.026*****
Aspartate transaminase (U/L)	30.50 (12:475)	29 (12:234)	28 (20:79)	46 (23:475)	0.088***
Urea (mg/dL)	26 (7:169)	23 (7:117)[a]	41 (18:169)[b]	56 (17:150)[b]	**<0.001*****
Creatinine (mg/dL)	0.75 (0.24:3.85)	0.72 (0.29:3.85)	0.76 (0.24:2.50)	0.99 (0.37:1.95)	0.329***
HS troponin I (ng/L)	5 (1.20:723)	4 (1.20:21)[a]	12.25 (3.30:723)[b]	17.70 (5.60:532.80)[b]	**<0.001*****
Procalcitonin (µg/L)	0.06 (0.02:100)	0.04 (0.02:1.38)[a]	0.09 (0.04:1.53)[a]	0.31 (0.14:100)[b]	**<0.001*****
D-dimer (µg/L)	586 (100:51300)	547 (100:28100)[a]	823 (200:27900)[a]	21800 (1440:51300)[b]	**<0.001*****
Ferritin (µg/L)	211.10 (6.10:25583)	188 (6.10:2731)[a]	428.70 (93.30:2097)[b]	1326.60 (433.70:25583)[b]	**<0.001*****
Thorax CT					
Not taken	40 (25.64%)	32 (25.40%)	2 (10%)	6 (60%)	0.058**
Abnormal	114 (73.08%)	92 (73.02%)	18 (90%)	4 (40%)	
Normal	2 (1.28%)	2 (1.59%)	0	0	
Costs (TL)	5690 (170:126908)	4562 (170:44675)[a]	17328 (2423:126908)[b]	7944 (4517:115361)[b]	**<0.001*****
ICU length of stay	7 (2:42)	-	9 (2:42)	4 (3:27)	0.859*
Total hospital length of stay	8 (1:44)	7 (1:32)[a]	17.50 (6:44)[b]	4 (3:27)[a]	**<0.001*****
Prognosis					
Discharged	143 (91.67%)	125 (99.2%)[a]	13 (65%)[b]	5 (50%)[b]	**<0.001****
Exitus	13 (8.33%)	1 (0.8%)[a]	7 (35%)[b]	5 (50%)[b]	

Data are expressed as n (%) and median (minimum: maximum), *: Mann-Whitney U test, **: Fisher-Freeman-Halton test, ***: Kruskal-Wallis test, length of stay in ICU was compared between the groups transferred to ICU from the wards and those admitted directly to ICU, ICU: Intensive care unit, CT: Computed tomography

likely to be elderly and had a median length of hospital stay of seven days. In our study, the median length of hospital stay was eight days.

The patients in the current study were primarily Syrian, including pregnant refugee patients. In a study by Çelik et al. (13) examining the demographic and clinical data of refugees giving birth in hospitals in Turkey, Syrians were the most common refugees. This can be explained by the greater number of Syrian refugees living in Turkey because of the war in Syria.

The most frequently seen symptoms of all the patients in this study were cough and fever, which is consistent with the findings of other studies in the literature (14,15). However, the most common symptom in the hospitalized patients of the current study was shortness of breath. The symptoms of fever, cough, nausea, diarrhea, myalgia, headache, listlessness, and hemoptysis were determined more in the hospitalized patients of the current study than in those who were discharged. These results demonstrate that the clinical condition at the time of presentation was more severe in the refugee patients who were hospitalized than in those who were discharged.

The most common laboratory test abnormalities seen in this study were lymphopenia and elevated CRP. These results were supported by the findings of other studies in the literature. The reason for lymphopenia in these studies could have been the cytokine storm caused by the severe acute respiratory syndrome-coronavirus-2 virus (14,15).

The patients in this study with stable vital signs and no comorbidities were discharged with the recommendation of home quarantine. In hospitalized patients, the most common comorbidities were hypertension and diabetes mellitus. Although other studies in the literature have also shown these to be the most common comorbidities, the rates of hypertension and diabetes mellitus in the current study patients were lower than in other studies in the literature (16-18). The reason for the low rate in the current study could have been the unavailability of the previous electronic health records for some refugees and that some of the refugees themselves were not aware that they had a chronic disease.

The median costs of the patients in this study were found to be 14.1 USD (120 TL) for outpatients and 669.4 USD (5690 TL) for hospitalized patients. In a study by Gulacti et al. (19), the mean costs of Syrian refugees presenting at ED were reported to be 19.3 USD for outpatients and 509.3 USD for hospitalized patients. The higher healthcare costs in the current study can be attributed to the longer length of stay in the wards and in the ICU.

Studies in Germany and the USA on the mortality rates of patients hospitalized with COVID-19 have reported rates of 14% and 21% respectively (16,20). The current study's mortality rate was 8.33%, which was lower than the rates in Germany and the USA, but similar to the rate in another study in a different center in Turkey (18). The reason for this could be that in Turkey, healthcare services are free for refugees and they have the same rights as Turkish citizens in this respect.

Study Limitations

As the study was retrospective, patients with incomplete data in the hospital information system were excluded from the study, and this could have caused a selection bias. There were no data on pediatric patients with COVID-19 because the pandemic area of the ED where the study was conducted only accepted adult patients. The data used in the study were the data of the refugee patients at the time of presentation at ED, and therefore, any change in the clinical condition and laboratory parameters during the hospitalization period could affect the results. The lack of data on factors that directly affect the health of refugees, such as the living environment, transportation costs, and socioeconomic status, may have affected the results of the study.

CONCLUSION

The results of this study showed that patients with COPD and CVD had a more severe disease course. In Turkey, access to emergency healthcare services is free for refugees. It can be considered that the data obtained in this study will be of guidance for healthcare policies directed at refugees in Turkey and throughout the world. There is a need for further studies to be able to better understand how refugees are affected by COVID-19.

Ethics

Ethics Committee Approval: This retrospective study was conducted in the ED of University of Health Sciences Turkey, Prof. Dr. Cemil Tascioglu City Hospital. Approval for the study was granted by the Local Ethics Committee of University of Health Sciences Turkey, Prof. Dr. Cemil Tascioglu City Hospital in January 2021 (decision no: E-48670771-514.10).

Informed Consent: Retrospective study.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: M.E.F, E.B.K., M.Ş., Concept: M.E.F., E.B.K., A.K., Design: A.D., Data Collection or Processing: M.E.F., Y.K., E.B.K., M.Ş., Analysis or Interpretation: M.E.F., A.D., Literature Search: M.Ş., E.B.K., Writing: M.E.F., M.Ş., Y.K.

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Outcome and Survival in Patients with Stage II/III Sigmoid, Rectosigmoid and Upper Third Rectal Cancer Treated with Upfront Surgery

Cemal Ulusoy[1], Andrej Nikolovski[2]

[1]University of Health Sciences Turkey, Prof. Dr. Cemil Taşcıoğlu City Hospital, Clinic of General Surgery, İstanbul, Turkey
[2]"Sv. Naum Ohridski", Skopje, Ss. Cyril and Methodius University, Department of Visceral Surgery, Skopje, North Macedonia

Abstract

Objective: Rectosigmoid junction is hard to define clinically. Its clinicopathological features seem different when compared to the ones of the sigmoid and upper rectal cancer. This study investigated the outcome and survival in patients with postoperative stage II/III sigmoid, rectosigmoid and upper third rectal cancer treated with upfront surgery.

Methods: Patients with sigmoid, rectosigmoid junction and upper rectal cancer underwent upfront curative surgery in the period (2016-2022) in tertiary institutions are retrospectively examined. Patient, tumor and follow-up data divided into three groups were retrospectively reviewed and compared for outcome and overall survival.

Results: Of a total number of 76 patients, 32 had rectosigmoid junction cancer, followed by sigmoid and upper third rectal cancer (in 27 and 17 patients, respectively). Most of the patients (63) presented with postoperative stage III. The mean follow-up period was 34.22 months. Patients with positive lymph nodes had worse survival (p=0.016). Perineural invasion affected the survival significantly (p=0.022). Rectosigmoid junction cancer showed the worst survival in comparison with sigmoid and upper rectal cancer (p=0.041).

Conclusion: Rectosigmoid junction cancer had the worst overall survival between the investigated groups. Perineural invasion presented as an independent factor for survival. The clinical behavior of the rectosigmoid junction cancer differs from the other cancers of the "terminal colon".

Keywords: Rectosigmoid junction cancer, sigmoid colon cancer, upper third rectal cancer, survival, outcome

INTRODUCTION

This retrospective single-center study aimed to evaluate and compare the clinicopathological features, postoperative outcome and overall survival (OS) of patients operated for sigmoid, rectosigmoid junction (RSJ) and upper third rectal cancer (URC) (all with postoperative stage II and III).

The difference in treatment between sigmoid colon cancer (SCC) and URC is clearly defined (1). When RSJ cancer is added "between", certain dilemmas are imposed. Namely, the precise preoperative localization of the RSJ itself is a diagnostic challenge (2,3). Eventual misclassification of the tumor localization (whether is rectal or sigmoid) can lead to inadequate type of surgery, possible different functional outcomes and additional overtreatment or under treatment with neoadjuvant radiotherapy (1). The RSJ is added in the International Classification of Diseases in 2014 (4). Current recommendations for RSJ cancer treatment consist of oncologic rectosigmoid resection (open or minimally invasive) with the addition of adjuvant chemotherapy for stage III and high-risk stage II addressing on the unresected micrometastases (5). The treatment of URC is depended on the preoperative stage in terms of whether neoadjuvant chemoradiation will be applied

Address for Correspondence: Cemal Ulusoy, University of Health Sciences Turkey, Prof. Dr. Cemil Taşcıoğlu City Hospital, Clinic of General Surgery, İstanbul, Turkey
Phone: +90 532 361 31 34 **E-mail:** drculusoy@gmail.com **ORCID ID:** orcid.org/0000-0002-4405-6618

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(6). Few studies addressing on the comparison of outcome, OS and clinicopathological features of sigmoid, RSJ and URC are present in the relevant literature (7-9).

METHODS

Patients with stages I and IV were excluded. Patient data were extracted from an electronic medical data system for the period (2016-2021). All the patients were treated with upfront surgery according to the decision of the gastrointestinal and colorectal oncologic board of the clinic.

The patients were assessed preoperatively with colonoscopy, abdominal computed tomography and magnetic resonance imaging (MRI) scans. Tumor location was determined with combined use of endoscopy, computerized tomography (CT) and MRI scan simultaneously in order to define its precise preoperative position. URC location was determined with colonoscopy and rectum MRI. Additional intraoperative assessment defined the localization for URC (above the peritoneal reflexion) and for the RSJ cancer (absence of colonic taenia). All the findings were reviewed on the clinic multidisciplinary oncologic board before surgery for proper tumor localization and oncologic protocol.

Six colorectal surgeons performed all the operations resulting with R0 resection. Standard laparoscopic and open approaches were used. High ligation of the inferior mesenteric artery was mandatory. Splenic flexure mobilization was not routinely performed and it depended on the colon length. Sigmoid resection was performed without TME. For RSJ and URC, PME or TME were performed (10). All the colo-rectal anastomoses were stapled with a circular stapler (no. 29, 31 and 33) by using the double-stapled technique. Fast-track feeding protocol was used in the postoperative period (11).

Patient characteristics, surgery and tumor data and follow-up period in months were collected. Demographic patient data used for statistical analysis were age, gender and American Society for Anesthesiologists (ASA) score.

Tumor data referred to localization, distal resection margin, postoperative tumor stage, number of retrieved lymph nodes per procedure, lymph node involvement with metastases grade and the presence of lymphovascular (LVI) and perineural invasion (PNI). The patients were divided in three groups according to tumor location for statistical analysis (sigmoid, rectosigmoid and upper rectum). Survival analysis was performed between the three groups in terms of OS and additional ones according to the presence of lymph node metastases, LVI and PNI.

Statistical Analysis

Statistical analysis was performed using the SPSS v. 18.0.0 (IBM Corp., Armonk, NY, USA) software. Numeric variables are presented as mean and compared with Student's t-test or the Mann-Whitney U test. Categorical variables are presented as numbers and compared with the chi-square test. OS was estimated by the Kaplan-Meier method and the log rank test was used to compare differences between the groups. Statistical significance was set for a p value of ≤0.05. The study was approved by the Local Ethical Committee of the University of Health Sciences Turkey, Prof. Dr. Cemil Tascioglu City Hospital, clinic, no. E-48670771-514.99, issue: 49.

RESULTS

A total number of 76 patients were operated, with the most frequent localization of tumor in the RSJ 32), followed by the sigmoid (27) and upper third rectum (17). Fifty patients were males, and the rest (26) were females. Mean age of patients was 63.3 years and no statistical difference was noted on the different tumor localization on age, gender and ASA score. Postoperative stage II was confirmed in 13 patients and the rest 63 were diagnosed with stage III. Number of patients presented with stage II for the sigmoid colon, rectosigmoid colon and upper rectum were 4,4,5 and the number of patients with stage III were 23,28,12 respectively. There was no statistical difference according to localization between each group (p=0.303). There was no statistical difference between stages II and stage III in terms of survival (p=0.551). Mean distal resection margin was 5.8 cm. The total mean number of harvested lymph nodes was 26.6. Lymph node metastases were present in 42 patients, half of them in patients with RSJ cancer. No statistical difference was seen between the groups (p=0.151). LVI invasion was present in 40 patients. More than half of them (21) were patients with RSJ cancer. There was no statistical difference between the groups (p=0.150). Of total number of 35 patients with PNI, the predominant cancer location was again the RSJ (17), followed equally by sigmoid and upper rectal cancer (9). The analysis of three different tumor localizations and its association with lymph node metastases, LVI and PNI revealed no statistical difference (Table 1).

There was no statistical difference in estimated survival according to age, gender, postoperative tumor stage, ASA score and LVI presence.

Estimated three-year survival rate for patients with metastases in lymph nodes was 66.7% (SE: 19.2), and in lymph node negative patients it was 96.6% (SE: 3.4), p=0.016, (Figure 1).

OS rate for the presence of PNI during follow-up period was 67.2% (SE: 8.3) and the patients without PNI had an OS rate of 93.2% (SE: 4.79). The long-rank test of equality of survival for patients with present PNI presented with statistical significance (p=0.022), therefore, confirming the PNI to be an independent factor for survival (Figure 2).

Overall three years survival rate was 81.6% for all tumor locations. Patients with SCC had the best OS rate of 96.3% (SE: 3.9), for RSJ cancer location 62.5% (SE: 9.6) and for patients with URC OS rate was 94.1% (SE: 6.4). Log-rank test for survival distribution according to tumor localization presented with significance meaning that the RJC cancer showed worst survival (p=0.041), (Figure 3).

The Cox regression analysis of different factors affecting survival showed that only the PNI is the independent prognostic factor in the survival (p=0.008), (Table 2).

DISCUSSION

The debate of proper cancer treatment of the terminal colon variously described as "rectosigmoid", "upper rectum", or "lower sigmoid" is old and still unanswered (12). Doubts exist on the RSJ

Table 1. Patient and tumor data

	Total n=76 (%)	Sigmoid colon (%)	Rectosigmoid junction (%)	Upper rectum (%)	p value
Patient data					
Gender					
Male	50 (65.8)	18 (23.6)	18 (23.6)	14 (18.4)	0.185
Female	26 (34.2)	9 (11.8)	14 (18.4)	3 (3.9)	
Age mean; (range)	63.3; (42-85)				
ASA score ASA I ASA II ASA III ASA IV	 13 (17.1) 26 (34.2) 25 (32.8) 12 (15.7)	 4 7 11 5	 7 13 6 6	 2 6 8 1	0.362
Tumor data					
Tumor stage					
Stage II	(17.2)	4	4	5	0.302
Stage III	(82.8)	23	28	12	
Distal resection margin (mean)		7.78	5.82	3.14	**0.002**
Tumor differentiation					
Well	4 (5.2)				
Moderate	58 (76.3)				
Poor	5 (6.5)				
Mucinous	6 (7.8)				
Not available	3 (3.9)				
Lymph nodes extracted (mean)	26.6	22.04	30.47	26.59	**0.043**
pN0	35 (46)	16	11	8	0.155
pN1/N2	41 (54)	11	21	9	
LVI					
(-)	36 (47)	15	11	10	0.150
(+)	40 (53)	12	21	7	
PNI					
(-)	41 (54)	18	15	8	0.256
(+)	35 (46)	9	17	9	

LVI: Lymphovascular invasion, PNI: Perineural invasion, ASA: American Society for Anesthesiologists

anatomic location. Different definitions have been proposed according to its anatomy and physiology, but none of them is associated with the same anatomical area which can be confusing for the surgeon when dealing with malignancy in this part of the colon. Several proposed definitions in the literature are dependent on different specialty (radiology, endoscopy, surgery). Hence, from surgeons' aspect two anatomic landmarks have been proposed: the disappearance of taenia (end-point of the sigmoid of the colon) and the peritoneal reflection (bellow the upper rectum) (13). Precise location of the colorectal cancer is essential for appropriate treatment modality choice. Insufficiently accurate endoscopic arbitrary measurements (from the anal verge) were used for the preoperative marking of the RSJ (2). In the study of Moltzer et al. (14) endoscopy failed to distinguish distal sigmoid carcinomas from rectal carcinomas in one out of 10 patients. Therefore, they recommend combining endoscopy and MRI/CT scans and underlay the importance of a multidisciplinary approach. Recently, after the Delphi consensus, the "sigmoid take-off" alternative landmark was implemented (15). It defines the transition from the rectum to the sigmoid with the beginning of the sigmoid mesocolon (2). A recent Dutch survey was conducted on the implemented Delphi consensus in the Dutch national guidelines. According to the results, although not yet been implemented in all multidisciplinary meetings, the new definition of the rectum improved the sensitivity and the negative predictive value. However, due to the small number of tumors in the area of the sigmoid take-off (only three cases), the authors concluded that the implementation of such a landmark should be accompanied with adequate training in order to ensure proper assessment (16). In the study of Hui et al. (17), patients were included with primary tumors located 9-20 cm from the anal verge on staging CT, MRI, or colonoscopy In this study, a combination of endoscopy, CT and MRI marking of the RSJ tumors was used for more precise accuracy.

Table 2. Multivariate analysis of different factors affecting survival (Cox regression)

		95.0% CI for Exp (B)		
	HR	Lower	Upper	p
LVI	0.672	0.173	2.606	0.566
PNI	0.120	0.025	0.578	0.008
Tumor localization	1.266	0.591	2.711	0.545
Met. lymph node	0.991	0.911	3.598	0.830
ASA score	1.811	0.917	1.072	0.090

LVI: Lymphovascular invasion, PNI: Perineural invasion, ASA: American Society for Anaesthesiologists, HR: Hazard ratio, CI: Confidence interval

The dilemma for the optimal management of patients with locally advanced RSJ cancer is unclear. Pros and cons exist whether upfront surgery or neoadjuvant chemoradiation should be implemented for the RSJ cancer on regard of OS (18-20). In their retrospective study, Venigalla et al. (21) suggest the use of neoadjuvant chemoradiation in patients with

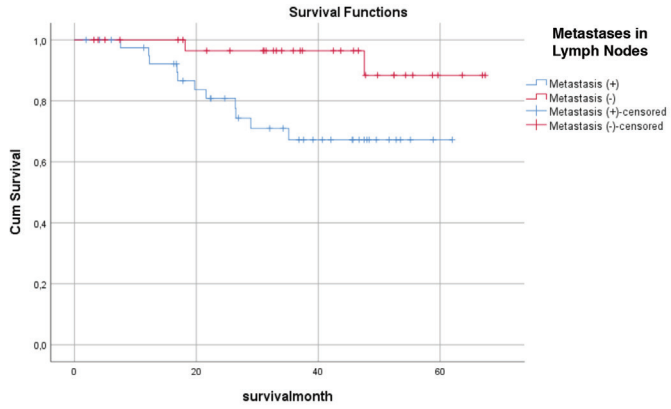

Figure 1. Kaplan-Meier curve on the survival distributions according to metastases presence in lymph nodes

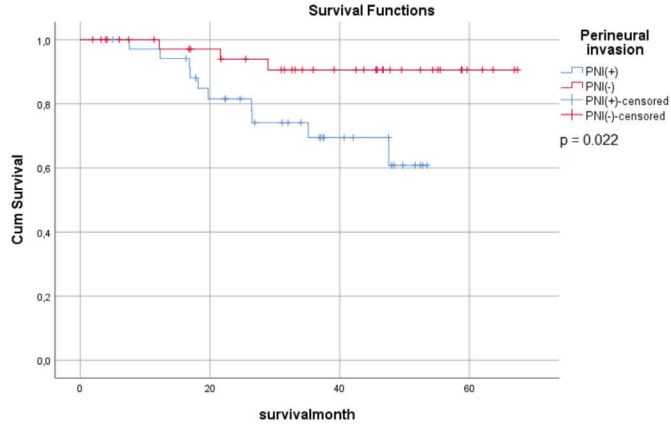

Figure 2. Kaplan-Meier curve on the survival distributions according to perineural invasion presence

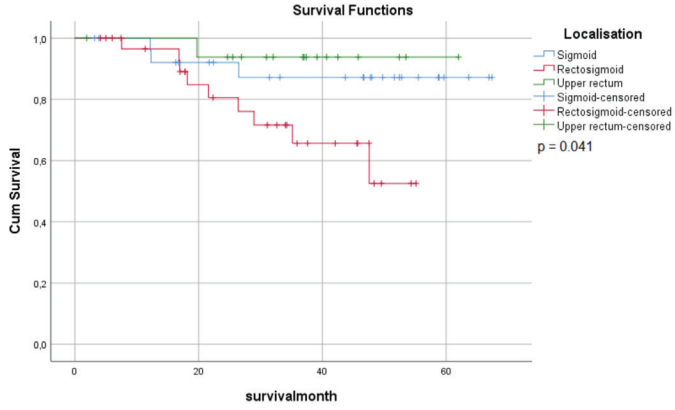

Figure 3. Kaplan-Meier curve on the overall survival distributions according to tumor localization

locally advanced RSJ cancer instead of upfront surgery use due to OS improvement. They reported 24% decreased hazard of death associated in neoadjuvant chemoradiation recipients (21). Hui et al. (17) found no statistical difference in the 2-year OS between the group of patients treated with upfront surgery and the one treated with neoadjuvant therapy. The Dutch rectal cancer study showed no improvement in local disease control with neoadjuvant radiotherapy use for tumors located 10.1-15 cm from the anal verge in comparison to more distal tumors (22). Contrary, the MRC CR07 and NCIC-CTG C016 trial revealed advantages of preoperative radiotherapy for tumor location >10-15 cm from the anus with a 3-year local recurrence rate of 1.2% in opposition to 6.2% recurrence rate for patients with the conduction of selective post-operative chemoradiation (23).

The proportion of lymph node metastases is reported to be different for cancers of the sigmoid, RSJ and upper rectum. Park et al. (9) reported significantly increased presence of pararectal lymph node metastases with exclusion of patients who underwent preoperative chemoradiotherapy. They emphasis different patterns of lymphatic spread in RSJ cancer, as a possible reason for the raised frequency of lymph node metastases (9). Falch et al. (7) reported significantly more frequent presence of four and more lymph node metastases (pN2;) in RSJ cancer in comparison to sigmoid and rectal one. Hui et al. (17) reported lymph node metastases presence in 54.7% (pN1) and in 25% (pN2) in his group of 64 patients treated with upfront surgery for RSJ cancer. In this study the most predominant cancer in terms of lymph node metastases appearance was also the one in RSJ, but without statistical significance.

Reports on the LVI and PNI are heterogeneous in terms of their rate in the RSJ cancer. Falch et al. (7) reported significantly higher rates of LVI in RSJ tumor location and no difference in terms of PNI. In the study of Park et al. (9) neither LVI, nor the PNI presented statistical difference between the three groups of patients. In this study LVI and PNI were predominant in about half of the RSJ cancers without statistical significance. Still, it was proven that the PNI is independent factor that affects the OS in all patients.

The most complex analysis of survival is reported by Mukai et al. (8). They found no statistical difference on the 5-year OS in patients with colon cancer, RSJ and rectal stage II cancer. However, in patients with stage III, patients with rectal cancer had the worst prognosis (significant differences were found for colon cancer vs. RSJ, and RSJ vs. rectal cancer (8). Park et al. (9) found his oncologic results on the RSJ cancer slightly unfavorable to SCC without difference in OS regarding tumor location. Falch identified the RSJ to be the risk factor for a worse OS. He pointed on the RSJ cancer to be with the worse five-year OS in comparison to patients with SCC and rectal cancer (44.6%, 70.9% and 70.2%, respectively) (7). In this study the RSJ cancer presented with the worst OS according to the long-rank test. However, in the Cox regression analysis tumor localization did not affect survival. Further analyses with large series are needed to clarify the importance of tumor localization in the RSJ and its influence on survival.

Study Limitations

This is retrospective study with small number of patients. Metastatic lymph nodes were not divided according to N stage into subgroups (N1 and N2). The follow-up period is relatively short.

CONCLUSION

The results from this study showed that RSJ cancer has significantly worse OS in comparison to SCC and URC in patients with stage II and III treated with upfront surgery. The presence of PNI represents an independent factor that affects survival in all three groups of patients. Therefore, we can conclude that RSJ cancer's clinical behavior is different from another adenocarcinoma appearing in the sigmoid colon and upper rectum. Certainly, more large comparative studies are needed for this conclusion to be confirmed.

Ethics

Ethics Committee Approval: The study was approved by the Local Ethical Committee of the University of Health Sciences Turkey, Prof. Dr. Cemil Tascioglu City Hospital, clinic, no. E-48670771-514.99, issue: 49.

Informed Consent: Retrospective study.

Peer-review: Internally and externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: C.U., A.N., Concept: C.U., A.N., Design: C.U., A.N., Data Collection or Processing: C.U., Analysis or Interpretation: C.U., A.N., Literature Search: C.U., A.N., Writing: C.U., A.N.

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ORIGINAL ARTICLE

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The Knowledge, Perception, and Attitudes of Residents Working in Intensive Care Unit About Local Anesthetic Systemic Toxicity: A University Hospital Data

Mehmet Nuri Yakar[1], Mehmet Meriç Çoban[2], Doğukan Şenberber[3], Mehmet Celal Öztürk[1], Murat Küçük[4], Bişar Ergün[4], Ali Necati Gökmen[1]

[1]Dokuz Eylül University Faculty of Medicine, Department of Anesthesiology and Reanimation, Division of Intensive Care, İzmir, Turkey
[2]Dokuz Eylül University Faculty of Medicine, Department of Internal Medicine, İzmir, Turkey
[3]Dokuz Eylül University Faculty of Medicine, Department of Anesthesiology and Reanimation, İzmir, Turkey
[4]Dokuz Eylül University Faculty of Medicine, Department of Internal Medicine, Division of Intensive Care, İzmir, Turkey

Abstract

Objective: The primary aim of this study is to evaluate the knowledge, perception, and attitudes of residents working in intensive care units from different disciplines about local anesthetic systemic toxicity (LAST).

Methods: Residents from anesthesiology and reanimation, internal medicine, cardiovascular surgery, thoracic surgery, and cardiology were enrolled in the study after they obtained written informed consent. The participants answered 41 questions about local anesthetics and LAST.

Results: A total of 148 residents [median age 28 (24-44) years, 56.1% male] were enrolled in the study. Of them, 34.5% stated that they received education on local anesthetics, and 22.3% declared that their education on this subject was sufficient. The most used methods for preventing LAST were the use of appropriate doses (74.3%), pre-injection aspiration (65.5%), and monitoring (63.5%). Of the participants, 59.5% indicated that they did not know whether there was 20% lipid-emulsion in their hospital and 72.3% in their unit. The participants had a low knowledge rate of early and late symptoms of LAST. They also gave rarely correct answers about the loading, maintaining, and maximum doses of 20% lipid emulsion. The basic principles of cardiopulmonary resuscitation in LAST were generally well known by participants, but the optimal length of the follow-up duration after convulsion and cardiovascular instability was not.

Conclusion: Prevention, recognition, management of the LAST, and the following of the patients with LAST are essential for patient safety in the intensive care unit. Residents working in intensive care units should be educated about LAST regardless of their branch.

Keywords: Medical education, local anesthetics, toxicity, intravenous lipid emulsions

INTRODUCTION

Local anesthetics provide a loss of sensation on the injection site without causing the loss of consciousness and alteration in the central control of vital functions (1). However, local anesthetics may cause local responses, including irritation on the injection site, cellular toxicity, temporary neurological symptoms, and systemic reactions such as anaphylaxis, methemoglobinemia, and local anesthetic systemic toxicity (LAST) (2).

The use of high doses of local anesthetics increases the risk of achieving toxic plasma levels. Accidental intravascular injection may also cause the LAST (2). In recent decades, using local anesthetics to provide regional analgesia in patients with trauma

Address for Correspondence: Mehmet Nuri Yakar, Dokuz Eylül University Faculty of Medicine, Department of Anesthesiology and Reanimation, Division of Intensive Care, İzmir, Turkey
Phone: +90 232 412 22 22 **E-mail:** dr.nuriyakar@gmail.com **ORCID ID:** orcid.org/0000-0002-3542-3906

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or who underwent an operation has become more common in intensive care units (3,4). However, the data related to the LAST in critically ill patients is limited. In regional anesthesia procedures, the LAST rate was 9.8 (5) and 8.7 (6) per 10.000 peripheral nerve blocks using conventional methods and under ultrasonography guidance, respectively. LAST is a life-threatening complication of local anesthetics, and prevention, recognition, diagnosis, and management of this entity by the residents working in intensive care units are essential. Previous studies revealed residents' knowledge about the LAST (7-9), but the data of residents from different disciplines working in intensive care units remain unclear.

In this prospective single-center study, we presented the knowledge, perception, and attitudes of the residents from internal medicine, anesthesiology and reanimation, cardiovascular surgery, thoracic surgery, and cardiology about the LAST.

METHODS

Study Design

The study was approved by the Local Ethics Committee of Dokuz Eylul University (date: 27.10.2021 and number: 2021/30-06) and conducted in Anesthesiology and Reanimation, Internal Medicine, Cardiovascular Surgery, Thoracic Surgery, and Cardiology Critical Care Units of Dokuz Eylul University Hospital between 01 and 30 November 2021, following the ethical standards of the revised version of the Helsinki Declaration in 2013. Written informed consent was obtained from each participant, and they were asked to answer a survey consisting of 41 questions. Five questions in the questionnaire were about the participants' demographic data and medical disciplines; twelve were about local anesthetics practices; and twenty-four were about participants' knowledge, perception, and attitudes about LAST.

Selection of Participants

Residents training in the disciplines of Anesthesiology and Reanimation, Internal Medicine, Cardiovascular Surgery, Thoracic Surgery, and Cardiology at Dokuz Eylul University, Faculty of Medicine, were enrolled in the study. Graduated residents or not previously worked in intensive care units were excluded from the study.

Variables

Demographic data (age, sex) and properties of the participants' professions (discipline, experience, duration of residency) were recorded. The participants were asked whether they received formal education on local anesthetics and LAST during residency and how they felt about their knowledge about these issues. Local anesthetic practices (frequency, preferred administration route and local anesthetic preferences), precautions to reduce the LAST risk, the local anesthetics' toxic doses, experiences about the LAST and knowledge about 20% lipid solution were investigated. Participants were also asked whether they knew the presence of 20% lipid emulsion in the hospital and their departments. Additionally, early, and late symptoms of the LAST, conditions needed reduction in local anesthetic doses, LAST treatment, and follow-up protocols were queried. General information about LAST in the questionnaire was prepared according to a previous study (2). LAST treatment and follow-up standards were drafted according to the recommendations in the LAST checklist of the American Society for Regional Anesthesia and Pain Medicine (10).

Outcomes

The primary aim of the study is to evaluate the knowledge, perception, and attitudes of residents from different disciplines (anesthesiology and reanimation, internal medicine, cardiovascular surgery, thoracic surgery and cardiology) about the LAST.

Statistical Analysis

The statistical analysis was performed using the SPSS statistical analysis software (version 24.0; IBM, Armonk, NY, USA). The distribution of the data was analyzed using the Shapiro-Wilk test. Categorical variables were presented as number (n) and percentage (%). Normally, distributed continuous variables were expressed as mean ± standard deviation, and non-normally distributed variables as median (minimum-maximum). In the statistical analysis, uni- or multivariate analyzes to compare the groups were not needed.

RESULTS

A totally 148 residents [median age 28 (24-44) years, 56.1% male] were included in the study (Table 1). Departments of the participants were distributed as internal medicine (50.0%), anaesthesiology and reanimation (37.8%), cardiovascular surgery (4.7%), thoracic surgery (4.7%), and cardiology (2.7%). The participants' median training duration in their disciplines was 3 (1-7) years.

Of them, 51 (34.5%) stated receiving a formal education about local anesthetics and LAST during residency (Table 2). Only 33 residents (22.3%) expressed that their knowledge about local anesthetics was sufficient. However, 47 (31.8%) residents stated that they knew the toxic doses of local anesthetics,

and 38 (25.7%) participants routinely checked the maximum doses of local anesthetics before the interventions. Only 17 (11.5%) participants had experienced the LAST before. The local anesthetic usage frequency of the participants was distributed as a few in a week (29.7%), every day (22.3%), and a few in a month (18.2%). The most frequently preferred local anesthetics were lidocaine and prilocaine, with a rate of 75.0%. The most frequent administration routes of local anesthetics were subcutaneous (77.0%), intravenous (49.3%), and intrathecal or epidural (36.5%).

Table 1. Demographic data and professional characteristics of the participants

Age, years	28 (24-44)
Sex, male	83 (56.1)
Professional experience, years	4 (1-23)
Discipline	
Internal medicine	74 (50.0)
Anaesthesiology and reanimation	56 (37.8)
Thoracic surgery	7 (4.7)
Cardiovascular surgery	7 (4.7)
Cardiology	4 (2.7)
Length of residency duration, years	3 (1-7)

All values are expressed as n (%) or median (minimum-maximum)

The participants' most common LAST prevention method was using an appropriate dose of local anesthetics, with a rate of 74.3%. Aspiration before injection (65.5%), monitorization (63.5%), use of a test dose (60.4%), and incrementally injection (42.6%) were the following prevention methods. Ultrasonography guidance with a rate of 27.7% was less frequent than the other prevention methods. Of all participants, 61 (41.2%) stated that they had knowledge of about 20% lipid emulsion, but 88 (59.5%) in the hospital and 107 (72.3%) in their departments did not know whether the presence of 20% lipid emulsion. Additionally, 8 (5.4%) participants stated the absence of 20% lipid emulsion in the hospital though it was present. Of them, 12 (8.1%) participants expressed no presence of 20% lipid emulsion in their units.

The early and late symptoms of the LAST were not known by 56 (37.8%) and 44 (29.7%) participants, respectively (Table 3). The most known early period symptoms were perioral numbness (41.2%), metallic taste (38.5%), dizziness (29.7%), tinnitus (27.7%), and arrhythmia (27.0%). Cardiac arrest, with a rate of 54.1%, was the most stated late-period complication. Respiratory depression (45.3%), convulsion (45.3%), arrhythmia (41.9%), and atrioventricular block (40.5%) were the other most known late symptoms of the LAST. Most of the participants (93.2%)

Table 2. Local anesthetic practices and experiences of the participants

I had a formal education on LA	51 (34.5)	**Most frequently preferred LAs**	
My knowledge about LA is sufficient	33 (22.3)	Lidocaine	111 (75.0)
I had a formal education on the LAST	41 (27.7)	Prilocaine	111 (75.0)
I have experienced the LAST before	17 (11.5)	Bupivacaine	80 (54.1)
Toxic dose of LAs		**Methods for preventing the LAST**	
I don't know	63 (42.6)	Use of an appropriate dose	110 (74.3)
I know	47 (31.8)	Aspiration before injection	97 (65.5)
I check it before administration	38 (25.7)	Monitorization	94 (63.5)
Frequency of LA use		Incrementally injection	63 (42.6)
A few a week	44 (29.7)	Use of a test dose	45 (60.4)
Every day	33 (22.3)	USG guidance	41 (27.7)
A few a month	27 (18.2)	Other	7 (4.7)
Once a month	16 (10.8)	**I know about 20% LE**	61 (41.2)
A few a year	13 (8.8)	**Whether 20% LE is present in the hospital**	
Once a week	12 (8.1)	I don't know	88(59.5)
LA administration routes		Present	52 (35.1)
Subcutaneous	114 (77.0)	Absent	8 (5.4)
Intravenous	73 (49.3)	**Whether 20% LE is present in my department**	
Epidural/intrathecal	54 (36.5)	I don't know	107 (72.3)
Intramuscular	37 (25.0)	Present	29 (19.6)
Intranasal	6 (4.1)	Absent	12 (8.1)

All values are expressed as n (%) or median (minimum-maximum). LA, Local anesthetic, LAST: Local anesthetic systemic toxicity, USG: Ultrasonography, 20% LE: 20% lipid emulsion

knew that the early period symptoms of the LAST might not occur. At least more than half of the participants knew the obligation to use of lower doses of local anesthetics in patients with kidney or liver failure, pregnancy, the elderly, and in infected surgical sites. Of the participants, 44 (29.7%) and 41 (27.7%) stated that they knew the 20% lipid emulsion loading

Table 3. Knowledge, perception, and attitudes of the residents about LAST

Early symptoms of LAST		**20% LE maintaining dose duration**	
I don't know	56 (37.8)	I know	39 (26.4)
Perioral drowsiness	61 (41.2)	I don't know	108 (73.7)
Metallic taste	57 (38.5)	**20% LE maintaining dose duration**	
Dysarthria	35 (23.6)	Rate of wrong answers	13 (8.8)
Hypertension	14 (9.5)	Rate of correct answers	26 (17.6)
Dizziness	44 (29.7)	**20% LE maximum dose**	
Muscle twitching	26 (17.6)	I know	37 (25.0)
Arrhythmia	40 (27.0)	I don't know	111 (75.0)
Tinnitus	41 (27.7)	**20% LE maximum dose**	
Tachycardia	31 (20.9)	Rate of wrong answers	7 (4.7)
Confusion	23 (15.5)	Rate of correct answers	30 (20.3)
Tremor	14 (9.5)	**During LAST**	
Late symptoms of LAST		The ECMO team should be informed	119 (80.4)
I don't know	44 (29.7)	The CPR duration may be longer than expected	122 (82.4)
AV block	60 (40.5)	Propofol is not the first choice for convulsions	97 (65.5)
Hypotension	50 (33.8)	Avoid from lidokain administration	121 (81.8)
Convulsion	67 (45.3)	Avoid from beta -blocker use	73 (49.3)
Arrhythmia	62 (41.9)	Amiodarone is the first-choice anti-arrhythmic agent	98 (66.2)
Respiratory depression	67 (45.3)	Avoids from calcium channel blockers	67 (45.3)
Cardiac arrest	80 (54.1)	Avoid from vasopressin use	88 (59.5)
Coma	59 (39.9)	The epinephrine dose should be reduced	118 (79.7)
Loading dose of 20% LE		**Other properties of LAST**	
I know	44 (29.7)	Early symptoms may not occur	138 (93.2)
I don't know	104 (70.3)	The dose should be reduced in the infected sites	68 (66.2)
Loading dose of 20% LE		The dose should be reduced during renal failure	100 (67.6)
Rate of wrong answers	6 (4.1)	The dose should be reduced during hepatic failure	119 (80.4)
Rate of correct answers	38 (25.7)	The dose should be reduced in the elderly	124 (83.8)
20% LE loading dose duration		The dose should be reduced during pregnancy	100 (67.6)
I know	43 (29.1)	**Follow-up duration after seizures**	
I don't know	104 (70.3)	Rate of correct answers	28 (18.9)
20% LE loading dose duration		Rate of wrong answers	91 (61.5)
Rate of wrong answers	14 (9.5)	No answer	29 (19.6)
Rate of correct answers	29 (19.6)	**Follow-up duration after cardiac instability**	
Maintenance dose of 20% LE		Rate of correct answers	31 (20.9)
I know	41 (27.7)	Rate of wrong answers	86 (58.1)
I don't know	105 (70.9)	No answer	31 (20.9)
Maintenance dose of 20% LE			
Rate of wrong answers	10 (6.8)		
Rate of correct answers	31 (20.9)		

All values are expressed as n (%) or median (minimum-maximum). LAST: Local anesthetic systemic toxicity, AV block: Atrioventricular block, 20% LE: 20% lipid emulsion, ECMO: Extracorporeal membrane oxygenation, CPR: Cardiopulmonary resuscitation

and maintenance doses, respectively. However, 38 (25.7%) and 31 (20.9%) participants correctly knew the loading and maintenance doses, respectively. The rate of participants who stated that they knew the administration duration of 20% lipid emulsion loading and maintenance doses were 43 (29.1%) and 39 (26.4%), respectively. However, only 29 (19.6%) and 26 (17.6%) participants correctly knew loading and maintaining duration, respectively. Only 10 (17.6%) participants knew the maximum dose of 20% lipid emulsion correctly. Most of the participants stated that the duration of cardiopulmonary resuscitation (CPR) might be longer than expected (82.4%), lidocaine should be avoided as an anti-arrhythmic agent (81.8%), the extracorporeal membrane oxygenation (ECMO) team should be informed in the LAST management (80.4%), and the epinephrine dose should be reduced during CPR (79.7%). Additionally, more than half of the participants knew that amiodarone is the first choice to treat arrhythmias in the LAST (66.2%), propofol should not be preferred to control convulsions (65.5%), and vasopressin administration should be avoided (59.5%). However, less than half of the participants stated that using beta-blockers (49.3%) and calcium channel blockers (45.3%) should be avoided. The proportions of the participants who correctly knew the length of follow-up duration after cardiovascular instability and seizure were 31 (20.9%) and 28 (18.9%), respectively.

DISCUSSION

In this study, we evaluated the knowledge, perception, and attitudes of the residents working in intensive care units from different disciplines about the LAST. Only one-third of the participants received formal education on local anesthetics and the LAST during the residency, and one-fifth felt their knowledge about these issues was sufficient. Most participants did not know whether the 20% lipid emulsion was present in the hospital or units where they worked. Additionally, the participants did not have sufficient information about the loading, maintenance, and maximum doses of 20% lipid emulsion therapy and the length of administration durations. Although the participants knew the conditions that the local anesthetic dosage should be reduced, one-third of the participants did not correctly know the toxic doses of the local anesthetics. Early and late symptoms of the LAST were known by less than half of the participants. Conversely, the participants' knowledge about anti-arrhythmic agents and managing CPR in the LAST was sufficient. However, the length of the follow-up duration in patients with cardiovascular instability or seizure was not commonly known by the participants.

Prevention of the LAST is essential, as well as its manage. Local anesthetics should be administered under monitorization standards, including electrocardiography, pulse oximetry, and non-invasive tension measurement (11). The dose of local anesthetics should be planned before the procedures, avoided high doses, and administrated in places that consist of CPR equipment. Additionally, frequent aspiration prevents intravascular injections by mistake, and slowly injections reduce the risk of achieving pick plasma concentration of the local anesthetics. Using a test dose may determine the migration of the neuraxial catheters (2). The ultrasonography-guided injection is a method to prevent LAST development (12). This method reduces the LAST risk by reducing local anesthetic consumption (2). In this study, most of the participants used the method of frequent aspiration before injection and provided monitorization standards. Most participants stated that they use the appropriate doses of local anesthetics. However, only one-third of the participants knew the toxic doses of local anesthetics, but a quarter of the participants checked the toxic doses before administration. Incremental injection was another standard method to prevent LAST, but the use of ultrasonography guidance was limited.

The Association of Anaesthetists of Great Britain and Ireland divided into four parts of LAST management such as (I) recognition, (II) immediately management, (III) treatment, and (IV) follow-up (13). Training health professionals on the LAST ensures patient safety by recognizing and immediate management of the LAST (2). Notably, the participants had insufficient knowledge of early LAST symptoms in this study. However, LAST is included in the formal education programs of anesthesiology and reanimation (14) and cardiovascular surgery (15) departments in Turkey, but not in internal medicine (16), cardiology (17), and thoracic surgery (18).

The LAST treatment depends on 20% lipid emulsion therapy (13,19). Different mechanisms have defined how 20% lipid emulsion affects the treatment of the LAST. The 20% lipid emulsion allocates a lipid compartment within the vascular compartment and provides local anesthetics to be drawn from their receptors to this compartment, but this effect may be limited (20). Local anesthetics block fatty acid metabolism in the heart; 20% lipid emulsion provides the substrate for cardiac metabolism and prevents the increase in mitochondrial inner membrane permeability that causes cell death (21). In addition, 20% lipid emulsion competitively inhibits the binding of local anesthetics to cardiac sodium channels (22). In this study, most participants incorrectly answered the questions related to the loading and maintenance doses of 20% lipid emulsion and the loading and maintaining durations.

High doses of 20% lipid emulsion may cause hypertriglyceridemia, acute pancreatitis, lipid embolism, acute kidney injury, acute lung injury, increased risk of infections, and cardiac arrest (23). Notably, only one-fifth of the participants knew the maximum dose of 20% lipid emulsion.

The CPR procedure has some differences in patients suffering cardiac arrest due to the LAST. The CPR duration may be longer than expected (13). ECMO is an alternative to provide survival for the patients until local anesthetics are eliminated. In patients with LAST, lidocaine and many other anti-arrhythmic agents should be avoided during CPR. The dose of norepinephrine should be reduced (10). In this study, participants sufficiently knew these abovementioned issues. The American Society of Regional Anesthesia and Pain Medicine recommends at least 2 h follow-up after seizures and 4-6 h after cardiovascular instability in patients with LAST (10). Most of the participants in this study incorrectly answered questions related to the length of follow-up duration in patients with LAST.

Study Limitations

This study had some limitations. The residents working intensive care units from different departments, such as Chest Diseases or Neurology, were excluded from the study. The results of this prospective single-center survey study could not be generalized and should be supported by novel studies with large sample sizes.

CONCLUSION

Local anesthetics are frequently used in intensive care units. LAST is one of the possible complications that also occur in intensive care units. Recognizing, preventing, and managing the LAST in critical patients are essential. Local anesthetics should be used under baseline standards, including monitorization, appropriate dosage, and ultrasonography guidance. To recognize and immediately treat the LAST, residents working in intensive care units from different disciplines should receive formal education on local anesthetics and LAST, regardless of the branch.

Ethics

Ethics Committee Approval: The study was approved by the Local Ethics Committee of Dokuz Eylul University (date: 27.10.2021 and number: 2021/30-06) and conducted in Anesthesiology and Reanimation, Internal Medicine, Cardiovascular Surgery, Thoracic Surgery, and Cardiology Critical Care Units of Dokuz Eylul University Hospital between 01 and 30 November 2021, following the ethical standards of the revised version of Helsinki Declaration in 2013.

Informed Consent: Written informed consent was obtained.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Concept: M.N.Y., M.M.Ç., D.Ş., M.C.Ö., M.K., B.E., A.N.G., Design: M.N.Y., M.M.Ç., D.Ş., M.C.Ö., M.K., B.E., A.N.G., Data Collection or Processing: M.N.Y., M.M.Ç., D.Ş., M.C.Ö., M.K., B.E., A.N.G., Analysis or Interpretation: M.N.Y., M.M.Ç., D.Ş., M.C.Ö., M.K., B.E., A.N.G., Literature Search: M.N.Y., M.M.Ç., M.C.Ö., B.E., Writing: M.N.Y., A.N.G.

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CASE SERIES

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Arthroscopic Medial Patellofemoral Ligament Reconstruction with a Double Suspension Technique

Özgür Başal[1], Recep Dinçer[2]

[1]*Emsey Hospital, Clinic of Orthopedics and Traumatology, İstanbul, Turkey*
[2]*Süleyman Demirel University Training and Research Hospital, Department of Orthopedics and Traumatology, Isparta, Turkey*

Abstract

Surgical treatment of recurrent patella dislocations is difficult, and combined techniques are required in most cases. To overcome this issue, we present the preliminary results of a novel alternative fixation technique for the medial patellofemoral ligament (MPFL) reconstruction with using a looped semitendinosus tendon autograft. Between January 2018 and January 2020, five cases with isolated MPFL injury were treated with a double-suspension technique. The double suspension technique describes the fixation of the semitendinosus autograft into the single femoral and patellar tunnels using the adjustable and fixed loop-button technique arthroscopically. Tips and tendon fixation with a double suspension technique are described here in cases applied with MPFL reconstruction using semitendinosus autograft with this technique. An evaluation was made of five patients with an average age of 25 (range 18-33) years, followed up for a mean of 16.8 months. There was a statistically significant improvement in all patient-reported outcomes from baseline to the final follow-up examination. In the clinical outcomes, the mean modified Lysholm knee score increased significantly from 48 preoperatively to 95.2 at the final follow-up examination ($p<0.001$). All cases returned to their daily activities and amateur sports in an average of 4 ± 0.2 (4-6) months. Anatomic MPFL reconstruction with a double-suspension technique provides biomechanical stability closest to the tensile strength of the natural MPFL. The reconstruction of this ligament forms the main leg of the treatment. Although several different methods have been described, failure and complications are seen as related to technique inadequacies.

Keywords: MPFL, recurrent patellar instability, suspension device, reconstruction, knee ligaments

INTRODUCTION

Patellar instability and recurrent patellar dislocation are common problems seen, particularly in the younger age group (1,2). This term defines pain, blockage, and clinical twisting due to the deterioration of the static and dynamic knee extensor mechanism. It is striking that of more than a hundred surgical techniques described in the literature, patella instability has been reported to be the second most common pathology (3,4). Nevertheless, a definitive, acceptable treatment protocol has not been adopted (1-4). It is reported that 15-44% of the acute dislocation cases, which are treated with conservative approaches, have recurrent patellar instability (1-4).

The medial patellofemoral ligament (MPFL), as a primary stabilizer of the patella, contributes 40-80% of the total medial restraining force (2,3,5). Although surgical techniques and treatment principles show differences, the basic rationale is to provide patellofemoral joint congruence. In patients where there is no MPFL integrity or if present it is loose, repair of this ligament does not generally give a successful result and there is a need for reconstruction. Other accompanying anatomic defects (malrotation, tight lateral retinaculum, shallow trochlear groove, etc.) are included in the treatment with additional procedures (2). Previous cadaver studies and experimental research have focused on two basic points (3,4). The first is that if the femoral attachment site is incorrectly planned, failure is inevitable. The

Address for Correspondence: Özgür Başal, Emsey Hospital, Clinic of Orthopedics and Traumatology, İstanbul, Turkey
Phone: +90 541 304 83 38 **E-mail:** basalozgur@gmail.com **ORCID ID:** orcid.org/0000-0001-5403-0043

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other point is which technique can be used in the fixation of the tendon graft on the femur and patella.

The femoral attachment of MPFL is supero-posterior to the medial femoral epicondyle and just distal to the adductor tubercle (4). The Schöttle point is 1 mm anterior to the posterior cortex extension line, 2.5 mm distal to the posterior origin of the medial femoral condyle, and proximal to the posterior point of the Blumensaat line on the lateral radiograph (2). It has been reported that the patella width is 55.8±5.8 mm, length is 34.3±3.8 mm and the thickness is 22.4±2.3 mm (6,7). The MPFL is attached to one-third of the upper part, i.e., the superomedial, of the patella. These landmarks must be well known for a successful anatomic reconstruction of the MPFL.

The fixation technique made to the femur and patella and the tendon graft tension are of great importance in clinical success. The double suspension device described in this paper is a technique that can be applied extremely easily and allows potential complications to be reduced to a minimum.

The fixation methods most preferred in MPFL reconstruction have been compared in the literature (3-5,8,9). According to biomechanical studies, the through-tunnel tendon graft method with femoral fixation at the lateral condyle has been reported to be the fixation closest to MPFL tensile strength (2,6,10). Although tensile tests have not been made biomechanically of the technique described in this paper, it is technically similar to the through-tunnel tendon graft method.

The aim of this study was to describe the double suspension technique for MPFL reconstruction with a looped semitendinosus tendon autograft using a double suspension device to secure the graft to the patella and the femur.

CASE PRESENTATION

Methods

Five patients who presented at our clinic with recurrent patellar instability due to an isolated MPFL injury were treated with this novel technique between January 2018 and January 2020. The average age at surgery was 25 years (range, 18 to 33 years). Of the patients, 3 were male and 2 were female. In addition to physical examination, all the patients diagnosed with MPFL injuries underwent magnetic resonance imaging (MRI). All patients had traumatic dislocation and instability (three contact sports injuries, one falling from a height, and one case suffering from a traffic accident). All the cases included in the study were isolated MPFL ruptures without any previous knee surgery. Patients with concomitant ligament injury, misalignment requiring osteotomy, and previous knee surgery were excluded, as were patients with neurological deficit. Informed consent was obtained from all the patients. All procedures were performed by a single senior surgeon. All cases were operated after a failed conservative treatment. Surgery was performed under a tourniquet with the patient in the supine position under spinal anesthesia. The operated knee was immobilized in a full extension brace, and crutches were used for 3 weeks postoperatively to protect the graft. All the patients were rehabilitated according to the defined program in the same rehabilitation unit. Range of motion exercises were started immediately after the removal of the drain with the aim of achieving 90° of knee flexion within 3 weeks. Partial weight-bearing was permitted after 3 weeks and gradually increased to full weight-bearing by the sixth postoperative week. Squatting was not allowed until 6 weeks, and sports activity was restricted for 4 to 6 months postoperatively. All cases were evaluated according to return to sports criteria by an independent physiotherapy specialist after a minimum of 4 months. Patients were asked for a follow-up at intervals of 2 or 3 weeks until the 12th week. At the final follow-up, Lysholm knee scoring was used to evaluate clinical outcomes.

Surgical Technique

The procedure is applied under tourniquet with the patient in a supine position. The arthroscopic knee was examined under spinal anesthesia and intra-articular pathologies were noted. The table height was adjusted to be able to obtain an image with C-arm fluoroscopy.

Graft Preparation

To obtain the semitendinosus tendon graft, a cut was made 2-3 cm from the center of the medial border of the tibia and the tibial tubercle and the sartorial fascia was palpated. After determination of the location of the tendons, the fascia was opened parallel to the tendon below the gracilis tendon. The thicker semitendinosus tendon was suspended by marking with no 2 high-strength non-absorbable suture (Ethicon, Somerville, NJ, USA), and was cut from the tibia attachment point. The obtained graft was cleaned with a tendon stripper. After passing into the fixed button suspension device, the tendon was folded in two and the proximal and distal ends were sutured together with the Krakow technique.

The thickness of the double layer tendon graft obtained was measured and recorded (generally 5-6.5 mm in diameter). The folded graft should be at least 9 cm in length and ≥5 mm in diameter. If the obtained graft is of insufficient diameter, a 4-leg tendon graft can be obtained by including the gracilis tendon. If

the graft thickness is ≥6.5 mm, it will be greater than the diameter of the patellar tunnel, and the tendon must be thinned, or two separate divergent patellar tunnels must be opened. It must be kept in mind that a tendon diameter thicker than 6.5 mm can cause iatrogenic patella fracture.

Fixation of the Tendon Graft

Entering the joint from the anteromedial and anterolateral portals, the MPFL patellar attachment site was checked. While the lateral retinaculum is routinely loosened in chronic cases, it can be protected in acute ruptures. Other intra-articular pathologies and the patellofemoral joint were evaluated. Under fluoroscopy guidance, a guidewire was placed for the patellar and femoral tunnels. When opening the patellar tunnel, the tunnel depth was determined by calculating the turning distance for the fixed-length system, and the distance planned for tendon placement in the tunnel was marked with a pen. Using the fixed-button CL Ultra (Smith & Nephew), the prepared tendon graft was fixed first to the patella (Figure 1). The site of the femoral tunnel marked with the guidewire under fluoroscopy was opened with a 1.5 cm cut. With a blunt end obturator, the tendon graft was advanced over the capsule from the medial patella towards the femur attachment site (over the joint capsule and below the medial retinaculum).

After preparation of the femoral tunnel to an appropriate diameter and depth, the tendon legs were advanced along the tunnel by mounting them on the buttons and threads of the elevator system. After placement in the adjustable loop and button system of the Liftlix Button Ti (Tulpar, Turkey), the suspension threads (Figures 2, 3) were tightened in the correct axis until appropriate tension was achieved. Tendon tension was adjusted by pulling the tightening threads while the knee was in 30° flexion. To avoid excessive tension, the tendon was checked by placing the round bone between the tendon and the lateral condyle in the elevator. After fixation, the femur trochlea was examined arthroscopically.

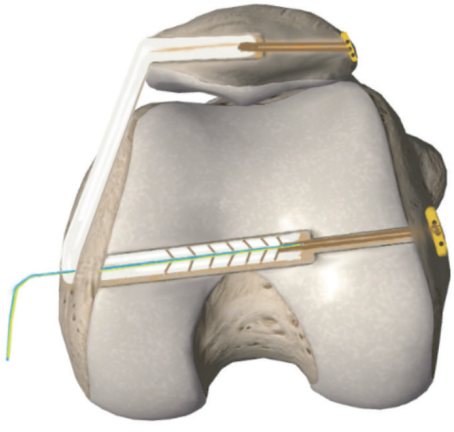

Figure 1. Illustration of double suspension technique

RESULTS

Three male and two female patients with an average age of 25 (range 18-33) were treated surgically after an acute knee injury. Time from injury to surgery was 7.6 weeks (range 6-10). Anatomic MPFL reconstruction with a double-suspension technique was achieved biomechanical stability closest to the tensile strength of the natural MPFL. The mean surgery time was 51 minutes (range 45-60). Clinical results were obtained in an average of 16.8 months (range 12 to 24) follow-up. Chondral damage was evaluated with MRI at the 6th month of surgery and graded according to the modified Outerbridge grading of chondromalacia. Of 5 patellae, three were graded II and two were graded as I according to the MRI. There was a statistically significant improvement in all patient-reported outcomes from baseline to the final follow-up examination. In the clinical outcomes, the mean modified Lysholm knee score increased significantly from 45.5 preoperatively to 95.2 at the final follow-up examination ($p<0.001$). A return to amateur sports at an average of 4±0.2 (4-6) months was achieved 100% (n=5) of the cases (Table 1).

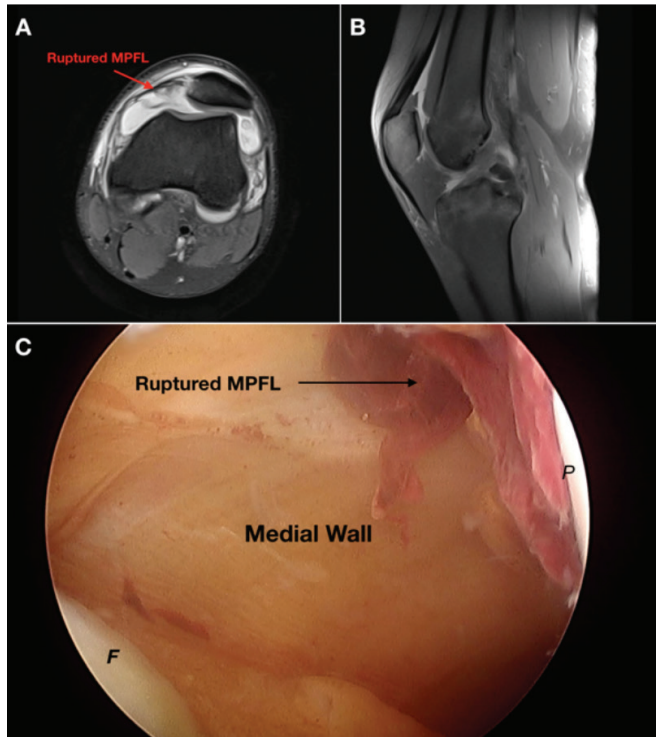

Figure 2. A) Axial MRI view of ruptured MPFL; B) Sagittal MRI view of injured knee and displaced patella; C) Arthroscopic view of ruptured MPFL and medial wall

F: Femur, P: Patella, MPFL: Medial patellofemoral ligament, MRI: Magnetic resonance imaging

DISCUSSION

Several techniques have been described for MPFL reconstruction. The major aim of all these techniques is to achieve a more anatomical reconstruction. Current fixation materials and the fixation methods used have been examined biomechanically in experimental models. According to tension tests, the graft resistance is highest when fixed along the tunnel. The results of clinical studies have shown that stabilization is provided with correct determination of the tendon attachment sites and tension that is neither too tight nor too loose. With the technique described in this paper, tendon tension is provided in a controlled manner. The elevator technique reduces to a minimum the possibility of tendon laxity or insufficient fixation.

The mean total length of the MPFL has been reported to be 58.8±4.7 mm, with a width of 12.0±3.1 mm and a thickness of 0.44±0.19 mm at the mid-point (4). The tensile force resistance of a natural MPFL is 208 N (10). The aim of MPFL reconstruction is to prevent this tensile force that causes dislocation. The methods most preferred for fixation of the tendon graft to the patella are anchor fixation, the docking technique, bone bridging, and transverse tunnel interference screw fixation. Of these techniques, the through-tunnel tendon graft method has been reported to have the closest tensile strength to that of the natural MPFL. Although the tunnel fixation technique with an interference screw seems to be superior in mechanical tests, the tendon is seen to slide back over the tendon. With the dual suspension method described in this paper, interference screw loosening is prevented and tension closest to the anatomy is provided.

Patellofemoral stability is a balance formed by dynamic and static structures working together. Failure in the first 30° of flexion of the knee occurs as instability. The femoral attachment point is of primary importance in providing a dynamic balance within this stability. The projection of this point in the coronal and sagittal planes should be identified with fluoroscopy (Table 2).

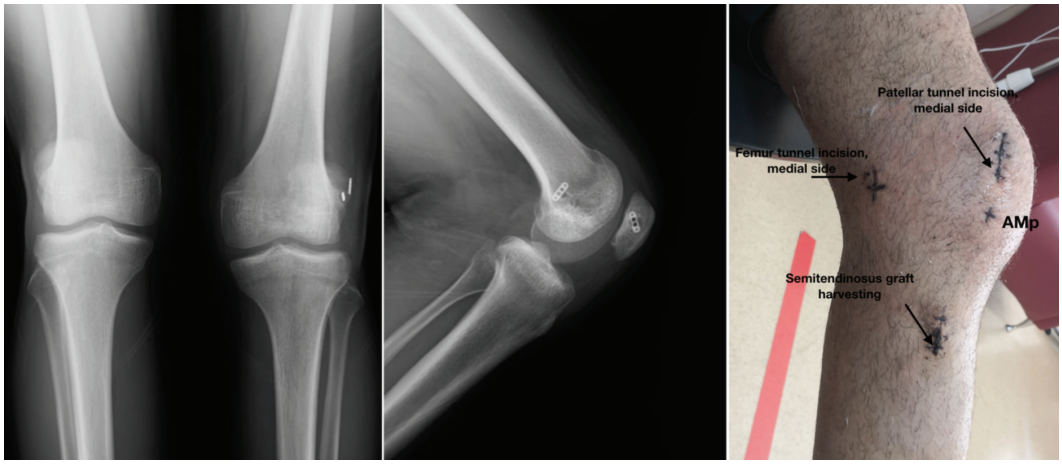

Figure 3. D. Postoperative X-ray image of suspension devices and tunnels, skin incisions of surgical technique from the medial aspect
AMp: Anteromedial portal

Table 1. Patient demographics, postoperative Lsyholm score, and subjective assessments

ID	Age	Gender	Side	Injury mechanism	TFIS (week)	Hospitalization	Duration of surgery (min)	Full recovery time (mo)	Follow-up (mo)	Lysholm knee score	Return to sports (mo)	Complication
1	22	M	L	Contact sports	6	4	45	3	12	96	4	Not
2	24	M	R	Fall from height	8	2	60	4	18	94	4	Not
3	28	F	R	Contact sports	8	2	45	3	24	94	6	Not
4	33	M	R	Contact sports	5	3	50	4	18	100	4	Joint effusion
5	18	F	L	Traffic accident	6	3	55	4	12	92	4	Not

M: Male, F: Female, R: Right, L: Left, TFIS: Time from injury to surgery, mo: Month

Table 2. Pearls of double suspension technique for MPFL reconstruction
1. If the tunnel opened in the patella is wider than 6.3 mm in diameter, the patella will not be resistant to axial loading on the patella. The tunnel length opened for the suspension button must be measured carefully and the tunnel depth appropriate to the tendon diameter must not be less than half the patella width (mean 20±4 mm). 2. The entry site of the guidewire to be placed for the femoral tunnel should be marked with fluoroscopy. 3. Excessive tension of the tendon graft must be avoided. A bone elevator should be inserted between the tendon graft and the lateral femur to avoid loading excessive tension on the tendon graft when pulling on the zip suture. 4. It is recommended that the length of the femoral tunnel prepared for the adjustable loop device is 5 mm longer than the length of the interference screw. 5. The graft tensioning and patellar tracking must be evaluated arthroscopically.
MPFL: Medial patellofemoral ligament

Complications such as chondral damage, arthrofibrosis, hemarthrosis, recurrent instability, and patella fracture may be seen after MPFL reconstruction. The selection of grafts is known not to have any effect on the development of complications. In this study, we preferred a semitendinosus autograft. The mean diameter of the semitendinosus tendon has been reported to be 6.29±0.61 mm in a non-sports group and 6.35±0.6 mm in a sports group (11). Over-tension or laxity in the graft and incorrect determination of the femoral fixation site are the primary reasons for complications. Therefore, to avoid potential complications, an appropriate tunnel diameter should be determined, the tunnel diameter should be expanded to a sufficient depth, and these should be confirmed with fluoroscopy.

Suspension systems are the most frequently used fixation methods in cruciate ligament reconstruction. The two different designs of adjustable loop and fixed length loop are usually used. In comparisons of these two techniques, fixation with the fixed-length device has been shown to be superior in mechanical tests (9). In adjustable suspension devices, suture slippage can occur as a result of over-loading. Prolongation of this suspension causes clinical laxity. Nakagawa et al. (12) described suspension devices in MPFL reconstruction. However, in the technique described in that study, a double tunnel was described for patellar fixation and no reference was made to the risk of loosening due to cyclic loading of the suspension system. In mechanical tests, adjustable length fixing devices experience a clinically significant increase in loop elongation during cyclic testing (9). This elongation can be partially adjusted with sutures, causing a shift in the length of the loop. The suspension loop technique applied for MPFL reconstruction in this study was applied as a fixed-length loop for the patella and as the adjustable loop technique for femoral fixation. The aim of this was to reduce to a minimum the loosening that can occur as a result of cyclic loading on the patella. Appropriate graft tension is provided with the adjustable suspension system benefiting from the femoral tunnel length in femur fixation. In addition to the adjustable loop device, to reduce to a minimum the sliding back of the tendon graft and loop loosening, fixation from the medial is strengthened with an interference screw.

Aperture fixation techniques (anchor suture, interference screw fixation, docking technique, etc.) are known to have insufficient tensile resistance strength compared to the transverse tunnel technique. However, there are no mechanical tests available as yet which compare the double tunnel and single tunnel techniques.

The advantages of the technique are that it allows the surgeon to easily adjust the tendon graft tension and there is no risk of suture slippage. However, there is a need for support of these results with clinical case series. Negative aspects of the technique are that mechanical tests have not yet been conducted and mid-term follow-up results have not yet been obtained.

CONCLUSION

Our preliminary results show that the double suspension technique is an easy and effective method for MPFL reconstruction. Anatomic MPFL reconstruction with double-suspension technique provides biomechanical stability closest to the tensile strength of the natural MPFL. This technique, which can be easily applied, can be recommended in the treatment of chronic or acute patellar instability.

Ethics

Informed Consent: An informed consent was obtained from all patients.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: Ö.B., Concept: Ö.B., R.D., Design: Ö.B., R.D., Data Collection or Processing: Ö.B., Analysis or Interpretation: Ö.B., Literature Search: Ö.B., R.D., Writing: Ö.B.

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

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CASE REPORT

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Cervicofacial Emphysema After a Dental Procedure: A Case Report

Yavuz Atar[1], Cem Çelik[2], Mustafa Berkiten[3]

[1]Acıbadem Maslak Hospital, Clinic of Otolaryngology, İstanbul, Turkey
[2]University of Health Sciences Turkey, Prof. Dr. Cemil Taşcıoğlu City Hospital, Clinic of Otolaryngology, İstanbul, Turkey
[3]İstanbul Health and Technology University Faculty of Dentistry, Department of Endodontics, İstanbul, Turkey

Abstract

Subcutaneous emphysema is a complication that can occur after dental procedures. Air leaking under the skin can diffuse into various potential spaces. When it spreads to the cervicofacial area, a complaint of significant facial swelling may occur a few hours after the procedure or the next day. Leaking into potential spaces can cause life-threatening situations in some cases. Two of these situations are pneumomediastinum and mediastinitis. The mucogingival barrier is a keratinized, protective structure at the junction of the oral cavity mucosa and gingiva. Caused by high-speed air rotors used in dental procedures, this complication can occur due to interventions that damage the mucogingival barrier, such as tooth extraction, restorative treatment, and root canal treatment. The aforementioned traumatic treatments may create a defect in the barrier, and the air emitted by high-speed air rotors may leak under the skin. It is rare for this complication to occur without significant damage to the mucogingival barrier. Even if cervicofacial emphysema develops, progression to pneumomediastinum and mediastinitis is rare. Clinical findings such as a significant dyspnea, high fever, and low oxygen saturation may be detected in the patient with these complications, or the patient may be asymptomatic. We present a 42-year-old female patient who developed subcutaneous emphysema and asymptomatic pneumomediastinum after caries treatment in which only 1/4 of her enamel was excised without tooth extraction.

Keywords: Dental care, subcutaneous emphysema, complication

INTRODUCTION

Subcutaneous emphysema is a rare but essential complication observed after dental procedures.

The main findings of this condition, which is characterized by the trapping of air under the skin, include crepitation and swelling on palpation. Air trapped under the skin may spread to the periorbital, mediastinal, pericardial, and thoracic regions. Subcutaneous emphysema developing after dental procedures has various causes such as tooth extraction, preparation, restorative treatment, endodontic treatment, and subgingival curettage (1).

High-speed air rotors in dental procedures that disrupt the mucogingival barrier are widely recognized as a risk factor for developing subcutaneous emphysema (2).

Emphysema in the head and neck region usually regresses spontaneously, but sometimes it can lead to significant complications such as pulmonary embolism, soft tissue infection, pneumomediastinum, and pneumopericardium (3).

We present a patient treated for dental caries who developed cervicofacial emphysema without tooth extraction.

Address for Correspondence: Assoc. Prof. Yavuz Atar, Acıbadem Maslak Hospital, Clinic of Otolaryngology, İstanbul, Turkey
Phone: +90 212 304 44 44 **E-mail:** dryavuzatar@gmail.com **ORCID ID:** orcid.org/0000-0003-4496-6408

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CASE PRESENTATION

After dental treatment, a 42-year-old female patient was admitted to our clinic complaining of swelling and pain in the left periorbital and submandibular areas. The patient had no other symptoms, such as fever or dyspnea. The patient stated that she had been treated for tooth decay the day before, and there was no tooth extraction. In the dental procedure, it was learned that 1/4 of the enamel of the left second mandibular molar was excised, and the remaining barriers were intact (Figure 1). Her general condition was good, and her vital signs were stable at the first examination. The patient's fever was 36.7 degrees Celsius; blood pressure was 120/80 mmHg; heart rate was 84/min, oxygen saturation of 99% on room air; and respiratory rate was 14/min. On physical examination, there was a painful swelling in the left periorbital and submandibular areas on palpation with crepitation (Figure 2). No infective focus was detected in the intraoral examination, and the treated tooth was intact. No pathological lung sound was heard during auscultation. The patient had no known comorbidities. The patient denied alcohol and tobacco use.

Neck computed tomography (CT) was performed as a radiological examination. Thorax CT examination was also performed due to the possibility of mediastinal spread. Both subcutaneous emphysema extended from the periorbital region to the submandibular and pneumomediastinum in the upper mediastinum (Figure 3). The white blood cell count of the patient was 11700, and the C-reactive protein value was 22 in the blood tests. Except for these, no abnormal values were detected. In the neck CT examination of the patient, it is seen that the subcutaneous emphysema extends from the left periorbital

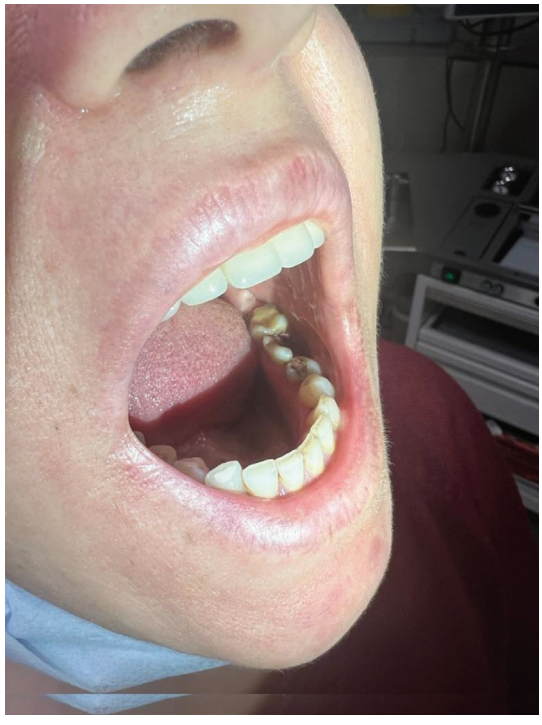

Figure 1. Pre-treatment view of the patients tooth

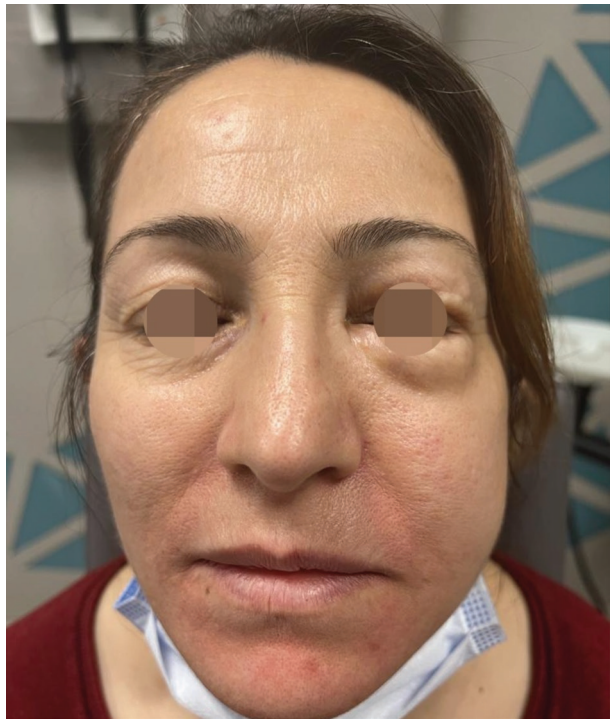

Figure 2. Patients first presentation and appearance of cervicofacial emphysema after dental procedure

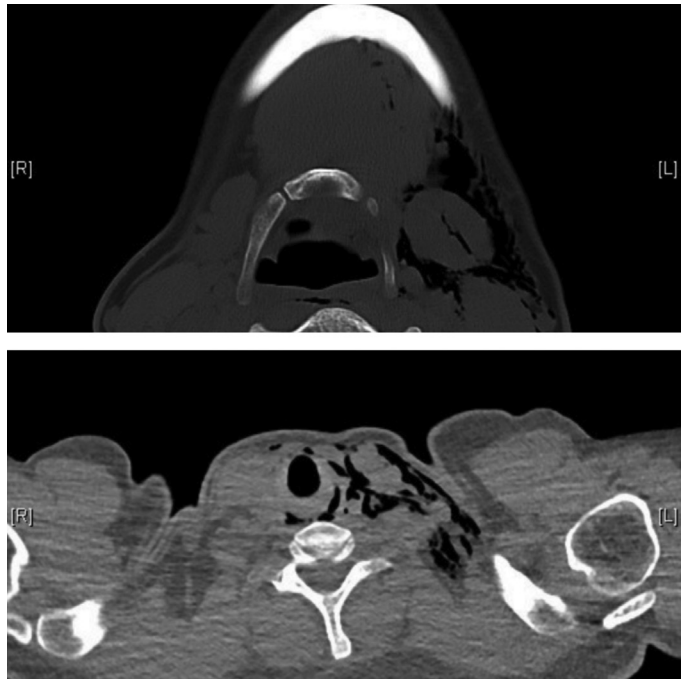

Figure 3. Above: CT image of cervicofacial emphysema below: pneumomediastinum on chest CT

CT: Computed tomography

area to the submandibular region and descends to the level of the hyoid bone. It is seen in thorax CT that subcutaneous emphysema extends to the mediastinum through the fascial planes and causes pneumomediastinum.

The patient was diagnosed with cervicofacial emphysema and asymptomatic pneumomediastinum secondary to dental caries treatment. Cefuroxime 500 mg per oral 2x1, chlorhexidine mouthwash 3x1, and a light-pressure massage to the face were used for 1 week in the therapy. Periorbital and submandibular swelling regressed significantly in the first week after the treatment, and no additional conditions or complications developed (Figure 4).

DISCUSSION

Tornbull first described subcutaneous emphysema in 1900 in a case of swelling in the neck that developed after a musician played a wind instrument whose tooth had been extracted (4). The etiology of subcutaneous emphysema can be iatrogenic, infectious, traumatic, or spontaneous. Iatrogenic causes are the most common etiological causes. These include head and neck surgery, intubation, mechanical ventilation, and dental surgery (5).

In subcutaneous emphysema developing after dental procedures, air passes through the mucosal defects and the dentoalveolar membrane to the fascial planes in the neck (6). Trapped air due to the relationship of the cervical fascia with the mediastinum can lead to pneumomediastinum and, worse, mediastinitis. Less commonly, pneumothorax (7), optic nerve damage (8), and even death due to air embolism (9) are reported complications. In sudden dyspnea and swelling after a dental procedure, most clinicians consider allergic reactions or angioedema, soft tissue infection such as cellulitis, hematoma, Ludwig's Angina, or Lemierre syndrome in the differential diagnosis. Painless edema is present in cases with isolated subcutaneous emphysema, and crepitation by palpation is pathognomonic (10).

Figure 4. The appearance of the patient whose symptoms regressed after 1 week of follow-up and treatment

The widespread use of advanced air-driven instruments in dental procedures has led to a marked increase in the incidence of subcutaneous emphysema. In especially the extraction of the mandibular third molar tooth is the most frequently reported cause in case series (11).

Less frequently, restorative treatment (12), root canal treatment (6), crown preparation (13), periodontal surgery (14), scaling (15), and laser irradiation (16) may cause subcutaneous emphysema.

Early diagnosis and treatment are essential in subcutaneous emphysema. Although subcutaneous emphysema in the head and neck region generally regresses within 5-7 days, it can lead to the previously mentioned complications through potential cavities. Patients with dyspnea should be monitored for absolute saturation, and 100% O2 support should be provided. Besides, prophylactic antibiotic use is not recommended for infections in potential cavities, but it is generally used.

In the presented case, it was observed that subcutaneous emphysema might occur without significant intraoral barrier damage, and it has been shown that this emphysema can cause asymptomatic pneumomediastinum without causing a clinical findings. Emphysema and pneumomediastinum after the endodontic procedure are mostly related to the root canal irrigated with hydrogen peroxide or dried with compressed air. Only the air turbine handpiece was used in our case, and the irrigation and root canal treatment were not applied. Although a rubber dam was used during the procedure, emphysema still developed.

CONCLUSION

Dentists should be careful when using air-driven handpieces or compressed air syringes, be aware of the possibility of subcutaneous emphysema and pneumomediastinum, and be able to diagnose. When this suspicion occurs, the extent of emphysema should be determined with the necessary imaging studies, and treatment should be started-using a rubber dam, avoiding irrigation with hydrogen peroxide, using a compressed

air syringe during irrigation, and using remote exhaust handpieces or electric motor-driven handpieces for passing these complications.

Ethics

Informed Consent: Informed consent was obtained from the patient.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: Y.A., M.B., Concept: Y.A., Design: Y.A., C.Ç., Data Collection or Processing: C.Ç., Literature Search: Y.A., C.Ç., Writing: Y.A., C.Ç., M.B.

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

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