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Online article not yet published in an issue

Butterly SJ, Pillans P, Horn B, Miles R, Sturtevant J. Off-label use of rituximab in a tertiary Queensland hospital. Intern Med J doi: 10.1111/j.1445-5994.2009.01988.x

Book

Sample1: Murray PR, Rosenthal KS, Kobayashi GS, Pfaller MA. Medical microbiology. 4th ed. St. Louis: Mosby; 2002.

Sample 2: Sümbüloğlu K, Akdağ B. Regresyon Yöntemleri ve Korelasyon Analizi. Hatiboğlu Yayınevi: Ankara; 2007.

Chapter in a book

Meltzer PS, Kallioniemi A, Trent JM. Chromosome alterations in human solid tumors. I n: Vogelstein B, Kinzler KW, editors. The genetic basis of human cancer. New York: McGraw-Hill; 2002. p. 93113.

Journal article on the Internet

Abood S. Quality improvement initiative in nursing homes: The ANA acts in an advisory role. Am J Nurs [serial on the Internet] 2002 [cited 12 Aug 2002]; 102. Available from: www.nursingworld.org/AJN/2002/june/wawatch.htm

Website

Cancer-pain.org [homepage on the Internet]. New York: Association of Cancer Online Resources [updated 16 May 2002; cited 9 Jul 2002]. Available from: www.cancer-pain.org

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The Intensive Care Society of Australia and New Zealand. Mechanical ventilation strategy in ARDS: Guidelines. Int Care J Aust 1996;164:282-4.

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The source of financial grants and the contribution of colleagues or institutions should be acknowledged.

Tables

Tables should be complementary, but not duplicate information contained in the text. Tables should be numbered consecutively in Arabic numbers, with a descriptive, self-explanatory title above the table. All abbreviations should be explained in a footnote. Footnotes should be designated by symbols in the following order: *,†, ‡, §, ¶.

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Editorial Correspondence

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Original Article / Orijinal Araştırma

Comparison of Testicular Elasticity with Histogram Analysis of Testicular Echogenicity

Testis Elastikiyetinin Testis Ekojenitesinin Histogram Analizi ile Karşılaştırılması

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Abstract

Aim: This study aims to evaluate the relationship between testicular tissue elasticity and ultrasound (US) histogram analysis obtained from testicular echo signals. The goal is to explore whether quantitative texture analysis can complement traditional US findings.

Material and Method: 46 patients with 92 testis were examined using B-mode ultrasound and strain elastography (SE). A transverse US image was analyzed for each testis to extract histogram parameters such as mean, standard deviation, skewness, kurtosis, and entropy. SE was used to measure testicular elasticity.

Results: Histogram analysis showed a significant correlation between age and homogenization of testicular tissue (r=0.444; p<0.001). Strain ratios were positively correlated with the mean region of interest (ROI) signal value (r=0.627; p<0.001), whereas an inverse correlation was found between the mean entropy values and strain ratios (r =-0.683; p<0.001).

Conclusion: These findings suggest that higher echo entropy increases testicular elasticity. This quantitative analysis offers a new objective method for assessing testicular function and provides data complementary to traditional ultrasound techniques.

Keywords: Histogram analysis; Male infertility; Testis; Ultrasound elastography

Öz

Amaç: Bu çalışmanın amacı testis dokusu elastikiyeti ile testis eko sinyallerinden elde edilen ultrason (US) histogram analizi arasındaki ilişkiyi değerlendirmektir. Amaç, kantitatif doku analizinin geleneksel US bulgularını tamamlayıp tamamlayamayacağını araştırmaktır.

Gereç ve Yöntem: 92 testisi olan 46 hasta B-mod ultrason ve gerinim elastografisi (SE) kullanılarak incelendi. Her testis için ortalama, standart sapma, çarpıklık, basıklık ve entropi gibi histogram parametrelerini çıkarmak için transvers US görüntüsü analiz edildi. SE, testis elastikiyetini ölçmek için kullanıldı.

Bulgular: Histogram analizi yaş ile testis dokusunun homojenizasyonu arasında önemli bir korelasyon gösterdi (r=0,444; p<0,001). Gerinim oranları ortalama ilgi alanı (ROI) sinyal değeri ile pozitif korelasyon gösterdi (r=0,627; p<0,001), ortalama entropi değerleri ile gerinim oranları arasında ise ters bir korelasyon bulundu (r=-0,683; p<0,001).

Sonuç: Bu bulgular daha yüksek eko entropisinin testis elastikiyetini artırdığını göstermektedir. Bu kantitatif analiz, testis fonksiyonunu değerlendirmek için yeni bir objektif yöntem sunar ve geleneksel ultrason tekniklerine tamamlayıcı veriler sağlar.

Anahtar Kelimeler: Histogram analizi; Erkek infertilitesi; Testis; Ultrason elastografi

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INTRODUCTION

The primary causes of male infertility, which affect approximately 7.5% of couples of reproductive ages, include varicocele, undescended testis, hypogonadism, genetic abnormalities, previous genital surgeries, and urogenital infections.[1,2] Currently, diagnosing male infertility requires both physical examination and ultrasonographic (US) evaluation of the testis.[3] The US is the preferred imaging technique for detecting testicular abnormalities and assessing various conditions, such as swelling, scrotal pain, and infertility.[4,5] Traditionally, urologists and andrologists use tissue palpation to evaluate scrotal stiffness; however, this method is subjective and relies heavily on clinician experience.[5] Ultrasound elastography is an innovative technique that measures tissue stiffness by applying mild compression using an ultrasound transducer that causes tissue changes based on its elastic properties.[6] There are two primary types of elastography: strain elastography (SE) and shear- wave elastography (SWE).[1,5] SE measures relative tissue displacement in response to applied pressure, whereas SWE utilizes acoustic radiation force to generate shear waves, which travel through the tissue at a speed dependent on tissue stiffness. SE is advantageous for real-time qualitative and semi-quantitative evaluation, but it depends on operator technique and external compression, leading to variability. In contrast, SWE provides quantitative measurements and is less operator-dependent, but it is sensitive to motion artifacts and requires specialized software. SE has become an additional tool for identifying pathological tissue changes, and large-scale studies on testicular tissue have used SE techniques.[7-10]

Extraction of quantitative features from medical images has become increasingly prevalent in diagnostic imaging. Advanced image analysis methods enable complex pattern recognition, which can be used alongside subjective assessments to enhance quality evaluation, image optimization, and interpretation.[11] This process, known as radiomics, is a new engineering approach that overcomes the visual limitations of radiologists by extracting high-dimensional data from medical images as quantitative features.[11-13]

This study aimed to develop a quantitative method for extracting texture features from testicular ultrasound images, with a focus on assessing testicular elasticity. Traditional ultrasound evaluations often rely on subjective visual assessments, which can vary among the operators. To address this issue, we employed a radiomics approach that allows the extraction of high-dimensional data to provide objective and reproducible measurements. The goal of this study was to explore how texture analysis can complement existing ultrasound techniques by offering additional operator-independent information for predicting testicular stiffness.

MATERIAL AND METHOD

Patient Selection

This study involving human participants was conducted in accordance with ethical guidelines and the principles outlined in the Declaration of Helsinki. It was approved by the local ethics committee (file number: 2015/104). The male patients who visited our outpatient clinic for infertility underwent testicular ultrasonography and strain elastography. Exclusion criteria included a history of testicular surgery, undescended testis, testicular microlithiasis, significant heterogeneity in echotexture, or low testicular volume. Low testicular volume was defined as a testicular volume of less than 12 mL, which is commonly accepted as the lower limit of normal adult testicular size.[2] This threshold was determined based on previous studies linking testicular volume to spermatogenic function and reproductive potential.

Equipment and Scanning

Image processing and feature extraction

A single experienced radiologist performed all B-mode ultrasound and strain elastography procedures to minimize inter-observer variability. B-mode and semi-quantitative SE were performed with patients in the supine position using an Aplio 400 Platinum (Toshiba Medical Systems Corporation, Tochigi, Japan) device, equipped with a 5-14 MHz linear transducer. Initially, the testicular parenchyma was scanned, and data were collected from both testis, including the following information: testis volume, echotexture, vascularization, testicular nodule detection, presence and grade of microlithiasis, description of the epididymis and vas deferens, and presence or absence of varicocele and hydrocele. The parenchyma of each testis was visually inspected for US inhomogeneity. Representative images of testicular parenchyma were selected for texture analysis. Strain elastography was performed immediately after the B-mode ultrasonography. To minimize movement artifacts, patients were asked to hold their breath during stiffness measurements. The local strain was obtained by applying mild repetitive compression using a rhythmic compression-relaxation cycle with the freehand technique while the probe was in the scanning position.[14] The SE image was displayed as a translucent, color-coded, real-time overlay on the B-mode image. Compression was repeated until more than three SE images were obtained. The stiffness of tissues is represented on a color-coded map: soft tissues in red, hard tissues in blue, and moderately elastic tissues in green.[15] The first ROI was placed in the subcutaneous fat tissue and the second ROI was placed over the testis. Using these ROIs, the strain values of both the subcutaneous fatty tissues and testis in the same image were determined. The strain ratio was automatically calculated using a sonographic device, as shown in **Figure 1** and **2**.

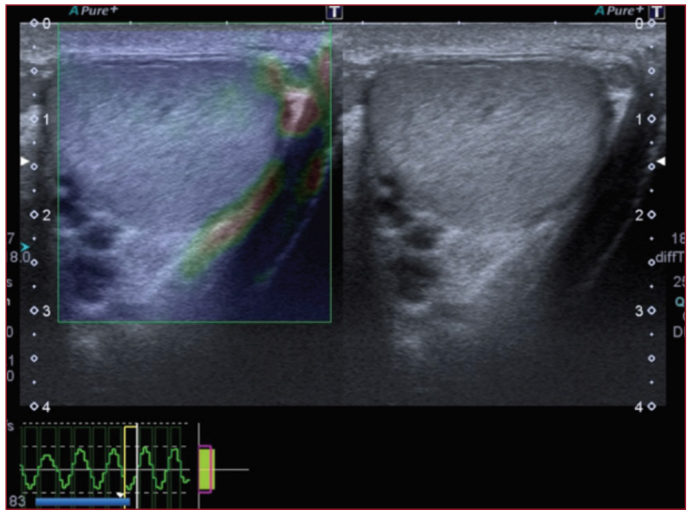

Figure 1. B mode and ultrasound elastography image of the left testis. Velocity profile during compression and decompression.

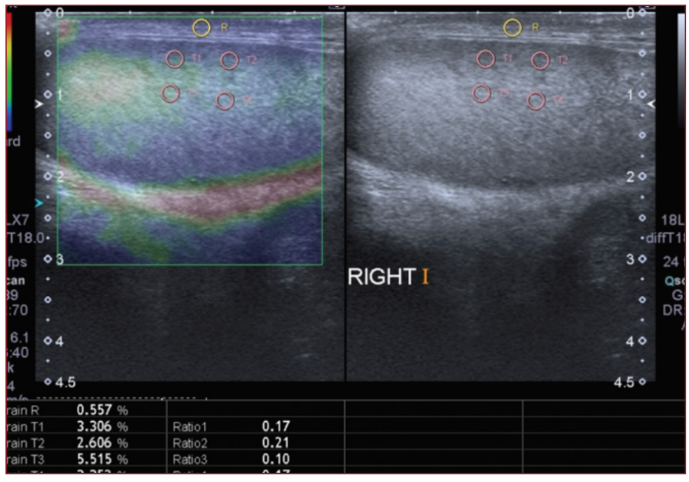

Figure 2. B mode and ultrasound elastography image of the right testis. The upper ROI is in the subcutaneous tissue and the lower four ROIs are in the subcapsular and intraparenchymal area.

Visual review and subsequent selection of saved DICOM images were performed. Each image was exported from the PACS server (2019, PacsOne Server version 6.8.1) in lossless image format [portable network graphics format (png)]. Radiomics was applied to ultrasound images in four steps: (i) image segmentation, (ii) image preprocessing, (iii) extraction of texture features, and (iv) statistical analysis. All image processing algorithms were created using MATLAB R2020b (MathWorks, Natick, Massachusetts, USA). These descriptors, known as textural features, can quantify the characteristics of the image texture. For the texture analysis, only pixel values within the segmented region were considered. Using this algorithm, we extracted texture features, including mean, standard deviation, skewness, kurtosis, and entropy. These features quantify pixel intensity variations within a region of interest (ROI). The mean refers to the average value of pixel intensity or echogenicity in the ultrasound images, ranging from 0 (black) to 255 (white). The standard deviation represents the variation in pixel intensity. Skewness indicates asymmetry of the mean distribution, whereas kurtosis measures the sharpness or flatness of the distribution peak. (Kurtosis is defined as a measure of the peakness of a distribution). Higher kurtosis values suggest a more peaked distribution, whereas lower kurtosis values indicate a flatter one. Entropy measures the randomness in the pixel distribution, with higher values indicating greater texture complexity.[16]

Statistical Analysis

Statistical analyses were performed using SPSS version 22. The mean values of the histogram parameters and strain ratios were compared between the tests using Student's t-test and Spearman's correlation analysis.

RESULTS

A total of 55 participants were considered eligible for the study. However, five declined to undergo the proposed examination, and measurements for four participants were unreliable because of motion artifacts. Consequently, 46 patients with 92 testis were included in the final analysis. The youngest participants were 20 years old, while the oldest were 55. The mean age of the patients was 36.73±12.43 years, ranging from 22 to 55 years. No parameters were found to cause differences between the testicles.

Based on the histogram analysis, as age increased, the regions representing one SD above and below the mean in the ROI echo signal decreased, whereas the middle region increased ($r=0.444$; $p<0.001$), indicating homogenization. The strain ratios showed an increase in correlation with the increase in the mean ROI signal value ($r=0.627$; $p<0.001$), as shown in **Figure 3**. A significant and strong inverse relationship was observed between the mean entropy values and strain ratios ($r=-0.683$; $p<0.001$), as shown in **Figure 4** and **Table 1**.

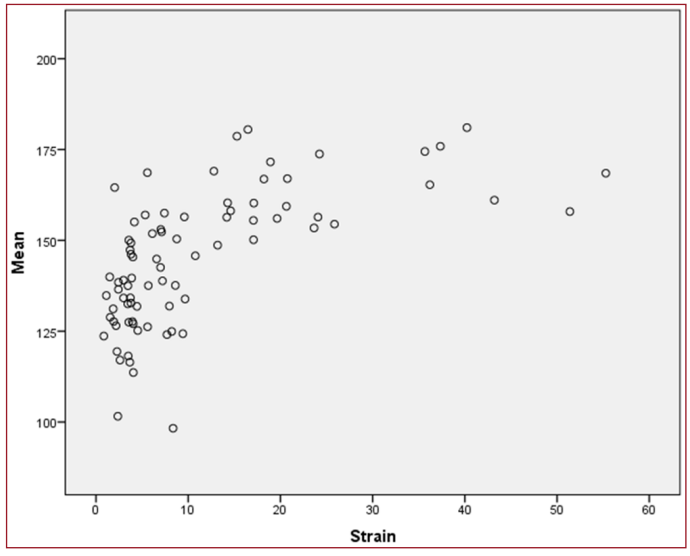

Figure 3: As the mean ROI signal value increased, strain rates also increased ($r=0.627$; $p=0.000$).

Table 1: Histogram analysis and strain ratio mean findings.

N (92)	Mean	Std. Deviation	Minimum	Maximum
Mean	141,44	21,53	87,15	181,03
Std. Deviation	16,52	2,75	11,04	24,85
Minimum	91,33	18,20	42,00	132,33
Maximum	190,76	19,64	134,67	229,00
Median	141,90	22,51	85,33	182,17
Variance	280,46	94,53	121,86	617,44
Size %L	16,72	1,53	12,93	21,93
Size %U	16,20	1,03	13,30	18,55
Size %M	67,09	2,08	60,51	71,62
Entropy	0,56	0,35	0,00	1,00
Strain Ratio	12,62	13,17	0,85	57,19

Size %U areas containing one SD above, Size %L below and Size %M between both.

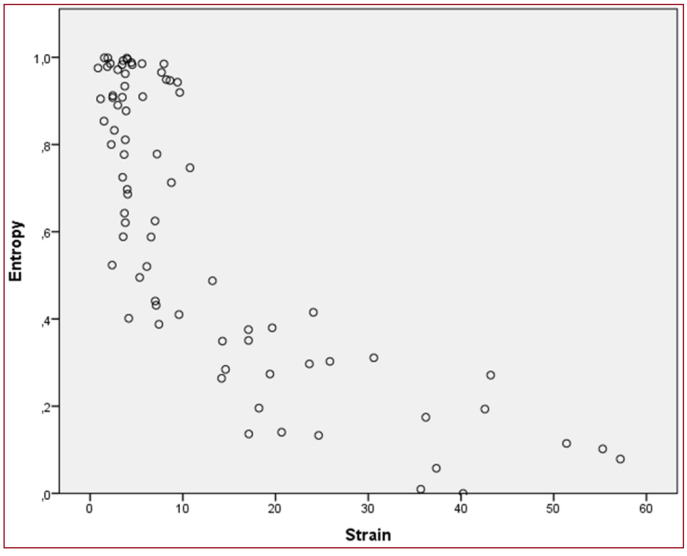

Figure 4: A histogram analysis revealed a significant and strong inverse relationship (r=-0.683; p=0.000) between the mean entropy values and strain rates.

DISCUSSION

This study confirmed that objective texture analysis of testicular ultrasound images correlates well with the visual features commonly used in subjective assessments, such as contrast, uniformity, and edge structures within the images. More importantly, our findings revealed that testicular tissue became more elastic as entropy increased, indicating that echo entropy could serve as a quantitative marker of tissue elasticity. This finding suggests that texture analysis has the potential to become a valuable quantitative tool for assessing testicular function. For texture analysis to hold diagnostic value, findings must closely align with the underlying pathophysiology. In other words, the appearance of testicles on imaging corresponds to their anatomy, functional state, or dysfunction. Studies have shown that testicular ultrasonographic texture can change in cases of impaired semen quality and carcinoma in situ.[13,17,18] Thus, it is plausible that in images of nodular lesions, textural features are modified because of disrupted spermatogenesis and the presence of nodular abnormalities.

Several studies have attempted to measure testicular stiffness, but most have focused on tumor cases, with few studies examining non-tumoral conditions such as infertility. For instance, Trottmann et al. conducted a study measuring testicular stiffness in healthy volunteers, but their sample had limitations, including the older age of participants (mean age 51.86 years) and the lack of fertility-related data.[1] In contrast, our study examined younger patients with infertility concerns, which more accurately reflects the clinical population in need of such assessment.

Most parameters collected in ultrasound-based testicular assessments tend to provide only a qualitative assessment of the male gonad, which is often influenced by both intra- and inter-operator variability and operator subjectivity. Normally functioning testis are characterized by a uniform echotexture with homogeneously distributed medium-level echoes.[10] Conversely, impaired testicular function is typically linked to ultrasound inhomogeneity, seen as regions of altered echogenicity, predominantly hypoechoic.[19]

One novel aspect of this study was the application of radiomics, which extends beyond traditional visual assessments. Radiomics enables the extraction of high-dimensional data and provides objective measurements of tissue characteristics that complement traditional sonographic evaluations. The use of radiomics has increased in recent years, with applications extending to oncological imaging and various other organ systems.[20] Radiomics has been validated in various contexts for its ability to describe tissue structures and predict the functions of the thyroid, breast, kidney, and prostate.[21-24] Additionally, outside of oncology, radiomics has shown potential in providing valuable and reliable imaging biomarkers for gonadal function.[12] In contrast, only a limited number of studies have assessed radiomics using testicular ultrasonography.[25] By combining radiomic data with standard ultrasound assessments, we can offer a more comprehensive evaluation of testicular tissue, potentially reducing operator dependency and improving the diagnostic accuracy. Future studies should focus on expanding the dataset used in machine-learning models, extracting a greater number of ultrasound texture features, and exploring deep learning algorithms for automatic and more complex feature extraction.

Although our results are promising, this study had several limitations. First, it was conducted with a relatively small sample size, which limits the generalizability of our findings. Larger multicenter studies are required to validate our results and to improve the robustness of the mathematical model used for texture analysis. Additionally, all ultrasound and elastography measurements were performed by a single operator, which means that we were unable to assess interobserver variability. Future studies should address this issue by incorporating multiple observers to ensure the reproducibility of the technique.

Another limitation was the lack of clinical integration of radiomics into testicular ultrasound. Although our study highlights the potential of radiomics in this field, it remains largely an experimental tool. For clinical adoption, further research is needed to standardize the texture features extracted from ultrasound images and establish clear diagnostic thresholds for testicular elasticity and other relevant parameters.

CONCLUSION

This study suggests that texture analysis of testicular ultrasound images offers a promising quantitative approach for assessing testicular elasticity, particularly in infertility evaluations. By refining elastography techniques and ensuring standardization, radiomics has the potential to provide objective, operator-independent data that could enhance diagnostic precision and improve clinical decision-making.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study protocol was approved by the Kahramanmaraş Sütçü İmam University Medical Research Ethics Committee (Decision No: 2015/104).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

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

Financial Disclosure: No research funding was received for this study.

Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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Original Article / Orijinal Araştırma

Evaluation of Cases with Contact with Rabid Animal Risk in Gaziantep City Hospital

Gaziantep Şehir Hastanesinde Kuduz Riskli Hayvan Teması Olan Olguların Değerlendirilmesi

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Abstract

Aim: The aim of this study was to evaluate the general characteristics and prophylaxis status of cases admitted to our hospital due to rabid animal contact.

Material and Method: Cases with rabid animal contact who were admitted to hospital between March 2024 and August 2024 were evaluated retrospectively.

Results: The mean age of the 660 cases was 21.45±17.12 years. 55.8% (n=368) of them were male and 44.2% (n=292) were female. 590 (89.4%) of cases applied within the first 24 hours after contact, while 70 (10.6%) applied after 24 hours. Prophylaxis was not recommended in 40.5% (n: 267), and prophylaxis was recommended in 59.5% (n: 393). The most common type of animal contact was cats (68.3%, n=451), followed by dogs (29.8%, n=197). 72% (n=475) of the animals were stray. Considering the wound depth, 380 (96.7%) of cases recommended for prophylaxis were evaluated as category type 2, and 13 (3.3%) were evaluated as category 3. Of cases recommended for prophylaxis, 20.3% (n=80) received 4 doses of rabies vaccine, 42.7% (n=168) received 3 doses of rabies vaccine, and 3.3% (n=13) received Human Rabies Immune Globulin in addition to the vaccine.

Conclusion: The intensity of exposure with stray animals is a serious public health problem that has been going on from the past to the present in terms of rabies risk. Early referral to a health center after a rabid animal contact, wound care, and timely administration of appropriate rabies prophylaxis show that rabies is a preventable disease.

Keywords: Vaccine, rabies, prophylaxis

Öz

Amaç: Bu çalışmada hastanemize kuduz riskli temas nedeni ile başvuran olguların genel özellikleri ve profilaksi durumlarının değerlendirilmesi amaçlanmıştır.

Gereç ve Yöntem: Mart 2024 - Ağustos 2024 tarihleri arasında hastanemize başvuran kuduz riskli hayvan teması olan olgular retrospektif olarak değerlendirildi.

Bulgular: Başvuran toplam 660 olgunun ortalama yaşı 21,45±17,12 yıl idi. Hastaların %55,8' i (n=368) erkek ve %44,2'si (n=292) kadındı. Olguların 590'ı (%89,4) temas sonrası ilk 24 saat içinde başvururken 70'i (%10,6) 24 saatten sonra başvurdu. Profilaksi önerilmeyen %40,5 (n: 267), profilaksi önerilen %59,5' ti (n:393). Temas edilen hayvan türü en sık kedi (%68,3- n=451) ile olup ikinci sıklıkta köpek (%29,8 - n=197) olarak saptandı. Hayvanların %72'si (n=475) sahipsizdi. Yara derinliği dikkate alındığında profilaksi önerilen olguların 380'i (%96.7) kategori tip 2, 13'ü (%3.3) ise kategori 3 olarak değerlendirildi. Profilaksi önerilen olguların.%20,3' üne (n=80) 4 doz, %42,7' sine (n=168) 3 doz kuduz aşısı ve %3,3' üne (n=13) aşıya ilave olarak Human rabies immün globulin uygulandı.

Sonuç: Sahipsiz hayvanlarla olan temasların yoğunluğu kuduz riski açısından geçmişten günümüze uzanan ciddi bir halk sağlığı sorunudur. Kuduz riskli temas sonrası sağlık merkezine erken başvuru, yara bakımı ve zamanında uygun kuduz profilaksinin yapılması, kuduz önlenebilir bir hastalık olduğunu göstermektedir.

Anahtar Kelimeler: Aşı, kuduz, profilaksi

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INTRODUCTION

Rabies virüs is a neurotropic, enveloped RNA virus belonging to the Rhabdoviridae family of the Lyssavirus genus.[1] This is a zoonotic disease that causes neurotropic viral infection and can be prevented by vaccination. Transmission usually occurs through the bite of infected animals and scratches a human or other animals. Saliva from an infected animal can also transmit rabies if the saliva comes into contact with the eyes, mouth, or nose.[2] Even though rabies is a vaccine-preventable disease, it has a high incidence in many parts of the world. There are very few documented cases of rabies that survived,[3,4] and in these cases, severe permanent sequelae have been observed.[5] In the developed countries, the incidence of the disease has been reduced with pre- and post-exposure preventıons. According to World Health Organisation data, an estimated 59000 people die each year from rabies.[6,7] According to the 2019 updated data of the Ministry of Health in Türkiye, the annual suspected rabid animal contact is 180,000 and 1 to 4 rabies-related human deaths occur each year.[2] Wound care, rabies vaccine and rabies immunoglobulin are recommended for patients admitted to hospital with rabid animal contact.[1,8] Transmission by contact with suspected rabid animals is most commonly by dog bite, but it can also be transmitted from other domestic animals such as cats, sheep, cows, goats, donkeys and horses. In addition, rabies is also spread by contact with other animals such as foxes, jackals, wolves, pigs, martens, bears, ferrets, weasels and skunks.[8] Nowadays, rabies transmission through suspected rabid animal contact still maintains its importance in terms of public health.

In this study, it was aimed to analyse the cases admitted to Gaziantep City Hospital Emergency Department after suspected rabid animal contact.

MATERIAL AND METHOD

The study was obtained from Gaziantep City Hospital Medical Research Ethics Committee (Date: 20.11.2024, Decision No: 76/2024/, E-22753161-514.10-235233430). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki. The study was designed retrospectively, no written informed consent form was obtained from patients.

In this study, records of 660 suspected rabid animal contact cases admitted to Gaziantep City Hospital Emergency Department between March 2024 and August 2024 were retrospectively analysed. Hospital records and ''Rabies Suspected Animal Contact Form" data including age, gender, wound characteristics, time till application to the hospital, vaccination and/or rabies immunoglobulin administration, tetanus prophylaxis administration, kind of animal contacted and whether it was owned or not were analysed. According to the 2019 National Rabies Prophylaxis Guide of the Turkish Directorate General of Public Health, in categories of contact with suspected rabid animals, categories 1 and 2 were classified as superficial, categories 3 and 4 as deep injuries. Age distribution range was categorised as 0-18, 18-65, and over 65 years.

Statistical Analysis

Statistical analysis was performed using IBM SPSS 23.0 version (IBM SPSS, Chicago, IL). Quantitative data were described as number and their percentages (%), and qualitative data were marked with their mean±standard deviation (SD) or median (minimum-maximum).

RESULTS

In the study, 660 rabies suspected animal contact cases admitted to Gaziantep City Hospital Emergency Department between March 2024 and August 2024 were evaluated. 368 (55.8%) of the cases were male and the average age of all cases was 21.45±17.12 years old (range: 1-75-years-old). The age distribution of the patients was as follows: 50.2% were under 18, 48.3% were between 18 and 65, and 1.5% were more than 65 years of age. 96 % of the cases lived in the city centres and 4 % in the rural areas. In cases with a history of rabies suspected animal contact, 475 (72%) of the animals were non-owners and 185 (28%) were owners. The distribution of kind of animal contacted was as follows; 451 (68.3%) cat contact, 197 (29.8%) dog contact, 1 (0.15%) horse contact, 1 (0.15%) donkey contact respectively. The most common animal type contact was with a cat, but animal type record of 6 contacts was not obtained. 267 cases were categorised as category type 1 and no prophylaxis was recommended. The distribution of the others was as follows: 380 (96.7%) were category type 2 and 13 (3.3%) were category 3. No application was assessed as category type 4. Category type 2 applications were assessed as superficial injury and type 3 was considered as deep injury. When the length of time until hospital admission was evaluated, 590 (89.4%) of the cases were admitted to hospital within the first 24 hours, 60 (9.1%) between 2 and 5 days and 10 (1.5%) more than 5 days. Prophylaxis was administered in 393 (59.5%) of suspected rabies animal contact cases, while prophylaxis was not applied in 267 (40.5%). Data analysis of rabies suspected animal contact cases is shown in **Table 1**. Of 393 patients who received prophylaxis, 80 (20.3%) received 4 doses, 169 (43%) received 3 doses and 150 (36.7%) received 2 doses of vaccine. In addition, rabies immunoglobulin was administered to 13 cases (3.3%). Tetanus prophylaxis was administered to 181 (46%) of all cases. The rabies post-exposure prophylaxis applications are shown in **Table 2**.

Table 1. Data analysis of rabies suspected animal contact cases

	N	(%)
Age groups		
<18	331	50.2
18-65	319	48.3
≥65	10	1.5
Gender		
Male	368	55.8
Female	292	44.2
Rabies prophylaxis		
Recommended	393	59.5
Non recommended	267	40.5
Species of contacted animals		
Cats	451	68.3
Dogs	197	29.8
Horses	1	0.2
Donkeys	1	0.2
Unknown	6	0.9
Owner of animals		
Known	185	28
Unknown	475	72
Classification by WHO		
1	267	
2	380	96.7
3	13	3.3
4	-	-
Length of time until hospital admission		
first days	590	89.4
2-5 days	60	9.1
>5 days	10	1.5

Table 2. The rabies post-exposure prophylaxis applications

	N	(%)
Rabies vaccine dosage		
1	0	0
2	150	36.7
3	169	43.0
4	80	20.3
Rabies immunoglobulin		
Applied	13	3.3
Not applied	380	96.7
Tetanus prophylaxis		
Applied	181	46.0
Not applied	212	54.0

DISCUSSION

Rabies is a mortal type of viral encephalitis. The disease can be prevented by post-exposure prophylactic procedures including wound disinfection, vaccination, and Ig application. There are many reports evaluating the cases admitted due to rabies suspected animal contacts. According to the gender distribution of our cases, 55.8% of them were male and it was compatible with the literature. In the study by Kurtoğlu et al. it was found that male patients were more likely to present with street animal contact. The relationship between gender and the type of animal contacted was analysed and it was found that females were exposed to more injuries by cats (62.9%) and males were injured by dogs (53.9%), and the relationship between the type of animal contacted and gender was statistically significant.[17] The reason for the predominance of male cases in these studies is that men spend more time in working life and in external environments and have more contact with animals.

In the study conducted by Aydın et al. it was observed that 98% of the cases were below 65 years of age, and 50% of the total cases were in the age range of 18-44 years.[10] Deveci et al. found that 54.4% of suspected animal contacts were under 20 years of age and 0.3% were between 81and 90 years of age.[11] In our study, the age groups 0-18 years and 18-65 years were the most frequently affected group (98.5% of the cases were in the 0-65 age group), whereas the least affected group was found to be over 65 years of age. The distribution of the admitted cases according to the place of residence was similar to the literature and it was found that those living in the city were more frequently admitted.[9-11] Aydın et al. showed that 79% of the animals were unowned and 54% of the contact animals were dogs.[10] Aldas et al. demonstrated that 73.7% of the cases were cat contacts, 26.2% were dog contacts and 83.2% of the animals were unowned.[9] In the study conducted by Karadas et al. it was found that there was suspected contact with cats (54.2%), dogs (44.5%) and wild animals with 0.5%, and 77.9% of the animal type was found to be unowned.[12] Similarly, in our study, the high frequency of cat contact and the high proportion of unowned animals was observed. It has been reported that rabies originating from wild animals is predominant in developed countries in which dog vaccination is carried out regularly, whereas in developing countries with many unowned animals, especially dogs, are the source of rabies.[8] Prophylaxis was not recommended for 40.5 per cent of applicants due to the high proportion of cat contact cases and the type of contact category.

Considering the duration of application to the emergency department as an indicator of people being sensitive and anxious about rabies disease, it was observed that the majority of the patients (89.4%) applied within the first 24 hours in our study and this was in accordance with similar studies.[9-11] In a study, it was observed that the shortness of application time varied according to the type of injury, applications were made in the first 8 hours in very serious injuries, and the risk of wound site infection increased in admissions made after the first 12 hours.[13] The fact that prophylaxis was not recommended to 40.5% of the admissions shows the lack of knowledge of the community about rabies disease. In the study conducted by Kurtoğlu et al. the level of knowledge of the population about the rabies vaccine and transmission routes was evaluated and it was found that they did not have sufficient level of knowledge.[17] In addition, in a study conducted by Şimşek et al. it was found that the level of knowledge of healthcare workers about rabies disease was low.[18] In our study, it was observed that the majority of rabies risk animal contact was superficial, category 2 (96.7%).

Aydın et al. found that 54% of the total injure of patients were superficial and 46% were deep. 53.6% of these injuries were category type 2 and 44.9% were category type 3.[10]

The most effective method to protect against rabies after suspected animal contact is washing the bite site with soap and water and early wound care.[14] The immunisation is the second stage of indispensable importance and vaccination should be started as early as possible after contact.[15] Among our total number of cases, 80 (20.3%) received 4 doses, 169 (43%) received 3 doses, and 150 (36.7%) received 2 doses of vaccine. It was observed that rabies immunoglobulin was administered to 13 (3.3%) of the cases for whom prophylaxis was recommended. Tetanus prophylaxis was also given to 46% of the patients who received prophylaxis. In general, in patients who received three doses of rabies vaccine, the contact animal was followed up for 10 days and vaccination was stopped according to the WHO recommendation.[19] Appropriate wound care and subsequent administration of rabies immunoglobulin may prevent death in patients with rabies suspected animal contact.[16] It was observed that the rate of rabies immunoglobulin administration was low in our study like in other similar studies conducted in our country.[9,11,20,21] The depth of the injury and the high rate of contact with dogs increase the use of rabies immunoglobulin.[10,12] While wound care, vaccination and rabies immunoglobulin application protect against rabies by 100%, vaccination and rabies immunoglobulin application increase the risk of rabies because it is below 10% in underdeveloped countries.[22]

CONCLUSION

Rabies is a serious public health problem that extends from the past to the present. In this study, the high incidence of unowned animal contact and its importance in terms of rabies disease were emphasised. For this reason, awareness was raised by drawing attention to the fact that rabies disease can be prevented by early application after contact, appropriate wound care and correct prophylaxis application.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Gaziantep City Hospital Medical Research Ethics Committee (Date: 20.11.2024, Decision No: 76/2024/, E-22753161-514.10-235233430

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

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

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Original Article / Orijinal Araştırma

Investigating the Effect of Pericapsular Nerve Group Block on Postoperative Analgesia in Hip Surgery

Kalça Cerrahisinde Perikapsüler Sinir Grubu Bloğunun Postoperatif Analjeziye Etkisinin İncelenmesi

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Abstract

Aim: With increasing numbers of patients undergoing hip surgery, postoperative analgesia planning for patients also becomes more important. Post-hip surgery pain is categorized as acute and severe, and its effective treatment is paramount. Our study investigates the effectiveness of Pericapsular Nerve Group (PENG) block in postoperative analgesia, the amount of opioid used, and the presence of postoperative nausea and vomiting in hip surgeries in a multimodal analgesia context.

Material and Method: This is a prospective study that includes 102 patients in total, undergoing elective hip surgery. The patients were randomly divided into two groups, and the first group (Group P, n=51) received a PENG block, while the second group (Group C, n=51) received no block. Intraoperative hemodynamic data, discharge-hospitalization time, presence of complications, visual pain scores (VAS) (rest and dynamic) were recorded. Total tramadol dose consumed, additional analgesic requirement, and time of first analgesic were evaluated.

Results: 102 patients completed the study. Rest and dynamic VAS scores were significantly lower in the blocked PENG group at all times postoperatively ($p<0.001$). Total tramadol dosage and additional analgesic rates were significantly lower in the blocked PENG group ($p<0.001$). Also, the rate of requiring additional analgesics and receiving rescue analgesia at an earlier time was significantly higher in the non-block group compared to the blocked PENG group ($p<0.001$, $p=0.023$).

Conclusion: We believe that application of a PENG block in hip surgeries will reduce patient pain scores, allowing for experiencing less pain with fewer opioids, and protection from side effects of opioids.

Keywords: Hip surgery, PENG block, Postoperative analgesia

Öz

Amaç: Kalça cerrahisi uygulanan hasta sayısının artmasıyla birlikte postoperatif dönemde hastaların analjezi planlaması da önem kazanmaktadır. Kalça cerrahisi sonrası ağrı akut ve şiddetli ağrı grubundadır ve etkin tedavisi büyük önem arz etmektedir. Çalışmamızda multimodal analjezi kapsamında kalça cerrahilerinde Perikapsüler Sinir Grubu bloğunun (PENG) postoperatif analjeziye etkinliğini, opioid miktarı ve postoperatif bulantı-kusma varlığını araştırmayı amaçladık.

Gereç ve Yöntem: Çalışmamız prospektif bir çalışma olup elektif şartlarda kalça cerrahisi planlanan toplam 102 hasta dahil edildi. Hastalar rastgele iki gruba ayrılarak ilk gruba PENG bloğu (Grup P, n=51) yapılırken ikinci gruba (Grup C, n=51) blok uygulanmadı. Hastaların intraoperatif hemodinamik veriler, taburculuk- hastanede kalış süresi ve komplikasyon varlığı, vizüel ağrı skorları (VAS) (istirahat ve dinamik) kaydedildi. Toplam tüketilen tramadol dozu, ek analjezik ihtiyacı ve ilk analjezik saati değerlendirildi.

Bulgular: 102 hasta çalışmayı tamamladı. Postoperatif tüm zamanlarda istirahat ve dinamik VAS skorları PENG bloğu yapılan grupta anlamlı bir şekilde daha düşük bulundu ($p<0.001$). PENG bloğu yapılan grupta total kullanılan tramadol dozları ve ek analjezik yapılma oranı anlamlı bir şekilde daha düşük bulundu ($p<0.001$). Ayrıca blok yapılmayan grupta PENG bloğu yapılan gruba göre daha erken saatte ek analjezik gereksinim gösterip kurtarma analjezisi yapılma oranları anlamlı bir şekilde daha yüksek olduğu bulundu ($p<0.001$, $p=0.023$).

Sonuç: PENG bloğu uygulamasının kalça cerrahilerinde hasta ağrı skorlarını azaltarak daha az opioidle daha az ağrı duyacağı opioid nedenli yan etkilerinden koruyacağı kanaatindeyiz.

Anahtar Kelimeler: Kalça cerrahisi, PENG blok, Postoperatif analjezi

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INTRODUCTION

Acute postoperative pain is defined as pain that gradually decreases with the healing of tissue that develops as a result of previous illness, surgical intervention, or a combination of the two in a patient who has undergone surgery. Postoperative pain is affected by many factors such as the location, type, duration of surgery, type of anesthesia, pain treatment applied pre- and post-surgery, the patient's previous pain experiences, and environmental factors.[1]

Total hip arthroplasty (THA) is an orthopedic surgical method used within the indications for degenerative and inflammatory hip diseases.[2] Hip fracture is a common orthopedic emergency in the elderly and is associated with significant mortality and morbidity.[3] Pain after hip surgery is categorized as severe pain, difficult to relieve with oral analgesics. Uncontrolled pain can cause reflex endocrine, metabolic and inflammatory responses that can lead to serious problems such as pulmonary, cardiac or renal problems and thromboembolism. Most of the adverse physiological effects can be prevented with effective postoperative pain management.[4]

The use of multimodal analgesia is recommended for postoperative pain management in hip surgery. Multimodal analgesia consists of pharmacological methods and neuraxial-regional-local techniques.[5] Regional anesthesia techniques are widely used due to their postoperative pain management and proven safety.[6] A Pericapsular Nerve Group (PENG) block, which blocks the nerves innervating the hip joint, was described by Giron-Arango et al. in 2018. For postoperative analgesia in patients undergoing hip surgery, fascia iliac compartment block (FICB), lumbar plexus block, femoral nerve block, quadratus lumborum block, erector spinae plane block, PENG block and lateral femoral cutaneous nerve (LFCN) block are commonly used blocks.[7] However, the best method for hip surgery has not yet been determined.[8] Studies show that a PENG block can be used for both acute pain and postoperative pain in hip fracture patients and for analgesia after elective hip surgeries (primary and revision total hip arthroplasties).[7,9,10]

In this study, we aim to compare the postoperative pain level, first analgesic time, amount of opioid and additional analgesic use primarly, and postoperative nausea and vomiting levels of patients, complications secondarly undergoing hip surgery with or without applying a PENG block under ultrasound guidance.

MATERIAL AND METHOD

Approval for this randomized prospective study was granted by the Ethics Committee of our University (2011-KAEK-2/05.11.2021) and written informed consent was obtained from each patient. All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

A total of 102 patients undergoing hip surgery, aged 18 years and over, with American Society of Anesthesiologists (ASA) physical status I–IV, were enrolled in this study.

Patients with coagulation disorders, allergy to local anesthetics, anticoagulant use, local/systemic infection, or serious arrhythmia were excluded from the study. Also, patients who gave up participating in the study at any time, who were uncooperative, had chronic analgesic/opioid use, and had mental or psychiatric disorders were excluded from the study. The visual analog scale (VAS) was clarified to all patients during the preoperative visit.

Patients were randomly divided into 2 groups using a sealed envelope system: Group P (n=51) patients received the PENG block and Group C (n=51) patients did not receive the PENG block.

Standard anesthesia monitoring (oxygen saturation, electrocardiogram, end-tidal carbon dioxide, noninvasive blood pressure) was applied throughout the surgery. Patients in both groups received midazolam before surgical procedures. While the PENG block was applied to the patients in Group P in the supine position before general anesthesia, it was not applied to Group C patients. Anesthesia was induced by 2 mg/kg propofol, 1 mg/kg lidocaine, 2 µg/kg fentanyl, and tracheal intubation was facilitated with 0.5 to 0.6 mg/kg rocuronium. Maintenance of anesthesia was provided with 50% air and 1 to 2% sevoflurane in oxygen. All patients were administered 1mg/kg tramadol IV for postoperative analgesia approximately 15 minutes before the end of the operation.

In Group P, before general anesthesia, the linear ultrasound probe was placed in the transverse plane over the spina iliac anterior superior (SIAS) in the supine position and moved downward to visualize the pubic ramus. After visualizing the femoral artery and the iliopubic eminence, visible block needle was inserted into the skin on ultrasound with a 30 to 45-degree incision and advanced from lateral to medial, and 20 mL of 0.25% bupivacaine was applied locally between the psoas tendon anteriorly and the pubic ramus posteriorly. All procedures were performed by an experienced anesthesiologist. Recording any side effects and complications such as hypotension, vascular puncture, paresthesia and local anesthetic toxicity was planned during the block application, but no side effects or complications were observed during the applications.

10 cm VAS (0= no pain, 10=maximal pain) was used by an anesthesiologist (who was unaware of the procedure) for the assessment of resting and dynamic pain at 1st, 2nd, 6th, 12th, 18th and 24th postoperative hours. At the end of the surgery, 4×1 g paracetamol and 2×1 mg/kg tramadol were given to all patients. 100 mg tramadol was given to all patients when VAS score was over 4 during postoperative follow-up as additional analgesia. And also when the

patient noticed strong pain despite these treatments, 20 mg meperidine IV was administered as rescue analgesic. When the VAS score evaluation was completed, the first analgesic time, the total tramadol dose administered to the patient, whether additional analgesic (tramadol) was needed, whether rescue analgesia was applied, the presence of nausea and vomiting, and the presence of complications were investigated and recorded.

Demographic data of the patients, such as age, sex, body mass index, comorbidities, type of surgery performed (e.g.) were recorded. Hemodynamic parameters including mean arterial pressures (MAP), heart rate (HR), and saturation of oxygen were noted before anesthesia induction (T0), at the 5th minute (T1), 30th minute (T2), 60th minute (T5), 90th minute (T6), 120th minute (T7), and at the end of the surgery (T8) intraoperatively. In addition, duration of the surgery, use of blood products during operation, discharge after surgery (service or intensive care need) and length of hospital stay were recorded. In the postoperative period, patients' VAS scores (at rest and dynamic at 1, 2, 6, 12, 18 and 24 hours) were evaluated and recorded. We evaluated the dynamic VAS score with the 15-degree straight leg raising test.

Statistics

G-Power 3.1.9.2 package program was used to determine the number of observations. With an effect size of 0.5, α = 0.05, and a power of 80%, a total sample size of 102 was determined for the study. A dropout margin of 10% was calculated and 112 patients were included in the study.

IBM SPSS Statistics version 20 was used for statistical analysis. Data were expressed as ratio, median (Interquartile range (IQR)), mean±SD. The suitability of variables for normal distribution was determined by visual (histogram) and analytical methods (Kolmogorov-Smirnov test). Student T or Mann Whitney U test was used to compare continuous variables, and Chi-square test was used to compare categorical variables. A p-value less than 0.05 was considered to show a statistically significant difference.

RESULTS

Of 112 patients who were assessed for eligibility, ten refused to sign informed consent and were therefore not included. The remaining 102 patients were randomly and equally divided between two groups. The data of a total of 102 patients who underwent PENG block (Group P; n: 51) and those who did not undergo PENG block (Group C; n: 51) were statistically analyzed (**Figure 1**). The patients' age, gender, body mass index (BMI), presence and distribution of additional diseases, and ASA scores were compared. There was no significant difference between the groups in the demographic data of the patients (**Table 1**).

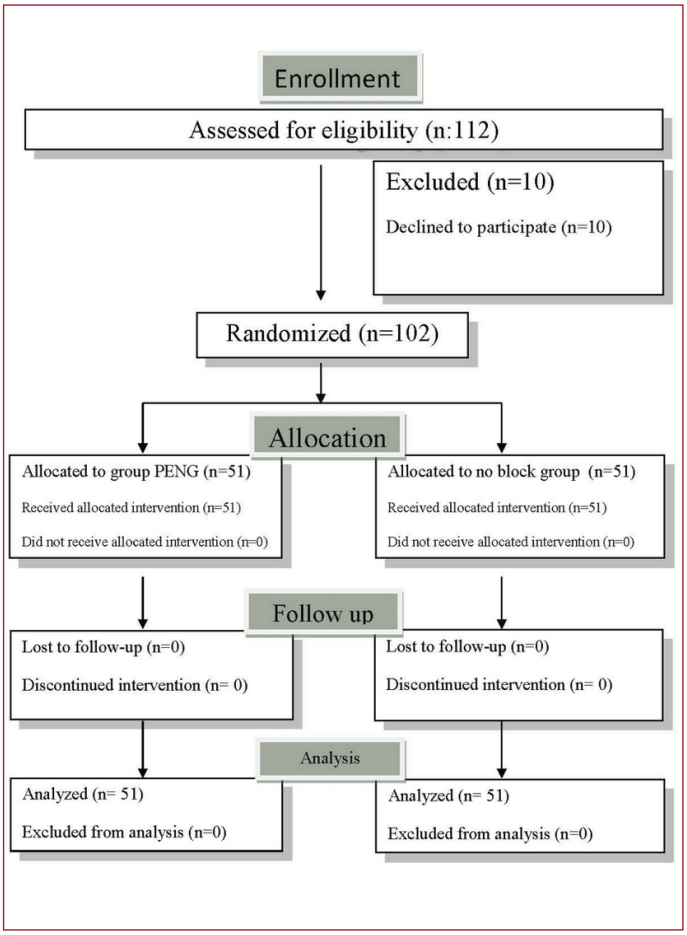

Figure 1. Study flow diagram shows the patient selection process

Table 1. Demographic data of patients

	Group P (n=51)	Group C (n=51)	Total (n=102)	p
Gender, F/M, n (%)	28 /23 (54.9/45.1)	25 /26 (49/51)	53 /49 (52/48)	0.552*
Age, year, Median (IQR)	74 (16)	70 (22)	72 (19.25)	0.078#
BMI, kg/m2, Mean±SD	29.10±6.45	29.29±5.92	28.94±6.16	0.806€
ASA, n (%)				
I	1 (2)	0	1 (1)	
II	9 (17.6)	18 (35.3)	27 (26.5)	0.182*
III	36 (70.6)	29 (56.9)	65 (63.7)	
IV	5 (9.8)	4 (7.8)	9 (8.8)	
Co-morbidity, Yes/no, n (%)	37 /14 (72.5/27.5)	38/13 (74.5/25.5)	75/27 (73.5/26.5)	0.822*

Data are given as number of patients (%), mean±SD (standard deviation), median (Interquartile range (IQR)), Group P; PENG block group, Group C; non- block group. BMI; Body mass index, F/M; Female/ Male, ASA; American Society of Anesthesiologists #Mann Whitney U, *Chi Square, €Student T-test,

The types of surgeries performed were similar between the two groups (p=0.929). The median surgical duration was 110 minutes, while the median hospital stay was 7 days, and there was no significant difference between the two groups (p=0.316, p=0.984). After the operation, 65.7% of the patients were transferred to the ward and 39.2% to the intensive care unit, and there was no significant difference between the two groups in terms of discharge (p=0.297, **Table 2**).

Table 2. Distribution of operation features according to groups

	Group P (n=51)	Group C (n=51)	Total (n=102)	p
Surgery performed, n (%)				
THA	14 (27.5)	16 (31.4)	30 (29.4)	0.929*
PFN	16 (31.4)	17 (33.3)	33 (32.4)	
Bipolar H	17 (33.3)	14 (27.5)	31 (30.4)	
Revision THA	4 (7.8)	4 (7.8)	8 (7.8)	
Operation time, min, median (IQR)	105 (45)	110 (65)	110 (42.50)	0.316#
Postoperative discharge, n (%)				
Service	36 (70.6) /	31 (60.8) /	67 (65.7) /	0.297*
ICU	15 (29.4)	20 (39.2)	35 (34.3)	
Length of hospital stay, days, median (IQR)	8 (4)	7 (6)	7 (6)	0.984#

Data are given as number of patients (%), mean±SD (standard deviation), median (Interquartile range (IQR)), Group P; PENG block group, Group C; non-block group THA; Total hip arthroplasty, PFN: proximal femoral nail, Bipolar H: bipolar hemiarthroplasty, ICU; Intensive care unit. #Mann Whitney U, *Chi Square,

Intraoperative heart rates and mean arterial pressures of the patients are shown in **Figure 2** and **Figure 3**. Heart rates and mean arterial pressure values were similar in both groups at all measured times.

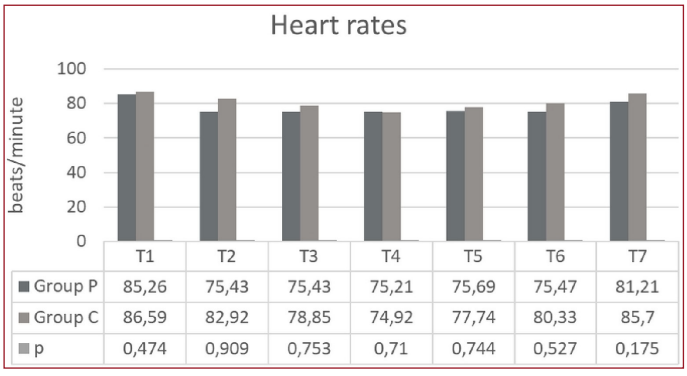

Figure 2. Comparison of patients' heart rates (beats/minute) intraoperatively. Group P; PENG block group, Group C; non- block group. T1:1st, 4th, 8th, 12th, and 24th hours intraoperatively (p > 0.05).

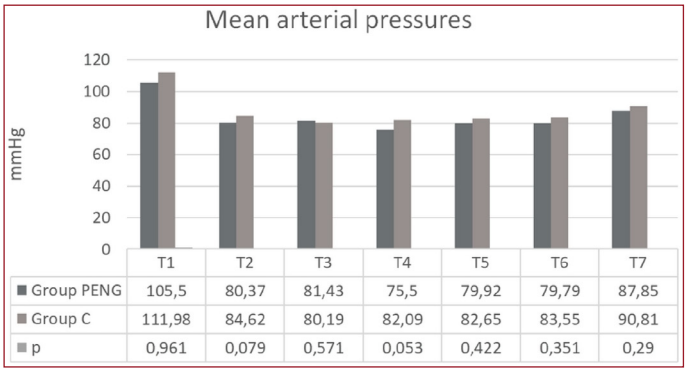

Figure 3. Comparison of patients' mean arterial pressures (mmHg) intraoperatively. Group P; PENG block group, Group C; non- block group. T1:1st, 4th, 8th, 12th, and 24th hours intraoperatively (p > 0.05).

When we evaluated the VAS scores of the patients, resting and dynamic VAS values were significantly lower in the PENG group than in non-block group at all times (**Table 3**). When we compared the patients of PENG group and non-block group according to the types of surgery performed; VAS values were statistically lower in the PENG group than in the non-block group postoperatively at all times in primary THA patients, after the 18th hour in Proximal Femoral Nail (PFN) patients, and after the 12th hour in bipolar hemiarthroplasty patients (**Table 4**).

Table 3. Comparison of postoperative resting and dynamic VAS scores between groups

	Group P (n=51)	Group C (n=51)	P#
Resting VAS scores			
VAS at 1st hour	0 (2)	2 (1)	<0.001
VAS at 2nd hour	2 (2)	4 (2)	<0.001
VAS at 6th hour	3 (2)	4 (2)	<0,001
VAS at 12th hour	3 (3)	3 (1)	0.001
VAS at 18th hour	3 (1)	3 (1)	<0.001
VAS at 24th hour	3 (1)	3 (1)	<0.001
Dynamic VAS scores			
VAS at 1st hour	2 (3)	4 (2)	<0.001
VAS at 2nd hour	3 (2)	5 (3)	<0.001
VAS at 6th hour	4 (2)	6 (2)	<0.001
VAS at 12th hour	4 (2)	5 (2)	<0.001
VAS at 18th hour	4 (2)	5 (2)	<0.001
VAS at 24th hour	4 (2)	5 (2)	0.017

Data are given as median (Interquartile range (IQR)), Group P; PENG block group, Group C; non-block group, VAS; Visual analog scale, #Mann Whitney U

Table 4. Comparison of resting and dynamic VAS values between groups according to the surgeries performed (p values)

VAS#	THA		PFN		Bipolar H		Revision THA	
	Group P (n=14)	Group C (n=16)	Group P (n=16)	Group C (n=17)	Group P (n=17)	Group C (n=14)	Group C (n=4)	Group C (n=4)
Resting VAS scores								
VAS at 1st hour	0.002	0.002	0.008	0.114				
VAS at 2nd hour	<0.001	0.002	0.006	0.343				
VAS at 6th hour	0.002	0.034	0.005	0.343				
VAS at 12th hour	0.025	0.021	0.230	0.886				
VAS at 18th hour	0.002	0.136	0.053	0.886				
VAS at 24th hour	0.003	0.058	0.056	0.886				
Dynamic VAS scores								
VAS at 1st hour	0,002	0,007	0.001	0.200				
VAS at 2nd hour	<0.001	0.019	0.008	0.343				
VAS at 6th hour	0.001	0.043	0.010	0.200				
VAS at 12th hour	0.015	0,010	0.215	0.200				
VAS at 18th hour	0.001	0.444	0.077	0.486				
VAS at 24th hour	0.070	0.276	0.064	0.686				

Data are given as p values. #Mann Whitney U. Group P; PENG block group, Group C; non- block group VAS; Visual analog scale, THA; Total hip arthroplasty, PFN: proximal femoral nail, Bipolar H: bipolar hemiarthroplasty

When we look at the postoperative analgesic use of the patients, total tramadol doses and additional analgesic use rates were significantly lower in the PENG group than in the non-block group (p<0.001, **Table 5**). The rate of requiring additional analgesics and receiving rescue analgesia at an earlier time was significantly higher in the non-block group than in the PENG group (p<0.001, p=0.023, **Table 5**). No significant difference was observed in terms of complications in both groups (p=0.375).

Table 5. Comparison of postoperative nausea, vomiting, complications, analgesic needed and consumed.

	Group P n=51)	Group C n=51)	Total (n=102)	p
Nausea, yes/no, n (%),	19 (36.5) / 33 (63.5)	32 (62.7) / 19(37.3)	51(49.5) / 52 (50.5)	0.008*
Vomiting, Yes/no, n (%)	9 (17.3) / 43 (82.7)	17 (33.3) / 34 (66.7)	26 (25.2) / 77 (74.8)	0.061*
Additional analgesic, Yes/no, n (%)	18 (35.3) / 33 (64.7)	34 (66.7) / 17 (33.3)	52 (51) / 50 (49)	0.002*
First analgesic requirement, hour, median (IQR)	4 (4)	2 (1)	2 (4)	<0.001#
Total tramadol dose, mg, median (IQR)	200 (200)	300 (100)	250 (100)	<0.001#
Rescue analgesic, yes/no, n (%)	13 (25.5) / 38 (74.5)	24 (47.1) / 27 (52.9)	37 (36.3) / 65 (63.7)	0.023*
Complication, yes/no, n (%)	7/44	9/42	16/86	0.375*

Data are given as number of patients (%), median (Interquartile range (IQR)), Group P; PENG block group, Group C; non- block group. *Chi Square, #Mann Whitney U

DISCUSSION

Regional analgesia techniques are widely used in patients with hip fractures because they provide adequate analgesia for pain management in a manner that spares opioids and is relatively safe.[11] The PENG block is a new and promising ultrasound-guided regional anesthesia technique, aiming to block the branches of femoral nerve, obturator nerve and accessory obturator nerve innervating the anterior hip capsule.[12,13] Currently, the PENG block has been shown to be effective in reducing pain in different hip-related procedures, including fracture and hip replacement surgery, but the most current evidence is mostly limited to case reports and case series, and clinical studies are few.[7,14-16]

In this randomized clinical trial, the PENG block reduced postoperative pain scores at resting and dynamic states, and the opioid consumption in the first 24 hours after total hip surgeries. Our findings are consistent with previously published reports. In a randomized, placebo-controlled trial conducted by Zheng J. et al., it was reported that the pain scores were lower in the PENG group compared to the placebo group in patients who underwent total hip arthroplasty.[17] Farag A. et al. showed in their meta-analysis that there was a statistically significant difference in favor of the PENG group in the overall analysis of dynamic pain scores measured by VAS or numerical rating score (NRS) approximately 30 minutes postoperatively, and there was a statistically significant difference in favor of the PENG group when comparing the postoperative pain scores of the lumbar plexus block or analgesics alone.[18] Pascarella G. et al. showed that the PENG block improved postoperative analgesia and reduced pain scores and opioid consumption in the first 48 hours after surgery in a study comparing PENG block and control groups in patients with total hip arthroplasty.[19]

In studies comparing PENG block with other regional techniques in hip surgery, it has been shown that PENG block has better analgesic efficacy and reduces opioid consumption.[20-22] In the meta-analysis of Farag A. et al., the difference in pain scores between the PENG block control groups and other regional techniques (such as FICB) was found to be significant only in the early postoperative period (first 6 hours), but no significant difference was found in pain scores in longer follow-ups, indicating that the effect of the PENG block decreases over time.[18] In the case series reported by Kukreja P. et al., the PENG block was performed in patients scheduled for primary THA and revision THA, and it was stated that the opioid consumption used in the primary THA group in the first 24 hours was significantly lower than in the revision THA group.[10] It has been proven that the PENG block is superior in terms of postoperative analgesia effects and opioid consumption levels in both primary and revision THA patients.[7,19] In our study, we compared the postoperative 24-hour rest and dynamic VAS scores of all patients. We evaluated the dynamic VAS score with the 15-degree straight leg raising test. As a result, VAS values were significantly lower in the PENG block group compared to non-block group patients, consistent with the literature. We believe that the postoperative analgesic efficacy of PENG block in hip surgery is high. We divided the patients into subgroups according to their surgery types and compared them with and without the block, the PENG block VAS values were found to be significantly lower in the first 18 hours postoperatively in primary THA patients and in the first 12 hours in the PFN and bipolar groups. However, it was determined that the PENG block did not make a difference in revision THAs.

In a study conducted by Lin D. et al., the PENG block and the femoral nerve block were compared and the time from surgery to the patient being ready to be discharged was found to be significantly shorter in the PENG group by an average of 1 day.[20] In a study conducted by Iglesias S.L. et al., the PENG block, the periarticular infiltration block (PAI) and the plexus nerve block (PNB) were compared in patients who underwent primary THA and the hospital stay was found to be shorter in the PENG group.[23] While there are studies in which the PENG block has positive effects on the hospital stay, there are also studies in which its effect has not been demonstrated.[7,8,18,20] In our study, no significant difference was found between the hospital stays of the PENG block group and the non-block group.

In a study conducted by Kukreja P. et al., PENG block was found to be superior in terms of opioid consumption between the PENG group and the group without block, while no significant difference was found in terms of pain scores and postoperative antiemetic requirement.[24] A meta-analysis conducted by Huda A. et al., with its weak results, showed that there was an insignificant difference in terms of postoperative nausea and vomiting between the PENG block and other groups.[25] In the meta-analysis conducted by Faraq A. et al., it was found that there was no significant difference in the incidence of postoperative nausea, but the incidence of vomiting was lower in the PENG group.[18] According to our results, the total tramadol dose used in the PENG block group was significantly lower than non-block group consistent with

the literature. And also in the PENG group, patients required less additional tramadol and their need for rescue analgesia significantly lower. We recorded the time when the patients first needed analgesics and it was shown that first analgesic need was significantly later in the PENG group ($p<0.001$). When we questioned the presence of nausea and vomiting in the first 24 hours postoperatively in our study, nausea was significantly less in the PENG block group compared to the non-block group, but no significant difference was found among the patients who had vomiting. We think that the lower nausea complaints in the PENG group are related to the lower opioid use in the PENG group.

Applying a preoperative block is effective in terms of preemptive analgesia and may also reduce intraoperative hemodynamic stability and intraoperative analgesic consumption. In this study, patients' MAP and heart rates were similar in both groups, but one of the limitations of our study was that we did not evaluate intraoperative opioid consumption. The fact that the PENG block does not cause any motor deficit or clinically significant weakness facilitates the rehabilitation of patients without pain by providing early mobilization in the postoperative period.[26] One of the limitations of our study was that we did not include the first mobilization times of the patients in the study. Ather limitation is that although our patient group was hip surgery, the surgeries performed were different (revision, PFN, etc) so analgesic needs may also be different.

CONCLUSION

We think that the PENG block contributes effectively to analgesia in hip surgeries, but the type of surgery may reduce the degree of benefit from the PENG block, and prospective studies are needed for other regional techniques that can be combined with the PENG block for postoperative analgesia, especially in patients undergoing revision THA.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study protocol was approved by the Afyonkarahisar Health Science Universtiy Clinical Researches Ethics Committee (Date: 05.11.2021, Decision No: 2021/506).

Informed Consent: All patients signed the free and informed consent form.

Referee Evaluation Process: Externally peer-reviewed.

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

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

Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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Original Article / Orijinal Araştırma

Evaluation of Digital Addiction Levels in Children and Adolescents with Asthma: A Case-Control Study

Astımlı Çocuk ve Ergenlerde Dijital Bağımlılık Düzeylerinin Değerlendirilmesi: Bir Vaka-Kontrol Çalışması

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Abstract

Aim: Asthma remains the most prevalent chronic condition among children, significantly affecting their health and contributing to increased school absenteeism. Digital addiction, defined by the excessive use of digital technologies, has become prevalent across different age groups, emerging as a significant societal concern. This study aims to evaluate the levels of digital addiction in children with asthma and compare these findings with those of their healthy peers, thereby contributing to a better understanding of the factors influencing asthma management in the digital age.

Material and Method: This cross-sectional case-control study was conducted at the outpatient pediatric clinic and the child psychiatry department of Konya Beyhekim Training and Research Hospital between December 2023 and March 2024. Data collection involved structured interviews with both the participants and their parents, during which details regarding device usage over the preceding six months were gathered.

Results: A total of 170 participants were recruited for the study, consisting of 56 females and 114 males, with a median age of 11 years (interquartile range: 5). The overall Digital Addiction Scale for Children score was also significantly higher in the asthma group compared to controls (p=0.003). The optimal threshold obtained from the receiver operating characteristic analysis was 50.5 points, which provided a sensitivity of 63.5% and a specificity of 60%. A significant association was identified between digital addiction and asthma with p=0.002 and an odds ratio of 2.613 (95% CI: 1.407-4.853).

Conclusion: Children and adolescents with asthma exhibit notably higher total digital addiction scores than their healthy counterparts, suggesting a potential association that merits further research. There is a need for comprehensive prospective investigations to clarify the nature of the relationship between asthma and digital addiction.

Keywords: Adolescent, asthma, children, digital addiction

Öz

Amaç: Astım, çocuklar arasında en yaygın kronik hastalık olmaya devam etmekte olup, onların sağlığı üzerinde önemli etkiler yaratmakta ve okul devamsızlığının artmasına katkıda bulunmaktadır. Dijital bağımlılık, dijital teknolojilerin aşırı kullanımı ile tanımlanmakta ve farklı yaş gruplarında yaygın hale gelmiş, önemli bir toplumsal sorun olarak ortaya çıkmaktadır. Bu çalışma, astımlı çocuklardaki dijital bağımlılık düzeylerini değerlendirmeyi ve bu bulguları sağlıklı akranları ile karşılaştırmayı, böylece dijital çağda astım yönetimini etkileyen faktörlerin daha iyi anlaşılmasına katkıda bulunmayı amaçlamaktadır.

Gereç ve Yöntem: Bu kesitsel vaka-kontrol çalışması, Aralık 2023 ile Mart 2024 tarihleri arasında Konya Eğitim ve Araştırma Hastanesi'nin ayaktan çocuk polikliniğinde ve çocuk psikiyatrisi departmanında gerçekleştirilmiştir. Veri toplama süreci, hem katılımcılarla hem de aileleriyle yapılandırılmış görüşmeler yapılarak, son altı ay boyunca cihaz kullanım detaylarının toplandığı aşamayı içermektedir.

Bulgular: Çalışmaya toplamda 170 katılımcı dahil edilmiştir; bunların 56'sı kız ve 114'ü erkektir. Katılımcıların medyan yaşı 11 yıl (çeyrek aralığı: 5) olarak belirlenmiştir. Astım grubundaki toplam Dijital Bağımlılık Ölçeği puanı, kontrol grubuna göre istatistiksel olarak anlamlı derecede daha yüksektir (p=0.003). Alıcı işletim karakteristik analizi ile elde edilen optimal eşik 50.5 puan olup, bu eşik %63.5 duyarlılık ve %60 özgüllük sağlamıştır. Dijital bağımlılık ile astım arasında p=0.002 anlamlı bir ilişki saptanmış ve odds oranı 2.613 (95% CI: 1.407-4.853) olarak bulunmuştur.

Sonuç: Astımlı çocuk ve ergenlerin toplam dijital bağımlılık puanları, sağlıklı akranlarına göre belirgin şekilde daha yüksektir; bu durum, daha fazla araştırmayı gerektiren potansiyel bir ilişkiyi düşündürmektedir. Astım ve dijital bağımlılık arasındaki ilişkinin doğasını netleştirmek için kapsamlı prospektif araştırmalara ihtiyaç vardır.

Anahtar Kelimeler: Ergen; astım, çocuklar, dijital bağımlılık

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INTRODUCTION

Asthma is the most prevalent chronic condition among children, significantly impacting their health and leading to increased school absenteeism.[1-3] The management of asthma is particularly challenging due to the interplay of various lifestyle factors such as reduced physical activity, sedentary behavior, poor nutrition, and obesity, all of which can exacerbate the condition.[4] In recent decades, participation rates in physical activity among children have notably declined, coinciding with a concerning rise in screen time.[5] This increase in digital engagement has resulted in a surge in sedentary behaviors, negatively affecting children's overall health outcomes.[6]

Digital addiction (DA), characterized by excessive use of digital technologies, has become widespread across different age groups and has emerged as a significant societal concern.[7,8] The pervasive use of digital devices, especially for social media, has been linked to various health issues, including poor sleep quality and increased stress levels.[9-11] Research has established connections between early childhood insomnia, internet addiction (IA), and disruptions in circadian rhythms, highlighting the need for early identification of at-risk children.[12,13]

Furthermore, the psychological issues associated with DA can complicate effective asthma management, further hindering treatment efforts.[14] Understanding the relationship between asthma and DA is essential, as digital addiction may create barriers to effective asthma management and treatment adherence. For instance, children with high levels of DA may engage less in physical activities crucial for asthma control and may neglect their treatment regimens due to distractions from digital devices.

Interventions targeting digital addiction in this population could promote increased physical activity and improve asthma outcomes. Given the rising prevalence of both asthma and DA, there is a significant gap in the literature regarding the specific impacts of DA on children diagnosed with asthma. This study aims to evaluate the levels of DA in children with asthma and compare these findings with those of their healthy peers. By addressing this gap, our research seeks to enhance the understanding of how digital behaviors uniquely affect children with chronic conditions like asthma, ultimately contributing to more effective pediatric asthma management strategies in the digital age.

MATERIAL AND METHOD

The research protocol received approval from the Ethics Committee of KTO Karatay University (approval number 2023/020), and informed consent was obtained from the parents of all participating children.

Study Design and Setting

This cross-sectional case-control study was conducted at the outpatient pediatric clinic and the child psychiatry department of Konya Beyhekim Training and Research Hospital between December 2023 and March 2024.

Sample Size Determination

The sample size was determined based on an estimated asthma prevalence of 11.5% in children reported in previous research.[15] Essential parameters, including a 5% alpha error, a 10% effect size, and 80% power, were established using G*Power 3.1.9.7 software. Consequently, the minimum required sample size was calculated to be 170 participants—comprised of 85 patients with asthma and 85 age-matched healthy controls.

Participants

The study evaluated 85 randomly selected children and adolescents with asthma aged between 6 and 17.9 years. 85 age- and sex-matched healthy children constituted the control group. Asthma was diagnosed according to the Global Initiative for Asthma criteria, specifically identifying individuals who had experienced recurrent wheezing within the past year.[16] The control group consisted of children and adolescents who attended pediatric outpatient clinics for non-specific ailments and consented to participate in the study. Participants were divided into two groups according to their ages: 6-11.9 years old (children) and 12-17.9 years old (adolescents).

Assessment of Digital Addiction

To assess DA among participants, we employed a scale initially developed by Hawi et al. and subsequently adapted into Turkish by Kaçmaz et al.[8] The evaluation encompassed a range of electronic devices, including PlayStation, Xbox, laptops, computers, tablets, iPads, and smartphones. Participants reported their usage patterns, which included activities such as engaging with social media platforms (e.g., YouTube, Instagram, Snapchat, and WhatsApp) and playing video games.

Data collection involved structured interviews conducted with both the participants and their parents, during which details regarding device usage over the preceding six months were gathered. Following the initial evaluation, participants were referred to the child psychiatry department for a comprehensive assessment of their DA levels.

The Digital Addiction Scale for Children (DASC) comprised 25 items categorized into two sub-dimensions: interpersonal relationships and introverted factors. The interpersonal relationships sub-dimension included items related to conflict, deceit, and relapse, while the introverted factors sub-dimension encompassed mental preoccupation, tolerance, withdrawal, and mood fluctuations. Participants responded to each item using a 5-point Likert scale ranging from "never" (1 point) to "always" (5 points). Higher total scores indicated a greater risk of DA, with overall scores ranging from 25 to 125 (**Table 1**).[8]

Table 1. Digital addiction scale for children

1	I spend most of my time using my device when I'm not at school.
2	I feel the need to spend more time when I'm using my device.
3	I feel anxious when I can't use my device.
4	I lie to my family about the time I spend using my device.
5	Using my device helps me forget my problems.
6	I don't spend time with my family because I prefer to use my device.
7	I'm spending more and more time on my device.
8	I get upset or angry when they tell me I need to put my device down.
9	My family tries to stop me from using my device or limit it, but they can't succeed.
10	I sleep less because I use my device.
11	When my device isn't with me, I think about what I'd do on it (video games, social media, messaging, etc.).
12	I get frustrated when I can't use my device (I feel bad).
13	I have issues with my family regarding the time I spend on my device.
14	The most important thing in my life is using my device.
15	Using my device is more fun than doing other things.
16	I lie to my family about what I'm doing when I use my device.
17	I can't control my device usage.
18	I've lost interest in my hobbies or other activities because I prefer using my device.
19	When I stop using my device, I start again before long.
20	I check my device when I'm doing my homework or important things.
21	I feel let down (bad) when I'm asked to stop using my device.
22	I argue with my family when they tell me to stop using my device.
23	I spend way too much money on things related to my device.
24	Using my device makes me feel better when I'm feeling down.
25	Even though my grades at school keep dropping, I keep using my device.

Note: interpersonal relationships (items 4, 6, 9, 10, 13, 16, 17, 18, 19, 20, 22, 23, and 25) and introverted factors (items 1, 2, 3, 5, 7, 8, 11, 12, 14, 15, 21, and 24).

Exclusion Criteria

Exclusion criteria for this study included mental retardation, any physical disabilities that could limit the use of technological devices, and parental refusal to participate.

Statistical Analysis

The distribution of parameters was evaluated using the Shapiro-Wilk test. For normally distributed data, descriptive statistics were reported as mean ± standard deviation, whereas non-normally distributed data were presented as median and interquartile range (IQR). Categorical variables were summarized using frequencies and percentages. For comparative analyses, the Mann–Whitney U test or the independent t-test was applied to continuous variables, while the chi-square test was utilized for categorical variables. The cut-off value of the total DASC score as a DA level predictor was calculated by use of a receiver operating characteristic (ROC) curve. Results were considered significant if $p<0.05$. All statistical analyses were performed using the SPSS software package for Windows, version 21.0.

RESULTS

Demographic Characteristics and Digital Addiction Scale Results for Children

A total of 170 participants were recruited for the study, consisting of 56 females and 114 males, with a median age of 11 years (IQR: 5). Statistical analysis revealed no significant differences in age or sex between the asthma group and the control group ($p>0.05$). In assessing DA, the median scores for interpersonal relationships, introversion factors, and total DASC scores were as follows: for males, 23 (IQR: 14), 29 (IQR: 14), and 54 (IQR: 26), respectively. For females, the corresponding scores were 22.5 (IQR: 19), 26.5 (IQR: 21), and 53.5 (IQR: 38). Although males exhibited higher scores across these domains, the differences were not statistically significant ($p >0.05$ for all comparisons). When evaluating these scores by age group, adolescents demonstrated median scores of 24 (IQR: 17) for interpersonal relationships, 30 (IQR: 16) for the introversion factor, and 56 (IQR: 36) for the total DASC score. In contrast, children achieved median scores of 22 (IQR: 13), 27 (IQR: 13), and 52 (IQR: 25), respectively. While adolescents showed higher scores than children, the differences did not reach statistical significance ($p >0.05$ for all comparisons).

In our analysis, we aimed to provide a comprehensive understanding of the DASC scores by evaluating specific items separately. This approach allows for a nuanced interpretation of how distinct factors, such as interpersonal relationships and introversion, contribute to overall DA, particularly in children with asthma. The separation of analyses helps to identify specific areas where interventions may be tailored for the asthma group, as these factors may require different prevention and treatment strategies. By analyzing the individual item scores, we can better understand the components of DA and how they manifest differently between asthmatic and non-asthmatic participants. **Table 2** summarizes the clinical characteristics of both cohorts. The analysis revealed that specific items on the DASC scored significantly higher in the asthma group compared to controls, particularly items 1, 3, 5, 6, 7, 12, 13, 16, 18, and 19. Within the asthma group, higher scores were particularly evident for items related to interpersonal relationships (specifically items 6, 13, 16, 18, and 19) and introversion factors (items 1, 3, 5, and 12). Consequently, asthmatic participants exhibited significantly elevated scores on both interpersonal relations and internal factors relative to their non-asthmatic counterparts. The overall DASC score was also significantly higher in the asthma group compared to controls ($p=0.003$) (**Figure 1**).

Table 2. Clinical features of children and adolescents with asthma and healthy controls

Variable	Subjects		p value
	Asthma (n: 85)	Healthy Controls (n: 85)	
Sex (Female/Male) (n, %)	28/57 (32.9/67.1)	28/57 (32.9/67.1)	
Age (years)	11 (4)	11 (5)	
Scores of Digital Addiction Scale for Children (DASC)			
Item 1 (point)	4 (1)	3 (2)	0.036
Item 2 (point)	3 (2)	3 (2)	0.918
Item 3 (point)	2 (3)	1 (2)	0.005
Item 4 (point)	1 (1)	1 (1)	0.050
Item 5 (point)	3 (2)	2 (2)	0.011
Item 6 (point)	3 (3)	2 (2)	0.007
Item 7 (point)	3 (2)	2 (2)	0.012
Item 8 (point)	3 (2)	2 (3)	0.084
Item 9 (point)	2 (3)	2 (2)	0.395
Item 10 (point)	1 (2)	1 (2)	0.617
Item 11 (point)	2 (3)	2 (2)	0.111
Item 12 (point)	2 (2)	2 (2)	0.049
Item 13 (point)	3 (2)	2 (2)	0.001
Item 14 (point)	1 (1)	1 (0)	0.353
Item 15 (point)	2 (3)	2 (2)	0.068
Item 16 (point)	1 (2)	1 (0)	0.005
Item 17 (point)	2 (3)	2 (2)	0.179
Item 18 (point)	2 (2)	1 (1)	0.048
Item 19 (point)	3 (2)	2 (2)	0.009
Item 20 (point)	2 (2)	1 (2)	0.389
Item 21 (point)	2 (3)	2 (2)	0.108
Item 22 (point)	2 (3)	2 (2)	0.065
Item 23 (point)	1 (0)	1 (0)	0.281
Item 24 (point)	3 (2)	3 (1)	0.093
Item 25 (point)	1 (3)	1 (1)	0.093
Sub-dimension scores of DASC			
Interpersonal relationships (point)	26 (15)	19 (13)	0.002
Introverted factors (point)	31 (16)	25 (14)	0.007
Total DASC score (point)	60 (30)	47 (28)	0.003

Values are expressed as median (IQR).

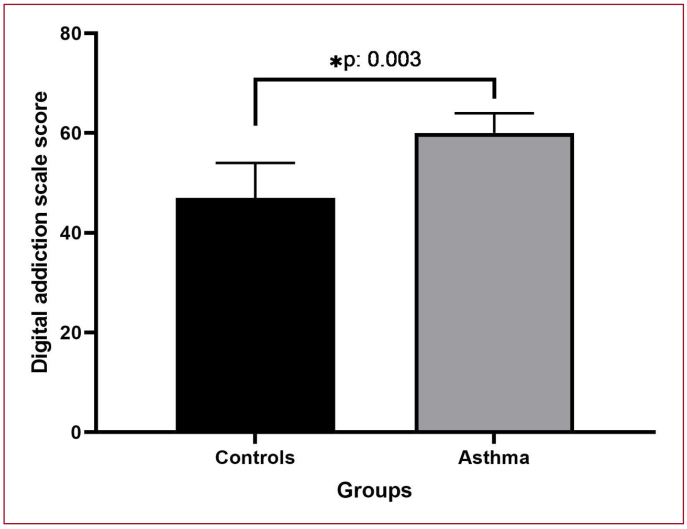

Figure 1. The digital addiction scale score in children and adolescents with asthma and healthy controls

No significant differences were observed when analyzing the total DASC scores or individual item scores based on sex within both the asthma and control groups (p >0.05) (**Table 3**). Furthermore, age categories (children versus adolescents) did not yield notable differences within either group (p >0.05). As depicted in **Figure 2**, the total DASC score was effective in distinguishing between subjects with asthma and those without, with an area under the curve (AUC) of 0.630 (standard error 0.043, 95% confidence interval: 0.547–0.714, p=0.003). The optimal threshold obtained from the ROC analysis was 50.5 points, which provided a sensitivity of 63.5% and a specificity of 60%. This cut-off value was determined by maximizing the balance between sensitivity and specificity using Youden's Index, which yielded a value of 0.24 for this threshold. A total DASC score above 50.5 was observed in 88 out of 170 participants (52%). Notably, among asthmatic individuals, 54 out of 85 (63.5%) exceeded this cut-off, in contrast to only 34 out of 85 (40%) in the control group, indicating a significant difference favoring the asthma cohort. Additionally, a significant association was identified between DA and asthma, with p=0.002 and an odds ratio of 2.613 (95% CI: 1.407-4.853).

Table 3. Comparison of DASC scores of children and adolescents with asthma and healthy controls by sex

Variable	Subjects				p value
	Asthma		Healthy Controls		
Sex (Female/Male) (n, %)	Female	Male	Female	Male	
Age (years)	11.5 (5.5)	11 (4)	11 (6.3)	12 (5)	0.778
DASC scores					
Item 1 (point)	4 (1)	4 (1)	3 (2)	3 (2)	0.840
Item 2 (point)	3 (2)	3 (2)	3 (2)	3 (1)	0.973
Item 3 (point)	3 (3)	2 (2)	1.5 (2)	1 (2)	0.173
Item 4 (point)	1 (3)	1 (1)	1 (1)	1 (1)	0.390
Item 5 (point)	3 (2)	3 (2)	3 (3)	2 (2)	0.147
Item 6 (point)	2.5 (3)	3 (3)	2 (2)	2 (2)	0.851
Item 7 (point)	3 (2)	3 (2)	3 (3)	2 (2)	0.989
Item 8 (point)	3 (2)	3 (2)	2 (3)	2 (3)	0.759
Item 9 (point)	3 (3)	2 (3)	3 (3)	2 (2)	0.880
Item 10 (point)	1.5 (3)	1 (2)	1 (2)	1 (1)	0.525
Item 11 (point)	2.5 (2)	2 (3)	1 (2)	2 (2)	0.915
Item 12 (point)	2 (3)	2 (2)	2 (2)	2 (2)	0.265
Item 13 (point)	3 (3)	2 (2)	2 (2)	2 (2)	0.825
Item 14 (point)	1 (1)	1 (1)	1 (0)	1 (1)	0.577
Item 15 (point)	2 (3)	2 (3)	2 (2)	2 (2)	0.254
Item 16 (point)	1 (2)	1 (1)	1 (0)	1 (0)	0.275
Item 17 (point)	3 (3)	2 (3)	1 (3)	2 (2)	0.387
Item 18 (point)	1.5 (3)	2 (2)	2 (2)	1 (1)	0.961
Item 19 (point)	2.5 (2)	3 (3)	2 (3)	2 (2)	0.802
Item 20 (point)	1.5 (2)	2 (2)	2.5 (3)	1 (2)	0.673
Item 21 (point)	2 (3)	2 (3)	2 (2)	2 (2)	0.912
Item 22 (point)	2 (3)	2 (3)	2 (3)	2 (2)	0.463
Item 23 (point)	1 (0)	1 (0)	1 (0)	1 (0)	0.550
Item 24 (point)	2.5 (3)	3 (2)	2 (1)	3 (1)	0.620
Item 25 (point)	1.5 (3)	1 (3)	1 (2)	1 (1)	0.756
Sub-dimension scores of DASC					
Interpersonal relationships (point)	24(19)	27 (16)	19 (20)	20 (11)	0.743
Introverted factors (point)	33 (20)	30.5 (15)	23.5 (23)	25 (13)	0.977
Total DASC score (point)	60 (37)	61 (27)	45 (44)	48 (26)	0.989

Values are expressed as median (IQR).

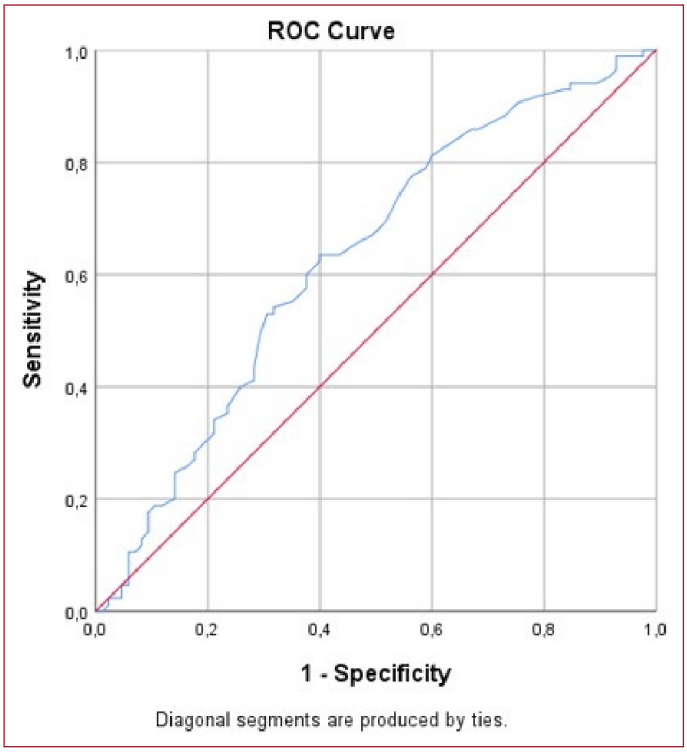

Figure 2. ROC curve analysis of total DASC score for distinguishing in children and adolescents with asthma and healthy controls

DISCUSSION

This investigation represents the first comparison of DASC scores between children and adolescents with asthma and their healthy peers, revealing significant insights into the association between asthma and DA behaviors. Our findings indicate that children and adolescents with asthma exhibit notably higher total DASC scores compared to their healthy counterparts. Specifically, the total DASC score was elevated in the asthmatic group, with an AUC of 0.630 suggesting moderate discriminatory power, and an optimal cutoff score of 50.5 points identified through ROC analysis. Notably, 63.5% of asthmatic participants surpassed this threshold, compared to only 40% of the control group. This substantial difference underscores a potentially important link between asthma severity and DA patterns, warranting further investigation into how these factors may interrelate.

Our hypothesis proposed that children and adolescents with asthma would exhibit higher levels of DA compared to their healthy peers. The findings of our study substantiate this hypothesis, revealing a significant elevation in DASC score among asthmatic participants. This increased prevalence of DA may be attributed to several factors associated with managing a chronic condition like asthma. Children facing the daily challenges of asthma may turn to digital devices as a coping mechanism, looking for distraction or relief from the stress of their condition. Additionally, the demands of asthma management—such as medication adherence, symptom monitoring, and lifestyle modifications—may inadvertently limit physical activity, leading to increased screen time. As a result, this reliance on digital devices could present barriers to effective asthma management, as engagement in physical activity is crucial for controlling asthma symptoms. Consequently, our findings underscore the need for further investigation into how DA may complicate asthma management and the importance of implementing interventions aimed at addressing DA within this vulnerable population.

In our study, the determination of the cut-off value of 50.5 points for the DASC score, as identified in our ROC analysis, reflects a balance between sensitivity (63.5%) and specificity (60%), which aligns with the principles of Youden's Index. While these values may appear relatively low, they highlight an important consideration in clinical contexts where early identification of at-risk populations is essential. The selected threshold efficiently distinguishes between children with asthma and those without, suggesting that even moderate discriminatory power can be clinically relevant. The implications of these findings suggest that children with asthma may be more susceptible to developing DA behaviors, which could further complicate their asthma management. However, the relatively low sensitivity indicates that some asthmatic individuals may not be identified as having high levels of DA, potentially leading to missed opportunities for early interventions. Therefore, while the cut-off value serves as a useful guideline, it also underscores the need for additional tools or assessments to comprehensively evaluate digital behaviors in this population. Future research could focus on refining the threshold through larger, multi-center studies to improve the diagnostic capabilities of the DASC in clinical practice.

Our study aligns with previous research that suggests an increasing prevalence of IA during adolescence.[17] While we found that DA scores were higher among adolescents than children, the absence of a statistically significant difference indicates that this trend may require more nuanced exploration. Furthermore, the relationship we observed between DA and asthma transcends sex-based differences, as previous studies have shown that males generally exhibit higher levels of DA.[18,19] In our cohort, while males scored higher than females, the lack of statistically significant variation within either group suggests that the correlation between asthma and DA might extend beyond demographic variables.

The mechanisms underlying the association between asthma and DA can be multifaceted. It is hypothesized that problematic internet use may heighten sympathetic activity and lead to increased corticosteroid levels, which could subsequently suppress the immune system.[20-22] Such physiological alterations may exacerbate asthma symptoms and severity. Additionally, visual stressors associated with extensive digital engagement may trigger negative psychological and immunological responses, potentially contributing to asthma exacerbations.[23] The association

between DA and various psychological issues, such as anxiety, sleep disturbances, and obesity, is well-established18 and recent evidence indicates that these psychological stressors may adversely affect asthma control in adolescents.[24]

Our findings align with the insights of Ding and Li, who highlighted the effectiveness of intervention programs in alleviating symptoms related to depression, anxiety, and DA among youth.[25,26] This underscores the potential benefits of proactive parental involvement in moderating children's digital engagement. Given the significantly heightened levels of DA observed in our asthmatic population, it is essential to address these behavior patterns to improve asthma management and overall health outcomes. Implementing targeted interventions that focus on reducing DA while simultaneously encouraging active lifestyles may help mitigate anxiety and other comorbid conditions frequently observed in this demographic. However, despite the well-documented negative effects of excessive internet use, particularly concerning psychological well-being,[25,26] we should remain cautious in interpreting these implications for asthma. The specific mechanisms linking IA to asthma are yet to be thoroughly understood, highlighting the need for longitudinal studies to explore these dynamics further. Such research could provide valuable insights into whether interventions targeting digital habits can enhance both psychosocial outcomes and asthma management strategies.

The relationship between IA and asthma presents a complex landscape, underscored by varying findings across populations and studies. Notably, a comprehensive investigation conducted among Korean adolescents established a connection between problematic internet usage and an increased prevalence of asthma.[20] This study not only highlighted the correlation but also revealed that asthmatic individuals had significantly higher interpersonal relationship scores compared to their non-asthmatic counterparts. Our findings resonate with this observation, as we similarly document elevated interpersonal relationship scores within the asthmatic group in comparison to the healthy control group. This may suggest that the psychosocial environment and relationship dynamics might play critical roles in the experience of asthma among adolescents. In contrast, a case-control study involving adult participants reported no significant differences in IA scores when comparing individuals with asthma to healthy controls.[27] Furthermore, this study found no significant relationship between IA and asthma control in the asthmatic cohort. Such discrepancies between studies raise important questions regarding age-related differences in the impact of IA on asthma. Adolescents may experience different psychosocial stressors and coping mechanisms related to their internet use compared to adults, which may help explain the variances in findings. The contrasting results between adolescent and adult populations could stem from several factors. Adolescents are in a critical developmental stage, making their interpersonal relationships and social engagement more susceptible to the effects of digital habits. The significant interpersonal relationship scores observed in our study and the study by Han et al.[20] indicate that relational dynamics may be influenced by digital engagement, which could potentially affect asthma symptoms and management in younger populations.

One of the key strengths of our study is its focus on a population that is often underrepresented in research on digital addiction. By comparing children and adolescents with asthma to healthy peers, we provide valuable insights into the unique challenges faced by this demographic. Furthermore, our use of a validated assessment tool for measuring digital addiction adds robustness to our findings. Importantly, while our study highlights a significant correlation between DA and asthma, it is crucial to acknowledge the limitations inherent in our research design. The cross-sectional nature of our study precludes the establishment of causal relationships between DA and asthma symptoms. Psychiatric comorbidities are indeed common in children with chronic diseases, such as asthma, and can significantly influence both the prevalence and characteristics of digital addiction behaviors. While our study primarily focused on the relationship between DA and asthma, we acknowledge that psychiatric screening was not conducted, and this represents a notable limitation. The absence of a detailed assessment of psychiatric comorbidities may have mediated the relationship we observed, and future research should consider including such screening to better understand these complex interactions.

We recognize the importance of integrating these results to provide a more comprehensive understanding of the implications. The significant association between asthma and DA highlights the need for targeted interventions that consider both physical and mental health in this population.

CONCLUSION

This study provides compelling evidence that DA scores are significantly higher in children and adolescents with asthma compared to healthy peers, suggesting a potential association that merits further research. There is an urgent need for comprehensive prospective investigations to clarify the nature of the relationship between asthma and DA, which could inform clinical practices and interventions aimed at this vulnerable population. By empowering parents, healthcare professionals, and educators to recognize and address the implications of DA, we may foster better health outcomes for children and adolescents with asthma.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of KTO Karatay University Faculty of Medicine Ethics Committee (Decision No: 2023/020).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.
Referee Evaluation Process: Externally peer-reviewed.
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Original Article / Orijinal Araştırma

Can Wound-Site Complications Be Predicted after Open Repair in Acute Achilles Tendon Ruptures?

Akut Aşil Tendon Kopmalarında Açık Onarım Sonrası Yara Yeri Komplikasyonları Öngörülebilir mi?

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Abstract

Aim: To examine the correlation between wound-site complications that arise following open repair of acute achilles tendon ruptures and patient-related factors.

Material and Method: Age, gender, mechanism of injury, time from rupture to surgery, and postoperative complications were analyzed in 39 patients who underwent open surgery by a single orthopedic and traumatology team between 2019 and 2024.

Results: As the time until surgical intervention increased after tendon rupture, wound-site complications were encountered more frequently ($p<0.001$) There was no other significant relationship between patient-based parameters and wound-site complications ($p>0.05$ for each).

Conclusion: The most effective parameter in predicting wound-site complications after open rupture of the AT rupture is the elapsed time between injury and surgery, whereas factors such as age, gender and injury mechanisms are not able to predict wound-site complications in such cases. Patients should be operated on as soon as possible to minimize the risk of wound site problems, which is a common complication of Achilles tendon rupture treatments.

Keywords: Achilles tendon, calcaneal tendon, postoperative wound infections, postoperative complication, hospital stay

Öz

Amaç: Akut aşil tendon rüptürlerinin açık onarımı sonrasında ortaya çıkan yara yeri komplikasyonları ile hastaya bağlı faktörler arasındaki ilişkiyi incelemek.

Gereç ve Yöntem: 2019-2024 yılları arasında tek bir ortopedi ve travmatoloji ekibi tarafından açık cerrahi uygulanan 39 hastada yaş, cinsiyet, yaralanma mekanizması, kopmadan cerrahiye kadar geçen süre ve ameliyat sonrası komplikasyonlar analiz edildi.

Bulgular: Tendon kopmasından sonra cerrahi müdahaleye kadar geçen süre arttıkça, yara yeri komplikasyonlarına daha sık rastlandı ($p<0,001$) Hasta bazlı parametreler ile yara yeri komplikasyonları arasında başka anlamlı bir ilişki yoktu (her biri için $p>0,05$).

Sonuç: Açık aşil tendon rüptüründen sonra yara yeri komplikasyonlarını öngörmede en etkili parametre yaralanma ile ameliyat arasında geçen süredir; yaş, cinsiyet ve yaralanma mekanizmaları gibi faktörler ise bu tür vakalarda yara yeri komplikasyonlarını öngörmede yetersiz kalabilir. Aşil tendon rüptürü tedavilerinin yaygın bir komplikasyonu olan yara yeri sorunları riskini en aza indirmek için hastalar mümkün olan en kısa sürede ameliyat edilmelidir.

Anahtar Kelimeler: Aşil tendonu, kalkaneal tendon, ameliyat sonrası yara yeri enfeksiyonu, ameliyat sonrası komplikasyon, hastane yatış süresi

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INTRODUCTION

The Achilles tendon (AT) has been identified as the most frequently ruptured tendon in the human body, with a reported frequency of 11-37 per 100,000 people per year.[1,2] The area most frequently injured is the hypo-vascular area, located 4-6 cm proximally to the insertion of the AT into the calcaneus.[3-5] In the treatment of acute AT ruptures, surgical treatment is conventionally recommended for cases of full-thickness rupture.[3-5] Primary repair can be performed either through an open approach or percutaneously.[6] Following surgery, it is standard practice to immobilize the ankle in the resting equinus position, and to advise movement restriction for a period of 4-6 weeks.[3-6]

While surgical treatment remains the preferred approach for full-thickness acute AT ruptures; there is an increasing tendency for conservative treatment. In the literature, conservative treatment is associated with a higher risk of tendon re-ruptures, while surgical treatment is more frequently associated with wound complications.[7] Consequently, conservative treatment is being favored by an increasing number of surgeons seeking to treat the condition without the risk of complications from surgery.[8]

Post-operative wound-site complications in the ankle area and around the AT are linked to inadequate soft tissue coverage and impaired nutrition in the region.[9] These complications may result in the necessity for repeated surgical interventions, protracted treatment durations, and diminished functional outcomes. Consequently, the ability to predict and prevent wound complications is a critical factor in ensuring patient satisfaction following acute AT repairs.

The objective of this study was to examine the correlation between wound-site complications that arise following open repair of acute AT ruptures and patient-related factors.

MATERIAL AND METHOD

The study was approved by the local ethics committee (Date: 21/09/2022 Decision No: E1-22-2908). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

All patients aged 18 years and over who were diagnosed with acute AT rupture and treated surgically in the study clinic between 2019 and 2024 were retrospectively evaluated. The study encompassed all acute AT ruptures that underwent open repair, while excluding patients treated with mini open or closed techniques, patients with calcaneal bone fragment fractures, patients treated with anchor sutures, patients who underwent external fixator due to multiple trauma, patients who did not comply with routine postoperative rehabilitation, patients with chronic AT ruptures, and patients with peripheral artery disease or diabetes. The study's final sample size was 39 patients, who met the stipulated inclusion and exclusion criteria. Informed consent form was not signed by all patients due to the retrospective design of the study.

In the study clinic, patients with a preliminary diagnosis of AT rupture are monitored with a long leg splint in plantar flexion until surgery, following an initial evaluation and positive examination findings. All patients are taken to surgery as soon as possible, as permitted by their general condition and comorbidities. The surgical procedure was performed under general anesthesia in the prone position, employing a completely open approach (**Figure 1**) and a Krakow double-row repair (**Figure 2**) with two reinforced sutures of the same brand (Ethibond Excel™ Suture, Ethicon Surgical Technologies, Johnson & Johnson MedTech). In the postoperative period, all patients were subjected to a long leg circular cast in 20º of plantar flexion for a period of six weeks. Thereafter, gradual dorsiflexion was administered using a ROM-Walker apparatus, and patients were subsequently enrolled in a uniform physical therapy and rehabilitation programme in the third month following surgery.

Figure 1. The preferred open approach for open repair of achilles tendon ruptures is shown. Patient is in the prone position and the incision is just medial to the Achilles tendon. , open approach. The open approach preferred for achilles.

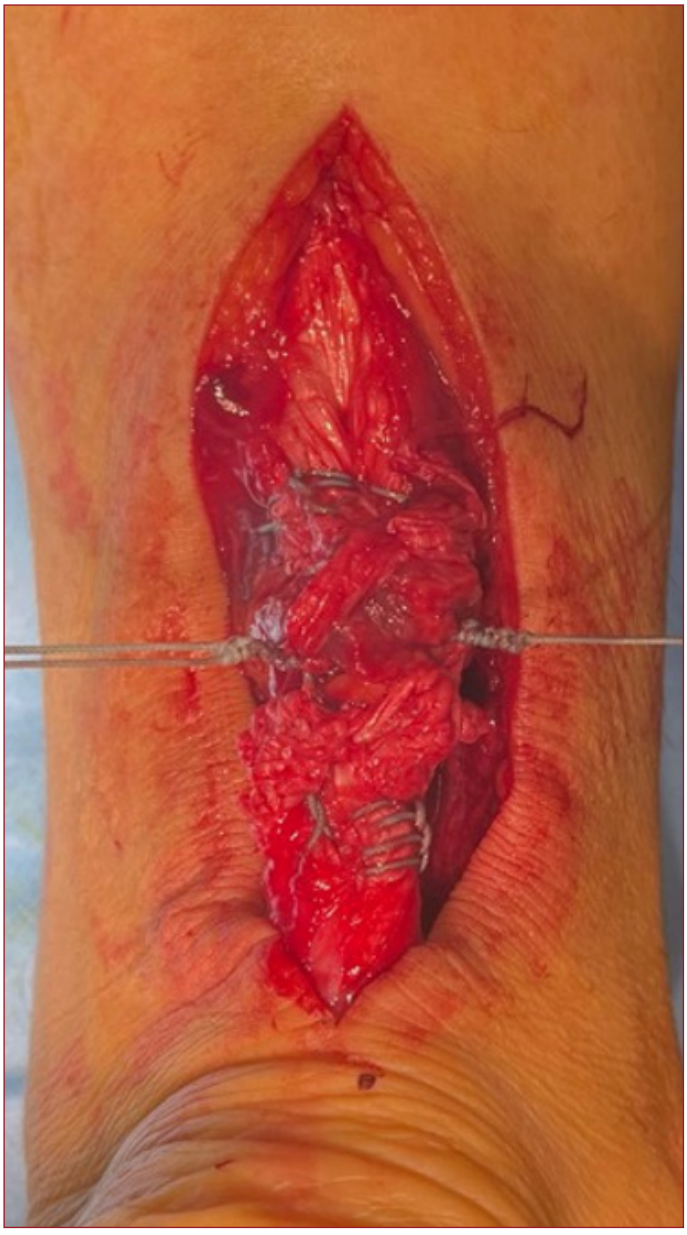

Figure 2. The preferred Krakow double-row repair is shown.

A retrospective review of patient data was conducted from patient files and records. Variables such as age, gender, the mechanism of injury (categorized as sports, penetrating, and blunt injuries, or unspecified), the time interval between trauma and surgery, and complications including re-rupture, wound-site problems, and the necessity for secondary surgery, were documented. Re-ruptures, and secondary operations occurring after six months were not taken into consideration to ensure that any re-ruptures unrelated to the repair procedure were excluded from the analysis.

The data were analyzed using the IBM SPSS Statistics for Windows, Version 22.0. (IBM Corp, Armonk, NY, USA). While the mean±standard deviation (minimum-maximum range) were used as descriptive statistics for numerical data, percentage (frequency) values were utilized to describe categorical data. The numerical data's compliance to normal distribution were examined through both visual (histogram and probability graphs) and analytical (Kolmogorov-Smirnov test) methods. The differences between the groups with and without wound-site problems in the parameters "age" and "time between trauma and surgery", which were found to have a normal distribution, were evaluated using the Independent Samples T Test. For the evaluation of categorical data, the Chi-square Test was employed, and in instances where the Chi-square assumption was not met, Fisher's Exact Test was utilized. P-values less than 0.05 were considered statistically significant.

RESULTS

Among the 39 patients evaluated in the study, 7.7% were female, and the mean age of the patients was 39.87 years (range: 20-57 years.). When the injury mechanisms of AT ruptures were analyzed, it was found that sports injuries ranked first with 46.2%, while 12.8% were caused by blunt trauma and 10.3% by penetrating trauma. The mean time to surgery after AT rupture was 3.08±5.268 days with a range of 1-27 days. Demographic and clinical characteristics of the patients are summarized in **Table 1**.

In terms of complications; six patients (15.4%) exhibited wound-site complications, whereas no re-rupture was observed in any patient after surgery, and no patient required secondary operation. All patients with wound-site complications were treated with frequent dressing changes and oral antibiotherapy and local debridement (**Table 1**).

Table 1. Demographic profile of the patients

	Achilles Tendon Ruptures N=39
Age (years)	39.87±9.707 (20-57)
Gender	
Female	3 (7.7%)
Male	36 (92.3%)
Injury Mechanism	
Penetrating Trauma	4 (10.3%)
Sports Trauma	18 (46.2%)
Blunt Trauma	5 (12.8%)
Unidentified	12 (30.8%)
Time Between Injury and Operation (days)	3.08±5.268 (1-27)
Re-rupture	
None	39 (100%)
Yes	0
Wound-site Complications	
None	33 (84.6%)
Yes	6 (15.4%)
Requirement for Secondary Surgery	
None	39 (100%)
Yes	0

N: number of patients. Mean±standard deviation (minimum-maximum range) were used as descriptive statistics for scale data.

An examination was conducted to ascertain the correlation between the development of wound-site complications and patient-based factors in patients who underwent primary repair following acute AT ruptures. Statistical analyses revealed a significant relationship between the time between injury and operation and the development of wound-site complications (p <0.001). No other significant relationships were observed (**Table 2**).

Table 2. Relationship between wound-site complication and patient-based factors

	Wound-site Problems		p
	Yes (N=6)	None (N=33)	
Age (years)	41.83±14.077 (20-57)	39.52±8.948 (21-55)	0.199
Gender			
Female	1 (6.1%)	2 (16.7%)	0.403
Male	5 (83.3%)	31 (93.9%	
Injury Mechanism			
Penetrating Trauma	2 (33.3%)	2 (6.1%)	0.129
Sports Trauma	1 (16.7%)	17 (51.5%)	
Blunt Trauma	1 (16.7%)	4 (12.1%)	
Unidentified	2 (33.3%)	10 (30.3%)	
Time Between Injury and Operation (days)	8.67±12.028 (1-27)	2.06±1.853 (1-8)	<0.001
Re-rupture			
None	6 (100%)	33 (100%)	N/A
Yes	0	0	
Requirement for Secondary Surgery			
None	6 (100%)	33 (100%)	N/A
Yes	0	0	

N: number of patients. P: statistical significance value. N/A: not applicable. Mean±standard deviation (minimum-maximum range) were used as descriptive statistics for scale data.

DISCUSSION

Despite the fact that AT ruptures are injuries that can be treated both conservatively and surgically, surgical treatment is a preferable option due to the low re-rupture rates and rapid rehabilitation advantages. Notwithstanding these advantages, the main disadvantage of surgical treatment is wound-site complications that are more common than conservative treatment. Wound-site complications not only prolong the healing process but also cause weakening of the tendon, delays in the patient's return to normal functions and increase the risk of chronic complications. The present study was undertaken with the objective of identifying the factors that contribute to wound-site complications. Our most striking finding was the observation that the duration from injury to surgery was a significant predictor of wound-site complications. This finding is at odds with the established knowledge surrounding the regression of soft tissue edema and hematoma that typically follow classical orthopaedic traumas.

In the literature, the mean age at time of rupture has been found to vary between 30 and 46 years.[11-14] Men are two to eight times more likely to rupture their AT than women.[11-14] The findings of this study are consistent with the literature. When the injury mechanism is examined, it is seen that approximately 87% of all AT ruptures occur during sports activities.[15,16] While sports injuries are considered the most significant injury mechanism in our study, in contrast to the literature, only 46.2% of the cases in our series were encountered with acute AT ruptures following sports injuries. A striking point is that a clear injury mechanism was not described in 30.8% of the injuries. Notably, 12 patients presented to the emergency department with hind foot pain that ensued after a solitary ankle sprain, yet no injury mechanism was disclosed. The observed variation in the distribution of injury mechanisms may be attributable to the influence of sociocultural factors that vary across different societies.

The most striking finding of our study is the significant relationship between the duration from injury to surgery and wound-site complications, which contradicts common orthopedic beliefs. It is well established that, in the case of orthopaedic injuries, increased waiting time is routinely associated with regression of edema, relaxation of soft tissue, and resolution of wound complications.[9] Soft tissue edema develops after ankle fractures and poses a risk for open surgery in surgical interventions performed after 24 hours after trauma. Therefore, the AO group recommends waiting at least 4 days after trauma in cases planned to undergo open reduction and internal fixation.[17] In contrast, Westberg et al. reported that the incidence of prosthetic infections rises as the preoperative waiting time increases in the treatment of femoral neck fractures with arthroplasty.[18] In contrast to the findings in the literature, our study observed that increased waiting time is associated with increased wound-site complications. The question arises as to why wound-site complications increase with increased waiting time. The primary and most salient reason that comes to mind is that with increased waiting time, the amount of tendon retraction increases despite the splint in plantar flexion and more dissection is required to bring it back to its place. Moreover, with increasing waiting time, the need to refresh the tendon ends increases. In the end-to-end repair technique applied to AT ruptures, the ruptured tendon ends need to be refreshed more as the time elapsed after the trauma increases, so a tighter repair and consequently a wound-site problem may be encountered.

The present study is subject to certain limitations. Firstly, while it is encouraging that no re-rupture or secondary operations were observed, the absence of such events impacts the investigation of the effect of this situation on the wound-site complications. Obtaining more optimal results would be facilitated by studies with large patient series. Although it was determined that all patients were satisfied after physical therapy and stated that they returned to their normal lives, the lack of functional scoring is an important limitation in this study. The patients were operated on expeditiously, and preoperative magnetic resonance imaging was not available for all of them, which hinders the assessment of the tendon injury severity. The retrospective nature of the study precludes the determination of the injury severity level through surgeon

observation during the perioperative period. Finally, due to the retrospective nature of our study, the study was unable to evaluate height, weight, body mass index, subcutaneous fat tissue, smoking, and metabolic health factors; which could influence wound complications.

CONCLUSION

The present study has demonstrated that factors such as age, gender and injury mechanisms are not able to predict wound-site complications in cases of open rupture of the AT rupture. The most effective parameter in predicting wound-site complications is the elapsed time between injury and surgery. In order to minimize the risk of wound-site complications, which are a common complication after AT rupture repair, patients should be taken to surgery as soon as possible.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Ankara City Hospital No:1 Clinical Researches Ethics Committee (Date: 21/09/2022, Decision No: E1-22-2908).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

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Original Article / Orijinal Araştırma

Revolutionizing Sausage Toe Treatment: The Power of Low-Pressure Bandaging in Diabetic Toe Osteomyelitis

Sosis Parmak Tedavisinde Devrim: Diyabetik Ayak Osteomiyelitinde Düşük Basınçlı Bandajlamanın Gücü

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Abstract

Aim: Swollen and reddened toes, often called "sausage toes," are a common symptom of diabetic toe osteomyelitis. This study aimed to evaluate the effectiveness of the bandages for this condition, using a technique previously validated for lymphoedema treatment.

Material and Method: Retrospective analysis was conducted at an outpatient clinic involving 94 patients with diabetic foot osteomyelitis that affected their toes. Toe bandages were applied twice weekly using a specially designed 4 cm low-pressure elastic bandage. Clinical remission was defined as the absence of signs of infection in ten months.

Results: The study included 60 patients who met the inclusion criteria, with a mean age of 59.45±10.43 years, and 78.3% of them were male. Most lesions were located on the right first toe (30%). A total of 52 patients (86.7%) achieved healing, with a mean healing time of 13.37±7.75 weeks. Previous use of antibiotics for toe osteomyelitis before the study has been associated with a lower healing rate.

Conclusion: A literature review reveals no evidence that toe bandages have been used to treat sausage toes. The findings of this study indicate that toe bandages may facilitate a rapid and high rate of healing in cases of sausage toes. This technique's simplicity, affordability, and high success rate make it a valuable addition to standard treatments for sausage toe. The study proposes that further prospective controlled studies be conducted to confirm the findings.

Keywords: Diabetic foot osteomyelitis, low-pressure bandaging, sausage toe, toe bandage

Öz

Amaç: Genellikle "sosis parmak" olarak adlandırılan şişmiş ve kızarmış ayak parmakları, diyabetik ayak osteomiyelitinin yaygın bir semptomudur. Bu çalışma, daha önce lenfödem tedavisi için onaylanmış bir bandajlama tekniğinin sosis parmak tedavisinde etkinliğini değerlendirmeyi amaçlamıştır.

Gereç ve Yöntem: Polikliniğimize ayak parmaklarınında diyabetik ayak osteomiyeliti ile başvuran 94 hasta retrospektif olarak analiz edildi. Tüm hastaların ayak parmaklarına 4 cm'lik düşük basınçlı elastik bandaj ile haftada iki kez ayak parmağı bandajı uygulandı. Klinik remisyon, on ay içinde enfeksiyon belirtilerinin olmaması olarak tanımlandı.

Bulgular: Çalışmaya dahil edilme kriterlerini karşılayan 60 hastanın yaş ortalaması 59.45±10.43 yıl olup, %78.3'ü erkekti. Lezyonların çoğu sağ birinci ayak parmağında (%30) yer almaktaydı. Toplam 52 hastada (%86,7) iyileşme sağlandı ve ortalama iyileşme süresi 13,37±7,75 hafta idi. Çalışmadan önce ayak osteomiyeliti için antibiyotik kullanımı daha düşük iyileşme oranı ile ilişkilendirildi.

Sonuç: Literatürde ayak parmak bandajlarının sosis parmaklarının tedavisinde kullanıldığına dair bir kanıt bulunamamıştır. Bu çalışmanın bulguları, ayak parmağı bandajlarının sosis parmakta hızlı ve yüksek oranda iyileşmeyi destekleyebileceğini göstermektedir. Bu tekniğin basitliği, ekonomikliği ve yüksek başarı oranı, bu yaklaşımı sosis ayak parmağı için standart tedavilere değerli bir katkı haline getirebilir. Çalışma, bulguların doğrulanması için daha ileri prospektif kontrollü çalışmaların yapılmasını önermektedir.

Anahtar Kelimeler: Diyabetik ayak osteomiyeliti, düşük basınçlı bandajlama, sosis parmak, ayak parmağı bandajı

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INTRODUCTION

Diabetes mellitus (DM) is a significant disease with high morbidity and mortality rates, affecting 2.5-3% of the global population.[1] The lifetime risk of developing a diabetic foot ulcer (DFU) is estimated to be between 10% and 25%. DFU is a common and significant complication in diabetic patients, with 14% to 24% of infections resulting in amputation. Notably, 85% of non-traumatic amputations are attributed to DFU.[2]

Osteomyelitis is an infection-related inflammatory disease of the bones. In order to reach a clinical diagnosis of osteomyelitis, imaging, and laboratory results are typically used to support the initial hypothesis. However, microbial cultures and bone biopsies must be conducted to reach a definitive diagnosis. The infection usually starts as soft tissue ulcers and spreads to the underlying bone tissue.[3] Bone infection in a diabetic foot requires more extended therapy and more surgeries, leading to higher recurrence rates, amputation risk, and lower treatment success. The eradication of diabetic foot osteomyelitis represents a significant challenge in efficacy and cost-effectiveness. The social burden associated with this condition is considerable, and the financial implications regarding the consumption of health resources are substantial. Patients with diabetic foot osteomyelitis have a high rate of amputation and hospitalization.[4]

The most effective method for treating osteomyelitis in diabetic patients involves removing infected and necrotic tissues, using systemic antibiotics, and closely monitoring and caring for the patients. A distinctive deformity known as 'sausage toe' can be observed in cases of osteomyelitis affecting the toes. This refers to a non-pitting, red toe swelling, which is considered a clear sign of osteomyelitis. It can be posited that this swelling is a consequence of inflammation in well-circulated feet and is, therefore, less likely to occur in cases of poor foot circulation.[5] The successful treatment of sausage toe with antibiotic therapy alone was reported in 20% of cases, while conservative surgery was successful in 58% of cases. Amputation was required in 45.8% of cases.[6]

Compression bandaging has been a standard recommendation for treating edema affecting the extremities. Furthermore, toe bandaging is an accepted component of multilayer lymphedema bandaging, and its use in venous hypertension and lymphedema has been documented.[7] The application of a toe bandage results in increased pressure within the subcutaneous tissues, reduced fluid entering the interstitial spaces, and decreased capillary filtration. Compression increases lymph flow and venous return, thereby reducing edema volume. Furthermore, it increases microcirculation, which may facilitate wound healing and soften thickened or hardened tissues.[8] This method, effective in lymphedema, may also prove similarly effective in toe osteomyelitis in diabetic patients presenting with edema-swelling despite their distinct etiology.

This study aimed to demonstrate the efficacy of toe bandage application with a technique that is safe in treating lymphedema in the literature, which may be significantly helpful in treating diabetic foot osteomyelitis developing in the toes.

MATERIAL AND METHOD

The study was initiated after approval from the ethics committee of Kayseri City Hospital with approval number 10.09.2024/173. The current study was conducted at the hyperbaric medicine outpatient clinic of Kayseri City Hospital. All procedures were carried out following the ethical rules and the principles of the Declaration of Helsinki.

The sample size was calculated to be 51 using G*Power version 3.1.9.7 (2020) from the University of Düsseldorf, Germany (for Windows 10), with a 95% power (beta) and a 0.05 type I error rate (alpha). The medical records of 94 patients admitted to our outpatient clinic between November 2022 and August 2024 who met the criteria for diabetic foot osteomyelitis in the toes, as defined by the American Infectious Diseases Society of Infectious Diseases,[9] were reviewed. These criteria included the presence of non-pitting red swelling of the toe and the use of a toe bandage for treatment. In the study context, the patient follow-up and treatment records were evaluated retrospectively. Patients who were followed up in our outpatient clinic for ten months were included in the evaluation, excluding those with missing information (**Figure 1**). A consent form detailing the risks of toe bandaging was obtained from all patients.

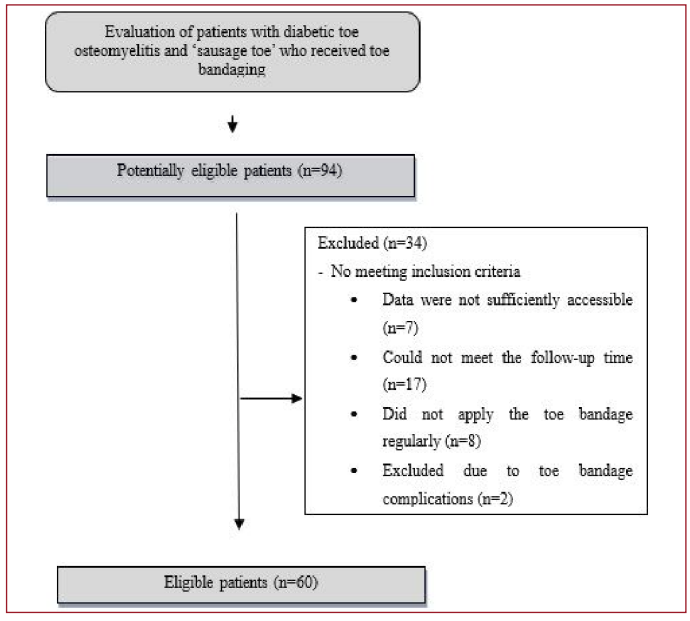

Figure 1. Study flow diagram

Toe bandages were not applied to patients who presented with circulatory disorders in the lower extremities. Ankle-brachial index (ABI) measurements were conducted to exclude lower extremity circulatory disorders in patients scheduled to receive a toe bandage. A normal ABI range is between 0.9 and 1.3, indicating adequate blood flow. An ABI less than 0.9 suggests varying degrees of arterial insufficiency, while an ABI greater than 1.3 may indicate arterial stiffness or calcification. A toe bandage was applied to patients with an ABI result between 0.9 and 1.3.

Furthermore, patients exhibiting signs of toe circulatory disorders, including pale and cyanotic foot skin color, loss of skin hair, skin thinning, decreased skin temperature, and absence of foot pulse, were excluded from the toe bandage application.

Age, gender, height, and body weight were extracted from the medical records. Body mass index (BMI), comorbidities, medications, and previous osteomyelitis treatments were also documented. The patient's medical history was recorded, including details of the wound's location, results of any cultures taken from the wound or bone, hemogram, C-reactive protein (CRP) level in the blood, sedimentation rate, HbA1C value, and the time taken for the toe to heal. This information was obtained from the hospital's automation system and the national digital health system.

The patients were provided with the standard of wound care, which included the application of a toe bandage twice weekly in the case of sausage toe. For control, the toe was re-examined only on the day following the initial application of the bandage, and the toe was monitored with bandaging throughout the study. The bandaging was performed using a 4 cm elastic bandage with low pressure, specially produced for the toes. The technique used was in accordance with the standard procedure described in the literature, with the bandage fully grasping the fingertip and extending downwards to ensure no gaps were present.[7] The toe and nail tips were left open to monitor any discoloration or circulatory disorders that may arise (**Figure 2**). This was done twice a week. Clinical remission was defined as the complete absence of clinical findings of infection in the follow-up period (**Figure 3**). The failure criteria included recurrent, persistent, progressive infection, ischemia, necrosis, and amputation.

Figure 2. The application of a toe bandage to the sausage toe

Figure 3. A-D, patients recovering with toe bandage application

Statistical Analysis

The data collected in this study were analyzed using the Statistical Package for the Social Sciences (SPSS 25) from IBM Corporation, Chicago, IL, USA. The analysis aimed to evaluate demographic factors, the rate of recovery, and the factors influencing recovery in patients with sausage toes. Normality was assessed using the Kolmogorov-Smirnov test. Descriptive statistics were obtained using the Chi-square test. Pearson's correlation test was applied to assess correlations in normally distributed data, while Spearman's rho test was used for non-normally distributed data. A p-value of less than 0.05, with a 95% confidence interval,

was considered statistically significant. The differences between independent groups-specifically demographic factors of recovered and non-recovered patients, as well as disease- and treatment-related factors—were compared using a t-test. One-way ANOVA was employed to compare more than two groups, particularly to investigate the impact of antibiotic usage (none, single, or multiple) on recovery and recovery time.

RESULTS

The study included 60 patients who met the inclusion criteria. The mean age of the patients included in the study was 59.47±10.40 years; 21.7% were female, and 30.0% of the lesions were located on the right first toe (**Table 1**).

Table 1. Demographic data and examination results of the participants

Variable	Mean±SD	Median	Min-max
Age (years)	59.45±10.43		
Height (cm)	170.21±8.76		
Weight (kg)		82.00	60-148
BMIa (kg/m²)		26.80	20.20-51.20
	n		**%**
Gender			
Male	47		78.3
Female	13		21.7
Location			
Right 1st toe	18		30.0
Right 2nd toe	7		11.7
Right 3rd toe	5		8.3
Right 4th toe	2		3.3
Right 5th toe	1		1.7
Left 1st toe	14		23.3
Left 2nd toe	9		15.0
Left 3rd toe	2		3.3
Left 4th toe	1		1.7
Left 5th toe	1		1.7
Previous Osteomyelitis Treatment (Antibiotics)			
No	28		46.7
Yes	32		53.3

BMI – Body mass index

Out of 60 patients, four were amputated, and four did not heal during the study period. 52 (86.7%) patients were successfully healed. The mean healing time of the healed patients was 13.37±7.75 weeks. Previous use of antibiotics for toe osteomyelitis was associated with a lower healing rate (**Table 2**).

Table 2: Factors affecting the healing process with the application of toe bandages

Variable	Healed	Not healed	p
Age	59.17±10.33	61.38±11.34	0.581β
Gender			0.503*
Woman	12	1	
Male	40	7	
Height	170.37±8.77	169.00±7.10	0.677β
Weight	81.00 (60.00-148.00)	82.50 (70.00-117.00)	0.459*
BMI	26.80 (20.20-51.20)	28.55 (26.20-40.00)	0.107*
Previous osteomyelitis treatment			0.039*
Yes	25	7	
No	27	1	
Hb	13.47±1.63	13.51±2.09	0.950β
WBC	8.38 (4.09-19.45)	9.92 (6.56-16.99)	0.123*
CRP	13.9 (1.3-243.3)	12.7 (5.7-331.0)	0.350*
ESR	19..0 (1.0-75.0)	14.5 (3.0-95.0)	0.761*
HbA1c	8.85±1.82	10.00±2.64	0.123β

BMI: body mass index; Hb: haemoglobin, WBC: white blood cells; CRP: c-reactive protein; ESR: erythrocyte sedimentation rate; HbA1C: haemoglobin A1C
*Mann Whitney U test, β Independent sample test

Of the 52 healed patients, 13 were not using antibiotics, 26 were using single antibiotics, and 13 used combined antibiotics with toe bandage application. The administration of single or combined antibiotics did not result in a statistically significant difference in the healing rate (p:0.128) (One-way ANOVA). Antibiotics used in combination with toe bandaging in patients included ciprofloxacin, fusidic acid, amoxicillin + clavulanic acid, trimethoprim + sulfamethoxazole, ceftriaxone, and rifampicin. The type of antibiotic was not found to be effective in healing (p:0.078) (One-way ANOVA). In addition, in patients who received antibiotics and were healed, it was determined that the antibiotic administered was unrelated to the healing duration (p:0.144) (One-way ANOVA).

In two patients, discoloration was observed as a consequence of the application of bandages. The bandaging was stopped to prevent damage to the skin. The patients were subsequently excluded from the study, as they had not been subjected to toe bandaging. The follow-up with the patients revealed that no permanent damage related to toe bandaging had occurred.

DISCUSSION

This study presents a highly efficacious solution to the problem of sausage toe, a prevalent but understudied phenomenon among individuals with diabetes mellitus. Despite the lack of information on sausage toe in the existing literature, there is no evidence to suggest using alternative methodologies for treating this condition, except for antibiotics and conservative surgical procedures.[6] The 86.7% recovery rate observed in our study, compared with the 54.2% reported by Yammine et al.[6] proves that the toe

bandage technique is an effective intervention for sausage toe in diabetic patients. Using a toe bandage, an effective and reliable technique in this study seems to be a valuable addition to the current treatment methods in this area.

Diabetic foot osteomyelitis requires prolonged treatment. In our study, the average healing time for healed patients was 13.37±7.75 weeks, compared to 15.8±9.7 weeks in a study of patients with diabetic foot osteomyelitis.[10] This suggests that the toe bandage method may shorten the healing time.

In the two case reports regarding sausage toe published in the literature, one reported successful treatment with antibiotics alone,[11] while the other reported success with conservative surgery combined with antibiotic therapy.[12] The presence of a sausage toe deformity should be a cause for concern in routine clinical practice. Evidence suggests that DFUs in patients are associated with suboptimal and inappropriate antibiotic therapy and infections caused by highly resistant pathogens.[13] We obtained wound or bone cultures from all patients in our study and adjusted antibiotic treatment according to the results of these cultures. Accordingly, no statistically significant difference was observed between the antibiotics already administered. We found that using antibiotics before presented to us was associated with a lower healing rate. This may reflect a higher incidence of failure due to latent chronic osteomyelitis and highly resistant pathogens.

The bandaging technique applied in this study may also prove effective in treating dactylitis, a condition characterized by a swollen, sausage-shaped finger or toe associated with various rheumatological disorders.[14] This represents a particularly challenging problem with few treatment options. In this case, flexor tenosynovitis, surrounding diffuse peri tendinous inflammation and soft tissue edema, is typically responsible for the 'sausage digit' appearance. High-resolution MRI has also shown that bone marrow edema, synovitis, and bone erosion can occur.[15] Similar findings are also seen in diabetic foot osteomyelitis[16] and sausage toe.[5,6] The findings of this study have the potential to provide a solution to the issue under investigation and to form the basis for further research in this field.

It is crucial to ensure that this risky treatment is administered correctly. In our study, we left the fingertips of patients who underwent toe bandaging uncovered and conducted a follow-up examination the next day. If unexpected symptoms such as discoloration, pain, or numbness occurred, we advised removal of the bandage. The toe was then carefully examined at least twice a week. Serious adverse events such as skin necrosis, nerve damage, or thromboembolic events resulting from compression therapy are rare when compression is applied correctly and contraindications are taken into consideration.[17] However, it is essential to always keep in mind that toe bandaging can be a risky treatment.

The sample size may need to be bigger to assess the success of this method reliably and in a generalizable manner. Moreover, the retrospective study design and the absence of a control group may restrict the assessment of treatment outcomes. Future studies must be conducted using a prospective, controlled design.

CONCLUSION

Diabetic toe osteomyelitis is a prevalent, challenging, and costly condition. Toe bandaging is an effective and fundamental technique for managing a range of toe-related problems. The results of our study indicate that this technique may facilitate healing, help prevent infection, and control edema in cases of sausage toes, as well as in lymphoedema and venous hypertension. Applying and using the correct materials correctly for optimal results is essential.

A literature review revealed no evidence that the toe bandages had been used to treat sausage toes. The findings of our study indicate that the incorporation of low-pressure bandage therapy into the conventional treatment regimen results in a rapid and high rate of healing in sausage toe. Demonstrating the efficacy of this inexpensive and reliable treatment, which will be added to standard treatments, will attract the attention of many medical centers worldwide, and further studies on this subject will be encouraged. It is thought that learning this valuable method by the clinics interested in this work may prevent major complications in many patients with sausage toe, shorten the treatment time, and increase the treatment rates.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Kayseri City Hospital Ethics Committee (Date: 10.09.2024, Decision No: 173).
Informed Consent: Informed consent was obtained from all individual participants included in the case.
Referee Evaluation Process: Externally peer-reviewed.
Conflict of Interest Statement: The authors have no conflicts of interest to declare.
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Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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Original Article / Orijinal Araştırma

Foreign Bodies Detected in the Upper Gastrointestinal Tract and Their Treatment

Üst Gastrointestinal Sistemde Saptanan Yabancı Cisimler ve Tedavisi

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Abstract

Aim: This study aims to evaluate adult patients presenting to our emergency clinic with complaints of foreign body ingestion in the upper gastrointestinal system.

Material and Method: Retrospective data from 37 patients diagnosed with foreign bodies in the upper gastrointestinal system at Sabuncuoğlu Şerefeddin Research and Training Hospital between June 2022 and November 2023 were analyzed. Patients were assessed based on demographic characteristics, symptoms, types and locations of foreign bodies, treatment methods, and complications.

Results: The mean age of the patients was 62.7 years, with 45.9% being male and 54.1% female. The most common site of foreign body impaction was the upper esophageal sphincter (45.9%). The most frequently encountered foreign body types were food and meat (56.8%) and bones (21.6%). Endoscopic intervention successfully removed 70.3% of the foreign bodies, 13.5% were advanced into the stomach, and 16.2% were not detected. Complications included mucosal lacerations in 10 patients and perforations in 2 patients.

Conclusion: Early diagnosis and treatment of foreign bodies in the upper gastrointestinal system are critical for preventing severe complications. Flexible endoscopy is an effective and reliable method for managing such cases. Particularly in geriatric patients, education of patients and their caregivers is essential for preventing these incidents.

Keywords: Upper gastrointestinal system, foreign bodies, flexible endoscopy

Öz

Amaç: Bu çalışma, üst gastrointestinal sistemde yabancı cisim yutma şikayeti ile acil kliniğimize başvuran erişkin hastaların değerlendirilmesini amaçlamaktadır.

Gereç ve Yöntem: Sabuncuoğlu Şerefeddin Araştırma ve Uygulama Hastanesinde Haziran 2022 ile Kasım 2023 tarihleri arasında üst gastrointestinal sistemde yabancı cisim tanısı konulan 37 hastanın retrospektif verileri incelenmiştir. Hastalar demografik özellikler, semptomlar, yabancı cisim türü ve lokalizasyonu, uygulanan tedavi yöntemleri ve komplikasyonlar açısından değerlendirilmiştir.

Bulgular: Çalışmaya katılan hastaların yaş ortalaması 62,7 olup %45,9'u erkek ve %54,1'i kadındır. Yabancı cisimlerin en sık takıldığı bölge üst özofagus sfinkteri (%45,9) olarak belirlenmiştir. En sık rastlanan yabancı cisim türleri et ve gıda (%56,8) ile kemik (%21,6) olmuştur. Endoskopik müdahale ile yabancı cisimlerin %70,3'ü çıkarılmış, %13,5'i mideye itilmiş ve %16,2'sinde yabancı cisim saptanmamıştır. Komplikasyon olarak 10 hastada laserasyon ve 2 hastada perforasyon gözlenmiştir.

Sonuç: Üst gastrointestinal sistemde yabancı cisimlerin erken tanı ve tedavisi, ciddi komplikasyonları önlemek açısından kritik öneme sahiptir. Fleksible endoskopi, bu tür olguların yönetiminde etkili ve güvenilir bir yöntemdir. Özellikle geriatrik hastalarda hasta ve yakınlarının eğitimi bu tür durumların önlenmesinde önem taşımaktadır.

Anahtar Kelimeler: Üst gastrointestinal sistem, Yabancı cisim, Flexible endoskopi

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INTRODUCTION

The presence of foreign bodies in the upper gastrointestinal (GI) system is more commonly observed in children, with coin ingestion being the most frequently encountered case. In adults, however, the most commonly swallowed foreign bodies are fish bones, which typically become lodged in the esophagus.[1] Adult patients are predominantly male.[2] In cases of foreign body ingestion, if there is complete esophageal obstruction or sharp-edged objects have been swallowed, therapeutic esophagogastroduodenoscopy is among the emergency treatment measures.[3]

The presence of foreign bodies in the upper gastrointestinal (GI) system is a significant clinical issue that often requires urgent medical intervention. Due to its anatomical characteristics, the esophagus is one of the most common sites where foreign bodies become lodged, frequently leading to severe symptoms and complications. In such cases, symptoms such as dysphagia (difficulty swallowing), odynophagia (painful swallowing), and inability to swallow are commonly observed.[4] More than 80% of foreign bodies are found in the esophagus.[5]

The type of ingested foreign bodies varies depending on dietary habits and cultural characteristics of the population. While meat and food particles are among the most commonly encountered foreign bodies, hard materials such as bones can cause severe complications. Complications following foreign body ingestion include deep lacerations, ulcers, and perforations.[6] Factors that increase the risk of complications include advanced age, sharp foreign bodies, and the presence of the foreign body for more than six hours.[7] Endoscopic intervention successfully removes more than 90% of foreign bodies, with a low complication rate.[8] However, conditions like perforation, if not treated appropriately, significantly increase the risk of mortality.[9]

Radiological evaluation is recommended in cases involving radiopaque objects, while barium studies are not advised.[10]

Most ingested foreign bodies pass through the esophagus and are expelled from the digestive system without complications. However, sharp and pointed objects significantly increase the risk of esophageal injury. Emergency endoscopy is required when the patient is unable to swallow secretions or when sharp objects are lodged in the esophagus. Endoscopic interventions are the most commonly used method for both diagnosis and treatment and generally have a high success rate.[11] According to the ESGE guidelines, emergency endoscopic intervention is recommended to remove sharp or hazardous foreign bodies within six hours.

This study aims to evaluate adult patients presenting to our clinic with complaints of foreign body ingestion in the upper gastrointestinal system.

MATERIAL AND METHOD

The study was carried out with the permission of Amasya University Non-interventional Clinical Research Ethics Committee (Decision No: E-30640013-2024/178). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

The hospital records of 37 cases who presented to the emergency clinic of our hospital between June 2022 and November 2023 with a diagnosis of foreign body in the upper gastrointestinal system and underwent endoscopic examination were retrospectively reviewed. The cases were evaluated in terms of age, gender, symptoms, type of foreign body, localization of the foreign body, treatment method applied, and complications. All cases were managed using flexible endoscopy.

The data were obtained from the hospital's record system. Information regarding patients demographic characteristics, symptoms, type and location of the foreign body, treatment methods applied, and complications were extracted from patient files and endoscopy reports.

The data obtained in this study were analyzed using SPSS (Statistical Package for the Social Sciences) version 25.0 software. Continuous variables were expressed as mean ± standard deviation, and categorical variables as frequencies and percentages. The chi-square test was used to evaluate differences between groups for categorical variables. For the analysis of continuous variables, the Shapiro-Wilk test was used to assess normality distribution; independent groups t-test was applied for normally distributed data, and the Mann-Whitney U test was used for non-normally distributed data. A p-value of <0.05 was considered statistically significant.

RESULTS

The mean age of the cases included in the study was 62.7 years (range: 20–93 years). Of the participants, 17 (45.9%) were male, and 20 (54.1%) were female. Nineteen patients were in the geriatric age group, with a mean age of 77.9 years for this subgroup.

The most commonly encountered type of foreign body was meat and food, identified in 21 patients (56.8%), followed by bones in 8 patients (21.6%). In one case, the patient had persistently ingested olive pits due to gastric complaints, which resulted in ulcers, obstruction, and vomiting in the duodenal bulb.

The most frequently reported symptoms among the patients were odynophagia (35.1%), dysphagia (29.7%), and inability to swallow (27%). The most common site of foreign body localization was the upper esophageal sphincter, which is the narrowest anatomical part of the esophagus (45.9%).

It was determined that foreign bodies were removed endoscopically in 26 patients (70.3%), advanced into the stomach in 5 patients (13.5%), and no foreign bodies were

detected in the upper gastrointestinal system in 6 patients (16.2%). Endoscopic examination of the esophagus revealed no mucosal damage in 25 patients (67.6%), while mucosal lacerations were observed in 10 patients (27%). Perforation was detected in 2 patients (5.4%) who had ingested bones; one of these patients presented to the hospital three days after the incident.

Endoscopic hemoclips were applied to 4 patients with esophageal lacerations. The 2 patients with perforations were treated medically with parenteral nutrition and antibiotic therapy. Malignancy was detected distal to the esophageal obstruction in 3 patients (8.1%). No complications or mortality were observed during the procedures in any of the patients.

Table 1. Demographic Data of Patients Presenting with Foreign Body Ingestion in the Upper Gastrointestinal System

	Number	Percent
Gender (M/F)	17 / 20	45.9% / 54.1%
Age	62.7	20-93
Symptoms		
Asymptomatic	2	5.4%
Difficulty swallowing	10	27%
Odynophagia	13	35.1%
Dysphagia	11	29.7%
Vomiting	1	2.7%
Foreign body		
Meat/food	21	56.8%
Bone	8	21.6%
Glass	2	5.4%
Fish bone	3	8.1%
Metal, other	3	8.1%
Foreign body lodgment location		
No foreign body observed	5	13.5%
Upper esophagus	17	45.9%
Middle esophagus	7	18.9%
Lower esophagus	6	16.2%
Stomach	1	2.7%
Duodenum	1	2.7%

Table 2. Endoscopic Findings

	Number	Percent
Foreign body lodgment location		
No foreign body observed	5	13.5%
Upper esophagus	17	45.9%
Middle esophagus	7	18.9%
Lower esophagus	6	16.2%
Stomach	1	2.7%
Duodenum	1	2.7%
No foreign body observed	6	16.2%
Foreign body removed	26	70.3%
Advanced to stomach	5	13.5%
Esophagus		
No damage	25	67.6%
Laceration	10	27%
Perforation	2	5.4%
Esophageal pathology		
Normal mucosa	34	91.9%
Malignancy	3	8.1%

DISCUSSION

The findings of this study demonstrate the critical importance of early diagnosis and treatment of foreign bodies in the upper gastrointestinal system in preventing serious complications. It is particularly evident that the geriatric patient group has a higher risk of complications due to anatomical changes, reduced reflexes, and accompanying comorbidities. The prominence of geriatric patients in our study, with a high mean age of 77.9 years, underscores the need for more cautious interventions in this group.

As reported in the literature, sharp and pointed foreign bodies can cause serious complications, such as mucosal damage and perforation in the esophagus.[4,12] Similarly, in our study, perforation was observed in two patients as a result of ingesting sharp materials. This supports the notion that complications are more frequently encountered in patients presenting late. Webb[9] and Ginsberg's[11] studies also highlight that delayed presentations increase the rates of complications, such as perforation and mucosal damage.

It is frequently noted in the literature that the majority of foreign bodies pass through the esophagus and are expelled from the digestive system without complications.[12] However, in our study, foreign bodies were often observed to become lodged in anatomically narrow regions, such as the upper esophageal sphincter (45.9%). This finding underscores the importance of early endoscopic interventions. The ASGE guidelines for foreign body management state that removing foreign bodies within 24 hours reduces the risk of complications.[4] The absence of mortality among the cases we managed highlights the importance of timely and effective intervention.

Endoscopic methods are considered one of the most effective and reliable approaches for treating foreign bodies in the upper gastrointestinal system.[11] In our study, the success rate of interventions performed with flexible endoscopy was 70.3%, supporting the efficacy of this method. However, in some cases, foreign bodies were advanced into the stomach (13.5%), emphasizing the need for follow-up in these patients.

Finally, another noteworthy finding in our study was the malignancy rate of 8.1% among patients with a history of foreign body ingestion. This rate highlights the importance of investigating malignancy in patients with foreign body detection in the esophagus. Similarly, Eisen et al.[12] suggested a potential association between foreign body detection and malignancy in their study.

Foreign body ingestion in the upper gastrointestinal system is a condition that requires prompt diagnosis and treatment. Sharp objects, such as fish bones, are the most common and often become lodged in the esophagus. Early endoscopic intervention is crucial to reduce the risk of complications. Factors such as age, sharpness of the object, and duration of ingestion can increase the risk of complications. Therefore, a swift and appropriate treatment plan should be developed for such cases.

In light of these findings, the application of early diagnosis, effective endoscopic intervention, and careful follow-up protocols in the management of foreign body ingestion cases is of great importance in reducing complication rates and improving patient outcomes.

CONCLUSION

Early diagnosis and treatment of foreign bodies in the upper gastrointestinal system are vital due to the potential for severe and life-threatening complications. Particularly in geriatric patients, informing and educating patients and their caregivers is important to reduce the occurrence of such emergencies, which may arise from dental, visual, or mental health problems. Flexible endoscopy is an effective and reliable method for the treatment of foreign bodies in the upper gastrointestinal system.

Geriatric patients and their caregivers should be provided with education on the precautions that need to be taken during meals to reduce the risk of foreign body ingestion. Specifically, the importance of carefully consuming hard, bony, or large-piece foods and emphasizing the chewing process should be highlighted.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Amasya University Non-interventional Clinical Research Ethics Committee (Decision No: E-30640013-2024/178).
Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.
Referee Evaluation Process: Externally peer-reviewed.
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Case Report / Olgu sunumu

A Clinical Labyrinth: Diagnosis of Hemophagocytic Lymphohistyocytosis

Klinik Bir Labirent: Hemofagositik Lenfohistiyositoz Tanısı

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Abstract

Hemophagocytic lymphohistiocytosis (HLH) is a rare, non-malignant immune regulation disorder characterized by hemophagocytosis. The HLH 2004 study listed the widely accepted diagnostic model, which requires the presence of 5 out of 8 criteria (Fever; splenomegaly; cytopenia; hypertriglyceridemia or hypofibrinogenemia; hemophagocytosis, ferritin >500 mcg/L; Low/absent NK-cell activity; soluble CD25 elevation). The current management guidelines based on HLH-94 studies involve immunosuppression with weekly chemotherapy (etoposide) and glucocorticoids (dexamethasone), and intrathecal methotrexate is administered in patients with CNS involvement.CASE:A 4-month-old male patient with no known disease was admitted to our institution with a fever complaint. The physical examination and ultrasound (USG) revealed an enlarged spleen: WBC 2600, Hg 7.3, ANS 390, platelet count 26.000, ferritin 8.300, triglyceride 767, AST 48, ALT 21, total bilirubin 1.6, Na 133, and fibrinogen 70. Genetic tests were processed and intravenous immunoglobulin (IVIG) treatment was initiated with 10 mg/m2/day of Dexamethasone. The findings flared up again in the following period, and a complete treatment regimen was administered according to the HLH 2004 protocol (IVIG + Dexamethasone + Cyclosporine + Etoposide). HLH should be considered in patients with prolonged fever, cytopenia hepatosplenomegaly, and hemophagocytosis, which should be investigated by performing bone marrow aspiration first.

Keywords: Hemophagocytic lymphohistiocytosis (HLH), hematopoietic stem cell transplantation (HSCT), hypertriglyceridemia, hypofibrinogenemia, hemophagocytosis

Öz

Hemofagositik lenfohistiyositoz (HLH), hemofagositoz ile karakterize nadir, malign olmayan bir bağışıklık regülasyon bozukluğudur. HLH 2004 çalışması, 8 kriterden 5'inin (ateş; splenomegali; sitopeni; hipertrigliseridemi veya hipofibrinojenemi; hemofagositoz, ferritin> 500 mcg/L; düşük/L; düşük/yok NK-hücre aktivitesi; CD25 Yüksekliği). HLH-94 çalışmalarına dayanan mevcut yönetim kılavuzları, haftalık kemoterapi (etoposid) ve glukokortikoidler (deksametazon) ile immünosupresyonu içerir ve CNS tutulumu olan hastalarda intratekal metotreksat uygulanır. Bilinen hastalığı olmayan 4 aylık bir erkek hasta, kurumumuza ateş şikayeti ile kabul edildi. Fizik muayene ve ultrason (USG) genişlemiş bir dalak ortaya çıkardı: WBC 2600, HG 7.3, ANS 390, trombosit sayısı 26.000, AST 48, ALT 21, TOPLAM BİLirubin 1.6, Na 133 ve fibrinojen 70. Testler işlendi ve 10 mg/m2/gün deksametazon ile intravenöz immünoglobulin (IVIG) tedavisi başlatıldı. Bulgular bir sonraki dönemde tekrar alevlendi ve HLH 2004 protokolüne (IVIG + Deksametazon + siklosporin + etoposid) göre tam bir tedavi rejimi uygulandı. Önce kemik iliği aspirasyonu yapılarak araştırılması gereken uzun süreli ateş, sitopeni hepatosplenomegali ve hemofagositozu olan hastalarda HLH düşünülmelidir.

Anahtar Kelimeler: Hemofagositik lenfohistiyositoz (HLH), hematopoietik kök hücre nakli (HSCT), hipertrigliseridemi, hipofibrinojenemi, hemofagositoz

INTRODUCTION

Hemophagocytic lymphohistiocytosis (HLH) if not treated is a rare, fatal phenomenon. It is a nonmalignant immune regulation disorder characterized by hemophagocytosis. There is uncontrolled activation of T lymphocytes and macrophages and overproduction of inflammatory cytokines (such as interferon-gamma, interleukin-1, interleukin-6, and tumor necrosis factor). Although there are two types, primary (familial) and secondary HLH, the clinical findings are the same. Fever, hepatosplenomegaly, pancytopenia, and lymphadenopathy are the most common findings.[1] Familial HLH is inherited as an

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autosomal recessive trait usually seen in infancy. Secondary HLH is known to be caused by pathogens. This condition is called infection-associated hemophagocytic syndrome. Secondary HLH is more likely to occur as a result of viral infections.Secondary HLH is more likely to occur as a result of viral infections. For this reason, it was defined as "virus-associated hemophagocytic syndrome."When it was observed that bacterial, fungal, or protozoal infections also caused HLH, it was named "infection-associated hemophagocytic syndrome." Macrophage activation syndrome, which develops due to collagen tissue diseases such as systemic lupus erythematosus and rheumatoid arthritis, is included in secondary HLH. Some immune deficiencies and malignancies also cause HLH.[1,2] The statement that 'HLH should definitely be considered in patients with prolonged fever under chemotherapy.

The HLH 2004 study listed the widely accepted diagnostic model, which requires the presence of 5 out of 8 criteria (Fever; splenomegaly; cytopenia; hypertriglyceridemia or hypofibrinogenemia; hemophagocytosis, ferritin >500 mcg/L; Low/absent NK-cell activity; soluble CD25 elevation). The current management guidelines based on HLH-94 studies involve immunosuppression with weekly chemotherapy (etoposide) and glucocorticoids (dexamethasone), and intrathecal methotrexate is administered in patients with CNS involvement.[3]

CASE

A 4-month-old male patient with no known disease was admitted to our institution with a fever complaint. The patient's fever had started seven days earlier. Physical examination revealed hepatosplenomegaly. There was no family history of malignancy. He was hospitalized due to persistent fever and was taken to the Pediatric Intensive Care the next day due to worsening of his general condition during follow-ups.

The physical examination and ultrasound (USG) revealed an enlarged spleen; WBC 2600, Hg 7.3, ANS 390, platelet count 26.000, ferritin 8.300, triglyceride 767, AST 48, ALT 21, total bilirubin 1.6, Na 133 and fibrinogen 70.

No atypia was seen in the peripheral smear. The patient underwent bone marrow aspiration (BMA). In the evaluation of bone marrow smears, it had a slightly hypocellular appearance. Granulocytic series elements were reduced, but each element was observed at every stage. There was no finding of malignant infiltration, and blasts were not seen. Widespread hemophagocytosis was detected, and megakaryocytes were reduced. Modified HLH 2009 diagnostic criteria were met, but HLH syndrome and disease could not be differentiated.

Previous immunological tests were normal, and genetic tests were processed. In the meantime, intravenous immunoglobulin (IVIG) treatment was initiated with 10 mg/m2/day of Dexamethasone. There was a significant improvement in all findings on the 7th day of dexamethasone; ferritin was 2.200, and it was planned to continue the treatment by decreasing it on the 15th day.

However, the findings flared up again in the following period, and a complete treatment regimen was administered according to the HLH 2004 protocol (IVIG + Dexamethasone + Cyclosporine + Etoposide). Amlodipine was started as the patient developed hypertension. After the patient's clinical condition was stabilized, the diagnosis was evaluated as HLH due to cerebral atrophy and white matter hyperintensity in the brain MRI. At the end of induction, a control brain MRI was planned to be performed under the HLH 2004 protocol, starting in the 3rd week of complete treatment and four doses of intrathecal therapy. UNC13D mutation was homozygous during follow-up from the Primary HLH gene mutation panel. HSCT (hematopoietic stem cell transplantation) was planned for the patient.

DISCUSSION

HLH can mimic several common conditions that cause fever, pancytopenia, hepatic abnormalities, or neurological findings. Many diseases, such as macrophage activation syndrome (MAS), infection/sepsis, liver disease/liver failure, multiple organ failure (MOF), encephalitis, and Autoimmune lymphoproliferative syndrome (ALPS), should be considered in the differential diagnosis. Cytopenia, elevated ferritin levels, and liver function abnormalities are particularly useful in distinguishing HLH from these conditions. Since our patient met the diagnostic criteria, we initiated preliminary treatment in this case. Upon the deterioration of the patient's clinical status, the therapy was converted to a complete regimen, and a rapid response was achieved in the laboratory tests and symptoms. Although the distinction between HLH disease and syndrome can only be performed through genetic tests, the genetic tests usually take a certain period to obtain. The response to treatment during this process guides the clinician.[3,4]

The most typical findings of HLH are fever, hepatosplenomegaly, and cytopenia. A fever of over 38.5°C usually lasts more than seven days. Ecchymosis and pallor secondary to pancytopenia may be observed. Jaundice is present in some cases. The nonspecific rash is detected in 65% of patients with HLH. Neurological symptoms such as convulsion, ataxia, hemiplegia, mental status disorders, and irritability have been reported. Weakness, anorexia, and weight loss may also be observed.[5] The presence of persistent fever for seven days, hepatosplenomegaly, and pancytopenia in our patient was considered indicative of HLH in the differential diagnosis.

There are diagnostic criteria determined by the "Histiocyte Society." HLH is diagnosed if 5 of the eight criteria are present: fever, splenomegaly, cytopenia, hypertriglyceridemia and hypofibrinogenemia, hemophagocytosis in the bone

marrow, spleen or lymph nodes without malignancy, decreased or absent NK cell activity, increased ferritin level and high soluble CD25 level. Although phagocytosis of erythrocytes is mainly seen, leukocytes and platelets are also phagocytosed. Activated macrophages can affect many organs; hence, the spleen, liver, lymph nodes, bone marrow, and central nervous system are commonly affected. In patients with HLH, cytopenia, high triglyceride, low fibrinogen, high ferritin, as well as high lactic dehydrogenase, high transaminase, bilirubin, hyponatremia, low protein, and low albumin may be detected. Moderate pleocytosis may be seen in the examination of cerebrospinal fluid. Prolonged partial thromboplastin time (PTT) and increased fibrin degradation products may be detected. Despite these diagnostic criteria, it may not be possible to distinguish familial or secondary HLH clinically and histologically. Family history and consanguinity between mother and father are helpful in the diagnosis.[6] Familial HLH is mainly seen in the first two years, while secondary HLH can be seen at any age. Not every detected hemophagocytosis is HLH. Hemophagocytosis can be seen in patients who have received blood transfusions or in sepsis. In addition, histiocytosis should be distinguished from X-linked lymphoproliferative syndrome, Chediak Higashi Syndrome, Gricelli Syndrome, lisinuric protein intolerance, DiGeorge syndrome, and Omenn syndrome.[7]

Many studies report that UNC13D mutation is associated with a high central nervous system (CNS) involvement rate. Although many members of the Munc protein family have specific functions in the CNS, Munc13-4 is not expressed in the CNS, so CNS involvement is higher in these patients and is still a matter of research.[8] In the patient discussed in this case report, the UNC13D mutation was homozygous, and CNS involvement was detected on brain MRI.

Familial HLH is fatal if left untreated, and the average life expectancy is approximately two months. The "Histiocyte Society" developed the HLH-94 protocol in 1994 and has been widely used worldwide. This protocol was modified in 2004 by adding intrathecal methotrexate and steroids in some selected cases. This treatment; dexamethasone (10 mg/kg/day for two weeks, 5 mg/kg/day for two weeks, 2.5 mg/kg/day for two weeks, 1.25 mg/kg/day for two weeks then 10 mg/kg/day for three days every two weeks), etoposide (150 mg/m2 iv, first two weeks; twice a week, six weeks; once a week, then once a week), cyclosporine (6 mg/kg/day divided into two doses and blood level will be 200 microg/L) and intrathecal methotrexate and prednisolone (when progressive neurological symptoms and abnormal CSF findings are detected), continues for 52 weeks.[6] Transplantation is recommended when a suitable donor is found for bone marrow transplantation. Even if the underlying disease cannot be demonstrated, the seriousness of the patient's condition is an indication for starting HLH-specific treatment. According to the HLH-2004 treatment guideline, the patient is evaluated after eight weeks of chemotherapy. If the diagnosis of familial or genetic HLH is confirmed, HLH treatment should be initiated and continued until hematopoietic stem cell transplantation (HSCT). If HLH cannot be demonstrated but the disease is persistent at the end of eight weeks of treatment, this treatment should be continued until HSCT is performed. If HLH cannot be demonstrated but resolution is achieved at the end of eight weeks of treatment, the treatment is terminated. However, if reactivation occurs in this group, chemotherapy should be continued until HSCT is performed, as in the other two groups. As understood from the diagnosis and treatment guidelines, morbidity and mortality are very high in both primary HLH and secondary HLH, and HSCT may be required in most patients.[6-8] The patient discussed in this case report was successfully treated with HSCT.

The most extensive single-center case series in the literature on HSCT was the 48 patients published by Chardin et al. In this study, it was found that donor compatibility, age at diagnosis, and the time from diagnosis to HSCT did not affect survival in patients undergoing HSCT, and the only factor influencing survival was disease control at the time of HSCT. Although CNS involvement was not found to affect survival, it was reported that the prognosis after HSCT tended to be worse in patients with neurological findings or neuroradiological imaging findings.[9] Similar results were reported in the study conducted by Yoon et al., emphasizing that the most important factor affecting survival was disease activity at the time of transplantation.[10]

CONCLUSION

As a result, HLH should be considered in patients with prolonged fever, cytopenia hepatosplenomegaly, and hemophagocytosis, which should be investigated by performing bone marrow aspiration first. The diagnosis of HLH can be missed and is often evaluated as sepsis. Mortality is very high in primary HLH patients who have not undergone HSCT. Therefore, mutation studies should be performed without delay.

ETHICAL DECLARATIONS

Informed Consent: All patients signed the free and informed consent form.

Referee Evaluation Process: Externally peer-reviewed.

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

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Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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Letter to the Editor/ Editöre Mektup

Is the Gender Difference in the Association Between Obesity and OSAS Really Less in Women?

Obezite ve OSAS Arasındaki İlişkide Cinsiyet Farkı Kadınlarda Gerçekten Daha Mı Az?

Mihrican Yeşildağ

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Dear Editor,

Obstructive sleep apnea syndrome (OSAS) is a serious disorder characterized by recurrent episodes of partial or complete upper airway obstruction. Although this syndrome carries significant systemic risks, such as metabolic and cardiovascular diseases, it is less often diagnosed in women than in men. It is recognized that OSAS is strongly associated with obesity and has a higher prevalence in the male gender. However, emerging evidence suggests that OSAS is significantly underdiagnosed in women due to different clinical presentations and physiological characteristics and that the gender difference may not be as high. Given that obesity is an important risk factor for OSAS, it is important to investigate gender-based variations in the effect of obesity on OSAS prevalence and severity. Although the male-female ratio in OSAS prevalence is reported to be 2:1 and even 4:1 in some studies, this may be thought to be due to the lack of standardization of factors such as age, hormonal status and ethnicity. It has been suggested that female hormones help prevent airway collapse by increasing the tone of the upper airway dilator muscles. This may be considered as one of the reasons for the difference in the prevalence of OSAS before and after menopause.[1,2]

Characteristics of body fat distribution in men and women, such as androgenic-gynoid, central-peripheral, visceral-subcutaneous, may explain some of the sex-related differences in the relationship between obesity and OSAS. Men typically have greater upper airway collapsibility due to increased fat deposition in the neck region, whereas women tend to accumulate adipose tissue peripherally rather than centrally. However, this may change in postmenopausal women due to hormonal differences, and the pattern of adiposity tends to be more androgenic-centralized. Recent evidence suggests that postmenopausal women experience a significant increase in OSAS risk, possibly due to a decline in protective estrogen and progesterone levels. Symptoms of OSAS may differ according to gender. While men may have typical symptoms such as apnea diagnosis, loud snoring and excessive daytime sleepiness, women may have more prominent non-classical symptoms such as insomnia, depression and fatigue. For this reason, many women may be diagnosed with different conditions such as chronic fatigue syndrome and mood disorders. This appears to be an important factor in the underdiagnosis of OSAS in women.

There is clearly a need to focus on approaches that are free of male gender bias in OSAS. The aim should be to provide more inclusive screening methods for the female sex that do not ignore postmenopausal hormonal changes and atypical OSAS symptoms that may increase the risk of OSAS. Furthermore, anthropometric measures such as waist-to-height ratio and visceral fat assessment should be added to traditional measures such as BMI.[3,4]

In conclusion, although OSAS is generally recognized as a predominant condition in the male gender, increasing data suggest that OSAS is also underdiagnosed in women. In this context, there should be more tailored approaches for the early diagnosis of OSAS in female patients, taking into account age, hormonal and regional factors and aiming to expand diagnostic guidelines to include female-specific symptoms.

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Letter to the Editor/ Editöre Mektup

Relationship Between Kartagener's Syndrome and Internal Diseases: Coincidence or Coexistence?

Kartagener Sendromu ile dahili hastalıkların ilişkisi: Tesadüf mü? Birliktelik mi?

Muhammet Limon, Nurdan Yıldırım

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Dear Editor,

Kartagener's syndrome (KS) is is a rare, autosomal recessive genetic mucociliary disorder that consist of a triad of situs inversus, chronic sinusitis and bronchiectasis.[1,2] Patients with primary ciliar dyskinesia (PCD), including KS, may present with various manifestations, such as infertility, olfactory disorders, ophthalmopathy and hydrocephalus resulting from ciliary dysfunction. Ciliopathy has become recognized as a multisystem disorder, of which PCD is an important subgroup. In our review of the literature, the coexistence of rheumatic disease,renal disease, maligancy and KS have been reported. We write this letter to draw attention to this issue.

The coexistence of rheumatic diseases and KS relationships have been rarely reported. Only 10 cases reported the association of KS and rheumatoid arthritis (RA).[3,4] One case described the association of systemic lupus erythematosus and dextrocardia.[5] One case described the association of undifferentiated connective tissue disease and dextrocardia.[6] An association between RA and bronchiectasis has been reported, although the underlying pathogenic mechanism remains unclear. There is no evidence that KS is associated with specific HLA antigens, indicating that the occurrence of RA may be coincidental.[7] Beutler et al. proposed that continuous exposure to infections resulting from mucociliary dysfunction in the airways may play an important role in pathogenesis of RA.[8]

Ali Momeni et al. reported KS with focal segmental glomerulosclerosis.[9] El Houssni S et al. reported renal amyloidosis revealing a KS.[10] Also cyanotic heart disease may be relationship with focal segmental glomerulosclerosis as reported by Flanagan, the probable cause of which could be hyperfiltration of the glomerulus.[11] Chronic hypoxia may cause many medical problems. Chronic hypoxia is mentioned as a cause of secondary focal segmental glomerulosclerosis. Hida and colleagues reported a case of congenital heart disease with focal segmental glomerulosclerosis.[12] A case of KS and polycystic kidney disease was reported by Sayarlioglu and colleagues.[13]

The coincidence of malignancy and KS have been reported. These reported cancers to date are renal cell carcinoma, testicular germ cell tumor, lung cancer, carcinoma of the ethmoid labyrinth, colon carcinoma, angioimmunoblastic T cell lymphoma, adenosquamous carcinoma of the paranasal sinuses, adenocarcinoma of the cervix uteri and endometrium. It is seen that most of these tumors are tissue or organ cancers with ciliated epithelium.The majority of these tumors can be explained by impaired mucociliary clearance and exposure to chronic irritations.[14]

In conclusion, we think, as suggested by other authors[8,9,14] that chronic infectious processes, impaired mucociliary clearance and chronic hypoxia may play an important role in the development of KS coincidence with internal diseases. As the number of cases demonstrating the coexistence of KS and internal diseases increase, it will be possible to obtain more detailed information about this issue.

Keywords: Kartagener's syndrome, relationship,internal disease

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Review / Derleme

Avicenna (Ibn Sina; 980-1037) : Father of Early Medicine

Avicenna (İbn Sina; 980-1037): Erken Tıp Biliminin Babası

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Abstract

Avicenna (Arabic: ابن سینا) was a polymath and physician known as the "father of early medicine" who is considered one of the most influential doctors, astronomers, thinkers, writers, and scholars of the Golden Age of Islam. This article briefly overviews Avicenna's life, introduces his medical textbook, and presents his essential contributions to medical science.

Keywords: Avicenna, Ibn Sina, canon of medicine

Öz

Avicenna (Arapça: ابن سینا), "erken dönem tıbbının babası" olarak bilinen ve İslam'ın Altın Çağı'nın en etkili doktorlarından, astronomlarından, düşünürlerinden, yazarlarından ve bilginlerinden biri olarak kabul edilen bir bilgin ve hekimdi. Bu makale, Avicenna'nın hayatına kısaca bir genel bakış sunuyor, tıp ders kitabını tanıtıyor ve tıp bilimine yaptığı temel katkıları sunuyor.

Anahtar Kelimeler: İbn sina, Avicenna, kanul fil tıp

INTRADUCTION

Ibn Sina or Avicenna (980–1037) (**Figure 1**) was a Muslim polymath and physician who lived during the flourishing of Islam in the Middle Ages. He was particularly noted for his contributions to Aristotelian philosophy and medicine.

Avicenna is the author of approximately 450 works on different aspects of science, especially medicine. Two hundred forty of these writings have survived to the present day.[1] He also made drawings in the field of human anatomy and included them in his book (**Figure 2**). Avicenna's most important book in medicine is the Canon, which, due to its chapter divisions, sound content, and intellectual discipline, influenced all medical books in the Islamic world and Europe for centuries. As an original source, this book was taught in scientific centers such as the Universities of Montpellier and Louvain.[2] In this article, we will present Avicenna's contributions to medical science.

Figure 1. A portrait of Ibn Sina (Avicenna) (from, Krueger, H.C.: Avicenna's poem on medicine. Springfield, Illinois; Charles C Thomas, 1963; p 52a).

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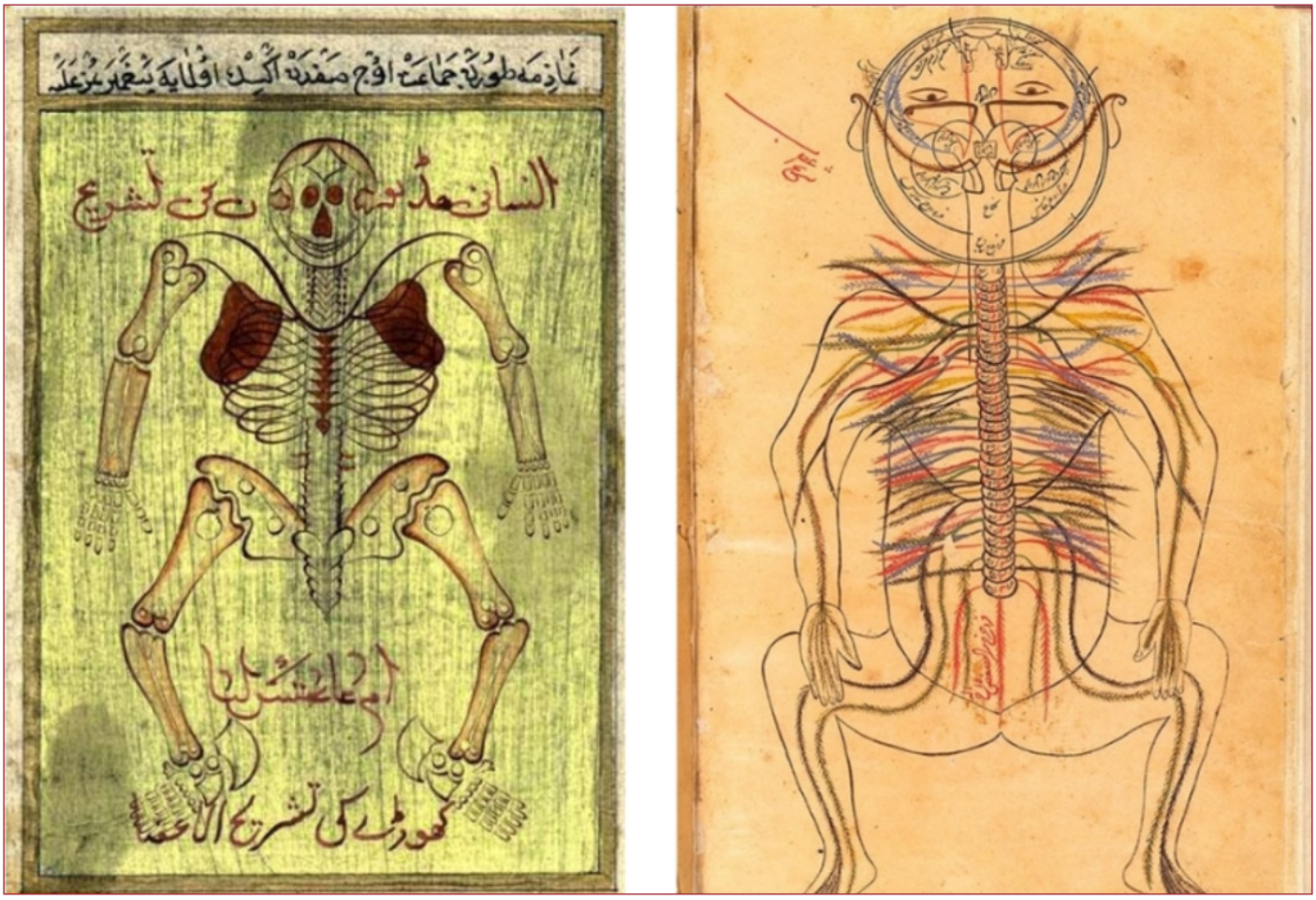

Figure 2. The human muscular and skeletal system drawn by Ibn Sina in his book Canon of Medicine

AVICENNA'S CONTRIBUTIONS TO MEDICAL SCIENCE

Cardiology

Avicenna's definition of heart disease was presented logically for perhaps the first time in the history of medicine. Ibn Sina was the first to describe carotid sinus hypersensitivity that occurs with vasovagal syncope. He pioneered the science of pulsation, and after developing Galen's pulsation theory, Ibn Sina gave the first accurate explanation.

Avicenna explained the symptoms, effects, and treatment of Palpitations in detail.[3]

Avicenna did not use the concept of Atherosclerosis in his book on Medicine. However, she noted that local accumulation of abnormal fluids in veins or other areas can cause blockage. Additionally, Ibn Sina said that the blockages that could cause the worst outcome were in the arteries of major organs such as the heart, brain, and liver.[4]

Ibn Sina has a remarkable book called "Kitab al-Adviyt-al-Qalbiye," which means "Book of Medicines against Heart Diseases.".[5] Due to its wide acceptance and importance, this treatise was translated into Latin under "De Medicines Cordialibus" by Arnaldo de Villanova (d. 1310 or 1313 A.D.) in the early 14th century. It was translated into Latin for the second time by Alpagus in 1520.[6] In this book, he describes simple and compound drug treatments for heart disease, but before that, he divides the drugs into several categories. These categories include stimulants, diuretics, and cooling agents.[7]

Surgery

Avicenna was one of the most famous surgeons of his time. [8] Although his surgical knowledge was greatly influenced by figures such as Galen (AD 130-200), Rhazes, and Haly Abbas, he developed techniques.[9] He viewed surgery and medicine as a whole.[10] Avicenna wore a green dress while performing surgery and emphasized that his assistant did the same.[1] He recommended placing the patient in the prone position after surgery to prevent aspiration.[11] He used materials such as single horse hair to stitch wounds after surgery.[12]

Avicenna performed his surgeries under general anesthesia with sterilized devices.[13] He recommended the administration of different preparations to provide adequate analgesia and anesthesia before surgery. For

example, he prescribed a mixture of mandragora and some other hypnotics to patients undergoing amputation.[14] Additionally, Ibn Sina was alert to the possible toxicity and potency of some of these recipes.

He described specific techniques for head and neck surgeries, including those used for tonsillectomy and transection of the lingual frenulum in patients with ankyloglossia.[15]

It appears that Ibn Sina initiated the use of tracheotomy in a drowning patient. He explains the process this way: "…extend the head [and neck] and hold it [in that position] and grab the skin [on the front of the neck] and cut it. Using a hook, it is better to hold the incised skin [in that position] Pull the skin away until the trachea becomes visible. Incise between the two exposed middle [cartilaginous] rings …. Each two [incised] skin margins should be folded and sutured later …"[15]

Internal Medicine

Avicenna likely provided the first description of post-hepatic jaundice secondary to biliary obstruction. According to Ibn Sina, post-hepatic jaundice manifests as pale yellow or whitish stools, dark yellow urine, abdominal discomfort on the right side, pain on the right side after feeding, and general itching.[16]

He also gave a detailed explanation of the causes, clinical symptoms, and treatments of intestinal obstruction. Avicenna was the first person in medical history to introduce a squeezable enema device.[9] He explained abdominal wall hernias, their clinical findings, and treatment.[9]

Ibn Sina discussed the repair of rectal fistulas. In the first volume of the Canon, he described the anatomy of the anal sphincter; In the third volume, he debated the surgical treatment of perianal fistulas using silk thread as ligature.[9]

Avicenna used different approaches to treat benign and malignant tumors. He emphasized the preoperative distinctions between these two types of lesions.[17]

Urology, Obstetrics, and Gynecology

In his famous book Canon of Medicine, he discussed pregnancy, prenatal, and postnatal care.[18] Existing research shows that he accurately described the prescription of contraception, prenatal and perinatal care, the heart as the first functional organ of the fetus, removal of the placenta after birth, as well as the identification and treatment of abnormal uterine bleeding with herbs.[19-22] He also described perineal injury during birth and its surgical treatment.[23] He also reported that diseases such as Berberis vulgaris were the cause of abortion.[18]

Avicenna believed that the origin of the formation of the human body was the man's semen and the woman's ovum. He stated that the health of the puppies depends on the health of the semen and ovum.[18] It was also believed in his time that sperm, semen, and eggs could deteriorate as a result of improper lifestyle and nutrition.[24]

Orthopedics and Neurosurgery

Avicenna mentioned injuries and deformities of the spine in 8 chapters of the third volume of Canon Medicine.[25] He proposed that the spinal cord consists of motor, sensory, sympathetic, and parasympathetic nerves. He defined injuries to different nerve types as causing different clinical signs and that other clinical signs and symptoms may develop depending on the injury site. He also made treatment recommendations based on these observations.[25-27]

He described that paresis of muscles could occur due to spinal nerve injuries and spinal cord shock, and C1 injury can have devastating effects due to shortness of breath. Also, Avicenna observed that trauma to the spine often leads to neurological disorders and even death.[25]

He advocated food therapy, medication, bloodletting, physiotherapy and exercise, dry sauna, surgery, spinal traction, cupping, and massage as treatment options for spinal trauma.[26,28]

Avicenna was interested in orthopedics. Several pages of his canon are devoted to bone fractures, joint dislocations, tendons, and nerve injuries.[9,29] Perhaps for the first time in the history of medicine, Avicenna distinguished between tendons and nerves. While explaining the nerves, he explained: "Voluntary movements of the extremities are under the control of brain commands that transmit them through the nerves..."[30]

Ibn Sina demonstrated a technique for repairing injured tendons. He suggested anastomosis with stitches between the two ends of an injured nerve.[31] Perhaps for the first time in medical history, Avicenna described limb compartment syndrome. He warned against tightly bandaging fractured extremities and warned of the possibility of occlusion of the arterial circulation as a result of this practice.[31]

Neurology and Psychiatry

Avicenna made significant contributions to neurology, especially regarding headaches and migraines. Although Ibn Sina believed in the humoral theory and divided migraine into two categories, hot and cold, and suggested specific treatments and general evaluations, most of his definitions and the pathologies he explained are supported by current medical concepts.[32] In addition, current findings show that most of the medicinal plants mentioned by Ibn Sina in the treatment of migraine (mint, chamomile, cannabis, opium poppy, etc.) are currently used in the production of central and peripheral sensitizers.[anti-neuroinflammatory agents, nitric oxide reducers, cyclooxygenase (COX)-2 inhibitors] as well as serotoninergic, neuroprotective agents and analgesics.[32]

Ibn Sina also contributed to the development of the diagnosis of different types of dementia and the discovery of its etiology.[33]

Avicenna regards depression not only as a mental illness but as a disorder resulting from the effects of the brain, heart, and blood. He believed that the primary cause of depressive episodes was heart disease. In most cases, the brain is affected only secondary to the heart. For this reason, he stated that underlying cardiovascular diseases should be taken into account in the treatment of depressive disorders.[33]

In his Code of Medicine, Ibn Sina defines various melancholic disorders as subheadings of brain diseases. He described a condition he called cerebral melancholia, which was very similar to the modern-day definition of depression.[33]

Infectious diseases

Ibn Sina is also known for some of the first moves of crucial public health and safety measures, such as quarantine, that are still practiced today. In his observations in The Canon, he describes Tuberculosis as an infectious disease whose victims must be quarantined or isolated to prevent further spread. He also emphasizes that water and soil are possible disease agents and should be targeted and treated together.[34,35]

CONCLUSION

Although Ibn Sina died in 1037 AD at 57, he lived on for hundreds of years through his legacy, books, and students. This is seen in Avicenna's teachings, which extend beyond the East and into the West. Avicenna's work was repeatedly adopted by physicians of later generations, adapting what he said as knowledge of previously obscure concepts was clarified. Al-Juzjani summarized this best with his words: 'Medicine did not exist until Hippocrates invented it. When he died, Galen revived him. He was blind; Hunayn bin Ishaq gave him an eye. Rhazes gave him consistency. And Ibn Sina made it whole and solid.

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