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Original Article
Özgün Araştırma

Endourol Bull. 2023;15(3):75-84. doi:10.54233/endouroloji.20231503-1293368

A Quality and Reliability Analysis of YouTube Videos on Chronic Prostatitis/ Chronic Pelvic Pain Syndrome

Kronik Prostatit/Kronik Pelvik Ağrı Sendromu ile İlgili YouTube Videolarının Kalite ve Güvenilirlik Analizi

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ÖZET

Amaç: Kronik prostatit/kronik pelvik ağrı sendromu (KP/KPAS) hakkında YouTube'da bulunan bilgilerin güvenilirliğini ve kalitesini değerlendirilmesi amaçlandı.

Gereç ve Yöntemler: "Kronik prostatit" ve "erkek kronik pelvik ağrı sendromu" arama terimleri kullanılarak toplam 200 video toplandı. İki ürolog videoları analiz etti ve kullanışlılıklarına, kalitelerine ve içerik güvenilirliklerine göre derecelendirdi. Videoların güvenilirliğini ve kalitesini değerlendirmek için modifiye DISCERN aracı ve Global Kalite Puanı (GQS) sıralama sistemi kullanıldı.

Bulgular: 200 videodan 120'si değerlendirme için uygun bulundu. Videoların çoğunluğu faydalı bulunmakla birlikte (%65,83) çoğunlukla sağlık profesyonelleri tarafından üretildiği saptandı (86 video). Akademik kökenli sağlık çalışanları tarafından üretilen videolar, özel sektör kökenli olanlara kıyasla daha yüksek görüntülenme sayısına ve daha uzun süreye sahipti (p=0.043 ve 0.011). Akademik sağlık çalışanları tarafından yüklenen videoların yüklenmesinden bu yana geçen sürenin daha uzun olduğu izlendi (p=0,003). Ortalama güvenilirlik puanı, ortalama GQS puanı ve ortalama içerik puanı akademik sağlık çalışanları tarafından yüklenen videolar için anlamlı derecede yüksek saptandı (p<0.001). Tüm değişkenlerin sağlık çalışanlarının uzmanlık alanlarına göre farklılık göstermediği bulundu (p=0.349; 0.349; 0.263; 0.307; 0.901; 0.118 ; 0.308 ; 0.114 ; 0.435 ve 0.187)

Sonuç: YouTube'da KP/KPAS hakkında bilgi arayan hastaların, özellikle akademik kurumlarla ilişkili sağlık uzmanları tarafından oluşturulan videolara odaklandıklarında değerli ve güvenilir içerik bulmaları muhtemeldir.

Anahtar Kelimeler: Prostatit; Pelvik Ağrı; Yaşam Kalitesi.

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This study was approved by the Uludag University Faculty of Medicine Clinical Research Ethics Committee (Decision No: 2023-7/38, Date: 11.04.2023).

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ABSTRACT

Objective: To evaluate the reliability and quality of information about chronic prostatitis/chronic pelvic pain syndrome (CP/CPPS) available on YouTube.

Material and Methods: A total of 200 videos were gathered using the search terms "chronic prostatitis" and "male chronic pelvic pain syndrome." Two urologists analyzed and rated the videos based on their usefulness, quality, and reliability of content. The modified DISCERN tool and the Global Quality Score (GQS) ranking system were used to assess the reliability and quality of the videos.

Results: Out of the 200 videos, 120 were found to be suitable for evaluation. The majority of videos were found to be useful (65.83%), and were mostly produced by healthcare professionals (86 videos). Videos produced by healthcare professionals of academic origin had higher views and longer duration compared to those from private origin (p=0.043 and 0.011 respectively). Time since upload was longer for videos uploaded by academic healthcare professionals (p=0.003). The average reliability score, average GQS score, and average content score were all significantly higher for videos uploaded by academic healthcare professionals (p<0.001). All variables were not different according to the specialty of healthcare professionals (p=0.349; 0.349; 0.263; 0.307; 0.901; 0.118 ; 0.308 ; 0.114 ; 0.435 and 0.187 respectively)

Conclusion: Patients seeking information on CP/CPPS on YouTube are likely to find valuable and trustworthy content, particularly when focusing on videos created by healthcare professionals, notably those associated with academic institutions.

Keywords: Prostatitis; Pelvic Pain; Quality of Life.

INTRODUCTION

In the age of the internet, individuals globally are increasingly resorting to digital platforms for health-related information. Particularly, YouTube has emerged as a prominent platform where patients not only seek information about various health issues but also share their experiences (1). One such health concern that is frequently discussed is Chronic Prostatitis/Chronic Pelvic Pain Syndrome (CP/CPPS), a complex clinical entity with an unknown etiology which significantly impacts the quality of life of affected individuals (2–6).

While traditional therapies for CP/CPPS often prove suboptimal, patients typically explore various treatment alternatives, including non-pharmacological modalities such as physiotherapy (7–10).

This quest for knowledge and alternative treatments has been facilitated by the internet, with YouTube offering a plethora of videos on the topic. However, with numerous videos produced by individuals lacking a medical background or expertise, the reliability and quality of the information provided may be questionable. Further complicating this scenario is the fact that personal testimonies about specific treatments may not necessarily represent their general efficacy. Therefore, there is a need to scrutinize and assess the quality and reliability of CP/CPPS-related information available on YouTube (6).

In this research, our objective was to assess the dependability and caliber of CP/CPPS-related information available on YouTube and compare these findings across various information sources.

MATERIAL AND METHODS

In this study, we adhered to the ethical guidelines outlined by our institution's local ethical committee, which reviewed our research protocol and deemed that it did not require formal ethical approval due to its non-clinical nature (Approval number:2023-7/38).

On November 12, 2022, the terms "chronic prostatitis" and "male chronic pelvic pain syndrome" were searched on using the Google Chrome internet browser. The search history was cleared prior to the search, and VPN settings were adjusted to mimic a user in the United States. The first 100 results for each search term were recorded.

Exclusion criteria for the videos included non-English language, lack of audio, irrelevance, and a focus on physical therapy exercises. Duplicate videos were also excluded, with only one entry considered. Data

collected for each video included the duration, upload date, and the number of views, likes, and comments.

Two urologists (BC, OA) independently assessed the videos for their utility, quality, and reliability. In cases of disagreement, a senior urologist (OK) provided a third opinion. Videos were classified as "useful" if they contained accurate scientific information about the condition and treatment options. Conversely, videos were deemed "non-useful" if they presented unproven pathophysiological relationships or treatment options. This classification methodology has been employed in various other studies (11,12).

Two distinct approaches were employed to assess the reliability and quality of the videos. Firstly, the modified DISCERN tool was utilized to evaluate the reliability of the content in the videos. The DISCERN tool is a widely recognized and established instrument designed specifically for assessing the quality of health information provided to patients (13).

The DISCERN tool comprises 15 questions, each rated on a scale of 1 to 5, that evaluate different aspects of the presented information. Aspects assessed include the clarity and achievement of the video's objectives, the inclusion of reliable sources of information, and the balanced and unbiased presentation of the content. In this study, a modified 5-item version of the DISCERN tool was used, which has been employed in previous research (14,15). Additionally, the Global Quality Score (GQS) ranking system was employed to assess the overall quality of the videos. The GQS employs a scale ranging from 1 to 5, with 1 signifying low quality and 5 indicating good quality (16). The GQS takes into account factors such as the accessibility of the provided information, its accuracy and reliability, as well as the overall flow and organization of the video. Each video's content was assessed based on five key areas: coverage of epidemiology, pathogenesis, clinical presentation, potential differential diagnoses, and treatment options. The final content score was determined by summing up the relevant information discussed within each of these areas.

The videos were categorized based on the source of information into the following groups: Healthcare professionals, patient experiences, and individuals. The healthcare professionals group was further classified by specialization, including urologists, physiotherapists, and other healthcare professionals. Additionally, this group was divided into private and academic origin.

Statistical Analysis

The Shapiro-Wilk test was employed to determine if the variables followed a normal distribution. Continuous variables were represented as median (25th percentile: 75th percentile), while categorical variables were expressed as n (%). Group comparisons were conducted using Mann-Whitney or Kruskal-Wallis tests. Subgroup analysis was performed utilizing the Dunn-Bonferroni method after overall significance was achieved. The source of the content rate was compared between useful and non-useful videos using the chi-squared test. For post hoc comparisons, the chi-squared test with Bonferroni correction was applied.

The agreement between the observers who rated the videos was assessed using the intraclass correlation coefficient (ICC). Statistical analysis was carried out using SPSS (IBM Corp. 2012, IBM SPSS Statistics for Windows, version 21.0, Armonk, NY: IBM Corp.), and the significance level was set at $\alpha=0.05$.

RESULTS

After applying the exclusion criteria to the first 100 videos obtained by each search term (200 in total), a total of 120 videos were found to be suitable for evaluation (Figure 1). The median length of the videos was 7.3 (0.49-88.50) minutes, the median days since upload was 727.5 (15-4834) days, the median number of views was 5305 (77-267,554), the median number of daily views was 6.91 (0.09-373.72), the median number of likes was 41.5 (0-2800), and the median number of comments was 7 (0-1152).

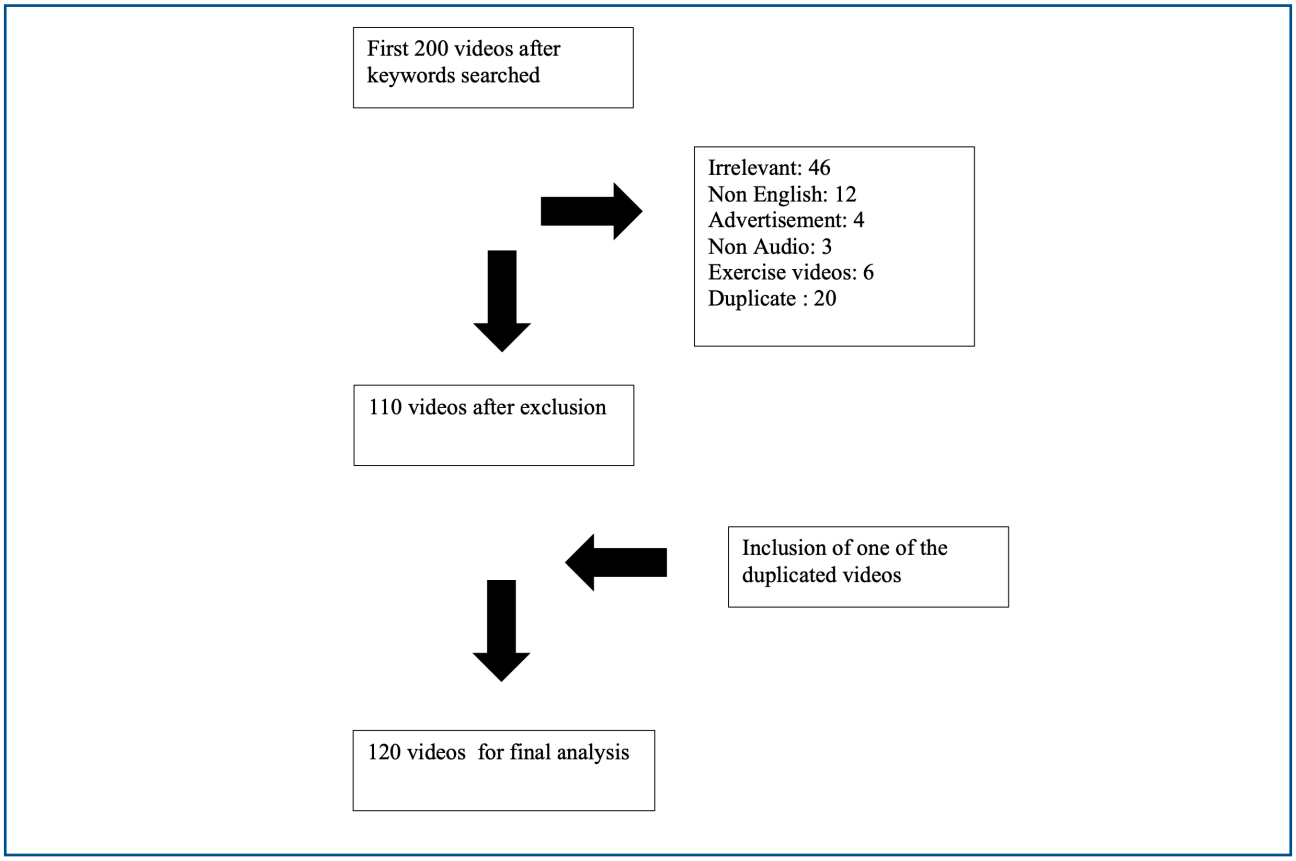

Figure 1. The diagram illustrates the process of selecting and evaluating videos for the study.

Evaluations on the usefulness of the videos were found to have a good level of agreement between the evaluators for all scores. The ICC for the Reliability Score, GQS Score, and Content Score were 0.89, 0.82, and 0.88 respectively, indicating very good to good agreement between the two raters in their ratings. All the ICC values were statistically significant, with p-values less than 0.001.

The comparison of video ratings, quality, reliability, content, and information source according to their usefulness is presented in Table 1. Time since upload was longer in useful videos (770 days vs. 340 days; p=0.003). The median average reliability score was higher for useful videos (3.50 vs. 1; p<0.001). The median average GQS score was higher in useful videos (3.50 vs. 2; p<0.001). The median average content score was higher in useful videos (4 vs. 1.50; p<0.001). There was a significant difference between useful and non-useful videos according to the distribution of source of video content (p<0.001). In the subgroup analyses, it was determined that the rate of videos uploaded by healthcare professionals was higher in the useful videos than in the non-useful videos (p<0.05).

The comparison of video ratings, quality, reliability, and content according to the source of information is presented in Table 2. There was a significant difference between videos according to the number of comments (p=0.001). In the subgroup analyses, it was found that the median number of comments to the videos uploaded by patients was higher than the median number of comments of videos uploaded by healthcare professionals (p=0.001). There was also a significant difference between the video groups according to the duration of videos (p=0.004). In the subgroup analyses, it was found that the duration of the videos originating from healthcare professionals and patients was longer than the videos uploaded by individuals (p=0.018 and p=0.002).

There was a significant difference in the average reliability scores between the video groups (p<0.001). In the subgroup analyses, it was found that the median score value of videos originating from healthcare

professionals was higher than the videos originating from patients (p<0.001). There was a difference in the average GQS score and average content score between the video groups (p<0.001), with the median score value of healthcare professional videos being higher than patient-based videos in both domains.

Table 3 represents the academic orientation of the healthcare professionals who uploaded the videos. It was determined that the number of views of the videos uploaded by healthcare professionals of academic origin was higher than the number of views for healthcare professionals of private origin (22.40 vs. 9624; p=0.043). The number of comments was higher in videos uploaded by private healthcare professionals (6 vs. 1; p=0.021). The median duration of the videos uploaded by healthcare professionals of academic origin was longer than the videos uploaded by private healthcare professionals (6.24 vs. 12.24; p=0.011). Time since upload was longer for videos uploaded by academic healthcare professionals (584.50 vs. 979; p=0.003). The average reliability score, average GQS score, and average content score were higher for videos uploaded by healthcare professionals of academic origin (2.75 & 4; p<0.001, 3 & 4.50; p<0.001, and 3 & 4.50; p<0.001, respectively).

Table 4 presents the comparison of video features, quality, and reliability among healthcare professionals by their specialties. It was found that all variables were not different according to the specialty of healthcare professionals (p>0.05).

Table 1. Comparison of video futures, quality, and reliability of videos by accuracy

	Useful (n=79)	Non-Useful (n=41)	p- value
Number of views	6027(1170:26096)	1885(480:17164)	0.294[a]
Number of likes	51(14:236)	31(8.50:278)	0.646[a]
Comments	6(0:56)	17(2.50:100.50)	0.065[a]
Duration of video	7.39(4.13:23.15)	7.22(3.44:11.77)	0.317[a]
Time since upload	770(454:1580)	340(166.50:1058)	0.003[a]
Avarage views per day	6.24(1.62:22.59)	7.62(2.59:25.48)	0.396[a]
Avarage Reliabilty score	3.50(3:4)	1(0.50:1.50)	<0.001[a]
Avarage GQS score	3.50(3:4.50)	2(2:2.50)	<0.001[a]
Avarage content score	4(3:5)	1.50(1:2.25)	<0.001[a]
Source of video content			
Health care professional	66(83.50%)	20(48.80%)	
Patient experience	8(10.10%)	18(43.90%)	<0.001[b]
Individual	5(6.30%)	3(7.30%)	

Data were presented as median (25th percentile : 75th percentile) and n%.
a: Mann-Whitney U Test, b: Chi-Square Test

Table 2. Comparison of video futures, quality, and reliability of videos by source of information

	Health care professional (n=86)	Patient experience (n=26)	Individual (n=8)	P value[b]
Number of views	3959.5(517:21636.25)	5934(824:31067.25)	5576(4576.50:16687.50)	0.656
Number of likes	35(8:219.5)	138(21.75:635.5)	46(11.75:172.75)	0.095

Comments	5.5(1:38.25)	58.5(15:208.25)	5(0.25:101.25)	0.001
Duration of video	7.32(3.38:18.27)	10.70(6.08:20.73)	2.75(1.29:5.67)	0.004
Time since upload	727.5(366.75:1320.5)	728(275.75:1280.5)	834(583.25:2521.75)	0.445
Avarage views per day	4.83(1.61:22.72)	9.09(3.70:32.09)	9.03(1.96:12.99)	0.218
Avarage Reliabilty score	3.5(2.5:4)	1(0.38:2.5)	2.75(2:3)	<0.001
Avarage GQS score	3.5(2.5:4.5)	2.5(2:3)	3.25(2.5:3.5)	<0.001
Avarage content score	3.5(2.5:4.625)	1.5(1:2)	3(1.875:3)	<0.001
Pairwise Comparisons	**$p_{HCP.-PE.}$**	**$p_{HCP.-IND.}$**	**$p_{PE.-IND.}$**	
Comments	0.001	>0.999	0.140	
Duration of video	0.377	0.018	0.002	
Avarage Reliabilty score	<0.001	0.736	0.361	
Avarage GQS score	<0.001	>0.999	0.180	
Avarage content score	<0.001	0.418	0.405	

Data were presented as median (25th percentile : 75th percentile)
b: Kruskal-Wallis Test
HCP.: Health care professional, PE.: Patient experience, IND.,: Individual

Table 3. Comparison of video futures, quality, and reliability among health care professionals by their academic orientation

	Private (n=62)	Academic (n=31)	P value[a]
Number of views	2240.5(428.25:11648.75)	9624(1129:33690)	0.043
Number of likes	24.5(8:156.75)	84(19:338)	0.065
Comments	6(2:50)	1(0:34)	0.021
Duration of video	6.24(2.33:12.86)	12.24(5.31:23.15)	0.011
Time since upload	584.5(230.25:1023.75)	979(603:2723)	0.003
Avarage views per day	4.48(1.61:20.60)	6.05(1.83:17.30)	0.672
Avarage Reliabilty score	2.75(1.5:3.5)	4(3.5:5)	<0.001
Avarage GQS score	3(2.5:3.5)	4.5(3:5)	<0.001
Avarage content score	3(2:4)	4.5(3:5)	<0.001

Data were presented as median (25th percentile : 75th percentile)
a: Mann-Whitney U Test

Table 4. Comparison of video futures, quality, and reliability among health care professionals by their specialties

	Urologists (n=43)	Physio therapists (n=32)	Others (n=11)	P value[b]
Number of views	7786(423:22970)	1744(450.25:16804)	6502(1129:33690)	0.349
Number of likes	28(8:236)	28.50(9-191.50)	172(22:446)	0.263
Comments	4(0:28)	6(2:46.75)	5(0:42)	0.307
Duration of video	7.22(3.38:16.31)	6.92(2.90:25.62)	8.18(3.53:14.31)	0.901
Time since upload	906(433:1802)	592(276:1179.25)	413(368:729)	0.118

Avarage views per day	4.52(1.86:16.49)	4.13(1.15:22.31)	16.38(2.35:44.34)	0.308
Avarage Reliabilty score	3.5(2.5:5)	3(2.13:3.50)	3.5(3:4)	0.114
Avarage GQS score	3.5(2.5:5)	3(2.50:4)	4(2.5:4.5)	0.435
Avarage content score	3.5(2.5:5)	3.50(2:4)	4.5(3:4.5)	0.187

Data were presented as median (25^{th} percentile : 75^{th} percentile)
b: Kruskal-Wallis Test

DISCUSSION

Over the past decade, the internet has emerged as a prevalent source of health information. YouTube has evolved into a significant platform for both physicians and patients to seek and share information on a wide range of medical topics, CP/CPPS (1,14). Concerns have been raised about the accuracy and quality of information in this domain, as a considerable portion of the available content tends to be speculative in nature, and there are limitations in content organization (17).

While a recent study has been published evaluating YouTube videos in relation to prostatitis, to the best of our knowledge, our study is the first to specifically focus on CP/CPPS using validated measures (6).

The findings of the current study suggest that a significant proportion of YouTube videos pertaining to CP/CPPS are considered useful by the authors, with 65.83% of the videos being classified as such. Consequently, patients searching for information on CP/CPPS via YouTube may have a relatively high likelihood of encountering accurate and valuable information.

In the present study we found that videos uploaded by patients as their experiences had lower scores for quality and reliability when compared to videos uploaded by healthcare professionals. This is consistent with the paper written by Rudisill et al, which found that the videos uploaded by patients achieved significantly lower scores on the Journal of American Medical Association (JAMA) Benchmark Criteria for reliability when evaluating YouTube as a source of information on pediatric scoliosis (18). Additionally, the videos produced by healthcare professionals of academic origin were found to have higher reliability, quality, and content scores compared to videos produced by private healthcare professionals.

The distribution of videos uploaded by healthcare professionals by specialty in this study was 50% urologists and 39.53% physiotherapists, with no significant differences observed in the quality, reliability, and content scores of the videos based on the healthcare professional's specialty. There was a significant interest and engagement from both urologists and physiotherapists in providing information and education about CP/CPPS on YouTube.

One potential explanation for the high percentage of physiotherapists among the healthcare professionals who have uploaded videos on CP/CPPS on YouTube may be related to the growing recognition of the importance of physiotherapy in the management of CP/CPPS. Physiotherapy approaches such as pelvic floor muscle training have been shown to be effective in the treatment of CP/CPPS, which may have led to more physiotherapists creating content on this topic. (19,20). Another possible explanation may be related to the marketing strategies used by physiotherapists. As YouTube is a widely used platform and can reach a large audience, it may be an attractive platform for physiotherapists to market their services, share their knowledge and expertise, and reach a wider audience.

In terms of the reliability and the quality of the videos, the results of this study suggest that a majority of the videos were rated as useful and were of relatively high quality and reliability as determined by the modified DISCERN tool and the Global Quality Score (GQS) ranking system. This finding is consistent with other studies that have evaluated the quality and reliability of health information on YouTube for several urological conditions. In a study evaluating YouTube videos related to premature ejaculation found that the majority of the videos were rated as useful and of high quality and reliability using similar evaluation tools

(DISCERN and GQS) (12). Similarly, a study on YouTube videos related to testicular self-examination found that the majority of the videos were rated as high quality (21). However, a study on YouTube videos related to nocturnal enuresis in Japan found that the majority of the videos were rated as low quality and unreliable using similar evaluation tools (22).

In the present study, it was found that the median number of views for videos was 5305, with a range of 77 to 267,554 views. However, there was no significant difference in the number of views between videos rated as "useful" and "non-useful" by the evaluators. This suggests that people may be exposed to both high-quality and low-quality information on PE at similar rates and may not be able to distinguish between the two. Furthermore, the median number of likes and comments for videos was 41.5 and 7 respectively, and there was no significant difference in these metrics between the useful and non-useful videos. This highlights the importance of evaluating the quality of medical information on YouTube, as viewers may not be able to distinguish between reliable and unreliable sources.

One limitation of this study is that it only evaluated videos on YouTube, and therefore may not represent the entirety of online information available on chronic prostatitis/chronic pelvic pain syndrome. Additionally, the sample size of 120 videos is limited, and may not accurately reflect the overall quality and reliability of all videos on this topic. Furthermore, the study only focused on videos in English, which may exclude a significant portion of videos that could provide valuable information to patients. Lastly, the study did not assess the impact of the information provided in the videos on patient outcomes or satisfaction. In addition to its limitations, this study has several strengths. Validated measures were used to evaluate the quality and reliability of the videos, and videos uploaded by healthcare professionals from various specialties were included.

CONCLUSION

In conclusion, the result of the present study shows patients seeking information on CP/CPPS on YouTube may have a relatively high chance of finding useful and reliable information, particularly if they focus on videos produced by healthcare professionals, and specifically those affiliated with academic institutions. More research is needed to evaluate the quality and reliability of online information about CP/CPPS on other platforms as well.

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Original Article
Özgün Araştırma

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Comparison of Understanding and Recall of Informed Consent Information in Written and Video Formats: A Focus on Retrograde Intrarenal Surgery

Yazılı ve Video Formatlarındaki Bilgilendirilmiş Onam Bilgilerinin Anlaşılması ve Geri Çağırılmasının Karşılaştırılması: Retrograd İntrarenal Cerrahiye Odaklanma

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ÖZET

Amaç: Bu çalışmanın amacı, retrograd intrarenal cerrahi (RIRS) için bilgilendirilmiş onam alınması sürecinde bir eğitim aracı olarak video kullanımının hasta anlayışı, memnuniyeti ve tercihleri üzerindeki etkisini geleneksel yazılı onam formlarına kıyasla değerlendirmektir.

Gereç ve Yöntemler: Bu çalışmaya RIRS planlanan toplam 114 hasta dahil edildi. Katılımcılar, RIRS prosedürü hakkındaki bilgilendirilmiş onamı okuduktan sonra hazırlanan soru anketini yanıtladılar. Daha sonra prosedürle ilgili bir eğitim videosu izlediler ve yazılı ve video tabanlı bilgilendirilmiş onam arasındaki bilgi ve tercihlerdeki değişiklikleri değerlendirmek için video sonrası bir anket doldurdular.

Bulgular: Bilgilendirilmiş onam sürecine videonun dahil edilmesinin, hastaların RIRS prosedürü hakkında daha doğru yanıtlar vermesine katkı sağladığı izlendi ($p<0.001$). Katılımcıların çoğunluğu (%94,5) video sunumunu yazılı onam formuna göre daha faydalı bulmuş ve geleneksel yönteme tercih etmiştir. Ek olarak, video kullanımı, prosedür hakkında bilinçli kararlar vermede artan güven ile ilişkilendirildi. Katılımcıların çoğu, videoyu kolay erişilebilir ve anlaşılır buldu ve bu da genel memnuniyetlerine katkıda bulundu.

Sonuç: Video ile zenginleştirilmiş bilgilendirilmiş onam süreci, klinik uygulamada standart bilgilendirilmiş onam sürecine değerli bir katkı olabilir. Sağlık hizmeti sunucuları, kolay erişilebilir ve anlaşılır bilgiler sağlayarak hastaların ihtiyaçlarını daha iyi karşılayabilir ve genel bakım kalitesini iyileştirebilir. Bu yaklaşım, daha iyi hasta sonuçlarına, sağlık hizmeti sağlayıcılarına artan güvene ve tıbbi bakıma daha hasta merkezli bir yaklaşıma yol açabilir.

Anahtar Kelimeler: Retrograd İntrarenal Cerrahi, aydınlatılmış onam, videoinfografi

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Approval was received for this study from the Uludağ University Faculty of Medicine Clinical Research Ethics Committee (March 18, 2020 / Decision No: 2020-5/5). The ethical rules of the Declaration of Helsinki were followed in the study protocol.

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ABSTRACT

Objective: The aim of this study was to assess the impact of using video as an educational tool in the informed consent process for retrograde intrarenal surgery (RIRS) on patient understanding, satisfaction, and preferences compared to traditional written consent forms.

Material and Methods: A total of 114 patients scheduled for RIRS participated in this study. After reading informed consent, participants completed a questionnaire assessing their baseline knowledge about the RIRS procedure. They then watched an educational video about the procedure and completed a post-video questionnaire to assess changes in knowledge and preferences between written and video-based informed consent.

Results: The results demonstrated that incorporating a video into the informed consent process led to significant improvements in patients' knowledge about the RIRS procedure ($p<0.001$). A majority of participants (94.5%) found the video presentation to be more helpful than the written consent form and preferred it over the traditional method. Additionally, the use of video was associated with increased confidence in making informed decisions about the procedure. The majority of participants found the video to be easily accessible and comprehensible, which contributed to their overall satisfaction.

Conclusion: Video-enhanced informed consent process can be a valuable addition to the standard informed consent process in clinical practice. By providing easily accessible and comprehensible information, healthcare providers can better meet patients' needs and improve the overall quality of care. This approach may lead to better patient outcomes, increased trust in healthcare providers, and a more patient-centered approach to medical care.

Keywords: Retrograde Intrarenal Surgery, informed consent, videoinfography

INTRODUCTION

Informed consent is a critical component of the ethical and legal framework in the field of medicine, particularly in surgical procedures (1). It represents the voluntary agreement of a patient to undergo a specific medical intervention after receiving comprehensive and accurate information about the nature, purpose, risks, benefits, and alternatives of the treatment (2). Informed consent not only serves as a legal protection for healthcare providers but also reinforces the shared decision-making process between the patient and the physician, fostering trust and promoting patient autonomy (2,3). Despite the importance of informed consent, studies have shown that patients may not fully understand the information provided in written consent forms due to a variety of factors, such as medical jargon, complex surgical procedures, and the inherent stress associated with the decision-making process (4,5). This raises concerns about the effectiveness of current methods in delivering informed consent information and highlights the need to explore alternative approaches to improve patient comprehension.

Retrograde intrarenal surgery (RIRS) is a minimally invasive treatment for kidney stones that involves the use of a flexible ureteroscope to access and fragment the stones within the kidney (6). Although RIRS is considered a less invasive alternative to other surgical procedures, it is not devoid of complications, making informed consent an essential aspect of patient care in this context (7).

In recent years, various educational materials have been developed to assist patients in understanding surgical procedures, including videos from academic institutions such as the European Association of Urology (EAU) Patient Information (8). However, these videos primarily serve as demonstrations of the surgical procedures rather than addressing the specific requirements of informed consent. The objective of this study is to compare the understandability and recall of informed consent information provided in written and video formats for patients undergoing RIRS.

MATERIAL AND METHODS

The written informed consent form used in this study was obtained from the Turkish Urological Association. This ensured that the content was in compliance with the established guidelines and standards for informed consent in urological procedures within Turkey, providing patients with accurate and relevant information about the risks, benefits, and alternatives of RIRS.

To enhance patient understanding and engagement, an infographic video was developed by STK and İİ, who have expertise in the field of video infographics, using Adobe After Effects™ as the primary tool for video creation. BC provided assistance throughout the development process. The video aimed to visually explain the RIRS procedure in a clear and concise manner, making it more accessible and understandable for patients.

Upon completion of the video, an audio narration was added to further supplement the visual elements. This narration included the complete text of the written informed consent form, ensuring that patients received consistent information through both the video and the written materials. By combining visual and auditory elements, the video was designed to cater to different learning preferences and improve patients' overall comprehension of the RIRS procedure and its implications.

The infographic video, which at https://youtu.be/RTnW61s9Oxo serves as a valuable educational resource for patients considering RIRS, can be accessed by making the video publicly available, we aim to facilitate informed decision-making among a broader patient population and contribute to the ongoing efforts to improve the informed consent process in urological care.

Patient Selection and Study Design

This prospective study was conducted at a tertiary referral center after obtaining approval from the institutional ethics committee (approval number: 2020-5/5) between 01.04.2020 and 30.10.2020, involving patients who underwent RIRS. Patients who declined to participate, had previously undergone RIRS, were under 18 years of age, cognitively impaired or were illiterate were excluded from the study. Upon admission for RIRS, patients provided written informed consent following a standard explanation by the physician. Subsequently, they completed a 26-item questionnaire (Appendix 1). Afterward, patients watched a 6-minute infographic video describing the RIRS procedure. A new copy of the previously administered questionnaire was given to patients, who were asked to complete it again. Throughout this process, the physician accompanied the patient and answered any questions that arose.

The first five questions focused on demographic information. The questionnaire also included a total of 14 true/false and multiple-choice questions aimed at evaluating patients' understanding of the RIRS procedure, with answers available in both the written informed consent document and the infographic video. An additional seven questions were added to the second administration of the questionnaire to assess patient satisfaction following the infographic video. These seven questions were analyzed to determine patient satisfaction levels. The responses provided before and after watching the video were compared to evaluate the potential benefits of video-assisted informed consent compared to conventional methods.

Statistical Analysis

Categorical variables were expressed as counts and related percentage values. Comparisons between the questionnaire data before and after watching the video were conducted using the McNemar test. The analyses were performed using SPSS (IBM Corp. Released 2017. IBM SPSS Statistics for Windows. Version 25.0 Armonk. NY: IBM Corp.), with a type I error rate of 5% considered statistically significant.

RESULTS

Of the 114 patients included in the study, 34 (29.8%) were female. The median age of the patients was

45.5 years. Out of the 105 patients who reported their educational status, 24 (22.9%) had a bachelor's or higher degree. When asked about their preferred learning method, 46 (40.4%) patients reported learning best by reading, 47 (41.2%) by writing, and 21 (18.4%) by watching. Demographic characteristics of the patients were listed in Table 1.

Table 1. Sociodemographic characteristics of the participants

	n	
Gender (F/M)	114	34/80
Age	114	45.5(17)
Education level	105	
Primary School		24(22.9%)
Middle School		21(20%)
High School		36(34.2%)
University		21(20%)
Graduate Degree		3(2.9%)
Learning Method	114	
Reading		46(40.4%)
Writing		47(41.2%)
		21(18.4%)

Data are presented as median (interquartile range) and n (%).

The analysis of questions 6-19, which inquired about patients' knowledge of RIRS, showed the following results. The proportion of patients who answered incorrectly before watching the video but found the correct answer after watching it were: 27.2% for question 6, 32.5% for question 7, 38.6% for question 8, 28.9% for question 9, 21.9% for question 10, 33.3% for question 11, 20.2% for question 12, 46.5% for question 13, 37.7% for question 14, 43.9% for question 15, 18.4% for question 16, 40.4% for question 17, 34.2% for question 18, and 35.1% for question 19. With the exception of question 16 (p=0.749), a statistically significant improvement in the proportion of correct answers after watching the video was observed for all other questions (p=0.008 for question 9, p=0.020 for question 12, and p<0.001 for all remaining questions) (Table 2).

Table 2. Comparison of consent form answers before and after watching the before video

		n	After Video	
Before Video	**S6/V6**		*Correct*	*Incorrect*
	Correct	114	53(46.5%)	7(6.1%)
	Incorrect		31(27.2%)	23(20.2%)
	p value[a]		**<0.001**	
Before Video	**S7/V7**		*Correct*	*Incorrect*
	Correct	114	31(27.2%)	3(2.6%)
	Incorrect		37(32.5%)	43(37.7%)
	p value[a]		**<0.001**	
Before Video	**S8/V8**		*Correct*	*Incorrect*
	Correct	114	49(43%)	10(8.8%)
	Incorrect		44(38.6%)	11(9.6%)
	p value[a]		**<0.001**	

Before Video	**S9/V9**		*Correct*	*Incorrect*
	Correct	114	40(35.1%)	14(12.3%)
	Incorrect		33(28.9%)	27(23.7%)
	p value[a]		**0.008**	
Before Video	**S10/V10**		*Correct*	*Incorrect*
	Correct	114	82(71.9%)	3(2.6%)
	Incorrect		25(21.9%)	4(3.5%)
	p value[a]		**<0.001**	
Before Video	**S11/V11**		*Correct*	*Incorrect*
	Correct	114	55(48.2%)	5(4.5%)
	Incorrect		38(33.3%)	16(14%)
	p value[a]		**<0.001**	
Before Video	**S12/V12**		*Correct*	*Incorrect*
	Correct	114	75(65.8%)	9(7.9%)
	Incorrect		23(20.2%)	7(6.1%)
	p value[a]		**0.020**	
Before Video	**S13/V13**		*Correct*	*Incorrect*
	Correct	114	44(38.6%)	4(3.5%)
	Incorrect		53(46.5%)	13(11.4%)
	p value[a]		**<0.001**	
Before Video	**S14/V14**		*Correct*	*Incorrect*
	Correct	114	59(51.8%)	3(2.6%)
	Incorrect		43(37.7%)	9(7.9%)
	p value[a]		**<0.001**	
Before Video	**S15/V15**		*Correct*	*Incorrect*
	Correct	114	41(36%)	6(5.2%)
	Incorrect		50(43.9%)	17(14.9%)
	p value[a]		**<0.001**	
Before Video	**S16/V16**		*Correct*	*Incorrect*
	Correct	114	28(24.6%)	18(15.8%)
	Incorrect		21(18.4%)	47(41.2%)
	p value[a]		0.749	
Before Video	**S17/V17**		*Correct*	*Incorrect*
	Correct	114	41(36%)	8(7%)
	Incorrect		46(40.4%)	19(16.6%)
	p value[a]		**<0.001**	
Before Video	**S18/V18**		*Correct*	*Incorrect*
	Correct	114	33(28.9%)	13(11.4%)
	Incorrect		39(34.2%)	29(25.4%)
	p value[a]		**<0.001**	
Before Video	**S19/V19**		*Correct*	*Incorrect*
	Correct	114	49(43%)	8(7%)
	Incorrect		40(35.1%)	17(14.9%)
	p value[a]		**<0.001**	

S: "Scribed"(assessment before watching the video)

V: "Video" (assessment after watching the video)

Of the participants, 65.5% believed that the information provided in the written consent form was sufficient, while 62.8% thought the surgical information in the form was explanatory. Almost 94% of participants found the information in the video to be adequate and understandable. Approximately 94.5% of participants stated that watching the video was more helpful for understanding the surgical procedure. After watching the video, 16 patients (14.2%) reported increased anxiety about the surgery, 46 patients (40.7%) reported decreased anxiety, and 51 patients (45.1%) reported no change in anxiety. Of the participants, 75 (68.2%) believed that using the video to explain the surgery saved time, while 35 (31.8%) thought it took more time. When asked to choose between the written consent form and the video, 85.8% of the participants preferred the video presentation (Table 3).

Table 3. Ratios of participants' written consent/video preferences information

	n	%
Is the information in the written consent form sufficient?		
Yes	74	65.5
No	39	34.5
Is the written consent form fully explanatory?		
Yes	71	62.8
No	42	37.2
Is the information in the video sufficient and understandable?		
Yes	106	93.8
No	7	6.2
Which was more helpful in understanding the procedure: written consent or video?		
Written consent	6	5.5
Video	104	94.5
How did the video affect your concern about the surgery?		
Increased	16	14.2
Decreased	46	40.7
Unchanged	51	45.1
Did the use of video in explaining the surgery save time or take more time?		
Saved time	75	68.2
Took more time	35	31.8
Would you prefer written consent or video explanation?		
Written Consent	16	14.2
Video	97	85.8

DISCUSSION

The main outcomes from the present study indicate that the use of infographic videos significantly improves patients' understanding of the RIRS procedure and their informed consent process. The study results demonstrated that after watching the infographic video, there was a significant increase in the number of correct answers provided by patients in response to questions related to RIRS. Several studies have similarly reported the benefits of using multimedia tools, such as videos and animations, to enhance patient comprehension in medical procedures and informed consent processes. Tait et al. found that using multimedia tools led to better comprehension and retention of information compared to traditional verbal or written methods (9). Another study conducted by Fink et al. reported that using an electronic informed consent process significantly improved patients' understanding of surgical procedures and risks involved (10).

Furthermore, the results of the present study highlight the importance of addressing different learning preferences among patients. The use of both visual and auditory elements in the infographic video caters to diverse learning styles, which can lead to improved overall comprehension (11). This approach aligns with the findings of Mayer and Moreno, who proposed that combining visual and auditory elements enhances cognitive processing and fosters better understanding of complex information (12).

The patients' perceptions regarding the usability of video as a tool for enhancing their understanding of the RIRS procedure and informed consent process were generally positive in the present study. Most participants found the video content to be both comprehensive and easily comprehensible. This is consistent with previous research highlighting the advantages of using multimedia tools in medical education and informed consent processes. A study by Rossi et al. showed that the use of video as a supplement to written informed consent significantly increased patients' comprehension of the surgical procedure, potential complications, and their rights as patients (13).

In addition, the present study revealed that a majority of patients preferred the video format over written consent forms, indicating a strong preference for visual aids in conveying complex medical information. This finding is supported by the work of Sahai et al. on informed consent in laparoscopic urology, which demonstrated that video consent positively impacted patient satisfaction (14). According to the Cognitive Theory of Multimedia Learning, integrating visual and auditory elements can lead to better retention and comprehension of information (12). By providing information in an accessible and engaging format, videos can help reduce anxiety and facilitate better decision-making among patients.

In a recent study by Eren et al, the authors investigated patients' understanding of consent forms for invasive procedures in a urology clinic, focusing on the comprehension levels across different age and education groups (15). The study utilized two intelligibility formulas specifically designed for the Turkish language, namely Ateşman and Bezirci-Yılmaz. After evaluating 69 separate consent forms, the results demonstrated that the average Ateşman intelligibility index score was 62.02, suggesting that individuals with a 9th or 10th-grade education level could comprehend the text. The Bezirci-Yılmaz index yielded an average of 11.13 points, indicating that the consent forms could be understood by those with a 10th or 11th-grade education level. The conclusion of Eren et al.'s study emphasized that the informed consent forms provided to patients before surgery were insufficient for their understanding. These findings align with previous studies in the literature, highlighting the need for improvement in the informed consent process.

The study underscores the importance of considering each country's health literacy and education levels when creating informed consent forms. This insight supports the notion that incorporating multimedia tools, such as video presentations, could help address the limitations of traditional written consent forms by enhancing patient understanding and satisfaction, as demonstrated in our study on video-enhanced informed consent for RIRS procedures.

There are several limitations of the present study that should be acknowledged when interpreting the results. First, the sample size of the study is relatively small, which may limit the generalizability of the findings to the broader population. Furthermore, the study population may not be representative of all patients undergoing the RIRS procedure, as participants were recruited from a single medical center. Second, the study design was not a validated but a pre- and post-test design without a control group, which prevents the direct comparison of the video-enhanced informed consent process to a standard informed consent process. A randomized controlled trial design would have been more robust in determining the true impact of the video on patients' understanding and perceptions. Third, the study relied on self-reported measures to assess participants' perceptions and understanding of the informed consent process. These measures may be subject to social desirability bias, as participants may feel inclined to provide favorable responses to the video intervention. Fourth, the study did not assess long-term retention of the information provided in the video, as participants were only tested immediately after watching it. It would be useful to evaluate whether the improved understanding of the procedure and informed consent process persists over time, as

this would be critical in ensuring that patients are able to make informed decisions about their care. Lastly, the study did not investigate the potential influence of participants' demographic characteristics, such as age, gender, education level, or previous experience with medical procedures, on their perceptions and understanding of the video-enhanced informed consent process. Further research is needed to explore whether these factors may affect the effectiveness of multimedia tools in medical education and informed consent processes.

CONCLUSION

In conclusion, this study suggests that using video in the informed consent process can improve patient understanding and satisfaction regarding RIRS procedures. Despite some limitations, the findings indicate that video-enhanced informed consent may be a valuable addition to clinical practice, helping to foster patient-centered care and better patient outcomes. Healthcare professionals and institutions should consider incorporating multimedia tools like videos to facilitate informed decision-making and enhance the quality of care provided.

Conflict of Interest: The authors have nothing to disclose.

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Ethical Approval: Approval was received for this study from the Uludağ University Faculty of Medicine Clinical Research Ethics Committee (March 18, 2020 / Decision No: 2020-5/5). The ethical rules of the Declaration of Helsinki were followed in the study protocol.

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Original Article
Özgün Araştırma

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The Role of Scoring Systems in Predicting Surgical Success in Percutaneous Nephrolithotomy: Results from a Single Center

Perkütan Nefrolitotomi'de Skorlama Sistemlerinin Cerrahi Başarıyı Öngörmedeki Yeri: Tek Merkez Sonuçları

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ÖZET

Amaç: Biz bu çalışmada, perkütan nefrolitotomide (PNL) en yaygın kullanılan modeller olan Guy's skoru, S.T.O.N.E skoru ve CROES nomogramının taşsızlığı öngörme etkinliklerini ve hangi modelin taşsızlığı daha başarılı öngördüğünü belirlemeyi amaçladık.

Gereç ve Yöntemler: Tersiyer akademik merkezimizde, 2009 ile 2018 tarihleri arasında böbrek taşı nedeniyle PNL uygulanan 18 yaşından büyük hastaların verileri retrospektif olarak değerlendirildi. İncelenen parametreler, hastaların demografik verileri, taşa ait özellikler, Guy's skoru, S.T.O.N.E. skoru, CROES nomogramı, operasyon süresi, transfüzyon oranı, hastanede kalış süresi ve taşsızlık idi. Taşsızlık açısından kestirim değerleri receiver operating characteristic (ROC) curve analizi kullanılarak belirlendi.

Bulgular: Çalışmaya toplam 200 hasta dahil edildi. Hastaların yaş ortalaması 43,7 ± 14,6 yıl idi. Hastaların ortalama taş skorları sırası ile şöyle idi: Guy's skoru: 2,11 ± 1,01, S,T,O,N,E skoru: 7,54 ± 1,73, CROES nomogramı: 194 ± 62,7, Taşsızlık oranı %66 olarak belirlendi. Taşsızlık sağlanamayan hastalarda taşsızlık sağlananlara göre Guy's skoru ve S.T.O.N.E skorunun anlamlı yüksek, CROES nomogramının ise anlamlı düşük olduğu belirlendi (sırasıyla p<0,001, p<0,001 ve p<0.001). Kestirim değeri ve eğri altındaki alan (AUC) sırasıyla Guy's skoru için 2,5 ve 0,770, S.T.O.N.E skoru için 7,5 ve 0,722 ve CROES nomogramı için 185 ve 0,843 idi.

Sonuç: PNL'de taşsızlığı öngörmede Guy's skoru, S.T.O.N.E skoru ile CROES nomogramı etkili modellerdir.

Anahtar Kelimeler: CROES nomogramı, Guy's skoru, perkütan nefrolitotomi, S.T.O.N.E skoru, taşsızlık

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ABSTRACT

Objective: In this study, we aimed to determine the effectiveness of Guy's score, S.T.O.N.E score, and CROES nomogram, the most widely used models in percutaneous nephrolithotomy (PNL) for predicting stone-free status, and to determine which model predicts stone-free status more successfully.

Materials and Methods: The data of patients older than 18 years of age who underwent PNL for kidney stones at our tertiary academic center between 2009 and 2018 were retrospectively analyzed. Examined parameters included the demographic data of patients, stone characteristics, Guy's score, S.T.O.N.E. score, CROES nomogram, surgical duration, transfusion rate, length of stay, and stone-free status. Prediction values for stone-free status were determined using receiver operating characteristic (ROC) curve analysis.

Results: A total of 200 patients were included in the study. The mean age of the patients was 43.7 ± 14.6 years. The mean stone scores of the patients were as follows: Guy's score: 2.11 ± 1.01; S.T.O.N.E. score: 7.54 ± 1.73; and CROES nomogram: 194 ± 62.7. The stone-free rate was determined to be 66%. The Guy's and S.T.O.N.E. scores were significantly higher, and the CROES nomogram was significantly lower in non-stone-free patients compared to stone-free patients ($p<0.001$, $p<0.001$, and $p<0.001$, respectively). The cut-off value and area under curve (AUC) were 2.5 and 0.770 for Guy's score, 7.5 and 0.722 for S.T.O.N.E score, and 185 and 0.843 for CROES nomogram, respectively.

Conclusion: Guy's score, S.T.O.N.E score, and CROES nomogram are effective models in predicting stone-free status in PNL.

Keywords: CROES nomogram, Guy's score, percutaneous nephrolithotomy, S.T.O.N.E score, stone-free

INTRODUCTION

The European Association of Urology recommends percutaneous nephrolithotomy (PNL) as the first choice of treatment for kidney stones larger than 2 cm (1). Developments in surgical technique and endoscopic equipment have resulted in an increase in stone-free status and a decrease in morbidity over the years (2). However, stone-free and complication rates vary between studies (3). Patient-centered treatment planning and the prominence of quality of life in patient management led to the development of various scoring systems and nomograms to predict treatment success prior to PNL. The most well-known ones are Guy's stone score (4), S.T.O.N.E. nephrolithometry (5), and the Clinical Research Office of the Endourological Society (CROES) nomogram (6).

Guy's score divides patients into four classes (Grade 1-4) based on stone complexity and pelvicalyceal anatomy (4). The S.T.O.N.E. score is based on these 5 variables: Stone size, tract length, obstruction, number of involved calices, and essence (stone density). Scoring based on these variables determines categorization into three risk groups (least complex ≤5 points, moderate 6-8 points, and most complex ≥8) (5). The CROES nomogram calculates a score ranging from 0 to 350 based on the variables of stone burden, stone location, prior treatments, presence of staghorn, number of stones (single/multiple), and number of cases per year (6). Higher Guy's score and S.T.O.N.E. score indicate an increase in complexity and a decrease in the stone-free rate, whereas, on the CROES nomogram, high scores indicate a decrease in complexity and an increase in the stone-free rate (4–6).

Although the effectiveness of these three models in predicting stone-free status has been shown in studies, their superiority to each other is not known, and there is no gold standard model that predicts stone-free status (7). In this study, we aimed to determine the effectiveness of Guy's score, S.T.O.N.E score, and CROES nomogram and to determine which model predicts stone-free status more successfully.

MATERIAL AND METHODS

After approval by our hospital's local ethics committee (2019/407) and obtaining patient informed consent forms, the data of patients who underwent PNL for kidney stones in our tertiary academic center between 2009 and 2018 were retrospectively analyzed. All female and male patients older than 18 years of

age were included in the study. Patients who received anticoagulant or antithrombotic therapy, underwent bilateral PNL, had a nephrostomy tube prior to surgery, and had missing data were excluded from the study. Our study was conducted in accordance with the ethical standards specified in the 1964 Declaration of Helsinki and later amendments.

All patients underwent non-contrast computed tomography (NCCT) and intravenous pyelography as part of their treatment plan. All patients had a preoperative sterile urine culture, and intravenous cefuroxime axetil prophylaxis was started one hour before the operation and continued for three days. Sterile urine cultures were obtained by giving appropriate antibiotic treatment to patients with growth in urine cultures.

The parameters examined included patient demographics, American Society of Anesthesiologists (ASA) score, stone characteristics (stone burden, stone density), Guy's score, S.T.O.N.E. score, CROES nomogram, surgical duration, transfusion rate, length of stay, and stone-free status. The stone burden was calculated with NCCT using the $length_{max}$*$width_{max}$*3.14*0.25 formula (8). In the presence of multiple stones, the total stone burden was calculated by separately calculating the stone burden of each stone and adding them together. Stone density (HU) was calculated with the region of interest encompassing the entire stone surface in axial NCCT images displaying the largest stone diameter. Partial staghorn was defined as the extension of the renal pelvis stone to at least two calyces, and staghorn was defined as the extension to all calyces. The surgical duration was calculated as the duration between the initial puncture and the insertion of a 14-F nephrostomy tube.

Surgical Technique

Under general anesthesia, a 4-6 F ureteral catheter was inserted into the ipsilateral kidney through a 22 F cystoscope (Karl Storz, Tuttlingen, Germany) in the lithotomy position. A 16-F Foley catheter was inserted. The ureteral catheter was fixed to the Foley catheter, and the patient was placed in the prone position. After cleaning the surgical area with an antiseptic solution, a sterile surgical drape set was used to cover the patient, along with a camera and C-arm fluoroscopy. Retrograde pyelography was used to determine the appropriate calyx, and monoplanar access was achieved using an 18-G percutaneous trocar needle. After inserting the 0.035-inch polytetrafluoroethylene-coated sensor guidewire (Boston Scientific, Massachusetts, USA) into the pelvicalyceal system, the tract was dilated, and a 30-F amplatz sheath (Boston Scientific, Massachusetts, USA) was placed. The pelvicalyceal system was accessed with a 26-F rigid nephroscope (Karl Storz, Tuttlingen, Germany) and the stones were fragmented with a pneumatic lithotripter (Vibrolith, Elmed, Ankara, Turkey). Following the removal of the fragments, the presence of residual fragments was determined using fluoroscopy, endoscopy, and an antegrade nephrostogram. A 16-F flexible nephroscope (Karl Storz, Tuttlingen, Germany) was used in cases where it was necessary. A 14-F nephrostomy tube was inserted in all patients. When necessary, an antegrade DJ stent was placed at the surgeon's discretion.

The nephrostomy tube was clamped and removed once the patient was pain-free and had produced urine of a clear color. In the first month postoperatively, stone-free status was determined using plain radiography and/or urinary system ultrasonography in cases of opaque stones and urinary system ultrasonography in cases of non-opaque stones. NCCT was used if stone-free status could not be determined with plain radiography/urinary system ultrasonography. The absence of stones or the presence of asymptomatic, non-obstructive, and non-infectious, clinically insignificant residual fragments smaller than 4 mm were considered stone-free.

Statistical Analysis

Categorical variables were presented as numbers and percentages, and continuous variables as mean and standard deviation. The normal distribution of continuous variables was assessed with the Shapiro-Wilk test. Student's t-test was used to compare the means of two normally distributed independent groups, while the Mann-Whitney U test was used to compare the means of two non-normally distributed independent

groups. The percentage of categorical variables was compared with the Pearson Chi-Square. Prediction values for stone-free status were determined using receiver operating characteristic (ROC) curve analysis. When $P < 0.05$ was detected, it was deemed statistically significant.

RESULTS

A total of 200 patients were included in the study. While the mean age of the patients was 43.7 ± 14.6 years, 130 of the patients were male and 70 were female. The mean stone burden was 552 ± 461 mm^2. The mean stone density was 983 ± 327 HU. The mean surgical duration was 82.2 ± 12.3 minutes. The mean stone scores were as follows: Guy's score: 2.11 ± 1.01; S.T.O.N.E. score: 7.54 ± 1.73; and CROES nomogram: 194 ± 62.7. The mean length of stay was 3.65 ± 1.63 days. The stone-free rate was determined to be 66%. The data and clinical characteristics of the patients are shown in Table 1.

There was no significant difference between stone-free and non-stone-free patients in parameters such as age, body mass index (BMI), gender, ASA score, or laterality. Stone burden, transfusion rate, and length of stay were found to be significantly higher in patients who were non-stone-free than those who were stone-free ($p<0.001$, $p<0.043$, and $p<0.001$, respectively). It was determined that Guy's score and S.T.O.N.E. score were significantly higher and the CROES nomogram was significantly lower in patients who were non-stone-free compared to those who were stone-free ($p<0.001$, $p<0.001$, and $p<0.001$, respectively). The comparison of stone-free and non-stone-free patients is presented in Table 2.

The ROC curve was used to determine cut-off values and area under curve (AUC) analysis for each variable. The cut-off value and AUC were 2.5 and 0.770 for Guy's score, 7.5 and 0.722 for S.T.O.N.E score, and 185 and 0.843 for CROES nomogram, respectively (Figure 1).

Table 1. Demographic data and clinical characteristics

Number of patients	200
Mean age ± SD, year	43.7 ± 14.6
Mean BMI ± SD, kg/m^2	23.5 ± 2.41
Gender, n(%)	
Male	130 (65.0)
Female	70 (35.0)
ASA, n(%)	
ASA 1	71 (35.5)
ASA 2	115 (57.5)
ASA 3	14 (7.0)
Laterality, n(%)	
Right	84 (42.0)
Left	116 (58.0)
Mean stone burden ± SD, (mm^2)	552 ± 461
Mean stone density ± SD, (HU)	983 ± 327
Mean Guy's score ± SD	2.11 ± 1.01
Mean S.T.O.N.E score ± SD	7.54 ± 1.73
Mean CROES nomogram ± SD	194 ± 62.7
Mean surgical duration ± SD, min	82.2 ± 12.3
Transfusion rate, n (%)	18 (9.0)
Mean LOS ± SD, day	3.65 ± 1.63
SFR, n(%)	132 (66.0)

SD:standart deviation; BMI:body mass index; ASA:American Society of Anaesthesiology; HU:hounsfield unit; LOS:length of stay; SFR:stone-free rate

Table 2. Comparison of patients' characteristic according to stone-free status

Variables	Stone-free	Non-stone free	P value
Number of patients	132	68	
Mean age ± SD, year	43.4 ± 15.2	44.4 ± 13.6	0.656*
Mean BMI ± SD, kg/m^2	23.5 ± 2.44	23.6 ± 2.37	0.790*
Gender, n(%) Male Female	 82 (62.1) 50 (37.9)	 48 (70.6) 20 (29.4)	0.234#
ASA, n(%) ASA 1 ASA 2 ASA 3	 49 (37.1) 71 (53.8) 12 (9.1)	 22 (32.4) 44 (64.7) 2 (2.9)	0.162#
Laterality, n(%) Right Left	 56 (42.4) 76 (57.6)	 28 (41.2) 40 (58.8)	0.866#
Mean stone burden ± SD, (mm^2)	426 ± 268	799 ± 632	<0.001**
Mean stone density ± SD, (HU)	968 ± 340	1012 ± 302	0.368*
Mean Guy's score ± SD	1.78 ± 0.92	2.73 ± 0.89	<0.001*
Mean S.T.O.N.E score ± SD	7.13 ± 1.65	8.33 ± 1.60	<0.001*
Mean CROES nomogram ± SD	218 ± 54.1	147 ± 50.9	<0.001*
Mean surgical duration ± SD, min	81.2 ± 11.5	84.1 ± 13.6	0.116*
Transfusion rate, n (%)	8 (6.1)	10 (14.7)	0.043#
Mean LOS ± SD, day	3.39 ± 1.46	4.16 ± 1.84	0.004**

SD:standart deviation; BMI:body mass index; ASA:American Society of Anaesthesiology; HU:hounsfield unit; LOS:length of stay; * Independent Sample t test; **Mann-Whitney U test; #Pearson Chi-Square

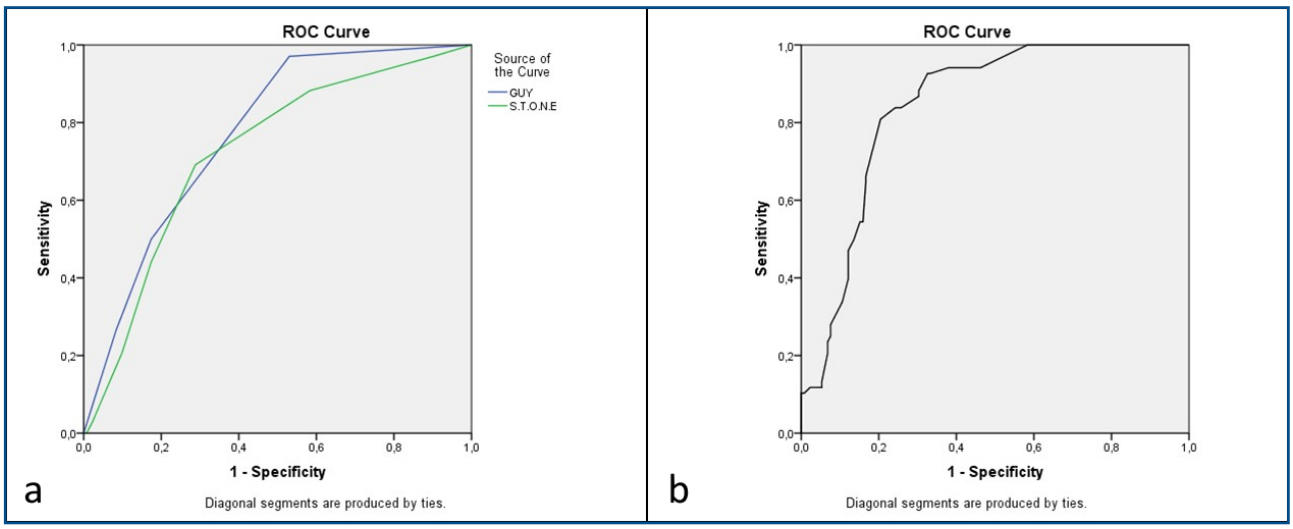

Figure 1. ROC curve for Guy's score, S.T.O.N.E score and CROES nomogram in predicting stone-free status. AUC, area under the curve (a) AUC value: 770 for Guy's score; 722 for S.T.O.N.E score, Cut-off value: 2.5 for Guy's score, 7.5 for S.T.O.N.E score (b) AUC value: 843, Cut-off value: 185 for CROES nomogram

DISCUSSION

The models utilized in PNL make significant contributions such as predicting surgical success and the risk of complications, planning surgical strategies, providing better counseling to the patient, and comparing the results of different institutions (9). They can also help determine which patients should be referred to specialized centers and help plan training (4). In our study, we aimed to determine the effectiveness of the most widely used models in predicting stone-free status and which model predicts stone-free status more accurately. As a result of the ROC analysis, we determined that all three models were effective in predicting stone-free status.

In a study by Thomas et al., who first defined Guy's score, it was determined that Guy's score was the only independent factor predicting the stone-free ratio (P = 0.010) (4). In a high-volume study conducted with 1000 patients who underwent PNL, De Souza Melo et al. reported that the success rate of PNL was 87.9% in patients with a Guy's score of 1, while it was 24.3% in patients with a Guy's score of 4 (2). Ingimarsson et al. determined that the inter-rater concordance of Guy's score was good (κ = 0.72) and 78% of the cases were categorized the same by both raters (10). Vicentini et al. determined that Guy's score (27.5 seconds) implementation time was significantly shorter than the S.T.O.N.E score (300.6 seconds) and the CROES nomogram (213.4 seconds) implementation times (11). In accordance with the literature, we determined in our study that Guy's score was significantly higher in non-stone-free patients compared to stone-free patients. In addition, we believe that Guy's score is superior to others since it is the most studied model and is simple to implement in clinical practice.

In the study of Okhunov et al., who first defined the S.T.O.N.E score, they found that the S.T.O.N.E score was significantly higher in non-stone-free patients compared to stone-free patients (9.7 vs 6.8, p=0.002, respectively) (5). In a study conducted by Farhan et al. with 107 patients who underwent PNL, it was determined that the S.T.O.N.E score was significantly higher in non-stone-free patients compared to stone-free patients (8.14 vs 7.24, respectively, p=0.02) (12). In a study by Akhevien et al. conducted with 122 patients who underwent PNL, it was reported that patients with lower S.T.O.N.E scores had significantly higher treatment success (p = 0.002) (13). In a prospective study performed by Danis et al. in 120 patients who underwent PNL, it was determined that S.T.O.N.E score was significant in predicting stone-free status and that S.T.O.N.E score was correlated with surgical duration, estimated blood loss, fluoroscopy time, hospital stay, and number of punctures (14). In our study, we determined that the S.T.O.N.E. score was significantly higher in patients who were non-stone-free than those who were stone-free, in line with the literature.

In the study by Smith et al., who first described the CROES nomogram, the CROES nomogram was created with six variables predicting stone-free status, and stone burden was found to be the best predictor (6). In a study conducted by Sfoungaristos et al. involving 176 patients who underwent PNL, it was determined that the CROES nomogram was an independent predictor of PNL success (15). In accordance with the literature, we determined in our study that the stone burden was significantly higher in non-stone-free patients than in those who were stone-free, and the CROES nomogram was significantly lower.

There are also studies evaluating the three models. In a prospective study involving 48 patients who underwent PNL, Singla et al. determined that all three models were equally effective at predicting stone-free status (16). In a study by Labadie et al. conducted with 246 patients who underwent PNL, it was determined that all three models were significantly associated with stone-free status (17). In a study by Ozgor et al. that compared the three models in obese patients, it was found that Guy's score and the CROES nomogram were independent factors in predicting PNL success, and the S.T.O.N.E. score was not correlated with PNL success (18). In our study, we determined that all three models were effective in predicting stone-free status in accordance with the literature.

Our study has limitations. Firstly, it was designed as a retrospective study. This may have caused selection bias. Secondly, the effectiveness of existing models in predicting intraoperative and postoperative complications were not evaluated. Thirdly, the scoring of the models was conducted by a single surgeon,

and inter-rater concordance was not assessed. The strength of our study is that it is a high-volume study evaluating the effectiveness of the 3 most used models.

CONCLUSION

Guy's score, S.T.O.N.E. score and the CROES nomogram are effective in predicting stone-free status in PNL. To determine which model is more useful and effective, large-volume prospective studies comparing these models in terms of stone-free status and complications are needed.

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Ethics Committe: Bakirkoy Dr. Sadi Konuk Education and Research Hospital Clinical Trials Ethics Committee Date Protocol: 02.09.2019/2019-17-22.

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Original Article
Özgün Araştırma

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Is There A Genetic Predisposition for Transitional Cell Carcinoma of the Bladder at a Young Age?

Genç Yaşta Görülen Transizyonel Hücreli Mesane Karsinomunda Genetik Yatkınlık Var Mıdır?

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ÖZET

Amaç: Bu çalışmada genç yaşta görülen mesane transizyonel hücreli karsinomlu (TCC) hastalarda genetik yatkınlığın olup olmadığı belirlenmeye çalışıldı.

Gereç ve Yöntemler: Ocak 2010-Ocak 2021 tarihleri arasında transüretral mesane tümörü rezeksiyonu (TUR-MT) yapılan total 652 hastanın verileri incelendi. Verilerine ulaşılabilen 40 yaş altında, sigara kullanmayan ve üriner sistem TCC açısından mesleki predispozan faktörü olmayan 7 hasta çalışmaya dahil edildi. Hastaların yaşı, vücut kitle indeksi (VKİ), cinsiyeti, meslekleri ve beş yıllık takipleri geriye dönük kayıt edildi. Hastaların kan örneklerinden toplam 403 kanserle ilgili gen çalışıldı. Genetik mutasyonları belirlemek için Clinical Exom Sequencing testi kullanıldı.

Bulgular: Hastaların 6'sı erkek 1'i kadındı. Ortalama yaş ve VKİ sırasıyla 31,42 ± 2,12 (22-39) yıl ve 21,72 ± 33,14 (22-27,7) kg/m2 idi. Hastaların hiçbirinin birinci derece akrabalarında üriner sistem TCC özgeçmişi yoktu. Tüm hastaların içinde sadece 1 hastada kesme noktası küme bölgesi geninde ekson 1-17 delesyonu vardı.

Sonuç: Genç yaşta görülen mesane TCC'de genetik predispozan faktörler henüz net ortaya konulamamıştır. Çalışmamız sınırlı sayıda hastayı içermekle birlikte, sonuçlarımıza göre mesane kanseri aile hikayesi olmayan genç yaşta görülen mesane TCC'li hastalarda genetik predispozan saptanmamıştır. Net ilişkinin değerlendirilebilmesi için daha büyük hasta sayılı prospektif randomize kontrollü çalışmalara ihtiyaç vardır.

Anahtar Kelimeler: Mesane Kanseri, gen değişimleri, transizyonel hücreli karsinom, genç hasta.

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Approval was received for this study from the University of Health Sciences, Antalya Training and Research Hospital (Approval no: 19/18, 10/12/2020). The ethical rules of the Declaration of Helsinki were followed in the study protocol.

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ABSTRACT

Objective: The aim of this study is to determine whether there is a genetic predisposition in young patients with transitional cell carcinoma (TCC) of the bladder.

Material And Methods: Data were collected from a total of 652 patients who underwent transurethral resection of bladder tumor (TUR-BT) between January 2010 and January 2021. Seven patients under the age of 40, non-smokers, and without occupational predisposing factors to urinary tract TCC were included in the study. Age, body mass index (BMI), sex, occupation, and five-year follow-up were collected retrospectively. A total of 403 cancer-related genes were analyzed from the patients' blood samples. The Clinical Exome Sequencing test was used to identify genetic mutations.

Results: Six of the patients were male and one patient was female. The mean age and BMI were 31.42 ± 2.12 (22-39) years and 21.72 ± 33.14 (22-27.7) kg/m2, respectively. None of the patients had a first-degree relative with urinary tract TCC. Of all the patients, only one patient had a deletion of exons 1 to 17 in the breakpoint cluster region gene.

Conclusion: Genetic predisposing factors in young bladder TCC have not been clearly identified. Although our study included a limited number of patients, our results showed no genetic predisposition in young patients with bladder TCC without family history of bladder cancer. To evaluate the exact relationship, prospective randomised controlled trials with larger numbers of patients are needed.

Keywords: Bladder cancer, gene alterations, transitional cell carcinoma, young patient.

INTRODUCTION

Bladder cancer (BCa) is a common malignancy and is four times more common in men than in women. Mortality in men is also four times higher than in women (1). BCa is predominantly a disease of older adults, and in the United States, 90% of diagnoses are made in people over 55 years of age and 80% in people over 65 years of age. The average age at diagnosis of BCa in the US is 73 years (2). Transitional (urothelial) cell carcinoma (TCC) accounts for 90% of BCa cases worldwide and is particularly common in developed countries. Tobacco smoking is by far the largest risk factor for BCa, accounting for approximately 50-65% of new cases each year (3). The second largest preventable risk factor for BCa is occupational exposure to chemicals (4). A linear relationship has been shown between BMI and the risk of developing BCa. A meta-analysis study showed that pre-obesity and obesity increased the risk of BCa by 7% and 10%, respectively (4).

A large number of genetic loci have been found to be moderately associated with an increased susceptibility to BCa by means of genome-wide association studies (5). Several oncogenes and tumour-suppressing genes have been studied in BCa. There are ongoing clinical trials targeting the HER2/neu and EGFR pathways. The UroVysion BCa test is based on FISH for the detection of genetic alterations in this disease. Studies are underway to answer questions about the genetic aetiology of BCa (6).

Bladder TCC is diagnosed between 1.0% and 2.4% in patients <40 years (7). Studies have shown that younger patients with urinary tract TCCs are more likely to have positive outcomes than older patients (8). Although bladder TCC in younger patients lack some of the genetic alterations often observed in older patients, genetic factors are likely to play an important role in the early onset of TCCs in younger patients (9, 10).

Main Points:

- There is a lack of research regarding hereditary transition of transitional cell carcinoma of the bladder in the literature
- A total of seven patients were analyzed. Only one male patient has exon 1-17 deletion of the breakpoint cluster region (BCR) gene.
- Our finding support there is no hereditary transition of transitional cell carcinoma of the bladder.

This study aimed to show the effect of genetic factors in young patients diagnosed with bladder TCC.

MATERIAL AND METHODS

After approval of the local institutional review board (Antalya Education and Research Hospital Human Ethics Committee, no: 19/18, date: 10/12/2020), Patients under 40 years of age who underwent transurethral resection of bladder tumours (TUR-BT) at the Urology Department of Antalya Training and Research Hospital between January 2010 and January 2021 and were diagnosed with TCC were studied. Patients with risk factors such as family history, smoking, occupational exposure (poly-aromatic hydrocarbons), obesity, chronic bladder infection (except chronic human papillomavirus infection) and sedentary lifestyle (lifestyle with no or irregular physical activity) were excluded. Only patients who were followed up for five years were analyzed.

We used 1973 WHO pathology staging and 2004 WHO grading system to BCa classification of the patients (11).

Genetical Analysis

Blood samples were collected from all patients and sent to the laboratory for analysis. Laboratory analyzes include amplification of disease-associated gene region(s) by polymerase chain reaction (PCR) and sequencing of this region using next-generation sequencing technology. For this purpose, Clinical Exome Solution kit (Sophia Genetics) was used. The sequencing reaction was performed using the Illumina NextSeq® system and compatible reagent kits. Raw data were analyzed via the Sophia DDM® data analysis platform. Sequence alignment and variant calling were performed by Pepper®, a proprietary base algorithm from Sophia Genetics, based on the hg19 human genome reference. Variant annotation was performed with Sophia Genetics› MOKA® software. Moreover, for each variant, data such as the effect of the variant on the protein sequence (missense, stop gain etc), the incidence in various populations (1000G, ESP, ExAC, gnomAD), prediction algorithms (SIFT, PolyPhen) and the destructive effect of the variant were added. A total of 403 cancer related genes were studied for each patients (Table 1).

Table 1. Demographic data of the patients

Patients	Age	BMI	Gender	Co-morbidity
1	36	27.7	♂	No
2	39	26.2	♂	No
3	33	23.7	♂	No
4	29	25.2	♂	No
5	33	22	♂	No
6	22	24.5	♀	No
7	28	22.6	♂	No
	Mean: 31.42	Mean: 21.72		

BMI: Body Mass Index

RESULTS

We found 652 patients who underwent TUR-BT in our database. After exclusions, we found that seven patients were eligible for the study. Six of the patients were male and one was female. Six of the patients were office workers and one was a student.

The mean age was 31.42 ± 2.12 (22-39) years, and the mean BMI was 21.72 ± 33.14 (22-27.7) kg/m^2. Demographic and characteristic features of the patients were recorded. The risk factors of the patients for BCa were determined. Pathological examination of all patients resulted in TCC. Demographic characteristics of the patients are given in Table 1.

All pathological examinations yielded a result that did not require cystectomy. The ratio to all patients was 1.07%. Initial pathological diagnosis and other features are given in Table 2.

Hereditary cancer gene panels were examined in 7 patients included in our study. One male patient has exon 1-17 deletion of the breakpoint cluster region (BCR) gene. Pathological examination of the patient with hereditary transmission resulted in PUNLMP Grade 2. No recurrence was observed in this patient. The detected hereditary parameters are given in Table 3.

Table 2. The first symptom, peroperative and postoperative findings of the patients.

Patients	First Symptom	Tumor Number	Size	Pathological Diagnosis	Relapse
1	Painless hematuria	1	< 3 cm	PUNLMP G2	No
2	Painless hematuria	2	< 3 cm	PUNLMP G2	Chronic cystitis
3	Painless hematuria	1	< 3 cm	PUNLMP G2	No
4	Painless hematuria	1	< 3 cm	PUNLMP G3	No
5	Painless hematuria	3	>3 cm	HG-PUC G2	pTa
6	Painless hematuria	1	< 3 cm	PUNLMP G3	No
7	Painless hematuria	1	< 3 cm	PUNLMP G3	No

G1, grade 1(well differentiated) ; G2 , grade 2: moderately differentiated ; G3, grade 3 (poorly differentiated); HG-PUC, high-grade papillary urothelial carcinoma; PUNLMP, papillary urothelial neoplasm of low malignant potential.

Table 3. Status of hereditary parameters of the patients after genetical analysis.

Patients	1	2	3	4	5	6	7
Gene name	-	-	CASP8	-	-	-	-
Chromosome-position	-	-	2: 202137619	-	-	-	-
Pattern of inheritance	-	-	AR AD SMu	-	-	-	-
hgvs.c hgvs.p	-	-	c.728-2A>G p.(?)	-	-	-	-
RS ID / NM	-	-	rs755309536 NM_001080125.1	-	-	-	-
Variation type	-	-	splice_acceptor_-2 pathogenic heterozygous	-	-	-	-
Clinical manifestation	-	-	Hepatocellular carcinoma, somatic {Lung cancer, protection against} {Breast cancer, protection against} ?Autoimmune lymphoproliferative syndrome, type IIB	-	-	-	-

AD, autosomal dominant; AR,autosomal recessive; NM_001080125.1, the RefSeq number of CASP8 gene; rs, reference SNP; SMu, somatic mutation; SNP, single nucleotide polimorphism

DISCUSSION

Hereditary transmission in young patients with bladder TCC has not been clearly demonstrated in the literature. Although there is no clear oncogenesis of TCC in young patients, many environmental and genetic factors may contribute to the etiology of the disease. Smoking is known to be a major risk factor for BCa in older patients, and the risk increases with the duration of smoking. One study showed that patients younger than 30 years with a history of smoking had an increased risk of invasive BCa (12). Occupational exposure is an another known risk factor for BCa. Although bladder TCCs in younger patients lack some of the genetic alterations often observed in older patients, genetic factors are likely to play an important role in the early onset of bladder TCCs (9, 10). Today, the existence of a genetic predisposition for the emergence of superficial and slowly progressing bladder tumors has been considered. Although BCa is not typically considered to have an inherited pattern, some cancer symptoms highlight the risk of bladder cancer. Riegert-Johnson et al. demonstrated Cowden Syndrome, an inherited defect in the tumor suppressor gene PTEN, which predisposes to a wide variety of neoplasms, including transitional and squamous cell urothelial cancer. In their study, the age of the patients was over 40 years, and no classification was made for etiological risks (13) . In another study, Van der et al. systematically questioned carriers and first-degree relatives of 95 families for the occurrence of carcinoma. The cumulative risk of cancer (CR70) occurring before age 70 years was compared with the CR70 of the general Dutch population. They performed microsatellite instability testing and/or immunohistochemistry (IHC) for mismatch repair proteins on bladder tumor tissue. In addition, they showed that patients with Lynch syndrome carrying the MSH2 mutation are at high risk for urinary tract cancer, including bladder cancer, and therefore they reported that surveillance program should be considered in these cases (14).

In our study, patients younger than 40 years of age had no family history at the time of diagnosis. There was no significant etiological risk of bladder cancer. Only one patient had exon 1-17 deletion of the BCR gene. The patient had a good prognosis, with absence of recurrence at 5-year follow-up. This result was 0.15% of the 652 patients screened**.** There was no study in the literature that included a young patient with hereditary transition. Therefore, we were unable to make any comparisons.

BCa has better prognosis in young patients (12, 15, 16) . Elderly patients had a higher incidence of invasive disease, which was reported by some studies to occur due to mutations in chromosomes 8, 9, 11, and 17, and often presented in elderly patients with a longer time to carcinogenesis (17, 18). Fine et al reported that all of the < 20 years patients with bladder TCCs had no recurrence within a mean follow-up of 4.5 years (19). However, another study reported that there is no difference on prognosis between young and elder patients with superficial bladder TCC. The population of the study has a tendency of developing TCCs, and, in terms of grade and stage, they have been found similar to older patients rather than the younger ones. It has been reported that TCC has an excellent prognosis in younger patients, especially in patients younger than 20 years, but with a decrease in favorable prognosis with increasing age (20).

Carcinogenesis of BCa is a complex interaction between genetic and environmental factors. The urinary bladder is significantly exposed to many mutagenic environmental substances as they are excreted in the urine (21). In our study, all patients had no etiological risk factors, except for dietary factors, analgesic use, and environmental factors. All patients had a lower grade tumor that did not require radical cystectomy. All patients were alive after 5 years of follow-up. This has been interpreted as the presence of mutations with a more aggressive course resulting from long-term exposure to etiological risk factors that are more important than the genetic transmission of bladder cancers.

There are some limitations in our study. First, the number of the patient is the most important limitation of the study. Second, chronic bladder infection of human papilloma virus cases were not excluded. Third, in our study occupational exposure of the patients were questioned but other environmental exposure of chemical materials were not excluded.

CONCLUSION

Although the number of patients in this study is limited, we believe that this study will make a scientific contribution to the literature. Prospective randomized controlled trials with larger numbers of patients are needed to investigate whether genetic factors affect patients who were diagnosed with bladder TCC under aged 40 years old. In addition, unexplained environmental factors may also have an effect on the development of bladder TCC at a young age.

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Original Article
Özgün Araştırma

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Comparison of Extracorporeal Shock Wave Lithotripsy Success Rates Between Ultrasound Targeting and X-ray Targeting

Vücut Dışı Şok Dalgası İle Taş Kırma Başarısında Ultrason Kılavuzluğu ile X Işını Kılavuzluğunun Karşılaştırılması

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ÖZET

Amaç: Bu retrospektif çalışmanın amacı, vücut dışı şok dalgası ile taş kırma (SWL) başarısında ultrason (USG) ile hedefleme ve X ışını ile hedeflemeyi karşılaştırmaktır.

Gereç ve Yöntemler: Ocak 2018 ile Aralık 2020 tarihleri arasında üriner sistem taş hastalığı için SWL uygulanan hastaların dosyaları geriye dönük olarak incelendi. Hastalar, SWL sırasında taş hedefleme için kullanılan görüntüleme yöntemine göre iki gruba ayrıldı: USG grubu ve X ışını grubu. SWL başarısı, taşların tamamen temizlenmesi veya klinik olarak önemsiz, rezidü fragmanların olması (<4 mm) olarak tanımlandı ve başarı oranı iki grup arasında karşılaştırıldı.

Bulgular: Çalışmaya her grupta 100 hasta olmak üzere toplam 200 hasta dahil edildi. İki gruptaki hastaların demografik verileri ve taş özelllikleri benzerdi. SWL'nin başarı oranı USG grubunda %84 iken, X ışını grubunda %72 idi (p=0,041). USG grubunda taşsızlık elde etme ihtimali, X ışını grubuna göre 2,04 (%95 GA: 1,02-4,07) kat fazlaydı.

Sonuç: Bu retrospektif çalışma, USG hedeflemesiyle yapılan SWL'nin, X ışını hedeflemeli SWL'ye kıyasla daha yüksek bir başarı oranına sahip olabileceğini önermektedir. USG kılavuzluğu, SWL sırasında taş hedefleme için iyonize radyasyon kullanmadan güvenli ve etkili bir alternatif sunmaktadır. Bu bulguları doğrulamak ve klinik pratikte USG kılavuzluğunda SWL'nin potansiyel faydalarını araştırmak için daha fazla çalışmaya ihtiyaç vardır.

Anahtar Kelimeler: vücut dışı şok dalga ile taş kırma, ultrason, X ışını, üriner taş hastalığı

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ABSTRACT

Objective: This retrospective study aims to compare the success rates of shock wave lithotripsy (SWL) using ultrasound (US) targeting versus X-ray targeting.

Material and Methods: A retrospective chart review was conducted on patients who underwent SWL for urinary tract stones between January 1, 2018, and December 31, 2020. The patients were divided into two groups based on the imaging modality used for stone targeting during SWL: the US group and the X-ray group. The success rates of SWL, defined as complete stone clearance or clinically insignificant residual fragments (<4mm), were compared between the two groups.

Results: A total of 200 patients were included in the study, with 100 patients in each group. The demographics and stone characteristics of the patients were similar between the two groups. The success rate of SWL in the US group was 84%, compared to 72% in the X-ray group (p=0.041). The odds ratio for success in the US group compared to X-ray group was 2.04 (95% confidence interval: 1.02-4.07)

Conclusion: This retrospective study suggests that SWL with US targeting may have a higher success rate compared to X-ray targeting. US provides a safe and effective alternative for stone targeting during SWL, avoiding the use of ionizing radiation. Further research is warranted to confirm these findings and explore the potential benefits of US guided SWL in clinical practice.

Keywords: extracorporeal shock wave lithotripsy, ultrasound, X-ray, urinary stone.

INTRODUCTION

Urinary tract stones, or urolithiasis, are a prevalent condition worldwide, affecting approximately 10% of the population at some point in their lives (1). The management of urinary stones depends on various factors, including stone size, location, composition, and patient-related factors. Among the treatment options available, extracorporeal Shock Wave Lithotripsy (SWL) has gained significant popularity due to its non-invasiveness and relatively low complication rates (2).

SWL works by delivering focused shock waves to the targeted stone, resulting in its fragmentation. The fragmented stone particles can then pass through the urinary tract and be eliminated naturally. The success of SWL depends on accurate targeting of the stone to maximize fragmentation while minimizing damage to surrounding tissues (3).

Traditionally, fluoroscopy or X-ray has been the standard imaging modality used for stone targeting during SWL. X-ray provides excellent visualization of urinary stones, allowing for precise targeting. However, the use of ionizing radiation raises concerns about potential risks, particularly in younger patients and women of childbearing age (4). Additionally, obese patients or those with a large body habitus may require higher radiation doses to achieve adequate image quality, increasing the risk of radiation-induced damage (5).

To address these concerns, ultrasound (US) has emerged as an alternative imaging modality for stone targeting during SWL. US offers several advantages, including real-time imaging guidance, absence of ionizing radiation, and portability, allowing for bedside procedures. Additionally, US can provide information about stone composition and characteristics, aiding in treatment planning (6).

Several studies have investigated the efficacy of US-guided SWL compared to X-ray- guided SWL. While some studies have demonstrated comparable success rates between the two modalities (7, 8), others have suggested potential benefits of US targeting, including higher stone clearance rates and reduced radiation exposure (9, 10).

The aim of this retrospective study is to compare the success rates of SWL using US targeting versus X-ray targeting in a real-world clinical setting. By assessing the outcomes of SWL with different imaging modalities, we aim to contribute to the existing body of literature and provide valuable insights for clinical decision-making.

MATERIAL AND METHODS

A retrospective chart review was conducted on patients who underwent SWL for urinary tract stones at our institution between January 1, 2018, and December 31, 2020. The study was approved by the Oxford University Hospitals Ethics Committee (approval reference number: 1249/23, decision date: 21.05.2021) and "informed consent" was obtained from all patients. Patients aged 18 years and older that had one kidney stone, no bleeding diathesis, sterile urine culture and no signs of obstruction distal to the stone were included. Those who were pregnant, those who were under the age of 18, those who had bleeding diathesis, and those who had more than one kidney stone or who had ureteral stone were excluded from the study. Those with active urinary tract infection were included after obtaining a sterile urine culture.

Patients were divided into two groups based on the imaging modality used for stone targeting during SWL: the US group and the X-ray group. The choice of imaging modality was determined by the treating urologist's preference and availability.

In the US group, stones were targeted using US guidance. The imaging was performed using a GE LOGIQ S8 US system (GE Healthcare, Chicago, IL) with a 1 MHz probe. The urologist utilized real-time US imaging to visualize the stone and guide the shock wave delivery.

In the X-ray group, stones were targeted using fluoroscopy. The imaging was performed using a GE Optima XR220amx fluoroscopy system (GE Healthcare, Chicago, IL) with a low- dose protocol to minimize radiation exposure. The urologist utilized fluoroscopic guidance to visualize the stone and guide the shock wave delivery.

SWL was performed using a Storz Modulith SLX-F2 lithotripter (STORZ Medical AG, Tägerwilen, Switzerland). The lithotripter utilized electromagnetic shock wave generation with a focal length of 130 mm, a focal width of 20 mm, and a frequency of 60 shocks per minute. The maximum energy level was set at 100% and was gradually increased until the fragmentation of the stone was achieved. SWL was applied in a maximum of 3 sessions with an interval of 1 week.

The primary outcome measure was the success rate of SWL, defined as complete stone clearance or clinically insignificant residual fragments (CIRFs) measuring less than 4mm. Success was assessed one month after the last session using post-procedure imaging, including US or X-ray, as appropriate.

Statistical analysis was performed using the Student's t-test for normally distributed continuous data, Mann-Whitney U test for continuous data that did not show normal distribution, and chi-square test to compare qualitative data. Kolmogorov-Smirnov test was used to determine the normal distribution of continuous data. Odds ratio (OR) with 95% confidence intervals (CI) was calculated to determine the likelihood of success with US targeting compared to X-ray targeting.

RESULTS

A total of 200 patients were included in the study, with 100 patients in each group. The baseline characteristics of the patients are summarized in Table 1. The majority of patients in both groups were male, but there was no statistically significant difference (p=0.374). Age, body mass index, stone size, stone side, stone Hounsfield Unit, and stone location of the patients were similar in both groups.

The success rates of SWL in the US and X-ray groups are presented in Table 2. The success rate of SWL in the US group was 84%, compared to 72% in the X-ray group (p=0.041). The odds ratio for success in the US group compared to X-ray group was 2.04 (95% CI: 1.02-4.07), indicating a higher likelihood of success with US targeting. Overall, the need for further interventions were higher in the X-ray group when compared to US group as 15% and 11% respectively, but this difference was not statistically significant (p=0.4).

Table 1. Baseline Characteristics of the Study Population

Characteristics	US Group (n=100)	XR Group (n=100)	p values
Age, mean ± SEM (years)	52.4 ± 0,8	54.1 ± 0,9	0.168[a]
Gender, n (%) (male)	62 (62%)	68 (68%)	0.374[b]
Body Mass Index, median (interquartile range)	26.0 (23.7-29.0)	26.8 (24.3-29.3)	0.133[c]
Stone Size, median (interquartile range) (mm)	10.0 (8.0-12.00)	10.0 (8.0-12.0)	0.585[c]
Stone Side, n (%) (right)	46 (46%)	52 (52%)	0.396[b]
Hounsfield Unit, median (interquartile range)	847.5 (765.5-961.0)	886.0 (756.7-1013.0)	0.395[c]
Stone Location (n (%))			
Pelvis	54 (54%)	50 (50%)	0.488[b]
Mid or Upper Calyx	38 (38%)	45 (45%)	
Lower Calyx	8 (8%)	5 (5%)	

Abbreviations: SEM, standard error of the mean; US, ultrasound; XR, X-ray.
Interquartile range: 25th to 75th percentile
[a] Student's t-test.
[b] Chi-Square test.
[c] Mann-Whitney U test.

Table 2. Success Rates of SWL in the US and X-ray Groups

Outcome	US Group	XR Group	p values
Stone Clearance, n (%)	84 (84%)	72 (72%)	0.041[a]
Clinically Significant Residual Fragments (>4mm), n (%)	16 (16%)	29 (29%)	0.041[a]
Need for Further Interventions, n (%)	11 (11%)	15 (15%)	0.4[a]

Abbreviations: US, ultrasound; XR, X-ray.
[a]Chi-Square test.

DISCUSSION

The findings of this retrospective study suggest that SWL with US targeting may have a higher success rate compared to SWL with X-ray targeting. There are some studies in the literature comparing targeting with US and X-ray in SWL success. Van Besien et al. designed a prospective randomized study on 114 patients who had renal and upper ureteric calculi. They showed that US-guided SWL was not inferior to fluoroscopy-guided SWL (7). Another prospective randomized study was designed on pediatric patients recommends the use of the ultrasonic focusing modality in SWL with similar success rates instead of the fluoroscopic focusing modality because of avoiding radiation and low complication rate (8). Similarly, some retrospective studies have shown similar success rates, while others report US-guided SWL has a better success rate than fluoroscopy-guided SWL in the treatment of urinary system stones (9-11).

The use of US for stone targeting during SWL offers several advantages, including the avoidance of ionizing radiation and real-time imaging guidance. There is an increased cancer risk with high-dose rates of ionizing radiation compared to low-dose rates especially total doses exceeded 0.5 Gy (12). Patients with urinary system stones are exposed to ionizing radiation in their life-long follow-up and treatment, and thus this risk increases. Fluoroscopy-guided SWL causes more radiation exposure compared to conventional radiography (13). Therefore, the more radiation dose can be reduced, the lower that risk in these patients.

In addition, ionizing radiation poses a risk to the SWL practitioner as well as to the patient. Therefore, it will be safe for urologists and technicians as well.

Real-time imaging by using hit/miss monitoring with US but not with X-ray can provide more accurate focusing on the stone (14). This advantage may contribute to improved accuracy in stone targeting, leading to higher success rates especially in obese patients. In our study, there were obese patients in both groups, but the success rates in these patients were not compared. This issue can be considered as a separate study topic. Another advantage of ultrasound guided SWL is that it is a safe and effective method in the treatment of radiolucent stones (15).

It is important to acknowledge the limitations of this study. First, this is a retrospective study. Second, there could potentially be selection bias. Third, more detailed patient information and SWL-related complication rates are not specified and therefore not compared. Fourth, although HU was similar between the two groups, it was not stated in the study whether there were radiolucent stones in the US group or how many patients had high HU in both groups. This may have disrupted the homogeneity of the groups. Prospective, randomized controlled trials are needed to further validate these findings and establish the superiority of US targeting in SWL.

CONCLUSION

In conclusion, this retrospective study suggests that SWL with US targeting may have a higher success rate compared to SWL with X-ray targeting. The use of US provides a safe and effective alternative to X-ray for stone targeting during SWL. Further research is warranted to confirm these findings and explore the potential benefits of US guided SWL in clinical practice.

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Conflict of Interest: The authors declare no conflict of interest.

Ethical Approval: The study was approved by the Oxford University Hospitals Ethics Committee (approval reference number: 1249/23, decision date: 21.05.2021). The study protocol conformed to the ethical guidelines of the Helsinki Declaration.

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Original Article
Özgün Araştırma

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Comparison of Success and Complication Rates of Percutaneous Nephrolithotomy Operations According to Kidney Stone Localization

Böbrek Taş Lokalizasyonuna Göre Perkütan Nefrolitotomi Operasyonlarının Başarı Ve Komplikasyon Oranlarının Karşılaştırılması

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ÖZET

Amaç: Perkütan nefrolitotomi (PNL), büyük ve kompleks böbrek taşları için birinci basamak cerrahi tedavi yöntemidir, ancak potansiyel morbidite ve ciddi komplikasyonlar gelişebilmektedir. Bu nedenle çalışmamızda geniş örneklem grubunda PNL sonrası taş lokalizasyonuna göre başarı ve komplikasyon oranlarını değerlendirmeyi amaçladık.

Gereç ve Yöntemler: Bu çalışmaya PNL uygulanan toplam 782 hasta retrospektif olarak dahil edilmiştir. Hastalar iki ana gruba ayrıldı; basit taş grubu (üst pol, pelvis, alt pol) ve kompleks taş grubu (parsiyel staghorn, multikalisyel, pelvis+alt pol, komplet staghorn). Tüm olgularda operasyon süresi, floroskopi süresi, hastanede yatış süresi ve nefrostomi kateteri çıkarma zamanı kaydedildi.

Bulgular: Olgularda taşların %67,1'i (n=525) basit taşlarken, %32,9'u (n=257) kompleks taşlardı. Çalışmamızda en sık %34,3 oranıyla alt kaliks taşı gözlendi. Olguların %15,1'inde kan transfüzyonu gerçekleştirildi. Kompleks taşa sahip olgularda ölçülen ortalama akses sayısı, operasyon süresi, floroskopi süresi, nefrostomi alınma zamanı ve hastanede yatış sürelerinin, basit taş gözlenen gruba kıyasla anlamlı şekilde yüksek olduğu belirlenmiştir (Sırasıyla p-değerleri = 0.000, 0.000, 0.009, 0.000 ve 0.000). Total komplikasyon oranı %9,7 (n=36) olarak belirlenirken; en sık komplikasyon (%4,4) ciddi kanama idi. Çalışmamızda total başarı oranı %74,6 (n=583) olarak belirlendi. Kompleks taşa sahip olgularda hesaplanan komplikasyon oranının (%14.4), basit taş gözlenen gruba (%7.4) kıyasla istatistiksel olarak anlamlı olacak şekilde yüksek (p=0.002), taşsızlık oranlarının (sırasıyla; 57.6% ve 82.9%) ise düşük olduğu belirlendi (p=0.000).

Sonuç: Çalışmamızda PNL prosedürünün basit taşa sahip olgularda, kompleks taşlı gruba kıyasla anlamlı şekilde yüksek başarı oranı ve düşük komplikasyon riski sağladığı açıkça gösterilmiştir. PNL, basit taşlı olgularda daha kısa ameliyat süresi ve hastanede yatış ile anlamlı olarak ilişkilendirilmiştir. Ayrıca geniş örneklem grubuna sahip çalışmamızın bulguları, yayınlanmış verilerle karşılaştırıldığında nispeten yüksek taşsızlık oranı ve düşük komplikasyon oranları gözlenmiştir.

Anahtar Kelimeler: Böbrek taşı; Ürolitiyazis; Perkütan nefrolitotomi; Taşsızlık oranı; Komplikasyon.

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Approval was received for this study from the İstinye University Human Research Ethics Committee Institutional Review Board protocol approval number: 23/199, date: 08.08.2023. The ethical rules of the Declaration of Helsinki were followed in the study protocol.

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ABSTRACT

Objective: Percutaneous nephrolithotomy (PNL) is first-line treatment modality for large and complex stones, however it is associated with potential morbidity and severe complications. Therefore, we aimed to evaluate the success and complication rates according to stone localization in large sample group following PNL.

Material and Methods: Total number of 782 patients who underwent PNL, were included in this retrospective multicenter study. Patients were divided into two major groups; simple stones group (upper pole, pelvis, lower pole) and complex stones group (partial staghorn, multi-caliceal, pelvis+lower pole, complete staghorn). Surgery time, fluoroscopy time, complications, hospitalization and nephrostomy catheter removal day were recorded.

Results: In our study, 525 cases (67.1%) had simple stones, 257 (32.9%) complex stones. The most frequent (34.3%) stone localization was lower pole. Overall blood transfusion rate was 15.1%. Significantly increased in mean number of accesses, surgery time, fluoroscopy time, nephrostomy removal time and hospitalization documented in cases with complex stones (p-values = 0.000, 0.000, 0.009, 0.000 and 0.000, respectively). Overall complication rate was 9.7% (n=76) and the most frequent complication (4.4%) was severe hemorrhage. Overall stone-free rates (SFR) are 74.6% (n=583). Furthermore, complication rate (14.4% vs. 7.4%) was statistically higher and SFR (57.6% vs. 82.9%) was lower in cases with complex stones than simple stones (p-values = 0.002 and 0.000, respectively).

Conclusions: Our findings clearly demonstrated that PNL achieved higher success rate and lower complication risk in patients with simple stones than complex stones. PNL is significantly associated with shorter operation duration and hospitalization in simple stones group. Furthermore, PNL provided relatively higher overall SFR and lower complication rates in our large sample group compared to the published data.

Keywords: Kidney stones; Urolithiasis; Percutaneous nephrolithotomy; Stone-free rates;

INTRODUCTION

Urolithiasis is a widespread disease with increasing prevalence, varies from 5 % to 20 % worldwide. The factors contributing to urinary stone formation are multi-factorial involving metabolic, genetic, anatomic, and environmental factors (1,2). Decision of the appropriate treatment strategy for kidney stone is based on stone size, density, localization, type, occlusion characteristics of stone, and kidney anatomy (3).

As kidney stone often recurs after intervention, the main goal of urinary stone treatment is to achieve higher stone-free rates (SFR) and decrease morbidity. Treatment modalities for urolithiazis include extracorporeal shock wave lithotripsy (ESWL), percutaneous nephrolithotomy (PNL, mini PNL), ureteroscopy, retrograde intrarenal surgery (RIRS), open or laparoscopic ureterolithotomy (4). Nowadays PNL is common first-line treatment procedure applied for large (typically > 2 cm) and complex kidney stones, which currently recommended by Urolithiasis Guideline of European Association of Urology (EAU) (5).

Although PNL provides significantly higher SFR with efficient stone extraction in the management of urinary tract stones, it is still associated with higher morbidity and potential severe complications particularly hemorrhage, infection, and death (6). Additionally, hemorrhage represents one of the most frequent and potential complication of difficult management following PNL (7). Therefore, in present study, we aimed to evaluate the success and complication rates according to stone localization in large sample group following percutaneous nephrolithotomy.

MATERIAL AND METHODS

Sample

This study was performed with the Institutional Review Board protocol approval date 08.08.2023 and number 23/199 in İstinye University. Total number of 782 patients (aged between 6-81 years old) who underwent PNL between January 2014 to January 2023, were included in this retrospective multicenter

study. Patients were divided into two major groups; simple stones group (Group 1) included the cases with kidney stone localized in upper pole, pelvis, lower pole and patients with partial staghorn, multi-caliceal, pelvis + lower pole, complete staghorn calculi represent complex stones group (Group 2). Patients with ectopic kidney, horseshoe kidney, pyelonephritis, kidney transplant, chronic renal failure, coagulopathy were excluded from present study.

Patients' demographic characteristics, detailed anamnesis (ESWL history /open nephrolithotomy history /PNL history), presence of comorbidity, physical examination findings, BMI, laboratory findings and PNL side were recorded. All patients were routinely evaluated with abdominal X-ray, computerized tomography (CT), intravenous pyelography or ultrasonography pre- and postoperatively. Urine culture, hemogram, renal function (urea, creatinine, vs) coagulation tests were performed and stone surface area (mm^2) were recorded preoperatively for all patients. The surface area of the stones were calculated with [(height × width × π) / 4] formula. The exact surgery time, fluoroscopy time, hospitalization time and nephrostomy catheter removal day as well as access number were recorded. Hemogram analyzes were performed at post-operative 1^{st} hour and at intervals thereafter, depending on the bleeding status. Hemogram and biochemical analyzes were also performed post-operatively at the 24^{th} hour for all patients.

PNL Technique

PNL was performed under general anesthesia by experienced urologists in the lithotomy position. Subsequently insertion of 5F/6F ureteral catheter, patients turned to the prone position. Immediately after, fluoroscopic-guided percutaneous access performed and dilatation was achieved by amplatz or balloon dilatators. 18-22 French (F) (Wolf®, Richard Wolf, GmbH, Germany) nephroscopes and 24-26 F (Storz®, Karl Storz Endoskope, Tuttlingen, Germany) rigid nephroscopes were used for operations. Flexible cystoscope, holmium laser and basket catheter were not utilized in all operations. Stones were fragmented via pneumatic lithotriptors or ultrasonic + pneumatic lithotriptors. Absence of stones in x-ray/CT imaging or detection of stones < 4 mm 24 hours after surgery was considered stone-free. Additionally, complications were classified according to the Modified Clavien classification in post-operative period. Severe hemorrhage was defined as abundant bleeding during operation, hemoglobin value less than 10 g/dL or reduction 3 units in hemoglobin after the operation.

Statistical Analysis

All the data were analysed with SPSS (Statistical Package for the Social Sciences) software for Windows (v21.0; IBM, Armonk, NY, USA). Individual and aggregate data were summarized using descriptive statistics including mean, standart deviations, medians (min-max), frequency distributions and percentages. Normality of data distribution was verified by Kolmogorov-Smirnov test. Comparison of the variables with normal distribution was made with Student t test. The variables which were not normally distributed, the Mann Whitney and Kruskal Wallis tests were conducted to compare between groups. Evaluation of categorical variables was performed by Chi-Square test. P-values of < 0.05 were considered statistically significant.

RESULTS

The 782 PNL patients included in this study were 319 females (40.8%) and 463 males (59.2%). The mean age was 41.6±15.0 years (Ranged =6-81 years) in our sample group. General clinical characteristics of sample group is presented in Table 1. The PNL side was left kidney in 50.9% (n=398) of the cases, while 49.1% (n=384) were right kidney. It was documented that 67.1% (n=525) of the cases had simple stones, 32.9% (n=257) had complex stones. The most frequent stone localization was lower pole with a rate of 34.3% (n=268); and followed by pelvis (22.1%, n=173), and pelvis + lower pole (12.4%, n=97) respectively. Previous history of ESWL, open nephrolithotomy, PNL is also presented in Table 1. History of open nephrolithotomy rate was

found statistically higher in patients with complex stone than patients with simple stone (11.6% vs. 17.1%) (p=0.034). In addition 460 (58.8%) patients had preoperative hydronephrosis (Table 1).

The mean pre- and post-operative hemoglobin change was 2.06±4.69 mg/dl, and the hematocrit change was 5.4±5.6 %. Overall blood transfusion rate was 15.1% (n=118) during postoperative period. However, preoperative hemoglobin (13.8±1.8 vs. 13.0±1.9 mg/dl) and hematocrit values (40.7±5.7 vs. 38.3±6.5%) of the patients who received blood transfusions were found to be statistically lower than the patients who didn't receive blood transfusions (p-values = 0.000 and 0.000, respectively) (Figure 1).

The median (IQR) stone surface was measured as 592.6 (38-9410) mm^2 in total patients. Mean stone surface area was significantly higher in patients with complex stone compared to the patients with simple stones (p-values: 0.000) (Figure 2) (Table 2).

According to the the perioperative characteristics; of the cases 77.9% (n=609) underwent one access, 16.1% (n=126) two accesses, 5.9% (n=46) 3 accesses and in 1 patient (0.1%) 4 accesses utilized to access. The median (IQR) surgery time was 120.0 (3-300) minutes, fluoroscopy time 4.4 (0-46) minutes, hospitalization time 4.0 (1-34) days, and the nephrostomy catheter removal time was 3.0 (1-18) days in our sample group. In addition, detected significantly increased in mean number of access, surgery time, fluoroscopy time, nephrostomy removal time and hospitalization time documented in cases with complex stones (p-values = 0.000, 0.000, 0.009, 0.000 and 0.000, respectively) (Figure 3) (Table 2).

Overall complication rate was 9.7% (n=76) in our study. Complication and treatment distribution of our cases according to Modified Clavien classification is presented in Table 3. The most frequent complication was severe hemorrhage with a rate of 4.4% (n=35); and followed by simple hemorrhage (1.5%), and persistent urine leakage (1.1%) in present study (Table 3).

Overall SFR is 74.6% (n=583) in present study. Furthermore, complication rate was statistically higher in cases with complex stones (14.4% vs. 7.4%) compared to the group with simple stones (p=0.002). Similarly, SFR was found to be statistically lower in cases with complex stones (57.6% vs. 82.9%) compared to the group with simple stones (p=0.000) (Figure 4) (Table 4).

Table 1. Clinical characteristics of cases.

	Clinical Variables	Groups		PNL Total	p-value
		Simple Stones (n=525, 67.1%)	Complex Stones (n=257, 32.9%)	(n=782)	
Age	Mean±SD	42.1±15.0	40.6±14.9	41.6±15.0	0.112
BMI	Mean±SD	26.2±5.3	26.2±5.6	26.2±5.4	0.906
Gender n (%)	Male Female	316 (60.2) 209 (39.8)	147 (57.2) 110 (42.8)	319 (40.8) 463 (59.2)	0.424
PNL Side n(%)	Right Left	268 (51.0) 257 (49.0)	116 (45.1) 141 (54.9)	398(50.9) 384(49.1)	0.120
ESWLHistory n(%)	No Yes	390 (74.3) 135(25.7)	194 (75.5) 63 (24.5)	584 (74.7) 198 (25.3)	0.717
Open Nephrolithotomy	No Yes	464 (%88.4) 61 (%11.6)	213 (%82.9) 44 (%17.1)	677 (86.6) 105 (13.4)	**0.034***
Percutaneous Nephrolithotomy	No Yes	499 (%95.0) 26 (%5.0)	239 (%93.0) 18 (%7.0)	738 (94.4) 44 (5.6)	0.242
Pre-op hydronephrosis	No Yes	218 (%41.5) 307 (%58.5)	104 (%40.5) 153 (%59.5)	322 (41.2) 460 (58.8)	0.778

* = p<0.05 statistically significant

Table 2. Comparison of perioperative and postoperative variables between the groups.

	n	Access No	Stone surface (mm^2)	Surgery time (min.)	Fluoroscopy time (min.)	Nephrostomy catheter remove (day)	Hospitalization time (days)
		Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)
Simple Stones	525	1.0 (1-3)	500.8 (38-9410)	110.0 (15-300)	4.0 (0-46)	2.0 (1-18)	4.0 (1-34)
Upper pole	84	1.0 (1-3)	557.3 (138-9410)	110.0 (15-300)	3.2 (0.6-26)	2.0 (1-13)	4.0 (2-12)
Pelvis	173	1.0 (1-3)	490.6 (38-6280)	102.5 (25-300)	4.1 (0-31)	3.0 (1-18)	4.0 (2-34)
Lowerpole	268	1.0 (1-3)	500.8 (70-4415)	120.0 (30-240)	4.3 (0.1-46)	2.0 (1-11)	4.0 (1-19)
Complex Stones	257	2.0 (1-4)	769.3 (113-4945)	120.0 (3-300)	5.0 (0.5-45)	3.0 (1-17)	5.0 (2-17)
Partial staghorn	62	1.0 (1-3)	785.0 (235-4945)	120.0 (3-240)	4.4 (0.5-22)	2.0 (1-7)	4.0 (2-11)
Multi-caliceal	52	2.0 (1-3)	765.3 (157-2119)	130.0 (60-240)	6.1 (0.7-45)	3.0 (1-7)	5.0 (2-16)
Pelvis + LowerPole	97	1.0 (1-3)	690.8 (113-4945)	120.0 (15-270)	4.4 (0.7-20)	3.0 (1-17)	5.0 (2-17)
Complete staghorn	46	3.0 (1-4)	588.7 (138-2826)	180.0 (70-300)	6.0 (1-33)	3.5 (1-7)	5.0 (2-12)

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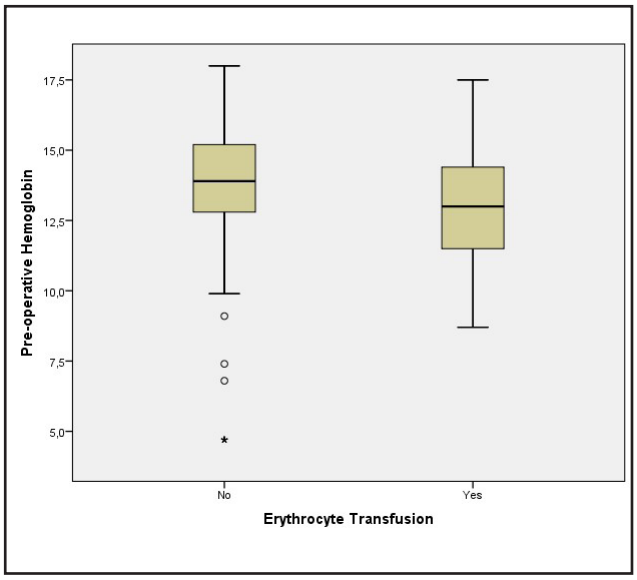

Figure 1. Comparison of pre-operative hemoglobin levels between groups with and without blood transfusion.

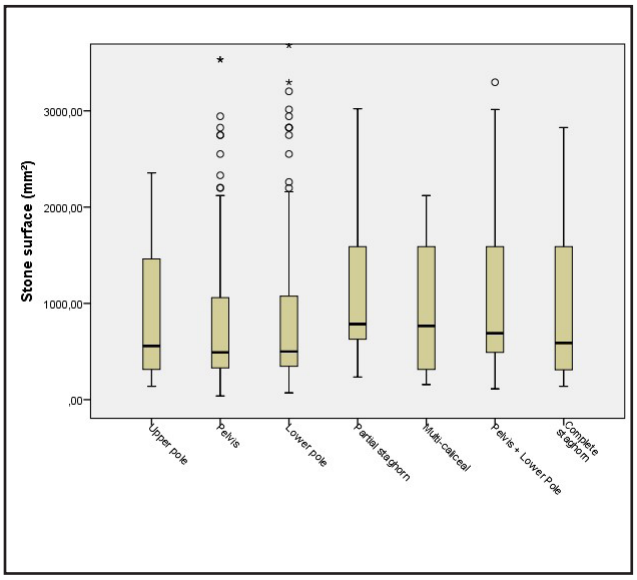

Figure 2. Comparison of mean stone surface between groups.

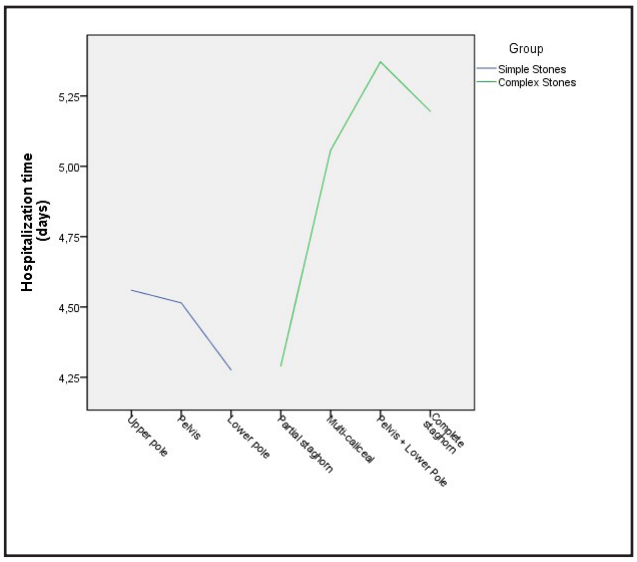

Figure 3. Comparison of mean hospitalization time between groups.

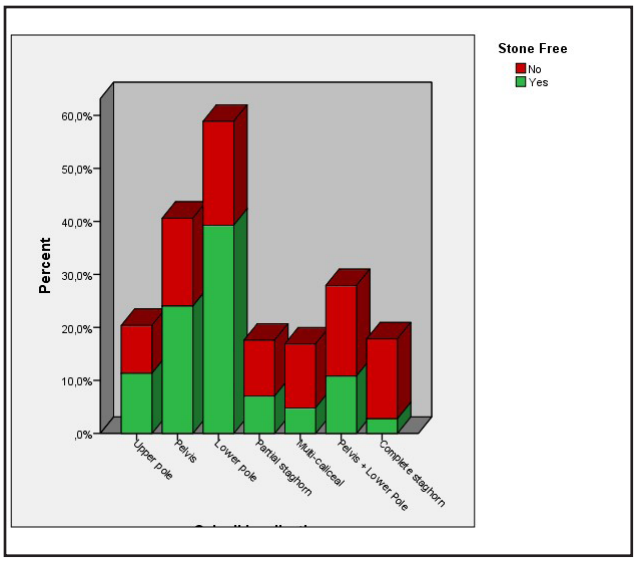

Figure 4. Comparison of stone-free rates between groups.

Table 3. Complications according to Modified Clavien Classification.

	Complication	n (%)	Treatment
Grade 1	Hemorrhage	12 (1.5)	Conservative Treatment
Grade 2	Severe hemorrhage	35 (4.4)	Blood Transfusion
	Pneumonia	3 (0.3)	Antibiotic Treatment
	Cellulite in the Lumbar Region	2 (0.2)	Antibiotic Treatment
Grade 3a	Pelvis Perforation	2 (0.2)	Double-J stent placement > 6 week
	Persistent Urine Leakage	9 (1.1)	Double-J stent placement > 4 week
	Hemothorax	3 (0.3)	Chest Tube Insertion
Grade 3b	Perirenal hematoma	5 (0.6)	Selective Angioembolization
Grade 4a	Life-threatening hemorrhage	1 (0.1)	Nephrectomy
	Colon Perforation	1 (0.1)	Primary repair, Colostomy
	Jejunal Perforation	1 (0.1)	Primary repair
Grade 4b	Urosepsis	4 (0.5)	Antibiotic Treatment

Table 4. Comparison of complication and stone-free rates between the groups.

	Complication (n%)		P-value	Stone Free (n%)		P-value
	No	Yes		No	Yes	
Simple Stones	486(%92.6)	39(%7.4)	**0.002***	90(%17.1)	435(%82.9)	**0.000***
Upperpole	68 (%9.6)	16(%21.1)		18 (%9.0)	66 (%11.3)	
Pelvis	164 (%23.2)	9(%11.8)		33(%16.6)	140(%24.0)	
Lowerpole	254(%36.0)	14(%18.4)		39(%19.6)	229(%39.3)	
Complex Stones	220(%85.6)	37(%14.4)		109(%42.4)	148(%57.6)	
Partial staghorn	57(%8.1)	5 (%6.6)		21(%10.6)	41(%7.0)	
Multi-caliceal	41(%5.8)	11 (%14.5)		24(%12.1)	28(%4.8)	
Pelvis + Lower Pole	89(%12.6)	8 (%10.5)		34(%17.1)	63(%10.8)	
Complete staghorn	33 (%4.7)	13 (%17.1)		30(%15.1)	16 (%2.7)	

*= Results of comparison beetween the simple-complex stones groups.

DISCUSSION

It is well-established that PNL procedure provides relatively higher stone-free rates which ranges over 90%, significant decreases in transfusion rate and lower morbidity. However, serious complications can also develop. The overall rate of complications ranges over 10% following PNL surgery in published data (8). Additionally, hemorrhage remains one of the most common and potential dangerous complication associated with PNL procedure (9). In a study Oner et al. reported an overall complication rate of 24.4% in 1750 PNL patients. Researchers documented hemorrhage requiring blood transfusion as the most frequent complication (12.6%) which classified as Grade 2 according to the Modified Clavien Classification. Furthermore; they reported 3 exitus due to severe urosepsis and 1 exitus due to severe bleeding. It was also noted that complication risk was significantly increased in patients with complex stones, multiple accesses and particularly patients with staghorn stones (p< 0,001) (10). Similarly in a study conducted with 671

patients who underwent PNL, Mousavi-Bahar et al. reported complication prevalence of 30.3%, moreover they documented renal parenchymal injury as the most frequent complication (15.4%), followed by peri-operative bleeding (6.3%). Researchers concluded that experienced hands may reduce complication rate in PNL procedure (11). In a multicenter cross-sectional study de la Rosette et al. reported an overall complication rate of 21.5% in 5,803 PNL patients. Researchers documented that the prevalence of grade I, II, III, IV and V complications based on modified Clavien system was 11.1%, 5.3%, 3.6%, 0.5% and 0.03%, respectively. Researchers also noted the most frequent minor complications as nephrostomy tube leakage, fever and major complications as injury to adjacent organs, bleeding (12). In accordance with these data, overall complication rate was 9.7% and the most frequent complication was severe hemorrhage (Grade 2) with a rate of 4.4% in our study. Furthermore, complication rate was statistically higher (14.4% vs. 7.4%) in cases with complex stones compared to the group with simple stones. On the other hand, overall blood transfusion rate was 15.1% during postoperative period. However, preoperative hemoglobin and hematocrit values of the patients who received blood transfusions were found to be statistically lower than the patients who didn't receive blood transfusions.

The European Association of Urology recommend PNL as gold standart procedure for renal stones>20 mm and lower pole stones>10 mm (5). In a meta-analysis Zhanget al. compared RIRS, PNL, and SWL techniques in 6 randomized and 8 non-randomized studies for treatment of lower pole renal stones. Researchers reported longer surgery time in RIRS and highest SFR in PNL procedure. Moreover, no statistical significant difference was noted according to the complication rates between the groups (13). Supportively in another meta-analysis Chen et al. concluded that PNL is a safe and feasible in treatment of staghorn stones compared to open surgery, furthermore they reported significantly lower complication rate, shorter surgery times, hospitalization times, less blood loss and blood transfusion in PNL group than open surgery (14). Ucer et al. reported significantly lower blood transfusion rates and hospitalization times in RIRS group (n=52) when compared to the PNL group (n=50) in patients with kidney stone 2-4 cm. On the other hand, researchers also highlighted that SFR was significantly higher in PNL group (15). However in a study ElSheemy et al highlighted that SFR is significantly affected by multiple stones or large stone burden during PNL technique (16). In another study consisting of 120 PNL patients, Karalar et al. reported overall prevalence of 74.1% (n=89) SFR. Additionally, researchers significantly associated stone-free status with stone localization, stone type and stone burden (p-values = $p<0.001$, $p<0.001$, and $p<0.01$, respectively) (17). Supportively, in a study conducted with 578 PNL procedure, Bayar et al. reported significantly higher (77% vs. 53%) SFR in cases with simple stones than complex stones ($p=0.005$). Researchers documented a significantly higher complication rate (19.5%) in group with complex staghorn stones ($p=0.006$). Moreover, researchers noted significantly higher mean duration of surgery and the number of access in patients with complex stones (18). Consistently in present study, PNL achieved a 74.6% overall SFR and SFR was found to be statistically lower in cases with complex stones (57.6% vs. 82.9%) than group with simple stones. Furthermore, significantly increased in mean number of accesses, surgery time, fluoroscopy time, nephrostomy removal time and hospitalization time documented in cases with complex stones. Since the patients included in this study were in all age groups and a rigid nephroscope was used, our findings were limited compared to studies that additionally used micro-perc and flexible nephroscope. Different findings may be obtained with selected patients group with similar age range. However we obtained markable and valuable findings particularly with our large sample group.

In conclusion, our findings clearly demonstrated that PNL achieved a higher success rate and lower complication risk in patients with simple stones compared to the group with complex stones. Moreover, PNL is significantly associated with shorter operation duration and hospitalization in cases with simple stones. Furthermore, PNL provided relatively higher overall SFR and lower complication rates in our large sample group compared to the published data.

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Conflict of Interest: Authors declare that they have no conflict of interest.

Informed Consent: Informed consent was obtained from all individual participants included in the study.

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Ethics Committee: İstinye University Human Research Ethics Committee Institutional Review Board protocol approval number: 23/199, date: 08.08.2023.

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Original Article
Özgün Araştırma

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Efficacy of Biphasic Fluid Therapy in Robot-Assisted Kidney Transplantation

Robot Yardımlı Böbrek Naklinde Bifazlı Sıvı Tedavisi'nin Etkinliği

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ÖZET

Amaç: Perioperatif sıvı tedavisi, nakledilen böbreğin işlevini etkileyen faktörlerden biridir. Bu çalışmada, perioperatif hasta stabilizasyonu ve allograft böbrek fonksiyonları üzerine ikili fazlı sıvı tedavisinin etkinliği değerlendirilmiştir.

Gereç ve Yöntemler: 2015-2017 yılları arasında gerçekleştirilen 65 canlı vericili robot yardımlı laparoskopik böbrek nakli operasyonu verileri retrospektif olarak analiz edildi (16/04/2018, Protokol no 2018-07-13). Hastalar nakil öncesi diyaliz tedavisi alan grup (Grup Preemptif: GP, n=27) ve nakil öncesi diyaliz tedavisi almayan grup (Grup Non-Preemptif: GNP, n=38) olarak bölündü. Tüm vakalarda ikili fazlı sıvı tedavisi kullanıldı (faz 1=vasküler anastomoz öncesi 1-3 ml/kg/s ve faz 2=vasküler anastomoz sonrası 10-12 ml/kg/s). Hastaların hemodinamik ve biyokimyasal durumu, erken ve geç allograft böbrek fonksiyonları değerlendirildi. Veriler istatistiksel olarak gruplar içinde ve arasında karşılaştırıldı.

Bulgular: Tüm hastalarda vasküler anastomoz sonrasında hemodinamik/metabolik stabilite ve diürez elde edildi. Gruplar arasında intravenöz (iv) sıvı toplam miktarında (faz 1'de verilen miktar dışında) fark yoktu, ancak GP'de faz 1' de verilen sıvı miktarı anlamlı olarak daha azdı ($p<0,05$). Ameliyat öncesi kan pH ve HCO3 değerleri GP'de düşüktü, Na+ ve Cl- değerleri yüksekti ($p<0,05$). K+ ve Ca+2 değerlerinde her zaman ve her iki grupta ekstübasyon sonrası pH değerlerinde fark bulunmadı. Ameliyat öncesi kan üre ve kreatinin düzeyleri GP'de anlamlı olarak yüksekti ($p<0,05$), ancak tüm değerler ameliyat sonrası 1. ve 7. günlerde normale döndü. Uzun süreli takipte, her iki grupta da benzer mortalite ve reddetme oranları görüldü.

Sonuç: Sonuçlarımız, canlı vericili robot yardımlı laparoskopik böbrek nakli hastalarında ikili fazlı sıvı tedavisinin hemodinamik/metabolik stabilite ve allograft böbrek fonksiyonlarını elde etmede etkili olduğunu desteklemektedir.

Anahtar Kelimeler: Anestezi, sıvı tedavisi, hemodinamik izleme, böbrek nakli, nakil alıcısı, robot yardımlı cerrahi

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Approval was received for this study from the Health Sciences University Istanbul Bakırköy Dr Sadi Konuk Training and Research Hospital ethics committee (16/04/2018, Protocol no 2018-07-13). The ethical rules of the Declaration of Helsinki were followed in the study protocol.

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ABSTRACT

Objective: Perioperative fluid treatment is among the factors affecting transplant kidney function. In this study, the efficacy of biphasic fluid treatment on per-operative patient stabilization and allograft kidney functions were evaluated.

Material and Methods: Data of 65 robotic living releated donor kidney transplantation performed between 2015-2017 were retrospectively analyzed (16/04/2018, Protocol no 2018-07-13). The patients were divided as preemptive (Group Preemptif: GP, n=27) and non-preemptive group (Group Non-Preemptif: GNP, n=38). Biphasic fluid treatment was used in all cases (Phase 1 = before-vascular anastomosis 1-3 ml/kg/h and phase 2 = after-vascular anastomosis 10-12 ml/kg/h, respectively). Hemodynamic and biochemical status of the patients, early and late allograft kidney function were evaluated. Datas were statistically compared within and between the groups.

Results: Hemodynamic/metabolic stability and diuresis were achieved after vascular anastomosis in all patients. There was no difference in the total amount of iv fluid given between the groups, except that the amount of fluid given in phase 1 was significantly less in GP ($p<0.05$). Pre-operative blood pH and HCO3 values were lower, Na+ and Cl- values were higher in GP($p<0.05$). No difference was found in K+ and Ca+2 values at all times and pH values after extubation in both groups. Pre-operative blood urea and creatinine levels were significantly higher in GP ($p<0.05$) but all decreased to normal on postoperative 1 and 7 days. In long-term follow-up, both groups had similar mortality and rejection rates.

Conclusion: Our results support that biphasic fluid treatment is effective to achieve hemodynamic/metabolic stability and allograft kidney functions in robotic living releated kidney transplantation patients.

Keywords: Anesthesia, Fluid therapy, Hemodynamic monitoring, Kidney transplantation, Transplant recipient, Robot-assisted surgery

INTRODUCTION

Kidney transplantation is the most common parenchymal organ transplantation. It is considered the best treatment method for end-stage renal disease patients because it provides usual living standards by improving short- and long-term outcomes (1). Robot-assisted laparoscopic surgery has been used for living donor nephrectomies as an alternative to open and laparoscopic techniques in kidney transplantation surgery, but there is minimal experience in transplant recipient patients (2).

Minimally invasive surgical techniques together with the subtleties in anesthesia management improve graft function and the recipient's health. Overall increased recipient lifelong and quality of life reduce the need for re-transplantation and thus increase the number of organs available for transplantation (3). However, protecting the allograft kidney during robotic kidney transplantation surgery with the additional problems such as intra-abdominal CO_2 insufflation, inability to reach the patient due to positioning and exaggerated deep Trendelenburg position make anesthesia management of these patients more difficult and challenging. Preemptive transplantation, defined as elective transplantation before the need for chronic dialysis, allows the patient to avoid dialysis entirely and has been applied with increasing frequency in recent years. However, preemptive transplantation patients possibly have excess intravascular volume and metabolic problems (such as hyperuricaemia, hyperkalemia and acidosis) which directly affect perioperative anesthesia management. In 2021, the American Society of Anesthesiologists (ASA) transplant anesthesia committee stated that intraoperative fluid management might affect the outcome of renal transplantation and emphasized that an individualized approach may be the best (4).

Besides the advantages and positive contributions of preemptive renal transplantation and robotic surgery on patients' comfort and allograft kidney function, they both make anesthesia management of these patients more complex. In this clinical study we aimed to investigate the efficacy of biphasic fluid management on hemodynamic/metabolic stability of recipients patients and on allograft kidney function

in both preemptive and non-preemptive robotic kidney transplantation patients.

MATERIAL AND METHODS

Obtaining Patient Data:

This study was designed retrospectively after ethics committee approval (16/04/2018, Protocol no 2018-07-13) of Bakırköy Dr Sadi Konuk Training and Research Hospital and was performed in line with the principles of the Declaration of Helsinki. As a result of power analysis, with an effect size of 0.8, a margin of error of 5%, and a power of 95%, the minimum sample size was 70, with 35 for each group. Between 2015 and 2017, 80 patients who underwent robot-assisted laparoscopic living related donor renal transplantation were screened from the hospital database and patient files. We excluded all cadaveric donor kidney transplantations, 9 patients with missing data, 1 who underwent open surgery and 5 who received peritoneal dialysis before transplantation. A phone call survey was done for long term results. The patients or their relatives are contacted by telephone for 5-year postoperative data.

Definitions

Timeframes: "Phase 1" was defined as the time from clamping the kidney in the donor until it was brought to the recipient, which includes both warm and cold ischemia periods. "Phase 2" was defined as the time from bringing the kidney to the recipient until extubation of the patient, that includes warming an reperfusion period and "Total phase" was defined as the time from opening the vascular access to the patient's recovery (Figure 1).

T0: donor kidney pedicle clamping, T1: induction of anesthesia, T2: before vascular anastomosis, T3: after vascular anastomosis and T4: extubation (Figure 1).

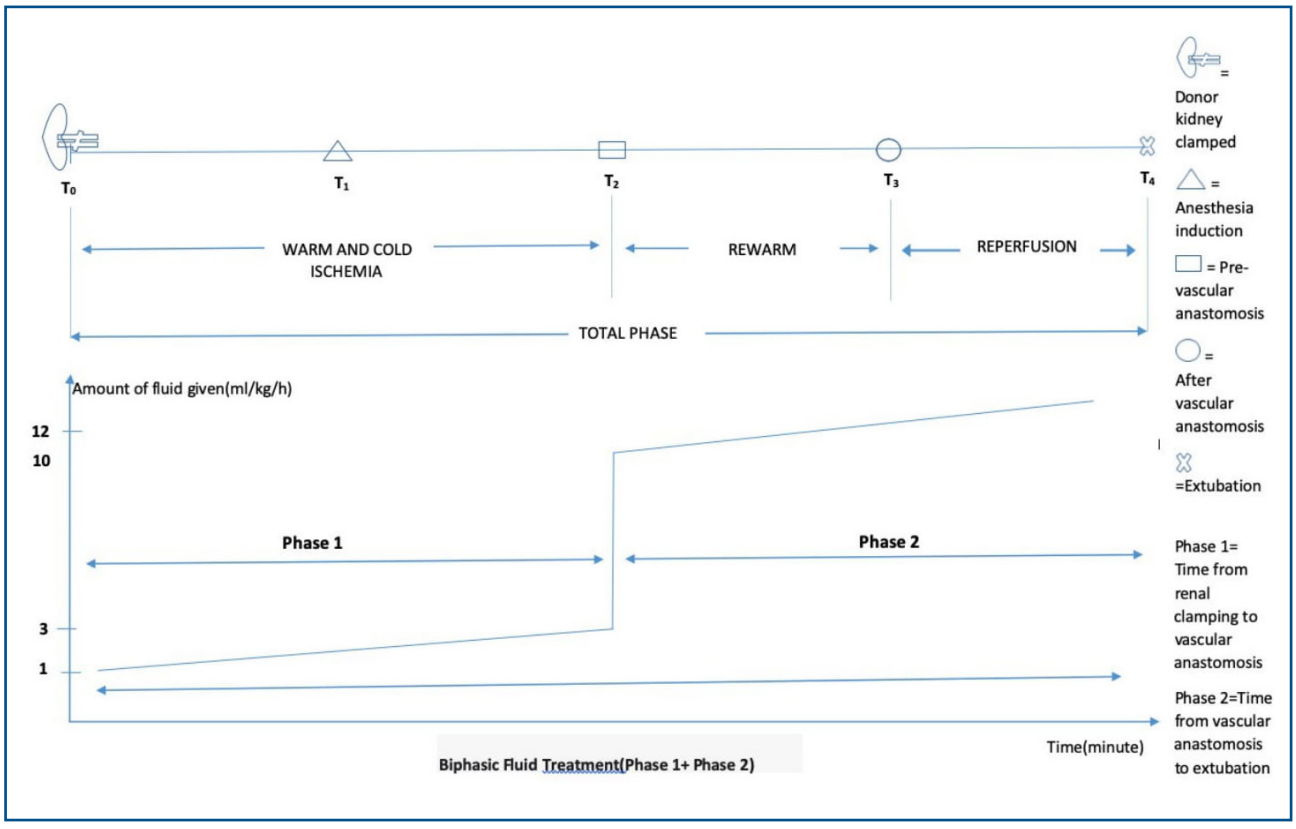

Figure 1. Timeframes

Warm ischemia time refers time period between donor kidney vascular clamping and commencement of cold storage.

Cold ischemia time refers time period between after cold package till the allograft kidney is brough recipient till reperfusion.

Rewarm time is the period from removal of the kidney from cold storage to vascular anastomosis and reperfusion. During this period the kidney is wrapped in ice until completion of the vascular anastomosis to decrease damage.

Patients were divided into two groups: those who had never undergone dialysis were included into the preemptive group (GP) and those who had undergone hemodialysis were included into the non-preemptive group (GNP). Demographic data (age, gender, weight, height), duration of anesthesia and surgery, preoperative and postoperative day 1 and 7 urea and creatinine values, hemodynamic data such as peak heart rate (HR) and mean arterial pressure (MAP) at time points during surgery and blood gases, (pH, Partial carbon dioxide pressure ($PCO_{2)}$, bicarbonate ($HCO_{3)}$, lactate (Lac), sodium (Na^{+}), potassium (K^{+}), chlorine (Cl^{-}), ionized calcium (Ca^{+2})) values, Phase 1 fluid, Phase 2 fluid, total fluid and urine amounts were recorded.

Biphasic fluid therapy: In cases of robotic kidney transplantation, the period from clamping the kidney in the donor until the kidney is brought into the recipient is defined as "Phase 1" and the period from and of phase 1 to extubation is defined as "Phase 2". Intravenous fluid infusion rate was administered at a rate of 1-3 ml/kg/h in Phase 1 and 10-12 ml/kg/h in Phase 2. This application was defined as biphasic fluid therapy (Figure 1).

Anesthesia Management

A standard anesthesia management is applied to all robotic renal transplantation patients. Electrocardiogram (ECG), peripheral oxygen saturation and non-invasive blood pressure monitoring are routinely performed on every patient. We give 1.5 mg midazolam for premedication, 1000 mg paracetamol for preventive analgesia, 100mg tramadol. If there is an arm with arteriovenous fistula for the dialysis, we protect that arm, wrapping it, and placing a fistula sticker on it. The connections of the arterial monitoring should be checked regularly, there is almost no chance of intervention in case of any separation or in case the trace shows incorrectly. Because we believe that these patients will need these vessels in the future life, we do not routinely insert central venous catheter. Because of increased infection risk, we also do not use any catheter that already in use neither for fluid infusion nor invasive monitorization.

Four vascular accesses are established with a 16-gauge peripheral cannula in both arms. Invasive arterial pressure monitoring is performed with radial artery cannulation using Seldinger technique and arterial blood gas samples are taken regularly. During all these processes, we do not start routine fluid infusion and we just we infuse the volume that required for medication of anesthesia management. During induction, midazolam 0.07-0.1 mg/kg, fentanyl 1-2 mcg/kg, propofol 20-30 mg and atracurium 0.6 mg/kg are administered and patients are orotracheally intubated and connected to the anesthesia device. Partial carbon dioxide pressure (pCO_2) is set to 35-45 mmHg, tidal volume 6-8 ml/kg, frequency 13-15/min, positive end-expiratory pressure (PEEP) 5-7 cmH_2O in PRVC mode on the Maquet Flow-I anesthesia device. Sevoflurane (MAC=0.5) and remifentanil (0.05-0.5 mcg/kg/min) maintain anesthesia. We fixed both arms on the sides and support with gel pads to prevent pressure from being of the operation. The material used to fix the arms should not cause any compression at any point. Any compression point can cause serious injury when the patient position is changed upside down. We use bilateral shoulder supports in our clinic to prevent the patient from slipping out of bed. The place where these supports are placed should be medial so that neither the carotids nor the brachial plexus is compressed. The neck should be in a neutral position so that it does not rotate on either side. The eyes and nose should be saved from the robot arms injury. However, the height of the safety guard should be at the nose level and a maximum of 4-5 cm so that it does

not hit the robot arms. After the lithotomy position is given, a 40-45° deep Trendelenburg position is added. The deep trendelenburg position should be reached intermittently, not all at once. During this period, it is important to choose the appropriate drug and dose to keep the patient's hemodynamics stable. To avoid fluid load, we use only 20-30 mg of propofol during induction of anesthesia and we arrange the max value for sevofloran at 0.5.

Isotonic (0.09 NaCl) infusion, 1 mL/kg/h, is used for maintenance fluid therapy. Following induction, 45.5 mg pheniramine maleate is started, followed by 1-1.5 mg/kg rabbit-derived anti-human thymocyte globulin (ATG) infusion in 250 ml 10% dextrose solution (50 – 100 and 150 mL/h) to be finished until the end of vascular anastomosis. We do not use colloids solution in these group of patients. A 500 mg methylprednisolone bolus is administered before circulation starts in the allograft kidney. We aim to keep the peak heart rate above 45 /min and the mean arterial pressure above 65 mmHg. When the heart rate drops below 45/min, 0.5 mg of atropine is administered. When the mean arterial pressure falls below 65 mmHg, a fluid bolus is given. If there is no response to the fluid response, vasopressor and inotrope is administered.

We routinely apply biphasic fluid therapy. We apply limited fluid therapy in the period between the clamping of the donor kidney, which we describe as phase 1, and anastomosis to the recipient kidney. During the period from vascular anastomosis to extubation, that is, in phase 2, we apply liberal fluid therapy to the patient. Thus, we apply fluid therapy to the patient when necessary. We perform routine blood gases monitoring at regular intervals. 1gr paracetamol and 100mg tramadol are administered for postoperative analgesia. Patients are extubated at the end of surgery when adequate respiration and alertness are achieved. Since these patients are immunosuppressed, they are not admitted to the intensive care unit but sent to the transplantation service.

Statistical Method

The data collected in the study was analyzed with GraphPad V5.0 software. The homogeneity of the data of the groups was evaluated by the Shapiro-Wilk test. The Student's t-test was used for homogeneous pairwise group comparisons. The Mann-Whitney U test evaluated nonhomogeneous pairwise comparisons. The frequency and percentage values of categorical variables were compared by the Chi-square test. In statistical representation, mean and standard deviation were used if the data were homogeneous. Median and interquartile range (Q25-75), number and percentage values were used for the non-homogeneous ones. Values with $P < 0.05$ were considered statistically significant. Intragroup comparisons were made with repeated Manova tests. Dunnet's multiple comparison tests detected significant differences between periods (Post hoc analysis). Values with $P < 0.017$ were considered statistically significant.

RESULTS

Total of 65 patients of which 27 GP pts, 38 GNP pts were included the study. There were 11 and 14 female patients and mean ages were 40 and 41 years in GP and GNP respectively. There was no statistically significant difference between the groups in demographic characteristics such as age, height, and gender. Preoperative blood Urea (152mg/dl vs 80 mg/dl) and Cr (7,04 mg/dl vs 5,72 mg/dl) respectively) values and total urine volume during the operation (650ml vs 400ml) were statistically significantly higher and the amount of fluid given in Phase 1 was statistically significantly lower (350ml vs 800ml) in GP compared to GNP ($p < 0.05$, Table 1). There was no statistically significant difference between the duration of anesthesia, duration of surgery, the amount of fluid given during Phase 2 and total fluid amounts of both groups, blood urea and Cr values on postoperative day 1 and 7 ($p>0.05$). Mean, SD, median, interquartile range (Q25-75), number and percentage of patients and p values of all parameters belonging to the groups are shown in Table 1.

Table 1. Age, height, preop Cr, preoperative and postoperative 7th day urea-creatinine Phase1 iv amount of fluid administered, total fluid, total urine amount of the patients in the preemptive group and the nonpreemptive group

Peroperatif	GP (n=27)	GNP (n=38)	U value	P value
Patients Data	**Mean ± SD and median (IQR_{25-75})**	**Mean ± SD and median (IQR_{25-75})**		
Female no (%)	11 (40,74%)	14 (36,84%)		0,9524 £
Age (year)	41(30-55)	40(29-50,5)	485,5	0,7192 *
Height (cm)	168(158-171)	167,5(160-171)	513	0,9947 *
Weight (kg)	68(60-78)	65,5(55,75-75,75)		0,4732 Ψ
Preop Cr	7,040(6,420-7,700)	5,725(4,448-7,085)	320,5	0,0106 *
Preop BUN	152 (137-174)	80(62,5-99,25)	174,5	< 0,0001 *
Anesthesia time, (minute)	313 ±56,59	307,6±47,07		0,6806 Ψ
Surgical time, (minute)	275,9±45,06	269,5±49,00		0,5937 Ψ
Postop day 1 urea	67,47±23,49	61,32±24,02		0,3089 Ψ
Postop day 7 urea	66(46-83)	61(45,50-78,25)	475	0,6175 *
Postop day 1 Cr	2,23(1,76-2,73)	2,49(1,725-3,308)	438	0,3213 *
Postop day 7 Cr	1,22(1,04-1,72)	1,25(0,9475-1,51)	436	0,3084 *
Phase 1 fluid amount (mL)	350 (300-500)	800(687,5-1000)	55,5	< 0.0001*
Phase 2 fluid amount (mL)	2409±764,1	2082±806,3		0,104 Ψ
Total amount of fluid(mL)	4000(3500-5000)	3775(3000-4225)	369	0,0551 *
Perop total amount of urine (mL)	650(400-1000)	400(250-500)	267,5	0,0011 *

Mann Whitney U test:*, Student T test : Ψ, Chi-Square test : £

The mean± SD/median IQR25-75 and p values of all parameters of both groups are shown in Table 2. The pH values of GP patients were found to be statistically significantly lower in the T1, T2 and T3 (7.32 ± 0.07, 7.29 ± 0.09, 7.24 ± 0.08) periods compared to GNP (7.36 ± 0.06, 7.35 ± 0.06, 7.29 ± 0.06) ($p < 0.05$). However, pH values were similar in the T4 period (7,24 ± 0,07 vs 7,27 ± 0,06.). PCO_2 values were statistically significantly higher in GNP compared to GP in the T1 period (P=0.007). In GNP, blood Na and Cl^- values were statistically significantly lower than GP values in all periods (approximately 3.5 meq/dL for Na and 6 meq/dL for Cl^-. GNP HCO_3 values were statistically significantly higher (approximately 3 meq/dL). There was no difference between the K^+ and Ca^{+2} values of both groups in all periods. Although a statistically significant difference was found between the lactate values of the T3 period, it was not considered clinically significant. Both groups had similar lactate values at other time points (Table 2). The mean and standard deviation values of T1 vs T2 and T1 vs T3 for HR in GP patients were calculated as 88 ± 15 vs 66 ± 13 and 88 ± 15 vs 73 ± 8 1/min, respectively and the differences were statistically significant ($p < 0.0001$, Figure 2-A). The T1 vs T4 mean and standard deviation values were 88 ± 15 vs 83 ± 16 1/min and were not statistically significant ($p>0.017$, Figure 2-A). T1 vs T2, T3 and T4 mean and standard deviation values for MAP in GP patients were 122 ± 90 vs 81 ± 17, 94 ± 19 and 101 ± 17 mmHg, respectively and the differences were not statistically significant ($p>0.017$, Figure 2-B). The analysis performed for GNP, T1 vs T2 and T1 vs T3 mean and standard deviation values for HR were calculated as 90 ± 17 vs 76 ± 15 and 90 ± 17 vs 81 ± 12 1/min, respectively and the differences were statistically significant (p values $p < 0.0001$ and 0.0013, respectively,

Figure 2-C). The T1 vs T4 mean and standard deviation values were 90 ± 17 vs 96 ± 16 1/min and were not statistically significant ($p > 0.017$ Figure 2-C). The T1 vs T2 mean and standard deviation values for MAP of GNP patients were calculated as 104 ± 16 vs 84 ± 13 and the difference was statistically significant ($p < 0.0001$, Figure 2-D). T1 vs T3 and T4 mean and standard deviation values were calculated as 104 ± 16 vs 100 ± 19 and 107 ± 15, respectively. However, the differences were insignificant ($p > 0.017$, Figure 2-D).

The differences between T1 vs T2 mean and standard deviation values for pH were not statistically significant in between-group evaluations of GP patients ($p=0.04$, Table 3). The T1 vs T3 and T1 vs T4 pH mean and standard deviation values were statistically significant ($p < 0.0001$, Table 3). Differences between T1 vs T2 mean and standard deviation values for Cl^- were not considered statistically significant. However, the differences between chloride mean and standard deviation values at times T1 vs T3 and T1 vs T4 were statistically significant ($p < 0.0001$, table 3), similar to the periods in pH values. HCO_3 mean values decreased by approximately 1 meq/L in each period (from T1 to T4) after the T1 period. Therefore, the differences between HCO_3, T1, T2, T3 and T4 mean and sd values were considered statistically significant ($p < 0.017$, Table 3). For potassium, only the difference between T1 vs T2 mean and standard deviation values was statistically significant ($p=0.0001$, Table 3). The differences between the value of potassium in T1 and the other periods (T3 and T4) were not statistically significant. No statistically significant difference was found between the periods for sodium and lactate. Although a statistically significant difference was found between all period values for free calcium, it was not considered clinically significant because it was within normal limits.

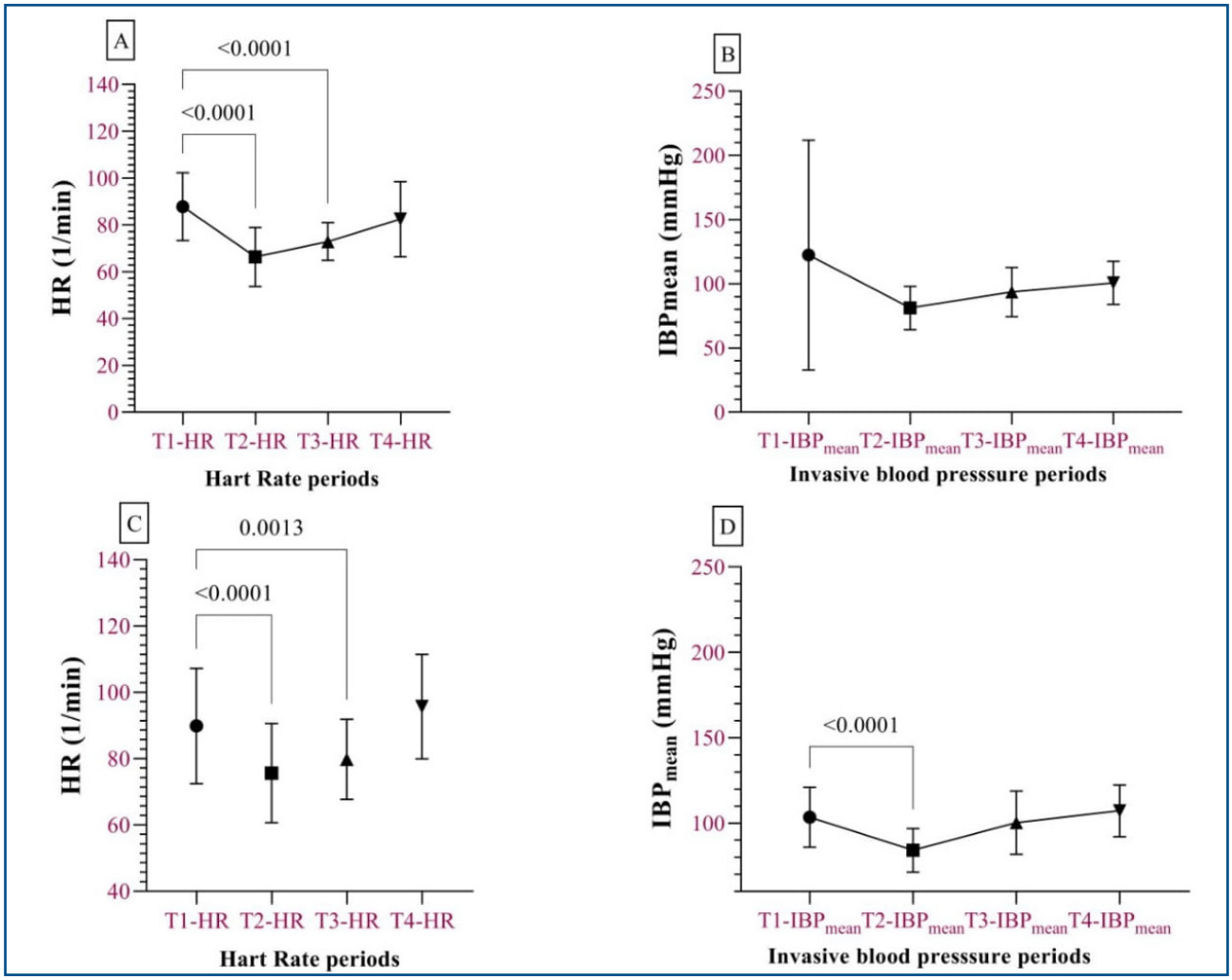

Figure 2. Comparison of GP (A – B) and GNP (C – D) HR and IBP mean results.

Table 2. pH, CO2, HCO3, K, Na, Cl, Ca, lactate values of the T1, T2, T3 and T4 periods ofthe patients in the preemptive group and the non-preemptive group

Arterial blood gas values		GP (n=27)	GNP (n=38)	U/X2	P value
		Mean ± SD or median (IQR_{25-75})	Mean ± SD or median (IQR_{25-75})		
pH,	T1	7.32 ± 0.07	7.36 ± 0.06		0.0007Ψ
	T2	7.29 ± 0.09	7.35 ± 0.06		0.0015Ψ
	T3	7.24 ± 0.08	7.29 ± 0.06		0.009Ψ
	T4	7.24 ± 0.07	7.27 ± 0.06		0.0797Ψ
CO_2, mmHg	T1	36 ± 5	42 ± 5		0.0007Ψ
	T2	39 ± 6	40 ± 5		0.7483Ψ
	T3	41 ± 5	43 ± 5		0.3567Ψ
	T4	43 ± 7	45 ± 8		0.5227Ψ
HCO_3, meq/L.	T1	19.8 ± 3.7	23.4 ± 2.7		< 0.0001Ψ
	T2	18.8 ± 3.7	21.9 ± 3.1		0.0004Ψ
	T3	17.1 (14.9-19.1)	19.8 (18.2-21.0)	272	0.0025*
	T4	16.5 (15.7-19.1)	19.6 (17.5-20.7)	277	0.0017*
K, meq/L	T1	4.4 (4.0-4.9)	4.5 (4.1-4.9)	484.5	0.7089*
	T2	4.8 ± 0.8	4.8 ± 0.9		0.7367Ψ
	T3	4.4 ± 0.7	4.5 ± 0.6		0.5861Ψ
	T4	4.5 ± 0.6	4.6 ± 0.7	444.5	0.3647*
Na, meq/L	T1	138 (135-139)	134 (132-136)	260.5	0.0007*
	T2	137 (134-138)	134 (131-135)	290.5	0.0029*
	T3	138 (135-140)	134 (133-136)	237	0.0002*
	T4	138 (136-141)	135 (132-136)	220	< 0.0001*
CL, meq/L	T1	109 (104-114)	102 (100-106)	238	0.0002*
	T2	111 (106-115)	105 (102-110)	324	0.012*
	T3	115 ± 6	110 ± 4	272	< 0.0001*
	T4	115 (111-119)	109 (106-112)	202.5	< 0.0001*
Lactate, meq/L	T1	0.96 ± 0.29	1.1 ± 0.49		0.0977Ψ
	T2	1.00 (0.80-1.20)	1.20 (0.88-1.50)	386	0.0912*
	T3	1.00 (0.60-1.30)	1.15 (0.90-1.53)	339.5	0.021*
	T4	1.20 (0.90-1.70)	1.35 (1.10-1.90)	386.5	0.0928*
Ca, meq/L.	T1	1.14 ± 0.08	1.12 ± 0.08		0.4257Ψ
	T2	1.10 ± 0.08	1.08 ± 0.08		0.2388Ψ
	T3	1.07 ± 0.10	1.08 ± 0.09		0.7987Ψ
	T4	1.08 ± 0.08	1.10± 0.09		0.4914Ψ

Mann Whitney U test: *, Student T test : Ψ

For pCO_2, the difference between T1 vs T2 and T3 periods was not statistically significant, while the difference between T1 vs T4 mean and standard deviation values was statistically significant, but it was not considered clinically significant because it was within normal limits (Table 3). The differences between the mean and standard deviation values of T1 vs T2, T1 vs T3 and T1 vs T4 times for Cl^- were statistically significant in the intragroup evaluations of GNP patients ($p < 0.0001$, table 4). Basal HCO_3 mean values were higher in all periods compared to the preemptive group values and there was a further decrease (approximately 1.3meq/L) from T1 to T4. Therefore, the differences between the mean and sd values of HCO_3 T1 vs T2, T3 and T4 were statistically significant ($p < 0.0001$, Table 4). The differences between the mean and standard deviation values of T1 vs T3 and T1 vs T4 times for pH were also statistically significant ($p < 0.0001$, table 4). No statistically significant difference existed between all period values for potassium, sodium, free Ca^{+2} and pCO_2 (Table 4). Although a statistically significant difference was found between T1 and T4 periods for lactate, it was not considered clinically significant because it was between normal limits. The last 5 years' follow-up data were compared with Fisher's exact test.

By phone call survey, we were able to reach all patients or their relatives. Mean postransplant folloup period was 5.6 (5.1- 6.8) years. There was total of 4 patients died and 7 rejections on both groups. In GP, 1 patient was died because of heart failure and there were 4 rejections while 22 patients are on follow up. In GNP, 3 patients were died, one because of MI and 2 of Covid-19 infection and ther were 3 rejection while 32 of them are on follow up.

The number and percentages of nonsurvival and kidney rejections and p values of GP and GNP patients were calculated as 1 (4 %) vs 3 (8 %) p=0.37 and 4 (15 %) vs 3 (8 %) p=0.18, respectively.

Table 3. pH, pCO2, HCO3, K, Na, Cl, Ca, lactate values of GP at T1, T2, T3 and T4. Repeated MANOVA and multiple comparisons tests were used for statistical comparison.

GP (n=27)	T1 vs T2	p	T1 vs T3	p	T1 vs T4	p
	Mean ± SD		Mean ± SD		Mean ± SD	
PH	7.32 ± 0.07 vs 7.29 ± 0.09	0.04	7.32 ± 0.07 vs 7.24 ± 0.08	<0.0001	7.32 ± 0.07 vs 7.24 ± 0.07	<0.0001
pCO_2, mmHg	36 ± 5 vs 39 ± 6	0.07	36 ± 5 vs 41 ± 6	0.03	36 ± 5 vs 43 ± 7	0.003
HCO_3, meq/L	19.8 ± 3.7 vs 18.8 ± 3.7	0.004	19.8 ± 3.7 vs 17.5 ±3.3	<0.0001	19.8 ± 3.7 vs 17.4 ± 2.6	0.0003
K^+, meq/L	4.5 ±0.7 vs 4.8 ± 0.8	0.0001	4.5 4.5 ±0.7 vs 4.4 ± 0.7	0.8	4.5 ± 0.7 vs 4.5 ± 0.6	0.9
Na^+, meq/L	137 ± 4 vs 136 ± 3	0.002	137 ± 4 vs 138 ± 3	0.3	137 ± 4 vs 139 ± 3	0.03
Cl^-, meq/L	109 ± 6 vs 110 ± 7	0.06	109 ± 6 vs 115 ± 6	<0.0001	109 ± 6 vs 115 ± 5	0.0001
Ca^{+2}, meq/L	1.14 ± 0.08 vs 1.10 ± 0.08	0.0003	1.14 ± 0.08 vs 1.07 ± 0.10	0.0006	1.14 ± 0.08 vs 1.08 ± 0.08	0.0007
Lactate, meq/L	0.96 ± 0.29 vs 1.01 ± 0.44	0.8	0.96 ± 0.29 vs 1.01 ± 0.43	0.8	0.96 ± 0.29 vs 1.30 ± 0.62	0.007

Table 4. pH, pCO2, HCO3, K, Na, Cl, Ca, lactate values of GNP, at T1, T2, T3 and T4 periods. Repeated MANOVA and multiple comparisons tests were used for statistical comparison.

GNP (n=38)	T1 vs T2 Mean ± SD	p	T1 vs T3 Mean ± SD	p	T1 vs T4 Mean ± SD	p
PH	7.36 ± 0.06 vs 7.35	0.4	7.36 ±0.06 vs 7.29 ±0.06	<0.0001	7.36 ±0.06 vs 7.27 ±0.06	<0.0001
pCO_2, mmHg	42 ± 5 vs 40 ±5	0.05	42 ± 5 vs 43 ±5	0.7	42 ± 5 vs 45 ± 8	0.08
HCO_3, meq/L	23.4 ± 2.7 vs 21.9 ±3.1	<0.0001	23.4 ± 2.7 vs 20.0 ±3.6	<0.0001	23.4 ± 2.7 vs 19.4 ± 2.7	<0.0001
K^+, meq/L	4.47 ± 0.6 vs 4.8 ± 0.9	0.8	4.47 ± 0.6 vs 4.5 ± 0.6	0.6	4.47 ± 0.6 vs 4.6 ± 0.7	0.6
Na^+, meq/L	134 ± 3 vs 133 ± 4	0.02	134 ±3 vs 134±3	0.7	134 ±3 vs 135 ±4	0.3
Cl^-, meq/L	103 ± 4vs 106 ± 5	<0.0001	103 ± 4 vs 110 ±4	<0.0001	103 ± 4 vs 109 ± 5	0.0001
Ca^{+2}, meq/L	1.12 ± 0.08 vs 1.08 ±0.08	0.001	1.12 ±0.08 vs 1.07 ±0.09	0.005	1.12 ±0.08 vs 1.10 ± 0.9	0.3
Lactate, meq/L	1.1 ± 0.5 vs 1.28 ± 0.6	0.4	1.1 ± 0.5 vs 1.33 ± 0.6	0.2	1.1 ± 0.5 vs 1.50 ± 0.5	0.003

DISCUSSION

Our results showed that the "biphasic fluid management" regime in robotic kidney transplantation is an effective method to achieve per-operative hemodynamic/metabolic stability and allograft function. Our study group is unique because of both, it consists of preemptive cases besides non-preemptive cases and all recipient procedures were performed using robotic surgery.

As known, transplant candidate patients have severe the metabolic condition including acidosis, hyperkalemia and hypervolemia, which make anesthesia management more difficult. On the other hand, anesthesia management of robotic surgery is also more challenging because of related factors such as patient position, intraabdominal CO_2 insufflation. In with this context in our series, perioperative hemodynamic stability and urine output was achieved after vascular anastomosis in all patients. There was no difference in the total amount of fluid given per-operatively between the two groups, except that the amount of fluid given in phase 1 was significantly less in GP. Not surprisingly, preoperative blood pH values were more acidotic, blood Na^+ and Cl^- values were significantly higher and HCO_3 values were significantly lower in GP.

Preoperative blood urea and creatinine levels were significantly higher in GP ($p < 0.05$) but all decreased to normal levels in both groups on postoperative days 1 and 7. In the five-year long-term follow-up, both groups had similar mortality and renal rejection rates, which are less.

The first objective of anesthesia management in kidney transplantation surgery is to provide hemodynamic and metabolic stability throughout the operation and also provide an "optimal" condition for allograft kidney when vascular anastomosis is completed. Because it's a minimally invasive option and has some advantages, robotic surgery has been gaining popularity and increasingly used in kidney transplantation in recent years (5). Robotic kidney transplantation has been associated with a lower risk of surgical site infection, less symptomatic lymphoceles and less postoperative pain (6). On the other hand, it is necessary to protect the patients who already have high comorbidities of ESRD from both possible complications such as hypervolemic heart failure and pulmonary oedema and some complications specific to robotic surgery such as increased intracranial pressure due to deep Trendelenburg position. In

our clinical practice, we believe we can overcome this problem by, using biphasic fluid treatment. We avoid fluid replacement except for the mandatory volumes of drugs used in induction during phase 1 as detailed before. We also limit intra-abdominal pressure levels to 8-12 mmHg.

Many variables can affect the function of the allograft kidney. Among these variables, ischemia and intraoperative hypotension are both very important. Clinical studies showed that avoiding ischemia is essential and avoiding intraoperative hypotension is also important and these vital measures support allograft kidney function (4). In other words, minimizing ischemic damage during the warm/cold ischemic phase and rewarming of a transplanted kidney and providing adequate perfusion after vascular anastomosis are the most critical factors to achieve allograft function. Therefore, intravenous fluid management becomes essential to maintain intravascular volume during transplant surgery and a dynamic fluid therapy is generally recommended according to mean arterial pressure measurements (7-9). Ischemia and/or reperfusion injury is thought to be a critical risk factor for both early and late graft dysfunction (10). It is known that delayed diuresis after reperfusion of transplanted kidney usually affects long-term outcomes of allograft, indicating possibly shorter graft functioning life and increased rejection rate (11, 12). For this reason, minimizing reperfusion damage by obtaining adequate mean arterial pressure with well-planned fluid management, positively affects graft function in the short and long term (13).

For the long-term result of our patients, we also did phone call survey and we found that there was no difference in renal rejection and mortality rate between the groups. On mean 5 years follow up of the present series, there was total of 4 patients died. One patient in the GP group died of heart failure, one in the GNP group died of MI and the other two died of covid 19 pneumonia. We believe the long-term results of our series are comparable with literature. Since the clinical status of renal transplant candidate patients may vary between hypovolemia and hypervolemia, fluid management of these patients also has a narrow safety range (14). Since the allograft kidney is denervated and its autoregulation is impaired, intraoperative fluid management should be organized to keep graft perfusion optimal while avoiding hypovolemia or hypervolemia after reperfusion (15). Allograft rejection may be caused by many factors, such as surgical kidney removal or damage during transplantation, injury during transport between donor and recipient and suboptimal allograft perfusion in the intraoperative and postoperative periods (16). A study by Fernandes et al. argued that the "flow-directed fluid" approach as a fluid therapy regimen in renal transplantation was more effective than other conventional methods (17). In their transplantation consensus, the ASA transplant committee stated that intraoperative fluid management could affect kidney transplantation outcomes and made recommendations to help anesthesiologists dealing with kidney transplant recipients. The best method of assessing fluid status is still controversial. However, it has been emphasized that an individualized approach may be the best (4). Similar to general recommendation, we have determined that hemodynamic and metabolic stability were achieved with close monitoring of arterial blood gas values and MAP in patients who were on restricted fluid therapy (phase 1) until vascular anastomosis. At the same time, the possible side effects of lithotomy and deep Trendelenburg position which had to be performed during robotic surgery, could also be compensated. During robot-assisted surgical procedures, it is necessary to combat the metabolic and respiratory difficulties caused by the deep Trendelenbug position as well (18). Intra-abdominal CO_2 insufflation and CO_2 retention with deep Trendelenburg may lead to a rapid decrease in pH and dangerous hyperkalemia (19). Both conditions are much more dangerous for patients with end-stage renal disease than normal healthy individuals because these patients are often at borderline acidosis and hyperkalemia. More importantly, preemptive cases have more severe metabolic status, as our results showed that the initial pCO_2 values and Ph values at T1,2,3 were lower in GP than in GNP, peroperative management of these patients becomes more complicated. The most crucial factor here is that GP patients are the patients with renal failure who had never been on dialysis and therefore have developed a compensation mechanism prone to metabolic acidosis. Metabolically, HCO_3 values were significantly lower in GP at all times for the same reason. In phase 1, HCO_3 values decreased

more because Cl^- values increased more due to 0.9% NaCl infusion (350 vs 800 mL) in GNP compared to GP (20). Preemptive kidney transplantation has been accepted as an ideal treatment method (21,22). Uremic toxins are better cleared with a functioning kidney allograft. The survival benefit may be greater than with maintenance dialysis treatment. Another reason may be chronic dialysis's regression of the inflammatory and/or oxidative process (23). In our study, GP patients' admission urea and Cr values were significantly higher concerning not being on dialysis. However, there was no difference between GP and GNP patients regarding early post-transplant laboratory results (day 1, day 7 urea, Cr). Both decreased to almost the same values (day1 and day 7 respectively, urea:66 and 61, Cr:1.22 and 1.25).

In fluid selection in renal transplantation, it has been argued that crystalloids should be the first choice over colloids (24). Hadimioğlu et al. Showed that all three crystalloids (isotonic, ringer lactate, plasmalyte) could be used safely in fluid management in renal transplantation (25). According to The European Renal Best Practice (ERBP, 2017) guidelines, there is no conclusive evidence that giving any fluid other than isotonic NaCl to renal transplant recipients during surgery positively affects the clinical course of the patient and the graft (26). A survey conducted in 2002 showed that 83% of transplant centres used more than 90%0,9% NaCl in renal transplantations. The reason for this preference is the belief that solutions containing potassium may potentially exacerbate hyperkalemia (27). Contrary to this belief, some studies on renal transplantation have shown that potassium concentrations increased during surgery with isotonic (0.9% NaCl) (28). Another study showed that isotonic use increased potassium levels postoperatively but not intraoperatively (29). In our study, although isotonic was used as the fluid in both groups, no significant change was determined in the follow-up of potassium values in intra-group blood gases during the perioperative period. The increase in Cl^- values in intra-group evaluations was insignificant in parallel with the administration of less fluid during Phase 1 in GP but significant during the other Phase 2 period, supporting that it is related to the isotonic we used. Despite the effect of the increase in Cl^- values on the metabolic status of the patients, it was observed that it did not cause any adverse effects on short-term hemodynamic responses and urea-creatinine values on postoperative days 1 and 7. Therefore, we think that a 0.9% NaCl solution, which has a known metabolic acidosis effect, does not have a negative effect on the allograft kidney in the short term.

The limitation of this study is that it is a single-center, retrospective study, and the number of cases relatively small. The second limitation is that we did not perform advanced hemodynamic monitoring during operation, because a conventional advanced monitorization as in open surgery is difficult during robotic surgery.

The survival rate of living kidney transplant patients is relatively high. However, this chance depends on the long-term function of the allograft kidney. In this study investigated the efficacy of biphasic fluid management in a unique patient's group which includes both preemptive and non-preemptive cases and all recipient kidney transplantations were performed by robotic surgery. Our results supported that biphasic fluid management regime is effective to achieve hemodynamic/metabolic stability of recipient patients and allograft kidney functions in robotic kidney transplantation patients.

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Original Article
Özgün Araştırma

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The Effect of Genital Warts on Men's Depression and Sexual Functions

Genital Siğillerin Erkeklerin Depresyonu ve Cinsel İşlevleri Üzerindeki Etkisi

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ÖZET

Amaç: Bu çalışma, insan papilloma virüsü enfeksiyonuna bağlı depresif durumun cinsel olarak aktif erkeklerde cinsel işlevleri nasıl etkilediğini gözlemlemek için tasarlanmıştır.

Gereç ve Yöntemler: 2020-2022 yılları arasında XXX Hastanesine başvuran ve fizik muayene ile genital siğil (GS) tanısı alan 77 primer erkek hasta çalışmaya dahil edildi. Hastalar siğillerin sayısı ve büyüklüğüne göre (küçük boy ve büyük boy) iki gruba ayrıldı. Hastalardan Hastane Anksiyete Depresyonu (HAD) ölçeği ve Uluslararası Erektil Fonksiyon İndeksi (IIEF-5) formlarını doldurmaları istendi. İki grubun verileri karşılaştırıldı ve analiz edildi.

Bulgular: Yaş ortalaması 39,7±10,3, VKİ kg/m2 27,0±7,2 idi. Siğil boyutlarına göre 2 gruba ayrılan hastalar normal dağılım gösterdi. Küçük siğil boyutu grubundaki hastaların %13'ünde ve büyük siğil boyutu grubundaki 21 hastanın %52,5'inde HAD skala kısmı anormal bulundu (p<0,0001). IIEF-5 ölçeği değerlendirmesine göre, küçük boy grubunda 5 hastanın %13,5'inde, büyük boy grubunda ise 19 hastanın %47,5'inde ciddi cinsel işlevlerin olduğu görüldü (p<0,0001). Kronik hastalığı olan 2 grup arasında anlamlı fark gözlenmedi (p=0,263).

Sonuçlar: Anksiyete ve depresyon GS tanısı konulan hastalarda tanı anından itibaren ortaya çıkmakta ve belirgin hale gelmektedir. Bu konunun dikkatle incelenmesi ve gerektiğinde psikiyatri konsültasyonlarının yönetime dahil edilmesi gerekebilir.

Anahtar Kelimeler: Genital siğil, Anksiyete, Depresyon, Seksüel fonksiyon

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Approval was received for this study from the Health Sciences University Şişli Hamidiye Etfal Training and Research Hospital Clinical Research Ethics Committee (04.04.2023/3851). The ethical rules of the Declaration of Helsinki were followed in the study protocol.

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ABSTRACT

Objective: This study was designed to observe how the depressive state due to human papilloma virus infection affects sexual functions in sexually active men.

Material and Methods: Between 2020-2022, 77 primary male patients who applied to the XXX Hospital and diagnosed with genital warts (GW) by physical examination were included in the study. The patients were divided into two groups according to the number and the size of the warts (small size vs. larger size). The patients were asked to fill out the Hospital Anxiety Depression (HAD) scale and International Index of Erectile Function (IIEF-5) forms. The data of the two groups were compared and analyzed.

Results: The mean age was 39.7±10.3, BMI kg/m2 27.0±7.2. Patients divided into 2 groups in terms of wart sizes showed normal distribution. The HAD scale part was found to be abnormal in 13% of patients in small wart size group and 52.5% of 21 patients in larger wart size group ($p<0.0001$). According to the evaluation of the IIEF-5 scale, it was observed that 13.5% of 5 patients in small size group and 47.5% of 19 patients in larger size group had severe sexual functions ($p<0.0001$). No significant difference was observed between the 2 groups with chronic diseases ($p=0.263$).

Conclusion: Anxiety and depression appear and become evident in patients diagnosed with GWs from the moment of diagnosis. It may be necessary to examine this issue carefully and to involve psychiatry consultations in the management when necessary.

Keywords: Genital wart, Anxiety, Depression, Sexual function

INTRODUCTION

Anogenital warts are one of the most common venereal diseases, caused by Human Papilloma Viruses (HPV) and transmitted sexually. It is easily transmittable. HPV, causing cutaneous and mucosal infection, is responsible for the formation of various lesions ranging from benign exophytic lesions such as anogenital warts to invasive skin cancers. Apart from disturbing visible lesions, HPV infections create a risk of invasive cancer and can lead to negative psychosocial effects such as conflict with cultural and religious beliefs, and questioning of one's own gender and sexual orientation (1).

There are 100 types of HPV, 40 of which infect the genital area, and types 6,11,16, 18 are the most common. Types 16 and 18 are associated with cervical and anal cancers, while 6 and 11 are responsible for genital warts and are in the low risk group (1). In 2013, Patel et al. reported the annual prevalence of GWs in the world as 160-289 per 100,000 in men and women (2, 3). The age groups with the highest incidence of GW in men and women are 25-29 and 20-24, respectively (4).

The most common factors affecting the incidence of genital wart (GW): age, gender, education level, race, marital status, age at first sexual contact, new sexual partner, number of sexual partners, condom use, smoking, family history, socioeconomic status, other sexually transmitted infections, oral contraceptive pills and alcohol consumption (2,5,6). According to some studies, HPV and GWs have many physical and psychological effects on patients. Among the first reactions of patients are anger, depression, isolation, shame and guilt (7).

GWs can affect sex life, self-image, self-esteem, emotions, daily activities and quality of life due to pain and discomfort, anxiety and depression (8,9,10). Almost all studies indicate that GWs threaten people's sexual health and cause marked changes in their sex lives (10). In our study, we aimed to investigate the anxiety and depression caused by wart sizes and diameters on patients after the diagnosis of the disease and its effects on sexual function.

MATERIAL AND METHODS

The study was approved by the ethics committee of Şişli Etfal Training and Research Hospital with the decision number 3851. Between the years 2020-2022, 79 patients aged 17-49 who were diagnosed with

primary genital warts during physical examination in the Urology outpatient clinic of Sisli Etfal Training and Research Hospital were evaluated. The inclusion criteria were to have primary genital warts diagnosed within the past 1 month. Two patients were excluded from the study because they had previously undergone cryotherapy for genital warts. All patients who accepted the study were informed about the study and their consent was obtained. All patients were evaluated by specialist physicians with more than 10 years of experience in andrology. Demographic data of the patients were extracted. They were divided into two groups according to the number of warts and wart sizes in the genital area. Patients were asked to fill out Hospital Anxiety Depression ("HAD", consisting of 14 questions) and International Index of Erectile Function ("IIEF-5", consisting of 5 questions) scales forms. The patients were grouped and evaluated based on the lesion sizes and number of lesions. The analysis were performed using SPSS software for Windows, version 23. Descriptive statistics were used to describe the demographic data of the patients. Distributions of the continuous variables were analysed with Shapiro-Wilk test. Continuous variables were defined as mean ± standart deviation (SD) and as median and interqurtile range (IQR). Intergroup analysis of continuous variables were performed with Mann Whitney-U test. Categorical variables were defined as frequencies (n) and percentages (%) and intergroup analysis were performed with Pearson's Chi-Square test. A p value of <0.05 was accepted as statistically significant.

RESULTS

While the mean age of 77 patients was 39.7+/-10.3, the mean BMI kg/m2 was 27.03+/- 7.23. Height (cms) 164+/- 8.1, Weight (kgs) 73.7+/-16.7, Body surface area (m2) 1.79+/- 0.21. The classification of patients according to their educational status revealed that 36.4% of them only had primary education, while 63.6% of them had at least high school level education. While 54.5% of the patients were smokers, 45.5% were non-smokers (Table 1).

The patients with larger wart size were older (39.5 vs. 34 years, p<0.001). There was no significance about the median BMI indexes of the patient groups (p=0.533). No significant difference was observed between the 2 groups with chronic diseases (p<0.09). Wart size was significantly larger in smokers (p<0.001). However, it was determined that the presence of comorbidity did not create a statistically significant difference in terms of wart size (p=0.263). In terms of wart sizes, there is a significant difference in HADS and IIEF-5 scoring. The wart size was found to be highly significant and the hospital anxiety depression scale was evaluated as abnormal (p<0.0001). The evaluation of the IIEF 5 scale depicted that the patients' sexual functions were severely affected (p<0.0001) (Table 2).

Table 1. Demographic and clinical features (n=77)

Age, mean ± SD	39.7 ± 10.3
BMI (kg/m^2), mean ± SD	27.0 ± 7.2
Comorbidities, % Hypertension Diabetes mellitus Hyperlipidemia	 20.8 18.2 16.9
Level of education, % High school or higher Primary school	 63.6 36.4
Smoking status, n (%) Smoker Non-smoker	 42 (54.5) 35 (45.5)
Wart size (cm), n (%) < 2cm > 2cm	 37 (48.1) 40 (51.9)

Table 2. Intergroup comparison according to ward number and size

	Number of genital warts < 5 or size < 2 cm (n=37)	Number of genital warts > 5 or size > 2 cm (n=40)	P value
Age (years), median (IQR)	34 (22-38)	39.5 (36-44)	<0.001
BMI (kg/m^2), median (IQR)	27.3 (22.4-32)	29.8 (22.5-32.6)	0.533
Smoking status, n (%)			<0.001
Smoker	3 (8.1)	32 (80)	
Non-smoker	34 (91.9)	8 (20)	
Comorbidities, n(%)			0.263
Absent	10 (27)	6 (17.6)	
Present	27 (73)	34 (82.4)	
HADS, n(%)			<0.001
Normal	25 (67.6)	11 (27.5)	
Moderate	7 (18.9)	8 (20)	
Abnormal	5 (13.5)	21 (52.5)	
IIEF-5, n (%)			<0.001
Severe	5 (13.5)	19 (47.5)	
Moderate	4 (10.8)	10 (25)	
Mild-Moderate	7 (18.9)	7 (17.5)	
Mild	6 (16.2)	2 (5)	
Absent	15 (40.5)	2 (5)	

Abbreviations: BMI, body mass index; HADS, Hospital anxiety depression scale; IIEF, International index of erectile function.

Also, there was a significant relationship between education level and wart size (p<0.015). Wart size was found to be smaller in individuals with higher education level. This result may be associated with increased awareness and earlier admission to the hospital as the level of education increases.

DISCUSSION

Genital warts are also named *condyloma acuminata* or *venereal warts*. Its morphology enables easy diagnosis of HPV infection by direct examination. It is usually observed in areas including external genitalia, perineum, perianal, inguinal fold and adjacent areas such as mons pubis. They can be seen as discrete, sessile, flat-surfaced, exophytic, papillomatous lesions (11).

Although genital warts are seen quite frequently in the society, the degree of change in the quality of life of the patient and the psychosocial effects of the disease shall be reckoned in the management, as they are equally significant as the number and appearance of the lesions. As with most sexually transmitted diseases, the psychosocial impact of genital warts is greater than the physical illness (12).

In many studies, it has been shown that genital warts affect the sexual life of individuals, cause anxiety and stress related to the disease, and negatively affect the quality of life of the person (13, 14). Although there are many studies measuring the psychosocial effect of abnormal Pap smear results, there are few studies investigating the relationship between the size and number of genital warts and the anxiety and sexual functions of patients (15). There are also studies in the literature investigating the effect of genital warts on quality of life. The negative effects of genital warts on quality of life have been shown in previous studies using different questionnaires in various centers. These reports showed that the disease causes anxiety, anger, embarrassment, discomfort, pain and deterioration in social function and sexual life in patients (16). In two different survey studies conducted on patients with genital warts, it was reported that the most significant effect on quality of life was in the dimension of anxiety/depression (17). In another study, it was revealed that the disease has negative effects on psychological and social life. In our study, we demonstrated that HADS and IIEF scores increased significantly as the wart size increased. It has been

observed that the size of the wart affects the psychosocial life and sexual functions negatively. According to the IIEF score, 47.5% of 19 patients with large warts and 13.51 percent of 5 patients with small warts had severe ED. In 52.5% of 21 patients with large warts and 13.5% of 5 patients with small warts, HADS resulted as abnormal.

The risk of cancer caused by the disease in men and their partners is an important factor that causes anxiety. In a study, it was reported that 2/3 of the patients experienced anxiety due to the risk of cancer. The fear and anxiety levels were observed to be higher in patients that have incomplete and/or incorrect information on the issue (18).

HPV infections occur in all age groups, genders and races. While benign cutaneous warts are most common in childhood, anogenital warts are common in adulthood and are considered to be the most common sexually transmitted infection (19). A study based the gender's role on the quality of life of genital wart patients, female patients was significantly more affected than male patients (16). However, since male patients are more often to apply to urology outpatient clinic, we excluded female patients in this study. We included sexually active male patients between the ages of 17 and 49 with genital warts, as this group constitutes a considerable part of our daily urology practice. The mean age was 39.7+/-10.3 in our study. In most studies, it has been reported that the risk of genital wart formation increases among smokers. This was thought to be due to the immunosuppression caused by smoking. In a retrospective case-control study in Sydney, it was found that smoking has a very significant dose-response effect in men. It was found that those who smoke more than 10 cigarettes a day are twice as likely to have genital warts than those who do not smoke, while those who smoke less than 10 cigarettes a day show less risk (20). In another study, because the immune system is suppressed by smoking (the risk is five times higher), viral clearance is more difficult and recurrence is more likely. There was a 27% increased risk of genital wart development in smokers compared to non-smokers (21). In our study, a significant correlation was found between genital wart size and smoking. While larger sized warts were detected in smokers, smaller sized warts were observed in non-smokers. Moreover, we depicted warts were more common in patients with chronic diseases, but there was no significant difference between wart size groups. ($p<0.263$) In most studies, chronic diseases and immunodeficiency have been associated with the progression or recurrence of latent warts (20, 21).In the study, a significant relationship was observed between education level and wart size ($p<0.035$) Wart size was observed to be smaller in individuals with higher education level. This is thought to be due to the shorter waiting time for admission to the hospital and higher awareness.

It is known that the studies investigating anxiety and depression in this patient group are not sufficient in the literature. Therefore, we think that our study will contribute to the literature. In addition, our study also has some limitations. Our main limitations are the relatively small number of patients and the fact that the duration and amount of smoking of the patients were not included in the study. There is need for more comprehensive studies on the duration and amount of smoking.

CONCLUSIONS

This study provides current evidence on the relationship between wart size and changes in sexual function in men with genital warts. Although the results of most studies indicated that men with genital warts of varying sizes experienced sexual dysfunction, anxiety, and depression; differences in the design and population of the studies made it difficult to identify specific pathologies such as libido or arousal disorders, which were the root cause in men. Based on the findings of this review, further research in this area is recommended in the future. Quality of life is adversely affected especially in psychosocial and sexual aspects, causing psychosocial comorbidities and changes in sexual life in patients. Inadequate and often incorrect information about the risk of developing cancer and the contagious nature of the disease place additional burdens on negative moods. The issue of overcoming these factors with correct information and guidance imposes important duties on physicians. Taking into account the findings of this specific study

as well as similar studies in determining the patient management and treatment requirements, patient satisfaction and treatment success, and thus the quality of the health service provided will eventually increase.

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Original Article
Özgün Araştırma

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The Role of Robotic Surgery For Managing Complex Upper Urinary Tract Stone Disease: A Single Center Experience

Kompleks Üst Üriner Sistem Taş Tedavisinde Robotik Cerrahinin Rolü: Tek Merkez Deneyimi

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ÖZET

Amaç: Bu çalışmanın amacı, farklı endikasyonlar ile da Vinci robotik sistem (Intuitive Surgical Incorporation, Sunnyvale, CA) kullanılarak yapılan üst üriner sistem taş hastalığı tedavilerinin klinik sonuçlarını paylaşmaktır.

Gereç ve Yöntemler: Temmuz 2016 ve Temmuz 2023 tarihleri arasında merkezimizde robotik taş cerrahisi yapılan 12 hastanın verisi retrospektif olarak incelenmiştir. Daha önce geçirilmiş başarısız taş cerrahisi olan hastalarda büyük ve/veya impakte üst üriner sistem taşı olması (n=7), eş zamanlı saptanan renal kitle için parsiyel nefrektomi gerekliliği (n=4) ve üreteropelvik bileşke (UPB) darlığına bağlı eş zamanlı pyeloplasti gerekliliği (n=1) sebebi ile robotik taş cerrahisi planlanmıştır.

Bulgular: Çalışmaya dahil edilen 12 hastanın 7'si (%58) erkek, 5'i kadındı (%42) ve ortanca yaş 58 (IQR: 44–68) yıldı. Preoperatif BT değerlendirmesinde taşların ortanca boyutu 38 mm (IQR: 16–53) olarak bulundu. Hastaların 7'sinde (%58) çoklu taşlar var iken 5'inde (%42) soliter taş saptanmıştı. Hastaların 8'inde (%66,7) robotik pyelolitotomi ve/veya nefrolitotomi uygulanırken dört hastada ise robotik üreterolitotomi uygulandı. Cerrahi esnasında hastaların 7'sinde (%58) eş zamanlı fleksibl üreterorenoskopi ile endoskopik asistans gerekti. Ortanca ameliyat süresi ve tahmini kan kaybı sırası ile 190 dk (IQR: 126–148) ve 50 ml (min:0, maks: 300) olarak saptandı. Eş zamanlı parsiyel nefrektomi yapılan bir hastada hemoraji görülmesi üzerine transfüzyon ve ardından endoskopik psödoanevrizma embolizasyonu ihtiyacı oldu. Robotik pyelolitotomi yapılan bir hastada ise kendiliğinden azalan uzamış dren aktivitesi (6 gün) görüldü. Ameliyat sonrası yapılan tetkiklerde hastaların 11'inde (%92) tam taşsızlık sağlandığı görüldü. Rezidü taş görülen hastada ise JJ stent çekilmesi esnasında retrograd intrarenal cerrahi (RIRC) yapılarak 8 mm boyutundaki rezidü kalkül fragmante edilerek mutlak taşsızlık sağlandı. İlave girişim sonrası hastaların tamamında mutlak taşsızlık görüldü.

Sonuçlar: Kompleks klinik senaryolarda robotik cerrahi, tek seansta yüksek mutlak taşsızlık ve düşük komplikasyon oranları yanında cerrahların artan robotik böbrek cerrahisi deneyimi de düşünüldüğünde büyük böbrek taşlarının tedavisinde de alternatif olarak hastalara sunulabilir.

Anahtar Kelimeler: robotik cerrahi, fleksibl üreterorenoskopi, ürolitiyazis, komplikasyon

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Approval was received for this study from the Ethics Committee of Koç University (2023/307.IRB1.103). The ethical rules of the Declaration of Helsinki were followed in the study protocol.

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ABSTRACT

Objective: The aim of this study is to present the outcomes of robotic surgery using a da Vinci robotic system (Intuitive Surgical Incorporation, Sunnyvale, CA) in different clinical indications in patients with upper urinary tract stone disease.

Material And Methods: The data of 12 patients who underwent robotic stone surgery at our academic center between July 2016 and July 2023 were retrospectively evaluated. The reason to perform robotic stone surgery was large and/or impacted upper tract stone disease after a previous unsuccessful stone surgery (n=7), the need for a partial nephrectomy due to simultaneously detected renal solid lesion (n=4), and the need for pyeloplasty resulting from ureteropelvic junction obstruction (n=1).

Results: Out of 12 patients included in the study, 7 patients (58%) were male, and 5 patients (42%) were female with a median age of 58 (IQR: 44 – 68) years. The median stone size was 38 mm (IQR: 16 – 53) as measured at a preoperative computerized tomography (CT) scan. 7 out of 12 patients (58%) had multiple urinary stones while 5 patients (42%) had a solitary stone. Assistance with flexible ureterorenoscopy was required in 7 out of 12 cases (58%). The median operation time and estimated blood loss were 190 minutes (IQR: 126 – 148) and 50 ml (min:0, max: 300), respectively. In a case who underwent concurrent partial nephrectomy, angioembolization was required due to postoperative bleeding. In another case, prolonged drain activity (6 days) was observed which resolved spontaneously during follow-up. Stone-free status was achieved in 11 out of 12 cases (92%). In the only case without stone-free status, the residual stone was fragmented during JJ stent removal by the technique of retrograde intrarenal surgery (RIRS). After this additional operation, stone-free status was achieved in all cases.

Conclusion: Robotic stone surgery with its high stone-free rate and low complication rate represents an alternative approach in complex clinical scenarios considering the increasing experience of surgeons in robotic surgery.

Keywords: robotic surgery, flexible ureterorenoscopy, urolithiasis, complication

GIRIŞ

Üst üriner sistem taş hastalığının tedavisi; kullanılan endoskopların minyatürize olması, gelişen lazer teknolojisi, artan cerrah tecrübesi ve yardımcı ekipmanların çeşitlenmesi ile yıllar içerisinde gelişerek değişime uğramıştır. Böylece açık taş cerrahisi yerini beden dışı ses dalgası ile taş kırma, semi-rigid üreteroskopi (URS), retrograd intrarenal cerrahi (RIRC) ile litotripsi, perkütan nefrolitotomi ve endoskopik kombine intrarenal cerrahi'ye (EKIRC) bırakmıştır (1).

Bununla birlikte, eş zamanlı rekonstrüktif veya ablatif cerrahi gerektiren büyük impakte üreter taşı (2), böbrek taşına eşlik eden konjenital anomaliler (3) veya intraabdominal tümörler-patolojiler gibi nadir görülen klinik senaryolarda, endoürolojik teknikler yeterli olmayabilmektedir. Bu gibi durumlarda geçmişte uyguladığımız açık cerrahi yerini güncel uygulamada önce laparoskopik cerrahiye bırakmıştır (4). Son yıllarda ise robotik cerrahinin kullanılmaya başlanması hem artan manevra kabiliyeti hem de daha yüksek kalitede görüntü ile açık ve laparoskopik cerrahinin dezavantajlarını ortadan kaldırmıştır. Bu olumlu etkenlere rağmen robotik cerrahinin üriner sistem taş hastalığının tedavisinde kullanımı nispeten yeni bir yaklaşımdır (1, 5, 6).

Robotik cerrahinin de bir seçenek olabileceği büyük komplike üst üriner sistem taşlarının günümüzdeki standart tedavisi PNL olsa da (7) majör ve minör komplikasyon riski sırasıyla %7 ve %25 olarak bildirilmiştir (8). Ayrıca taş boyutunun artması düşük mutlak taşsızlık oranları ile de sonuçlanabilmektedir (9-11). Cerrahların robotik böbrek cerrahisindeki tecrübelerinin artması ile birlikte kompleks böbrek taşlarının tedavisinde robotik pyelolitotomi ve nefrolitotomi sonuçları da yayınlanmaya başlamıştır (6, 12-14).

Fakat robotik taş cerrahisi hakkında giderek artan sayıda literatür verisi ortaya konulsa da yeterli kanıt hala eksiktir (13) ve bu çalışmanın amacı, farklı endikasyonlar ile da Vinci robotik sistem (Intuitive Surgical Incorporation, Sunnyvale, CA) kullanılarak yapılan üriner sistem taş hastalığı tedavilerinin klinik sonuçlarını paylaşmaktır.

GEREÇ VE YÖNTEMLER

Etik kurul onayının (Koç Üniversitesi Etik Kurulu 2023/307.IRB1.103) alınmasının ardından Temmuz 2016 ve Temmuz 2023 tarihleri arasında merkezimizde robotik taş cerrahisi yapılan 12 hastanın verisi retrospektif olarak incelenmiştir. Daha önce geçirilmiş başarısız taş cerrahisi olan hastalarda büyük ve/veya impakte üst üriner sistem taşı olması (n=7), eş zamanlı saptanan renal kitle için parsiyel nefrektomi gerekliliği (n=4) ve üreteropelvik bileşke (UPB) darlığına bağlı eş zamanlı pyeloplasti gerekliliği (n=1) sebebi ile robotik taş cerrahisi planlanmıştır. Tüm hastalar cerrahi öncesi bilgisayarlı tomografi (BT) ile değerlendirilmiş ve taş boyutu, sayısı, yerleşim yeri ve dansitesi (Hounsfield ünitesi) gibi taş-ilişkili klinik özellikler kayıt altına alınmıştır. Taş boyutu olarak soliter taş olgularında en uzun aks ölçümü, çoklu taş olgularında ise tüm taşların en uzun akslarının toplamı hesaplanmıştır. Uygulanacak taş cerrahisi tekniği ve eş zamanlı fleksible üreterorenoskopi (endoluminal endoskopik girişim) gerekliliği taşa bağlı özellikler ve hastanın anatomik yapısına göre ameliyatı gerçekleştiren cerrah tarafınca belirlenmiştir. Cerrahi öncesi tüm hastalarda serum hemoglobin seviyesi (Hb), serum kreatinin ve tahmini glomerüler filtrasyon hızı (tGFH) not edilmiştir.

Tüm robotik taş cerrahileri lateral dekubitus pozisyonunda Da Vinci Si ya da Xi robotik sistemler (Intuitive Surgical Incorporation, Sunnyvale, CA) kullanılarak transperitoneal yolla ve cerrah tercihine göre üç veya dört kol yardımı ile gerçekleştirilmiştir. Hastaların tamamında intraoperatif JJ stent ve dren yerleştirilmiştir. Tüm cerrahilerde ameliyat süresi, tahmini kan kaybı ve intraoperatif komplikasyonlar kaydedilmiştir. Ayrıca hospitalizasyon süresi ve postoperatif dönemde yaşanan komplikasyonlar değerlendirilmiştir. Postoperatif dönemde tüm hastalarda serum Hb değerleri, serum kreatinin ve tGFH kaydedilmiş ve preoperatif değerlere göre değişimleri kayıt altına alınmıştır. Komplikasyonları değerlendirmek için Modifiye Clavien-Dindo sınıflama sistemi kullanılmıştır. Cerrahi sonrası tedavi sonucunu değerlendirmek için tüm hastalar ameliyattan 4 hafta sonra direk üriner sistem görüntülemesi (DÜSG) ve abdominal ultrasonografi ile değerlendirilmiştir. Bu görüntülemelerde taş için şüpheli bulguları olan hastalarda BT çekilmiş ve taşsızlık 2 mm üzerinde rezidü taşı olmaması olarak tanımlanmıştır.

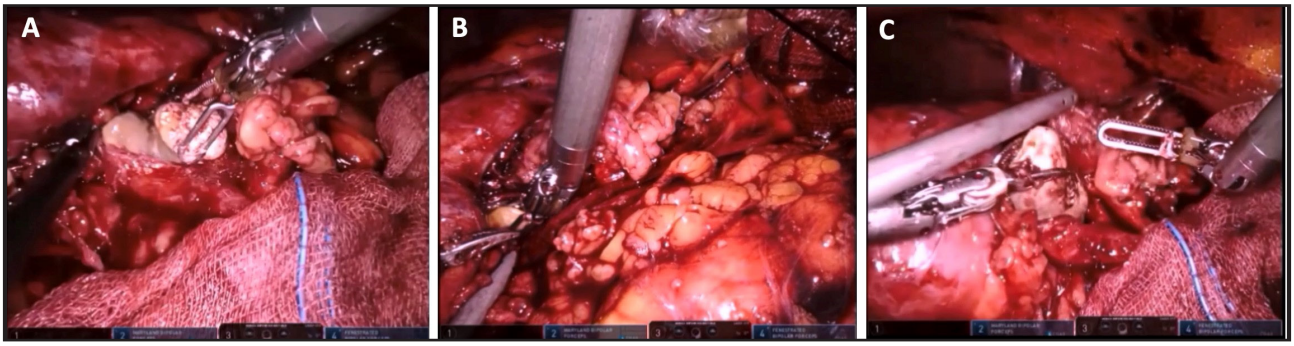
İstatistiksel analizler SPSS versiyon 24 (IBM Corporation, Armonk, New York, USA) kullanılarak yapılmıştır. Tanımlayıcı istatistikler devamlı değişkenler için ortanca ve çeyrekler arası aralıklar (Interquartile range – IQR), kategorik parametreler için ise yüzdeler verilerek sunulmuştur.

BULGULAR

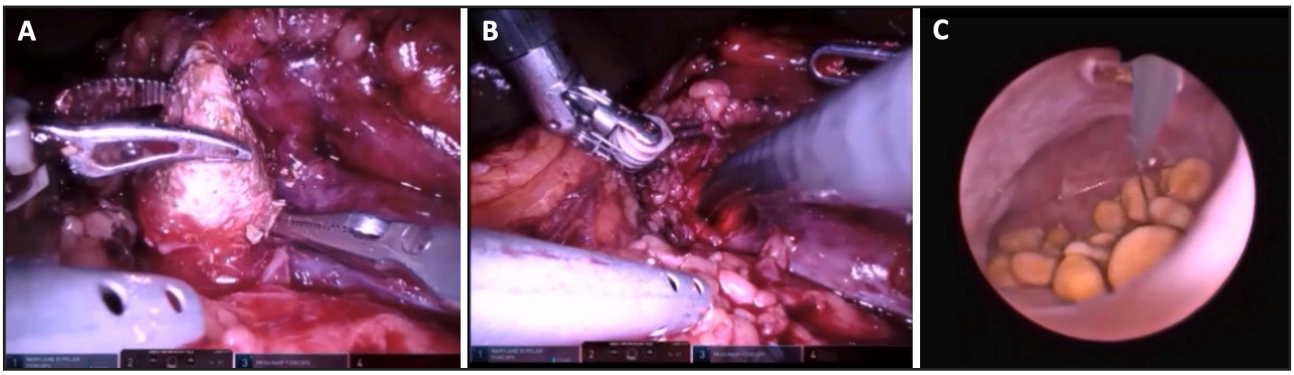
Hastaların yaş, taş boyutu, sayısı ve lokalizasyonu, uygulanan cerrahi teknik, ameliyat süresi, tahmini kan kaybı ve nihai taşsızlık durumları Tablo'da özetlenmiştir. Çalışmaya dahil edilen 12 hastanın 7'si (%58) erkek, 5'i kadındı (%42) ve ortanca yaş 58 (IQR: 44–68) yıldı. Hastaların cerrahi esnasında ortanca vücut kitle indeks (VKİ) değeri 27.7'di (IQR: 24,4–30,1). Preoperatif BT değerlendirmesinde saptanan taşların ortanca boyut ve dansitesi sırası ile 38 mm (IQR: 16–53) ve 1263 HU (910 –1583) olarak bulundu. On hastada (%83) sol böbrek toplayıcı sistemi opere edilmişken kalan 2 hastada (%17) sağ tarafa işlem gerçekleştirildi. Hastaların 7'sinde (%58) çoklu taş var iken 5'inde (%42) soliter taş saptanmıştı. Hastaların 4'ünde taş lokasyonu proksimal üreter iken kalan 8 hastada taş(lar) renal pelvis ve/veya renal kaliks(ler) yerleşimliydi. Preoperatif değerlendirmede ortanca serum Hb değeri 13,4 g/dL (IQR: 12,3–14), ortanca serum kreatinin 1,08 mg/dL (IQR: 0,73–1,58) ve ortanca tGFH 82 mL/dk/1,73 m^2 (IQR: 49–98) olduğu saptandı.

Hastaların 8'inde (%66,7) robotik pyelolitotomi ve/veya nefrolitotomi (Resim1) uygulanırken kalan dört hastada ise robotik üreterolitotomi uygulandı. Cerrahi esnasında hastaların 7'sinde (%58) eş zamanlı fleksibl üreterorenoskopi ile endoskopik asistans gerekti (Resim 2). Ortanca ameliyat süresi ve tahmini kan kaybının sırası ile 190 dk (IQR: 126–148) ve 50 ml (min:0, maks: 300) olduğu kaydedildi. Hastaların hiçbirisinde robotik cerrahiden açık veya laparoskopik cerrahiye dönülmedi. Tüm hastalara intraoperatif JJ stent yerleştirildi ve ameliyattan ortanca 6 hafta sonra çekildi. Postoperatif alınan kan tetkiklerinde ortanca serum Hb 11,8 g/dL olduğu görüldü. Ortanca serum kreatinin ve tGFH ise sırası ile 1,1 mg/dL ve 79 mL/dk/1,73 m^2 idi. Ortanca hospitalizasyon süresi 4 gündü (IQR: 3-5 gün). Eş zamanlı parsiyel nefrektomi yapılan bir hastada

hemoraji görülmesi üzerine transfüzyon ve ardından endoskopik psödoanevrizma embolizasyonu ihtiyacı oldu (Modifiye Clavien-Dindo IIIa komplikasyon-parsiyel nefrektomi ilişkili). Robotik pyelolitotomi yapılan bir hastada ise kendiliğinden azalan uzamış dren aktivitesi (6 gün) görüldü. Postoperatif dönemdeki takiplerinde pelvik koleksiyon/ürinom saptandı ancak takiplerde kendiliğinden iyileşmesi üzerine ek girişim gerekmedi. Ameliyat sonrası yapılan tetkiklerde hastaların 11'inde (%92) tam taşsızlık sağlandığı görüldü. Rezidü taş görülen hastada ise JJ stent çekilmesi esnasında RIRC yapılarak 8 mm boyutundaki rezidü kalkül Thulium fiber laser (TFL) ile fragmante edilerek mutlak taşsızlık sağlandı. İlave girişim sonrası hastaların tamamında mutlak taşsızlığa ulaşıldı.



Resim 1.
Sol böbrek renal pelvis ve alt pol taşları için pür robotik pyelolitotomi yapılan hastanın intraoperatif görüntüleri
A - Renal pelvisi dolduran 32x27 mm boyutundaki kalkülün ekstrakte edilmesi
B ve C - Alt pole uzanım gösteren büyüğü 21x13 mm boyutundaki kalküllerin pyelotomi insizyonundan çıkarılması



Resim 2.
A- Renal pelvisi dolduran 37x19 mm boyutundaki kalkülün komplet olarak robotik forseps yardımı ile çıkarılması
B ve C - Alt ve orta kalikslerde yerleşimli çok sayıda ve küçük kalküllerin robotik trokar içerisinden ilerletilen flexibl üreterorenoskop yardımı ile endoskopik olarak vizualize edilmesi ve basket kateter ile çıkarılması

Tablo 1.

Hasta	Yaş	Taş boyutu *(mm)	Taş sayısı ve lokasyonu	Robotik taş cerrahisi	Cerrahi süresi (dk)	Tahmini kan kaybı (mL)	Nihai taşsızlık durumu
H1	34	30	Tek – Sol proksimal üreter	Robotik üreterolitotomi	123	50	Tam taşsızlık
H2	42	43	Çoklu – Sol orta ve alt kaliksler	Robotik pyelolitotomi + fleksibl üreterorenoskopi	135	25	Tam taşsızlık
H3	57	75	Çoklu –Sağ renal pelvis ve alt pol	Robotik pyelolitotomi + fleksibl üreterorenoskopi	324	50	Tam taşsızlık
H4*	67	68	Çoklu – Sol renal pelvis, alt-orta ve üst kaliks	Robotik pyelolitotomi + fleksibl üreterorenoskopi	180	50	Tam taşsızlık
H5	53	67	Çoklu – Sol staghorn	Robotik pyelolitotomi + fleksibl üreterorenoskopi	240	200	Tam taşsızlık
H6	58	53	Çoklu – Sol renal pelvis ve alt-orta kaliksler	Robotik pyelolitotomi + fleksibl üreterorenoskopi	225	50	Tam taşsızlık
H7	67	33	Çoklu – Sağ proksimal üreter ve alt kaliks	Robotik üreterolitotomi	120	150	Tam taşsızlık
H8	34	44	Çoklu – Sol alt kaliks	Robotik pyeloplasti + pyelolitotomi + fleksibl üreterorenoskopi	250	10	Tam taşsızlık
H9	74	20	Tek - Sol alt kaliks	Robotik parsiyel nefrektomi + robotik nefrolitotomi	180	300	Tam taşsızlık
H10	48	13	Tek – Sol proksimal üreter	Robotik parsiyel nefrektomi + ureterolitotomi + fleksibl üreterorenoskopi	120	150	Tam taşsızlık
H11	66	11	Tek - Sol proksimal üreter	Robotik parsiyel nefrektomi + üreterolitotomi	315	50	Tam taşsızlık
H12	68	15	Tek - Sol proksimal üreter	Robotik parsiyel nefrektomi + üreterolitotomi	200	50	Tam taşsızlık

* 8 mm boyutundaki rezidü kalkül JJ stent çıkarılması esnasında RIRC yapılarak Thulium fiber laser (TFL) ile fragmante edildi ve mutlak taşsızlık sağlandı

TARTIŞMA

2000 yılında ABD Gıda ve İlaç İdaresinin (FDA), da Vinci cerrahi robotunun (Intuitive Surgical Inc., Sunnyvale, CA) klinik amaçlarla kullanılmasını onaylaması ile robotik teknoloji üroloğlar tarafından geniş çapta benimsenmiş ve başta üroonkoloji ve rekonstruktif cerrahilerde olmak üzere giderek artan sıklıkta uygulanmaya başlamıştır (15). Oysaki ürolitiyazisin güncel tedavisinde kapladığı alan hem maliyeti hem robotik sistemlerin yaygınlığının sınırlı olması hem de endoürolojik prosedürler ile üst üriner sistem taşlarının büyük bir kısmının tedavi edilebilmesi nedeniyle henüz oldukça küçüktür. Buna bağlı olarak da ürolitiyazis tedavisinde robotik cerrahi kullanımını konu alan literatür verisi ya olgu sunumları ya da küçük hasta gruplarını içeren olgu serilerinden oluşmaktadır (3, 5, 6, 12-14, 16-21). Literatürdeki olgu serilerindeki düşük hasta sayıları düşünüldüğünde bizim serimizin 12 olgunun sonuçları ile literatüre önemli bir katkı verebildiği görüşündeyiz.

Hasta güvenliği ve klinik sonuçlar açısından da bulgularımız robotik taş cerrahisi ile ilgili yapılan diğer çalışmalarla uyumludur(1, 4). Ayrıca sonuçlarımız (yüksek mutlak taşsızlık ve düşük komplikasyon oranı) büyük ve kompleks üst üriner sistem taşlarının tedavisinde robotik platformların kullanımına ilişkin kanıt düzeyi yüksek çalışmalara olan ihtiyacı da doğrulamaktadır. Çalışmamızda yer alan hastaların hiçbirisinde intraoperatif komplikasyon yaşanmamakla birlikte robotik pyelolitotomi + fleksibl üreterorenoskopi ile kalkül ekstraksiyonu yapılmış bir hastada (%8,3) uzamış dren aktivitesi sebebiyle çekilen BT'de ürinoma saptanmış ve medikal tedavi ile spontan düzelmiştir (Modifiye Clavien-Dindo II). Robotik üreterolitotomi ve eş zamanlı parsiyel nefrektomi yapılan bir başka hastada ise postoperatif dönemde persiste eden hematüri ve Hb düşüşü için transfüzyon sonrası angiografi yapılmış ve parsiyel nefrektomi sahasında gelişmiş psödoanevrizma embolize edilmiştir (Modifiye Clavien-Dindo IIIa). Ayrıca robotik taş cerrahisi yapılan hastaların hiçbirisinde açık veya laparoskopik cerrahiye geçiş yapılmasına gerek duyulmamıştır.

Ürolitiyazisin aktif tedavisinin temel amacı mutlak taşsızlığı sağlamak olsa da SWL tedavisinin kullanıma girmesi ile 'klinik önemsiz rezidü fragman' (KÖRF) kavramı da taşsızlık tanımının içerisine dahil edilmiştir (22). KÖRF; küçük (<5mm), obstrüksiyon ve enfeksiyona yol açmayan, asemptomatik ve strüvit dışı taşları tanımlamak üzere kullanılsa da yıllar içerisinde bu rezidü fragmanların (RF) 'klinik önemsiz' olmaktan çok uzak olduğu çalışmalarda gösterilmiştir (23-25). PNL sonrası ≤ 4 mm RF saptanan hastaların komplikasyon ve taş progresyon oranlarının > 4 mm RF ile benzer olduğu saptanmıştır (25-27). Dahası, ≤ 4 mm RF saptanan hastaların %53'e ulaşan oranlarda anlamlı bir klinik olay yaşaması yada yeniden girişim gerekliliği, KÖRF tanımını tartışmalı hale getirmiştir. Güncel çok merkezli, retrospektif bir çalışmada PNL sonrası RF saptanan hastaların taş boyutundan bağımsız %27,1'inde yeniden girişim yapılmış, %11,4'ünde ise taşa bağlı klinik olay yaşanmıştır (23). Robotik cerrahi ise kalkülü fragmante etmeden mutlak taşsızlığı sağlayabildiğinden kısa dönem takiplerinde taşa bağlı klinik olay yaşanmaması ve yeniden girişim ihtiyacının minimal olması avantajına sahiptir (12). Bizim serimizde de sadece bir hastada yapılan postoperatif görüntülemede RF saptanarak mevcut JJ stent çıkarılması esnasında RIRC yapılmış ve mutlak taşsızlık sağlanmıştır. Tek seansta ise %92 olarak sağlanan mutlak taşsızlık da literatür verileri ile uyumlu olarak bulunmuştur (1,13)

Kompleks büyük böbrek taşlarının tedavisinde ilk PNL seansı sonrası %40'dan fazla hastada RF kalmasına bağlı olarak ikincil cerrahi işlem ihtiyacı doğabilmektedir (10, 11). Bu hasta grubunda ECIRS, hem tek seansta taşsızlık oranlarını arttırması hem de çoklu perkütan trakt oluşturma ihtiyacını minimize ederek olası komplikasyon riskini düşürmesi açısından kendisine bir yaşam sahası oluşturmuştur (28, 29). Fakat kombinasyon tedavileri sadece PNL-RIRC birlikteliği ile sınırlı değildir. Robotik cerrahiler sırasında abdominal trokardan ilerletilen fleksibl üreterorenoskop veya nefroskop vasıtası ile rigid robotik yardımcı enstrümanlar ile ulaşılamayan alt ve üst kalikslerin vizualize edilmesi ve bu alanlardaki kalküllerin de gerek lazer litotripsi ile fragmantasyonu gerekse basket kateter ile en-bloc ekstraksiyonu mümkün olabilmektedir (16, 17). Bizim çalışmamızda çoklu taş saptanan 7 hastanın 6'sında (%85,7) taşsızlık sağlamak için simultane endoluminal endoskopi yapılması ve basket kateter ile taş ekstraksiyonu gerekirken bir hastada pür robotik cerrahi ile mutlak taşsızlığa ulaşılmıştır. İntraoperatif taşsızlık sağlandığı düşünülen bir hastada

ise postoperatif yapılan görüntülemede RF saptanarak asenkron RIRC yapılarak mutlak taşsızlık mümkün olabilmiştir. Bu hastanın ameliyat kayıtları yeniden incelendiğinde büyük pelvis taşının ekstraksiyonu için pyelotomi insizyonunun rölatif büyük açılması gerektiği, irrigasyon mayiinin sızmasına bağlı toplayıcı sistemde yeterince basınç oluşmadığı ve doku koaptasyonundan dolayı RF kalan kaliks girişinin vizualize edilemediği düşünüldü. Çoklu taş için kombine cerrahi yapılan hastalar dışında robotik üreterolitotomi yapılan bir hastada da kalküle ulaşmak ve en-bloc çıkarılması için fleksibl üreterorenoskop kullanılması gerekti ve soliter kalkül basket kateter ile ekstrakte edilerek mutlak taşsızlık sağlandı.

Bu çalışmanın limitasyonları retrospektif yapısı, dahil edilen hasta sayısının az olması ve tek merkez verilerini içermesidir. Ancak bu limitasyonlar, robotik taş cerrahisinin nadir kompleks klinik senaryolarda tercih edilmesinden kaynaklanmaktadır. Ayrıca maliyet ve robotik cerrahi uygulayan merkez sayısının kısıtlı olması da bu limitasyonları desteklemektedir. Yeni robotik platformların klinik uygulamaya girmesi ile cihaz satın alma ve yardımcı ekipman maliyetlerindeki olası azalma, bu cerrahinin daha fazla merkezde yapılmasını ve etkinlik-maliyet oranında artışı sağlayabilir. Yine de güncel koşullarda her ne kadar robotik cerrahi muhtemelen daha büyük ön ekipman maliyetlerine sahip olsa da uygun şekilde seçilmiş bir kohortta daha düşük komplikasyon ve yeniden müdahale oranları, bu maliyetleri azaltma potansiyeline sahiptir. Robotik taş cerrahisinin yapıldığı hasta grubunun henüz kısıtlı olması hem prospektif hem de PNL ile randomize karşılaştırmalı (taşsızlık, maliyet-etkinlik, uzun dönem sonuçlar vb sonuçları içeren) bir çalışma yapılmasına engel olmaktadır.

SONUÇLAR

Tek merkez verilerini içeren çalışmamızın sonuçları, pür robotik veya eşlik eden endolüminal endoskopik yaklaşımın üst üriner sistem taş hastalığı tedavisinde güvenli ve etkin bir yöntem olduğuna dair mevcut bulunan kısıtlı literatür verisine katkıda bulunabilir. Kompleks klinik senaryolarda robotik cerrahi, tek seansta yüksek mutlak taşsızlık ve düşük komplikasyon oranları yanında cerrahların artan robotik böbrek cerrahisi deneyimi de düşünüldüğünde büyük böbrek taşlarının tedavisinde de alternatif olarak hastalara sunulabilir.

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Original Article
Özgün Araştırma

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Factors Affecting the Efficacy of Ureterorenoscopic Holmium: YAG Laser Lithotripsy in Ureteral Stones

Üreter Taşlarında Üreterorenoskopik Holmiyum: YAG Lazer Litotripsi Etkinliğini Etkileyen Faktörler

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ÖZET

Amaç: Üreterorenoskopik lazer litotripsi (URS-LL) için Holmium:Yttrium Aluminum Garnet (YAG) lazer altın standarttır. Lazer litotripsiyi etkileyen en önemli faktörler taş hacmi, taş yoğunluğu, taşın konumu, lazer ayarları ve lazer fiberinin özellikleridir. Biz bu çalışmada lazer litotripsi verimliğini etkileyen prediktif faktörleri objektif yöntemlerle ölçmeyi amaçladık.

Gereç ve Yöntemler: Ekim 2020- Şubat 2022 tarihleri arasında kliniğimizde üreter taşları için yapılmış URS-LL vakaları retrospektif olarak incelendi. Klinik anlamlı rezidü taşı kalan hastalar çalışmaya dahil edilmedi. Hastalar için Holmiyum:YAG lazer 550 µm fiber kullanıldı. Hastaların demogafik verileri, taş boyutu, taş hacmi, taş yoğunluğu hounsfield ünitesi (HU) olarak hesaplandı. Hastaların enerji (joule-J), frekans (hertz-Hz), güç (watt) değerleri ve toplam lazer kullanım süreleri kayıt edilerek toplam lazer enerji miktarı saptandı. Bu veriler elde edildikten sonra toplam enerji miktarı taş hacmine bölünerek 1mm^3 taşı parçalamak için gerekli enerji miktarı (J/mm^3) hesaplandı. Ayrıca taş hacmi toplam lazer süresine bölünerek saniyede parçalanan taş hacmi (mm^3/sn) hesaplandı.

Bulgular: Lazer süresi ≤240 sn ve >240 sn olan gruplar arasında enerji, frekans, güç anlamlı (p>0.05) farklılık göstermemiştir.Lazer süresi >240 sn olan grupta taş hacmi, taş HU değeri, toplam enerji, 1 mm^3 taşı parçalamak İçin kullanılan enerji, lazer süresi ≤240 sn olan gruptan anlamlı olarak daha yüksekti. Lazer süresi >240 sn olan grupta 1 sn'de kırılan taş hacmi (mm^3) lazer süresi ≤240 sn olan gruptan anlamlı olarak daha düşüktü. Lazer süresi ≤240 sn ve >240 sn olan hastaların ayrımında taş 1050 HU kestirim değerinin anlamlı etkinliği gözlenmiştir. Toplam Enerji >2750 J olan grupta taş hacmi, taş HU değeri, toplam enerji, 1 mm^3 taşı parçalamak için kullanılan enerji toplam enerji ≤ 2750 J olan gruptan anlamlı (p<0.05) olarak daha yüksekti. Toplam enerji >2750 J olan grupta 1 sn'de parçalanan taş hacmi (mm^3/sn) toplam enerji ≤ 2750 J olan gruptan anlamlı (p<0.05) olarak daha düşüktü.

Sonuç: Lazer litotripsinin etkinliğini ölçmek için bir saniyede parçalanan taş miktarı (mm^3/sn) ve 1 mm^3 taşı parçalamak için gerekli olan enerji miktarı (J/mm^3) gibi daha objektif verilere gereksinim vardır. Bu verilerin bilinmesi üreterorenoskopik lazer litotripsi etkinliğini artırmada prediktif bir faktör olabileceği düşünülmektedir.

Anahtar Kelimeler: Üreter Taşı, Ho:YAG Lazer Litotripsi, Joule, Frekans

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ABSTRACT

Objective: Holmium:Yttrium Aluminum Garnet (YAG) laser for ureterorenoscopic lithotripsy (URS-LL) is the gold standard. The most important factors affecting laser lithotripsy are stone volume, stone density, location of the stone, laser settings and properties of the laser fiber. We aimed to measure the predictive factors affecting the efficiency of lithotripsy with objective methods.

Materials and Methods: Between October 2020-February 2022 ureterorenoscopic laser lithotripsy (URS-LL) cases performed for ureteral stones in the our hospital. It was examined retrospectively. Patients with remaining clinically significant stones were not included in the study. Holmium:YAG laser 550 µm fiber was used. Demographic data of the patients, stone size, stone volume, stone density (hounsfield unit -HU) was recorded. The energy (joule-J), frequency (hertz-Hz), power (watt) values and total lasing time of the patients determined and the total laser energy amount was calculated. After the data is obtained, the total amount of energy is divided by the stone volume and the amount of energy required to fragment 1 mm^3 stone (J / mm^3) was calculated. Additionally, dividing the stone volume by on total laser time, fragmented stone volume per second (mm^3 / sec) was calculated.

Results: Energy, frequency and power did not differ significantly ($p>0.05$) between groups with laser duration ≤240 sec and >240 sec. Stone volume, stone HU value, total energy, and energy used to fragment 1 mm^3 stone were significantly higher in the group with laser duration >240 sec than in the group with laser duration ≤240 sec. The fragmented stone volume in 1 second (mm^3/s) in the group with laser duration >240 sec was significantly lower than the group with laser duration ≤240 sec. Significant efficacy of stone 1050 HU cut-off value was observed in the differentiation of patients with laser duration ≤240 sec and >240 sec. In the group with total energy >2750 J, stone volume, stone HU value, total energy, and energy used to break 1 mm^3 stone were significantly ($p<0.05$) higher than in the group with total energy ≤2750 J. In the group with total energy >2750 J, the fragmented stone volume in 1 second (mm^3/sec) was significantly ($p<0.05$) lower than in the group with total energy ≤2750 J.

Conclusion: In order to determine the effectiveness of laser lithotripsy more objective data is needed, such as fragmented stone volume in 1 second (mm^3/s) and the amount of energy required to the fragment 1 mm^3 stone (J/mm^3).

Keywords: Ureteral Stone, Holmium:YAG Laser Lithotripsy, Joule, Frequency

GİRİŞ

Üreter taşlarının tedavisi için üreteroskopik litotripsi daha az invaziv olması, daha az kan kaybı ve daha az hastanede kalış süresi nedeniyle standart hale geldi. Holmiyum:YAG lazer litotripsi, pnömatik litotripsi ile karşılaştırıldığında daha yüksek taşsızlık oranına ve daha düşük komplikasyon oranına sahiptir (1).

Holmiyum: YAG lazer, üriner sistem taşlarının cerrahi tedavisinde 1990 lardan başlayarak yaygın olarak kullanılan intrakorporeal bir litotriptördür (2). Holmium:YAG lazer retropulsiyonu azaltmak için darbe genişliğinin genişletilerek ve darbe modülasyon teknolojisi eklenerek iyileştirmeler yapıldı (3,4). Esneklik, çap, bükülmeyle kırılmaya karşı direnç ve uç konfigürasyonunun tümü, fiberin genel performansına katkıda bulunan önemli faktörlerdir ve bu özelliklerin anlaşılması, yapılacak prosedürler için uygun fiber seçiminde yardımcı olur (5). Fiberlerin çekirdek çapına göre belirtilen farklı boyutlar mevcuttur: Esnek ve rijit üreteroskoplarda sırasıyla 150–300 µm, rijit üreterorenoskop (URS) ve perkütan nefrolitotomi (PNL)'de 300–500 µm ve böbrek ve mesane taşlarının tedavisinde >500 µm kullanılır (2). Liflerin bir çekirdeği, bir kılıfı ve ceketi vardır. Yapıların her biri fiberin genel performansında önemli bir rol oynar (6). Holmiyum:YAG lazer, yakın kızılötesi spektrumda yaklaşık 2140 nm dalga boyunda çalışır. Bu, lazer enerjisinin suda emilmesiyle sonuçlanır ve dolayısıyla lazer litotripsinin gerçekleştirildiği sulu ortam için idealdir (7). Lazerin etkinliği, kullanılan lazer fiberinin türüne, darbe enerjisine ve frekans ayarlarına ve taşın bileşimine ve hacmine göre etkilenebilir (2). Lazer litotripside farklı yoğunluk ve hacimdeki taşlara lazer ayarlarını değiştirerek farklı frekans, enerji ve süre uygulayarak taş parçalanmasının etkilerini araştırmak mümkün olabilir. Özellikle yeni nesil holmiyum lazerlerle enerji, frekans ve frekans uzunluğunun değiştirilebilir ayarlamaları sayesinde ürologlar, 'parçalama' ve 'tozlama' tekniği arasında doğru seçim yapabilir. Son zamanlarda, Lumenis Pulse

P120H holmium lazere eklenen yeni bir özellik olan 'Moses modu' daha az retropulsiyon gösterdiği için, in vitro çalışmalarda lazer fiberden hedeflenen taşa daha iyi enerji aktarımı yaparak daha yüksek taş ablasyonunu sağladı (8). Biz de bu çalışmamızda Holmiyum:YAG lazer ile farklı yoğunluk ve hacimdeki taşlara farklı frekans ve enerji uygulayarak daha verimli taşın parçalanması için taş yoğunluğunun, taş hacminin, lazer kullanım süresinin ve lazer frekans ve enerji değerlerinin ne kadar etkili olduğunu göstermeyi amaçladık.

GEREÇ VE YÖNTEMLER

Bu çalışma hastanemiz etik kurulu tarafından onaylandıktan (2020-351) sonra kliniğimizde Ekim 2020 - Şubat 2022 tarihleri arasında üreter taşları nedeniyle üreterorenoskopik lazer litotripsi (URS-LL) uygulanan hastaların dataları retrospektif olarak incelenerek gerçekleştirildi. Çalışmaya 67 'si erkek 13'ü kadın 80 hasta dahil edildi. Birden fazla taşı olan ve klinik anlamlı rest taşı kalan hastalar çalışmaya dahil edilmedi. Tüm hastaların demografik verileri kayıt edildi. Tüm hastaların taş yoğunluğu (HU) ve taş hacmi bilgisayarlı tomografi (BT) ile saptandı. Ameliyat öncesi aksiyal görüntüler kontrastsız BT taramalarının koronal rekonstrüksiyonları ile elde edildi ve toplam taş hacmi uzunluk x yükseklik x genişlik x $\pi \times 1/6$ formülü kullanılarak hesaplandı (9). Hastalar için Sphinx 30 litho cihazı ve holmium YAG lazer 550 µm fiber kullanıldı. Lazer ayarları için enerji median değeri 1,5(0,6-1,9) J, frekans median değeri 10 (7,8-15) Hz, güç median değeri 15 (8-18) watt kullanıldı. Ameliyat bitiminde hastalara ait olan enerji,frekans, güç değerleri ve total lazer kullanım süreleri kayıt edildi. Sonrasında toplam enerji hesaplanarak, 1mm^3 taşın parçalanmasında kullanılan enerji (J/mm^3) ve 1 saniyede kırılan taş hacmi (mm^3/sn) değerleri saptandı. Hastalar etki düzey ve kestirim değerleri receiver operating characteristic (ROC) eğrisi ile araştırılması sonucu hastalar toplam lazer enerjisi, taş yoğunluğu (HU), toplam lazer süresine göre ikili gruplara ayrılarak analiz edildi. Bununla birlikte hastalar güç, frekans, enerji ,cinsiyet, yaş ve tarafa göre ayrıca değerlendirildi.

İstatistiksel Yöntem

Verilerin tanımlayıcı istatistiklerinde ortalama, standart sapma, medyan, en düşük, en yüksek, frekans ve oran değerleri kullanılmıştır. Değişkenlerin dağılımı Kolmogorov-Smirnov test ile ölçüldü. Nicel bağımsız verilerin analizinde Mann-Whitney U test kullanıldı. Nitel bağımsız verilerin analizinde Ki-kare test, Ki-kare test koşulları sağlanmadığında Fisher's exact test kullanıldı. Etki düzey ve kestirim değeri ROC eğrisi ile araştırıldı. Etki düzeyi tek değişkenli ve çok değişkenli lojistik regresyon ile araştırıldı. Analizlerde SPSS 28.0 programı kullanılmıştır.

İstatistiksel olarak anlamlı p değeri $p<0,05$ olarak kabul edildi.

BULGULAR

Çalışmaya dahil edilen 80 hastanın 63'ü erkek (%78,7), 17'si kadın (%21,3) ort. yaşları 46,5±13,6 idi. Taş tarafı sol 37 (%46,3), sağ 43 (%53,7) idi. Hastaların median taş hacmi 357 (91,8-1705) mm^3, median taş yoğunluğu 1125 (500-1550) HU olarak saptandı. Toplam median lazer enerjisi 2743 (266-22258) J, median lazer süresi 193 (21,1-1484) saniye olarak hesaplandı. Taşın parçalanması için kullanılan median toplam enerji 2874 (1617-4332) J , median lazer süresi 224 (128-298) saniye olarak hesaplandı. 1mm^3 taşı parçalamak için median enerji miktarı 8,8 (0,38-38,7) J, 1 saniyede parçalanan median taş hacmi ise 1,7 (0,39-3,92) mm^3 olarak hesaplandı (Tablo-1).

Lazer süresi >240 sn olan grupta hastaların yaşı lazer süresi ≤240 sn olan gruptan anlamlı olarak daha düşüktü. Lazer süresi >240 sn olan grupta erkek hasta oranı lazer süresi ≤240 sn olan gruptan anlamlı olarak daha yüksekti. Lazer süresi ≤240 sn ve >240 sn olan gruplar arasında taş tarafı anlamlı ($p>0,05$) farklılık göstermemiştir. Lazer süresi >240 sn olan grupta taş hacmi, taş HU değeri, toplam enerji, 1 mm^3 taşı parçalamak için kullanılan enerji, lazer süresi ≤240 sn olan gruptan anlamlı olarak daha yüksekti. Lazer süresi >240 sn olan grupta 1 sn'de parçalanan taş hacmi (mm^3) lazer süresi ≤240 sn olan gruptan anlamlı olarak daha düşüktü. Lazer süresi ≤240 sn ve >240 sn olan gruplar arasında enerji, frekans, güç anlamlı

(p>0,05) farklılık göstermemiştir (Tablo 2).

Tek değişkenli modelde lazer süresi >240 sn olmasına yaş, cinsiyet, taş hacmi, taş HU değeri, toplam enerji, 1 mm^3 taşı parçalamak için kullanılan enerji, 1 sn'de kaç mm^3 taş parçalandığının anlamlı (p<0,05) etkisi gözlenmiştir (Tablo 3).

Çok değişkenli indirgenmiş modelde Lazer süresi >240 sn olmasına cinsiyet, taş, HU değeri, 1 sn'de kaç mm^3 taş parçalandığının anlamlı-bağımsız (p<0,05) etkisi gözlenmiştir (Tablo 3).

Lazer süresi ≤240 sn ve >240 sn olan hastaların ayrımında taş HU değerinin anlamlı (Eğri altı alan 0,737 (0,630-0,845)) etkinliği gözlenmiştir. Lazer süresi ≤240 sn ve >240 sn olan hastaların ayrımında taş 1050 HU kestirim değerinin anlamlı (Eğri altı alan 0,713 (0,599-0,827)) etkinliği gözlenmiştir. Duyarlılık % 86,7, pozitif kestirim % 54,2, özgüllük % 56,0, negatif kestirim % 87,5 di (Tablo 4).

Toplam enerji ≤2750 J ve >2750 J olan gruplar arasında hastaların yaşı anlamlı (p>0,05) farklılık göstermemiştir. Toplam Enerji >2750 J olan grupta erkek hasta oranı toplam enerji ≤2750 J olan gruptan anlamlı (p<0,05) olarak daha yüksekti. Toplam enerji >2750 J olan grupta taş hacmi, taş HU değeri, toplam enerji, 1 mm^3 taşı parçalamak için kullanılan enerji toplam enerji ≤2750 J olan gruptan anlamlı (p<0,05) olarak daha yüksekti. Toplam enerji >2750 J olan grupta 1 sn'de parçalanan mm^3 taş hacmi toplam enerji ≤2750 J olan gruptan anlamlı (p <0,05) olarak daha düşüktü (Tablo 5).

Toplam enerji >2750 J olan grupta enerji, güç değeri, toplam enerji ≤2750 J olan gruptan anlamlı (p <0,05) olarak daha yüksekti.Toplam enerji >2750 J olan grupta frekans değeri toplam enerji ≤2750 J olan gruptan anlamlı (p <0,05) olarak daha düşüktü (Tablo 5).

Toplam enerji ≤2750 J ve >2750 J olan hastaların ayrımında taş HU değerinin anlamlı (Eğri altı alan 0,696 (0,579-0,814)) etkinliği gözlenmiştir. Toplam enerji ≤2750 J ve >2750 J olan hastaların ayrımında taş 1050 HU kestirim değerinin anlamlı (Eğri altı alan 0,690 (0,573-0,808)) etkinliği gözlenmiştir. Duyarlılık % 79,5, pozitif kestirim % 64,6, özgüllük % 58,5, negatif kestirim % 75,0 idi (Tablo 6).

Tablo 1. Hastaların demografik bilgileri, taş özellikleri ve lazer parametre değerleri

		Medyan	n-%	I.Q-3.Q (IQR)
Yaş		46.0		36,0-54,0
Cinsiyet	Kadın		17	(21.3)
	Erkek		63	(78.7)
Taş Tarafı	Sol		37	(46.3)
	Sağ		43	(53.7)
Taş Hacmi (mm^3)		357		205-571
Taş HU		1125		958-1300
Toplam Enerji (J)		2743		1537-4580
Lazer Süresi		193		108-280
1 mm^3 Taş Parçalamak İçin Kullanılan Enerji (J)		8,8		5,0-13,3
1 Sn'de Parçalanan Taş (mm^3)		1,7		1,1-3,0
Enerji (J)		1,5		5-1,5
Frekans (Hz)		10,0		10,0-10,0
Güç (Watt)		15,0		15,0-15,0

Tablo 2. Hastaların taş özellikleri ve kullanılan lazer ayarlarının lazer süresine göre karşılaştırmalı analizi

		I.Q-3.Q (IQR)	n (%)	Medyan	I.Q-3.Q (IQR)	n (%)	Medyan	P	
Yaş		42-57		50,5	32,8-46,3		43,0	0,004	m
Cinsiyet	Kadın		16 (%32)			1 (%3,3)		0,002	X^2
	Erkek		34 (%68)			29 (%96,7)			
Taş Tarafı	Sol		20 (%40)			17 (%56,7)		0,148	X^2
	Sağ		30 (%60)			13 (%46,3)			
Taş Hacmi (mm^3)		172-413		266	357-828		473	0,001	m
Taş HU		750-1200		1000	1100-1300		1250	0,001	m
Toplam Enerji (J)		1097-2743		1641	4020-11529		5276	0,001	m
Lazer Süresi		84,5-183		134	268-672		386	0,001	m
1 mm^3 Taş Parçalamak İçin Kullanılan Enerji (J)		4,2-10,1		6,0	8,8-21,2		11,4	0,001	m
1 Sn'de Parçalanan Taş (mm^3)		1,3-3,6		2,5	0,71-1,7		1,4	0,001	m
Enerji		1,5-1,5		1,5	1,5-1,5		1,5	0,409	m
Frekans		10,0-10,0		10,0	10,0-10,0		10,0	0,598	m
Güç		15,0-15,0		15,0	15,0-15,0		15,0	0,302	m

X^2 Ki-kare test / m Mann-Whitney U test

Tablo 3. Tek Değişkenli ve Çok Değişkenli Analiz Sonuçları

	Tek Değişkenli Model					Çok Değişkenli Model				
	RR	% 95 GA			p	RR	% 95 GA			p
Yaş	0,948	0,911	-	0,986	0,008					
Cinsiyet	13,65	1,70	-	109,25	0,014	20,36	2,31	-	179,46	0,007
Taş Tarafı	0,510	0,204	-	1,276	0,150					
Taş Hacmi (mm^3)	1,002	1,001	-	1,004	0,008					
Taş HU	1,005	1,002	-	1,007	0,001	1,005	1,002	-	1,009	0,004
Toplam Enerji (J)	1,003	1,001	-	1,004	0,001					
1mm^3 Taşı Parçalamak İçin Kullanılan Enerji (J)	1,144	1,055	-	1,241	0,001					
1 sn'de Parçalanan Taş (mm^3/sn)	0,358	0,193	-	0,666	0,001	0,403	0,194	-	0,836	0,015
Enerji (J)	2,71	0,42	-	17,41	0,293					
Frekans (Hz)	0,926	0,660	-	1,297	0,653					
Güç (Watt)	1,126	0,896	-	1,415	0,310					

Lojistik Regresyon (Forward LR)

Tablo 4. Taş Hounsfield ünitesi değeri ile lazer süresi öngörü modelinin duyarlılık, özgüllük değerleri

		Eğri Altı Alan		% 95 GA			p
Taş HU		0,737		0,630	-	0,845	0,001
Taş 1050 HU kestirim değeri		0,713		0,599	-	0,827	0,001
		Lazer Süresi					
		≤ 240 sn	> 240 sn				
Taş HU	≤1050	28	4	Duyarlılık			86,7%
	>1050	22	26	Pozitif Kestirim			54,2%
				Özgüllük			56,0%
				Negatif Kestirim			87,5%

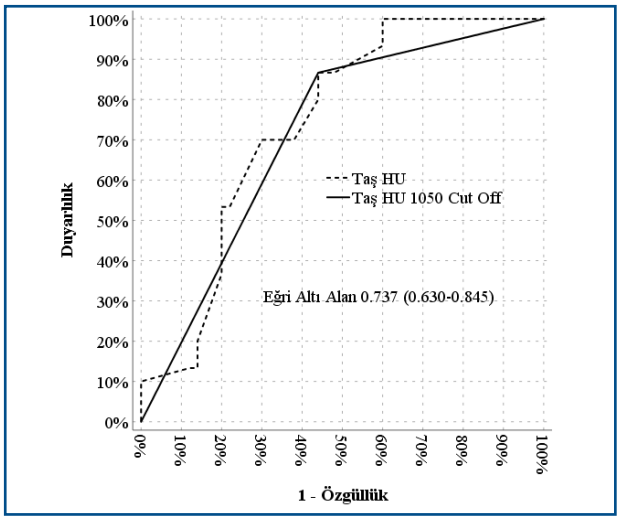
Tablo 5. Hastaların taş özellikleri ve kullanılan lazer ayarlarının toplam enerji miktarına göre karşılaştırmalı analizi

		Toplam Enerji ≤ 2750 J			Toplam Enerji > 2750 J			p	
		I.Q-3.Q (IQR)	n (%)	Medyan	I.Q-3.Q (IQR)	n (%)	Medyan		
Yaş		36-58		48,0	33-53		44,0	0,353	m
Cinsiyet	Kadın		13 (%31,7)			4 (%10,3)		***0,019***	X^2
	Erkek		28 (%68,3)			35 (%89,7)			
Taş Tarafı	Sol		20 (%48,8)			17 (%43,6)		0,642	X^2
	Sağ		21 (%52,2)			22 (%56,4)			
Taş Hacmi (mm^3)		170-398		266	322-621		410	***0,001***	m
Taş HU		775-1200		1000	1090-1300		1250	***0,002***	m
Lazer Süresi		73,3-150		108	236-638		280	***0,001***	m
1 mm^3 Taş Parçalamak İçin Kullanılan Enerji (J)		3,5-7,9		5,9	8,8-21,1		11,6	***0,001***	m
1Sn'de Parçalanan Taş (mm^3)		1,5-4,1		2,6	0,71-1,7		1,3	***0,001***	m
Enerji (J)		1,3-1,5		1,5	1,5-1,5		1,5	***0,002***	m
Frekans (Hz)		10,0-11,0		10,0	10,0-10,0		10,0	***0,002***	m
Güç (Watt)		12,5-15,0		15,0	15,0-15,0		15,0	***0,019***	m

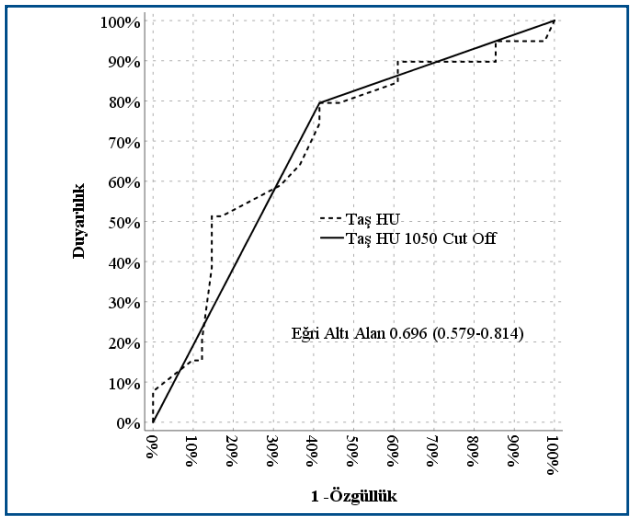
X^2 Ki-kare test / m Mann-Whitney U test

Tablo 6. Taş Hounsfield ünitesi değeri ile kullanılan toplam enerji öngörü modelinin duyarlılık, özgüllük değerleri

		Eğri Altı Alan		% 95 GA			p
Taş HU		0,696		0,579	-	0,814	0,003
Taş 1050 HU kestirim değeri		0,690		0,573	-	0,808	0,003
		Toplam Enerji					
		≤ 2750	> 22750				
Taş HU	≤1050	24	8	Duyarlılık			79,5%
	>1050	17	31	Pozitif Kestirim			64,6%
				Özgüllük			58,5%
				Negatif Kestirim			75,0%



Figür 1. Taş Hounsfield ünitesi değeri ile lazer süresi öngörü modelinin ROC eğrisi



Figür 2. Taş Hounsfield ünitesi değeri ile kullanılan toplam enerji öngörü modelinin ROC Eğrisi

TARTIŞMA

Holmium: YAG lazere potansiyel alternatifler (frekansı iki katına çıkarılmış, çift darbeli YAG (FREDDY), erbiyum: YAG, femtosaniye ve tülyum fiber lazerler) gibi yeni lazer teknolojileri araştırılıyor olsa da halen son 20 yıldır URS-LL de en çok tercih edilen lazer olmuştur (10). Lazer litotripsi etkinliği taş yoğunluğu,taş hacmi, taşın konumu, lazer fiberinin özelliği, lazer ayarlarındaki, frekans, güç ve enerjiye bağlıdır (2,11). Molina ve ark. çalışmalarında taş boyutu ve hacminin lazer enerjisi ile anlamlı pozitif korelasyonu vardı, HU ve lazer süresi arasındaki korelasyon ise anlamlıydı (12). Bizim çalışmamızda da yüksek hacim ve yoğunluktaki taşlar düşük hacim ve yoğunluktaki taşlara göre daha uzun lazer kullanım süresi ve daha fazla toplam enerji gerektirdiği görüldü. Bizim çalışmamızda yüksek hacim ve yoğunluktaki taşların 1 mm^3 birim taşı parçalamak için kullanılan enerji daha fazla saptanırken 1 sn de parçalanan taş hacmi ise daha azdı. Lazer kullanım süresi uzadıkça, taş yoğunluğu ve hacmi arttıkça 1 mm^3 birim taşı parçalamak için daha fazla enerjiye gereksinim olduğu saptandı. Diğer tarafta ise Ntasiotis ve ark. taş tipi ve atım süresi ne olursa olsun, daha yüksek enerjilerle daha yüksek güç ayarlarının kullanılması ablasyon oranlarını artırdığını ve uzun atım süresi kullanılan sert taşlarda ve kısa atım süresi kullanılan yumuşak taşlarda daha yüksek ablasyon oranlarını göstermiştir (13). Çalışmamızda toplam lazer süresi ile frekans arasında anlamlı farklılık yokken toplam enerji ile frekans arasında anlamlı farklılık saptandı. Aldoukhi ve ark. ise fiber hızının arttırılması, yüksek frekans ayarları kullanıldığında taş ablasyonunu artırdığını ve fiber sabitlendiğinde, atım frekansının arttırılmasının ablasyonda minimum kazanıma yol açtığı bir eşik olduğunu bildirdiler (14). Bizim çalışmamızda1 mm^3 taşı parçalamak için median enerji miktarı 8,8 J, 1 saniyede parçalanan median taş hacmi ise 1,7 mm^3 olarak saptanmışken, Majdalany ve ark. sırasıyla 38,2 J/mm^3 , 0,9 mm^3/sn; Ventimiglia ve ark. ise sırasıyla 19 J/mm^3 ve 0,7mm^3/sn olarak buldular (15,16). Buna karşın Chen ve ark. parçalama ve tozlama modellerinde enerji ve frekans ayarlarının taşsızlık oranı üzerinde anlamlı bir etkisi olmadığını öne sürdüler (17). Çalışmalarda farklı sonuçların ortaya konması daha fazla enerji ve frekans çeşitliliğine gereksinim olduğunu göstermektedir .Benzer şekilde hasta örneklemesinin az olması bizim çalışmamızın da kısıtlılıkları arasında idi. Kuroda ve ark taş hacmi, maksimum HU'lar, operatör deneyimi, cinsiyet, preoperatif stentleme ve üreteral kılıf çapında oluşan 6 preoperatif özellikten yararlanarak fleksibl URS-LL sırasında ameliyat süresini tahmin etmek için bir model geliştirdiklerini bildirdiler (18). Shrestha ve ark toplam enerji ve J/mm^3 değerlerini yüksek güç grubunda düşük güç grubuna göre daha yüksek buldular; lazer süresi, ameliyat süresi, ablasyon hızı ve taşsızlık oranını ise benzer buldular (19). Çalışmamızda taş yoğunluğu,

taş hacmi, toplam lazer süresi, enerji, güç ve frekans faktörlerini kullanarak toplam lazer süresi, toplam enerji verilerini elde ettik. Bu verilerle 1 mm^3 birim taşı parçalamak için kullanılan enerji (mm^3/J) ve 1 sn de kırılan taş hacmi (mm^3/sn) birim değerlerinin önemli objektif bir faktör olarak düşünülmektedir. Literatürler incelendiğinde bu faktörlerin yanı sıra lazer fiberin türü ve çapı, cerrahın deneyimi, taşın komposizyonu ve lokalizasyonu gibi birçok faktör lazer litotripsi etkinliğinde rol oynamaktadır.

SONUÇ

Üreter taşlarında Holmium:YAG lazer litotripside taş yoğunluğu, taş hacmi ,toplam lazer süresi ve toplam enerji verilerinden elde edilen bir saniyede parçalanan taş miktarı (mm^3/sn) ve 1 mm^3 taşı parçalamak için gerekli enerji miktarı (J/mm^3) değerleri objektif prediktif faktörler olarak kullanılabileceğini düşünmekteyiz. Bununla birlikte daha fazla sayıda objektif prediktif faktörleri saptamak için çok merkezli geniş vakaları içeren çalışmalara gereksinim vardır.

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- Ana belge (Tüm makalelerde, ana metinden önce de Özet bölümü yer almalıdır)
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Yazılar bilgisayar ile çift aralıklı olarak 12 punto büyüklüğünde ve Times New Roman karakteri ile yazılmalıdır. Her sayfanın bütün kenarlarında en az 2.5 cm boşluk bırakılmalıdır. Ana metin, yazarların adları ve kurulları hakkında hiçbir bilgi içermemelidir.
Yayın çeşitleri;

Araştırma Türü	Özet	Kelime Sayısı	Referans Sayısı	Tablo ve Figürler
Özgün Araştırma	250	4000	30	10
Derleme	250	5000	100	10
Olgu Sunumu	300	2000	20	10

Özgün makaleler yapılandırılmış bir Özet (abstract) (Giriş, Gereç ve yöntemler, Bulgular, Sonuçlar, Referanslar, Tartışma, gerekli ise Onam, Figürler; resim, grafik çizim, video, Tablolar) içermelidir.
Olgu sunumları için yapılandırılmış Özet gerekmez. Özet bölümü 300 sözcük ile sınırlandırılmalıdır. Özet de kaynaklar, tablolar ve atıflar kullanılamaz. Özün bittiği satırın altında sayısı 3-5 arasında olmak üzere anahtar kelimeler verilmelidir.
Türkiye dışındaki ülkelerden yazı gönderen yazarlar için Başlık, Özet, Anahtar Kelimeler ve yazıyla ilgili diğer bazı temel bölümlerin Türkçe olarak gönderilmesi zorunlu değildir. Bu bölümlerin çevirileri, yazarlar tarafından gönderilen özgün İngilizce metinler dikkate alınarak dergi editörlüğü tarafından yapılacaktır.
Makalede kullanılan tüm kısaltmalar, ilk kullanımda tanımlanmalıdır. Kısaltma, tanımı ardından parantez içinde verilmelidir.
Ana metinde bir ilaç, ürün, donanım veya yazılım programından bahsedildiğinde, ürünün adı, ürünün üreticisi, üretim şehri ve üreten şirketin ülkesi de dahil olmak üzere ürün bilgileri (ABD'de ise devlet dahil) parantez içinde verilmelidir.
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Tüm kaynaklara, tablolara ve şekillere ana metinde atıfta bulunulmalı ve kaynaklar, ana metinde geçen sıraya göre numaralandırılmalıdır. Kullanılan semboller, sembollerin standart kullanımlarına uygun olmalıdır.
Özgün Araştırma makaleleri klinik veya temel araştırma sonuçlarını içermeli, eleştirel okuyucular için kabul edilebilir olacak kadar iyi belgelenmelidir. En fazla 4000 kelime olmalı ve sırasıyla aşağıdaki başlıkları içermelidir;

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- Gereç ve yöntemler
- Bulgular

- Tartışma
- Sonuçlar
- Şekillerin ve tabloların başlıkları (gerekirse)
- Kaynaklar

Olgu sunumları en fazla 2000 kelime olmalı ve sırasıyla aşağıdaki başlıkları içermelidir;

- Başlık (hem Türkçe hem İngilizce)
- Özet (hem Türkçe hem İngilizce)
- Anahtar Kelimeler (hem Türkçe hem İngilizce)
- Giriş
- Olgu sunumu
- Tartışma ve Sonuç
- Şekillerin ve tabloların başlıkları (gerekirse)
- Kaynaklar

Derlemeler yapılandırılmış olmalı, en fazla 5000 kelimeden oluşmalı ve sırasıyla aşağıdaki başlıkları içermelidir;

- Başlık (hem Türkçe hem İngilizce)
- Özet (hem Türkçe hem İngilizce)
- Anahtar Kelimeler (hem Türkçe hem İngilizce)
- Ana metin
- Sonuç
- Şekillerin ve tabloların başlıkları (gerekirse)
- Kaynaklar

Sistematik derlemeler için yazarla PRISMA yönergelerine uymalıdır; http://www.prisma-statement.org/documents/PRISMA%202009%20checklist.pdf

Editöre Mektuplar en fazla 1000 kelime olmalı ve aşağıdaki alt başlıkları içermelidir;

- Başlık
- Anahtar kelimeler
- Ana metin
- Şekillerin ve tabloların başlıkları (gerekirse)
- Kaynaklar

Şekillerin ve tabloların yayına hazırlığı

- Şekiller, grafikler ve fotoğraflar, makale yükleme sistemi aracılığıyla ayrı dosyalar (JPEG formatında) halinde sunulmalıdır.
- Dosyalar bir Word belgesine veya ana belgeye gömülmemelidir.
- Şeklin alt birimleri olduğunda; alt birimler tek bir görüntü oluşturmak için birleştirilmemelidir. Her alt birim, başvuru sistemi aracılığıyla ayrı ayrı sunulmalıdır.
- Şekil alt birimlerini belirtmek için görüntüler Arabik rakamlarla (1,2,3...) numaralandırılmalıdır.
- Gönderilen her bir şeklin en düşük çözünürlüğü 300 DPI olmalıdır.
- Şekillerin başlıkları ana belgenin sonunda listelenmelidir.
- Bilgi veya resimler hastaların tanımlanmasına izin vermemelidir. Kullanılan herhangi bir fotoğraf için hastadan ve/veya yasal temsilcisinden yazılı bilgilendirilmiş onam alınmalıdır.

Tablolar ana belgeye gömülmeli veya ayrı dosyalar halinde sunulmalıdır. Tablo sayısı altı adet ile sınırlandırılmalıdır. Tüm tablolar, ana metinde kullanıldığı sırayla art arda numaralandırılmalıdır. Tablo başlıkları ve açıklamaları ana belgenin sonunda listelenmelidir.

Kaynaklar

Kaynaklar yazıda kullanılan kaynaklar cümlenin sonunda parantez içinde belirtilmelidir. Kaynaklar makalenin sonunda yer almalı ve makalede geçiş sırasına göre sıralanmalıdır. Kaynaklar yazarların soyadlarını ve adlarının baş harflerini, makalenin başlığını, derginin adını, basım yılını, sayısını, başlangıç ve bitiş sayfalarını belirtmelidir. Altı ve daha fazla yazarı olan makalelerde ilk 3 yazardan sonrası için 'et al.' veya 've ark.' ifadesi kullanılmalıdır. Kısaltmalar Index Medicus' a uygun olmalıdır.
Kaynakların sonuna alıntı yapılan makalelerin doi linki eklenmelidir.

Örnekler

Makaleler için:

1. Tasci A, Tugcu V, Ozbay B, Mutlu B, Cicekler O. Stone formation in prostatic urethra after potassium-titanyl-phosphate laser ablation of the prostate for benign prostatic hyperplasia. J Endourol 2009;23:1879-81. https://doi.org/10.1089/end.2008.0596

Kitap için:

1.Günalp İ: Modern Üroloji. Ankara: Yargıçoğlu matbaası, 1975. Kitap bölümleri için: Anderson JL, Muhlestein JB. Extra corporeal ureteric stenting during laparoscopic pyeloplasty. Philadelphia: W.B. Saunders; 2003. p. 288-307

Web sitesi için;

Gaudin S. How moon landing changed technology history [Internet]. Computerworld UK. 2009 [cited 15 June 2014]. Available from: http://www.computerworlduk.com/in-depth/it-business/2387/how-moon-landing-changed-technology-history/

Bildiriler için;

Proceedings of the Symposium on Robotics, Mechatronics and Animatronics in the Creative and Entertainment Industries and Arts. SSAISB 2005 Convention. University of Hertfordshire, Hatfield, UK; 2005.

Tez için;

Ercan S. Venöz yetmezlikli hastalarda kalf kası egzersizlerinin venöz fonksiyona ve kas gücüne etkisi. Süleyman Demirel Üniversitesi Tıp Fakültesi Spor Hekimliği Anabilim Dalı Uzmanlık Tezi. Isparta: Süleyman Demirel Üniversitesi. 2016.

Geri Çekme veya Reddetme

Yazıyı Geri Çekme: Gönderilen yazının değerlendirme sürecinde gecikme olması vb. gibi gerekçelerle yazıyı geri çekmek ve başka bir yerde yayınlatmak isteyen yazarlar yazılı bir başvuru ile yazılarını dergiden geri çekebilirler.

Yazı Reddi: Yayınlanması kabul edilmeyen yazılar, gerekçesi ile geri gönderilir.

Kabul sonrası

Makalenin kabul edilmesi durumunda, kabul mektubu iki hafta içinde sorumlu yazara gönderilir. Makalenin baskıdan önceki son hali yazarın son kontrolüne sunulur. Dergi sahibi ve yayın kurulu, kabul edilen makalenin derginin hangi sayısında basılacağına karar vermeye yetkilidir.

Yazarlar, makalelerini kişisel veya kurumsal web sitelerinde, uygun alıntı ve kütüphane kurallarına bağlı kalarak yayınlayabilirler.

PREPARATION OF MANUSCRIPT

Manuscripts can only be submitted through the journal's online manuscript submission and evaluation system, available at https://dergipark.org.tr/ Manuscripts submitted via any other medium will not be evaluated.

Manuscripts submitted to the journal will first go through a technical evaluation process where the editorial office staff will ensure that the manuscript has been prepared and submitted following the journal's guidelines. Submissions that do not conform to the journal's guidelines will be returned to the submitting author with technical correction requests. The editor reserves the right to reject manuscripts that do not comply with the aforementioned requirements. Corrections may be done without changing the main text.

Authors are required to submit the following:

- Copyright Agreement&Acknowledgement of Authorship Form,
- Informed Consent Form
- ICMJE Disclosure of Interest Form
- Title Page (including Title of Manuscript, Running title, author (s) 's name, title, and institution, corresponding author's contact information, Name of the organization supporting the research)
- Main document (All articles should have an abstract before the main text).
- Figures (Jpeg format)
- Tables (max 6 tables)

Preparation of the Main Document

The articles should be written double-spaced in 12 pt, Times New Roman character and at least 2.5 cm from all edges of each page. The main text should not contain any information about the authors' names and affiliations.

Publication Types;

Type of Article	Abstract	Text (Word)	References	Table&Figures
Original Article	250	4000	30	10
Review Article	250	5000	100	10
Case Reports	300	2000	20	10

Original articles should have a structured abstract. (Aim, Material and Methods, Results, Conclusion). For case reports, the structured abstract is not used. Limit the abstract to 300 words. References, tables, and citations should not be used in an abstract. Authors must include relevant keywords (3-5) on the line following the end of the abstract. The Turkish title, abstracts, and Turkish keywords are not required for the international authors. The editorial office will provide these.
All acronyms and abbreviations used in the manuscript should be defined first, both in the abstract and in the main text. The abbreviation should be provided in parentheses following the definition.
When a drug, product, hardware, or software program is mentioned within the main text, product information, including the name of the product, the producer of the product, and city and the country of the company (including the state if in the USA), should be provided in parentheses.
All references, tables, and figures should be referred to within the main text, and they should be numbered consecutively in the order they are referred to within the main text. The symbols used must be nomenclature used standards.
Original Research Articles should be maximum of 4000 words and include subheadings below;

- Title (both in Turkish and English)
- Abstract (both in Turkish and English)
- Keywords (both in Turkish and English)
- Introduction
- Material and Methods
- Results
- Discussion
- Conclusions
- Figures and Tables Legend (if necessary)
- References

Case Reports should be maximum of 2000 words and include subheadings below;

- Title (both in Turkish and English)
- Abstract (both in Turkish and English)
- Keywords (both in Turkish and English)
- Introduction
- Case Presentation
- Discussion and Conclusion
- Figures and Tables Legend (if necessary)
- References

Literature Reviews should be maximum of 5000 words and include subheadings below;

- Title (both in Turkish and English)
- Abstract (both in Turkish and English)
- Keywords (both in Turkish and English)
- Main text
- Conclusion
- Figures and Tables Legend (if necessary)
- References

Letters to the editor should be maximum of 1000 words and should include subheadings below;

- Title
- Keywords
- Main text

- Figures and Tables Legend (if necessary)
- References

Preparation of the Figures and Tables

The submission system should submit figures, graphics, and photographs as separate files (in JPEG format).

- The files should not be embedded in a Word document or the main document.
- When there are figure subunits, the subunits should not be merged to form a single image. Each subunit should be submitted separately through the submission system.
- Arabic numbers should number images to indicate figure subunits.
- The minimum resolution of each submitted figure should be 300 DPI.
- Figure legends should be listed at the end of the main document.
- Information or illustrations must not permit the identification of patients, and written informed consent for publication must be sought for any photograph.

Tables should be embedded in the main document or submitted as separate files, but if tables are submitted separately, please note where it is suitable in the main text. Tables are limited to six tables. All tables should be numbered consecutively in the order they are used to within the main text. Tables legends should be listed at the end of the main document.

References

The references used in the article must be written in parenthesis at the end of the sentences. References should be numbered in the order they appear in the text and placed at the end of the article. References must contain surnames and initials of all authors, article title, name of the journal, the year, and the first and last page numbers. Articles with 6 or more authors 'et al.' are mixed with the first three authors. Abbreviations should be according to index Medicus.
Authors must add the DOI (Digital object identifier) at the end of each reference.

For Examples;
Article in journal: 1. Tasci A, Tugcu V, Ozbay B, Mutlu B, Cicekler O. Stone formation in prostatic urethra after potassium-titanyl-phosphate laser ablation of the prostate for benign prostatic hyperplasia. J Endourol 2009;23:1879-81. https://doi.org/10.1089/end.2008.0596
For Books: 1.Günalp İ: Modern Üroloji. Ankara: Yargıçoğlu matbaası, 1975. Chapters in books: Anderson JL, Muhlestein JB. Extra corporeal ureteric stenting during laparoscopic pyeloplasty. Philadelphia: W.B. Saunders; 2003. p. 288-307
For website; Gaudin S. How moon landing changed technology history [Internet]. Computerworld UK. 2009 [cited 15 June 2014]. Available from: http://www.computerworlduk.com/in-depth/it-business/2387/how-moon-landing-changed-technology-history/
For conference proceeding; Proceedings of the Symposium on Robotics, Mechatronics and Animatronics in the Creative and Entertainment Industries and Arts. SSAISB 2005 Convention. University of Hertfordshire, Hatfield, UK; 2005.
For Thesis; Ercan S. Venöz yetmezlikli hastalarda kalf kası egzersizlerinin venöz fonksiyona ve kas gücüne etkisi. Suleyman Demirel University Faculty of Medicine Sports Medicine Department Thesis. Isparta: Suleyman Demirel University. 2016.
Retraction or Reject; Manuscript Retraction: For other reasons, authors may withdraw their manuscript from the journal with a written declaration.

Manuscript Reject

The manuscripts which are not accepted to be published are rejected with explanations.

AFTER ACCEPTANCE

If the manuscript is accepted, the acceptance letter is sent within two weeks, the last version of the manuscript is sent to the author for the last corresponding. The journal owner and the editorial board are authorized to decide which volume of the accepted article will be printed.
Authors may publish their articles on their personal or corporate websites by linking them to the appropriate cite and library rules.

Peer Review Process
Yayın Değerlendirme Süreci

Çift-Kör Değerlendirme Süreci

1. Makale Başvurusu

İlgili yazar, makalesini Dergipark çevrimiçi sistemi aracılığıyla dergiye gönderir.

2. Editöryal Değerlendirme

Editörlük, ilgili makalenin derginin yazım kurallarına göre düzenlenip düzenlenmediğini kontrol eder. Bilimsel içeriği bu aşamada değerlendirmez.

3. Editör tarafından değerlendirme

Editör, makalenin orijinal olup olmadığını denetler. Değilse, makale ret edilerek süreç tamamlanır.

4. Hakem Daveti

Editör, makalenin bilimsel içeriğinin değerlendirilmesi için konu ile ilgili hakemlere davet gönderir. Genellikle 2 hakeme davet gönderilir. İlgili yazıyı hakemlerden birisi ret diğeri kabul ettiği takdirde, bölüm editörü uygun görürse üçüncü bir hakemin incelemesi için davetiye gönderebilir.

5. Davete Yanıt

Seçilen hakemler, daveti gönderilen yazıyı kendi uzmanlıklarına, çıkar çatışmalarına ve kullanılabilirlik durumlarına karşı gizli olarak değerlendirir. Daha sonra kabul veya reddetmektedirler.

6. İnceleme Süreci

Hakem, makaleyi çeşitli açılardan değerlendirdikten sonra (15 gün içerisinde) eleştiri ve önerilerini içeren hakem değerlendirme formunu editöre gönderir. Major veya minör revizyonlar sonrasında hakem yazıyı tekrar değerlendirmek istemiş ise öneri ve eleştiriler yazarlara iletilerek düzeltilmiş yazıyı tekrar sisteme yüklemeleri istenir. Bu süreç hakemin kabul veya ret cevabı verene kadar devam eder.

7. Derginin Değerlendirme Süreci

Bölüm Editörü, genel bir karar vermeden önce geri gönderilen tüm değerlendirmeleri dikkate alır. Hakem değerlendirme sonuçları çok farklıysa, editör bir karar almadan önce fazladan bir fikir edinmek için ek bir inceleme isteyebilir.

8. Kararın İletilmesi

Bölüm Editörü, yazı hakkındaki son kararına hakem isimleri gizlenerek hakem raporlarını da ekler ve yazara çevrimiçi sistem ve e-mail aracılığı ile gönderir.

9. Sonraki Adımlar

Makale kabul edilirse, dil editörüne gönderilir. Bu aşamalardan sonraki adımlar;

- Son kopya gönderisi
- Mizanpaj
- Düzeltmeler
- Yayınlanacak gönderilerin erken baskı olarak web sayfasına yerleştirilmesi
- Sayı oluşturulması
- İçindekiler sayfası düzenlenmesi
- Web sitesinde sayı olarak yayınlanması ve baskı

**Kurum içi değerlendirme sürecinde; çift kör değerlendirme sürecindeki adımlar izlenmektedir.*

The Double-Blind Peer Review Process

1. Submission of Paper

The corresponding author submits the paper via Dergipark online system to the journal.new

2. Editorial Office Assessment

Editorial Office checks the paper's composition and arrangement against the journal's Author Guidelines to make sure it includes the required sections and stylizations. The quality of the paper is not assessed at this point.

3. Appraisal by the Editor

Editor checks that the paper is appropriate for the journal and is sufficiently original and interesting. If not, the paper may be rejected without being reviewed any further.

4. Invitation to Reviewers

Editor sends invitations to individuals he or she believes would be appropriate reviewers. As responses are received, further invitations are issued, if necessary, until the required number of acceptances is obtained – commonly this is 2.

5. Response to Invitations

Potential reviewers consider the invitation as anonymous against their own expertise, conflicts of interest and availability. They then accept or decline. If possible, when declining, they might also suggest alternative reviewers.

6. Review is Conducted

The reviewer sets time aside to read the paper several times. The first read is used to form an initial impression of the work. If major problems are found at this stage, the reviewer may feel comfortable rejecting the paper without further work. Otherwise they will read the paper several more times, taking notes so as to build a detailed point-by-point review. The review is then submitted to the journal, with a recommendation to accept or reject it – or else with a request for revision (usually flagged as either major or minor) before it is reconsidered.

7. Journal Evaluates the Reviews

The Section Editor considers all the returned reviews before making an overall decision. If the reviews differ widely, the editor may invite an additional reviewer so as to get an extra opinion before making a decision.

8. The Decision is Communicated

The Section Editor sends a decision email to the author including any relevant reviewer comments as anonymous.

9. Next Steps

If accepted, the paper is sent to language Editor. If the article is rejected or sent back for either major or minor revision, the Section Editor should include constructive comments from the reviewers to help the author improve the article. At this point, reviewers should also be sent an email or letter letting them know the outcome of their review. If the paper was sent back for revision, the reviewers should expect to receive a new version, unless they have opted out of further participation. However, where only minor changes were requested this follow-up review might be done by the Section Editor. After these;

- Copyedit submission
- Layout
- Corrections
- Publishing the submissions on the web page as early print
- Creating issues
- Organize Table of Contents
- Publishing the issue on the web page and printing hardcopy

**We are applying the same steps on The Double-Blind Peer Review Process when we got the in-house submission.*

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