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2025 yılının bu ilk sayısında, bilimsel kalitesi yüksek ve üroloji alanına önemli katkılar sağlayan yedi araştırma makalesi bir derleme ve bir olgu sunumu yer alıyor. Bu çalışmalar, kendi alanlarında uzman akademisyenler tarafından titizlikle hazırlanmış olup, ürolojinin çeşitli alt disiplinlerine ışık tutmaktadır. Yazarlar, güncel araştırma bulguları ve sonuçlarıyla hem bilimsel literatüre hem de klinik pratiğe önemli katkılar sunuyor.

Alanımızdaki en güncel bilgileri meslektaşlarımızla paylaşarak hem klinik hem de akademik anlamda üroloji camiasına katkı sağlamayı sürdürüyoruz. Ayrıca, siz değerli meslektaşlarımızın desteğiyle büyüyen Endoüroloji Bülteni, www.endourolojibulteni.com adresindeki web sitemiz üzerinden daha geniş bir erişime açıldı. Web sitemiz aracılığıyla bültenimizin tüm sayılarına ulaşabilir, yayımlanan makaleleri inceleyebilir ve dergimiz hakkında güncel bilgilere kolayca erişebilirsiniz.

Bugüne kadar çalışmalarını bizimle paylaşan ve bilimsel katkılarıyla bültenimizi zenginleştiren tüm meslektaşlarımıza içten teşekkürlerimizi sunarız. Bilim dünyasını daha ileriye taşımak adına yaptığınız katkılar bizim için büyük bir değer taşımaktadır. Dergimizin akademik ve bilimsel faaliyetlere olan katkısını artırarak sürdürmeyi hedefliyor, bu süreçte sizlerin desteğinin ne kadar önemli olduğunu bir kez daha vurgulamak istiyoruz.

2025 yılı ve sonrasında da bilimsel faaliyetlerinizi Endoüroloji Bülteni aracılığıyla paylaşmaya devam etmenizi temenni eder, katkılarınızın ve desteğinizin devamını dileriz.

Saygılarımızla,

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Original Article
Özgün Araştırma

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Lower Cost Way of Retrograde Intrarenal Surgery

Retrograd İntrarenal Cerrahi'de Maliyeti Düşürmek

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ABSTRACT

Objective: The aim of this study is to compare the results of operations with re-use flexible ureterorenoscope (URS) (FLEX X2, Karl Storz) and single-use digital URS (RP-U-C12, Redpine) and find lower cost way of retrograde intrarenal surgery (RIRS) without compromising their clinical performance.

Material and Methods: One re-use URS and one single-use digital URS were investigated with respect to operation numbers, times, laser and fluoroscopy times in operations and their effectiveness in the operations. All operations were achieved by same surgeon who has completed RIRS learning curve. Two small groups of patients (n = 63 for each group) was taken because it can be reached by one re-use URS.

Results: The clinical application of the single-use URS is of equal quality compared to re-use one. In our study one case with FLEX X2 costs 399 euros, one case with RP-U-C12 costs 51.5 euros (only ureterorenoscope and its sterilization costs). This shows us single-use URS is lower cost way of retrograde intrarenal surgery.

Conclusion: Now for our country one FLEX X2 costs as same as 41 RP-U-C12. But if you use RP-U-C12 as re-use flexible URS as we do, for one case with FLEX X2 costs nearly 8 times with RP-U-C12 costs. This shows us that RP-U-C12 has much lower cost. Our clinical evaluation showed markedly high performance for the single-use ureterorenoscope, which is comparable to the one of multi-used instruments.

Keywords: cost-effective, re-use, flexible ureterorenoscope

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ÖZET

Amaç: Bu çalışmanın amacı, yeniden kullanılan fleksibl üreterorenoskop (URS) (FLEX X2, Karl Storz) ve tek kullanımlık dijital URS (RP-U-C12, Redpine) ile yapılan operasyonların sonuçlarını karşılaştırmak ve klinik performanslarından ödün vermeden retrograd intrarenal cerrahinin daha düşük maliyetli bir yolunu bulmaktır.

Gereç ve Yöntemler: Bir yeniden kullanılan URS ve tek kullanımlık dijital URS'ler ile, operasyon sayıları, süreleri, lazer ve floroskopi süreleri ile operasyonlardaki etkinlikleri incelenmiştir. Tüm operasyonlar, RIRS öğrenme eğrisini tamamlamış aynı cerrah tarafından gerçekleştirilmiştir. Bir yeniden kullanılan URS ile yapılabilecek sayıda hasta grubu ile (her grup için n = 63) çalışma planlanmıştır.

Bulgular: Tek kullanımlık URS'nin klinik uygulaması, yeniden kullanılan URS ile karşılaştırıldığında eşit kalitededir. Çalışmamızda bir FLEX X2 vakasının maliyeti 399 Euro, bir RP-U-C12 vakasının maliyeti ise 51,5 Euro'dur (sadece üreterorenoskop ve sterilizasyon maliyetleri). Bu, tek kullanımlık URS'nin retrograd intrarenal cerrahinin daha düşük maliyetli bir yolu olduğunu göstermektedir.

Sonuç: Şu anki durumda, ülkemizde bir FLEX X2, 41 adet RP-U-C12'ye eşdeğer maliyetlere sahiptir. RP-U-C12'yi bizler gibi yeniden kullanılabilir fleksible URS olarak kullanırsanız, FLEX X2 ile bir vakada harcanan maliyet, RP-U-C12 ile yapılan bir vakadan yaklaşık 8 kat daha fazladır. Bu, RP-U-C12'nin çok daha düşük maliyetli olduğunu göstermektedir. Klinik değerlendirmemiz, tek kullanımlık üreterorenoskopun, çok kullanımlı aletlerle karşılaştırılabilir şekilde oldukça yüksek performans gösterdiğini ortaya koymuştur.

Anahtar Kelimeler: flexible ureterorenoscope, kostefektivite, re-use

INTRODUCTION

Retrograde intrarenal surgery (RIRS) has emerged as a cornerstone in the treatment of upper urinary tract stones, as emphasized by the European Association of Urology Guidelines. Two main types of ureterorenoscopes (URS) are utilized in RIRS: reusable and single-use models. Despite advancements in the technology of reusable URSs, challenges such as limited durability, potential contamination risks, and high maintenance costs persist. These concerns have led to an increasing preference for single-use ureterorenoscopes in procedures like ureterorenoscopic laser lithotripsy, which is used for treating ureteral and renal stones.

In recent years, notable improvements have been achieved in areas like image quality, device durability, irrigation efficiency, and reduced shaft diameter (1). These advancements have made ureterorenoscopic laser lithotripsy a safer and more effective method for stone management (2). A significant innovation in this field is the advent of single-use ureterorenoscopes, which offer economic advantages by eliminating the need for sterilization and repair—two major cost factors for reusable devices (3). Additionally, some single-use URSs can be sterilized for limited reuse, further enhancing their cost-effectiveness (4).

The aim of this study is to compare the clinical outcomes of reusable flexible URSs (FLEX X2, Karl Storz) and single-use digital URSs (RP-U-C12, Redpine) to identify the most cost-efficient approach for RIRS without compromising clinical performance.

MATERIAL AND METHODS

This study was approved by the Cumhuriyet University Ethics Committee under the approval number 2023-09/06, and written consent was obtained from patients with upper urinary tract stone disease. A total of 126 interventions were conducted using the single-use URS (RP-U-C12, Redpine) and reusable URS (FLEX X2, Karl Storz), performed by a single, experienced surgeon.

The clinical performance of both devices was assessed by measuring operation numbers, operation times, laser and fluoroscopy durations, and effectiveness. To reduce costs, single-use URSs were sterilized with ethylene oxide for limited reuse, with the medical company's permission. Reusable URSs were sterilized using Cidex. Each device was used until it was no longer functional for any reason.

Two patient groups (n = 63 each) were formed. For the reusable URS, a single device was used across all cases. In contrast, five single-use URSs were required to complete the same number of procedures. Patients requiring active ureteral dilation were excluded. For reusable URS procedures, 7 patients were pre-stented, and a DJ stent was placed postoperatively in 62/63 cases. For single-use URS procedures, 9 patients were pre-stented, and a DJ stent was inserted in all cases.

All interventions involved the placement of a 12/14 F ureteral access sheath at the ureter/ureteropelvic junction. A Ho:YAG laser (CyberHo 150W, Quanta, Germany) was used for stone fragmentation with a laser parameter of 1.5 J per pulse and a 10 Hz repetition rate, utilizing a 272 µm fiber. Stone retrieval was performed using a 1.9 F nitinol basket. The primary goal was to determine the cost-effectiveness of single-use versus reusable URSs without compromising clinical outcomes. Secondary endpoints included comparisons of operative times, laser and fluoroscopy times, maneuverability, visibility, and third-month postoperative stone-free rates. Stone-free status was evaluated via non-contrast CT, with residual stones ≥2 mm considered significant. Maneuverability and visibility were rated as "very good," "good," or "satisfactory" based on the surgeon's immediate post-intervention feedback.

The devices' technical features are summarized in Table 1. Statistical analyses were conducted using SPSS 23.0, employing descriptive statistics, Independent Samples T-Test was used because the data followed a normal distribution., Chi-square analyses, and one-way ANOVA. A p-value <0.05 was considered statistically significant.

Table 1. Summary of technical features of the single-use and re-use URSs.

	RP-U-C12 Single-use	FLEX X2 Re-use
Technical data		
Platform	Digital	Fiberoptic
Reusable	No	Yes
Shaft diameter French (Fr)	9.12Fr (8.7-9.6)	7.5 Fr
Working channel French (Fr)	3.6 Fr	3.6 Fr
Deflection [°]		
Empty	268	248
272 µm fibre	249	223
Wire basket	260	245

RESULTS

The mean age of patients in the single-use group was 45.5 ± 1.98 (21–82 years), and in the reusable group, it was 46.2 ± 1.67 (22–80 years) (p = 0.778). In the single-use group, 32 female and 31 male patients (n = 63) were included, while the reusable group consisted of 25 female and 38 male patients (n = 63). The total number of stones in the single-use group was 89, with a mean stone size of 12.1 ± 0.47 mm (4–25 mm), while in the reusable group, there were 87 stones with a mean diameter of 12.2 ± 0.50 mm (5–25 mm) (p = 0.905).

Regarding stone localization, in the single-use group, 33 stones were located in the lower pole of the kidney, 21 in the upper/mid-pole, and 35 in the pelvis. In the reusable group, 16 stones were in the lower pole, 36 in the upper/mid-pole, and 35 in the pelvis. Seventeen patients in the single-use group had multiple stones, while twenty-three patients in the reusable group had multiple stones. Patients' characteristics and procedure details are summarized in Table 2.

Table 2. Summary of patients' demography, stone and intervention data.

Patients demography	Single-use	Re-use
Number of patients	63	63
single stone	46	40
multiple stone	17	23
Age [year] mean (min-max)	45.5 ± 1.9 (21–82)	46.2 ± 1.6 (22–80)
Sex (female/male)	32/31	25/38
Preoperative stent	9/63	7/63
Stone data		
Total number of stones	89	87
Mean Stone diameter [mm] mean (min-max)	12.1 ± 0.4 (4–25)	12.2 ± 0.5 (5–25)
Stone localization		
Upper-mid pole	21/89	36/87
Lower pole	33/89	16/87
Renal pelvis	35/89	35/87
No stone	-	1/87
Intervention data		
Access sheath	63/63	63/63
Lithotripsy (Ho:YAG)	63/63	62/63
Basket (1.9 F)	16/63	27/63
Postoperative Stent	63/63	62/63
HU of stones mean±SD (min-max)	1164 ± 28.8 (698–1549)	1152 ± 36.7 (632–1555)

No additional or replacement ureterorenoscopes were required during the procedures. The mean operation time for the single-use group was 44.5 ± 2.03 minutes (min-max 20–90 minutes), while for the reusable group, it was 53.9 ± 2.83 minutes (min-max 17–90 minutes) (p = 0.08). The mean fluoroscopy time for the single-use group was 18.52 ± 0.90 seconds (min-max 5–37 seconds), and for the reusable group, it was 17.73 ± 0.84 seconds (min-max 5–30 seconds) (p = 0.521). The mean laser time in the single-use group was 11.13 ± 0.49 minutes (min-max 3.5–20 minutes), compared to 12.15 ± 0.82 minutes (min-max 4–25 minutes) in the reusable group (p = 0.360). No significant differences were observed between the two groups regarding age, stone size, number of stones, operation time, fluoroscopy time, laser time, or Hounsfield unit scores. The p-values for these comparisons were 0.778, 0.905, 0.720, 0.08, 0.521, 0.360, and 0.792, respectively. A summary of the data is presented in Table 3.

Table 3. The average values of the groups

	Single-use (n=63)	Re-use (n=63)	p
Age	45.5 ± 1.9	46.2 ± 1.7	0.778
Size (mm)	12.1 ± 0.5	12.2 ± 0.5	0.905
Number of Stones	1.4 ± 0.1	1.3 ± 0.1	0.720
Operation Time (min)	44.5 ± 2.0	53.9 ± 2.8	0.08
Floroscopy Time (sec)	18.5 ± 0.9	17.7 ± 0.8	0.521
Laser Time (min)	11.1 ± 0.5	12.1 ± 0.8	0.360
HU	1164 ± 28.8	1152 ± 36.7	0.792

Table 4. Maneuverability of URSs (rfURS: re-use flexible URS, sfURS: single-use flexible URS)

	Very Good (first cases, times)				Good or Satisfying (later cases, times)			
	number of cases	operation time (min)	laser time (min)	Floroscopy time (sec)	number of cases	op time (min)	laser time (min)	Floroscopy time (sec)
rfURS	45	2865	607	828	18	527	234	316
sfURS 1	10	545	130	182	8	260	68	161
sfURS 2	6	300	71	101	5	140	47	87
sfURS 3	6	345	75.5	122	4	145	32	58
sfURS 4	6	345	63.5	100	5	175	52	96
sfURS 5	7	303	76.5	161	6	277	84	99

Table 5. Visibility of URSs (rfURS: re-use flexible URS, sfURS: single-use flexible URS)

	Very Good (first cases, times)				Satisfying or Enough (later cases, times)			
	number of cases	operation time (min)	laser time (min)	Floroscopy time (sec)	number of cases	operation time (min)	laser time (min)	Floroscopy time (sec)
rfURS	55	2940	742	1009	8	452	99	135
sfURS 1	11	585	137	195	7	220	68	161
sfURS 2	7	345	84	116	4	95	34	72
sfURS 3	8	430	92.5	152	2	60	15	28
sfURS 4	7	390	76.5	118	4	130	39	78
sfURS 5	9	415	111.5	200	4	165	49	60

In chi-square analysis, categorical variables such as gender, stone side, location, presence of residual stones, and the placement of a DJ catheter prior to the procedure showed no significant differences between the groups. The p-values were 0.52, 0.52, 0.08, 0.38, and 0.61, respectively. Post-procedure, a stone-free rate of 48/63 patients was achieved in the single-use group, while 51/63 patients in the reusable group were stone-free. The clinical performance of the single-use URS was evaluated across clinical procedures (n = 63), totaling 2835 minutes with five devices.

Maneuverability was rated as "very good" in 10/18 cases (first device, 545 minutes), and "good" or "satisfactory" in 6/13 cases (last device, 277 minutes). The average time for maneuverability was 367.6 minutes across the five devices. Visibility was "very good" in 11/18 cases (first device, 585 minutes), and "satisfactory" or "sufficient" in 7/18 cases (last device, 220 minutes). The average time for visibility was 433 minutes.

When comparing the five single-use devices, the average operation time, fluoroscopy time, laser time, stone sizes, number of stones, and Hounsfield unit scores were similar. The p-values for these variables were 0.71, 0.88, 0.78, 0.93, 0.09, and 0.32, respectively. The clinical performance of the reusable URS was tested across 63 clinical procedures, totaling 3392 minutes. Maneuverability was rated as "very good" in 45/63 cases, and "good" or "satisfactory" in 18/63 cases. Visibility was rated as "very good" in 55/63 cases, while it was "satisfactory" or "sufficient" in 8/63 cases.

DISCUSSION

The durability of reusable ureterorenoscopes has been a subject of various studies, with working hours ranging between 14 and 48 hours before they are no longer functionalle ureterorenoscope (FLEX X2) was used for an average of 56.5 working hours, which exceeds the typical usage times reported in previous studies (5-7). Our findings suggest that both single-use and reusable ureterorenoscopes can offer comparable performance, provided that all associated costs (e.g., labor, sterilization, consumables, and repair) are taken into consideration.

The introduction of single-use digital flexible ureterorenoscopes has significantly reduced the need for costly repairs and the risk of unpredictable performance, which could otherwise delay procedures. In our study, the FLEX X2 had a cost of €25,000, while the RP-U-C12 was priced at €600. This means the cost of one FLEX X2 device is equivalent to that of 41 RP-U-C12 units. When the RP-U-C12 is used for limited re-use, the cost becomes even lower. For instance, in our country, sterilization costs for FLEX X2 with Cidex are €2 per case, while for RP-U-C12 with ethylene oxide sterilization, the cost is €4 per case. Consequently, the cost per case for FLEX X2 was €399, whereas for RP-U-C12, it was €51.5, covering only the cost of the ureterorenoscope and sterilization (8).

These findings suggest that single-use ureterorenoscopes could be a more economically viable option, particularly for smaller hospitals with limited budgets. The initial purchase cost of RP-U-C12 is lower than that of FLEX X2, and the absence of maintenance or repair costs further reduces overall expenses. Moreover, using single-use URSs in teaching hospitals might have advantages, as the risk of damaging the instrument during training is minimized.

Despite their higher environmental impact, as single-use devices contribute to waste disposal, they offer a significant advantage in terms of safety and ease of use. In contrast, reusable devices require proper sterilization, and their performance cannot always be guaranteed throughout their lifecycle. This is especially relevant in teaching settings where instruments might fail earlier due to improper handling.

Mazzucchi et al. have pointed out that single-use flexible ureterorenoscopes tend to be lighter and offer superior image quality when compared to fiberoptic models (9). These devices are also ergonomically favorable for surgeons. However, environmental concerns regarding waste disposal remain a notable disadvantage of single-use instruments (10). On the other hand, the environmental impacle instruments is associated with the use of toxic detergents for sterilization (11).

When evaluating surgical outcomes, there was no difference between the single-use and reusable URS groups. Both types of devices produced nearly identical results, indicating that single-use ureterorenoscopes can be a viable alternative to reusable ones, providing comparable performance in upper urinary tract stone treatment.

Our study aligns with findings from other research, where no significant differences were found between single-use digital flexible ureterorenoscopes and reusable fiberoptic models in terms of image quality, device failure rates, lithotripsy success rates, and adverse event occurrences. Single-use URSs have demonstrated good safety and effectiveness in treating upper urinary tract stones (12) . Additionally, a study by Wei Zheng So et al. highlighted that devices like RP-U-C12 and INNOVEX EU-Scope™ were favored by participants for their performance (13).

CONCLUSION

Our clinical evaluation indicates that the performance of the single-use ureterorenoscope is comparable to that of reusable instruments. The clinical outcomes achieved with the single-use device were on par with those observed with reusable models, suggesting that single-use ureterorenoscopes can be a reliable alternative. Furthermore, single-use devices offer significant economic benefits, particularly in terms of reduced repair costs, sterilization expenses, and maintenance efforts. These factors contribute to lower overall costs, making single-use ureterorenoscopes a more cost-effective option for hospitals with limited resources.

However, it is important to consider the environmental impact of single-use devices, which result in increased waste production. On the other hand, reusable ureterorenoscopes, although more ecologically favorable, are associated with the use of toxic sterilization agents and the potential risk of performance degradation over time.

In conclusion, single-use ureterorenoscopes, such as the RP-U-C12, provide an economically advantageous solution for treating upper urinary tract stones, without compromising clinical effectiveness. Their reliability, lower cost, and ease of use make them an attractive option for healthcare facilities, particularly in settings where cost reduction is a priority. Nevertheless, further studies are needed to evaluate the long-term outcomes and safety of these devices, as

well as to assess their potential in comparison to the latest generation digital and fiberoptic ureterorenoscopes.

Data Availability: Data are available on specifc request

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Conflict of Interest: The authors have no financial or proprietary interests in any material discussed in this article.

Ethical Approval: This study was approved by the Sivas Cumhuriyet University Ethics Committee (Approval No: 2023-09/06, Date: 2023/09/21). Research involving human participants and/or animals All analysis performed involving human participants were in accordance with the 1964 Helsinki Declaration and its later amendments.

Consent to Participate: All patients signed an informed consent agreeing to supply their anonymous information for research purposes.

Author Contributions: Aydemir Asdemir first author, review of articles, manuscript preparation. Abuzer Öztürk data collection, manuscript writing/editing. Ismail Emre Ergin analysis and interpretation of data, manuscript editing. Hüseyin Saygın manuscript writing/editing. Esat Korğalı supervising the manuscript. All the authors discussed the results and commented on the manuscript.

REFERENCES

1. Somani BK, Al-Qahtani SM, de Medina SD & Traxer O. Outcomes of flexible ureterorenoscopy and laser fragmentation for renal stones: comparison between digital and conventional ureteroscope. Urology. 2013;82:1017-1019 https://doi.org/10.1016/j.urology.
2. Gridley CM & Knudsen BE. Digital ureteroscopes: technology update. Research and reports in urology. 2017;9:19-25, https://doi.org/10.2147/RRU.S104229
3. Davis NF, Quinlan MR, Browne C, Bhatt NR, Manecksha RP, D'Arcy FT et al. Single-use flexible ureteropyeloscopy: a systematic review. World J Urol. 2018;36:529-536 https://doi.org/10.1007/s00345-017-2131-4 (2018).
4. Legemate JD, Kamphuis GM, Freund JE, Baard J, Zanetti SP et al. Durability of Flexible Ureteroscopes: A Prospective Evaluation of Longevity, the Factors that Affect it, and Damage Mechanisms. Eur Urol Focus. 2019;5(6):1105-1111 https://doi.org/10.1016/j.euf.2018.03.001.
5. Carey RI, Gomez CS, Maurici G, Lynne CM, Leveillee RJ, Bird VG. Frequency of ureteroscope damage seen at a tertiary care center. J. Urol. 2006;176:607-610 https://doi.org/10.1016/j.juro.2006.03.059
6. Karaolides T, Bach C, Kachrilas S, Goyal A, Masood J, Buchholz N. Improving the durability of digital flexible ureteroscopes. Urology. 2013;81:717-722 https://doi.org/10.1016/j.urology.2013.01.016 (2013).
7. Tosoian JJ, Ludwig W, Sopko N, Mullins JK & Matlaga BR. The effect of repair costs on the profitability of a ureteroscopy program. J Endourol. 2015;29:406-409 https://doi.org/10.1089/end.2014.0435 (2015).
8. Taguchi K, Usawachintachit M, Tzou DT, Sherer BA, Metzler I, Isaacson D et al. Micro-Costing Analysis Demonstrates Comparable Costs for LithoVue Compared to Reusable Flexible Fiberoptic Ureteroscopes. J Endourol. 2018;32:267-273 https://doi.org/10.1089/end.2017.0523
9. Mazzucchi E, Marchini GS, Berto FCG, Denstedt J, Danilovic A, Vicentini FC et al. Single-use flexible ureteroscopes: Update and perspective in developing countries. A narrative review. Int Braz J Urol. 2022;48(3):456-6.
10. Doizi S & Traxer O. Re: Evaluation of a Novel Single-use Flexible Ureteroscope. Eur Urol. 2017;72:152-153 https://doi.org/10.1016/j.eururo.
11. Eckelman MJ, Sherman J. Environmental Impacts of the U.S. Health Care System and Effects on Public Health. *PLoS*

One. 2016;11(6):e0157014. Published 2016 Jun 9. https://doi.org/10.1371/journal.pone.0157014

12. Wenbiao L, Guohua Z, Jinchun X, Chao S, Yunhe X, Lingchao M et al. A prospective multicenter randomized controlled clinical trial study of a domestic single-use digital flexible ureteroscope versus a reusable digital flexible ureteroscope fort he treatment of upper urinary tract stones. Chin J Urol. 2022;43:5. https://doi.org/10.3760/cma.j.cn112330-20210901-00467
13. So WZ, Gauhar V, Chen K, Lu J, Chua WJ, Tiong HY. An in vitro Comparative Assessment of Single-Use Flexible Ureteroscopes Using a Standardized Ureteroscopy Training Model [published correction appears in Urol Int. 2022;106(10):1089. doi: 10.1159/000525721]. *Urol Int*. 2022;106(12):1279-1286. https://doi.org/10.1159/000525246

Original Article
Özgün Araştırma

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How Reliable Are Imaging Study Reports in Assessing Pediatric Ureteropelvic Junction Obstruction? A Real-World Experience

Pediatrik Üreteropelvik Bileşke Darlıklarının Değerlendirilmesinde Görüntüleme Raporları Ne Kadar Güvenilir? Gerçek Dünya Deneyimi

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ABSTRACT

Objective: Serial ultrasonography (US) and nuclear scintigraphy imaging are sufficient in the decision-making process in most ureteropelvic-juntion obstruction (UPJO) patients. Contrast-enhanced cross-sectional imaging (CE-CSI) can be used in uncertain indications or the presence of additional anatomical anomalies. We evaluate the effectiveness and reliability of pre-operative US and CE-CSI reports of UPJO patients who underwent pyeloplasty.

Material and Methods: The data of pediatric patients under the age of 18 who underwent CE-CSI with suspicion of UPJO between March 2020-2024 and who subsequently underwent pyeloplasty were reviewed retrospectively. The patients were divided into two groups. Primarily, ultrasound and CE-CSI reports were compared, and secondarily, the initial and re-evaluated CE-CSI report findings were compared in terms of the reporting of crossing vessels (CV).

Results: The data of 44 patients (23 boys and 21 girls) with a mean age of 8.1 years were reviewed. Ultrasound and CE-CSI reports were compared, and it was seen that significantly more parenchymal thickness information was reported in the CE-CSI group than in the US group (CE-CSI:31(70.5%), US:18(40.9%), p=0.007). Crossing vessels were reported in 10 patients (41.6%) in initial CE-CSI reports. After re-evaluation of images by a radiologist who cooperated with the pediatric urologist, CV was reported in 21 patients (87.5%), and the difference was statistically significant (p=0.003)

Conclusion: Despite its disadvantages in the pediatric age group, the success of CE-CSI in revealing detailed anatomical information, particularly vascular anatomy, cannot be ignored. Our study demonstrated that investigating the presence of CV in pediatric patients with UPJO is crucial, particularly in older and symptomatic children. In CE-CSI, the results should be evaluated by an experienced uroradiologist.

Keywords: cross-sectional imaging, pyeloplasty, ureteropelvic-junction obstruction, ultrasound

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ÖZET

Amaç: Seri ultrasonografi (US) ve nükleer sintigrafi görüntüleme, çoğu üreteropelvik bileşke darlığı (ÜPBD) hastasında karar verme sürecinde yeterli olmaktadır. Kontrastlı kesitsel görüntüleme (KKG), belirsiz endikasyonlar veya ek anatomik anomalilerin varlığında kullanılabilir. Bu çalışmada, pyeloplasti uygulanan ÜPBD hastalarının preoperatif US ve KKG raporlarının etkinliği ve güvenilirliği değerlendirilmiştir.

Gereç ve Yöntemler: Mart 2020 ile 2024 arasında ÜPBD şüphesiyle KKG yapılan ve ardından pyeloplasti operasyonu geçiren 18 yaş altındaki pediatrik hastaların verileri retrospektif olarak incelenmiştir. Hastalar iki gruba ayrılarak, birincil olarak ultrasonografi ve KKG rapor bulguları karşılaştırılmış, ikincil olarak ise çaprazlayan damar basısı (ÇDB) bildirimi açısından ilk ve yeniden değerlendirilen KKG rapor bulguları karşılaştırılmıştır.

Bulgular: Ortalama yaşları 8.1 yıl olan 44 hastanın (23 erkek, 21 kız) verileri incelenmiştir. Ultrason ve KKG raporları karşılaştırıldığında, parankimal kalınlık bilgisi, KKG grubunda US grubuna göre anlamlı derecede daha fazla rapor edilmiştir (KKG: 31 (%70,5), US: 18 (%40,9), p=0,007). İlk KKG raporlarında 10 hastada (%41,6) ÇDB bildirilmiştir. Bir pediatrik ürolog ile iş birliği yapan deneyimli bir radyolog tarafından yapılan yeniden raporlama sonrasında ÇDB, 21 hastada (%87,5) bildirilmiş ve fark istatistiksel olarak anlamlı bulunmuştur (p=0,003).

Sonuç: Pediatrik yaş grubunda bazı dezavantajlarına rağmen, KKG'nin özellikle damar anatomisini ortaya koymadaki başarısı göz ardı edilemez. Çalışmamız, ÜPBD olan pediatrik hastalarda ÇDB'nin varlığını araştırmanın, özellikle büyük ve semptomatik çocuklarda önemli olduğunu göstermiştir. KKG sonuçları, deneyimli bir üro-radyolog tarafından değerlendirilmelidir.

Anahtar Kelimeler: kesitsel görüntüleme, piyeloplasti, üreteropelvik bileşke darlığı, ultrason

INTRODUCTION

Ureteropelvic junction obstruction (UPJO) is among the most common causes of upper urinary tract obstruction. With the help of antenatal imaging, the incidence of UPJO has been increasing in recent years (1). The most common causes include extrinsic compression, intrinsic stenosis, and ureteral insertion abnormalities. Crossing vessels (CV) originate from the abdominal aorta or iliac artery, supply the lower pole of the kidney, and can cause obstruction due to the compressive effect on the ureteropelvic junction. Patients with UPJO due to CV are more commonly diagnosed in late childhood, accounting for approximately 29-65% of UPJO cases (2). Diagnosing the presence of CV in the pre-operative period is important, as it may influence the surgical approach. Failure to identify CV during surgery can result in unfavorable outcomes and may necessitate redo-pyeloplasty (3). Additionally, endoscopic endopyelotomy should not be performed in the presence of CV.

Serial ultrasonography (US) and nuclear scintigraphy are sufficient imaging modalities for decision-making in most UPJO patients (4). Ultrasonography provides valuable information on kidney size, echogenicity, parenchymal thickness, and the degree of hydronephrosis. Although it is easily accessible and applicable, its accuracy largely depends on the operator's experience. Furthermore, it may be insufficient for detecting CV (5). Computed tomography urography (CTU) is a fast and non-invasive method used to diagnose CV. However, exposure to ionizing radiation is one of the major disadvantages of CTU, particularly in children. Magnetic resonance urography (MRU) is preferred in children due to its radiation-free nature; however, it may require anesthesia in younger children for the procedure (6). In addition to imaging quality, proper reporting of findings and the evaluator's expertise are crucial for guiding the clinician. Several studies in the literature have focused on improving both the quality of imaging techniques and the reporting process by using detailed checklists (7,8).

This study aims to assess the reliability of preoperative US, CTU, and MRU imaging reports in patients with UPJO who underwent pyeloplasty. The secondary objective is to compare the frequency of CV reporting, as identified during surgery, in the initial and re-evaluated contrast- enhanced cross-sectional imaging (CE-CSI) reports. This will provide a real-world assessment of the consistency between preoperative imaging reports and intraoperative findings.

MATERIAL AND METHODS

The institutional ethical committee has approved this study protocol (2023/28). Written and verbal consent were obtained from the parents of all participants. The data of pediatric patients under the age of 18 with UPJO who underwent pyeloplasty between March 2020 and 2024 were retrospectively reviewed, including those who had undergone CE-CSI prior to surgery. Patients who underwent non-contrast imaging, had unsuitable imaging protocols or low quality images, or whose images were unavailable were excluded.

Contrast-enhanced cross-sectional imaging was not routinely performed, except for those conducted at external centers, and was only used in selected instances. Magnetic resonance urography was primarily performed when there were inconsistencies between scintigraphy results and serial US findings, or when it was needed to help determine surgical indications. Computed tomography urography, which had very limited use in our practice for pediatric patients, was preferred in addition to the suspicion of UPJO if stone formation was also suspected. All CE-CSIs were initially reported by a general radiologist and then subsequently re-evaluated and reported by an experienced radiologist preoperatively. Surgical indications were determined through the collaborative decision of two pediatric urologists, following the European Association of Urology guidelines (4).

The patients' demographics, complaints, preoperative US findings, dynamic scintigraphy results, CTU and MRU reports, and operative data were recorded. Ultrasound and initial CE-CSI reports were compared based on the grading of hydronephrosis, anterior-posterior pelvic diameter (APD), and parenchymal thickness. Additionally, the initial and re-evaluated CE-CSI reports of patients with and without CV, as identified intraoperatively, were compared in terms of preoperative CV reporting.

The Statistical Package for the Social Sciences (SPSS) was used for data analyses. Quantitative data are expressed as mean ± standard deviation. Categorical data were expressed in n (frequency) and percentages (%). Categorical parameters between US/CE-CSI groups were compared with the chi-square and Fisher's exact tests. The results were considered statistically significant if the p-value was <0.05.

RESULTS

The data of 44 patients (23 boys and 21 girls), with a mean age of 8.1 years, were reviewed. Magnetic resonance urography was performed in 30 patients, nine of whom underwent the procedure under anesthesia, while CTU was performed in 14 patients. In addition to UPJO, kidney stones were identified in three children who underwent CTU. The demographic and preoperative data are presented in Table-1.

It was observed that significantly more information regarding parenchymal thickness was reported in the CE-CSI group compared to the US group ($p=0.007$), while no significant difference was found in the reported data for APD and hydronephrosis grading ($p=1.000$)(Table-2).

Crossing vessels were detected intraoperatively in 24 patients (54.5%). When the data of patients with and without CV were compared, the age was found to be significantly higher in the CV group (CV=11.5±4.3, non-CV=2.5±2.0 $p<0.001$). While the majority of patients in the CV group were symptomatic (58% experiencing pain), most patients in the non-CV group were asymptomatic, with this difference being statistically significant ($p = 0.048$). Initial CE-CSI reports identified a CV in only 10 patients (41.6%). After re-evaluation of images by a experienced radiologist a CV was reported in 21 patients (87.5%), and the difference was statistically significant ($p=0.003$) (Figure-1).

Table 1. Patient Demographics and Preoperative Data

Gender, n (%)	
Male	23 (52.3)
Female	21 8(47.7)
Age (year)*	8.1±5.7
Side, n (%)	
Left	27 (61.4)
Right	17 (38.6)
Symptoms, n (%)	
Asymtomatic	20 (45.5)
Pain	18 (40.9)
Hematuria	6 (13.6)
CE-CSI method, n (%)	
MRU	30 (68.2)
CTU	14 (31.8)
Parenchymal thickness (mm) *	5.5±1.9
APD (mm) *	30.2±10.9
Hydronephrosis Grading n (%)	
G1	0
G2	1 (2.3)
G3	18 (40.9)
G4	25 (56.8)
Separated renal function (%)*	37.5±3.2

*mean±standart deviation

Table 2. Comparison of Cross-Sectional Imaging and Ultrasound Report Data

	CE-CSI	US	p
Reported parenchymal thickness, n (%)	31 (70.5)	18 (40.9)	0.007
Reported APD, n (%)	37 (83.8)	37 (83.8)	1.000
Reported Hydronephrosis, n (%)	41 (93.2)	41 (93.2)	1.000

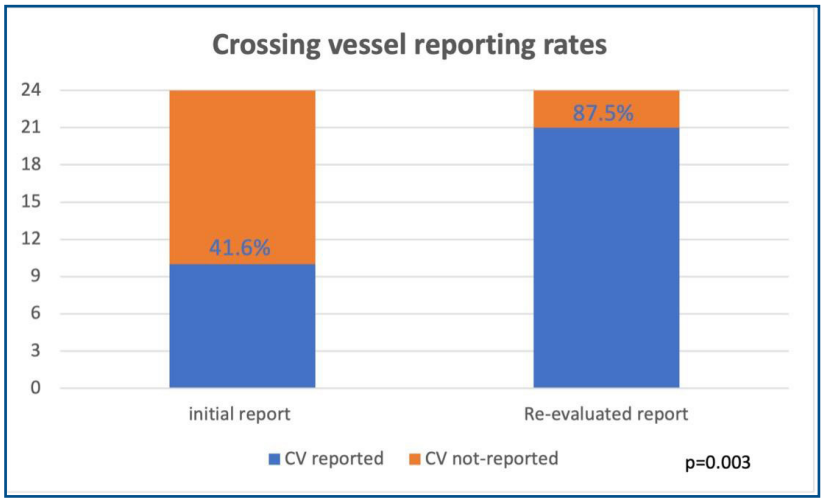

Figure 1. Comparison of crossing vessel reporting rates in initial and re-evaluated reports

DISCUSSION

Distinguishing patients who will require surgical intervention is of significant importance, as spontaneous resolution is observed in the majority of cases of antenatally diagnosed hydronephrosis (4). In most cases, evaluation with US and scintigraphy alone is typically sufficient. Although US is a fast, cost-effective, easily accessible, and repeatable examination, it has the drawbacks of being operator-dependent and inadequate for assessing dynamic urinary drainage, detecting CV and evaluating the condition of the middle and lower ureter. Renal scintigraphy is another method used to make treatment decisions for UPJO, offering a functional evaluation of kidney performance (4). Since Tc-99m mercaptoacetyltriglycine (MAG-3) is cleared mainly by tubular secretion, the elimination half-life of the substance from the kidney provides valuable ideas in follow-up (9). However, its main disadvantages are radiation exposure, low anatomical resolution, and the inability to provide information about vascular variations. Therefore, CE-CSI is still required in cases where the diagnosis remains uncertain. Computed tomography urography effectively identifies the cause of obstruction and evaluates the presence of CV (10). However, its use in children is limited due to the use of contrast agents and exposure to high doses of ionizing radiation. Although MRU provides detailed information about the collecting system and surrounding organ tissues compared to conventional methods, its use is recommended only in specific indications due to its high cost and the need for anesthesia in young children (11).

Real-world challenges have led to an increased reliance on cross-sectional imaging. Factors such as high patient volume, particularly in tertiary care settings, limit the time available for adequately evaluating these specialized patient groups. Additionally, the limited number of pediatric radiologists, with many centers lacking this expertise, further exacerbates the problem. The involvement of multiple radiologists in interpreting imaging studies results in significant variability in reports, making reliable comparative analyses nearly impossible. Consequently, CE-CSI is used more frequently than ideally recommended, as it provides a more consistent and accessible method for diagnosis under these constraints.

Our findings show that in the CE-CSI group, significantly more parenchymal and vascular findings were reported compared to US. Beyond mere reporting, cross-sectional imaging allows both radiologists and the surgical team to review the images, providing valuable insights for decision-making. Since urolithiasis is not uncommon in patients with UPJO, computed tomography may offer distinct advantages in those suspected of having nephrolithiasis. Rarely, CTU may be helpful in differentiating whether the cause of the obstruction is a stone or UPJO. In our series, 9 patients had CTU performed at external centers. CTU was performed on 5 patients in our center with suspected UPJO, in addition to a concomitant suspicion of kidney stones. Kidney stones were detected in three of these patients, allowing for the successful performance of concurrent laparoscopic-assisted endoscopic stone surgery in these cases. Considering disadvantages such as radiation exposure, CTU should be used judiciously. If the presence of UPJO is confirmed by US and scintigraphy, and there is suspicion of stones, it should be kept in mind that non-contrast computed tomography may be sufficient for detecting kidney stones, rather than CTU.

Crossing vessels account for approximately one-third of the causes of UPJO, and the need for surgery is higher in these patients (12). One study found that a CV was present in 11% of patients diagnosed antenatally, while it was observed in 49% of symptomatic children (13). Similarly, in our study, the patient group with CV had a significantly higher age ($p<0.001$). Additionally, the rate of symptomatic admissions was significantly higher in the CV group ($p<0.048$). Distinguishing these patients is crucial, as they benefit significantly from surgery. However, the imaging methods used to achieve this distinction remain a subject of debate, and a widely accepted algorithm has yet to be established. Crossing vessel compression may be overlooked in surgeries performed through retroperitoneal or dorsal lumbotomy approaches. In our series, a 1-year-old male patient underwent laparoscopic transperitoneal pyeloplasty instead of open retroperitoneal surgery after CV were detected on preoperative MRU.

In a study highlighting the importance of the evaluator's experience, the sensitivity of MRU in detecting the presence of crossing vessels (CV), initially 60-65%, increased to 88.2%, and specificity was 91.2% when evaluated by an experienced uroradiologist (14). Our study supports similar findings; CE-CSI reports provided more detailed information; however, the reporting of crossing vessels (CV) remained low in the initial reports, with CV detected in

41.6% of cases, and in 87.5% after re-evaluation by an experienced radiologist. Based on our clinical observations, another reason for the deficiencies in imaging reports is the lack of certain necessary findings in the report template. Studies show that preparing some checklists for the US and voiding cystourethrography is helpful in improving the quality of imaging protocols and reports (7,8). For CTU and MRU imaging, sharing detailed clinical information with the radiologist, along with face-to-face or telephone consultations when necessary, will facilitate a thorough evaluation and comprehensive reporting of the findings.

Besides reporting and evaluation, it is crucial to remember that failing to implement the necessary procedures can result in unnecessary time and labor loss. A study on this subject evaluated 14 patients planned for endopyelotomy after MRU, and re-imaging was performed using the correct protocols, which revealed the presence of CV in 4 patients (15). In our series, despite evaluation by an experienced radiologist, 12.5% of CV cases were not detected preoperatively. These findings highlight the importance of accurate imaging.

Our study has several limitations. The first is its retrospective design and small sample size. Secondly, the quality of the reports varied, as they were evaluated by multiple radiologists due to the high workload at the training and research hospital. Since cross-sectional imaging was performed only in selected pediatric patients, the results should not be generalized to all children with UPJO. To draw more definitive conclusions, prospective studies with larger patient populations are needed.

CONCLUSION

Despite its disadvantages in the pediatric age group, the ability of CE-CSI to reveal detailed anatomical information, particularly regarding vascular anatomy, should not be overlooked. Our study demonstrated that investigating the presence of CV in pediatric patients with UPJO is crucial, especially in older and symptomatic children. Furthermore, the results from CE-CSI should be evaluated by an experienced uroradiologist.

Conflict of İnterest: There is no conflict of interest in our study.

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Ethics Committee Report: Received by the T.C. KTO Karatay University, School of Medicine, Pharmaceutical and Non-Medical Device Research Ethics Committee. Approval Date: 24.01.2023, Approval Number: 2023/028.

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REFERENCES

1. Choi YH, Cheon JE, Kim WS, Kim IO. Ultrasonography of hydronephrosis in the newborn: a practical review. Ultrasonography. 2016;35(3):198-211. https://doi.org/10.14366/usg.15073
2. Ucar AK, Kurugoglu S. Urinary Ultrasound and Other Imaging for Ureteropelvic Junction Type Hydronephrosis (UPJHN). Front Pediatr. 2020;8:546. Published 2020 Sep 16. https://doi.org/10.3389/fped.2020.00546
3. Lee RS, Retik AB, Borer JG, Peters CA. Pediatric robot assisted laparoscopic dismembered pyeloplasty: comparison with a cohort of open surgery. J Urol. 2006;175(2):683-687. https://doi.org/10.1016/S0022-5347(05)00183-7
4. Radmayr C, Bogaert G, Bujons A, Burgu B, Castagnetti M et al. EAU Guidelines on Paediatric Urology. EAU Guidelines Office. 2024. Available from: https://uroweb.org/guidelines/paediatric-urology/chapter/the-guideline [Last accessed: August, 2024]
5. Paliwalla M, Park K. A practical guide to urinary tract ultrasound in a child: Pearls and pitfalls. Ultrasound.

2014;22(4):213-222. https://doi.org/10.1177/1742271X14549795

6. Parikh KR, Hammer MR, Kraft KH, Ivančić V, Smith EA, et al. Pediatric ureteropelvic junction obstruction: can magnetic resonance urography identify crossing vessels?. Pediatr Radiol. 2015;45(12):1788-1795. https://doi.org/10.1007/s00247-015-3412-y
7. Walsh C, Wessely K, De Caluwe D, Rahman N, Farrugia MK. Radiology reporting of micturating cystourethrograms (MCUGs): What the paediatric urologists want to know. J Pediatr Urol. 2020;16(6):790.e1-790.e6. https://doi.org/10.1016/j.jpurol.2020.09.008
8. Bosmans JM, Weyler JJ, De Schepper AM, Parizel PM. The radiology report as seen by radiologists and referring clinicians: results of the COVER and ROVER surveys. Radiology. 2011;259(1):184-195. https://doi.org/10.1148/radiol.10101045
9. Krajewski W, Wojciechowska J, Dembowski J, Zdrojowy R, Szydełko T. Hydronephrosis in the course of ureteropelvic junction obstruction: An underestimated problem? Current opinions on the pathogenesis, diagnosis and treatment. Adv Clin Exp Med. 2017;26(5):857-864. https://doi.org/10.17219/acem/59509
10. Zhu W, Xiong S, Xu C, Zhu Z, Li Z et al. Initial experiences with preoperative three-dimensional image reconstruction technology in laparoscopic pyeloplasty for ureteropelvic junction obstruction. Transl Androl Urol. 2021;10(11):4142-4151. https://doi.org/10.21037/tau-21-590
11. Gołuch M, Pytlewska A, Sarnecki J, Chodnicka, P., Śliwińska, A et al. Evaluation of differential renal function in children - a comparative study between magnetic resonance urography and dynamic renal scintigraphy. BMC Pediatr. 2024;24(1):213. Published 2024 Mar 25. https://doi.org/10.1186/s12887-024-04694-2
12. Panthier F, Lareyre F, Audouin M, Raffort J. Pelvi-ureteric junction obstruction related to crossing vessels: vascular anatomic variations and implication for surgical approaches. Int Urol Nephrol. 2018;50(3):385-394. https://doi.org/10.1007/s11255-017-1771-z
13. Sertorio F, Wong MCY, Incarbone V, Pistorio A, Mattioli G et al. Non-contrast-enhanced magnetic resonance angiography for detecting crossing renal vessels in infants and young children: comparison with contrast-enhanced angiography and surgical findings. Pediatr Radiol. 2019;49(1):105-113. https://doi.org/10.1007/s00247-018-4252-3
14. Weiss DA, Kadakia S, Kurzweil R, Srinivasan AK, Darge K, et al. Detection of crossing vessels in pediatric ureteropelvic junction obstruction: Clinical patterns and imaging findings. J Pediatr Urol. 2015;11(4):173.e1-173.e1735. https://doi.org/10.1016/j.jpurol.2015.04.017
15. Chiarenza SF, Bleve C, Fasoli L, Battaglino F, Bucci V et al. Ureteropelvic junction obstruction in children by polar vessels. Is laparoscopic vascular hitching procedure a good solution? Single center experience on 35 consecutive patients. J Pediatr Surg. 2016;51(2):310-314. https://doi.org/10.1016/j.jpedsurg.2015.10.005

Original Article
Özgün Araştırma

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Comparison of Pneumatic Lithotripter and Holmium-YAG Laser Lithotripter in Supine Mini Percutaneous Nephrolithotomy: A Single-Centre Experience

Supin Mini Perkütan Nefrolitotomide Pnömatik litotriptör ile Holmium-YAG Lazer Litotriptör Karşılaştırması: Tek Merkez Deneyimi

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ABSTRACT

Objective: The aim of this study was to compare the efficacy and safety of lithotripters used in supine mini percutaneous nephrolithotomy.

Material and Methods: Medical record of patients who underwent mini percutaneous nephrolithotomy in supine position between January 2023 and June 2024 due to kidney stone larger than 2 cm were evaluated. Thirty-nine patients were operated with Ho:YAG laser lithotripter (LL) and 54 patients were operated with pneumatic lithotripter (PL). Results of patients' demographics, stone size, stone density, operation time, stone-free rate (SFR), complications were compared.

Results: Mean age was 49.56±13.02 in LL group and 50.20±14.24 in PL group (p=0.825). Mean stone size was 3184±2117 mm^3 in LL group and 4117±2975 mm^3 in PL group and the results were similar between groups (p=0.097). Operation time was significantly higher in LL group than PL group (99.8±24.7 min, 85.7±28.1 min, respectively). SFR at postoperative 3rd month was similar between groups (92% in LL, 87% in PL) (p=0.512). Hemoglobin decrease rate (1.5±1.1 g/dL (IQR 1.5 g/dL) (LL) vs. 1.6±1.0 g/dL (IQR 1.6 g/dL) (PL), p=0.513) and overall complication rates (20% vs. 18%, p=0.897, respectively) were similar in the groups.

Conclusion: Both lithotripters can be preferred effectively in supine percutaneous lithotomy. Ballistic lithotripters are still a safe and effective option for mini-PNL with the advantage of reduced operation time.

Keywords: kidney stone, lithotripsy, supine percutaneous nephrolithotomy, laser, pneumatic

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ÖZET

Amaç: Bu çalışmanın amacı supin mini perkütan nefrolitotomide kullanılan litotriptörlerin etkinlik ve güvenilirliklerini karşılaştırmaktır.

Gereç ve Yöntemler: Ocak 2023 ile Haziran 2024 tarihleri arasında 2 cm'den büyük böbrek taşı nedeniyle supin pozisyonda mini perkütan nefrolitotomi uygulanan hastaların tıbbi kayıtları değerlendirildi. Otuzdokuz hasta Ho:YAG lazer litotriptör (LL) ve 54 hasta pnömatik litotriptör (PL) ile ameliyat edildi. Hastaların demografik özellikleri, taş boyutu, taş yoğunluğu, operasyon süresi, taşsızlık oranı, komplikasyon sonuçları karşılaştırıldı.

Bulgular: Ortalama yaş LL grubunda 49,56±13,02 ve PL grubunda 50,20±14,24 idi (p=0,825). Ortalama taş boyutu LL grubunda 3184±2117 mm^3 ve PL grubunda 4117±2975 mm^3 idi ve sonuçlar gruplar arasında benzerdi (p=0,097). Operasyon süresi LL grubunda PL grubuna göre istatistiksel olarak daha yüksekti (99,8±24,7 dak, 85,7±28,1 dak, sırasıyla). Ameliyat sonrası 3. ayda taşsızlık oranı gruplar arasında benzerdi (LL'de %92, PL'de %87) (p=0,512). Hemoglobin düşüş oranı (1,5±1,1 g/dL (IQR 1,5 g/dL) (LL) vs. 1,6±1,0 g/dL (IQR 1,6 g/dL) (PL), p=0,513) ve genel komplikasyon oranları (sırasıyla %20 vs. %18, p=0,897) gruplarda benzerdi.

Sonuç: Her iki litotriptör de supin perkütan litotomide etkili bir şekilde tercih edilebilir. Balistik litotriptörler, operasyon süresini kısaltma avantajıyla mini-PNL için hala güvenli ve etkili bir seçenektir.

Anahtar Kelimeler: böbrek taşı, taş kırma, lazer, pnömatik, supine perkütan nefrolitotomi

INTRODUCTION

Percutaneous nephrolithotomy (PCNL) is the first-line treatment for kidney stones larger than 2 cm and the second-line treatment for kidney stones measuring between 1-2 cm (1). Standard PCNL (24-30 F) has higher stone-free rates (SFR) compared to shock wave lithotripsy (SWL) and retrograde intrarenal surgery (RIRS). However, PCNL has some disadvantages, such as a higher rates of hemorrhage, higher blood transfusion, and analgesic requirement (2,3). Mini-PCNL was described by Helal et al. to reduce these complications (4). Jackman et al. first used this technique on adults (5). While stone-free rates of mini-PCNL are similar to standard PCNL, mini-PCNL has advantages over standard PCNL such as lower transfusion and complication rates. However, mini-PCNL associated with longer operation time in patients with larger stones (1,6-7).

PCNL was initially performed in the oblique position, but the prone position later became the standard. The prone position provides easier access and a larger space for manipulation of the nephroscope (5). However, this position does not allow simultaneous retrograde access and poses challenges in patients with cardiovascular disease or obesity during the anesthesia (8). Supine position has become popular due to its advantages such as easier anesthetic intervention, less radiation exposure, retrograde access to the kidney, more efficient spontaneous evacuation of stone fragments, and shorter operation time (9).

After successful access to the collecting system, stones are fragmented using pneumatic, ultrasonic or laser lithotripters. The type of lithotripter can affect the operation time, complication rates, stone-free rate SFR and overall costs (10). Previous studies have investigated the outcomes of mini PCNL using holmium:yttrium-aluminum-garnet (Ho:YAG) lithotripter (LL) and pneumatic lithotripter (PL) in prone position. Sharma et al. compared the results of Ho:YAG and PL in prone mini-PCNL. In their study, SFR and complication rates were similar, while fragmentation time was significantly shorter in the LL group (11). In another study comparing LL and PL in prone mini-PCNL, operation times were similar between the groups (12).

There are several studies comparing laser lithotripters with pneumatic lithotripters in mini-PNL. However, there is still limited research comparing different lithotripters in the supine position. This study aims to evaluate the effects of low power LL (30 Watt) and PL on operational duration, SFR, and complication rates in supine mini-PCNL.

MATERIAL AND METHODS

This research was designed as a retrospective analysis. The study protocol was approved by the local ethics committee of our institution (Decision No:2024/0l0.99/6/3l, Decision Date:26.07.2024). Ninety-three patients who underwent supine mini-PCNL due to kidney stone larger than 2 cm between January 2023 and June 2024 were included in the study. Of these patients 54 underwent mini-PCNL using PL and 39 patients were operated on using LL. Patients' demographics, stone size, stone density, stone volume, operation time, hemoglobin decrease, complications, re-treatment and SFR were recorded. The diameter of the largest stone, stone volume, stone density, and degree of hydronephrosis were measured on CT. Stone volume was calculated with the following formula: V=0.523xAxBxC (13). All patients exhibited sterile urine cultures before the procedure. Patients were operated on in the Bart's flank-free position (14). After the placement of a 5 F open-ended ureteral catheter and a 16 F transurethral catheter, puncture of the collecting system was accomplished utilizing ultrasound and fluoroscopic imaging. An 18-gauge needle was placed into the renal collecting system, and the tract was dilated using Amplatz dilators (Amplatz Sheath, Boston Scientific, Natick, MA, USA), followed by the insertion of a 20 F Amplatz sheath.

A 12 F nephroscope (Richard Wolf, Knittlingen, Germany) was used in all procedures. Following fragmentation, stones were extracted using stone graspers. The stone fragmentation was performed with either 1.5 mm pneumatic lithotripter (Swiss Lithoclast, Nyon, Switzerland) or 30W-550 micron fiber Ho:YAG laser lithotripter (Quanta System Litho, Samarate, Italy). The insertion of the Double-j stent and nephrostomy catheter was conducted in accordance with the surgeon's preference. Double-j stent was placed in some patients. A re-entry nephrostomy catheter was not routinely used. The nephrostomy catheter was removed either postoperative first or second day. Kidney-Ureter-Bladder X-ray (KUB) was performed in all patients at postoperative first day. Double-j stent was removed at postoperative 3rd week. Residual control was performed with low-dose computed tomography (CT) at the postoperative 3rd month. Stone-free status was defined as <4 mm residual fragments. Postoperative complications were classified according to the Clavien Dindo classification system. Grade 1-2 complications were considered minor complications (postoperative fever, blood transfusion, additional pharmacological treatment), Grade 3 (requiring intervention under local or general anaesthesia) and above (Grade 4: sepsis, septic shock, organ failure, Grade 5: death) were considered major complications.

Statistical Analysis

Quantitative variables such as age and stone volume are presented as mean±standard deviation. Numbers and percentages were used for qualitative variables. Categorical variables were analysed using the chi-square test. Normality of distribution of variables was analysed using Kolmogorov and Smirnov test. The t-test was used for the comparison of continuous variables with a normal distribution. The Mann-Whitney U test was used for the comparison of continuous variables that had a skewed distribution. All analyses were performed using SPSS software version 23.0 (SPSS Inc., Chicago, IL, USA). Statistical tests were two-tailed and a p-value of 0.05 was considered significant.

RESULTS

Patients' mean age was 49.5±13.0 in the LL group and 50.2±14.2 in the PL group (p=0.825). The mean stone volume was 3184±2117 mm^3 (IQR 2667mm^3) in the LL group and 4117±2975 mm^3 (IQR 3090 mm^3) in the PL group, with no significant difference observed between the groups (p=0.097) (Table-1). Operation time was significantly shorter in the PL group (LL=99.8±24.7 min, PL=85.7±28.1 min; p=0.014). SFR in KUB on the postoperative first day was %84 (33/39) in the LL group and %79 (43/54) in the PL group (p=0.597). No statistically significant difference was noted between the groups regarding the stone-free rate at the third month postoperatively (LL=84%, PL=79%, p=0.512) (Table-2).

Table 1. Demographic data and stone characteristics

	LL (n=39)	PL (n=54)	P value
Age (mean±SD)	49.5±13.0	50.2±14.2	0.825
Gender (female/male)	11/28	15/39	0.964
Side (right/left)	22/17	23/31	0.212
Stone volume (mm^3) (mean±SD) **(IQR)**	3184±2117 2667	4117±2975 3090	0.097
Stone density (HU) (mean±SD)	969±300	978±320	0.889
Guy's stone score (mean±SD) **1** **2** **3**	1.3±0.6 28 7 4	1.4±0.6 38 10 6	0.874

Hemoglobin decrease rate (1.5±1.1 g/dL (IQR 1.5 g/dL) (LL) vs. 1.6±1.0 g/dL (IQR 1.6 g/dL) (PL), p=0.513) and overall complication rates (%20 vs. %18, p=0.897, respectively) were similar in the groups. Moreover, the rate of minor complications between the two groups did not differ significantly (15% (n=6) vs. 14% (n=8), P=0.940). Two patients in the LL group and one patient in the PL group received antibiotic therapy for postoperative infection, while one patient in the PL group required a blood transfusion. Double-j stent was placed under local anesthesia on 2 patients in each group due to residual fragments in the postoperative period. Grade 4 or 5 complications did not occur in both groups (Table-2).

Table 2. Intraoperative and postoperative data

	LL (n=39)	PL(n=54)	P value
Stone free rate **Postoperative first day, n (%)** **Postoperative 3 months, n (%)**	 33/6 (84) 36/3 (92)	 43/11 (79) 47/7 (87)	 0.597 0.512
Hemoglobin drop (g/dl) (mean±SD) **(IQR)**	1.5±1.1 **1.5**	1.6±1.0 **1.6**	0.513
Operation time (minutes)	99.8±24.7	85.7±28.1	**0.014**
Auxillary procedure **Dj insertion, n (%)**	 2 (5)	 2(3)	0.740
Clavien Dindo Complications, n (%) **Grade 1** **Grade 2** **Grade 3a**	8 (20) 5 1 2	10(18) 6 2 2	0.987

DISCUSSION

The present study investigated the perioperative outcome and complications of LL and PL in supine mini PNL. Both techniques demonstrated comparable stone-free rates and exhibited comparable complication rates. However, the PL technique was associated with reduced operative time.

Ho:YAG laser is the first-choice lithotripter in mini-PCNL. The reduced probe size facilitates compatibility with a smaller nephroscope and enhances irrigation efficiency. Another important advantage of LL is that it provides better fragmentation by changing energy and frequency values at different stone densities (10). Furthermore, it offers

reduced retropulsion. This advantage enables for the fragmentation of stones into smaller fragments compared to PL (15). However, LLs are expensive devices, and the cost of laser fibers are also quite high. High-power holmium YAG lasers require a specific energy source. Concerning PL, retropulsion, particularly in hydronephrotic kidneys, represents the most significant disadvantage (16). Stone migration to other calyxes may cause difficulties in reaching the stone and lead to residual fragments. Besides that, PL can cause mucosal damage, bleeding or stone migration out of the collecting system. One of the most notable advantages of ballistic lithotripters is the relatively low financial burden associated with the initial assembly and maintenance expenses.

Mini-PCNL presents several advantages over conventional PCNL, including increased SFR and reduced complication rates (6). The duration of the procedure in mini-PCNL may be extended due to the reduced size of the sheath. The stone burden substantially impacts operational time (17,18). Research comparing LL and PL in mini-PCNL performed in the prone position yields inconsistent findings. Ganesamoni et al. conducted a prospective comparison of lithotripter types in mini-PCNL operations. Operation and fragmentation times were comparable in both the LL and PL groups, whereas the stone migration rate was higher in the PL group (12). Concordantly to this study, both types of lithotripters revealed equivalent stone-free rates in our research. Another prospective study indicated that, although operation times were comparable, fragmentation time was longer in the PL group (11). Similarly, İbis et al. conducted a comparison of high-power LL and PL in supine mini-PCNL, revealing that the operation time was greater in the PL group (10). They concluded that the high-power settings with the Ho:YAG laser provided a much more efficient lithotripsy and took out the possible advantage of the ballistic lithotripter. Liu et al. performed an evaluation of data from 100 patients to compare PL and 12W LL, finding that the operation time was shorter in the PL group. However, the study did not specify the position type (19).

In our investigation, the stone volume was greater in the PL group, however this difference was not statistically significant. (3184±2117 mm^3 vs. 4117±2975 mm^3, p=0.097). Nonetheless, the surgery duration was statistically considerably reduced in the PL group (99.8±24.7 min vs. 85.7±28.1 min, p=0.014). The differences in literature in outcomes can be explained by the variety of the power of Ho:YAG laser and variety in stone volume among the studies. Stone volume might be another factor effecting outcomes. We believe that the duration of the procedure may have been extended in the LL group due to the use of a 30 W Ho:YAG laser in our study.

Stone freeness is the most important factor reflecting surgical success. Studies examining the results from standard and mini-PCNL have indicated comparable outcomes. A review involving 1196 patients indicated that the SFR for mini-PCNL was 92.9%, which is comparable to that of standard PCNL(6). Tangal et al. conducted a retrospective evaluation of data from 312 patients who underwent supine PCNL. This study compared LL, PL, and their combination, revealing similar SFR statuses of 92.3%, 91.3%, and 91.3%, respectively (p=0.95) (20). A retrospective study comparing LL and PL in the supine position found that SFR status was similar between groups, with rates of 92.5% and 90.2%, respectively (p=0.23) (10). Our research revealed that, consistent with previous literature, the SFR status at three months postoperatively was 87% in the PL group and 92% in the LL group (p=0.512).

Abdelhafez et al. reported that the rates of bleeding and transfusion were higher in standard PCNL compared to mini-PCNL (21). When evaluating blood loss in mini PCNL for LL and PL, the outcomes appeared to be similar (11,12,19). In our research the rate of blood loss was comparable among the groups (p=0.513). Only one patient required a blood transfusion postoperatively. In our study, complication rates were similar in each group. This is likely attributed to the comparatively smaller size of renal calculi in this study and the relative safety associated with mini-PCNL.

The primary limitations of our study are the absence of randomization and the retrospective nature of the data analysis. Additionally, the present study's findings are derived from applying a 30 W laser. The use of high-power lasers, capable of reaching frequencies up to 100 Hz, significantly reduces operative times for laser lithotripsy. Besides that, we were

unable to report our stone fragmentation time results. Instead, we collected data on total operative times.

CONCLUSION

Both technics provided similar outcomes in SFR and complications. Ballistic lithotripters are still a safe and effective option for mini-PNL with the advantage of reduced operation time. We believe that PL will continue to be preferred in mini-PNL because of their similar SFRs, similar complication rates, and their cost-effectiveness. More reliable results could be achieved with prospective randomized studies.

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

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REFERENCES

1. Turk C, Petrik A, Sarica K et al. EAU guidelines on Interventional Treatment for Urolithiasis. Eur Urol. 2016;69:475-82. https://doi.org/10.1016/j.eururo.2015.07.041
2. Michel MS, Trojan L, Rassweiler JJ. Complications in percutaneous nephrolithotomy. Eur Urol. 2007;51:899-906. https://doi.org/10.1016/j.eururo.2006.10.020
3. Jiang K, Zhang P, Xu B, et al. Percutaneous Nephrolithotomy vs. Retrograde Intrarenal Surgery for Renal Stones Larger than 2cm in Patients with a Solitary Kidney: A Systematic Review and a Meta-Analysis. Urol J. 2020;17:442-448. https://doi.org/10.22037/uj.v16i7.5609
4. Helal M, Black T, Lockhart J, Figueroa TE. The Hickman peel-away sheath: alternative for pediatric percutaneous nephrolithotomy. J Endourol. 1997;11:171-2. https://doi.org/10.1089/end.1997.11.171
5. Jackman SV, Docimo SG, Cadeddu JA, et al. The "mini-perc"technique: a less invasive alternative to percutaneous nephrolithotomy. World J Urol. 1998;16:371-4. https://doi.org/10.1007/s003450050083
6. Lahme S. Miniaturisation of PCNL. Urolithiasis. 2018;46:99-106. https://doi.org/10.1007/s00240-017-1029-3
7. Scoffone CM, Cracco CM, Cossu M, Grande S, Poggio M, Scarpa RM. Endoscopic combined intrarenal surgery in Galdakao-modified supine Valdivia position: a new standard for percutaneous nephrolithotomy? Eur Urol. 2008;54:1393-403. https://doi.org/10.1016/j.eururo.2008.07.073
8. Li P, Ma Y, Liao B, et al. Comparison of safety and efficacy of different positions in percutaneous nephrolithotomy: a network meta-analysis. Int J Surg. 2024;110:2411-2420. https://doi.org/10.1097/JS9.0000000000001130
9. Keller EX, DE Coninck V, Proietti S, et al. Prone versus supine percutaneous nephrolithotomy: a systematic review and meta-analysis of current literature. Minerva Urol Nephrol. 2021;73:50-58. https://doi.org/10.23736/S2724-6051.20.03960-0

10. Ibis MA, Özsoy AF, Özkaya MF, et al. Comparison of lithotripsy methods during mini-PNL: is there a role for ballistic lithotripsy in the era of high-power lasers. BMC Urol. 2024;24:54. https://doi.org/10.1186/s12894-024-01443-6
11. Sharma A, Giri A, Garg G, et al. A prospective comparative study to evaluate safety and efficacy of pneumatic versus laser lithotripsy in mini-percutaneous nephrolithotomy. Am J Clin Exp Urol. 2023;11:258-264. https://pmc.ncbi.nlm.nih.gov/articles/PMC10333137
12. Ganesamoni R, Sabnis RB, Mishra S, et al. Prospective randomized controlled trial comparing laser lithotripsy with pneumatic lithotripsy in miniperc for renal calculi. J Endourol. 2013;27:1444-9. https://doi.org/10.1089/end.2013.0177
13. Aminsharifi A, Irani D, Amirzargar H. Shock Wave Lithotripsy is More Effective for Residual Fragments after Percutaneous Nephrolithotomy than for Primary Stones of the Same Size: A Matched Pair Cohort Study. Curr Urol. 2018;12:27-32. https://doi.org/10.1159/000447227
14. Papatsoris AG, Zaman F, Panah A, Masood J, El-Husseiny T, Buchholz N. Simultaneous anterograde and retrograde endourologic access: "the Barts technique". J Endourol. 2008 Dec;22(12):2665-6. https://doi.org/10.1089/end.2008.0283
15. Yin X, Tang Z, Yu B, et al. Holmium: YAG laser lithotripsy versus pneumatic lithotripsy for treatment of distal ureteral calculi: A meta-analysis. J Endourol 2013;27:408–414. https://doi.org/10.1089/end.2012.0324
16. Mager R, Balzereit C, Gust K, et al. The hydrodynamic basis of the vacuum cleaner effect in continuous-flow PCNL instruments: an empiric approach and mathematical model. World J Urol. 2016;34:717–24. https://doi.org/10.1007/s00345-015-1682-5
17. Cheng F, Yu W, Zhang X, et al. Minimally invasive tract in percutaneous nephrolithotomy for renal stones. J Endourol. 2010;24:1579–1582. https://doi.org/10.1089/end.2009.0581
18. Timm B, Farag M, Davis NF, et al. Stone clearance times with mini-percutaneous nephrolithotomy: Comparison of a 1.5 mm ballistic/ultrasonic mini-probe vs. laser. Can Urol Assoc J. 2021;15:E17-E21. https://doi.org/10.5489/cuaj.6513
19. Liu C, Zhou H, Jia W, Hu H, Zhang H, Li L. The Efficacy of Percutaneous Nephrolithotomy Using Pneumatic Lithotripsy vs. the Holmium Laser: a Randomized Study. Indian J Surg. 2017;79:294-298. https://doi.org/10.1007/s12262-016-1473-2
20. Tangal S, Sancı A, Baklacı U, et al. What is the optimum lithotripsy method for high density stones during mini-PNL? Laser, ballistic or combination of both. Lasers Med Sci. 2020;35:1765-1768. https://doi.org/10.1007/s10103-020-02971-x
21. Cheng F, Yu W, Zhang X, Yang S, Xia Y, Ruan Y. Minimally invasive tract in percutaneous nephrolithotomy for renal stones. J Endourol. 2010;24:1579-82. https://doi.org/10.1089/end.2009.0581

Original Article
Özgün Araştırma

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The Long-Term Effects on Recurrence and Progression of Bladder Tumors of Chemotherapeutic Agents Used After Transurethral Resection

Mesane Tümörlerinde Transüretral Rezeksiyondan Sonra Kullanılan Kemoterapötik Ajanların Nüks Ve Progresyon Üzerindeki Uzun Vadeli Etkileri

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ABSTRACT

Objective: Early single dose chemotherapy may have a reducing effect on recurrence and progression. In this study, we aimed to compare non-muscle invasive patients diagnosed with bladder cancer who did not receive early single dose chemotherapy and those who received intravesical Epirubicin or Gemcitabine in terms of recurrence and progression.

Material and Methods: 116 patients were followed up for 48 months (May 2020-June 2022) with diagnosis of primary non-invasive bladder cancer. After transurethral resection of the bladder, patients were followed up with 3 groups: who received intravesical epirubicin, who received gemcitabine, who did not receive any chemotherapeutic agent.

Results: The mean age was 63. There were no statistically significant difference in age and, body mass index. Recurrence was determined 57.1% (n=20), 40% (n=18), and 41.7% (n=15) (p=0.263) of the patients, respectively who were not administered any intravesical agent, were administered Epirubicin and, Gemcitabine. While recurrence rates were observed 50%, 25%, 0% (p=0.177) respectively, in low-risk, no progression was detected. In intermediate risk group, 66.7%, 33.3%, 42.8% (p=0.378) recurrence, and 33.3%, 22.7%, 6.7% (p=0.282) progression were detected, respectively. High-risk group, recurrence was found in 56%, 64.2%, 56.2% (p=0.866) of the patients and progression 8%, 14.3%, 6.3% (p=0.723) respectively. In low-grade group, 35.7%, 42.9%, 21.4% (p=0.045) recurrence, and 16.6%, 12.1%, and 4.3% (p=0.164) progression were determined , respectively. In the high-grade group, 58.8%, 50%, 69.2% (p=0.982) recurrence, 5.9%, 16.6% and 7.7% (p=0.581) progression were detected, respectively.

Conclusion: These findings demonstrated that intravesical chemotherapeutics can delay or prevent recurrence and progression, should therefore be administered in early postoperative period. Gemcitabine is not in widespread use and has been found to be a good alternative.

Keywords: bladder cancer, recurrence, progression, epirubicin, gemcitabine

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ÖZET

Amaç: Erken tek doz kemoterapinin nüks ve progresyonu azaltıcı etkisi olabilmektedir. Çalışmamızda mesane kanseri tanısı almış, erken tek doz kemoterapi almayan ve intravezikal Epirubisin veya Gemcitabin alan kasa invaziv olmayan hastaların nüks ve progresyon açısından karşılaştırılmasını amaçladık.

Gereç ve Yöntemler: Primer non-invaziv mesane kanseri tanısı almış 116 hasta 48 ay (mayıs 2020-haziran 2022) boyunca takip edildi. Mesanenin transüretral rezeksiyonundan sonra hastalar 3 grupta takip edildi: intravezikal epirubisin alanlar, gemcitabin alanlar ve herhangi bir kemoterapi ajanı almayanlar.

Bulgular: Olguların ortalama yaşı 63 idi. Hastalarda yaş ve vücut kitle indeksi arasında istatistiksel olarak fark yoktu. Herhangi bir intravezikal ajan uygulanmayan, Epirubisin, Gemcitabine uygulanan hastalarda sırasıyla %57,1 (n=20), %40 (n=18) ve %41,7 (n=15) (p=0,263) oranında nüks saptandı. Düşük riskli grupta nüks oranları sırasıyla %50, %25, %0 (p=0,177) olarak gözlenirken, progresyon saptanmadı. Orta riskli grupta ise sırasıyla %66,7, %33,3, %42,8 (p=0,378) nüks, %33,3, %22,7, %6,7 (p=0,282) oranında progresyon saptandı. Yüksek riskli grupta ise hastaların sırasıyla %56, %64,2, %56,2'sinde nüks (p=0,866), %8, %14,3, %6,3'ünde (p=0,723) progresyon saptandı. Düşük dereceli grupta sırasıyla %35,7, %42,9, %21,4 nüks (p=0,045) ve %16,6, %12,1 ve %4,3 (p=0,164) progresyon saptandı. Yüksek dereceli grupta sırasıyla %58,8, %50, %69,2 nüks (p=0,982), %5,9, %16,6 ve %7,7 (p=0,581) progresyon belirlendi.

Sonuç: Bu bulgular, intravezikal kemoterapötiklerin nüks ve progresyonu geciktirebileceğini ve/veya önleyebileceğini, bu nedenle erken postoperatif dönemde uygulanması gerektiğini göstermiştir. Gemsitabin yaygın kullanımda olmayıp alternatif olarak iyi bir tercih olduğu görülmüştür.

Anahtar Kelimeler: mesane kanseri, nüks, progresyon, epirubisin, gemcitabine

INTRODUCTION

All types of cancers are known to be increasing all over the world depending on lifestyles and environmental conditions. Bladder cancer is the tenth most commonly diagnosed cancer in all genders (1). Approximately 75% of transitional epithelial cancer of the bladder is a disease with mucosa (stage Ta or carcinoma in situ) or submucosa (stage T1) involvement and is defined non-muscle invasive bladder cancer (NMIBC) (2).

Tumor resection is the main treatment approach in superficial bladder cancers, and recurrence or progression is relatively common during follow-up according to grade and stage. There is a risk of frequent recurrence in NMIBC. Moreover it can advance to a life-threatening disease (3). Therefore, a scoring system developed by the European Organization for Research and Treatment of Cancer (EORTC) defining risk groups to be able to monitor patients and facilitate the treatment process. Risk factors for recurrence and progression are multifocality, tumor size, number of previous recurrences, grade, stage, and presence of carcinoma in situ (CIS) (4). It has been well known for many years that various intravesical chemotherapeutic agents are used and different protocols are applied after resection of superficial bladder tumors. The current guidelines recommend that early single-dose intravesical chemotherapy should be administered after resection to prevent or delay recurrence and progression. Intravesical chemotherapy has an ablative effect on small tumors that remain in the resection area, which have been missed following transurethral resection of the bladder (TURB) (5).

In this study it was aimed to compare progression and recurrence rates of patients with bladder tumor who were administered intravesical Epirubicin or Gemcitabine or who did not receive any early single-dose chemotherapy.

MATERIAL AND METHODS

This was a prospective, cross sectional study. It was conducted at Sivas Cumhuriyet University from May 2020 to June 2022 after obtaining the local ethics committee's approval, with decision number 2020-05/02.

Between 2020 and 2022, a total of 116 primary consecutive patients with the diagnosis of superficial bladder cancer were followed up for 48 months. All patients diagnosed with superficial bladder cancer who were eligible for the study between the specified dates were included. All patients were evaluated by cystoscopy. The data were evaluated according to the pathology results and included in the study.The patients were separated into 3 groups randomly: Those who did not receive any intravesical chemotherapy (n:35), those who received Epirubicin (n:45), and those who received Gemcitabine (n:36). Also a subdivision made to the patients into 3 groups as low, intermediate, and high risk, and 2 groups according to the degree of invasiveness as high grade and low grade. These groups were formed based on the risk scale of the EORTC. Follow-up of the patients was done by cystoscopy at 3-month intervals.

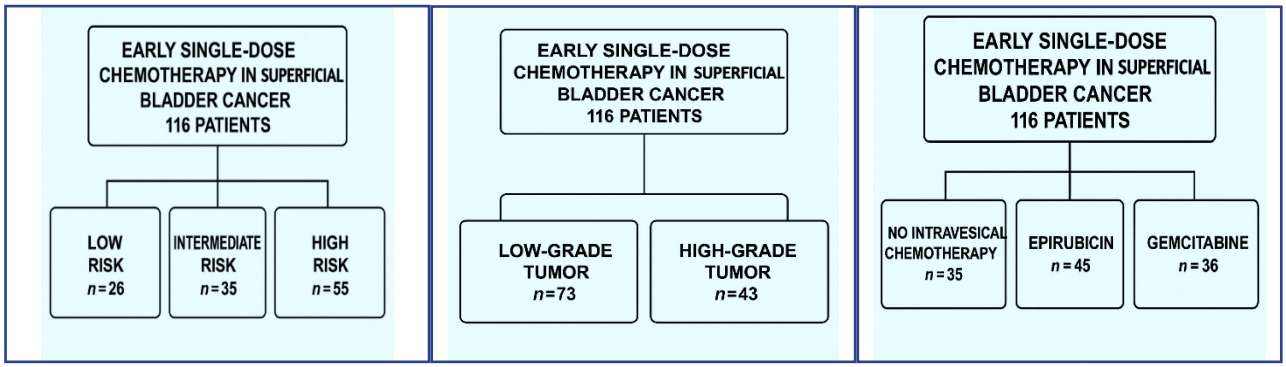

Figure 1. Classification of 116 patients receiving early single-dose chemotherapy according to risk groups, grade and whether they received treatment or not

Inclusion Criteria of Patients

We included patients in whom we performed resection with the TUR method and did not deepen the resection too much, patients whose hematuria was not very intense after resection, and patients who allowed intravesical chemotherapy in our study.

Exclusion Criteria of Patients

We did not include patients with previous bladder tumor surgery and variant pathology, patients with a history of chemotherapy and radiotherapy applied to the bladder, and patients with T2 or higher pathology in 59 of the 175 patients in whom we performed resection with the TUR method.

Approximately 1 hour after the bladder tumor resection which was performed with the conventional method: 50 mg of Epirubicin was prepared with 50 ml of saline and then administered intravesical via a 22f Foley catheter. 2000 mg of Gemcitabine was prepared with 100 ml of saline and then administered intravesical via a 22f Foley catheter. Intravesical chemotherapeutic agent was not administered to patients who had grade 2 or grade 3 perforation during TURB according to the Depth of Endoscopic Perforation (DEEP) scale, had extensive hematuria, or did not accept intravesical early single-dose chemotherapy treatment. These patients who did not administered any intravesical chemotherapeutic agent were included in the 1st group.

Statistical Analysis

Statistical analysis of the data obtained in the study was performed using SPSS vn. 22.0 software. The categorical variables were presented as numbers (n) and percentages (%). All the continuous variables were analysed and expressed by mean ± standard deviation. Conformity of continuous data to normal distribution was examined with the Shapiro-Wilk test and the results showed that the disstribution of continuous variables was not normal ($p<0.05$). The Kruskal-Wallis H test was applied in multiple comparisons. The Mann-Whitney U-test was used again in posthoc

analyses. Categorical data were examined with Chi-square analysis. At the same time, Breslow test results were interpreted to interpret the tests on the survival of patients**.** All the analyses were interpreted at 95% confidence level. A value of p below 0.05 was accepted as statistically significant.

RESULTS

Evaluation was made of patients who did not receive early single-dose intravesical chemotherapy, patients who were administered intravesical Epirubicin, and those who were administered intravesical Gemcitabine in terms of progression and recurrence in bladder tumors. The groups were compared in respect of the time to recurrence and progression. The difference between the groups were not statistically significant. (Table 1).

Table 1. Comparisons of the treatments of bladder tumor in terms of recurrence(63) and progression (12), and the time elapsed (months) in patients with recurrence and/or progression

	No IV Treatment	Epirubicin	Gemcitabine	p Value
Recurrence (+ / n) %	15/35 42.90%	27/45 60.00%	21/36 58.30%	0.263[a]
Time To Recurrence (Median) (Min / Max Months)	 3.8 3/5	 5.3 3/7	 18.1 3/24	0.234[b]
Progression (+ / n)	4/35 11.40%	6/45 13.30%	2/34 5.60%	0.505[a]
Time To Rogression (Median) (Min / Max Months)	9.1 4/13	11.9 9/16	21.2 3/42	0.486[b]

a: Chi-Square Test

b: Kruskal-Wallis H Test

Recurrence times were compared with the Breslow test and recurrence times were not statistically different according to intravesical use or intravesical type (p=0.095). For the whole patient group, the time to recurrence was 6.698 months (hazard ratio (HR): 0.40; 95% confidence interval (CI), 4.100-9.296; p<0.001), as 4.059 months (HR: 0.41; 95% CI, 2.977-5.141; p<0.001) in Group 1, patients not administered intravesical agents, 5.188 months (HR: 0.25; 95% CI, 3.234-7.141; p<0.001) in Group 2, patients administered Epirubicin, and 13.6 months (HR: 0.30; 95% CI, 3.865-23.335; p<0.001) in Group 3, patients administered Gemcitabine.

The patients were separated into three groups as low risk, intermediate risk, and high risk. The groups with and without chemotherapeutic agents were compared in terms of progression and recurrence. No statistically significant difference was found. (Table 2).

Table 2. Comparisons of the patient risk groups in terms of recurrence and progression in patients with and without IV agents, time to recurrence (months), and time to progression (months)

Risk Groups	Recurrence			p value (recurrence) p value (time)	Risk Groups	Progression			p value (progression) p value (time)
	No IV Treatment	Epirubicin	Gemcitabine			No IV Treatment	Epirubicin	Gemcitabine	
Low Risk					Low Risk				
(+ / n)	2/4 50%	4/16 25%	0/6 0%	0.177[a]	(+ / n)	0/4 0%	0/16 0%	0/6 0%	-
Time to recurrence (min-max month)	3/9	4/18	0	0.248[b]	Time to progression (min-max month)	0	0	0	-
Intermediate Risk					Intermediate Risk				
(+ / n)	4/6 66.6%	5/15 33.3%	6/14 42.8%	0.378[a]	(+ / n)	2/6 33.3%	4/15 26.6%	1/14 7.1%	0.282[a]
Time to recurrence (min-max month)	3/8	3/9	4/21	0.462[b]	Time to progression (min-max month	6/15	9/13	42	0.325[b]
High Risk					High Risk				
(+ / n)	14/25 56%	9/14 64.2%	9/16 56.2%	0.866[a]	(+ / n)	2/25 8%	2/14 14.2%	1/16 6.2%	0.723[a]
Time to recurrence (min-max month)	2/5	3/9	4/24	0.241[b]	Time to progression (min-max month	2/11	16/27	3	0.223[b]

a: Chi-Square Test

b: Kruskal-Wallis H Test

The compare means kruskal-wallis h test and chi-square test was applied

Then compared in terms of progression and recurrence. Low-grade bladder tumor patients were compared with and without intravesical chemotherapy, and a statistically significant difference was determined between these subgroups in terms of recurrence and progression ($p<0.05$). The comparisons between the other groups demonstrated no statistically significant difference (Table 3).

Table 3. Comparisons of patients histologically classified as low grade and high grade, who received and did not receive IV chemotherapeutic agents in terms of recurrence and progression, time to recurrence (months), and time to progression (months)

	RECURRENCE				PROGRESSION			
	NO IV TREATMENT	EPIRUBICIN	GEMCITABINE		NO IV TREATMENT	EPIRUBICIN	GEMCITABINE	
GRADE of INVASION				p value (recurrence) p value (time)				P value (progression) p value (time)
LOW GRADE					LOW GRADE			
(+ / n)	9/18 50%	10/33 30%	3/22 13.6	0.045[a]	(+ / n)	3/18 16.6%	4/33 12.1%	1/22 4.5%	0.164[a]
Time to recurrence (min-max months)	3/7	3/9	6/36	0.091[b]	Time to progression (min-max months)	6/15	9/13	(4/2)	0.999[b]
HİGH GRADE					HİGH GRADE			
(+ / n)	9/17 5.2%	6/12 50%	7/14 50%	0.982[a]	(+ / n)	1/17 5.8%	2/12 16.6%	1/14 7.1%	0.581[a]
Time to recurrence (min-max months)	3/3	3/4	3/9	0.301[b]	Time to progression (min-max months)	2/2	12/27	3/3	0.368[b]

a: Chi-Square Test
b: Kruskal-Wallis H Test

The compare means kruskal-wallis h test and chi-square test was applied

The Breslow test was applied to compare the times to recurrence times, and a statistically significant difference was determined according to grade (low/high), intravesical use, and intravesical type ($p=0.029$). The time to recurrence in all low-grade patients was calculated to be 7.864 months (HR: 0.32; 95% CI, 4.463-11.264; $p<0.001$), as 5.111 months (HR: 0.33; 95% CI, 3.529-6.693; $p<0.001$) in Group 1, (no intravesical chemotherapy), as 6.100 months (HR: 0.30; 95% CI, 3,260-8,940; $p<0.001$) in Group 2 (Epirubicin), and as 22.0 months (HR: 0.33; 95% CI, 4.913-39.087; $p<0.001$) in Group 3 (Gemcitabine).

The time to recurrence in all high-grade patients was found to be 5.476 months (HR: 0.19; 95% CI, 1.508-9.444; $p<0.001$), as 2.875 months (HR: 0.62; 95% CI, 1.865-3.885; $p<0.001$) in Group 1 (no intravesical chemotherapy), as 3.667 months (HR: 0.33; 95% CI, 1.796-5.538; $p<0.001$) in Group 1 (Epirubicin), and as 10.0 months (HR: 0.14; 95% CI, 0.00-21.564; $p<0.001$) in Group 3 (Gemcitabine).

DISCUSSION

The global age-standardised incidence rate is 9.5 for males and 2.4 for females (per 100,000 person/years). These rates are 20 for males and 4.6 for females in the European Union. Despite significant advances and changes in the field of molecular and technology science, TURB remains the first approach in the treatment and diagnosis of primary bladder cancers. The most prominent clinical features of NMIBC are that it is progressive and recurrent. After TURB, the probability of recurrence within 1 year in low-risk patients is 15%, and 31% within 5 years. In high-risk patients, the

probability of recurrence is 61% within 1 year and 78% within 5 years. For high-risk NMIBC the probability of 1-year progression patients is 3.5% and probability of annual progression is 9.6%. For very high-risk NMIBC the probability of 1-year progression patients is 16.5%, and probability of annual progression is 40% (6).

Epirubicin, one of the anticancer agents of the anthracycline group, is a periodic, non-specific anticancer agent. Its mechanism of action is to prevent DNA replication and transcription by controlling polymerase (7). Due to powerful anticancer activity, low drug resistance, rapid diffusion, and low toxicity, Epirubicin is a highly preferred intravesical chemotherapeutic agent (8). In a study of a total of 512 patients by Oosterlink et al., intravesical Epirubicin was administered to 50.2% of the patients after TURB, and not to 49.8%. In the cystoscopic examination performed on the patients 4 weeks later, recurrence was observed in 3.9% of the patients, and it was seen that only one of the patients who developed recurrence was from the Epirubicin group (9). In the current study, intravesical Epirubicin was administered to 38.7% of patients after TURB, while intravesical treatment was not applied to 30% of patients. In the cystoscopic examination performed 3 months later, recurrence was seen to have developed in 15.5% of the patients who received Epirubicin and in 17.2% of the patients with no intravesical treatment. The reason for the higher recurrence rate in the current study in the group treated with Epirubicin was thought to be the earlier performance of first cystoscopy by Oosterlink et al., or that the majority of patients who received Epirubicin in the current study were at moderate or high risk.

In contrast, Masters et al.'s clinical study stated that a 42% complete response was obtained in 122 patients in 3 months with a single Epirubicin administration on a 0.5 cm tumor (10). That study demonstrated that early single-dose intravesical chemotherapy prevents recurrences by both chemoresection and preventing implantation. In the present study, patients with bladder tumors of a small size (<3 cm) and those with a single tumor were in the low-risk group, constituting 22.4% of the total patients. Epirubicin was administered to 61.5% of these patients, and no intravesical treatment was applied to 15.4%. Recurrence developed in 25% of the patients who received Epirubicin and in 50% of the patients with no intravesical treatment, thereby demonstrating that Epirubicin administration reduced the likelihood of recurrence proportionally.

Sylvester et al.'s study examined 13 publications with 2278 patients. Of the 1161 patients treated with TURB only, and 1117 patients with Pirarubicin, Epirubicin, Thiotepa, or Mitomycin C, recurrence was seen in 1128 patients. ($p<0.001$). Single-dose chemotherapy was administered IV to 42.5% of the patients with recurrence, and no intravesical treatment was administered to 56.2% of the patients. A single dose of chemotherapy which administered intravesically reduced the likelihood of recurrence by 35% (11). In the current study, Epirubicin or Gemcitabine was administered to 86 of 116 patients, and recurrence occurred in 36% of the patients. No intravesical agent was administered to 30.1% of the patients and recurrence developed in 57.1%. These results can be interpreted as Epirubicin and other IV chemotherapeutics being very advantageous in terms of preventing recurrence compared to patients not administered with intravesical chemotherapeutic agents.

Gemcitabine is anticancer agent a pyrimidine antimetabolite, which replication disrupts cell by acting on the cell cycles S phase (12). Although Gemcitabine and Epirubicin differ in terms of the mechanism of action, both show antitumor activity through interference in the division of tumor cells. Gemcitabine, which is widely used in many different types of cancer, is also used in the treatment of urological cancers. In a clinical study of 86 patients followed up for 36 months, Ye HB et al. compared Epirubicin and Gemcitabine. Of the total patients, 48.9% were administered Gemcitabine and 51.1% received Epirubicin. The results from a 2-year follow-up period showed that recurrence developed in 33.3% of the patients who received Gemcitabine and in 40.1% of the patients who received Epirubicin (13). In the final of the 4-year follow-up period of the current study, recurrence was seen to have developed in 40% of the patients administered Epirubicin and in 41.6% of the patients administered Gemcitabine. Both studies showed no statistically significant difference.

Gemcitabine and physiological saline application were compared 406 patients in a study by Messing et al. Gemcitabine was administered as a single dose to 49.5% of the patients, and intravesical irrigation with saline solution was applied to 50.5% of the patients. Tumor recurrence occurred within 4 years in 33.3% of the patients administered Gemcitabine and in 44.4% of the patients treated with saline irrigation ($p<0.001$). Of the 215 patients with low-grade tumors who had undergone TURB, recurrence developed in 33.3% of the patients in the Gemcitabine group and in 52.2% of the saline solution group ($p=0.001$) (14). In the current study, 36 patients were administered Gemcitabine, and recurrence developed in 41.6% of these patients during the 4-year follow-up period ($p<0.001$).

Of the 73 patients with low-grade NMIBC in the current study, 8.2% of those who received Gemcitabine developed recurrence. It was determined that Gemcitabine administered to patients with low-grade bladder tumors statistically significantly reduced the probability of recurrence compared to those who were not administered any intravesical agents. These results were consistent with findings of Messing et al. ($p<0.001$), and Gemcitabine administration was shown to be beneficial, especially in patients with low-grade NMIBC.

NMIBC is a heterogeneous group of tumors, each exhibiting different behavior. To predict the behavior of these heterogeneous groups, namely tumor recurrence, and progression, the EORTC developed a scoring system with risk groups defined accordingly. Patients are classsified as low risk, intermediate risk, or high risk according to the probability of progression and recurrence. Zhang et al. followed up 335 patients for 4 years, with Epirubicin administered to 32.5%, Gemcitabine to 34%, and Pirarubicin to 33.5%. The patients were separated into high risk and intermediate risk groups according to the risk of NMIB tumor. Of the patients treated with Epirubicin, 38.5% were classified as intermediate-risk and 61.5% as high-risk, 28.9% of the patients treated with Gemcitabine were classified as intermediate-risk and 71.1% as high-risk, and 33.9% of the patients treated with Pirarubicin were classified as intermediate-risk and 66.1% as high-risk. The intermediate risk groups recurrence was 7.1% of patients with Epirubicin treatment, 6% of patients with Gemcitabine treatment, and 7.8% of patients with Pirarubicin treatment. In the high-risk group, recurrence developed in 10.4% of patients treated with Epirubicin, 3.7% of patients treated with Gemcitabine, and 13.1% of patients treated with Pirarubicin. The intermediate-risk groups recurrence after administration of all three chemotherapeutic agents was not statistically significant. The high-risk groups rate of recurrence in the Gemcitabine treatment group was determined to be lower statistically significantly compared to the other chemotherapeutic agents ($p<0.017$) (15). In the current study, the intermediate-risk group included 35 patients and the high-risk group included 55. Epirubicin was administered to 42.9% and Gemcitabine to 40% of the intermediate-risk patients, and Epirubicin was administered to 25.5% and Gemcitabine to 29.1% of the high-risk patients. In the intermediate-risk group, recurrence developed in 38.5% of patients administered Epirubicin and in 30.8% of patients administered Gemcitabine. In the high-risk group, 33.3% of patients administered Epirubicin and 22.2% of patients administered Gemcitabine developed recurrence. In terms of recurrence between the intermediate-risk and high-risk groups no statistically significant difference was determined. However, it was observed that administration of Gemcitabine decreased the recurrence probability proportionally.

Early single-dose intravesical chemotherapy does not change the progression and cancer-related death rate (11). Messing et al. compared the administrations of Gemcitabine and saline in terms of progression. A single dose of intravesical chemotherapy with Gemcitabine was administered to 201 patients, and intravesical irrigation with saline was applied to 205 patients. Progression developed in 5.9% of the patients administered Gemcitabine and in 8.8% of those administered saline irrigation. No statistically difference significant was determined in terms of the effect of early single-dose intravesical chemotherapy on progression ($p=0.25$) (14). In the current study, 31% of 116 patients were administered Gemcitabine, 38.9% were administered Epirubicin, and 30.1% received no intravesical chemotherapy. Progression developed in 5.6% of the patients who received Gemcitabine, in 13.3% of the patients who received Epirubicin, and in 11.4% of those who did not receive any intravesical chemotherapy. Intravesical single-dose chemotherapy was not found to be statistically significant in terms of progression, and similar results were obtained

in the other groups (p=0.244). Sylvester et al.'s meta-analysis from 13 publications of 2278 patients demonstrated that 1161 patients were treated with only TURB, and 1117 patients were administered Epirubicin, Mitomycin C, Pirarubicin, or Thiotepa, and progression developed in 4.8% of the total patients (11). The advantage of intravesical chemotherapeutic agent administration in preventing progression has not been proven, but it appears to reduce the probability of progression proportionally. In the current study, it was observed that Gemcitabine administration reduced the probability of progression more proportionally than Epirubicin.

There is a relatively limited number of comparative studies in the literature. Epirubicin, Gemcitabine, and Pirarubicin administered to 335 patients were compared over a 4-year follow-up period by Zhang et al., and the results showed complications of 8.7% of the patients with hematuria, 2.7% with fever, and 11% with bladder irritation symptoms (15). In the current study, no major complications developed in any of the patients. Of the patients treated with Epirubicin, 6.7% had hematuria and 11.1% had bladder irritation symptoms (urgent urination sensation, detrusor hyperactivity, pain due to contraction). In the patient group treated with Gemcitabine, 2.8% had hematuria and 2.8% had bladder irritation symptoms. No patient had a fever. A clearer evaluation would be able to be made with data obtained from more patients, but the possibility of complication development in patients who received Gemcitabine was seen to be reduced.

In comparison with patients not receiving any intravesical chemotherapy, there are clear benefits of single-dose chemotherapy administered intravesically after TURB. To be able to decide which patients will benefit most or least from intravesical chemotherapy and to reveal clearer results, the keeping of optimal records regarding intravesical chematheraputic agents used immediately after resectıon, reporting the known risk factors for the progression and recurrence of bladder cancer, classifying the study results according to risk groups, studying more patients and collecting data more systematically are necessary.

Limitations of this study can be said to be the relatively short time to follow up for recurrence and progression, and the low number of patients. Despite these limitations, the strength of the study is that it shows that gemcitabine is more effective in low-grade, non-muscle-invasive tumors and should be used more widely. Patients continue to be followed up in our clinic, and a further study is planned in which more precise results will be able to be obtained by including new patients.

CONCLUSION

A single dose of early postoperative intravesical chemotherapy is effective against circulating tumor cells and residual tumors in the resection area after TURB. Even if the lesion is completely resected after TURB, intravesical chemotherapeutic agents delay and even prevent short-term recurrence and progression, and should be applied in the early postoperative period.

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Conflicts of Interest: The authors declare no conflicts of interest.

Ethical Consideration: The study was authorized by the Ethics Committee at the Faculty of Medicine, Cumhuriyet University, on the date of 05/20/2020 With ethical number: 2020-05/02.

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REFERENCES

1. IARC, Cancer Today. Estimated number of new cases in 2020, worldwide, both sexes, all ages. 2021
2. Burger M, Catto JW, Dalbagni G. Epidemiology and risk factors of urothelial bladder cancer. Eur Urol. 2013;63(2):234-241. https://doi.org/10.1016/j.eururo.2012.07.033
3. Grossman, H. Barton et al. 'Intravesical Therapy – BCG and Beyond'. 2019; Jan:73 – 80. https://doi.org/10.3233/BLC-180198
4. Sylvester RJ, van der Meijden AP, Oosterlinck W. Predicting recurrence and progression in indİVidual patients with stage Ta T1 bladder cancer using EORTC risk tables: a combined analysis of 2596 patients from seven EORTC trials. Eur Urol. 2006;49(3):466-477.https://doi.org/10.1016/j.eururo.2005.12.031
5. Brocks CP, Büttner H, Böhle A. Inhibition of tumor implantation by intravesical gemcitabine in a murine model of superficial bladder cancer. The Journal of Urology. 2005;Sep;174(3):1115-1118. https://doi.org/10.1097/01.ju.0000168657.51551.49
6. Sylvester RJ, Rodríguez O, Hernández V, et al. European Association of Urology (EAU) Prognostic Factor Risk Groups for Non-muscle-invasive Bladder Cancer (NMIBC) Incorporating the WHO 2004/2016 and WHO 1973 Classification Systems for Grade: An Update from the EAU NMIBC Guidelines Panel. 2021;79(4):480-488. https://doi.org/10.1016/j.eururo.2020.12.033
7. R. J. Cersosimo and W. K. Hong, "Epirubicin: a review of the pharmacology, clinical activity, and adverse effects of an adriamycin analogue," Journal of Clinical Oncology. 1986. vol. 4, no. 3, pp. 425–439. https://doi.org/10.1200/JCO.1986.4.3.425
8. S. V. Onrust, L. R. Wiseman, and K. L. Goa, "Epirubicin," Drugs & Aging, 1999. vol. 15, no. 4, pp. 307–333 https://doi.org/10.2165/00002512-199915040-00006
9. Oosterlinck W, Kurth KH, Schröder F. A prospective European Organization for Research and Treatment of Cancer Genitourinary Group randomized trial comparing transurethral resection followed by a single intravesical instillation of epirubicin or water in single stage Ta, T1 papillary carcinoma of the bladder. J Urol. 1993;149:749-52. https://doi.org/10.1016/s0022-5347(17)36198-0
10. Masters JR, Popert RJ, Thompson PM. Intravesical chemotherapy with epurubicin: a dose response study. J Urol. 1999;161:1490-3.
11. Sylvester, R.J. Systematic Review and Individual Patient Data Meta-analysis of Randomized Trials Comparing a Single Immediate Instillation of Chemotherapy After Transurethral Resection with Transurethral Resection Alone in Patients with Stage pTa-pT1 Urothelial Carcinoma of the Bladder: Which Patients Benefit from the Instillation? Eur Urol. 2016;69: 231. https://doi.org/10.1016/j.eururo.2015.05.050
12. P. Huang, S. Chubb, L. W. Hertel, G. B. Grindey, and W. Plunkett, "Action of 2′,2′-difluorodeoxycytidine on DNA synthesis," Cancer Research, 1991. vol. 51, no. 22, pp. 6110–6117.
13. Ye HB, Chen S, Wang J. A comparatİVe study of gemcitabine and epirubicin in adjuvant chemotherapy of non muscle invasive bladder cancer. Research Square; 2020. https://doi.org/10.21203/rs.3.rs-20323/v1
14. Messing, E.M. Effect of Intravesical Instillation of Gemcitabine vs Saline Immediately Following Resection of Suspected Low-Grade Non-Muscle-İnvasive Bladder Cancer on Tumor Recurrence: SWOG S0337 Randomized Clinical Trial. Jama. 2018; 319:1880. https://doi.org/10.1001/jama.2018.4657
15. Jianglei Zhang, Miao Li, Ze Chen, Jun OuYang, Zhixin Ling, "Efficacy of Bladder Intravezical Chemotherapy with Three Drugs for Preventing Non-Muscle-İnvasive Bladder Cancer Recurrence", Journal of Healthcare Engineering; 2021 https://doi.org/10.1155/2021/2360717

Original Article
Özgün Araştırma

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The Relationship Between Urinary System Stone Disease and Serum Fetuin-A Glycoprotein

Üriner Sistem Taş Hastalığı ile Serum Fetuin-A Glikoproteini Arasındaki İlişki

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ABSTRACT

Objective: This study aimed to investigate the relationship between Fetuin-A glycoprotein, a known systemic and localized calcification inhibitor, and urinary system stone disease.

Material and Methods: A total of 63 patients with urinary stone disease and 70 healthy controls were included. Serum Fetuin-A levels were measured using enzyme-linked immunosorbent assay, and various biochemical parameters were analyzed. Statistical comparisons were performed by using Pearson correlation to determine relationships, with significance set at $p<0.05$.

Results: The mean serum Fetuin-A levels were slightly higher in the stone disease group (503.5 ± 87.6 mg/dL) compared to the control group (462.7 ± 101.6 mg/dL); however, the difference was not statistically significant ($p>0.05$). The mean age was 42.87 ± 11.0 years in the stone group and 41.6 ± 11.7 years in the control group ($p=0.497$). In the stone group, 65% were male and 35% female, while in the control group, 66% were male and 34% female, with no significant difference in gender distribution ($p=0.831$). Body mass index (BMI) was 25.3 ± 2.57 kg/m^2 in the stone group and 26.9 ± 3.08 kg/m^2 in the control group, also showing no significant difference ($p=0.067$). No correlations were found between serum Fetuin-A levels and other parameters such as age, BMI, or biochemical markers.

Conclusion: Although some previous studies have suggested a relationship between Fetuin-A levels and urinary stone disease, this study found no significant association. Further research focusing on genetic polymorphisms of Fetuin-A may clarify its role in stone formation.

Keywords: kidney calculi, urinary calculi, fetuins

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ÖZET

Amaç: Bu çalışmada, sistemik ve lokal bir kalsifikasyon inhibitörü olan Fetuin-A glikoproteini ile üriner sistem taş hastalığı arasındaki ilişki araştırılmıştır.

Gereç ve Yöntemler: Çalışmaya 63 üriner sistem taş hastası ve 70 sağlıklı kontrol grubu dahil edilmiştir. Serum Fetuin-A seviyeleri ELISA yöntemiyle ölçülmüş ve çeşitli biyokimyasal parametreler analiz edilmiştir. İki grup arasındaki ilişkiyi belirlemek için Pearson korelasyonu kullanıldı ve istatistiksel anlamlılık $p<0,05$ olarak belirlendi.

Bulgular: Serum Fetuin-A seviyeleri taş hastalarında (503,5 ± 87,6 mg/dL), kontrol grubuna (462,7 ± 101,6 mg/dL) göre hafifçe yüksek bulunmuş ancak istatistiksel olarak anlamlı fark saptanmamıştır ($p>0,05$). Taş hastalarının yaş ortalaması 42,87 ± 11 yıl, kontrol grubunun ise 41,6 ± 11,7 yıl idi ($p=0,497$). Taş hastalarının %65'i erkek, %35'i kadın; kontrol grubunun %66'sı erkek, %34'ü kadın olup cinsiyet dağılımı açısından anlamlı fark bulunmamıştır ($p=0,831$). Vücut kitle indeksi (VKİ) taş hastalarında 25,3 ± 2,57 kg/m^2, kontrol grubunda 26,9 ± 3,08 kg/m^2 olup bu fark da anlamlı değildi ($p=0,067$). Serum Fetuin-A seviyeleri ile yaş, VKİ veya biyokimyasal belirteçler arasında bir ilişki saptanmamıştır.

Sonuç: Daha önceki bazı çalışmalar Fetuin-A seviyeleri ile üriner sistem taş hastalığı arasında bir ilişki olduğunu öne sürse de, bu çalışmada anlamlı bir ilişki tespit edilmemiştir. Fetuin-A'nın genetik polimorfizmleri üzerinde yapılacak ileri çalışmalar, taş oluşumundaki rolünü daha iyi açıklayabilir.

Anahtar Kelimeler: böbrek taşı, üriner taş, fetuin

INTRODUCTION

Urinary system stone disease is a significant clinical condition with an increasing global prevalence, causing substantial health issues. Epidemiological studies have shown that this disease affects approximately 10% of the population and significantly reduces quality of life (1). The formation of urinary stones involves various factors, including genetic predisposition, metabolic imbalances, environmental influences, and dietary habits (2). However, the biochemical mechanisms underlying stone formation are not yet fully elucidated (3).

Fetuin-A, a glycoprotein produced by the liver, prevents calcium phosphate precipitation and plays a critical role in inhibiting soft tissue calcification (4). While the protective effects of Fetuin-A in the vascular system are well-documented, its role in urinary stone disease remains underexplored. Some studies suggest that a deficiency in Fetuin-A may increase the risk of calcification, potentially influencing the mechanisms of stone formation (5). However, conflicting findings in the literature highlight the need for further investigation (6).

This study aims to evaluate the relationship between serum Fetuin-A levels and urinary system stone disease. The findings may enhance our understanding of stone formation mechanisms and contribute to the development of preventive strategies in the future. Addressing this gap in the literature underscores the significance of research in this field.

MATERIAL AND METHODS

Study Population

After obtaining local ethical approval, the study was initiated (SEEAH 2009 17/12-08). Between 2010 and 2011, 63 patients diagnosed with urinary system stone disease and 70 control individuals with no history of urinary stone disease were included in this study. Participants were selected from those attending urology outpatient clinic or being treated as inpatients. The control group consisted of individuals of similar age without urinary stone disease. Patients with urinary tract infections or a history of acute stone episodes were excluded from the study. Patients previously treated for stone disease were included only after at least one month had passed since their treatment. All participants were aged 18 years or older, with an age range of 18 to 82 years. Informed consent was obtained from all participants before their inclusion in the study.

Diagnostic Methods

Stone diagnosis and exclusion were performed using at least one of the following imaging methods: direct urinary system radiography, ultrasonography (USG), intravenous pyelography (IVP), or abdominal computed tomography (spiral CT with 5 mm sections). The collected data included participants' age, sex, body mass index (BMI), history of stones, and family history. Biochemical analyses involved measuring serum creatinine, uric acid, calcium, phosphorus, magnesium, sodium, potassium, and parathyroid hormone levels. Morning urine pH was determined using a stick test and documented for analysis.

Measurement of Serum Fetuin-A Levels

Venous blood samples (4-5 mL) were collected from all participants in the morning after fasting. The serum Fetuin-A (AHSG) concentrations were measured using an enzyme-linked immunosorbent assay (ELISA) kit (BioVendor – Asheville, North Carolina, USA). After centrifugation, serum samples were stored at -20°C for up to two weeks. Prior to analysis, the samples were thawed and diluted 10,000 times. These diluted samples were added to microwells coated with polyclonal anti-human AHSG/Fetuin-A-specific antibodies. After incubation, peroxidase-conjugated polyclonal anti-human AHSG/Fetuin-A antibodies were added. Subsequent incubation and washing procedures were followed by absorbance measurement at 450 nm using an automatic microplate reader. Concentrations were determined using a standard curve for human AHSG/Fetuin-A, and the actual concentrations were calculated. Mean, median, standard deviation, minimum, and maximum values of Fetuin-A levels were compared between patient and control groups.

Statistical Analysis

The study utilized Statistical Package for the Social Sciences (SPSS) software. For the comparison of biochemical parameters between groups, independent samples t-test (Welch) was used for normally distributed parameters, while the Mann-Whitney U test was applied for non-normally distributed parameters. The chi-square test was used for categorical data comparisons, while Pearson correlation was applied to determine relationships between variables. Statistical significance was considered at $p<0.05$. This comprehensive methodology enabled the evaluation of the relationship between serum Fetuin-A levels and urinary system stone disease, providing reliable results and supporting the study's aims.

RESULTS

The study included 63 patients with urinary system stone disease and 70 healthy individuals without any history of urinary system stone disease. The demographic and clinical characteristics of the study participants, including age, BMI, and gender distribution, are detailed in (Table 1). The mean age of the stone disease group was 42.87 ± 11 years, compared to 41.6 ±11.7 years in the control group. Gender distribution was similar between the groups, with females constituting 65.08% and males 34.92% in the patient group, compared to 66.67% females and 33.33% males in the control group.

Table 1. Profile of the Study Groups

	Stone Disease Group		Control Group	
	n	Mean ± SD	n	Mean ±SD
Age	63	42.87 ± 11	70	41.6 ±11.7
BMI (kg/m2)	63	25.3 ±2.57	70	26.9 ±3.08
Gender	n	%	n	%
Male	41	65.08	44	66.67
Female	22	34.92	26	33.33

Blood samples were analyzed for serum creatinine, uric acid, potassium, sodium, calcium, magnesium, phosphorus, and parathyroid hormone (PTH) levels in both groups. No statistically significant differences were observed between the groups for any of these biochemical parameters as shown in Table 2. Similarly, the urinary pH, measured from fresh morning urine samples, showed no differences between the two groups.

Table 2. Distribution of Serum Parameters Between Groups (Group 1: Stone Disease Group, Group 2: Control Group)

Parameter	Group 1: (Mean ± SD)	Group 2: (Mean ± SD)	p-value
Creatinine (mg/dL)	1.03 ± 0.24	0.97 ± 0.15	0.251
Uric Acid (mg/dL)	5.08 ± 1.04	5.37 ± 1.52	0.392
Sodium (mEq/L)	140.84 ± 3.32	141.22 ± 4.66	0.717
Potassium (mEq/L)	4.58 ± 0.35	4.62 ± 0.6	0.754
Calcium (mg/dL)	9.95 ± 0.57	9.92 ± 0.5	0.829
Phosphorus (mg/dL	3.42 ± 0.58	3.3 ± 0.69	0.469
Magnesium (mg/dL)	2.17 ± 1.89	1.79 ± 0.18	0.282
PTH (pg/mL)	61.4 ± 24.8	57 ± 20.2	0.417 *

** Group 1 Median value: 55, IQR: 29*

** Grup 2 Median value: 54, IQR: 23*

Serum Fetuin-A Levels

The mean serum Fetuin-A levels were higher in the stone disease group (503.46 ± 87.6 mg/dL) compared to the control group (462.69 ± 101.56 mg/dL). However, this difference was not statistically significant as shown in Table 3 (p=0.358). Correlation analysis of serum Fetuin-A levels with other parameters, including age, BMI, serum creatinine, uric acid, albumin, sodium, potassium, magnesium, and PTH levels, revealed no significant relationships.

Table 3. Serum Fetuin-A Levels in Study Groups

Parameter	Stone Disease Group	Control Group	p-value
Mean (mg/dL)	503.46	462.69.	0.358
Standard Deviation	87.65	101.56	
Median (mg/dL)	540.84	487.65	
Maximum (mg/dL)	647.33	590.19	
Minimum (mg/dL)	364.83	291.80	

In summary, while serum Fetuin-A levels were slightly elevated in patients with urinary stone disease compared to healthy controls, this increase was not statistically significant.

DISCUSSION

Fetuin-A glycoprotein has been established as a critical inhibitor of calcification in the human body (7). Its normal serum concentration ranges from 0.4 to 1.0 g/L (8). The gene encoding Fetuin-A is located on chromosome 3q27, a region previously associated with metabolic disorders such as type 2 diabetes and metabolic syndrome (9). While Fetuin-A's role in vascular and soft tissue calcification is well-documented (10), its involvement in urinary stone disease remains underexplored. Emerging evidence suggests that Fetuin-A deficiency may contribute to calcium-rich stone formation by enhancing calcification mechanisms in the urinary system (11).

Studies have investigated the relationship between genetic polymorphisms of Fetuin-A and its role in pathological calcification. Aksoy et al. examined the 766 C/G (T256S) and 742 C/T (T248M) polymorphisms of Fetuin-A in 112 kidney stone patients and 73 healthy controls. While the 742 C/T polymorphism showed significant differences, the 766 C/G polymorphism did not. Furthermore, patients with the 766 CG genotype exhibited lower serum Fetuin-A levels compared to those with the CC genotype (12). These findings suggest that certain polymorphisms may influence serum levels and predispose individuals to stone formation.

Similarly, Emoto et al. demonstrated an inverse correlation between serum Fetuin-A levels and the extent of atherosclerotic calcification in 416 patients with type 2 diabetes. Their study highlights the systemic implications of Fetuin-A deficiency in promoting calcification processes (13). Ross et al. further confirmed the association between the 766 C/G polymorphism of Fetuin-A and arterial stiffness in patients with normal renal function but confirmed vascular calcification. Their genetic analysis provided evidence that the same polymorphism associated with vascular stiffness might contribute to pathological calcification mechanisms relevant to urinary stone disease (14).

In the present study, serum Fetuin-A levels were slightly higher in patients with urinary stone disease compared to healthy controls, although the difference was not statistically significant. This aligns with previous findings indicating that while Fetuin-A plays a role in calcification, its involvement in urinary stone formation is complex and multifactorial (15). Factors such as genetic polymorphisms, metabolic conditions, and environmental influences likely interact to determine an individual's susceptibility to stone disease.

Future research should focus on integrating genetic, environmental, and metabolic factors to provide a more comprehensive understanding of the pathophysiology of urinary stone disease. Expanding the sample size and employing advanced genetic and biochemical analyses could pave the way for new preventive and therapeutic strategies (16).

Limitations

This study has certain limitations that should be acknowledged. One significant constraint is the lack of analysis of stone subtypes (e.g., calcium oxalate, uric acid), as this data was not collected, limiting our ability to evaluate Fetuin-A's relationship with different stone compositions and potentially overlooking a key aspect of stone formation mechanisms. Additionally, the relatively small sample size, with only 63 patients and 70 controls, may have impacted the generalizability and statistical power of our findings. Including a larger sample could have enhanced the reliability of our analyses. Moreover, the incorporation of additional data, such as stone recurrence or family history, could have expanded the study's scope and offered a more comprehensive understanding of stone disease risk factors. These limitations highlight the need for cautious interpretation of our results and underscore the importance of larger samples and broader data collection in future research.

CONCLUSIONS

Fetuin-A glycoprotein, a calcification inhibitor, has been linked to various diseases. This study investigated its relationship with urinary system stone disease. Although hypothesized to influence urinary calcium excretion and stone formation, no significant difference in serum Fetuin-A levels was found between 63 stone patients and 70 controls. While previous studies suggested an association, our findings indicate otherwise. Future research should focus on genetic polymorphisms of Fetuin-A to better understand its role in stone disease.

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

Ethics Committee Approval: This study was approved by the Sisli Etfal Trainig and Research Hospital Local Ethics Committee (approval number: 0478-5637).

Author Contributions: The authors contributed equally to the study, which was a collaborative effort.

REFERENCES

1. Raja A, Fayez R, Morsi H, Abol-Enein H, Mokhtar A. The impact of urinary stone disease on patients' quality of life. *Urolithiasis*. 2019;47(4):313-321. https://doi.org/10.1007/s00240-019-01142-0
2. Sorokin I, Mamoulakis C, Miyazawa K, Rodgers A, Talati J, Lotan Y. Epidemiology of stone disease across the world. *World J Urol*. 2017;35(9):1301-1320. https://doi.org/10.1007/s00345-017-2008-6
3. Wang Z, Zhang Y, Zhang J, Deng Q, Liang H. Recent advances on the mechanisms of kidney stone formation (Review). *Int J Mol Med*. 2021;48(2):149. https://doi.org/10.3892/ijmm.2021.4982
4. Icer MA, Koçak T, Icer Y, et al. Low Serum and Urine Fetuin-A Levels and High Composite Dietary Antioxidant Index as Risk Factors for Kidney Stone Formation. *J Clin Med*. 2025;14(5):1487. Published 2025 Feb 23. https://doi.org/10.3390/jcm14051487
5. Wu J, Tao Z, Deng Y, et al. Calcifying nanoparticles induce cytotoxicity mediated by ROS-JNK signaling pathways. *Urolithiasis*. 2019;47(2):125-135. https://doi.org/10.1007/s00240-018-1048-8
6. Emoto M, Mori K, Lee E, Yamada S, Ichikawa S, Tsuchikura S, et al. Inverse correlation between Fetuin-A and atherosclerotic plaque in type 2 diabetes. *Diabetes Care*. 2013;36(4):1036-1042. https://doi.org/10.2337/dc12-1847
7. Ramírez-Vélez R, García-Hermoso A, Hackney AC, Izquierdo M. Effects of exercise training on Fetuin-a in obese, type 2 diabetes and cardiovascular disease in adults and elderly: a systematic review and Meta-analysis. *Lipids Health Dis*. 2019;18(1):23. Published 2019 Jan 22. https://doi.org/10.1186/s12944-019-0962-2
8. Lanthier N, Lebrun V, Molendi-Coste O, van Rooijen N, Leclercq IA. Liver Fetuin-A at Initiation of Insulin Resistance. *Metabolites*. 2022;12(11):1023. Published 2022 Oct 25. https://doi.org/10.3390/metabo12111023
9. Pan X, Wen SW, Bestman PL, Kaminga AC, Acheampong K, Liu A. Fetuin-A in Metabolic syndrome: A systematic review and meta-analysis. *PLoS One*. 2020;15(3):e0229776. Published 2020 Mar 5. https://doi.org/10.1371/journal.pone.0229776
10. Rudloff S, Jahnen-Dechent W, Huynh-Do U. Tissue chaperoning-the expanded functions of fetuin-A beyond inhibition of systemic calcification. *Pflugers Arch*. 2022;474(8):949-962. https://doi.org/10.1007/s00424-022-02688-6
11. Moe SM, Reslerova M, Ketteler M, O'Neill K, Duan D, Koczman J, et al. Role of calcification inhibitors in the pathogenesis of vascular calcification in chronic kidney disease (CKD). *Kidney Int*. 2005;67(6):2295-2304. https://doi.org/10.1111/j.1523-1755.2005.00328.x
12. Aksoy S, Aydin S, Aydin S, Bas F, Celik B, Celik M, et al. The relationship between fetuin-A levels and kidney stone disease. *Clin Invest Med*. 2011;34(5):E281. https://doi.org/10.25011/cim.v34i5.15580
13. Emoto M, Mori K, Tsuchikura S, Yamada S, Ichikawa S, Lee E, et al. Fetuin-A and atherosclerotic calcified

plaque in patients with type 2 diabetes mellitus. *Metabolism*. 2010;59(6):873-878. https://doi.org/10.1016/j.metabol.2009.10.021

14. Al Ali L, van de Vegte YJ, Said MA, et al. Fetuin-A and its genetic association with cardiometabolic disease. *Sci Rep*. 2023;13(1):21469. Published 2023 Dec 6. https://doi.org/10.1038/s41598-023-48600-9
15. Wang MC, Tsai WC, Chen JY, Huang JJ. Association between fetuin-A and renal function in patients with chronic kidney disease. *Clin Lab*. 2010;56(9-10):423-429.
16. Geraghty R, Lovegrove C, Howles S, Sayer JA. Role of Genetic Testing in Kidney Stone Disease: A Narrative Review. *Curr Urol Rep*. 2024;25(12):311-323. https://doi.org/10.1007/s11934-024-01225-5

Original Article
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Comparison of Outcomes Between Disposable and Reusable Flexible Ureteroscopes in the Treatment of Lower Pole Renal Stones

Alt Kutup Böbrek Taşlarının Tedavisinde Tek Kullanımlık ve Yeniden Kullanılabilir Üreteroskopların Sonuçlarının Karşılaştırılması

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ABSTRACT

Objective: Kidney stone disease is a significant health problem that substantially affects individuals' quality of life. Approximately 30% of kidney stones are located in the lower pole, which presents challenges in accessing these stones during retrograde intrarenal surgery. In the surgical treatment of lower pole kidney stones, we aimed to evaluate the efficacy and success rates of single-use and reusable flexible ureterorenoscopes, and to determine the most optimal option based on these findings.

Material and Methods: This study included patients with lower pole kidney stones who underwent retrograde intrarenal surgery. Patients were divided into two groups based on the type of ureterorenoscope used: single-use or reusable. The collected data were compared between the two groups.

Results: A total of 61 patients, including 34 men and 27 women, were included in the study. Thirty-four patients were evaluated in the single-use group, and 27 patients in the reusable group. The median stone size was 78.5 mm^2 (50.3–127.6) mm^2 in the reusable group and 125.3 mm^2 (56.5–201.1) mm^2 in the single-use group. There was no statistically significant difference between the groups in terms of demographic characteristics, Clavien-Dindo scores, or postoperative complications ($p > 0.05$). However, vomiting was observed significantly less frequently in the single-use group compared to the reusable group ($p < 0.05$).

Conclusion: Flexible ureterorenoscopes are commonly used in the surgical management of lower pole kidney stones. When choosing between single-use and reusable flexible ureterorenoscopes, factors such as cost and ease of use should be taken into consideration. To better compare the advantages of each type and obtain more reliable results, larger case series and prospective studies are needed.

Keywords: ureteroscopes, urolithiasis, kidney stone

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ÖZET

Amaç: Böbrek taşı hastalığı, önemli bir sağlık sorunu olup bireylerin yaşam kalitesini büyük ölçüde etkiler. Böbrek taşlarının yaklaşık %30'u alt kutupta yer alır ve bu durum retrograd intrarenal cerrahi sırasında taşlara erişimde zorluklara neden olur. Alt kutup böbrek taşlarının cerrahi tedavisinde tek kullanımlık ve yeniden kullanılabilir üreterorenoskopların etkinliğini ve başarı oranlarını değerlendirmeyi; bu bulgulara dayanarak en iyi seçeneği belirlemeyi amaçladık. **Gereç ve Yöntemler:** Çalışmamıza, esnek üreterorenoskopi kullanılarak retrograd intrarenal cerrahi ile tedavi edilen alt kutup böbrek taşı olan hastalar dahil edildi. Hastalar, kullanılan üreterorenoskop tipine göre tek kullanımlık veya yeniden kullanılabilir esnek üreterorenoskop gruplarına ayrıldı. Elde edilen veriler bu iki grup arasında karşılaştırıldı. **Bulgular:** Çalışmamıza 34 erkek ve 27 kadın olmak üzere toplam 61 hasta dahil edildi. Tek kullanımlık grupta 34 hasta ve yeniden kullanılabilir grupta ise 27 hasta değerlendirildi. Yeniden kullanılabilir grupta ortanca taş boyutu 78.5 mm^2 (50.3–127.6) mm^2, tek kullanımlık grupta ise 125.3 mm^2 (56.5–201.1) mm^2 olarak bulundu. Gruplar arasında demografik özellikler, Clavien-Dindo skorları veya postoperatif komplikasyonlar açısından istatistiksel olarak anlamlı bir fark gözlenmedi ($p>0,05$). Tek kullanımlık grupta kusma, yeniden kullanılabilir gruba göre anlamlı ölçüde daha az sıklıkta gözlendi ($p<0,05$). **Sonuç:** Alt kutup böbrek taşlarının cerrahisinde esnek üreterorenoskoplar yaygın olarak kullanılır. Tek kullanımlık ve yeniden kullanılabilir esnek üreterorenoskoplar arasında seçim yaparken, maliyet ve kullanım kolaylığı dikkate alınmalıdır. Her iki üreterorenoskop tipinin avantajlarını karşılaştırmak ve daha güvenilir sonuçlar elde etmek için daha büyük serilere ve prospektif çalışmalara gereksinim duyulmaktadır.

Anahtar Kelimeler: üreteroskoplar, ürolitiyazis, böbrek taşı

INTRODUCTION

With a global prevalence of approximately 10% , kidney stone disease is a significant health issue that adversely affects quality of life (1). Treatment options include retrograde intrarenal surgery (RIRS), percutaneous nephrolithotomy (PCNL) and extracorporeal shock wave lithotripsy (ESWL) in interventional or surgical approaches (2). About 30% of stones are found within the lower pole kidney stones (LPKS), often complicating access during RIRS (3).

Flexible ureterorenoscopes were first introduced in 1964 as reusable fiberoptic instruments, and with subsequent technological advancements, digital flexible ureterorenoscopes emerged in 2006 (4,5). Disposable flexible ureterorenoscopes were introduced later, in 2015 (6). These single-use ureterorenoscopes were designed to address some of the limitations associated with reusable models, such as high costs, maintenance and repair requirements, infection risks, and restricted reusability (7).

Recognizing the importance of deflection for reaching LPKS, we sought to compare the effectiveness and success rates of disposable versus reusable flexible ureterorenoscopes in surgical treatment. The goal was to provide data that could guide the selection of most appropriate device based on these outcomes.

MATERIAL AND METHODS

After obtaining approval from local ethics committee (decision number 01 and date 02.05.2024), we conducted a retrospective review of records for patients who visited our clinic for kidney stone treatment between January 2023 and June 2024. Sixty-one adult patients with LPKS treated via RIRS with flexible ureterorenoscopy were included. Patients younger than 18 years, those with kidney stones located outside the lower pole, and those who did not undergo RIRS were excluded.Collected patient data included age, history of kidney stones, comorbidities, prior surgical or stone--related treatments, presence of a preoperative JJ catheter, stone size (estimated surface area – mm^2), Hounsfield unit (HU) of the stone, infundibulopelvic angle (IPA), infundibulopelvic length (IL), operative time, hospitalization duration, postoperative JJ catheter duration, stone-free status, occurrence of postoperative complications, and the need for reoperation due to residual stones. Patients were grouped based on whether they underwent treatment

with a disposable or reusable flexible ureterorenoscope, and the data were then analyzed between these two groups.

Surgical Technique

Patients were placed in the lithotomy position. Out of the 61 cases, 53 were performed under spinal anesthesia, while 8 were conducted under general anesthesia. For each patient, a 6 Fr semi-rigid ureteroscope (Storz, Germany) was initially inserted up to the renal pelvis to achieve active ureteral dilation, after which a hydrophilic guidewire was placed. Once the semi-rigid ureteroscope was withdrawn, the subsequent approach varied based on the type of flexible ureterorenoscope used. Intracorporeal laser lithotripsy was utilized in every case.

In the disposable ureteroscope group, a 10.7/12.7 Fr ureteral access sheath was advanced into the ureter along the hydrophilic wire under fluoroscopic guidance. A disposable flexible ureteroscope (F-URS, HugeMed HU30 9.0 Fr, Shenzhen HugeMed Medical Technical Development Co., China) with an inner diameter of 3.6 Fr was then used for stone management. In the reusable ureteroscope group, a 9.5/11.5 Fr ureteral access sheath was inserted in a similar manner along the hydrophilic wire with fluoroscopic guidance. A reusable flexible ureteroscope (F-URS, Olympus URF-P6 7.95 Fr, Canada) with an inner diameter of 3.6 Fr was used for the procedure.

Statistical Analysis

Descriptive statistics were presented as mean ± standard deviation for normally distributed numerical variables,median (interquartile range) for non-normally distributed variables, and n (%) for categorical variables. The Kolmogorov-Smirnov and Shapiro-Wilk tests were used to assess variable distribution. For independent quantitative variables, the independent samples t-test was applied to normally distributed data, and the Mann-Whitney U test was used for non-normally distributed data. The Chi-square test was applied for independent categorical variables; if Chi-square assumptions were not met, Fisher's exact test was used instead. All statistical analyses were performed using SPSS version 28.0.

RESULTS

The study included 61 patients in total, with 34 men and 27 women, and a mean age of 48.4 years. Of these, 34 patients were placed in the disposable ureteroscope group, while 27 were in the reusable group. The median stone size was 78.5 mm^2 (50.3–127.6) mm^2 in the reusable group and 125.3 mm^2 (56.5–201.1) mm^2 in the disposable group. In terms of surgical laterality, 31 surgeries were performed on the right side and 30 on the left. No statistically significant differences were found between the disposable and reusable groups regarding age, gender distribution, comorbidity rates, side of surgery, ASA scores, or Clavien-Dindo scores ($p > 0.05$). Similarly, no significant differences in postoperative symptoms, such as flank pain, dysuria, hematuria, or the proportion of asymptomatic patients, were noted between the groups ($p > 0.05$). Postoperative nausea, however, was observed significantly less frequently in the disposable group ($p < 0.05$). Additionally, both groups showed no significant differences ($p > 0.05$) in terms of surgical history, spontaneous stone passage, presence of previous urinary tract infections (UTI), or preoperative JJ catheter history (Table 1).

No statistically significant differences ($p > 0.05$) were observed between the reusable and disposable groups in terms of anesthesia type, preoperative catheter placement, stone size, stone count, HU value, IPA, IL, operative time, residual stone size, JJ stent duration, hospitalization or postoperative JJ stent use. In the disposable group, the use of kidneys, ureters, and bladder (KUB) radiography during follow-up was significantly lower ($p < 0.05$) than in the reusable group. There was no significant difference ($p > 0.05$) between groups in the use of ultrasonography (USG) imaging for follow-up. However, the rate of computed tomography (CT) imaging during follow-up was significantly higher ($p < 0.05$) in the disposable group compared to the reusable group. No significant differences were found between the groups regarding stone-free rates, postoperative UTI, sepsis, or readmission rates ($p > 0.05$). Detailed comparative values are presented in Table 2.

Tablo 1. Comparison of Demographic Characteristics of Reusable and Disposable Ureteroscopy Groups

Parameter	Reusable (N:27)	Disposable (N:34)	p value
Age	49.3±13.2	47.4±13.3	0.575 [t]
Gender			
Male	19(55.9%)	15 (55.6%)	0.980 [x²]
Female	15(44.1%)	12 (44.4%)	
Side			
Right	18 (52.9%)	13 (48.1%)	0.710 [x²]
Left	16 (47.1%)	14 (51.9%)	
ASA Score			
I	6 (17.6%)	7 (25.9%)	0.433 [x²]
II	28 (82.4%)	19 (70.4%)	
III	0 (0.0%)	1 (3.7%)	
Clavien Dindo Score			
I	33 (97.1%)	25 (92.6%)	0.579 [x²]
II	1 (2.9%)	2 (7.4%)	
Comorbidity			
(-)	29 (85.3%)	19 (70.4%)	0.157 [x²]
(+)	5 (14.7%)	8 (29.6%)	
Symptoms			
Flank pain	32 (94.1%)	26 (96.3%)	1.000 [x²]
Nausea	8 (23.5%)	0 (0.0%)	***0.007*** [x²]
Dysuria	2 (5.9%)	5 (18.5%)	0.124 [x²]
Hematuria	4 (11.8%)	1 (3.7%)	0.254 [x²]
Asymptomatic	2 (5.9%)	0 (0.0%)	0.498 [x²]
Surgical History			
(-)	17 (63.0%)	12 (46.2%)	0.219 [x²]
(+)	10 (37.0%)	14 (53.8%)	
Stone Passage History			
(-)	14 (43.8%)	11 (40.7%)	0.973 [x²]
(+)	20 (62.5%)	16 (59.3%)	
UTI History			
(-)	31 (91.2%)	20 (74.1%)	0.073 [x²]
(+)	3 (8.8%)	7 (25.9%)	
Preoperative Catheter			
(-)	25 (73.5%)	19 (70.4%)	0.785 [x²]
(+)	9 (26.5%)	8 (29.6%)	

UTI; urinary tract infection

Tablo 2. Comparison of Perioperative Findings between Reusable and Disposable Ureteroscopy Groups

Parameter	Reusable	Disposable	p value
Anesthesia Type			
Spinal	30 (88.2%)	23 (85.2%)	0.726 $^{X^2}$
General	4 (11.8%)	4 (14.8%)	
Stone size/mm^2	78.5 (50.3–127.6)	125.3 (56.5–201.1)	0.142 ^{m}
Stone Count	1.0 (1.0–1.0)	1.0 (1.0–2.0)	0.511 ^{m}
Hounsfield Unit (HU)	1021.0 (743.0–1138.2)	933.0 (666.5–1041.0)	0.309 ^{m}
Infundibulopelvic Angle (IPA)	65.6 ± 20.29	63.1 ± 29.8	0.237 ^{m}
Infundibulopelvic Length (IL)	22.96 ± 8.2	21.5 ± 5.8	0.988 ^{m}
Surgery Time/min	85.0 (70.0–105.0)	85.0 (75.0–110.0)	0.070 ^{m}
Residual Stone Size/mm^2	0.0 (0.0–0.0)	0.0 (0.0–10.0)	0.213 ^{m}
Catheter Duration/Days	30.0 (21.0–30.0)	28.0 (21.0–31.0)	0.510 ^{m}
Hospitalization/Days	1.0 (1.0–1.0)	1.0 (1.0–2.0)	0.761 ^{m}
Postoperative Catheter			
DJ (-)	2 (5.9%)	0 (0.0%)	0.498 $^{X^2}$
DJ (+)	27 (79.4%)	25 (92.6%)	
Ureteral Catheter	5 (14.7%)	2 (7.4%)	
Control Imaging			
KUB	30 (88.2%)	16 (59.3%)	***0.009*** $^{X^2}$
USG	1 (2.9%)	2 (7.4%)	0.579 $^{X^2}$
CT	3 (8.8%)	9 (33.3%)	***0.017*** $^{X^2}$
Stone Free			
(+)	27 (79.4%)	22 (81.5%)	0.840 $^{X^2}$
(-)	7 (20.6%)	5 (18.5%)	
Postoperative UTI			
(-)	34 (100.0%)	25 (92.6%)	0.192 $^{X^2}$
(+)	0 (0.0%)	2 (7.4%)	
Postoperative Sepsis			
(-)	33 (97.1%)	27 (100.0%)	1.000 $^{X^2}$
(+)	1 (2.9%)	0 (0.0%)	
Readmission			
(-)	32 (94.1%)	21 (77.8%)	0.060 $^{X^2}$
(+)	2 (5.9%)	6 (22.2%)	

KUB; kidney ureter bladder grapghy , USG; ultrasonograhpy

^{m} Mann-whitney u test / $^{X^2}$ Chi-square test (Fischer test)

DISCUSSION

The annual incidence of kidney stones is approximately 9 per 1,000 individuals, making it a prevalent condition that adversely affects health and quality of life (8). Symptoms frequently reported by patients with kidney stones include flank pain, hematuria, dysuria, nausea, vomiting, fever, chills, and even chronic kidney disease (9). Initial management typically focuses on addressing acute symptoms through hydration and analgesia, followed by medical therapies aimed at preventing stone recurrence. To promote spontaneous expulsion of stones, α-blockers and calcium channel blockers may be prescribed. If medical treatment proves insufficient, ESWL or surgery might be required (10).

Achieving optimal stone clearance with minimal complications is the primary goal of kidney stone surgery. The choice of technique is guided by the stone size and location. With advancements in technology, minimally invasive techniques have largely replaced open surgical procedures (11). However, the selection of specific endourological approaches, such as PCNL or RIRS, remains a topic of continued debate (12).

Flexible ureteroscopy has emerged as a widely adopted technique, with stone-free rates (SFR) exceeding 90% (13). Although it is frequently preferred for treating LPKS, several factors can negatively impact its success. According to Göger et al., variables such as stone burden, stone count, HU, and IPA lowered SFR (14). Likewise, Jessen et al. observed that a long infundibulum and narrow IPA correlated with reduced SFR, though full clearance was achievable in a second session (15).

To boost SFR and minimize complications through reduced intrarenal pressure, ureteral access sheaths have been suggested. However, Ergün et al. reported in their study that there was no significant difference between the use of a ureteral access sheath and surgical success or complication rates (16). At our clinic, the use of ureteral access sheaths is part of our standard practice. Although we did not find significant differences in surgical outcomes between different types of flexible ureteroscopes, our experience suggests that digital flexible ureteroscopes offer superior image quality but are more prone to deformation, whereas reusable ureteroscopes provide greater durability. This factor should be considered when evaluating cost-effectiveness.

The objective of RIRS is to achieve a high SFR while minimizing complications. Despite efforts to optimize outcomes, approximately 20% of patients may experience general complications, including flank pain, hematuria, and UTI (17). In rare cases, severe complications such as massive retroperitoneal hematoma or sepsis may occur (18). Ensuring proper sterilization, especially for reusable ureterorenoscopes, is crucial to minimize the risk of postoperative infections (19). Bragaru et al. reported no significant difference in postoperative complication rates or SFR between disposable and reusable ureteroscopes, consistent with our findings (20). In our study, we observed that the rate of Clavien-Dindo scores >1 in the evaluation of complications was between %2 and 7%, which was similar to the literature (21).

In our clinical practice, we have utilized both types of flexible ureteroscopes effectively and safely. While neither demonstrated definitive superiority, we observed that disposable ureteroscopes are advantageous for training purposes due to their enhanced digital imaging capabilities and lighter weight, whereas the tips of reusable ureteroscopes are notably more durable. However, larger-scale studies are needed to validate these findings. We hope our results will enrich the literature and support future studies in this domain.

Our study has limitations such as small sample size, retrospective design and limited access to data. In addition, the recent introduction of flexible ureterorenoscopes in our institution contributed to the limited number of cases. Furthermore, cost-effectiveness analysis could not be performed due to insufficient access to relevant data.

CONCLUSION

Flexible ureteroscopes including those used for the treatment of LPKS, represent a valuable minimally invasive option for the surgery of kidney stones. When choosing flexible ureteroscopes, ease of use should be a key consideration. To more definitively assess the comparative benefits of each type and obtain more reliable outcomes, larger-scale prospective studies are warranted.

Conflict of Interest: The authors have no conflict of interest regarding this study.

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Authors Contribution: Concept ATU,ATo , Design ATU, ATO, EA , Data Collection and/or Processing ATU,ATO , Analysis and/or Interpretation ATU, SS, YA, EA , Writing-review-revision ATU, SS , Literature Review: ATU, SS , Writing: ATU, SS , Critical Review: ATU, SS.

REFERENCES

1. Giulioni C, Fuligni D, Brocca C, Ragoori D, Chew BC, Emiliani E, et al. Evaluating the Safety of Retrograde Intrarenal Surgery (RIRS): Intra- and Early Postoperative Complications in Patients Enrolled in the Global Multicentre Flexible Ureteroscopy Outcome Registry (FLEXOR). Int Braz J Urol. 2024 Jul-Aug;50(4):459-469. https://doi.org/10.1590/S1677-5538.IBJU.2024.0055
2. Mazzucchi E, Berto FCG, Denstedt J, Danilovic A, Batagello CA, Torricelli FCM, et al. Treatment of renal lower pole stones: an update. Int Braz J Urol. 2022 Jan-Feb;48(1):165-174. https://doi.org/10.1590/S1677-5538.IBJU.2020.1023
3. Ur Rehman O, Imran M, Rafaqat M, Haider FUR, Rehman A, Farooq U, et al. Outcomes in Lower Pole Kidney Stone Management Using Mini-Percutaneous Nephrolithotomy Compared with Retrograde Intra Renal Surgery: A Randomized Controlled Trial. Cureus. 2023 Feb 23;15(2): e35343. https://doi.org/10.7759/cureus.35343
4. Bragaru M, Multescu R, Geavlete P, Popescu R, Geavlete B. Comparison of Flexible Ureteroscope Performance between Reusable and Single-Use Models. J Clin Med. 2023 Jan 30;12(3):1093. https://doi.org/10.3390/jcm12031093
5. Gridley CM, Knudsen BE. Digital ureteroscopes: technology update. Res Rep Urol. 2017 Jan 27;9:19-25. https://doi.org/10.2147/RRU.S104229
6. Butticè S, Sener TE, Netsch C, Emiliani E, Pappalardo R, Magno C. LithoVue™: A new single-use digital flexible ureteroscope. Cent European J Urol. 2016;69(3):302-305. https://doi.org/10.5173/ceju.2016.872
7. Ventimiglia E, Godínez AJ, Traxer O, Somani BK. Cost comparison of single-use versus reusable flexible ureteroscope: A systematic review. Turk J Urol. 2020 Nov;46(Supp. 1): S40-S45. https://pmc.ncbi.nlm.nih.gov/articles/PMC7731961/
8. Fontenelle LF, Sarti TD. Kidney Stones: Treatment and Prevention. Am Fam Physician. 2019 Apr 15;99(8):490-496. PMID: 30990297. https://pubmed.ncbi.nlm.nih.gov/30990297/
9. Tseng TY, Preminger GM. Kidney stones. BMJ Clin Evid. 2011 Nov 10;2011:2003. PMCID: PMC3275105. https://pmc.ncbi.nlm.nih.gov/articles/PMC3275105/
10. Frassetto L, Kohlstadt I. Treatment and prevention of kidney stones: an update. Am Fam Physician. 2011;84(11):1234-1242. PMID: 22150656. https://pubmed.ncbi.nlm.nih.gov/22150656/
11. Demirbas A, Yazar VM, Ersoy E, Demir DO, Ozcan S, Karakan T, ve ark. Comparision of Percutaneous Nephrolithotomy and Retrograde Intrarenal Surgery For The Treatment of Multicalyceal and Multiple Renal Stones. Urol J. 2018 Nov 17;15(6):318-322. https://doi.org/10.22037/uj.v0i0.4213
12. Fuchs GJ, Fuchs AM. Flexible Endoskopie des oberen Harntraktes. Eine neue minimal invasive Methode für Diagnose und Behandlung [Flexible endoscopy of the upper urinary tract. A new minimally invasive method for diagnosis and treatment]. Urologe A. 1990 Nov;29(6):313-20. http://pascal-francis.inist.fr/vibad/index.php?action=getRecordDetail&idt=5380299.[German]
13. Aboumarzouk OM, Monga M, Kata SG, Traxer O, Somani BK. Flexible ureteroscopy and laser lithotripsy for stones

>2 cm: a systematic review and meta-analysis. J Endourol. 2012 Oct;26(10):1257-63. https://doi.org/10.1089/end.2012.0217

14. Göger YE, Özkent MS, Kılınç MT, Taşkapu HH, Göger E, Aydın A, ve ark. Efficiency of retrograde intrarenal surgery in lower pole stones: disposable flexible ureterorenoscope or reusable flexible ureterorenoscope? World J Urol. 2021 Sep;39(9):3643-3650. https://doi.org/10.1007/s00345-021-03656-y
15. Jessen JP, Honeck P, Knoll T, Wendt-Nordahl G. Flexible ureterorenoscopy for lower pole stones: influence of the collecting system's anatomy. J Endourol. 2014 Feb;28(2):146-51. https://doi.org/10.1089/end.2013.0401
16. Ergün M, Sağır S. Flexible Üreterorenoskopide Erişim Kılıfının Kullanımı Vazgeçilmez mi? Van Sağlık Bilimleri Dergisi. 2022;15(2):149-155. https://doi.org/10.52976/vansaglik.1125856. [Turkish]
17. Corrales M, Sierra A, Doizi S, Traxer O. Risk of Sepsis in Retrograde Intrarenal Surgery: A Systematic Review of the Literature. Eur Urol Open Sci. 2022 Aug 30;44:84-91. https://doi.org/10.1016/j.euros.2022.08.008
18. Choi T, Choi J, Min GE, Lee DG. Massive retroperitoneal hematoma as an acute complication of retrograde intrarenal surgery: A case report. World J Clin Cases. 2021 Jun 6;9(16):3914-3918. https://doi.org/10.12998/wjcc.v9.i16.3914
19. Ofstead CL, Heymann OL, Quick MR, Johnson EA, Eiland JE, Wetzler HP. The effectiveness of sterilization for flexible ureteroscopes: A real-world study. Am J Infect Control. 2017 Aug 1;45(8):888-895. https://doi.org/10.1016/j.ajic.2017.03.016
20. Bragaru M, Multescu R, Georgescu D, Bulai C, Ene C, Popescu R, et al. Single-use versus conventional reusable flexible ureteroscopes - an evaluation of the functional parameters. J Med Life. 2023 Jan;16(1):10-15. https://doi.org/10.25122/jml-2022-0269
21. Ozimek T, Hochguertel L, Hupe MC, Struck JP, Wiessmeyer JR, Gilbert N, Merseburger AS, Kramer MW. Risk Factors for a Complicated Postoperative Course in Flexible Ureteroscopy. Urol Int. 2021;105(7-8):611-618. https://doi.org/10.1159/000512892

Original Article
Özgün Araştırma

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Evaluation of the Effectiveness of Local Anesthesia and Patient Tolerance in Penile Prosthesis Implantation

Penil Protez İmplantasyonunda Lokal Anestezinin Etkinliğinin ve Hasta Toleransının Değerlendirilmesi

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ABSTRACT

Objective: This study aims to evaluate the effectiveness, safety, and patient tolerance of penile prosthesis implantation (PPI) performed under local anesthesia (LA). The study investigates its impact on perioperative pain management, postoperative recovery, and overall patient satisfaction.

Material and Methods: This prospective study included 26 male patients who underwent PPI under LA between January 2024 and December 2024. Ethical approval was obtained from the Ethics Committee Antalya Training and Research Hospital No: 2/24, Date: 30.01.2025). Pain intensity was assessed using the Visual Analog Scale (VAS), while patient stability and intraoperative parameters were monitored. The American Society of Anesthesiologists (ASA) classification system was used for anesthesia risk assessment.

Results: The mean age of the patients was 67.25 ± 11.48 years. Diabetes mellitus and hypertension were present in 75% and 62.5% of patients, respectively. According to ASA classification, 46.2% were classified as ASA-II, while 53.8% were ASA-III. The mean intraoperative VAS score was 1.8 (mild pain), while the mean postoperative VAS score was 4.6 (mild-to-moderate pain). No patients required additional sedation or conversion to general anesthesia. No major intraoperative complications or postoperative prosthesis-related complications were observed.

Conclusion: Local anesthesia is a feasible and effective alternative for penile prosthesis implantation, offering benefits such as minimal intraoperative discomfort, avoidance of systemic anesthetic complications, and a favorable recovery profile. Further studies with larger cohorts are needed to optimize pain management strategies and evaluate long-term functional outcomes.

Keywords: penile prosthesis implantation, local anesthesia, erectile dysfunction, pain management

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ÖZET

Amaç: Bu çalışmanın amacı, lokal anestezi altında gerçekleştirilen penis protezi implantasyonunun (PPI) etkinliğini, güvenliğini ve hasta toleransını değerlendirmektir. Çalışma, perioperatif ağrı yönetimi, postoperatif iyileşme süreci ve genel hasta memnuniyeti üzerindeki etkilerini araştırmaktadır.

Gereç ve Yöntemler: Bu prospektif çalışmaya, Ocak 2024 ile Aralık 2024 tarihleri arasında lokal anestezi altında PPI uygulanan 26 erkek hasta dahil edildi. Çalışma için etik onay, Antalya Eğitim ve Araştırma Hastanesi Etik Kurulu'ndan alındı (Karar No: 2/24, Tarih: 30.01.2025). Ağrı şiddeti Görsel Analog Skalası (VAS) kullanılarak değerlendirildi ve intraoperatif parametreler ile hasta stabilitesi takip edildi. Anestezi riski değerlendirmesinde Amerikan Anesteziyologlar Derneği (ASA) sınıflandırma sistemi kullanıldı.

Bulgular: Hastaların ortalama yaşı 67,25 ± 11,48 yıl olup, %75'inde diyabetes mellitus, %62,5'inde hipertansiyon mevcuttu. ASA sınıflandırmasına göre hastaların %46,2'si ASA-II, %53,8'i ASA-III kategorisinde yer aldı. Ortalama intraoperatif VAS skoru 1,8 (hafif ağrı), ortalama postoperatif VAS skoru ise 4,6 (hafif-orta şiddette ağrı) olarak ölçüldü. Hiçbir hastada ek sedasyon gereksinimi ya da genel anesteziye geçiş ihtiyacı oluşmadı. Ayrıca, intraoperatif veya erken postoperatif dönemde ciddi komplikasyon veya protezle ilişkili olumsuz durum gözlenmedi.

Sonuç: Lokal anestezi, penis protezi implantasyonu için güvenilir ve etkili bir alternatif olup, minimal intraoperatif rahatsızlık, sistemik anestezik komplikasyonlardan kaçınma ve avantajlı bir iyileşme süreci sunmaktadır. Daha geniş hasta gruplarında yapılacak ileri çalışmalar, ağrı yönetimi stratejilerinin optimize edilmesi ve uzun dönem fonksiyonel sonuçların değerlendirilmesi açısından gereklidir.

Anahtar Kelimeler: Penis protezi implantasyonu, Lokal anestezi, Erektil disfonksiyon, Ağrı yönetimi, Postoperatif iyileşme

INTRODUCTION

Erectile dysfunction (ED) is a prevalent and multifactorial condition characterized by the inability to achieve or maintain sufficient penile rigidity to engage in satisfactory sexual intercourse (1). ED represents a significant burden on both individual well-being and public health. Its prevalence increases progressively with age and is closely associated with common comorbidities such as diabetes mellitus, cardiovascular diseases, and metabolic syndrome. Recent epidemiological data from multi-country population studies confirm that the global incidence of ED continues to rise in parallel with aging populations and lifestyle-related health conditions (2,3).

The therapeutic landscape for ED is diverse, encompassing pharmacological agents, behavioral and psychological interventions, and surgical modalities. While oral phosphodiesterase type 5 (PDE5) inhibitors and intracavernosal injections remain the mainstay of pharmacotherapy, a subset of patients with severe or refractory ED fails to achieve satisfactory outcomes with these conservative approaches. In such cases, penile prosthesis implantation (PPI) emerges as a definitive treatment option, providing a highly effective and durable solution for restoring sexual function (4).

Traditionally, PPI has been performed under general or regional (spinal) anesthesia, ensuring optimal surgical conditions and patient comfort. However, there has been a growing interest in recent years in the utilization of local anesthesia (LA) for this procedure. The potential benefits of local anesthesia include a reduced perioperative risk profile, avoidance of systemic anesthetic complications, shorter hospitalization durations, and a faster recovery trajectory. Additionally, local anesthesia may provide an alternative for patients with contraindications to general or regional anesthesia. Despite these advantages, concerns persist regarding the adequacy of analgesia, intraoperative patient experience, and the potential impact on complication rates (5).

Given the increasing emphasis on minimally invasive techniques and enhanced recovery protocols in surgical practice, evaluating the feasibility of PPI under local anesthesia is of paramount importance. This study aims to assess the efficacy, safety, and patient tolerance of penile prosthesis implantation performed under local anesthesia. Furthermore, it seeks to elucidate its impact on perioperative pain management, postoperative recovery, and overall patient satisfaction. By addressing these key parameters, this study endeavors to contribute valuable insights into the optimization of anesthesia protocols for PPI, thereby enhancing patient-centered surgical care.

MATERIAL AND METHODS

Study Design and Patient Selection

This retrospective study included 26 male patients who underwent penile prosthesis implantation under local anesthesia between January 2024 and December 2024. Ethical approval for the study was obtained from the Ethics Committee of Antalya Training and Research Hospital (Decision No: 2/24, Date: 30.01.2025). Data were collected from patient medical records and surgical reports. The inclusion criteria encompassed male patients diagnosed with severe erectile dysfunction unresponsive to pharmacological interventions and considered suitable candidates for penile prosthesis implantation. Exclusion criteria included a history of significant bleeding disorders, known hypersensitivity to local anesthetic agents, and severe psychiatric conditions that could interfere with pain perception and procedural compliance. Additionally, four patients who initially consented to participate later withdrew and were consequently excluded from the final analysis. Importantly, all procedures in this study were primary (de-novo) implantations, and no revision or replacement surgeries were performed.

Anesthetic Technique

Local anesthesia was administered using a mixture of 0.5% bupivacaine (Marcaine®) and 0.5% lidocaine, without adrenaline, in a 25:75 ratio. A 23-gauge, 1.5-inch needle was used for precise infiltration. The anesthetic solution was injected into the peno-scrotal region following a stepwise approach, which involved superficial infiltration first, followed by deeper tissue injection to achieve comprehensive regional anesthesia. This technique aimed to optimize pain control, enhance patient comfort, and ensure optimal surgical conditions. Similar field block and regional infiltration techniques for penile prosthesis surgery have been described in recent literature, showing satisfactory analgesic outcomes and patient tolerability (6).

Surgical Procedure

The surgical procedure was performed using the peno-scrotal approach in all cases. A midline scrotal incision was made to expose the corpora cavernosa. After careful dilatation, three-piece inflatable penile prostheses (Rigicon®) were bilaterally positioned within the corpora cavernosa. The reservoir component was placed in the retropubic space via the external inguinal ring. Meticulous hemostasis was maintained throughout the procedure, and the surgical site was closed using absorbable sutures. Postoperative antibiotic prophylaxis was administered according to institutional protocols to minimize the risk of infection. Notably, no patients reported intraoperative or early postoperative abdominal pain or discomfort related to reservoir placement.

Pain Assessment and Perioperative Monitoring

Pain intensity was evaluated using the Visual Analog Scale (VAS), with a score ranging from 0 to 10, where 0 represented no pain and 10 indicated the worst possible pain. Pain severity was categorized into three levels: mild pain (<3), mild-to-moderate pain (3–6), and moderate-to-severe pain (>6). Throughout the procedure, hemodynamic parameters, including blood pressure, heart rate, and oxygen saturation, were continuously monitored to ensure patient stability and optimal intraoperative comfort.

Anesthesia Risk Assessment

The American Society of Anesthesiologists (ASA) physical status classification system was employed to assess preoperative anesthesia risk. Patients were categorized as ASA I (healthy individuals with no systemic disease), ASA II (patients with mild systemic disease, such as controlled hypertension or diabetes), and ASA III (patients with severe systemic disease, such as significant cardiovascular pathology). No patients classified as ASA IV or higher were included in this study (7).

Postoperative Care and Follow-Up

Patients were observed in the postoperative care unit for an initial recovery assessment. Analgesic requirements, early complications, and patient-reported satisfaction were meticulously documented. Discharge was determined based on postoperative recovery and pain management, with most patients being discharged on the same day or within 24 hours.

Statistical Analysis

Descriptive statistics were employed in this study. Continuous variables are presented as mean ± standard deviation and range (minimum–maximum), while categorical variables are expressed as absolute numbers and percentages. All calculations were performed using Microsoft Excel (Microsoft Corp., Redmond, WA, USA). No inferential statistical analyses were conducted.

RESULTS

The study included 26 male patients with a mean age of 67.25 ± 11.48 years (range: 48–92 years). Among these, 75% (19 patients) had diabetes mellitus, and 62.5% (16 patients) had hypertension. Additionally, 18.75% (4 patients) had a history of radical prostatectomy, and 30.8% (8 patients) had cardiovascular disease. According to the ASA classification, 46.2% (12 patients) were classified as ASA-II, while 53.8% (14 patients) were classified as ASA-III. The mean intraoperative VAS score was 1.8, indicating mild pain, whereas the mean postoperative VAS score was 4.6, corresponding to mild-to-moderate pain. No patients required additional sedation during the procedure. There were no major intraoperative complications, and no patients required conversion to general anesthesia. Additionally, no severe postoperative complications, such as prosthesis infection or mechanical failure, were observed within the immediate postoperative period (Table 1).

Table 1. Patient Demographics, Clinical Characteristics, and Outcomes

Parameter	Value (%, n) or Mean ± SD
Number of Patients, n	26
Mean Age (years)	67.25 ± 11.48 (range: 48–92)
Diabetes Mellitus, % (n)	75% (19 patients)
Hypertension, % (n)	62.5% (16 patients)
History of Radical Prostatectomy, % (n)	18.75% (4 patients)
ASA-II, % (n)	46.2% (12 patients)
ASA-III, % (n)	53.8% (14 patients)
Mean Intraoperative VAS Score	1.8 ± 0.6 (mild pain)
Mean Postoperative VAS Score	4.6 ± 1.2 (mild-to-moderate pain)
Major Complications	None

Continuous variables are presented as mean ± standard deviation and range. Categorical variables are expressed as number (percentage). ASA: American Society of Anesthesiologists, VAS: Visual Analog Scale.

DISCUSSION

The findings of this study contribute to the growing body of evidence supporting the feasibility and safety of penile prosthesis implantation under local anesthesia. By evaluating perioperative outcomes, pain control, and patient experience, this study provides an in-depth analysis of the potential advantages and challenges associated with this approach.

Consistent with prior research, our results indicate that local anesthesia is an effective alternative to general or spinal anesthesia, offering significant benefits in terms of reduced systemic anesthetic risks and accelerated recovery (3). The observed intraoperative VAS scores (mean 1.8) align with previous studies reporting minimal discomfort during surgery (4). Additionally, the postoperative VAS score (mean 4.6) suggests that while local anesthesia provides sufficient analgesia intraoperatively, postoperative pain management strategies may require further optimization. A recent multi-institutional study demonstrated that multimodal analgesia protocols can significantly reduce early postoperative pain and narcotic requirements in patients undergoing penile prosthesis implantation (7).

A notable difference between our study and existing literature lies in the variability of postoperative pain scores. While some studies report lower pain levels following local anesthesia, our findings suggest that patient-reported pain perception may vary due to factors such as individual pain thresholds, procedural duration, and intraoperative

anxiety (8,9). This discrepancy underscores the importance of individualized pain management strategies and the potential role of adjunctive analgesic techniques to enhance patient comfort. Furthermore, unlike certain reports indicating a need for intraoperative sedation, our study found no such requirement, supporting the effectiveness of our anesthetic protocol in maintaining procedural tolerance (10).

Despite the advantages of local anesthesia, challenges remain in ensuring optimal patient comfort and minimizing anxiety. Recent studies emphasize the role of preoperative psychological preparation and intraoperative communication in mitigating anxiety-related discomfort (11,12). Additionally, optimizing the local anesthetic mixture and refining injection techniques may further enhance intraoperative analgesia and postoperative recovery (13,14) These refinements could be instrumental in improving overall patient satisfaction and procedural outcomes.

Furthermore, the long-term implications of local anesthesia in penile prosthesis implantation remain an area of ongoing investigation. While immediate postoperative outcomes are promising, further research is required to determine the impact of local anesthesia on long-term prosthesis functionality, patient-reported sexual satisfaction, and potential late-onset complications (15). Studies have suggested that intraoperative pain perception and overall procedural experience may be influenced by factors such as surgical duration and psychological state, necessitating a more tailored approach to pain and anxiety management (16). Additionally, refining multimodal analgesia strategies, including the potential use of regional nerve blocks in conjunction with local infiltration, may optimize perioperative analgesia and enhance recovery (17). In addition, broader implementation of local anesthesia protocols aligns with current efforts to minimize opioid usage and enhance patient-centered recovery pathways, especially in outpatient prosthetic surgery settings (17). Recent studies have also emphasized the importance of comprehensive strategies to improve patient satisfaction, surgical success rates, and long-term functional outcomes in penile prosthesis implantation, further supporting the integration of minimally invasive and patient-tailored anesthetic approaches (18).

This study has several limitations. First, the relatively small sample size limits the external validity of our findings. Larger, multi-center trials are needed to validate these results and explore potential patient subgroups who may benefit the most from local anesthesia. Second, long-term functional outcomes and prosthesis durability were not assessed, highlighting the need for extended follow-up studies. Finally, while this study systematically evaluated intraoperative and immediate postoperative pain, additional parameters such as long-term patient satisfaction and sexual function recovery should be incorporated into future research.

CONCLUSION

In conclusion, local anesthesia represents a viable and potentially superior alternative for penile prosthesis implantation, demonstrating favorable safety and recovery profiles. However, continuous evaluation and refinement of anesthetic protocols are essential to optimize patient outcomes and enhance surgical experiences. Future research should focus on long-term functional outcomes and the integration of multimodal analgesia strategies to further improve postoperative care.

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REFERENCES

1. Haensch, C. A., Hilz, M., Jost, W., Kaufmann, A., Kessler, T., & Lahrmann, H. (2019). S1-Leitlinie Diagnostik und Therapie der erektilen Dysfunktion [S1-Guideline for Diagnosis and Treatment of Erectile Dysfunction]. Fortschritte der Neurologie · Psychiatrie, 87(4), 225-233. https://doi.org/10.1055/a-0747-5892
2. Goldstein, I., Goren, A., Li, V. W., Tang, W. Y., & Hassan, T. A. (2020). Epidemiology Update of Erectile Dysfunction in Eight Countries with High Burden. Sexual medicine reviews, 8(1), 48–58. https://doi.org/10.1016/j.sxmr.2019.06.008
3. Kessler, A., Sollie, S., Challacombe, B., Briggs, K., & Van Hemelrijck, M. (2019). The global prevalence of erectile dysfunction: a review. BJU international, 124(4), 587–599. https://doi.org/10.1111/bju.14813
4. Porst, H., Burnett, A., Brock, G., Ghanem, H., Giuliano, F., Glina, S., Hellstrom, W., Martin-Morales, A., Salonia, A., & Sharlip, I. (2013). SOP conservative (medical and mechanical) treatment of erectile dysfunction. Journal of Sexual Medicine, 10(1), 130-171. https://doi.org/10.1111/jsm.12023
5. Fidel, M. G., Shah, J., Bal, D. S., Roque, C., Ko, Y., Dhillon, H., Bard, R., Pandian, A., Nayak, J. G., & Patel, P. (2024). Inflatable penile prosthesis implantation in the outpatient setting is safe and feasible: a prospective, singe center study. International journal of impotence research, 10.1038/s41443-024-01004-3. Advance online publication. https://doi.org/10.1038/s41443-024-01004-3
6. Elatreisy, A., Ahmed, Y., Elgarhy, A., Hindawy, M., Abouelgreed, T., Ahmed, I., et al.(2024). Comparative study between intrathecal fentanyl and dorsal penile nerve block for controlling postoperative pain after inflatable penile prosthesis implantation. Archivio italiano di urologia, andrologia : organo ufficiale [di] Societa italiana di ecografia urologica e nefrologica, 96(4), 12951. https://doi.org/10.4081/aiua.2024.12951
7. Lucas, J., Gross, M., Yafi, F., DeLay, K., Christianson, S., El-Khatib, F. M., Osman, M., & Simhan, J. (2020). A Multi-institutional Assessment of Multimodal Analgesia in Penile Implant Recipients Demonstrates Dramatic Reduction in Pain Scores and Narcotic Usage. The journal of sexual medicine, 17(3), 518–525. https://doi.org/10.1016/j.jsxm.2019.11.267
8. Klimek, L., Bergmann, K. C., Biedermann, T., Bousquet, J., Hellings, P., Jung, K., Merk, H., Olze, H., Schlenter, W., Stock, P., Ring, J., Wagenmann, M., Wehrmann, W., Mösges, R., & Pfaar, O. (2017). Visual analogue scales (VAS): Measuring instruments for the documentation of symptoms and therapy monitoring in cases of allergic rhinitis in everyday health care. Allergo Journal International, 26(1), 16-24. https://doi.org/10.1007/s40629-016-0006-7
9. American Society of Anesthesiologists. (2014). ASA Physical Status Classification System. Retrieved from https://www.asahq.org/resources/clinical-information/asa-physical-status-classification-system
10. American Society of Anesthesiologists. (2012). Practice Guidelines for Preoperative Assessment. Anesthesiology.
11. Cherobin, A. C. F. P., & Tavares, G. T. (2020). Safety of local anesthetics. Anais Brasileiros de Dermatologia, 95(1), 82-90. https://doi.org/10.1016/j.abd.2019.09.025
12. Schnabl, S. M., Herrmann, N., Wilder, D., Breuninger, H., & Häfner, H. M. (2014). Clinical results for use of local anesthesia with epinephrine in penile nerve block. Journal of the German Society of Dermatology, 12(4), 332-339. https://doi.org/10.1111/ddg.12287
13. Hsu GL, Hsieh CH, Chen HS, Ling PY, Wen HS, Liu LJ, Chen CW, Chua C. The advancement of pure local anesthesia for penile surgeries: can an outpatient basis be sustainable? J Androl. 2007 Jan-Feb;28(1):200-5. https://doi.org/10.2164/jandrol.106.000679. Epub 2006 Sep 20. PMID: 16988329.
14. Althof, S. E., et al. (2014). An update of the International Society of Sexual Medicine's guidelines for the diagnosis and treatment of premature ejaculation (PE). The Journal of Sexual Medicine, 11(6), 1392-1422.
15. Brennan, F., Carr, D. B., & Cousins, M. (2007). Pain management: A fundamental human right. Anesthesia & Analgesia, 105(1), 205-221. https://doi.org/10.1213/01.ane.0000268145.52345.55
16. Altieri, V. M., Saldutto, P., Verratti, V., La Rocca, R., Di Mauro, E., Celentano, G., Capece, M., Morgera, V., Cacace, G., Vena, W., Mastrangelo, F., Napolitano, L., & Iacono, F. (2024). Altieri modified Nesbit corporoplasty for the

treatment of penile curvature: Comparison of local anesthesia vs loco-regional anesthesia on the clinical outcomes. Archivio Italiano di Urologia e Andrologia, 96(4), 12957. https://doi.org/10.4081/aiua.2024.12957

17. Reinstatler, L., Shee, K., & Gross, M. S. (2018). Pain management in penile prosthetic surgery: A review of the literature. Sexual Medicine Reviews, 6(1), 162-169. https://doi.org/10.1016/j.sxmr.2017.05.005
18. Hellstrom W. J. G. (2025). Advances in penile prosthetics: current trends and future directions in erectile dysfunction treatment. International journal of impotence research, 37(1), 1–3. https://doi.org/10.1038/s41443-024-01010-5

Case Report
Olgu Sunumu

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Nephrostomy Tube Placed in the Vena Cava as a Complication of Percutaneous Nephrolithotomy: A Case Report

Perkütan Nefrolitotomi Komplikasyonu Olarak Vena Cavaya Yerleşen Nefrostomi Tüpü: Bir Vaka Sunumu

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ABSTRACT

Percutaneous nephrolithotomy (PNL) is an important approach for removing kidney stones. Percutaneous nephrostomy drainage tube placement is performed to prevent extravasation and ensure hemostasis after PNL surgery. In this case, we will report on the successful conservative removal of the nephrostomy tube extending into the inferior vena cava, which was inserted to provide hemostasis after unilateral PNL surgery. Sometimes, as in our case, the catheter may perforate the renal parenchyma and extend into the renal vein or even the vena cava. In our case, the nephrostomy tube was located in the inferior vena cava (IVC). In case of possible massive bleeding that we could not control, the catheter was removed under fluoroscopy in the presence of the Cardiovascular Surgery-Interventional Radiology team. The patient had no problems during follow-up and was discharged successfully.

Keywords: percutaneous nephrolithotomy, renal stone, nephrostomy tube, inferior vena cava

ÖZET

Perkütan nefrolitotomi (PNL), böbrek taşlarının çıkarılması için önemli bir yaklaşımdır. Perkütan nefrostomi drenaj tüpü yerleştirilmesi, PNL ameliyatı sonrası ekstravazasyonu önlemek ve hemostazı sağlama amacıyla yapılır. Bu vakada da tek taraflı PNL ameliyatı sonrasında hemostaz sağlama amacıyla takılan inferior vena kavaya uzanan nefrostomi tüpünün başarılı şekilde konservatif olarak çekilmesini bildireceğiz. Bizim vakamızda olduğu gibi bazen, kateter böbrek parankimini perfore edebilir ve renal vene hatta vena kavaya kadar uzanabilir. Vakamızda nefrostomi tüpü inferior vena cava (İVC) içerisinde yer almaktaydı. Kontrol altına alamadığımız olası masif kanama durumunda Kalp Damar Cerrahisi-Girişimsel Radyoloji ekibinin de bulunduğu vakada floroskopi altında katater çekilmesi uygulandı. Hastanın takiplerinde bir sıkıntı izlenmedi ve başarıyla taburcu edildi.

Anahtar Kelimeler: perkütan nefrolitotomi, böbrek taşı, nefrostomi tüpü, vena cava inferior

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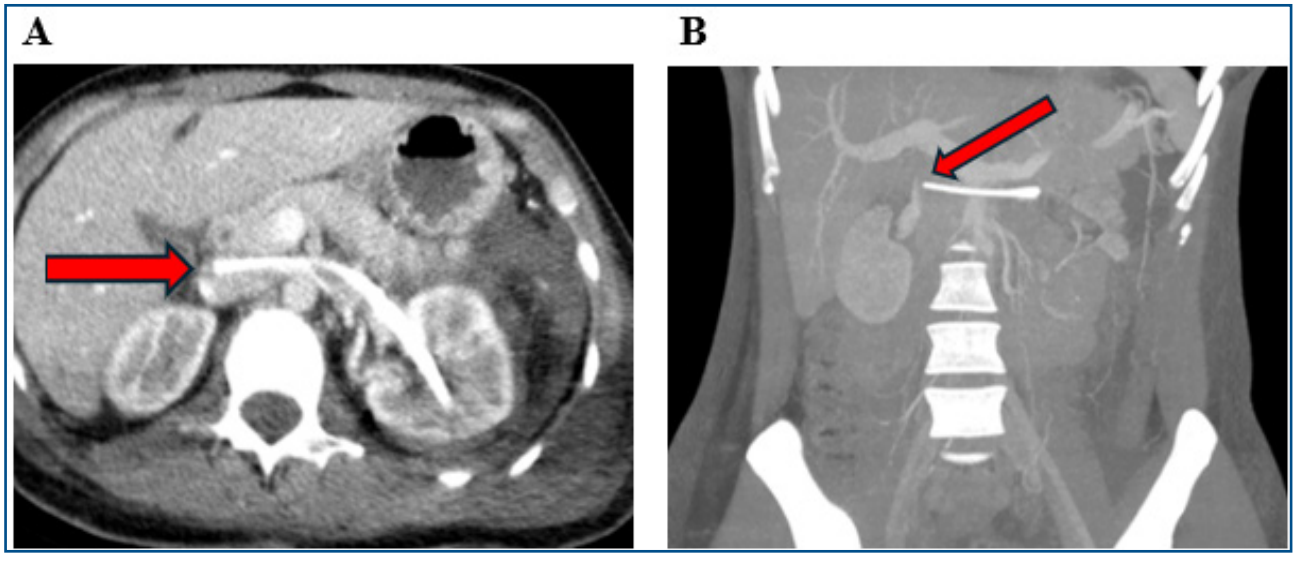
GİRİŞ

Perkütan nefrolitotomi (PNL), böbrek taşlarının tedavisinde yaygın olarak kullanılan minimal invaziv bir cerrahi yaklaşımdır. PNL, özellikle büyük, çoklu veya alt kaliks böbrek taşlarının tedavisinde birinci basamak yöntem olarak tercih edilmektedir. Taş boyutu ve yerleşimine göre uygulanan perkütan nefrolitotomi (PNL) çeşitleri; standart (24-30 Fr), mini (16-20 Fr) ve mikro (12-14 Fr) olarak sınıflandırılmaktadır. PNL genellikle güvenli ve etkili bir prosedür olmasına rağmen, nadiren de olsa ciddi komplikasyonlar gelişebilir. Literatürde bildirilen komplikasyon oranı yaklaşık %7 olup, en ciddi komplikasyonlardan biri olan vasküler yaralanma oranı ise %0,5'tir (1,2). PNL sırasında meydana gelen kanamaya bağlı operasyonu sonlandırılan ve sonrasında yeterli kontrol yapılmadan yerleştirilen nefrostomi tüpünün renal ven üzerinden vena cavaya yerleştiği nadir bir durumu vaka raporu olarak bildiriyoruz.

VAKA SUNUMU

Yirmi altı yaşındaki kadın hasta, sol yan ağrısı şikayetiyle kliniğimize başvurmuştur. Yapılan tetkiklerde sol böbrekte 3 cm^3 boyutunda taş tespit edilmesi üzerine, hastaya mini PNL planlanmıştır. Prone pozisyonunda, floroskopik görüntü eşliğinde alt pol girişimi gerçekleştirilmiş ve kademeli dilatasyonlar ile 20 Fr kılıf yerleştirilmiştir. Çalışma kanalından yoğun kanama geldiği görüldü nefroskop ile renal pelvis görüntülenmeye çalışılsa da net bir görüntü sağlanamadı. Operasyon sonlandırılarak pelvikaliksiyel sistem olarak düşünülen bir yere guide üzerinden 14 F nefrostomi tüpü yerleştirildi. Hemostaz açısından nefrostomi tüpü klemplendi. Post-op takiplerinde vital bulguları stabil olan hastaya, işlemden on iki saat sonra nefrostomi açıldığında belirgin hemorajik drenaj izlenmesi ve tüpün yerinde olup olmadığının kesin olarak değerlendirilememesi üzerine, kontrastlı bilgisayarlı tomografi (BT) anjiyografi ile nefrostomi tüpünün pozisyonu kontrol edildi. BT anjiografide nefrostomi tüpünün renal venden vena cava inferiora uzanım gösterdiği ve tüp çevresinde kan birikimi gözlenmedi **(**Şekil 1). Acil olarak girişimsel radyoloji, kalp damar cerrahisi, üroloji olarak cerrahi ekip kuruldu. Kalp damar cerrahisi önerisiyle tüp floroskopi eşliğinde çekimi planlandı. Çekim sırasında anjioembolizasyon ve açık cerrahi müdahale açısından ekip hazırda bulundu. Floroskopi altında nefrostomi çekildi. Hasta ameliyat sonrası bir saat boyunca operasyon masasında vital bulgular açısından izlenmiş, herhangi bir olumsuzluk gözlenmemiştir. Sonrasında, olası komplikasyonlara karşı önlem olarak hasta bir gün süreyle yoğun bakım ünitesinde takip edilmiştir. Bu süreç içerisinde hematüri, idrar çıkımında azalma, kanama gözlenmedi. Postoperatif 3. günde ultrasonografi yapılan hastada olumsuz bir duruma rastlanmadı. Postoperatif 5.gün komplikasyon gelişmeyen hasta taburcu edildi. Hastanın taşına müdahale ise iki seans retrograd intrarenal cerrahi olacak şekilde bir sonraki seansa bırakıldı.



Şekil 1. A- BT Transvers düzlem görüntülemesinde, nefrostomi kataterinin sol renal venden vena cava inferiora uzandığı görüldü. B- BT Koronal düzlem görüntülemesinde, nefrostomi kataterinin vena cava inferiora uzandığı görüldü.

TARTIŞMA

Kanama PNL'nin en önemli komplikasyonudur ve prosedürlerin %7' sine kadar transfüzyon gerekli olabilir (2). Diğer komplikasyonlar arasında sepsis, komşu organ perforasyonu (karaciğer, dalak ve bağırsak gibi), böbreklere girişimde başarısızlık, üriner sisteminin perforasyonu, pnömotoraks ve plevral efüzyon yer alır (3). PNL sonrası toplayıcı sisteme nefrostomi tüpü yerleştirilmesi tercih edilen bir uygulamadır. Ürinom oluşumunu engellemesi ve venöz kanamanın kontrol edilmesinde etkili bir yöntemdir (4). Ancak nadiren de olsa nefrostomi tüpü renal parankimi perfore edebilir veya venöz sisteme ilerleyebilir. PNL'den sonra intravenöz nefrostomi tüpünün yanlış yerleştirilmesi insidansının binde 0,23 olduğu gösterilmiştir. Bugüne kadar PubMed veri tabanında yalnızca 15 vaka rapor edilmiştir ve bazı vakalarda renal vene, vena cavaya hatta atriuma ulaştığı bildirilen vakalar vardır (5,6). Bu vakalar, doğru yerleştirilmemiş nefrostomi tüpünün büyük damarlara ilerleyebileceği olasılığını göstermektedir. Özellikle rotasyon anomalisine sahip böbreklerde komplikasyon riski artmaktadır. Abrate A ve arkadaşlarının, at nalı böbrek anomalisine sahip bir hastada bildirdikleri nefrostomi tüpünün vena cava yerleştirilmesi komplikasyonu vakasında, açık cerrahi müdahale uygulanmış ancak hasta, hemodinamik instabilite, pulmoner emboli ve pnömoni nedeniyle hayatını kaybetmiştir (7). Bu komplikasyonun yönetimiyle ilgili yapılan bir literatür taramasında, on dört vakanın yalnızca ikisinde açık cerrahi yöntem kullanıldığı bildirilmiş olmakla birlikte, genel görüş, diğer on iki vakada olduğu gibi, nefrostomi tüpünün floroskopi altında, kontrast madde enjekte edildikten sonra kateterin geri çekilmesiyle pelvise tek aşamalı veya iki aşamalı olarak çıkarılması yönündedir (6). Vasküler yapılara yerleştirilen nefrostomi tüplerinin çekimi sırasında tromboz oluşumuna bağlı komplikasyonlarda literatürde bildirilmiştir. Bir vakada operasyon sonrası beşinci günde fark edilen nefrostomi tüpünün vena cavada tromboz oluşturduğu hatta vene cava filtresi konulduğu bildirilmiştir (8). Bizim vakamızda tekrar müdahale süresimiz on iki saat sonra olduğundan bu ihtimale karşı vena cava filtresi ve antitrombotik tedavi düşünülmemiştir. Ancak, pulmoner emboli potansiyel olarak majör bir komplikasyon oluşturduğundan, pıhtılaşma bozukluğu olan hastalarda vena cava filtresi ve antitrombotik tedavi seçenekleri göz önünde bulundurulmalıdır. Böyle nadir görülen durumlarda, hızlı bir literatür taraması yapmak, alınacak kararlar açısından büyük önem taşımaktadır. PNL, özellikle öğrenme sürecinde komplikasyonların yaşanma oranının yüksek olduğu bir cerrahi prosedürdür. Bu işlemin başarılı bir şekilde uygulanabilmesi için cerrahi yeterlilik yanı sıra, hastane altyapısının sağlam olması ve kalp-damar cerrahisi ile girişimsel radyoloji gibi diğer ilgili bölümlerin olanaklarının da mevcut olması gerekmektedir.

Kliniğimizde son beş yıl içinde gerçekleştirilen 482 perkütan nefrolitotomi (PNL) vakasında, ilk kez böyle bir komplikasyonla karşılaşılmıştır. İnsidansımız, literatürde bildirilen oranlarla benzerlik göstermektedir. Bu vaka, PNL sonrası şüpheli durumlarla karşılaşıldığında, cerrahların nadir komplikasyonların farkında olmaları gerektiğini ve doğru görüntüleme tekniklerini kullanarak tanıyı kesinleştirmeleri ile ekip olarak tedavi planlaması yapmalarının önemini vurgulamaktadır.

SONUÇ

Bu vaka, perkütan nefrolitotomi (PNL) sonrası ortaya çıkan ve oldukça nadir görülen bir komplikasyon olan nefrostomi tüpünün vena cavaya yerleşmesini detaylandırmaktadır. Bu tür komplikasyonlarla karşılaşılan hastalarda, tedavi yönetimi genellikle floroskopik rehberlik altında, tek veya iki aşamalı adımlarla tüpün geri çekilmesi ile yapılabilir. Takip sürecinde, hasta iki gün boyunca yoğun bakım ünitesinde izlenmeli ve ultrason ile düzenli olarak takip edilmelidir. Cerrahların bu nadir komplikasyonlara karşı dikkatli olmaları ve erken müdahalede bulunmaları kritik öneme sahiptir.

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KAYNAKLAR

1. Mazzucchi, E., Mitre, A., Brito, A., Arap, M., Murta, C. et al (2009). Intravenous misplacement of the nephrostomy catheter following percutaneous nephrostolithotomy: two case reports. Clinics (Sao Paulo, Brazil), 64(1), 69-70. https://doi.org/10.1590/s1807-59322009000100013
2. Seitz, C., Desai, M., Häcker, A., Hakenberg, O. W., Liatsikos, E. et al.(2012). Incidence, prevention, and management of complications following percutaneous nephrolitholapaxy. European urology, 61(1), 146-158. https://doi.org/10.1016/j.eururo.2011.09.016
3. Lingeman JE, Matlaga BR, Evan AP. Surgical management of upper urinary tract calculi. In: Wein AJ, et al., editors. Campbell-Walsh Urology. 9th edition.Philadelphia: Saunders; 2007. p. 1500. https://doi.org/10.1016/j.juro.2009.01.023
4. Winfield HN, Weyman P, Clayman RV. Percutaneous nephrostolithotomy: Complications of premature nephrostomy tube removal. J Urol. 1986;136:77–9. https://doi.org/10.1016/s0022-5347(17)44733-1
5. AbdelAziz, H. H., & Gad, M. H (2023). Successful Management of an Inadvertent Placement of a Nephrostomy Tube Into the Inferior Vena Cava Following Percutaneous Nephrolithotomy: A Case Discussion and Literature Review of a Rare Complication. Cureus, 15(8), e44422. https://doi.org/10.7759/cureus.44422
6. Liu, J., Jiang, B., Mao, J., Zeng, Z., Gong, L., et al (2020). Intravenous misplacement of the nephrostomy catheter following percutaneous nephrostolithotomy: a case report and literature review. The Journal of international medical research, 48(12), 300060520979447. https://doi.org/10.1177/0300060520979447
7. Abrate, A., Tulone, G., Giaimo, R., & Simonato, A (2020). Percutaneous Nephrostomy Catheter Misplacement into Inferior Vena Cava in a Patient with a Horseshoe Kidney. Journal of endourology case reports, 6(3), 202–204. https://doi.org/10.1089/cren.2020.0012
8. Xiong, W., Wei, W., Ju, X., Hu, W., Xu, Y., et al (2024). Intravenous misplacement of the nephrostomy catheter into the inferior vena cava and secondary thrombosis following percutaneous nephrostolithotomy: A case report and literature review. Heliyon, 10(14), e34495. https://doi.org/10.1016/j.heliyon.2024.e34495

Review Article
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Metaphlyxia in Urinary System Stone Disease

Üriner Sistem Taş Hastalığında Metaflaksi

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ABSTRACT

Urolithiasis should not be considered merely an acute condition requiring episodic treatment, but rather a chronic and multifactorial disease with increasing global prevalence and a high recurrence rate. Metaphylaxis, encompassing secondary preventive strategies to prevent stone recurrence, has become a central component of modern stone management. This review outlines the definition and scope of metaphylaxis in stone disease, patient risk stratification, protocols for metabolic evaluation, dietary and lifestyle interventions, and pharmacological treatment options in line with current clinical guidelines and recent literature. Evidence from randomized controlled trials demonstrates that personalized treatment strategies targeting metabolic abnormalities such as hypercalciuria, hypocitraturia, and hyperuricosuria can reduce recurrence rates by more than 50%. Furthermore, lifestyle modifications combined with pharmacological agents such as potassium citrate, thiazide diuretics, and allopurinol have shown long-term clinical benefits. The success of metaphylaxis is closely tied to structured patient education, regular metabolic monitoring, and radiological follow-up. Effectively implemented metaphylaxis programs not only prevent new stone formation but also reduce the need for surgical interventions and stone-related complications. In conclusion, individualized, guideline-based metaphylaxis strategies have become indispensable in prolonging stone-free intervals in the management of urolithiasis.

Keywords: urolithiasis, metaphylaxis, stone recurrence, metabolic evaluation, diet, pharmacotherapy

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ÖZET

Ürolitiyazis, dünya genelinde artan prevalansı ve yüksek tekrarlama eğilimi nedeniyle sadece akut dönemde tedavi edilmesi gereken bir tablo değil, aynı zamanda uzun dönem takip gerektiren çok yönlü bir hastalık olarak değerlendirilmelidir. Taş nüksünün önlenmesine yönelik sekonder profilaksi stratejileri içeren metaflaksi, üriner taş hastalığı yönetiminin merkezinde yer almaktadır. Bu derlemede taş hastalığında metaflaksinin tanımı, kapsamı, risk temelli hasta sınıflandırması, metabolik değerlendirme yöntemleri, diyet ve yaşam tarzı modifikasyonları ile farmakolojik tedavi yaklaşımları güncel kılavuzlar ve literatür doğrultusunda ele alınmıştır. Metabolik analizlere dayalı bireyselleştirilmiş tedavi stratejilerinin hiperkalsiüri, hipositratüri ve hiperürikozüri gibi patolojilerde taş rekürrensini %50'nin üzerinde azaltabildiği gösterilmiştir. Ayrıca yaşam tarzı değişiklikleri ile birlikte potasyum sitrat, tiyazid diüretikler ve allopurinol gibi ajanların uzun dönem faydaları randomize kontrollü çalışmalarda ortaya konmuştur. Metaflaksinin başarısı hasta eğitimi, düzenli metabolik ve radyolojik takip ile doğrudan ilişkilidir. Etkin yürütülen metaflaksi programları, yeni taş oluşumunu engellemenin yanında cerrahi müdahale ihtiyacını ve taş ilişkili komplikasyonları da azaltmaktadır. Sonuç olarak, ürolitiyazis tedavisinde bireyselleştirilmiş güncel kılavuz temelli metaflaksi stratejileri, taşsız kalma süresinin uzatılmasında vazgeçilmez bir yaklaşım haline gelmiştir.

Anahtar Kelimeler: ürolitiyazis, metaflaksi, taş rekürrensi, metabolik değerlendirme, diyet, farmakoterapi

GIRIŞ

Ürolitiyazis, hem gelişmiş hem de gelişmekte olan ülkelerde prevalansı giderek artan, tekrarlama eğilimi yüksek ve yaşam kalitesini ciddi şekilde etkileyen bir sağlık problemidir. Toplum temelli çalışmalarda yaşam boyu taş oluşturma riskinin erkeklerde %13, kadınlarda ise %7 düzeyinde olduğu ve taş hastalarının yaklaşık yarısının beş yıl içinde yeniden taş oluşturduğu bildirilmektedir (1,2). Türkiye'de özellikle sıcak iklim bölgelerinde prevalansın %15'e yaklaştığı ve endemik özellik gösterdiği raporlanmaktadır (3).

Taş hastalığının yönetimi geleneksel olarak cerrahi veya minimal invaziv girişimlere odaklansa da rekürrens riski göz önüne alındığında bu yaklaşım yetersiz kalmaktadır. Literatürde sadece cerrahi tedavi uygulanan hastalarda rekürrens oranlarının 10 yıl içinde %75'e kadar çıkabildiği, buna karşın etkin metaflaksi stratejileriyle bu oranın %20 'nin altına indirilebildiği bildirilmektedir (4, 5). Bu nedenle ürolitiyazis, akut bir ürolojik tablo olmanın ötesinde kronik bir metabolik hastalık olarak değerlendirilmelidir. Bu derlemede taş hastalığında metaflaksinin kapsamı, risk temelli hasta sınıflandırması, metabolik değerlendirme protokolleri, diyet ve farmakoterapötik müdahaleler ile uzun dönem takip stratejileri güncel literatür eşliğinde ele alınacaktır.

Taş Hastalığında Metaflaksi: Tanım, Kapsam ve Önemi

Ürolitiyazis, yüksek rekürrens oranları nedeniyle akut taş epizotlarının yönetimi yanında uzun vadeli sekonder profilaksi stratejilerini de zorunlu kılan kronik bir hastalık olarak kabul edilmektedir (6,7). Taş oluşumunun tekrarını önlemeye yönelik tüm koruyucu uygulamaları kapsayan metaflaksi kavramı taş hastalığının multidisipliner yönetiminde önemli bir yer teşkil etmektedir. Yalnızca taşı ortadan kaldırmakla yetinmeyip hastalığın fizyopatolojik temelini hedef alan bireyselleştirilmiş bir yaklaşımı temsil eder (8,9).

Literatürde, ilk taş atağı sonrasında beş yıl içinde nüks oranının %30 ila %50 arasında olduğu bildirilmektedir (1,10). Özellikle metabolik yatkınlığı olan bireylerde bu oran daha da artmakta, bazı serilerde 10 yıllık rekürrens oranları %75'e ulaşabilmektedir (2). Avrupa Üroloji Derneği (EAU) Kılavuzu, ürolitiyazisi rekürren ve yüksek riskli taş hastaları olarak kategorize ederek bu hastalarda detaylı metabolik değerlendirme sonrası metaflaksi stratejilerinin uygulanmasını önermektedir (11).

Etkin bir metaflaksi yaşam tarzı düzenlemeleri ve hedefe yönelik farmakoterapötik müdahaleler yoluyla sağlanmaktadır.

Ancak literatürde metaflaksiye uyumun oldukça değişken olduğu, hasta eğitimi ve multidisipliner takibin bu noktada belirleyici rol oynadığı belirtilmiştir (9,12). Randomize kontrollü çalışmalarda etkin şekilde uygulanan metaflaksi programlarının taş rekürrensini %50'nin üzerinde azaltabildiği gösterilmiştir (5,13). Bu nedenle metaflaksi tekrarlayan cerrahi girişimlerin ve taş ilişkili renal fonksiyon kaybının önlenmesi açısından da kritik önemdedir (14).

Metaflaksi Risk Sınıflandırması ve Metabolik Değerlendirme

Metaflaksinin etkili bir şekilde uygulanabilmesi için öncelikle hastanın taş oluşum riski açısından düşük veya yüksek riskli olarak sınıflandırılması gerekmektedir. EAU, yüksek riskli taş hastalarını tanımlarken bilateral böbrekte taş hastalığı, taş hikayesinin çocukluk çağında başlaması, ailesel taş öyküsü, taş atakları arası sürenin kısa olması, rezidüel taş varlığı, ürik asit ve enfeksiyon taşları, soliter böbrekli olması, malabsorpsiyon sendromları, metabolik hastalıklar, hiperparatiroidi, renal tübüler asidoz, sistinüri, üriner anomaliler ve tekrarlayan taş öyküsü gibi çeşitli klinik ve biyokimyasal kriterleri temel almaktadır (11). Bu hasta grubunda taşın biyokimyasal kompozisyonundan bağımsız olarak detaylı metabolik analiz yapılmalıdır.

Metabolik değerlendirme 24 saatlik idrar toplanarak gerçekleştirilir. Bu analizde kalsiyum, oksalat, ürik asit, sitrat, magnezyum, sodyum, kreatinin ve toplam idrar hacmi gibi parametreler kaydedilir. Ayrıca idrar pH'sı ölçümü, özellikle ürik asit ve sistin taşlarının yönetiminde kritik öneme sahiptir (14). Serumda kalsiyum, fosfor, ürik asit, parathormon, kreatinin ve bikarbonat gibi parametrelerin incelenmesi hiperparatiroidi, renal tübüler asidoz ve hiperürisemi gibi altta yatan taş oluşum mekanizmalarının tanınmasında yardımcıdır (15).

Metabolik değerlendirme bireyselleştirilmiş metaflaksi stratejilerinin temelini oluşturur. Örneğin, hiperkalsiüri varlığında tiyazid diüretikler; hipositratüri saptanan hastalarda potasyum sitrat; hiperürikozüri veya ürik asit taşı varlığında allopurinol ve idrar alkalileştiricileri ön plana çıkar (16). Aynı şekilde, sistinüri gibi kalıtsal taş hastalıklarında tiopronin veya D-penisilamin gibi tiol bağlayıcı ajanlar önerilmektedir (17).

Metabolik değerlendirmenin taş tedavisinden en erken 3-4 hafta sonra yapılması önerilir. Çünkü akut dönemdeki hidrasyon değişiklikleri ve taş obstrüksiyonu metabolik parametreleri etkileyebilir (14). Hastanın rutin beslenme ve sıvı alımı döngüsüne dönmesi, doğal hayattaki durumunun ortaya konması için bu süre gereklidir. Ayrıca değerlendirme sırasında hastanın diyetine sadık kalarak idrar toplaması büyük önem taşır, aksi takdirde sonuçlar yanıltıcı olabilir. Gerekli durumlarda test 2-3 kez tekrarlanarak sonuçlar netleştirilir. Metabolik değerlendirme uzun vadede tekrarlayan invaziv işlemlerin, hastane yatışının ve taş ilişkili komplikasyonların önlenmesine katkı sağlar (18).

Diyet ve Yaşam Tarzı Temelli Metaflaksi Yaklaşımları

Metaflaksinin en önemli basamağı yaşam tarzı değişikliği ve diyet düzenlemeleridir. Diyet ve sıvı alımına ilişkin davranışların, taş oluşumuna doğrudan etki eden idrar bileşimini değiştirdiği ve bu yolla litogenez sürecini etkilediği çok sayıda çalışmada ortaya konmuştur (19, 20). EAU ve Amerikan Üroloji Derneği (AUA), her taş hastasında metabolik profil ne olursa olsun temel yaşam tarzı önlemlerinin mutlaka başlanması gerektiğini vurgulamaktadır (6, 21).

Yaşlı bireylerde osteoporozun önlenmesine yönelik olarak yürüyüş gibi fiziksel aktivitelerin teşvik edilmesi, sedanter yaşam tarzının azaltılması açısından önemlidir. Bununla birlikte, bu hasta grubunda osteoporoz tedavisinde yaygın olarak kullanılan D vitamini ve benzeri destek tedavilerinin, hiperkalsemiye neden olarak idrar ile kalsiyum atılımını artırabileceği ve dolayısıyla üriner taş oluşum riskini artırabileceği göz önünde bulundurulmalıdır. Bu nedenle, bu tür tedavilerin toksik dozlara ulaşmaması için düzenli biyokimyasal izlem yapılmalı ve taş oluşumu açısından riskli bireyler uygun şekilde takip edilmelidir.

Taş hastalarında en temel öneri günlük idrar volümünü ≥2,5 litre düzeyinde tutacak şekilde yeterli sıvı alımı sağlanmasıdır. Randomize kontrollü çalışmalarda (RKÇ), bu hedefin sağlanmasının 5 yıllık nüks oranlarını %12,1'e

kadar düşürebildiği gösterilmiştir (5). Prospektif kohort çalışmalarda da artan su tüketiminin taş oluşum riskini lineer şekilde azalttığı bildirilmiştir (20). Bu bağlamda, özellikle fiziksel aktivitenin yoğun olduğu günlerde veya sıcak iklim koşullarında sıvı ihtiyacının arttığı unutulmamalıdır. Tüketilecek sıvının tercihen su olması ve su tüketim sıklığının gün içinde homojen olması önerilirken kolalı içecekler, fruktoz içeriği yüksek gazlı içecekler ve enerji içeceklerinden kaçınılması önerilmektedir (19).

Kalsiyum oksalat taşları, tüm taşların yaklaşık %70-80'ini oluşturduğundan bu iki molekülün diyette düzenlenmesi metaflaksinin temelini oluşturur (22). Diyette kalsiyumun gereğinden fazla kısıtlanmasının taş oluşumunu artırabileceği, barsaklarda serbest oksalat emilimini yükselttiği ve sonuçta idrar oksalatını artırarak kalsiyum oksalat taşlarının riskini artırdığı gösterilmiştir (23). Bu nedenle, özellikle süt ve süt ürünlerinden günlük 1000–1200 mg diyet kaynaklı kalsiyum alımı önerilmektedir. Ancak kalsiyum takviyeleri yalnızca yemeklerle birlikte alındığında güvenli kabul edilmektedir (20).

Oksalat açısından zengin ıspanak, pancar, çikolata, çay, fındık ve fıstık gibi gıdaların sınırlanması oksalüriyi azaltarak taş riskini düşürebilir. Ancak bu öneri genellikle hiperoksalüri saptanan veya tekrarlayan kalsiyum oksalat taşı öyküsü olan hastalarda ön plandadır (23).

Diyette yüksek sodyum alımı, böbrek tübüllerinde kalsiyum geri emilimini baskılayarak hiperkalsiüriye neden olur. Prospektif çalışmalarda, günlük 2300 mg'ı aşan sodyum alımının kalsiyum taşı riskini anlamlı ölçüde artırdığı gösterilmiştir (17). EAU bu nedenle, tuz tüketiminin 5–6 g/gün ile sınırlandırılmasını önermektedir (6).

Ayrıca yüksek miktarda hayvansal protein tüketimi idrarda sülfat, ürik asit ve amonyum üretimini artırarak idrar pH'sını düşürmekte, hipositratüriyi tetiklemekte ve taş oluşum riskini artırmaktadır (23). Bu nedenle hayvansal protein tüketiminin ~0.8–1 g/kg/gün sınırında tutulması önerilir. Alternatif olarak bitkisel protein kaynaklarının artırılması önerilmektedir.

Sitrat, kalsiyum ile çözünür kompleksler oluşturarak kristal büyümesini inhibe eden önemli bir taş inhibitörüdür. Hipositratüri kalsiyum taşı oluşumuna yatkınlığı artırır (8). Yapılan çalışmalarda, yoğun oksalat içeren greyfurt dışındaki turunçgil meyvelerinin sitrat içerikleri nedeniyle koruyucu etki gösterdiği belirtilmiştir (13). Ev yapımı limonata veya doğal narenciye suyu tüketimi, düşük idrar sitrat düzeylerinin yükseltilmesinde faydalı olabilir. Ayrıca sebze-meyveden zengin diyetlerin genel olarak alkali yükü artırarak idrar pH'sını düzenlediği ve sitrat düzeylerini yükselttiği gösterilmiştir (24).

Son yıllarda yapılan çalışmalar Akdeniz Diyeti ile DASH (Dietary Approaches to Stop Hypertension) diyetinin hem taş oluşumunu hem de kardiyometabolik hastalıkları azaltıcı etkiler gösterdiğini ortaya koymuştur (20,25). Bu diyet modelleri meyve, sebze, tam tahıl, bitkisel protein ve sağlıklı yağ asitlerinden zengin; tuz, kırmızı et ve işlenmiş gıdalardan fakirdir. Ferraro ve arkadaşlarının Nurses' Health Study verileri üzerinden yaptığı analize göre DASH diyetiyle beslenen bireylerde taş riski %40'a kadar daha düşük saptanmıştır (25).

Metaflaksinin Farmakolojik Bileşenleri

Diyet ve yaşam tarzı modifikasyonlarına rağmen taş oluşumu devam eden veya metabolik değerlendirmesinde belirgin patoloji saptanan bireylerde farmakolojik metaflaksi, rekürrens riskini azaltmada etkin bir strateji olarak öne çıkar. Güncel kılavuzlar, farmakolojik ajanların yalnızca uygun endikasyonlarda ve bireyselleştirilmiş modelde kullanılmasını önerirken gereksiz medikasyonun önüne geçilmesini vurgulamaktadır (11,26).

Hiperkalsiüri, kalsiyum oksalat ve kalsiyum fosfat taşlarının en yaygın metabolik nedenlerinden biridir ve yönetiminde tiyazid türevi diüretikler (hidroklorotiyazid, klortalidon, indapamid) birinci basamak farmakoterapidir. Tiyazidler distal

tübülde sodyum ve dolaylı olarak kalsiyum reabsorpsiyonunu artırarak idrar kalsiyum atılımını azaltır (27). Literatürde hidroklorotiyazid kullanan hastalarda rekürrens oranlarının 3 yıl içinde %50 azaldığı bildirilmiştir (28). Başka bir çalışmada tiyazid tedavisinin düşük sodyum alımı ve yeterli kalsiyum alımı ile kombine edildiğinde monoterapiye kıyasla anlamlı ölçüde daha etkili olduğu gösterilmiştir. Tiyazid tedavisi süresince hipokalemi, glukoz intoleransı ve hiperürisemi gibi yan etkiler açısından yakın biyokimyasal takip önerilmektedir (29).

Hipositratürinin kalsiyum taşı oluşumunu arttırıcı etkisi uzun yıllardır bilinmektedir. Sitrat, kalsiyum ile çözünür kompleksler oluşturarak kristalizasyonu önler; idrar pH'sını artırarak ürik asit taşlarının da çözünmesini kolaylaştırır (30). Bu bağlamda potasyum sitrat, hem kalsiyum taşları hem de ürik asit taşlarının sekonder profilaksisinde etkinliği kanıtlanmış bir ajan olup genellikle 10-30 mEq/gün dozlarında kullanılır. Kang ve arkadaşlarının 2007 yılında yürüttüğü çift kör RKÇ'da, potasyum sitrat tedavisi alan hastalarda 3 yıl sonunda yeni taş oluşumu %10.4 iken, plasebo grubunda bu oran %50.5'e ulaşmıştır (4). Bu bulgular, sitrat tedavisinin hem önleyici hem de litolitik etkisini ortaya koymaktadır (13). Alternatif olarak sodyum bikarbonat da kullanılabilir ancak yüksek sodyum içeriği nedeniyle hiperkalsiürili ve hipertansif hastalarda dikkatli olunmalıdır.

Hiperürikozüri veya ürik asit taşı varlığında ksantin oksidaz inhibitörü olan allopurinol, ürik asit sentezini azaltarak hem ürik asit taşlarının hem de ürik asit ile indüklenen kalsiyum oksalat taşlarının önlenmesinde kullanılabilir (31). Yapılan bir kohort çalışması serum ürik asit düzeyinin ve hayvansal protein tüketiminin artışıyla taş riskinin paralel olarak arttığını ortaya koymuştur (32). Allopurinol tedavisi alan hiperkalsiürik taş hastalarında nüks oranlarının anlamlı olarak düştüğü belirtilmiştir (33). Allopurinol tedavisi sırasında nadir fakat ciddi advers etkiler olan hipersensitivite sendromu ve karaciğer enzim yüksekliği açısından takip önemlidir. Yeni nesil ksantin oksidaz inhibitörü olan febuksostat, allopurinol intoleransı olan hastalar için alternatif olabilir ancak taş metaflaksisi için yeterli RKÇ verisi literatürde saptanmamıştır.

Sistinüri hastalarında idrar süpersatürasyonunu azaltmak için yoğun hidrasyonun yanı sıra pH'nın 7,5 düzeyine çıkarılması hedeflenir. Bu durumda potasyum sitrat ile birlikte sistin çözünürlüğünü artıran tiopronin ve D-penisilamin gibi tiol bileşikleri kullanılabilir ancak bu ajanların proteinüri, agranülositoz, hepatotoksisite gibi potansiyel toksisiteleri nedeniyle kullanımları sınırlıdır (17).

Struvit taşları, üreaz üreten mikroorganizmaların varlığı ile ilişkili olup antibiyotiklerle enfeksiyon eradikasyonu esas tedavi yaklaşımıdır. Uzun süreli antibiyotik profilaksisine rağmen rekürrens yaşanan olgularda asetohidroksamik asit gibi üreaz inhibitörleri kullanılabilir. Bu ajanların kullanımında hastalar gastrointestinal ve nörolojik yan etkiler nedeniyle dikkatle izlenmelidir (34).

Primer hiperoksalüri olgularında B6 vitamini (piridoksin) oksalat üretimini azaltabilir. Bu hastalarda tedavi genetik danışmanlık ve ileri merkezlerde multidisipliner yönetim gerektirir (35).

Tedaviye Uyum ve Klinik Sonuçlar

Farmakolojik metaflaksi doğru endikasyona dayalı ilaç seçimi ve hasta uyumu ile yüksek etkinlik kazanır. Tedaviye başlarken hastaya ayrıntılı eğitim verilmesi, düzenli takiplerle biyokimyasal hedeflerin kontrol edilmesi ve yan etkilerin yönetimi önem arz eder. Tedaviye yanıtın değerlendirilmesinde 6-12 hafta içinde 24 saatlik idrar parametrelerinin yeniden ölçülmesi önerilmektedir.

Taş Hastalarında Uzun Dönem Takip ve Metaflaksinin Klinik Yararları

Ürolitiyazis tedavisinin başarısı mevcut taşların uzaklaştırılmasının yanında yeni taş oluşumunun önlenmesi ve böbrek fonksiyonunun korunmasıyla ölçülmelidir. Bu nedenle, etkin metaflaksi uygulamasının ayrılmaz bir parçası olan uzun dönem hasta takibi büyük önem taşır (11). Takip protokolleri hastanın taş tipi, rekürrens öyküsü ve metabolik profiline

göre bireyselleştirilmelidir. Düşük riskli hastalarda yılda bir klinik değerlendirme ve ultrasonografi yeterli olabilecekken, yüksek riskli veya metabolik bozukluğu olan hastalarda bu aralık daha kısa tutulmalı, gerektiğinde 6 ayda bir 24 saatlik idrar incelemesi ve biyokimyasal değerlendirme yapılmalıdır (11,14). Farmakolojik metaflaksi uygulanan hastalarda tedaviye yanıtın değerlendirilmesi için 6-12 hafta içerisinde tekrarlayan metabolik analiz önerilir (15). Görüntüleme takibi, sessiz seyreden yeni taş oluşumlarının erken saptanmasında kritik öneme sahiptir. Yılda bir kez radyasyon içermeyen, kolay erişilebilir ve tekrarlanabilir bir yöntem olarak ultrasonografi tercih edilmektedir. Taş boyutunda artış ya da hidronefroz gelişmiş ise düşük doz taş protokollü bilgisayarlı tomografi ile desteklenebilmektedir (6).

Metaflaksinin uzun dönem sonuçları hem taş rekürrensinde hem de invaziv girişim gereksiniminin azalması açısından yüz güldürücüdür. Kang ve arkadaşlarının çalışmasında 3 yıl takip edilen hastalarda potasyum sitrat tedavisiyle rekürrens oranının %10'a kadar gerilediği ortaya konmuştur (4). Benzer şekilde, tiyazid tedavisi ve tuz kısıtlaması kombinasyonunun rekürrens riskini belirgin azalttığı bildirilmiştir (29).

Metaflaksinin diğer bir faydası ise taş ilişkili komplikasyonların ve cerrahi yükün azaltılmasıdır. Tekrarlayan cerrahi girişimlerin hem hastaya hem de sağlık sistemine getirdiği maliyet göz önüne alındığında metaflaksi uygulamaları klinik olduğu kadar ekonomik olarak da avantajlıdır (36). Hasta eğitimi, uyumun artırılması ve davranış değişikliğinin sürdürülebilirliği açısından oldukça önemlidir. Literatürde yazılı eğitim materyalleri, düzenli diyetisyen desteği, mobil uygulamalar ve hatırlatma sistemlerinin hasta uyumunu artırdığı gösterilmiştir (37). Bu nedenle uzun dönem hasta takibi eğitsel bir süreç olarak ele alınmalıdır.

SONUÇ

Ürolitiyazis yönetimi yalnızca akut taş ataklarının tedavisiyle sınırlı olmamalı, rekürrensi önlemeyi hedefleyen bireyselleştirilmiş ve bütüncül metaflaksi stratejilerini içermelidir. Gerek sıvı alımının artırılması, diyetin yeniden düzenlenmesi ve yaşam tarzı modifikasyonları; gerekse metabolik bozukluklara yönelik farmakolojik müdahaleler, taş oluşumunun temel fizyopatolojisini hedefleyerek uzun vadeli başarıya ulaşılmasını sağlar. Literatürde metaflaksi uygulamalarının rekürrens oranlarını %50'nin üzerinde azalttığı, komplikasyon ve cerrahi yükü önemli ölçüde düşürdüğü gösterilmiştir. Bu nedenle her taş hastası, taş tipi ve risk profilinden bağımsız olarak en azından temel metaflaksi önlemleri ile takip edilmelidir. Güncel kılavuzlar doğrultusunda yürütülen, hasta eğitimini içeren metabolik temelli bireyselleştirilmiş metaflaksi programları taş hastalığının kronik yönetiminde vazgeçilmezdir.

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Yazar Katkıları: Yazarlar çalışmaya eşit katkı sağlamışlardır.

KAYNAKLAR

1. Scales Jr CD, Smith AC, Hanley JM, Saigal CS, Project UDiA. Prevalence of kidney stones in the United States. European urology. 2012;62(1):160-5. https://doi.org/10.1016/j.eururo.2012.03.052.
2. Rule AD, Lieske JC, Li X, Melton III LJ, Krambeck AE, Bergstralh EJ. The ROKS nomogram for predicting a second symptomatic stone episode. Journal of the American Society of Nephrology. 2014;25(12):2878-86. https://doi.org/10.1681/ASN.2013091011.
3. Şahin A, Ürkmez A, Yıldırım Ç, Akan S, Güner D, Yüksel ÖH. Correlation of renal colic incidences with the season, gender and age: cross-sectional study. Haydarpaşa Numune Med J. 2020;60(1):10-5. https://doi.org/10.14744/hnhj.2018.33254.

4. Kang DE, Maloney MM, Haleblian GE, Springhart WP, Honeycutt EF, Eisenstein EL, et al. Effect of medical management on recurrent stone formation following percutaneous nephrolithotomy. The Journal of urology. 2007;177(5):1785-9. https://doi.org/10.1016/j.juro.2007.01.061.

5. Borghi L, Meschi T, Amato F, Briganti A, Novarini A, Giannini A. Urinary volume, water and recurrences in idiopathic calcium nephrolithiasis: a 5-year randomized prospective study. The Journal of urology. 1996;155(3):839-43.

6. Geraghty RM, Davis NF, Tzelves L, Lombardo R, Yuan C, Thomas K, et al. Best practice in interventional management of urolithiasis: an update from the European Association of Urology Guidelines Panel for Urolithiasis 2022. European urology focus. 2023;9(1):199-208. https://doi.org/10.1016/j.euf.2022.06.014.

7. Alelign T, Petros B. Kidney stone disease: an update on current concepts. Advances in urology. 2018;2018(1):3068365. https://doi.org/10.1155/2018/3068365.

8. Kok DJ. Metaphylaxis, diet and lifestyle in stone disease. Arab Journal of Urology. 2012;10(3):240-9. https://doi.org/10.1016/j.aju.2012.03.003.

9. Fritsche H-M, Dötzer K. Improving the compliance of the recurrent stone-former. Arab Journal of Urology. 2012;10(3):342-6. https://doi.org/10.1016/j.aju.2012.07.003.

10. Pearle MS, Goldfarb DS, Assimos DG, Curhan G, Denu-Ciocca CJ, Matlaga BR, et al. Medical management of kidney stones: AUA guideline. The Journal of urology. 2014;192(2):316-24. https://doi.org/10.1016/j.juro.2014.05.006.

11. Lombardo R, Tzelves L, Geraghty R, Davis NF, Neisius A, Petřík A, et al. Follow-up of urolithiasis patients after treatment: An algorithm from the EAU Urolithiasis Panel. World Journal of Urology. 2024;42(1):202. https://doi.org/10.1007/s00345-024-04872-y.

12. Montgomery TA, Nair HR, Phadke M, Morhardt E, Ludvigson A, Motamedinia P, et al. Protein Intake and High Uric Acid Stone Risk. Kidney Medicine. 2024;6(9):100878. https://doi.org/10.1016/j.xkme.2024.100878.

13. Kang DE, Sur RL, Haleblian GE, Fitzsimons NJ, Borawski KM, Preminger GM. Long-term lemonade based dietary manipulation in patients with hypocitraturic nephrolithiasis. The Journal of urology. 2007;177(4):1358-62. https://doi.org/10.1016/j.juro.2006.11.058.

14. Skolarikos A, Somani B, Neisius A, Jung H, Petřík A, Tailly T, et al. Metabolic evaluation and recurrence prevention for urinary stone patients: an EAU guidelines update. European Urology. 2024. https://doi.org/10.1016/j.eururo.2024.05.029.

15. Tiselius H-G. Metabolic risk-evaluation and prevention of recurrence in stone disease: does it make sense? Urolithiasis. 2016;44(1):91-100. https://doi.org/10.1007/s00240-015-0840-y.

16. Finger M, Finger E, Bellucci A, Malieckal DA. Medical management for the prevention of kidney stones. Postgraduate medical journal. 2023;99(1169):112-8. https://doi.org/10.1136/postgradmedj-2021-140971.

17. Sakhaee K, Maalouf NM, Sinnott B. Kidney stones 2012: pathogenesis, diagnosis, and management. The Journal of Clinical Endocrinology & Metabolism. 2012;97(6):1847-60. https://doi.org/10.1210/jc.2011-3492.

18. Ferraro PM, Taylor EN, Curhan GC. 24-Hour urinary chemistries and kidney stone risk. American Journal of Kidney Diseases. 2024;84(2):164-9. https://doi.org/10.1053/j.ajkd.2024.02.010.

19. Ferraro PM, Taylor EN, Gambaro G, Curhan GC. Soda and other beverages and the risk of kidney stones. Clinical Journal of the American Society of Nephrology. 2013;8(8):1389-95. https://doi.org/10.2215/CJN.11661112.

20. Ferraro PM, Bargagli M. Dietetic and lifestyle recommendations for stone formers. Archivos espanoles de urologia. 2021;74(1):112-22.

21. Liu Kot K, Labagnara K, Kim JI, Loloi J, Gupta K, Agalliu I, et al. Evaluating the American Urologic Association (AUA)

dietary recommendations for kidney stone management using the National Health And Nutritional Examination Survey (NHANES). Urolithiasis. 2023;51(1):60. https://doi.org/10.1007/s00240-023-01423-9.

22. Coe FL, Evan A, Worcester E. Kidney stone disease. The Journal of clinical investigation. 2005;115(10):2598-608. https://doi.org/10.1172/JCI26662.
23. Siener R. Nutrition and kidney stone disease. Nutrients. 2021;13(6):1917. https://doi.org/10.3390/nu13061917.
24. Meschi T, Maggiore U, Fiaccadori E, Schianchi T, Bosi S, Adorni G, et al. The effect of fruits and vegetables on urinary stone risk factors. Kidney international. 2004;66(6):2402-10. https://doi.org/10.1111/j.1523-1755.2004.66029.x.
25. Rodriguez A, Curhan GC, Gambaro G, Taylor EN, Ferraro PM. Mediterranean diet adherence and risk of incident kidney stones. The American journal of clinical nutrition. 2020;111(5):1100-6. https://doi.org/10.1093/ajcn/nqaa066.
26. Arivoli K, Valicevic AN, Oerline MK, Hsi RS, Patel SR, Hollingsworth JM, et al. Preventive pharmacological therapy and risk of recurrent urinary stone disease. Clinical Journal of the American Society of Nephrology. 2024:10.2215. https://doi.org/10.2215/CJN.0000000000000428.
27. Curhan GC, Goldfarb DS. Thiazide use for the prevention of recurrent calcium kidney stones. Clinical Journal of the American Society of Nephrology. 2023:10.2215. https://doi.org/10.2215/CJN.0000000000000399.
28. Ghazaani MZ, Rizi FSD, Malekpour E, Momeni E, Abbasi F. Hydrochlorothiazide and kidney stone recurrence; an in-depth analysis of the NOSTONE trial. Journal of Renal Injury Prevention. 2024;13(3):e32279-e. https://doi.org/10.34172/jrip.2024.32279.
29. Li D-f, Gao Y-l, Liu H-c, Huang X-c, Zhu R-f, Zhu C-t. Use of thiazide diuretics for the prevention of recurrent kidney calculi: a systematic review and meta-analysis. Journal of Translational Medicine. 2020;18:1-12. https://doi.org/10.1186/s12967-020-02270-7.
30. Goldfarb DS, Modersitzki F, Asplin JR, Nazzal L. Effect of a high-citrate beverage on urine chemistry in patients with calcium kidney stones. Urolithiasis. 2023;51(1):96. https://doi.org/10.1007/s00240-023-01468-w.
31. Moe OW, Xu LHR. Hyperuricosuric calcium urolithiasis. Journal of Nephrology. 2018;31(2):189-96. https://doi.org/10.1007/s40620-018-0469-3.
32. Arowojolu O, Goldfarb DS. Treatment of calcium nephrolithiasis in the patient with hyperuricosuria. Journal of nephrology. 2014;27:601-5. https://doi.org/10.1007/s40620-014-0084-x.
33. Sfoungaristos S, Gofrit ON, Yutkin V, Pode D, Duvdevani M. Prevention of renal stone disease recurrence. A systematic review of contemporary pharmaceutical options. Expert opinion on pharmacotherapy. 2015;16(8):1209-18. https://doi.org/10.1517/14656566.2015.1037740.
34. Das P, Gupta G, Velu V, Awasthi R, Dua K, Malipeddi H. Formation of struvite urinary stones and approaches towards the inhibition—A review. Biomedicine & pharmacotherapy. 2017;96:361-70. https://doi.org/10.1016/j.biopha.2017.10.015.
35. Türkmen MA, Kavukçu S. Primer Hiperokzalüri. Turkiye Klinikleri Pediatric Nephrology-Special Topics. 2024;5(2):37-45.
36. Roberson D, Sperling C, Shah A, Ziemba J. Economic considerations in the management of nephrolithiasis. Current urology reports. 2020;21:1-9. https://doi.org/10.1007/s11934-020-00971-6.
37. Kianian R, Carter M, Finkelshtein I, Eleswarapu SV, Kachroo N. Application of artificial intelligence to patient-targeted health information on kidney stone disease. Journal of Renal Nutrition. 2024;34(2):170-6. https://doi.org/10.1053/j.jrn.2023.10.002.

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Yazının Gönderimi

Makaleler yalnızca online olarak https://dergipark.org.tr/pub/endouroloji adresinden gönderilebilir. Başka bir yolla gönderilen yazılar değerlendirilmeye alınmayacaktır.
Dergiye gönderilen yazılar, öncelikle yazının dergi kurallarına uygun olarak hazırlanmasını ve sunulmasını sağlayacakları teknik değerlendirme sürecinden geçer. Derginin kurallarına uymayan yazılar, teknik düzeltme talepleri ile gönderen yazara iade edilir. Editör, ana metni değiştirmeden düzeltme yapabilir. Editör, yukarıda belirtilen şartlara uymayan makaleleri reddetme hakkını saklı tutar.
Yazarların aşağıdaki belgeleri göndermeleri gerekir:

- Yazar Katkı ve Telif Hakları Formu
- Bilgilendirilmiş Onam Formu
- ICMJE Çıkar Çatışması Formu
- Başlık Sayfası (Makale Başlığı, kısa başlık, yazarın adı, unvanı ve kurumu, sorumlu yazarın iletişim bilgileri, araştırmayı destekleyen kuruluş varsa kuruluşun adı)
- Ana belge (Tüm makalelerde, ana metinden önce de Özet bölümü yer almalıdır)
- Şekiller (JPEG formatı)
- Tablolar (en fazla 6 tablo)

Ana Belgenin Yayına Hazırlığı

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.
Anahtar kelime seçimi için lütfen Index Medicus'un (MeSH) tıbbi konu başlıklarına bakınız: https://meshb.nlm.nih.gov/MeSHonDemand .
Tüm kaynaklara, tablolara ve şekillere ana metinde atıfta bulunulmalı ve kaynaklar, ana metinde geçen sıraya göre numaralandırılmalıdır. Kullanılan semboller, sembollerin standart kullanımlarına uygun olmalıdır.

1. Orijinal Araştırma Makaleleri

Amaç

Orijinal Araştırma Makaleleri, eleştirel okuyucular için güvenilirliği garanti altına almak için yeterli dokümantasyonla klinik veya temel araştırma sonuçlarını sunmalıdır. Bu makaleler alana yeni bakış açıları katmalı ve sağlam veriler ve sağlam metodoloji ile desteklenmelidir.

Gönderme Yönergeleri
Kelime Sınırı: Maksimum 4.000 kelime (kaynaklar, tablolar ve şekil başlıkları hariç).
Yapı: El yazmaları aşağıdaki şekilde yapılandırılmalıdır:
Başlık (hem Türkçe hem de İngilizce)
Özet (hem Türkçe hem İngilizce)
Anahtar Kelimeler (hem Türkçe hem İngilizce)
Giriş
Materyaller ve Yöntemler
Sonuçlar
Tartışma
Sonuçlar
Şekil ve Tablo Başlıkları (varsa)
Referanslar

İnceleme Süreci
Gönderilen tüm araştırma makaleleri, bilimsel değerlerini, özgünlüklerini ve derginin kapsamıyla alakalarını değerlendirmek için çift kör hakem incelemesinden geçecektir. İstatistiksel analizler ve metodoloji açıkça sunulmalı ve yeniden üretilebilir olmalıdır.

2. Olgu Sunumları
Amaç
Vaka Raporları, tanı zorlukları, tedavi yaklaşımları veya yeni gözlemler hakkında değerli içgörüler sağlayan benzersiz veya nadir klinik vakaları tanımlamalıdır. Bu raporlar iyi belgelenmeli ve tıbbi bilginin ilerlemesine katkıda bulunmalıdır.

Gönderme Yönergeleri
Kelime Sınırı: Maksimum 2.000 kelime (referanslar, tablolar ve şekil başlıkları hariç).
Yapı: El yazmaları aşağıdaki gibi yapılandırılmalıdır:
Başlık (hem Türkçe hem de İngilizce)
Özet (hem Türkçe hem de İngilizce)
Anahtar Kelimeler (hem Türkçe hem de İngilizce)
Giriş
Vaka Sunumu
Tartışma ve Sonuç
Şekil ve Tablo Başlıkları (varsa)
Referanslar

İnceleme Süreci
Vaka Raporları, önemli bir öğrenme fırsatı sunduklarından, uygun şekilde referanslandırıldıklarından ve klinik uygulamaya veya tıbbi araştırmaya katkıda bulunduklarından emin olmak için editöryal ve çift kör hakem değerlendirmesine tabidir.

3. Derleme Makaleleri
Amaç
Derleme Makaleleri, belirli bir konunun kapsamlı ve yapılandırılmış bir analizini sunar, mevcut literatürü özetler ve eleştirel olarak değerlendirir. Bu makaleler iyi organize edilmeli ve araştırma bulgularının güncel bir sentezini içermelidir.

Gönderme Yönergeleri
Kelime Sınırı: Maksimum 5.000 kelime (kaynaklar, tablolar ve şekil başlıkları hariç).
Yapı: El yazmaları aşağıdaki gibi yapılandırılmalıdır:
Başlık (hem Türkçe hem de İngilizce)
Özet (hem Türkçe hem İngilizce)
Anahtar Kelimeler (hem Türkçe hem İngilizce)
Ana Metin

Sonuç
Şekil ve Tablo Başlıkları (varsa)
Referanslar

Sistematik İncelemeler
Sistematik inceleme gönderen yazarlar, şeffaflığı ve metodolojik titizliği sağlamak için PRISMA yönergelerine uymalıdır. PRISMA kontrol listesine şu adresten ulaşılabilir: PRISMA Kontrol Listesi

İnceleme Süreci
İnceleme Makaleleri, analiz derinliği, alaka düzeyi ve bilimsel topluluğa katkısı açısından editör kurulu ve editöryal ve çift kör hakem değerlendirmesi tarafından değerlendirilecektir.

4. Editöre Mektuplar
Amaç
Editöre Mektuplar, okuyucuların daha önce yayınlanmış makalelere yanıt vererek, kısa bilimsel gözlemler sunarak veya derginin okuyucularının ilgisini çeken konulara değinerek akademik tartışmalara katılmalarını sağlar.

Gönderim Yönergeleri
Yapı: El yazmaları aşağıdaki şekilde yapılandırılmalıdır:
Başlık (hem Türkçe hem de İngilizce)
Anahtar Sözcükler (hem Türkçe hem İngilizce)
Ana Metin
Şekil ve Tablo Başlıkları (varsa)
Referanslar

İçerik: Mektuplar öz olmalı, söz konusu makalenin belirli yönlerine odaklanmalı ve akademik söyleme anlamlı bir şekilde katkıda bulunmalıdır. Bunlar şunları içerebilir:
Yayınlanmış bir makalenin metodolojileri, yorumları veya sonuçları hakkında eleştirel analiz veya yorum.
Konuyu daha iyi anlamayı sağlayan doğrulayıcı veya çelişkili verilerin sunumu.
Makalenin bulgularını daha geniş çalışma alanı içinde bağlamlandıran tartışmalar.
Uzunluk: Genellikle, mektuplar referanslar dahil 1.000 kelimeyi geçmemelidir.
Başlık: Orijinal makaleye atıfta bulunan bir başlıkla başlayın, örn. "[Yazar Adı(ları)] tarafından [Makale Başlığı] hakkında yorum."
Yazar Bilgileri: Tüm katkıda bulunan yazarların tam adlarını, akademik bağlantılarını ve iletişim bilgilerini ekleyin.
Referanslar: Orijinal makaleyi ve diğer ilgili literatürü uygun şekilde atıfta bulunun.
Ton: Kişisel yorumlardan ziyade akademik eleştiriye odaklanarak saygılı ve profesyonel bir ton koruyun.

İnceleme Süreci
Gönderilen tüm mektuplar, açıklık, akademik değer ve etik standartlara uyumu sağlamak için editör ekibi tarafından incelenecektir. Mektuplar profesyonel bir üslupla yazılmalı ve anlamlı bir akademik söyleme katkıda bulunmalıdır.

5. Araştırma Notu
Amaç
Bir Araştırma Notu, tam uzunlukta bir makaleyi gerektirmeyen ancak yine de bilim camiası için değerli olan ön bulguların, yeni metodolojilerin veya önemli gözlemlerin kısa raporlarını yaymak için kullanılır.

Gönderme Yönergeleri
Uzunluk: Ana metin, referanslar, şekiller ve tablolar hariç 2.000 kelimeyi geçmemelidir.
İçerik: Araştırma Notları şunları içerebilir:
Potansiyel bir atılım veya yeni bir içgörü öneren ön veriler.
Yenilikçi tekniklerin veya metodolojilerin açıklamaları.
Daha fazla araştırmayı teşvik eden veya ortaya çıkan eğilimleri vurgulayan gözlemler.

Yapı
Notu, aşağıdaki gibi net başlıklarla düzenleyin:
Başlık (hem Türkçe hem de İngilizce)
Özet (hem Türkçe hem İngilizce)
Anahtar Kelimeler (hem Türkçe hem İngilizce)
Giriş: Çalışmanın bağlamını ve önemini kısaca ana hatlarıyla belirtin.
Yöntemler: Kullanılan yaklaşımı ve teknikleri özetleyin.
Sonuçlar: Temel bulguları özlü bir şekilde sunun.
Tartışma: Sonuçları ve potansiyel gelecekteki yönleri tartışın. Referanslar: Çalışmayı destekleyen temel alıntılarla sınırlayın.
Şekiller ve Tablolar: Yalnızca notun netliğini ve etkisini artırıyorsa ekleyin.

İnceleme Süreci
Araştırma Notları, bilimsel geçerliliği, özgünlüğü ve derginin kapsamıyla alakalı olmasını sağlamak için çift kör hakem incelemesinden geçecektir.

6. Kitap İncelemesi
Amaç: Kitap İncelemesi, alandaki son yayınların eleştirel bir değerlendirmesini sunarak okuyuculara kitabın içeriği, önemi ve devam eden akademik tartışmalarla alakalılığı hakkında fikir verir.

Gönderim Yönergeleri
İçerik: İncelemeler şunları içermelidir:
Uzunluk: Genellikle 1.500 ila 2.500 kelime arasındadır.
Kitabın ana temalarını ve argümanlarını özetleyin.
Çalışmanın güçlü ve zayıf yönlerini değerlendirin.
Kitabın alana katkısını ve güncel araştırma veya uygulamayla alakalılığını tartışın.
Kitabı mevcut literatüre yerleştirin ve benzersiz bakış açılarını veya yaklaşımları not edin.
Başlık: İncelemenin başında kitabın tam başlığını, yazar(lar), yayıncı, yayın yılı, sayfa sayısı ve ISBN'yi ekleyin.
Ton: Nesnel ve akademik bir ton koruyun, kanıtlarla desteklenen dengeli eleştiriler sunun.

İnceleme Süreci
Kitap İncelemeleri, editör ekibi tarafından açıklık, analiz derinliği ve derginin okuyucu kitlesiyle alakalılık açısından değerlendirilecektir.

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. Yazar değişikliği (isim, yazar ekleme) talebi, değerlendirme süreci tamamlanmadan önce tüm yazarlar tarafından imzalanmış bir mektupla Yayın Kurulu’na (yayıncı/dergi adresi) iletilmelidir.

Geri çekme ve düzeltmeler hakkında daha fazla bilgi için lütfen Geri Çekme ve Düzeltme Politikası sayfasını inceleyiniz.

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.

1. Original Research Articles

Purpose

Original Research Articles should present the results of clinical or basic research with sufficient documentation to ensure credibility for critical readers. These articles must contribute novel insights to the field and be supported by robust data and sound methodology.

Submission Guidelines
Word Limit: Maximum 4,000 words (excluding references, tables, and figure captions).
Structure: Manuscripts must be structured as follows:
Title (in both Turkish and English)
Abstract (in both Turkish and English)
Keywords (in both Turkish and English)
Introduction
Materials and Methods
Results
Discussion
Conclusions
Figure and Table Captions (if applicable)
References
Review Process

All submitted research articles will undergo double-blind peer review to assess their scientific merit, originality, and relevance to the journal's scope. Statistical analyses and methodology must be clearly presented and reproducible.

2. Case Reports

Purpose

Case Reports should describe unique or rare clinical cases that provide valuable insights into diagnostic challenges, treatment approaches, or novel observations. These reports should be well-documented and contribute to the advancement of medical knowledge.

Submission Guidelines
Word Limit: Maximum 2,000 words (excluding references, tables, and figure captions).
Structure: Manuscripts must be structured as follows:
Title (in both Turkish and English)
Abstract (in both Turkish and English)
Keywords (in both Turkish and English)
Introduction
Case Presentation
Discussion and Conclusion
Figure and Table Captions (if applicable)
References

Review Process

Case Reports are subject to editorial and double-blind peer review to ensure they present a significant learning opportunity, are properly referenced, and contribute to clinical practice or medical research.

3. Review Articles

Purpose

Review Articles provide a comprehensive and structured analysis of a specific topic, summarizing and critically evaluating existing literature. These articles should be well-organized and include an up-to-date synthesis of research findings.

Submission Guidelines
Word Limit: Maximum 5,000 words (excluding references, tables, and figure captions).
Structure: Manuscripts must be structured as follows:
Title (in both Turkish and English)
Abstract (in both Turkish and English)
Keywords (in both Turkish and English)
Main Text

Conclusion
Figure and Table Captions (if applicable)
References

Systematic Reviews
Authors submitting systematic reviews must adhere to PRISMA guidelines to ensure transparency and methodological rigor. The PRISMA checklist can be accessed at: PRISMA Checklist

Review Process
Review Articles will be evaluated by the editorial board and editorial and double-blind peer review for their depth of analysis, relevance, and contribution to the scientific community.

4. Letters to the Editor

Purpose
Letters to the Editor allow readers to engage in academic discussions by responding to previously published articles, presenting brief scientific observations, or addressing issues of interest to the journal's readership.

Submission Guidelines
Structure: Manuscripts must be structured as follows:
Title (in both Turkish and English)
Keywords (in both Turkish and English)
Main Text
Figure and Table Captions (if applicable)
References

Content: Letters should be concise, focused on specific aspects of the article in question, and contribute meaningfully to the academic discourse. They may include:
Critical analysis or commentary on the methodologies, interpretations, or conclusions of a published article.
Presentation of corroborative or contradictory data that enhances the understanding of the topic.
Discussions that contextualize the article's findings within the broader field of study.

Length: Typically, letters should not exceed 1,000 words, including references.
Title: Begin with a title that references the original article, e.g., "Comment on [Article Title] by [Author Name(s)]."
Author Information: Include full names, academic affiliations, and contact details of all contributing authors.
References: Cite the original article and any other relevant literature appropriately.
Tone: Maintain a respectful and professional tone, focusing on academic critique rather than personal remarks.

Review Process:
All submitted letters will be reviewed by the editorial team to ensure clarity, academic merit, and adherence to ethical standards. Letters must be professional in tone and contribute to meaningful scholarly discourse.

5. Research Note

Purpose: A Research Note serves to disseminate brief reports of preliminary findings, novel methodologies, or significant observations that may not warrant a full-length article but are nonetheless valuable to the scientific community.
Submission Guidelines
Length: The main text should not exceed 2,000 words, excluding references, figures, and tables.
Content: Research Notes may include:
Preliminary data that suggest a potential breakthrough or novel insight.
Descriptions of innovative techniques or methodologies.
Observations that prompt further investigation or highlight emerging trends.

Structure
Organize the note with clear headings, such as:
Title (in both Turkish and English)
Abstract (in both Turkish and English)
Keywords (in both Turkish and English)
Introduction: Briefly outline the context and significance of the work.
Methods: Summarize the approach and techniques employed.
Results: Present key findings succinctly.
Discussion: Discuss the implications and potential future directions.
References: Limit to essential citations that support the work.
Figures and Tables: Include only if they enhance the clarity and impact of the note.

Review Process
Research Notes will undergo double-blind peer review to ensure scientific validity, originality, and relevance to the journal's scope.

6. Book Review

Purpose: A Book Review offers a critical evaluation of recent publications in the field, providing readers with insights into the book's content, significance, and relevance to ongoing scholarly discussions.

Submission Guidelines
Content: Reviews should:
Length: Typically between 1,500 to 2,500 words.
Summarize the book's main themes and arguments.
Assess the strengths and weaknesses of the work.
Discuss the book's contribution to the field and its relevance to current research or practice.
Situate the book within the existing literature, noting any unique perspectives or approaches.
Title: Include the book's full title, author(s), publisher, publication year, page count, and ISBN at the beginning of the review.
Tone: Maintain an objective and scholarly tone, offering balanced critiques supported by evidence.

Review Process
Book Reviews will be evaluated by the editorial team for clarity, depth of analysis, and relevance to the journal's readership

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

Withdrawal of the Article: Authors are required to submit a written application addressed to the Editor who has declared their withdrawal request and justification. They must wait for the Editor's response before submitting the manuscript to another journal.
Rejection: 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 correspondence. 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.
Should you wish to request a change of author (name, author addition), we kindly ask that you submit this to the Editorial Board (publisher/journal address) with a letter signed by all authors before the evaluation process is completed.

For more information about withdrawals and corrections, please see the Retraction and Correction Policy page.

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.*

Prof.Nurettin Öktel St
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