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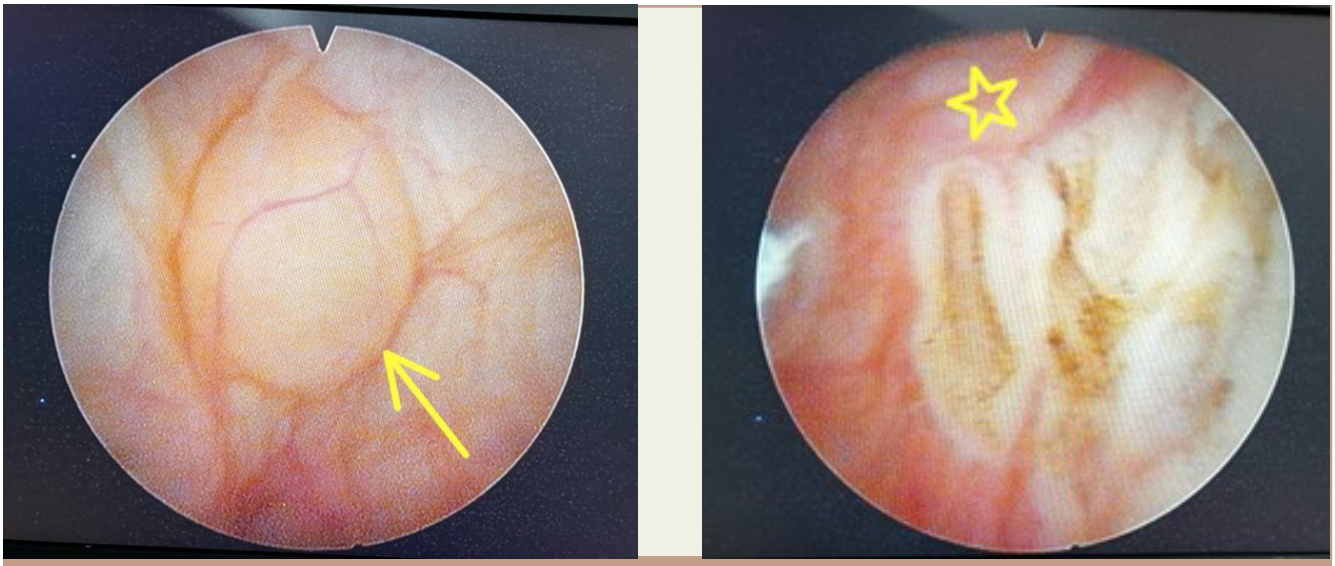

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Dear Colleagues,

We are pleased to have published the first issue of The New Journal of Urology for 2025. This issue includes five (5) original articles, one (1) review an done (1) case report.

We believe that all the current articles will be read with interest and these articles are expected to contribute to the literature and serve as a reference for future studies. The New Urology Journal has been indexed in the TUBİTAK ULAKBİM TR Index since the first issue of 2011. Our journal is indexed in Google Scholar, Turkish Medline, Turkish Citation Index, SOBIAD, Scilit, Ideal Online Database, J-GATE, and EBSCO. In addition, the New Journal of Urology is in collaboration with the Orcid and CrossRef DOI systems. The process of our journal being included in the ESCI, PubMed, and EMBASE indexes is ongoing. The editorial team is very grateful to all the authors and reviewers who have contributed to this issue.

We request that you submit your articles to The New Journal of Urology, take timely and rigorous action as a referee, and read the articles published in the journal and cite them where appropriate.

Respectfully yours,

Ali İhsan Taşçı
Editor-in-Chief

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CONTENTS

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RESEARCH ARTICLE

Effect of Stone Density, Skin-Stone Distance and Stone Size on Extracorporeal Shock Wave Lithotripsy Success of Ureter Stones: A Clinical Investigation

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Abstract

Objective: This study aimed to investigate the correlation between demographic characteristics, stone size, density, and location, skin-to-stone distance (SSD), urinary parameters, and the success rate of extracorporeal shock wave lithotripsy (ESWL) in patients with ureteral stones.

Material and Methods: A total of 151 patients with ureteral stones were included in this retrospective study, and ESWL treatment was successful in 116 of them. Stone size, density, and ureteral location (upper/lower and right/left) were evaluated using non-contrast computed tomography, and SSD was measured. Demographic characteristics [age, gender, and BMI (Body Mass Index)] and complete urinalysis parameters (pH, specific gravity, protein, leukocytes, erythrocytes, casts, and various crystal types) were recorded. The impact of these factors on ESWL success was statistically analyzed.

Results: A significant negative correlation was found between ESWL success and stone density [in Hounsfield units (HU)], SSD, and patient age. Treatment success was lower for hard stones (HU ≥ 1000) compared to soft stones (HU < 1000) (ESWL successful: 28/45 (62%) vs 88/106 (83%), p = 0.006). Similarly, patients with successful ESWL had lower ages and SSD compared to those with unsuccessful outcomes (41±13 vs 45±9 years and 117±18 vs 125±17 mm, respectively). Additionally, stones with higher density were found to be larger compared to those with lower density, with a low-level positive correlation (9.0(4.8-15.0) vs 7.8(4.2-15.0) mm, p=0.0458; r=0.240, p=0.0029). Binary regression analysis revealed that SSD, stone density (HU), and stone location significantly influenced ESWL success and could predict outcomes with 78.8% accuracy (p=0.005, 0.002, and 0.014, respectively).

Conclusion: Increased stone density, longer SSD, and advanced age can decrease the success of ESWL treatment. This study highlights the importance of considering these variables when planning ESWL treatment.

Keywords: age, ESWL successful, skin-stone distance, stone density (HU)

Cite; Erdogan E, Ozcelik F, Kahraman G, Simsek M, Sarica K. Effect of Stone Density, Skin-Stone Distance and Stone Size on Extracorporeal Shock Wave Lithotripsy Success of Ureter Stones: A Clinical Investigation. New J Urol. 2025;20(1):1-12. **doi:** https://doi.org/10.33719/nju1560480

INTRODUCTION

Urolithiasis that causes serious health problems, is a condition characterized by the formation of crystal agglomerates in the urinary tract and its incidence is increasing worldwide. Many factors, including age, gender, occupation, climate, systemic disease, diabetes, vascular disease, chronic kidney disease, diet and ethnicity, affect the prevalence and incidence of urolithiasis. It also causes pain, urinary tract infections and kidney dysfunction, limiting individuals' daily life activities, making it difficult to participate in the workforce and increasing the social financial burden (1–6).

Among the various methods used in the treatment of urolithiasis, Extracorporeal Shock Wave Lithotripsy (ESWL) stands out as a non-invasive option. While ESWL breaks stones with shock waves and allows them to be expelled from the body, its success varies depending on many factors. Many variables such as the physical properties of the stone, the anatomical structure of the patient and biochemical parameters have been found to be directly related to the success of ESWL (7–9). Therefore, being able to predict the results of ESWL treatment is important in terms of the management and treatment planning of patients with these variables.

Recent studies have shown that smaller stone size, younger patient age, and shorter skin-stone distance (SSD) are the most important factors predicting ESWL success. In addition, the composition and density of the stone, measured in Hounsfield Units (HU), have been reported to affect the efficiency of stone fragmentation, with denser stones being more resistant to treatment (10–13). However, further studies are needed on this subject.

This study aims to contribute to the literature by investigating a wider range of factors beyond the commonly studied factors (stone size, age, SSD) that may influence ESWL success. By including demographic characteristics [age, gender, BMI (Body Mass Index)], urine parameters (such as pH, density, protein, leukocytes, erythrocytes, casts and various crystal types) and stone density (in HU), potentially new predictors can be identified.

By considering this wider range of factors, this study may contribute to the adoption of a more personalized approach to the treatment of urolithiasis, contributing to the literature with better patient outcomes and potentially reduced healthcare costs.

MATERIAL AND METHODS

Design of Working Groups and Inclusion Criteria

The study that was conducted as a single-center analytical cross-sectional retrospective study, examined approximately 450 patients who came to the Sancaktepe Education and Research Hospital urology clinic with suspicion of urolithiasis between June 2023 and June 2024. Patients with ureteral stones detected by Non-Contrast Computed Tomography (NCCT) and complete clinical data were selected for the study. Of these patients, 151 patients who had an indication for ESWL treatment due to ureteral stones were included in the study. The density of the stones was measured in HU. Demographic characteristics (age, gender, BMI), symptoms [renal colic, oliguria/anuria, nausea and vomiting, dysuria, difficulty urinating, pollakiuria, fever and chills, and costovertebral angle (CVA) tenderness (CVAT)] and urine examination findings [hematuria, urine color, urine odor, density, pH, erythrocytes, leukocytes, casts, protein, calcium oxalate monohydrate (COM) or calcium oxalate dihydrate (COD) crystals, Struvite crystals, amorphous urate crystals, amorphous phosphate crystals] were recorded. In addition, patients were questioned about physical inactivity, oral contraceptives (OCs) use, and comorbidity status (hypertension, diabetes, metabolic syndrome, obesity, chronic kidney disease, cardiovascular diseases, gout, hyperlipidemia, inflammatory bowel disease, osteoporosis, malignancy, thyroid disease, uric acid metabolism disorder, and hypercoagulability, etc.). Those included in the study groups were divided into 2 groups according to the success of ESWL treatment, 116 of them were successful in treatment, while 35 patients were unsuccessful.

Exclusion Criteria

Those who were younger than 18 or older than 70 years, those with urinary tract infection, those who were pregnant, those who had undergone surgery before treatment, those with chronic renal failure, those with coagulopathy, those with stones >20 mm or <5 mm [In the treatment planning of patients in our study, the recommendations of the EAU (European Association of Urology) guidelines were considered. URS was regarded as the first-line treatment

option for ureteral stones larger than 10 mm. However, in accordance with the practice protocol of our center, patients were evaluated for ESWL feasibility rather than undergoing URS. Patients included in this study had not undergone URS previously and were directly assessed for ESWL treatment.], those with anatomical anomalies in the kidney, those with serious cardiac disease, patients with a single kidney, those with a stent inserted in the urinary system, those who were noncompliant with treatment or did not come for follow-up were excluded from the study.

Stone Density (HU) Measurement

Stone density of each patient was measured in HU on NCCT images (Canon, Aquilion Lightning 16, Japan). Images were obtained using the same standards [2 mm slice thickness, 120 kVp, 200 mA]. The site of the ureteral calculi was identified by the radiologist and the density of the stone was measured. Using radiology software for measurement, HU values were obtained from at least 3 different points from the center of the stone and the mean density of the stone was determined by calculating the average of these values.

ESWL Treatment Protocol

Patient Selection: Patients who were diagnosed with ureterolithiasis by NCCT or ultrasound and who were eligible for ESWL according to stone size (5 - 20 mm), localization (stones located in the upper and lower part of the ureter) and HU values were treated with ESWL. The stone density was measured by HU values. Stones below 1000 HU could be easily fragmented by ESWL, while stones with high density above 1000 HU were predicted to be more resistant to treatment.

Preoperative Evaluation: Laboratory tests including complete blood count, coagulation parameters, urinalysis and urine culture were performed before treatment. Patients with active urinary infection were enrolled in ESWL procedure after controlling with antibiotic treatment. During treatment, patients were hospitalized in supine position. To provide pain control during ESWL, 75 mg diclofenac potassium was administered intramuscular half an hour before the procedure.

Modulith SLK inline lithotripter [Storz Medical, Switzerland] was used in ESWL treatment. The treatment was performed by applying a maximum of 4000 shock waves at a frequency of 60-90 shocks/minute in each session. The energy level of the shock waves was initially set between 0.5-1.0 mJ/mm^2 and gradually increased up to 2.0-3.0 mJ/mm^2 according to the characteristics of the stone and the patient. Fluoroscopy was used for stone localization and ultrasonography was used for radiolucent stones. If no complications developed after ESWL treatment, the next session was scheduled 7 days later. A total of 3 sessions were performed and treatment response was evaluated at each session.

Post-Treatment Follow-up: After ESWL treatment, patients were followed up clinically to evaluate renal function. NCCT was performed 3 months after treatment to evaluate treatment success. Stone-free or stone fragmentation ≤4 mm on post-treatment imaging was considered as a criterion for treatment success. Post-treatment complications such as hematuria, severe renal pain, urinary infection or stone obstruction were controlled.

Ethical Approval for this study was obtained from the Sancaktepe Training and Research Hospital Clinical Research Ethics Committee (Decision No: 2024/298, dated 24.09.2024, numbered E-46059653-050.99-254458275). All patients participating in the study were informed about the study and their informed consent was obtained.

Statistical Analysis

IBM SPSS Statistic Software program (Version-27, Chicago, USA) was used for processing the data obtained from the study and for statistical evaluation. Kolmogorov Smirnov test was used for normality test of the data. Chi square test was applied for evaluation of categorical data. Student t test and Mann-Whitney test were used for comparison of parametric and non-parametric data of two groups, respectively. Pearson correlation analysis and Spearman correlation analysis were performed for examination of the relationship between parametric and non-parametric data of independent variables, respectively. Binary logistic regression analysis was applied using independent variables consisting of age, lower/upper localization, SSD, stone density and stone size, which are thought to influence ESWL success. Bar chart and box plots graphics were used for presentation of non-parametric data.

Power Analysis of the Study

In order to determine the minimum number of subjects required for this study, a priori power analysis (G-Power version 3.1, Germany) was performed based on the data of a study investigating the factors affecting the outcome of ESWL in the treatment of urinary stones (14). As a result of this analysis, it was calculated that at least 18 experimental subjects (ESWL successful) and 18 independent controls (ESWL unsuccessful) were required for urolithiasis stone density (effect size d = 1.01, α = 0.05, power = 0.90). However, since each group should consist of at least 30 subjects to achieve a stronger prediction and parametric statistical analyses, the number of ESWL successful groups was determined as 116 and the number of ESWL unsuccessful groups as 35.

RESULTS

Comparison of Demographic and Clinical Characteristics

When the demographic characteristics of the study groups were analyzed (Table 1), while there were no statistical differences between the groups in terms of gender and BMI (p=0.156 and p=0.2011, respectively), the age of the patients in the unsuccess group was higher compared to the success group (p=0.0458). There was no difference between the groups in terms of symptoms (renal colic, oliguria or anuria, nausea and vomiting, dysuria, difficulty urinating, pollakiuria, fever and chills, and CVAT) and comorbidities (p>0.05). Although there was no statistical difference between the groups in terms of upper/lower and right/left (R/L) localization and stone size (p=0.805, p=0.065 and p=0.7126), the stones of the success group tended to be on the right compared to the unsuccess group (Table 2). Stone density was higher, and SSD was longer in the unsuccessful group (p=0.0059 and p=0.0288). Urine specific gravity (u-SG), urine pH (u-pH), urine protein (u-Pr), urine red blood cell (u-RBC), urine white blood cell (u-WBC), Casts, urine amorphous urate crystals (u-AUC), urine amorphous phosphate crystals (u-APC), urine struvite crystals (u-SC), urine calcium oxalate monohydrate crystals (u-COM) and urine calcium oxalate dihydrate crystals (u-COD) did not differ between the groups (p>0.05).

Table 1. Comparison of demographic and clinical data of urolithiasis study groups according to the success of ESWL treatment

	Success Group	Unsuccess Group	p value
n	116	35	-
Gender, M (%)	90(78%)	23(66%)	[c] 0.156
Mean Age ± SD (year) Median Age (min-max) (year)	41±13 38(17-73)	45±9 47(26-60)	[b] 0.0458
Mean BMI±SD (kg/m^2) Median BMI (min-max) (kg/m^2)	27±4 27(18-40)	28±4 28(21-40)	[b] 0.2011
Renal colic, n(%)	81(70%)	20(57%)	[c] 0.162
Dysuria, n(%)	17(15%)	9(26%)	[c] 0.129
Difficulty in urination, n(%)	17(15%)	9(26%)	[c] 0.129
Oliguria/Anuria, n(%)	3(3%)	0	[c] 0.337
Pollakiuria, n(%)	15(13%)	9(26%)	[c] 0.070
Fever and chills, n(%)	6(5%)	3(9%)	[c] 0.433
Nausea and vomiting, n(%)	21(18%)	5(14%)	[c] 0.645
CVAT, n(%)	6(5%)	3(9%)	[c] 0.436
Comorbidities, n(%)	49(42%)	14(40%)	[c] 0.814

b Independent sample t test, c Chi-Square test.

Statistical significance level is p<0.05.

Parametric data were given as mean ± standard deviation and nonparametric data were given as median (min-max).

ESWL: Extracorporeal Shock Wave Lithotripsy **M:** Male, **BMI:** Body mass index, **CVAT:** Costovertebral angle tenderness, **SD**= Standard Deviation, **min:** minimum, max: maximum, **n:** Number

Table 2. Comparison of radiological and laboratory data of urolithiasis study groups according to the success of ESWL treatment

	Success Group	Unsuccess Group	p value
n,	116	35	-
Lower/Upper, n(%)	47(%41)/69(%59)	15(%43)/20(%57)	[c] 0.805
Right/Left, n(%)	57(49%)/59(51%)	11(31%)/24(69%)	[c] 0.065
Mean stone size ± *SD*, mm Median stone size (min-max), mm	8.3±2.3 7.8(4,2-15.0)	8.6±2.6 8.8(4.2-15.0)	[a] 0.7126
Mean stone density ± *SD*, HU Median stone density (min-max), HU	808±265 781(295-1517)	964±360 987(326-1781)	[b] 0.0059
Mean SSD ± *SD*, mm Median SSD (min-max), mm	117±18 117(66-173)	125±17 124(87-168)	[b] 0.0288
Mean u-SG ± *SD* Median u-SG (min-max)	1018±7 1017(1002-1055)	1018±10 1018(1002-1055)	[b] 0.7077
Mean u-pH ± *SD* Median u-pH (min-max)	6.3±0.5 6.0(5.5-8.0)	6.3±0.4 6.0(5.5-7.5)	[a] 0.3842
u-Pr, n(%)	25(22%)	5(14%)	[c] 0.460
u-RBC, n(%)	93(80%)	27(77%)	[c] 0.857
u-WBC, n(%)	75(52%)	20(30%)	[c] 0.420
Casts, n(%)	5(4%)	2(6%)	[c] 0.663
u-AUC, n(%)	12(10%)	3(9%)	[c] 0.759
u-APC, n(%)	9(8%)	6(17%)	[c] 0.115
u-SC, n(%)	4(3%)	1(3%)	[c] 1.000
u-COM, n(%)	7(6%)	3(9%)	[c] 0,698
u-COD, n(%)	8(7%)	2(%6)	[c] 1.000

a Mann-Whitney U Test, b Independent sample t test, c Chi-Square test. Statistical significance level is p<0.05.
Parametric data were given as mean ± standard deviation and nonparametric data were given as median (min-max).
ESWL: Extracorporeal Shock Wave Lithotripsy, **HU**: Hounsfield Units, **SSD:** Skin-to-stone distance, **u-SG:** Urine specific gravity, **u-pH:** Urine pH, **u-RBC:** Urine red blood cell, **u-WBC:** Urine white blood cell, **u-Pr:** urine protein, **u-AUC:** Urine amorphous urate crystals, **u-APC:** Urine amorphous phosphate crystals, **u-SC:** Urine struvite crystals, **u-COM:** Urine calcium oxalate monohydrate crystals, **u-COD:** Urine calcium oxalate dihydrate crystals, **SD** = Standard Deviation, **min:** minimum, **max:** maximum, **n;** Number

When HU<1000 and HU≥1000 groups formed according to stone density were examined (Table 3), no statistical difference was found between the groups in terms of R/L localization, SSD, u-SG, u-PH, u-Pr, u-RBC, u-WBC, Casts, u-AUC, u-APC, u-SC(p>0.05). The HU <1000 group had smaller stone size (p=0.0458) (Table 3) and higher ESWL success (p=0.006) (Figure 1A). Again, compared to the HU <1000 group, stones in the HU ≥1000 group tended to be located in the upper ureter (p=0.019) (Figure 1B) and the stone size tended to be larger (p=0.0458) (Table 3). The incidence of u-COD crystal was higher in the HU<1000 group, while u-COM crystal was higher in the HU≥1000 group (p=0.033 and p=0.001, respectively) (Figure 2A and B).

When SSD ≤110 and SSD >110 groups formed according to SSD were analyzed in terms of ESWL success, it was found that the SSD ≤110 group had a higher success rate (90% vs 71%, respectively, p=0.001) (Figure 3).

Correlation and Regression Analysis

According to the results of correlation analysis, there was no statistically significant correlation between stone size and SSD and u-pH (Spearman r (rs) = -0.035, p = 0.6715 and rs = 0.101, p = 0.2126, respectively). However, there was a low but significant correlation between stone size and stone density (Pearson r = 0.240 p = 0.0029) (Figure 4). In addition, there was no statistically significant correlation between stone density and SSD and u-pH, nor between SSD and u-pH (p>0.05).

Table 3. Comparison of radiological and laboratory data of urolithiasis study groups according to stone density

	Stone Density		
	HU < 1000 (Soft Stones)	**HU ≥ 1000 (Hard Stones)**	**p value**
n,	106	45	-
Upper/Low, n(%)	56(53%)/50(47%)	33(73%)/12(27%)	[c] 0.019
Right/Left, n(%)	45(42%)/61(58%)	23(51%)/22(49%)	[c] 0.328
Stone size, mm	8.2±2.3 7.8(4.2-15.0)	9.0±2.6 9.0(4.8-15.0)	[a] 0.0458
ESWL successful, n	88(83%)	28(62%)	[c] 0.006
Mean SSD ± *SD*, mm Median SSD (min-max), mm	120±20 119(66-173)	117±13 119(88-144)	[b] 0.3677
Mean u-SG ± *SD* Median u-SG (min-max)	1018±7 1019(1004±1033)	1018±8 1017(1002-1055)	[b] 0.9111
Mean u-pH ± *SD* Median u-pH (min-max)	6.3±0.5 6.0(5.5-8.0)	6.2±0.5 6.0(5.5-7.5)	[a] 0.2076
u-Pr, n(%)	18(17%)	10(22%)	[c] 0.448
u-RBC, n(%)	83(78%)	37(82%)	[c] 0.686
u-WBC, n(%)	69(65%)	26(58%)	[c] 0.395
Casts, n(%)	5(4%)	2(6%)	[c] 0.942
u-AUC, n(%)	10(9%)	5(11%)	[c] 0.770
u-APC, n(%)	11(10%)	4(9%)	[c] 0.780
u-SC, n(%)	5(5%)	0(0%)	[c] 0.312
u-COM, n(%)	2(2%)	8(18%)	[c] 0.001
u-COD, n(%)	10(9%)	0(0%)	[c] 0.033

a Mann-Whitney U Test, b Independent sample t test, c Chi-Square test. Statistical significance level is p<0.05.
Parametric data were given as mean ± standard deviation and nonparametric data were given as median (min-max).
ESWL: Extracorporeal Shock Wave Lithotripsy, **HU:** Hounsfield Units, **SSD:** Skin-to-stone distance, **u-SG:** Urine specific gravity, **u-pH:** Urine pH, **u-RBC:** Urine red blood cell, **u-WBC:** Urine white blood cell, **u-Pr:** urine protein, **u-AUC:** Urine amorphous urate crystals, **u-APC:** Urine amorphous phosphate crystals, **u-SC:** Urine struvite crystals, **u-COM:** Urine calcium oxalate monohydrate crystals, **u-COD**: Urine calcium oxalate dihydrate crystals, **SD** = Standard Deviation, **min:** minimum, **max:** maximum, **n;** Number

Table 4. Binary logistic regression analysis results applied to determine the effect of five independent variables on ESWL success

Variable	**b**	**SE**	**OR**	**95% CI**		**p**
				LL	**UL**	
Constant	9,006	2,159	8149,664			0,000
Age	-0,032	0,019	0,968	0,934	1,004	0,084
SSD	-0,032	0,012	0,969	0,946	0,993	0,012
Stone density (HU)	-0,002	0,001	0,998	0,996	,999	0,002
Stone size	0,016	0,093	1,016	0,846	1,220	0,867
R/L location	-1,062	0,450	0,346	0,143	0,835	0,018

Note. Overall estimate percentage = %79.5 Omnibus Test (Chi-square= 23,287, p<0.001), Hosmer and Lemeshow Test (Chi-square= 11,051, p=0.199), Nagelkerke R2=0,216. **ESWL:** Extracorporeal Shock Wave Lithotripsy, **R/L:** Right/Left, **SSD:** Skin-to-stone distance, **HU:** Hounsfield Units, **LL:** Lower Limit, **UL:** Upper Limit

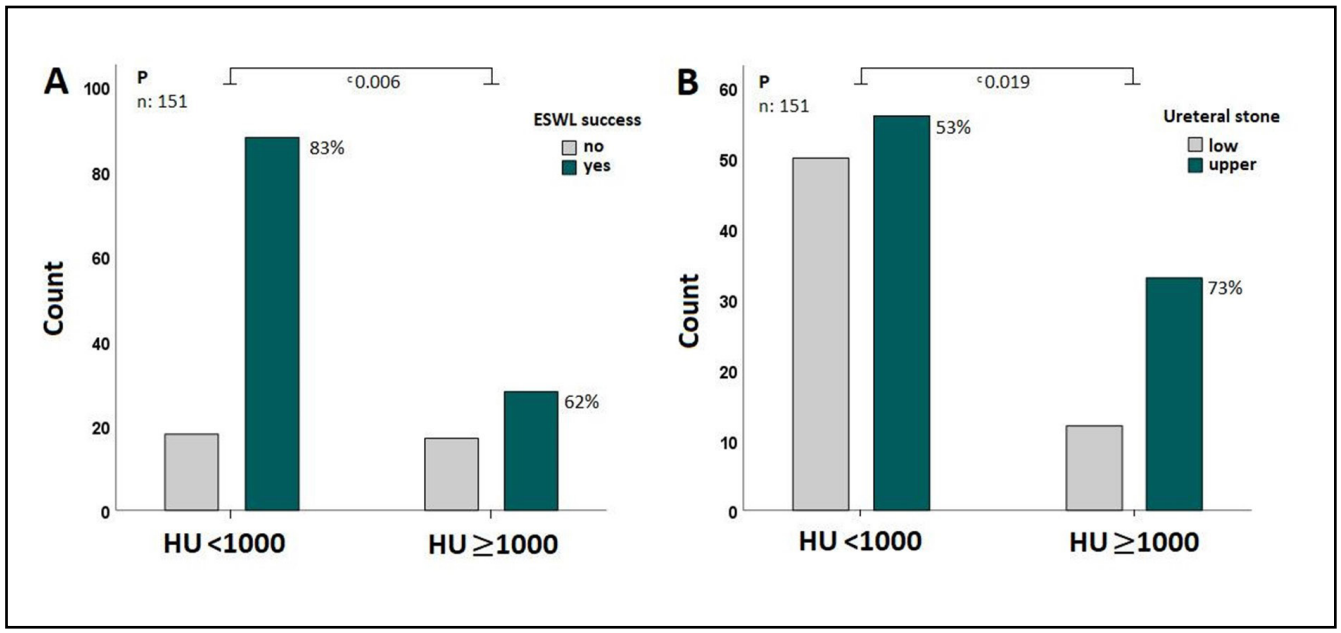

Figure 1. Bar chart showing the comparison of extracorporeal shock wave lithotripsy (ESWL) success (A) and stone localization (right/left side) (B) between the Hounsfield Units (HU) <1000 and HU ≥1000 groups. It is observed that ESWL success is higher in the HU <1000 group. Additionally, stones in the HU ≥1000 group are more frequently located in the upper ureter compared to the HU <1000 group. c Chi-square test.

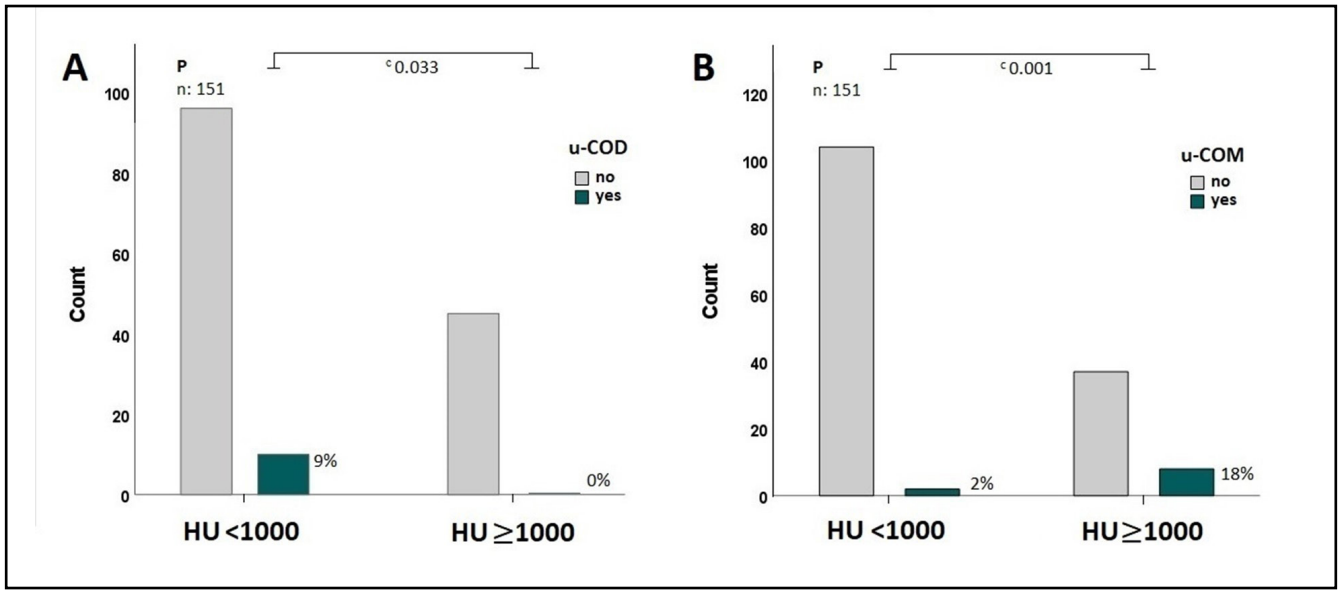

Figure 2. Bar chart displaying the occurrence rates of urine calcium oxalate dihydrate crystals (u-COD) (A) and urine calcium oxalate monohydrate crystals (u-COM) (B) crystals in the Hounsfield Units (HU) <1000 and HU ≥1000 groups. The occurrence rate of u-COD crystals is higher in the HU <1000 group, while u-COM crystals are more frequent in the HU ≥1000 group. c Chi-square test.

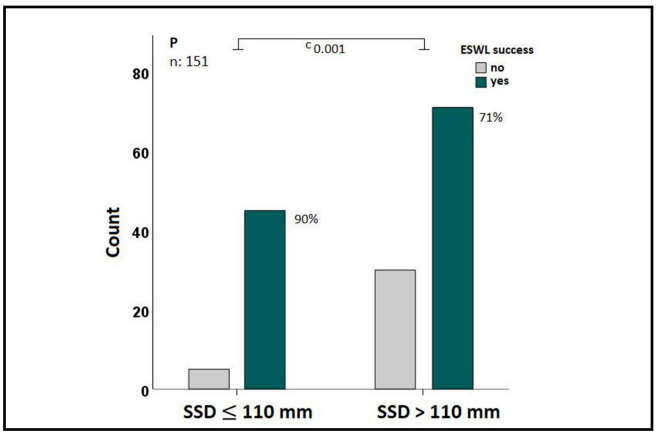

Figure 3. Bar chart illustrating extracorporeal shock wave lithotripsy (ESWL) success rates between skin-to-stone distance (SSD) ≤110 and SSD >110 mm groups based on skin-stone distance (SSD). ESWL success is higher in the SSD ≤110 mm group.

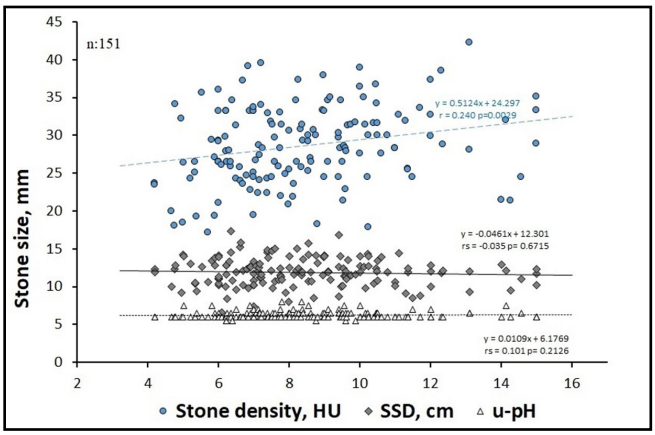

Figure 4. Spearman correlation graph representing the relationship between stone size and skin-to-stone distance (SSD), stone density, and urine pH (u-pH) values across all study groups. According to the correlation analysis, there is no statistically significant correlation between stone size and u-pH or SSD. However, a weak but significant correlation exists between stone size and stone density. rs: Spearman correlation test, r: Pearson correlation test.

Table 5. Binary logistic regression analysis results applied to determine the effect of three independent variables on ESWL success

Variable	b	SE	OR	95% CI		p
				LL	UL	
Constant	8,021	1,902	3044,483			0,000
SSD	-0,035	0,012	0,966	0,943	0,990	0,005
Stone density (HU)	-0,002	0,001	0,998	0,996	0,999	0,002
R/L location	-1,093	0,444	0,335	0,140	0,800	0,014

Note. Overall estimate percentage = %78,8, Omnibus Test (Chi-square= 20.265, p<0.001), Hosmer and Lemeshow Test (Chi-square= 12.849, p=0.117), Nagelkerke R2=0.190, ESWL: Extracorporeal Shock Wave Lithotripsy, R/L: Right/Left, SSD: Skin-to-stone distance, HU: Hounsfield Units, LL: Lower Limit, UL: Upper Limit

The results of Binary regression analysis to determine the effect of 5 independent variables including age, SSD, stone density, stone size and R/L location on ESWL success status are shown in Table 4. This five-variable model explaining ESWL success seemed to be appropriate overall (Omnibus Test, p<0.001 and Hosmer-Lemeshow goodness of fit test, p=0.199). However, except for SSD, stone density and R/L location, the effect of patient age and stone size on ESWL success was statistically insignificant (p>0.05). Therefore, these independent variables were excluded from the model. Binary regression analysis was performed again with a simpler model consisting of SSD, stone density and R/L location (Table 5). This three-independent variable model was found to predict with similar accuracy to the five-independent variable model (79.5% vs. 78.8% overall prediction percentage, respectively). In this model, the effects of the independent variables SSD, stone density and R/L location on ESWL success were statistically significant (p=0.005, p=0.002 and p=0.014, respectively). The formula created with the B coefficients obtained from this simple model can be used to estimate the probability of ESWL success. A probability value >0.5 was considered as success. Euler (e) number: 2.718281.

$$P(Y)=\frac{1}{1+e^{-(B0+Ba*Xa+Bb*Xb+Bc*Xc)}}$$

According to the odds ratios (OR) obtained from the binary logistic regression analysis, a one-unit increase in SSD, stone density, and R/L location decreased the probability of successful ESWL by 0.966, 0.998, and 0.335 times, respectively.

The results of statistical comparisons of the groups, correlation, binary regression and ROC (Receiver operating characteristic) analysis suggest that SSD, stone density and R/L location parameters are closely related to ESWL success and that these parameters can be used independently of each other as predictive markers for predicting ESWL success. Furthermore, when the three parameters SSD, stone density and R/L location were used together, ESWL success could be predicted with an accuracy of approximately 78.8%.

DISCUSSION

This study underscores the potential for decreased ESWL success in patients exhibiting increased stone density, prolonged SSD, and advanced age. These findings emphasize the critical need for a comprehensive assessment of these factors when formulating ESWL treatment plans.

ESWL is a preferred and widely used method for the treatment of ureteral calculi in clinical practice. However, many factors affecting the success of this treatment method are among the difficulties faced by clinicians in treatment planning. For this reason, Guidelines that can be used worldwide have been established. In the literature, there are numerous studies examining the effects of stone size, density, SSD, patient age and urinary parameters on ESWL success (10,13,15,16). Accurate evaluation of these factors plays a critical role in optimizing treatment outcomes. Moreover, ESWL procedure involves certain risks. ESWL exerts a series of mechanical forces on the stones, causing cavitation and fragmentation of the stones. These effects have the potential to cause aseptic inflammation and tissue damage in the kidney and adjacent organs (17). Therefore, comprehensive studies are still needed to predict ESWL success.

In this study, although the study groups were found to be similar in terms of gender and BMI, the fact that the group with failed ESWL treatment was older coincides with the study reporting that the management of elderly patients with urolithiasis is difficult due to the presence of comorbidities (18). However, there are also many studies reporting no relationship between age and ESWL (14,16,19). The possible reason for these different results regarding age may be due to individual differences in the groups, the composition of the stone or differences in ESWL application.

The relationship between stone localization and ESWL success has been discussed for a long time. In this study, ESWL success was tested with the location of the stone in the upper/lower ureter and/or R/L ureter. Despite of the fact that there was no statistical difference between stone location and ESWL success, the fact that the stones tended to be relatively localized on the right in ESWL successful patients was not ignored. This finding reminds us the study that was conducted by Soleimani et al. who pointed out that stone type and location were factors contributing to the success of ESWL (20). Stones can be located anywhere from the kidneys to the urethra. The physiology underlying stone formation is complex and involves many factors. Stone formation most often begins with Randall's plaques, which consist of calcium phosphate deposits in the renal papilla (21,22). Calcium oxalate stones form in the loop of Henle. Kidney stones commonly contain calcium. The rarer Struvite stones are associated with infection. In our study, complete urinalysis parameters and crystals were not associated with ESWL success. However, the lack of chemical analysis of the stones is a shortcoming of the evaluation. Our study results and all this information emphasize that future comprehensive studies should include stone localization and stone analysis. Another indicator of the importance of stone localization was the finding that R/L localization had a significant effect on the prediction of ESWL success in regression analysis.

Previous studies have frequently emphasized the effect of stone density on ESWL treatment outcomes. Anatomic factors such as SSD have also been reported to have a significant effect on the success of ESWL (13,16,23). However, the relationship of urinary components, especially crystal types and other urinary biochemical parameters, with treatment outcomes has been less investigated (13,24,25). In this context, our study aimed to elucidate the role of stone structure, patient characteristics and urine analysis in ESWL success. The most important result of our study was that those who failed ESWL treatment had higher stone density and longer SSD. Moreover, the logistic regression analysis showed that SSD, stone density and R/L localization had significant effects

on ESWL success, which supports the previous statistical evaluation. The significant differences in these parameters in terms of ESWL treatment success overlap with the studies of Garg, who independently reported a correlation between shock wave lithotripsy results and stone density, and Doherty, who suggested that the greater the distance between the stone and the skin, the less effective the shock wave emitted by the lithotripter (13,26). Therefore, considering that it is not possible to alter the stone density or the SSD, it is necessary to adjust the shock waves of the ESWL units according to this distance and stone density.

In this study, it was found that those with a stone density <1000 HU had smaller stone size and higher ESWL success, as well as a correlation between stone size and density, which coincides with the finding of Al-Zubi et al. who reported that determination of stone density and stone size before ESWL can be used to predict ESWL success (16). In another study on ESWL success, the importance of factors such as age, stone size, density and SSD were emphasized (13). In line with this, as it is seen in the study by Soleimani et al., the fact that the stone more frequently chooses the upper localization in those who have successful ESWL may be evidence of a relationship between stone localization and ESWL success (20). Another result obtained in this study was that u-COD crystal was more common in the HU <1000 group and u-COM crystal was more common in the HU ≥1000 group. This finding was considered as evidence that the density and crystal content of urine may be associated with stone formation and ESWL success (13,24,25). In this context, knowing the density, size and content of stones before treatment will help to make more accurate predictions of ESWL success. Therefore, using SSD, stone density and R/L location information together will be useful in predicting ESWL success.

Limitations

This cross-sectional study is obtained from retrospective data, so the cause-effect relationship is more limited than cohort studies. Future prospective studies may provide more definitive findings. Although no statistical difference was found between the study groups in terms of BMI and gender, the complaints and comorbidities of the patients were based on the existing records and patient statements. This may limit the generalizability of the results of the study. The inability to fully determine the chemical composition of the fragmented stones has limited the full evaluation of the different factors affecting the success of ESWL. Although chemical analyses of the patient urine were performed, these results may not represent the exact chemical composition of the stone. In addition, the fact that different people performed the urine analyses in the laboratory has the potential to affect the results of the groups.

CONCLUSION

Higher stone density, longer SSD and older age may lead to decreased success of ESWL treatment. This study highlights the importance of evaluating these variables during ESWL treatment planning to predict outcome and optimize patient management.

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Author contributions: Erdoğan E, Ozcelik F and Simsek M designed the study and performed the laboratory work; Erdoğan E, Kahraman G, and Sarıca K collected the samples and patient data; Ozcelik F and Erdoğan E analyzed the data and wrote the manuscript; Erdoğan E and Sarıca K revised the draft and took responsibility for the final content.

Ethical Approval: Ethical Approval for this study was obtained from the Sancaktepe Training and Research Hospital Clinical Research Ethics Committee (Decision No: 2024/298, dated 24.09.2024, numbered E-46059653-050.99-254458275). All patients participating in the study were informed about the study and their informed consent was obtained.

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RESEARCH ARTICLE

Antithrombotic Therapy Does Not Jeopardize Emergency Percutaneous Nephrostomy

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Abstract

Objective: This study aims to evaluate the clinical outcomes of patients receiving antithrombotic (antiaggregant and anticoagulant) therapy who underwent emergency percutaneous nephrostomy (PN) for the treatment of receiving complicated upper urinary tract infection.

Material and Methods: Data of consecutive patients who underwent emergency PN from January 2014 to October 2024 were retrospectively reviewed. A total of 34 patients on antithrombotic treatment (Group 1) and 35 control group patients (Group 2) without bleeding disorders or any antithrombotic treatment were included. Demographics, indications for PN, pre- and post-procedural hematological, biochemical, and microbiological parameters and complications were analyzed.

Results: The mean age was 68.65±1.49 in group 1 and 62.09±1.77 in group 2 (p = 0.006). Sex distribution and indications for PN were comparable between groups. There was no significant difference in emergency PN indications, grade of hydronephrosis, and PN placement sides. The most common antithrombotic agent in group 1 was warfarin (44.1 %). *Escherichia coli* was the most common bacteria isolated in both groups (55.9% vs. 48.6 % for groups 1 and 2, respectively). No major complications were observed in either group. Blood replacement was performed in 4 and 3 patients in groups 1 and 2, respectively. Mean post-procedure Hg levels were similar in both groups (9.53 ±1.39 vs. 9.98 ±1.18 for groups 1 and 2, respectively). No difference in median hospital stay was observed between the groups.

Conclusion: Antithrombotic drugs pose a potential bleeding risk during PN placement. This is the first study in the literature on PN placement in patients on antithrombotic therapy, and it shows that the procedure can be performed with low complication rates in patients on antithrombotic therapy.

Keywords: antiaggregant, anticoagulant, emphysematous pyelonephritis, percutaneous nephrostomy, pyelonephrosis, urological emergency.

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INTRODUCTION

Percutaneous nephrostomy (PN) procedure is the insertion of a catheter through the skin into the renal pelvicalyceal system to drain urine. The first PN procedure was performed by Goodwin et al. in 1955 for the treatment of hydronephrosis (1). The treatment of obstructive pyelonephritis, emphysematous pyelonephritis, pyonephrosis, and renal abscess is emergency renal decompression with PN or ureteral double-J (D-J) stent placement (2).

Emphysematous pyelonephritis was often treated with emergency nephrectomy in the past, but in recent years emergency renal decompression with PN and delayed nephrectomy are usually performed. Percutaneous drainage is thought to reduce the burden of infection and prevent its spread to surrounding tissues (3-5).

Relative contraindications to PN include the use of antithrombotic (antiaggregant or anticoagulant) drugs and coagulopathy (6,7). Life expectancy is increasing, leading to a global rise in the use of antithrombotic therapy (8). In some clinical conditions, emergency PN may be required for patients receiving antithrombotic therapy. Due to the risk of sepsis and septic shock in infectious conditions, there is insufficient time for antithrombotic withdrawal and bridging therapy before emergency PN in patients receiving antithrombotic therapy. The possibility of life-threatening renal hemorrhage requiring blood replacement should be considered in patients undergoing elective PN procedure (9).

Patients on antithrombotic therapy are known to have higher rates of bleeding and complications during PN placement (6,7,10). To date, no comprehensive studies have evaluated the indications and complications of emergency PN in patients receiving antithrombotic therapy. This study evaluated the outcomes of patients on antithrombotic therapy who underwent emergency PN.

MATERIALS AND METHODS

Patients and Data Collection

After approval by the institutional clinical research ethics committee approval, data of consecutive patients who underwent emergency PN in our hospital from January 2014 to October 2024 were retrospectively reviewed. Patients who had undergone open or percutaneous surgery on the same kidney and those who had previously undergone a PN on the same kidney were excluded from the study. Patients reveiving antiplatelet and/or anticoagulant were the antithrombotic group. Antiplatelet drugs included acetylsalicylic acid, clopidogrel. Anticoagulants included warfarin and new generation (dabigatran, rivaroxaban, etc). Thirty-four patients on antithrombotic treatment whose emergency PN was placed for obstructive pyelonephritis, pyonephrosis, renal abscess, retroperitoneal abscess, or emphysematous pyelonephritis, were enrolled in the study as Group 1. In addition, the last 35 consecutive patients whose emergency PN was placed for the same reasons and who didn't have a bleeding disorder or were not on antithrombotic treatment, were enrolled in the study as a control group (Group 2).

Procedure

Patients in Group 1 were informed about the possibility of higher rates of bleeding complications due to emergency PN. All patients received empiric 1 g ceftriaxone and IV hydration prior to the procedure and were confirmed to be hemodynamically stable. No bridging treatment was given to any patient in group 1, and all emergency PN procedures were performed on the same day that the patients were applied. The procedures were performed under local anaesthesia (5-7 cc of 2% 20 mg/ml prilocaine) in the lateral decubitus position, with the target kidney on top, using the Seldinger method, accompanied by ultrasound (11). A 30 cm, pigtail-type, 8 Fr polyurethane nephrostomy catheter was used in all patients. Cultures and antibiotic sensitivity tests were performed to analyze the nephrostomy content in all patients.

After recording of demographic information, the patients were analyzed for PN indications and post-procedural complications. Pre-procedural hydronephrosis grades, white blood cell (WBC) counts, hemoglobin (Hg) levels, creatinine levels, C-reactive protein (CRP) levels, International Normalized Ratio (INR) levels, and platelet count (PLT) levels were documented for all patients. Additionally, first-day the post-procedure results were documented for Hg, WBC count, creatinine level, CRP level, PLT count and culture antibiotic sensitivity.

Statistical Analysis

Statistical analyses were performed using SPSS version 22.0 for Windows software (Armonk, NY: IBM Corp., USA). The Shapiro-Wilk test was used to assess the normality of distributions of continuous variables. Normally distributed continuous variables were compared using the Student's t-test, and non-normally distributed variables were compared using the Mann-Whitney U test. Pearson's chi-square or Fisher's exact test was used for categorical data. Dependent variables were compared using a Paired-Samples T-test or Wilcoxon test depending on their distribution status. Normally distributed continuous variables are expressed as mean ± standard error of the mean (SEM) and non-normally distributed variables as median and interquartile ranges (IQR). Categorical variables are expressed as numbers and percentages. Logistic regression analysis and multiple linear regression analysis were performed to evaluate the association between predictive factors and outcomes. Statistical significance was set at a p-value of less than 0.05.

RESULTS

The mean age of the patients was 68.65±1.49 in group 1 and 62.09±1.77 in group 2 (p=0.006). There was no difference in the gender distribution of the patients between the two groups (p>0.05). Malignancy caused urinary obstruction in 17 (50.0%) patients in Group 1 and 22 (62.9%) patients in Group 2. Six patients in Group 1 had no detectable obstructive cause (stone, malignancy, ureteral stricture, etc.), whereas all patients in Group 2 had urinary obstruction (p=0.034). A total of 30 patients in Group 1 and 16 patients in Group 2 had at least one chronic disease, including diabetes mellitus, hypertension, hyperlipidaemia and cardiovascular disease (p<0.001). Emphysematous pyelonephritis was observed in three patients in group 1 and two patients in group 2. There was no significant difference between the groups regarding indications for emergency PN placement, the grade of hydronephrosis, or the side of PN placement. The most frequently used antithrombotic agent in Group 1 was warfarin (Table 1).

Table 1. Patients' characteristics

		Group 1 (n 34)	Group 2 (n 35)	p Value
Age (mean±SEM)		68.65±1.49	62.09±1.77	**0.006**
Gender (n,%)	Female	18 (52.9)	23 (65.7)	0.280
	Male	16 (47.1)	12 (34.3)	
Etiology (n,%)	Malignancy	17 (50.0)	22 (62.9)	**0.034**
	Urinary stone	11 (32.4)	13 (37.1)	
	Undetected	**6 (17.6)**	**0**	
Chronic disease (n,%)		**30**	**16**	**<0.001**
Main diagnosis (n,%)	Pyelonephritis	14 (41.2)	20 (57.1)	0.510
	Pyelonephrosis	14 (41.2)	12 (34.3)	
	Retroperitoneal abscess	3 (8.8)	1 (2.9)	
	Emphysematous pyelonephritis	3 (8.8)	2 (5.7)	
Side (n,%)	Right	14 (41.2)	12 (34.3)	0.555
	Left	20 (58.8)	23 (65.7)	
Hydronephrosis Grade (n,%)	1	0	0	0.013
	2	9 (26.5)	15 (42.9)	
	3	22 (64.7)	17 (48.6)	
	4	3 (8.8)	3 (8.6)	
Antithrombotics (n,%)	Warfarin	15 (44.1)	-	
	Acetylsalicylic acid	14 (41.2)	-	
	Clopidogrel	3 (8.8)	-	
	New generation	2 (5.9)	-	

SEM: standard error of the mean

Table 2. Blood sample test results

	Group 1 (n 34)	**Group 2 (n 35)**	**p Value**
Hb level (before PN, g/dl)	9.80±0.24	10.28±0.25	0.093
Hb level (after PN, g/dl)	9.53 ±0.24	9.98 ±0.20	0.151
p Value	**0.005**	**0.049**	
WBC count (before PN, cells/mm3)	12.15 (IQR:7.42)	13.44±5.20	0.631
WBC count (after PN, cells/mm3)	11.22±3.01	11.44±3.98	0.791
p Value	**0.003**	**0.001**	
Crp level (before PN, mg/dL)	147.5 (IQR:145.5)	118.0 (IQR:111.0)	0.838
Crp level (after PN, mg/dL)	90.0 (IQR:74.3)	82.5 (IQR:86.0)	0.933
p Value	**<0.001**	**<0.001**	
Cre level (before PN, mg/dL)	3.53 ±1.59	2.5 (IQR:2.76)	**0.011**
Cre level (after PN, mg/dL)	2.18 (IQR:1.09)	1.5 (IQR:1.06)	**<0.001**
p Value	**<0.001**	**<0.001**	
Plt count (before PN, 10^3/µL)	281± 112	261 (IQR:202)	0.904
Plt count (after PN, 10^3/µL)	219± 102	230 (IQR:140)	0.581
p Value	**<0.001**	**<0.001**	
INR level	1.96 (IQR:2.10)	1.17 (IQR:0.15)	**<0.001**

Hg: hemoglobin, WBC: white blood cell, IQR: interquartile range,CRP: C-reactive protein, INR: International Normalized Ratio, Plt: platelet.

Table 3. Clinical outcomes and urine culture results after PN.

		Group 1 (n 34)	**Group 2 (n 35)**	**P Value**
Blood replacement (n,%)		4 (11.7)	3 (8.6)	
Fever >38 °C after PN (n,%)		12 (35.3)	10 (28.6)	0.549
Urine culture (n,%)	*Escherichia coli*	19 (55.9)	17 (48.6)	0.964
	None	8 (23.5)	11 (31.4)	
	candida albicans	0	1 (1.4)	
	enterococcus faecium	2 (5.9)	2 (5.7)	
	klebsiella pneumoniae	2 (5.9)	2 (5.7)	
	proteus mirabilis	1 (2.9)	1 (2.9)	
	pseudomonas aeruginosa	1 (2.9)	0	
	Staphylococcus aureus	1 (2.9)	0	
	Acinetobacter baumannii	0	1 (2.9)	
Leinght of hopital stay (day)		11.50 (IQR:10)	11.00 (IQR:9)	0.318

PN: percutaneous nephrostomy, IQR: interquartile range

As observed, there was no significant difference between the groups in terms of blood test results, both before and after percutaneous nephrostomy placement, except for creatinine and INR levels. The median INR and the median pre- and post-procedure creatinine levels were higher in group 1. Only one patient, with an INR value of 8.80, was injected with 5 mg of vitamin K1 and received 1 unit of fresh frozen plasma infusion before the procedure. Post-procedure levels of Hg, creatinine, WBC, CRP and platelets were significantly lower than pre-procedure levels in both groups (Table 2).

No patient experienced major vascular injury, retroperitoneal bleeding, or hemodynamic instability after PN placement. Twelve patients in group 1 and ten patients in group 2 had a fever above 38°C for 48 hours after the procedure. One patient with an INR of 8.80 had hematuria for 5 days after PN, and 1 unit of erythrocyte suspension was infused. Blood replacement was performed in four and three patients in groups 1 and 2, respectively. There were no Clavien-Dindo grade III or higher complications occurred in any patient. *Escherichia coli* was the most frequently isolated pathogen in the urine cultures of patients in both groups. There was no significant difference in the median length of hospital stay (days) between the groups [11.50 (IQR:10) vs. 11.00 (IQR:9)], (Table 3).

In logistic regression analysis, high INR significantly indicated an association with a higher blood replacement ratio (OR: 1.75; $p = 0.035$). Other factors, including antithrombotic therapy, presence of chronic disease, and platelet level, were not significantly associated with blood replacement ($p > 0.05$). The presence of a chronic disease was found to be significantly associated with the longer length of hospital stay in multiple linear regression analysis ($p = 0.037$).

None of the patients underwent an emergency nephrectomy. Elective nephrectomy was performed in 3 patients in all groups, with emphysematous pyelonephritis 2 months after PN placement.

DISCUSSION

Since its first description, PN has been one of the most commonly performed procedures in daily urological practice (1). Since Pedersen's description of ultrasound-guided PN alone, it has also become feasible even in the office setting (12). With the increasing image quality of modern ultrasound equipment, the success rate of PN placement in the office setting has reached 100% in dilated kidneys (13). In our study, all patients had a grade ≥ 2 renal dilatation degree, and the technical success rate of PN placement was 100% in all patients.

Bleeding diathesis is a relative contraindication for PN placement; however, if intravascular coagulopathy develops due to urosepsis, it is unlikely that the patient's condition can be corrected without PN (6,7).

Decompression of the infected kidney via PN provides clinical improvement, particularly in patients who cannot tolerate major surgery and anaesthesia. During this time, the patient can be more closely ecaluated, potential fluid-electrolyte imbalances can be corrected, the infection can be managed, and valuable time can be gained in preparation for subsequent surgical intervention.

Following PN placement, major complications such as bleeding, sepsis, and injury to adjacent organs have been reported in 3% to 4% of cases (14). The rate of nephrectomy due to bleeding after PN has been reported to be less than 1% (9). In our study, no patient experienced major complications, such as adjacent organ injury or nephrectomy.

In situations involving obstructive pyelonephritis, pyonephrosis, renal-retroperitoneal abscess, and urosepsis, the primary therapeutic approach is urgent decompression through either percutaneous nephrostomy (PN) or placement of a double-J (D-J) stent (15). Furthermore, in cases of pyonephrosis and abscess drainage, the lumen of a D-J stent may be insufficient to adequately drain dense contents or pus.

Emergency nephrectomy is generally favored in the management of emphysematous pyelonephritis, and in current practice, urgent PN is often the first therapeutic step. In a retrospective study of 20 patients with emphysematous pyelonephritis, Shokeir et al. reported a mortality rate of 20% associated with emergency nephrectomy (3). A systematic review of 210 patients diagnosed with emphysematous pyelonephritis, the reported mortality rates were 25% and 13.5% for emergency nephrectomy and PN, respectively (16). Emergency PN makes delayed nephrectomy more reasonable

under more stable conditions after achieving clinical improvement. None of our patients with emphysematous pyelonephritis underwent emergency nephrectomy. Elective nephrectomy was performed in 3 patients with emphysematous pyelonephritis 2 months after PN placement.

Numerous studies have reported that the incidence of major bleeding in patients taking warfarin without surgery ranges from 0.4% to 7.2% per year, while the incidence of minor bleeding can be as high as 15.4% per year (17). In the AVERROES trial, which included 5599 patients, the bleeding rate was 3.8%/year with aspirin and 4.5%/year with apixaban (a new-generation anticoagulant), 18). The use of low-dose acetylsalicylic acid has been shown to increase the risk of major bleeding by about 1.5 times, and chronic diseases such as diabetes mellitus and older age are independent factors that increase the risk of bleeding (19,20). In addition, RCTs reported an equivalent risk of major bleeding with aspirin or clopidogrel compared with warfarin. Bleeding of any severity and intracranial bleeding are less common with antiplatelet drugs than with warfarin (21).

PN placement in patients receiving antithrombotic therapy is known to be associated with a high risk of bleeding (6,7,10). Some studies have suggested that antithrombotics do not increase intraoperative blood loss during emergency gastrointestinal surgery (22,23). However, there is a lack of sufficient data on emergency surgery in patients receiving antithrombotic therapy. To the best of our knowledge, this is the first case-control study of investigating PN placement in patients receiving antithrombotic therapy. According to the results of our study, although the antithrombotic group had a higher rate of chronic disease and a higher mean age of patients, no difference was found between the groups in terms of bleeding complications and Hg lowering.

In our study, emergency PN in patients on antithrombotic medication appeared to be generally safe with low complication rates. The fact that the majority of our patients had grade 2 or higher hydronephrosis and that kidney access was achieved with a single needle puncture in all patients supports the low complication rates. The fact that none of our patients had renal hemorrhage requiring additional intervention after PN supports the fact that emergency PN can be performed when necessary, taking into account the risk/benefit ratio.

The indication for emergency PN in patients on antithrombotic therapy is a rare clinical scenario and resulting in a small sample size. The retrospective nature of the study and the relatively small sample size are the main limitations that may have influenced the results. Prospective randomized controlled trials with large number of patients are needed to determine the safety and clear limits of the applicability of PN in patients on antithrombotic therapy.

CONCLUSIONS

This study suggests that antithrombotic drugs do not significantly increase the risk of complications or bleeding in patients undergoing emergency PN placement. These findings may aid in the clinical decision-making process for the management of patients requiring emergency PN while on antithrombotic therapy.

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

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

Ethical Approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional (Antalya Training and Research Hospital, Approval No: 11/15, date 24.08.2023.) and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Authors' Contributions: Conception: SK, ASA Design: SK, ASA, EK Supervision: CO, MS, ST Data Collection: SK, ASA, EK,CO, MS Analysis: SK, MS, ASA Literature Review: SK, EK, CO, MS Writing: SK, ASA, MS Critical Review: SK, ASA, EK, CO, ST.

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RESEARCH ARTICLE

Evaluation of Chat Generative Pretrained Transformer (ChatGPT) Performance in Answering Kidney Transplant Related Questions

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Abstract

Objective: Social media such as (Youtube, Facebook, Instagram, Twitter, etc.) and artificial intelligence (AI) are applications that have become popular in recent years, they are the first resources that patients turn to today. ChatGPT is an AI-powered language model developed by OpenAI and its success on health problems are demonstrated by many studies. In this study, we aimed to evaluate the adequacy of ChatGPT's answers to questions about kidney transplantation.

Material and Methods: Frequently asked questions about kidney transplantation by patients on health forums, websites and social media (YouTube, Instagram, Twitter) were analyzed. We also analyzed the recommendation tables of the Kidney Transplantation section of the 2024 European Association of Urology (EAU) guidelines. Those with strong recommendations were translated into a question form. ChatGPT version 4o questions were asked and the answers were evaluated by 3 urologists experienced in kidney transplantation.

Results: Of the 126 questions evaluated, 65 questions were continued after the exclusion criteria. 57 (87.6%) of the answers were correct and adequate. According to EAU Guideline recommendations, 77 questions were prepared. 64 (83.1%) of the questions were answered completely correctly. There were no completely wrong answers in both frequently asked questions and questions adapted from the EAU Guidelines. Reproducibility of the questions was 100%.

Conclusion: Our study confirms that ChatGPT is a reliable source for kidney transplantation. We think that it will be a platform that both patients and their relatives and healthcare professionals can frequently refer to in the future.

Keywords: kidney transplantation, artificial intelligence, ChatGPT

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INTRODUCTION

End-stage renal failure patients and kidney donors are worried, fearful and curious about kidney transplantation. They research their questions on the internet and social media before meeting with the transplant team (1). Social media (Youtube, Facebook, Instagram, Twitter, etc.) and artificial intelligence (AI) applications that have become popular in recent years are the first sources that come to mind in this regard (2)defined as interactive Web applications, have been on the rise globally, particularly among adults. The objective of this study was to investigate the trend of the literature related to the most used social network worldwide (i.e. Facebook, Twitter, LinkedIn, Snapchat, and Instagram.

ChatGPT is an AI-supported language model developed by OpenAI. It is based on a large text data set that allows to provide information on a wide range of topics and enable multilingual communication (3)primarily caused by non-urgent cases overwhelming the system, have spurred a critical necessity for innovative solutions that can effectively differentiate genuine emergencies from situations that could be managed through alternative means, such as using AI chatbots. This study aims to evaluate and compare the accuracy in differentiating between a medical emergency and a non-emergency of three of the most popular AI chatbots at the moment. Methods In this study, patient questions from the online forum r/AskDocs on Reddit were collected to determine whether their clinical cases were emergencies. A total of 176 questions were reviewed by the authors, with 75 deemed emergencies and 101 non-emergencies. These questions were then posed to AI chatbots, including ChatGPT, Google Bard, and Microsoft Bing AI, with their responses evaluated against each other and the authors' responses. A criteria-based system categorized the AI chatbot answers as \"yes,\" \"no,\" or \"cannot determine.\" The performance of each AI chatbot was compared in both emergency and non-emergency cases, and statistical analysis was conducted to assess the significance of differences in their performance. Results In general, AI chatbots considered around 12-15% more cases to be an emergency than reviewers, while they considered a very low number of cases as non-emergency compared to reviewers (around 35% fewer cases. The increasing use of ChatGPT has been tested on health issues and its success has been demonstrated by many studies (4–6)hospitals, and social media about prostate cancer and BPH were evaluated. Also, strong recommendation-level data were noted in the recommendations tables of the European Urology Association (EAU).

Although it has been the subject of many studies in the medical field, ChatGPT has not been previously evaluated in kidney transplantation. In this study, we aimed to evaluate the adequacy of ChatGPT's answers to questions related to kidney transplantation.

MATERIAL AND METHODS

Patients' frequently asked questions about kidney transplantation on health forums, websites and social media (YouTube, Instagram, Twitter) were analyzed. Only questions in English were included in the study. We also analyzed the recommendation tables of the Kidney Transplantation section of the 2024 European Association of Urology (EAU) Guidelines (7). Those with a strong recommendation level were translated into a question form and categorized under the topic heading in the guideline. All questions were asked in English in ChatGPT version 4o. The answers generated by the AI were noted. All questions were asked twice at different times during the day to assess reproducibility of answers.

The answers were reviewed by 3 urologists experienced in kidney transplantation. The reviewers scored the answers compared to how they would have answered if asked this question by a patient. Responses were scored by each reviewer on a scale of 1-4.

4: Correct and adequate answer (no further information to add)

3: Correct answer but insufficient (more detailed explanation required)

2: Accurate and misleading information in one

1: Wrong or irrelevant answer

For questions where not all raters gave the same score, the median score was recorded. The agreement analysis between raters was also subjected to statistical analysis to assess the responses to the ChatGPT. Repeatability was defined as the consistency of the answers given to the same question at different times. Responses generated at different times were considered reproducible if they received the same score. Exclusion criteria were repetitive questions with similar

meanings, questions that did not comply with language rules, non-medical questions, cost-related questions, and questions about transplantation that were not considered ethical. Ethics committee approval was not required since patient data were not used in the study.

Statistical Analysis

Excel version 16.0 (Microsoft Corp.; Washington, USA) was used for statistical analyses. The scores of the responses were expressed as n (%). Reproducibility of responses was expressed as %. Inter-rater agreement was analyzed using K statistics. Landis and Koch's classification system was used to interpret Fleiss' Kappa coefficient: 0.0-0.20: Poor agreement, 0.21-0.40: Low agreement, 0.41-0.60: Moderate agreement, 0.61-0.80: High agreement, 0.81-1.00: Excellent agreement. The analysis was performed using R software. For this purpose, the categorical responses given by the evaluators for each evaluation topic were organized in a data matrix and Fleiss's Kappa coefficient was calculated using the irr package. The results of the analysis were interpreted to assess whether there was significant agreement between the raters.

RESULTS

The flowchart of the questions included in the study is shown in Figure 1. Of the 126 questions evaluated, 61 were excluded from the study after the exclusion criteria. Answers to 65 questions were included in the study (Table 1). Of the answers, 57 (87.6%) were correct and adequate, 7 (10.7%) were correct but inadequate, and 1 (1.5%) was a combination of correct and misleading information. No question was answered incorrectly.

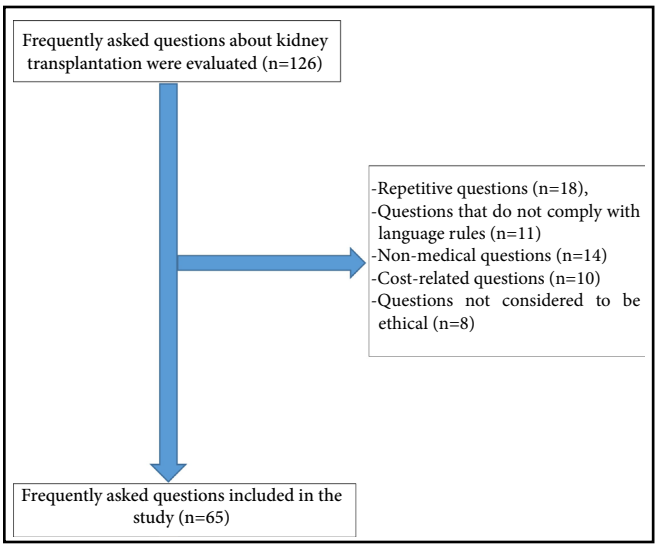

Figure 1. Flowchart of the questions in the study

According to EAU Guideline recommendations, 77 questions were prepared (Table 2). 64 (83.1%) of the questions were answered completely correctly. Nine (11.6%) questions received 3 points and 4 (5.1%) questions received 2 points. Similar to the frequently asked questions, there were no completely wrong answers in the guideline recommendations. Inter-rater agreement was generally good ($\mathcal{K}$ = 0.84), 95% CI: 0.65-0.93), with only 18 questions with inter-rater disagreement. Inter-rater agreement was excellent for all three ($\mathcal{K}$ > 0.92).

The reproducibility and similarity rate of the answers to the questions was 100% for both the frequently asked questions and the questions prepared according to the EAU Guideline recommendations.

Table 1. Frequently Asked Questions About Kidney Transplantation

		4 Points	3 Points	2 Points	1 Point
1.	What is a kidney transplant?	*			
2.	Who can get a kidney transplant?	*			
3.	Why is a kidney transplant necessary?	*			
4.	How is kidney transplant surgery performed?	*			
5.	Where to get a kidney for transplantation?	*			
6.	What is a living donor?	*			
7.	What is a cadaver donor?	*			
8.	Is it safe to be a donor?	*			
9.	Is there an age limit to become a donor?	*			

10.	Who can be a kidney donor?	*			
11.	Is kidney transplantation risky?	*			
12.	What are the risks of kidney transplant surgery?	*			
13.	What happens if the transplanted kidney is rejected?		*		
14.	How to prevent organ rejection after transplantation?	*			
15.	What are immunosuppressive drugs?	*			
16.	Do these drugs have side effects?	*			
17.	How long will I need to take medication after the transplant?	*			
18.	What will change in my lifestyle after transplantation?	*			
19.	When can I return to work after transplantation?	*			
20.	What should my diet be after kidney transplantation?	*			
21.	How long will I recover after transplantation?	*			
22.	How long does kidney transplant surgery take?	*			
23.	Is there pain after a kidney transplant?	*			
24.	Is there a risk of infection after transplantation?	*			
25.	How do I know if the kidney was rejected after transplantation?	*			
26.	Are regular check-ups necessary after kidney transplantation?	*			
27.	How many years will I live after transplantation?	*			
28.	How long does the kidney function after transplantation?		*		
29.	Can a kidney transplant recipient play sports?	*			
30.	Do smoking and alcohol affect kidney transplantation?	*			
31.	Is it possible to get pregnant after a kidney transplant?	*			
32.	How will my sex life be affected after transplantation?	*			
33.	Can a kidney transplant recipient have dental treatment?	*			
34.	Do allergic reactions affect kidney transplantation?	*			
35.	Can I travel after transplant?	*			
36.	What happens if the kidney transplant fails?	*			
37.	Can a kidney transplant be repeated?	*			
38.	Can a kidney transplant be performed in emergencies?		*		
39.	How important is tissue matching in kidney transplantation?		*		
40.	What happens if tissue compatibility is not achieved?	*			
41.	How long is the waiting period for a kidney transplant?		*		
42.	How to get on the waiting list?	*			
43.	What happens if a living donor cannot be found?	*			
44.	How is organ donation done?	*			
45.	What should I pay attention to after kidney transplantation?	*			
46.	Which vaccinations should I get after a kidney transplant?	*			
47.	In which cases should I consult a doctor after kidney transplantation?	*			
48.	Are chronic diseases affected after kidney transplantation?	*			

49.	Does diabetes affect kidney transplantation?	*			
50.	Does hypertension affect kidney transplantation?	*			
51.	Can kidney transplantation be performed on children?	*			
52.	Can kidney transplantation be performed in the elderly?	*			
53.	Can HIV positive patients receive a kidney transplant?	*			
54.	Does blood group incompatibility prevent kidney transplantation?	*			
55.	Are medications used for life after kidney transplantation?	*			
56.	Which medications are not used after transplantation?		*		
57.	How much water should I drink after kidney transplantation?	*			
58.	Which foods should I avoid after transplantation?	*			
59.	Is psychological support important during kidney transplantation?	*			
60.	Does stress affect the kidney after kidney transplantation?	*			
61.	What about sleep patterns after kidney transplantation?		*		
62.	Can I work after a kidney transplant?	*			
63.	Will my kidneys recover completely after transplantation?			*	
64.	How is the immune system affected after a kidney transplant?	*			
65.	Can a person with cancer have a kidney transplant?	*			

Table 2. Questions Related to the European Association of Urology (EAU) Guideline Recommendations

Organ retrieval and transplantation surgery		4 Points	3 Points	2 Points	1 Point
1.	Which technique should be preferred for living donor nephrectomy?	*			
2.	Which technique can be used for living donor nephrectomy in centers where endoscopic methods are not accessible?	*			
3.	When can laparo-endoscopic single site (LESS) surgery, robotic and natural orifice transluminal endoscopic surgery-assisted (NOTES) living-donor nephrectomy be preferred?	*			
Organ preservation					
4.	In which solutions can a donor kidney be stored for cold storage?	*			
5.	Where should the donor kidney be stored if the University of Wisconsin or histidine tryptophan ketoglutarate preservation solutions for cold storage are not available?	*			
Methods of kidney preservation: static and dynamic reservation					
6.	Is the duration of ischemia important and how should it be?	*			
7.	What should be done to reduce delayed graft function in cadaveric donor kidneys?	*			
8.	Can hypothermic machine perfusion (HMP) be performed in cadaveric donor kidneys with standard criteria?	*			
9.	What should be the pressure level in HMP maintenance?		*		
10.	Should HMP be intermittent or continuous and is pressure or flow more important in HMP?			*	
Donor Kidney Biopsies					
11.	Is the decision to accept a donor kidney based only on histology? Are there other important parameters?	*			

12.	Should paraffin histology or frozen sections be used for histomorphology in donor kidney biopsy?	*			
13.	Who should evaluate procurement biopsies?			*	
Peri-operative antibiotics in renal transplant					
14.	Should perioperative antibiotic prophylaxis in kidney transplant recipients be in multiple doses or single doses?	*			
Specific fluid regimes during renal transplantation					
15.	How should pre-, intra- and postoperative hydration be adjusted to improve kidney transplant function?	*			
16.	How should intraoperative hydration be managed to reduce rates of delayed graft function and optimize early graft function?	*			
Surgical approaches for first, second, third and further transplants					
- Single kidney transplant – living and deceased donors					
17.	What should be done before starting immunosuppression and anesthesia for cadaveric kidney transplantation?	*			
18.	What should be considered in the donor and recipient arteries before starting arterial anastamosis?		*		
19.	How should the preoperative surgical approach be planned for third or subsequent transplants?	*			
Ureteric implantation in normal urinary trac					
20.	Which ureteral anastamosis should be preferred in kidney transplant recipients with normal urologic anatomy?	*			
21.	Which type of anastamosis can be used especially in very short or poorly vascularized transplant ureters?		*		
22.	Should a transplant ureteric stent be used and is it beneficial?	*			
23.	Is the surgical principle different in double ureters and how can anastamosis be performed?	*			
Donor complications					
24.	In which centers should living donor nephrectomies be performed?	*			
25.	How long should kidney donors be followed up?	*			
Arterial thrombosis					
26.	What should be done when graft thrombosis is suspected?	*			
27.	What should be done if ultrasonography shows poor graft perfusion?		*		
28.	Non viable greft varlığında ne yapılmalıdır?	*			
Venous thrombosis					
29.	What should be done when graft thrombosis is suspected?	*			
30.	Should pharmacologic prophylaxis be routinely used to prevent transplant renal vein thrombosis?		*		
Transplant renal artery stenosis					
31.	Which test should be performed primarily for the detection of arterial stenosis and what are the other diagnostic methods in case of doubt?	*			
32.	What should be the first-line treatment of arterial stenosis in the transplanted kidney?		*		
33.	What should be done in case of recent transplantation, multiple, long and narrow stenoses or failure of angioplasty?	*			

Arteriovenous fistulae and pseudo-aneurysms after renal biopsy					
34.	Which test should be performed if arteriovenous fistula or pseudoaneurysm is suspected?	*			
35.	What should be the first-line treatment for symptomatic arteriovenous fistula or pseudoaneurysm?		*		
Lymphocele					
36.	What is the primary treatment of large and symptomatic lymphocele?	*			
37.	What should be done if percutaneous treatments fail?	*			
Urinary leak					
38.	How should urine leakage be managed in kidney transplantation?		*		
39.	What should be done when conservative treatment fails?	*			
Ureteral stenosis					
40.	In the case of ureteral stricture, what should be done to diagnose stricture by both renal decompression and antegrade pyelogram?	*			
41.	How should strictures < 3 cm in length be managed?	*			
42.	What is the primary treatment for late recurrent and/or strictures longer than 3 cm?	*			
Kidney stones					
43.	Should causes of urolithiasis be evaluated in a kidney transplant recipient?	*			
44.	How should stone-induced ureteral obstruction be treated?	*			
45.	Which treatment methods should be used for stones smaller than 15 mm?	*			
Malignancy after renal transplantation					
46.	Should the presence of a transplant kidney in the pelvis and the possibility of subsequent transplants be considered when planning treatment for prostate cancer?	*			
47.	Which centers should kidney transplant patients with prostate cancer be referred to?	*			
Matching of donors and recipients					
48.	Should ABO blood group and human leukocyte antigen (HLA) A, B, C and DR phenotypes be determined for all kidney transplant candidates?	*			
49.	Should the donor and recipient be tested for HLA DQ and can susceptible patients be tested for HLA DP?	*			
50.	Should comprehensive HLA testing be performed before transplantation?	*			
51.	Should cross-match testing be performed before each kidney and combined kidney/pancreas transplantation to prevent hyperacute rejection?	*			
General immunosuppression after kidney transplantation					
52.	Which drugs should be used for first rejection prophylaxis?	*			
Calcineurin inhibitors					
53.	Should calcineurin inhibitors be used in rejection prophylaxis?	*			
54.	Which drug should be preferred as a first-line calcineurin inhibitor?	*			
55.	What should be done to ensure appropriate dose adjustment of calcineurin inhibitors?	*			
Mycophenolates					
56.	Should mycophenolate be administered as part of an initial immunosuppressive regimen?	*			

Steroids					
57.	Should steroid therapy be part of immunosuppression in the perioperative and early posttransplant period?	*			
Inhibitors of the mammalian target of rapamycin (m-TOR)					
58.	What should be the calcineurin inhibitor dose in combination regimen with m-TOR inhibitors to prevent nephrotoxicity?	*			
59.	Can m-TOR inhibitors be used in patients with proteinuria and poor renal function?	*			
60.	What should be done to ensure appropriate dose adjustment of sirolimus and everolimus?	*			
Immunological complications					
61.	How long should transplant recipients be monitored after transplantation for acute rejection?	*			
62.	What should be the follow-up to detect graft dysfunction during hospitalization?	*			
63.	How to exclude other causes of graft dysfunction in suspected acute rejection and which tests should be performed first?	*			
64.	According to which criteria should renal biopsy be graded in patients with suspected acute rejection episodes?	*			
65.	When can 'blind' steroid bolus therapy be administered when immunologic complications are suspected after kidney transplantation?			*	
66.	Should patients with acute rejection be tested for anti-HLA antibodies against grafts, and if so, what should be the timing?	*			
67.	How should patients be evaluated, especially in late rejection?	*			
Hyper-acute rejection					
68.	Is adequate ABO blood group and HLA matching in donors and recipients important in preventing hyperacute rejection?	*			
Treatment of T-cell mediated acute rejection					
69.	What should be the first-line treatment of T-cell mediated rejection?			*	
70.	Which agents can be used in severe or steroid-resistant T-cell mediated rejection?	*			
Treatment of antibody mediated rejection					
71.	Should treatment of antibody-mediated rejection include antibody elimination?	*			
Follow-up after transplantation					
72.	How often, how long in total and by whom should post-transplant follow-up be performed?		*		
73.	What advice should be given to patients during follow-up?	*			
74.	Which parameters should be evaluated during post-transplant follow-up? What should be done in case of abnormalities in these parameters?	*			
75.	In case of graft dysfunction, what tests should be performed to rule out obstruction and renal artery stenosis?	*			
76.	What should be done in patients on calcineurin inhibitor therapy and/or with interstitial fibrosis and tubular atrophy with histologic findings suggestive of calcineurin inhibitor toxicity (e.g. arteriolar hyalinosis, striated fibrosis)?	*			
77.	Should the treatment of diseases such as hypertension, diabetes, proteinuria, cardiac risk factors encountered in post-transplant follow-up be initiated appropriately according to current guidelines?	*			

DISCUSSION

Social media has come to the forefront as the place where people primarily turn to for information, especially in recent years (8). It has been shown in the literature that there is a lot of misinformation and misdirection, product marketing as well as accurate information accessible on YouTube, Instagram and TikTok. It is also noteworthy that people without medical training easily publish content on these platforms (9).

As AI has become popular in many areas of life, it is becoming more and more prominent in the field of health. ChatGPT is an AI model developed by OpenAI. Many studies have investigated to what extent ChatGPT accurately answers the questions that patients are curious about (6). Caglar et al. found that ChatGPT gave satisfactorily accurate answers in the field of andrology and benign prostatic hyperplasia (4,5). Samaan et al. demonstrated the program's superior success on questions related to bariatric surgery. In these studies, the model provided approximately 90% correct answers to the questions (10). Although there are many studies showing the success of ChatGPT on urological diseases, this deficiency continues in the literature on kidney transplantation. In our study, we tested the accuracy and reliability of ChatGPT in answering questions related to kidney transplantation.

ChatGPT answers questions with information based on previously published articles and books. This suggests that ChatGPT provides quality, accurate information more frequently than other social media platforms (11). In their new study, Mankowski et al. tested how ChatGPT can be used in kidney transplantation by comparing it with human participants. They posed 12 multiple-choice questions about kidney transplantation on the American Society of Nephrology fellowship exam to ChatGPT versions 3.5, 4, 4 Visual (4 V) and nephrology residents and nephrology fellowship program directors. According to the results of the study, the 4V version performed as well as nephrology residents and training program directors (Mankowski et al. 2024). This result shows that ChatGPT is a promising tool that can help experts in kidney transplantation(12). Our study showed that 87.6% of the answers given by ChatGPT were correct. The ability of AI software to access the literature and its capacity to continuously improve itself are among the important factors in the high rate of correct answers.

Our results showed that ChatGPT provided a high percentage of correct answers to questions adapted from the EAU Guidelines and frequently asked by patients. It was remarkable that it gave correct answers even to a text as dense and high quality information as the EAU Guidelines. Kung et al. demonstrated that the model can pass a serious exam such as the United States Medical Licensing Exam (USMLE) (13). In 2024, a meta-analysis of 45 studies also revealed the high success of ChatGPT in medical licensing exams. Another important result in the meta-analysis was that ChatGPT surpassed the average score of medical students (14).

Reproducibility is an issue to be considered in AI-supported programs. Yeo et al. showed that ChatGPT's answers to frequently asked questions about hepatocellular carcinoma were about 90% reproducible (15). High reproducibility was also observed in the answers to questions asked in the field of andrology. In addition, the answers were in an easy-to-understand language (5). Our results showed that ChatGPT's answers to questions related to kidney transplantation were reproducible.

The limitations of our study include the fact that ChatGPT has no experience in examining individual patients and therefore cannot determine subjective procedures related to patients, the questions asked may not cover all topics related to kidney transplantation, and the questions were asked only in English. Although the answers were evaluated by a team experienced in transplantation, it is obvious that some of the answers may contain differences on an individual basis. We tried to minimize these differences by working with more than one experienced expert.

CONCLUSION

Our study confirms that ChatGPT is a reliable and preferable resource for kidney transplantation. The evolving structure of AI can be used in patient consultations in the future, as well as becoming an auxiliary control mechanism for experts. With its ever-evolving structure, we think that it will be a platform that both patients and their relatives and healthcare professionals can frequently refer in the future.

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RESEARCH ARTICLE

Effects of Different Urinary Catheterization Practices on Urinary Complications and Quality of Life

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Abstract

Objective: This study investigates the effects of different urinary catheterization methods—transurethral catheterization (TC), suprapubic catheterization (SC), and clean intermittent catheterization (CIC)—on urinary complications and quality of life.

Material and Methods: This research conducted as a descriptive design with 91 patients at a urology clinic in Istanbul between November 2023 and September 2024, the research evaluates catheterization-related complications and their impact on patients' emotional, social, and physical well-being over a six-month period. Data collection utilized the Patient Information Form and the King's Quality of Life Questionnaire.

Results: Indicate that while all methods present complications such as urinary tract infections (UTIs), urgency, and hematuria, CIC and SC showed significant reductions in UTI rates over time ($p=0.001$ and $p=0.042$, respectively). CIC also resulted in fewer cases of hematuria compared to other methods ($p=0.039$). In terms of quality of life, SC demonstrated improvements in emotional and social domains over six months, whereas CIC offered enhanced autonomy and better physical health outcomes. Transurethral catheterization, despite its widespread use, was associated with higher complication rates, particularly UTIs.

Conclusion: The findings underscore the importance of individualized catheterization decisions as based on multidisciplinary team approach and emphasize the critical role of nursing in following patient outcomes. Comprehensive patient education and adherence to hygiene protocols were instrumental in reducing complications and enhancing quality of life. Future studies should explore the long-term implications of these catheterization methods and further assess the role of nursing interventions in improving patient care.

Keywords: clean intermittent catheterization, transuretral catheterization, suprapubic cystostomy, complications, quality of life

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INTRODUCTION

Urinary catheterization is the process of draining urine stored in the bladder using a catheter (1). Urinary catheterization is performed in two different ways, transurethral permanent catheterization and clean intermittent catheterization, depending on the purpose of use and the needs of the patient (2). Transurethral indwelling catheterization is one of the most frequently performed procedures in hospitals, as it is performed in approximately 25% of hospitalized patients (3). Clean intermittent catheterization (CIC) is a preferred method for emptying the bladder instead of long-term indwelling catheterization in patients who develop bladder dysfunction due to various reasons (1, 4)

Indwelling catheterization is applied to the bladder via the urethral or suprapubic route. The application of the catheter to the bladder via the urethral route is called urinary catheterization (bladder catheterization). Suprapubic catheterization is usually preferred after bladder, urethral surgery, pelvic surgery or genitourinary trauma. Suprapubic catheterization has some advantages over urinary catheterization, such as increasing the individual's independence, facilitating participation in sexual activities, and reducing the risk of some complications such as epididymitis (5, 6). (CIC) is considered a safe and effective catheterization method that supports the independence of the individual's bladder function, reduces the negative impact on daily life activities, and results in improvements in the individual's body image, self-confidence, and quality of life (5, 7). While the decision to apply or remove a urinary catheter is made by the physician, clinical nurses are responsible for the application, removal and routine care of the catheter (8). In CIC practices, nurses have an important role in teaching and providing the patient/caregiver with catheterization skills during the hospital/home care process (4, 7).

Correct catheter application, care and catheterization training play a fundamental role in eliminating these problems that negatively affect the patient's quality of life and motivation to comply with treatment (5). When the literature was reviewed, no study was found that examined the effects of different urinary catheterization practices on urinary complications and quality of life. This study was conducted to examine the effects of different urinary catheterization practices on urinary complications and quality of life.

MATERIAL AND MEDHODS

Design of Study

This study was conducted as a descriptive and correlational research to investigate the effects of different urinary catheterization practices on urinary complications and quality of life.

The study was conducted with 91 patients who applied to the urology clinic of a city hospital in Istanbul between November 2023 and September 2024, who were applied transurethral catheter or suprapubic catheter and applied clean intermittent catheterization. The study was approved by the ethics committee (258/2023). Written informed consent was obtained from each patient and the study was designed in accordance with the Declaration of Helsinki.

The study included patients aged 18 years and over, who were applied indwelling transurethral catheter or suprapubic catheterization for the first time due to urinary retention, and who had just started clean intermittent catheterization. Patients who were hospitalized for other reasons and who had upper extremity coordination disorders that would prevent them from performing CIC were not included in the study.

Data Collection Forms

Data were collected using the Patient Information Form and the King's Quality of Life Questionnaire.

Patient Information Form: This form was prepared by the researcher in light of the literature to determine the factors affecting the patients' catheterization-related problems (4). The Patient Information Form consisted of two sections including questions aimed at determining individual characteristics and characteristics that may affect the application. The first section included questions aimed at determining the patient's age, gender, education level, marital status and chronic disease status, and the second section included questions aimed at determining the type of catheterization applied, the number of times CIC will be applied per day, the type of catheter used, the need for assistance from others in daily life and complications associated with catheterization.

King's Quality of Life Questionnaire: The adaptation study of the questionnaire developed in 1997 at the King's College Hospital (London) (9) to the Turkish society was carried

out by Akkoç et al. (10). It consists of 21 questions and 8 sections that question general health perception, the effect of urination complaints on the patient's life, daily life activities, social and private life restrictions, mood, sleep patterns and behaviors related to urinary incontinence. However, there is also a section that questions the patient's symptoms related to urinary voiding. With this question, the effect and severity of bladder problems on the patients are questioned under subheadings. These are; pollakiuria, nocturia, sudden urge, sudden urge incontinence, stress incontinence, nocturnal enuresis, incontinence during sexual intercourse, frequent urinary tract infection and pain in the bladder. All questions are evaluated out of 4 points. The lowest score that can be obtained from the questionnaire is 0; the highest score is 100. A high score indicates a level of complaints that leads to greater deterioration in quality of life.

Implementation of the Research

Patients who underwent transurethral catheterization were monitored by the research physician by periodically changing the 16-18 Fr Foley catheter (20-30 days interval). CIC training was given to patients who started clean intermittent catheterization in a urodynamics room where CIC could be performed and where patient privacy was appropriate. The training lasted approximately 20 minutes and was given by the research physician and nurse, along with the verbal training included in routine practice and video-supported CIC training. The video prepared by the research nurse in accordance with the European Association of Urology Nurses (EAUN) Society of Urologic Nurses and Associates (SUNA) CIC practice guidelines was used.

Suprapubic cystostomy was performed under local anesthesia, under ultrasound guidance, using a percutaneous cystostomy catheter kit, with a catheter placement of 14-16fr at the time the bladder was optimally full (mean 300 ml). The suprapubic catheter was changed under local anesthesia at 20-30 days.

After the information, patients were asked to answer the Patient Information Form and King's Quality of Life Questionnaire. In the clinical routine, patients were asked to answer the Patient Information Form and King's Quality of Life Questionnaire at the 1st, 3rd and 6th month follow-ups when they came to the outpatient clinic for routine follow-up.

Statistical Analysis

All data were analyzed using SPSS 21.0 statistical software for Windows (SPSS, Chicago, IL, USA). Results are reported as mean ± SD. All continuous variables were checked with Kolmogorov-Smirnov normality test to show normality of distributions. Comparisons between groups were evaluated with independent sample t-test, Mann-Whitney U test, ANOVA test and chi-square test. Statistical significance was accepted as $p<0.05$.

For the sample analysis of the study, it was planned to include at least 29 patients in each group with 80% reliability and 5% margin of error, taking the satisfaction scores in the study conducted by Lavelle et al. as an example (11).

RESULTS

The research was conducted with 91 patients who applied to the Urology Clinic of a City Hospital. Of the patients included in the study, 30 had been applied transurethral catheterization (TC), 31 been applied suprapubic cystostomy (SC), and 30 applied when the characteristics of the patients included in the study were examined, the mean age was 53.14±9.80 years, 54.9% were male, the mean BMI was 25.01±4.65, 70.3% were married, 52.7% did not have a chronic disease and 67% did not need anyone's help in performing their daily living activities. No significant difference was found between the groups in terms of individual characteristics ($p>0.05$) (Table-1).

In the first month of follow-up, 31 patients had UTI, 22 had urgency, 29 had incontinence, 33 had hematuria, and 16 had urethral stricture. Of these complications, the frequency of UTI, urgency, incontinence, and hematuria decreased over time, while the frequency of urethral stricture increased. When the catheter-related complications of the patients were examined, it was found that the rate of urinary system infection in the sixth month in patients who underwent suprapubic catheterization and clean intermittent catheterization decreased statistically significantly compared to the first and third months ($p=0.042$ for SC and $p=0.001$ for CIC). On the other hand, the rate of hematuria in the third month was significantly lower in patients who underwent clean intermittent catheterization compared to the patients in the other group ($p=0.039$). No significant difference was observed between the groups in terms of other complications ($p>0.05$) (Table-2).

Table 1. Individual and Disease Characteristics of Patients (N=91)

Characteristics		Total (n=91)	Transurethral catheterization (n=30) n (%)	Suprapubic catheterization (n=31) n (%)	Clean intermittent catheterization (n=30) n (%)	p
Age		53.14±9.80	53.17±10.35	53.23±10.02	53.03±9.34	0.997
Gender	Female	41(45.1%)	13(43.3%)	14(45.2%)	14(46.7%)	0.068
	Male	50(54.9%)	17(56.7%)	17(54.8%)	16(53.3%)	
Height (cm)		169.12±8.93	169.37±9.36	168.90±8.83	169.10±8.94	0.980
Weight (kg)		70.96±10.34	72.23±10.92	70.32±10.08	70.33±10.25	0.756
BMI		25.01±4.65	25.38±4.78	24.87±4.70	24.78±459	0.868
Marital status	Married	64(70.3%)	23(76.7%)	21(67.7%)	20(66.7%)	0.399
	Single	27(29.7%)	7(23.3%)	10(32.3%)	10(33.3%)	
Educational Status	Primary	61(67%)	19(63.3%)	23(74.2%)	19(63.3%)	0.672
	High school	26(28.6%)	9(30%)	7(22.6%)	10(33.3%)	
	University	4(4.4%)	2(6.6%)	1(3.2%)	1(3.3%)	
Presence of chronic diseases	Yes	43(47.3%)	15(50%)	14(45.2%)	14(45.2%)	0.928
	No	48(52.7%)	15(50%)	17(54.8%)	16(52.7)	
Needing help from others in daily life	Yes	30(33%)	5(16.7%)	11(35.4%)	14(46.7%)	0.044
	No	61(67%)	25(83.3%)	20(64.5%)	16(53.3%)	

ANOVA test

Table 2. Comparison of Complications of Ctaheterization in Patients Between Groups

Complications	Group	First Month (1)* n(%)	Third Month (2)* n(%)	Sixth Month (3)* n(%)	p
Urinary System Infection	Transurethral catheterization	9(30%)	9(30%)	5(16.7%)	0.449
	Suprapubic catheterization	11(35.5%)	13(41.9%)	5(16.1%)	**0.042**
	Clean intermittent catheterization	13(43.3%)	11(36.7%)	2(6.7%)	**0.001**
		0.558	0.593	0.435	
Urgency	Transurethral catheterization	9(30%)	7(23.3%)	5(16.7%)	0.301
	Suprapubic catheterization	8(25.8%)	5(16.1%)	2(6.5%)	0.121
	Clean intermittent catheterization	5(16.7%)	4(13.3%)	2(6.7%)	0.467
		0.230	0.576	0.316	
Urinary Incontinence	Transurethral catheterization	7(76.7%)	8(26.7%)	5(16.7%)	0.671
	Suprapubic catheterization	11(35.5%)	12(38.7%)	8(25.8%)	0.322
	Clean intermittent catheterization	11(36.7%)	11(36.7%)	7(23.3%)	0.109
		0.470	0.571	0.673	
Hematuria	Transurethral catheterization	10(33.3%)	11(36.7%)	10(33.3%)	0.899
	Suprapubic catheterization	13(41.9%)	8(25.8%)	6(19.4%)	0.233
	Clean intermittent catheterization	10(33.3%)	4(13.3%)	6(20%)	0.344
		0.721	**0.039**	0.359	
Urethral Stricture	Transurethral catheterization	4(13.3%)	5(16.7%)	6(20%)	0.761
	Suprapubic catheterization	4(12.9%)	8(25.8%)	8(25.8%)	0.488
	Clean intermittent catheterization	8(26.7%)	10(33.3%)	8(26.7%)	0.812
		0.455	0.140	0.806	

Chi-square test

Table 3. Comparison of King Health Survey Mean Scores in Patients Between Groups

Survey	Group	First Month (1)*		Third Month (2)*		Third Month (3)*		p
		Mean	SD	Mean	SD	Mean	SD	
KHQ-General Health	Transurethral catheterization	34.17	20.218	39.17	19,35	33,33	23,057	0.808
	Suprapubic catheterization	37.90	23.158	36.29	25,69	34,68	22,058	0.762
	Clean intermittent catheterization	32.50	25.554	35.00	23,30	35,00	25,931	0.351
		0.646		0.772		0.959		
KHQ-Incontinence Impact	Transurethral catheterization	62.22	28.68	58.89	28,61	60,00	30,83	0.639
	Suprapubic catheterization	58.06	30.99	55.91	32,65	59,14	30,68	0.465
	Clean intermittent catheterization	55.56	33.14	61.11	29,14	60,00	30,83	0.322
		0.703		0.797		0.992		
KHQ-Role limitation	Transurethral catheterization	53.33	14.12	47.22	17,00	51,11	15,12	0.558
	Suprapubic catheterization	46.77	15.76	55.38	11,70	45,70	16,08	0.112
	Clean intermittent catheterization	52.78	14.57	48.33	16,58	51,11	14,47	0.235
		0.165		0.082		0.281		
KHQ-Physical Limitations	Transurethral catheterization	41.11	18.43	39.44	18,30	35,00	16,58	**0.014**
	Suprapubic catheterization	41.94	18.19	42.47	19.17	40.86	18.18	0.871
	Clean intermittent catheterization	41.11	15.62	42.22	18.94	38.89	18.22	0.371
		0.978		0.786		0.425		
KHQ-Social Limitations	Transurethral catheterization	51.85	16.85	54.07	17.92	51.85	18.76	0.432
	Suprapubic catheterization	54.12	17.86	49.46	16.44	56.99	19.40	**0.035**
	Clean intermittent catheterization	54.81	17.73	56.67	18.99	53.70	19.37	0.911
		0.790		0.282		0.572		
KHQ-Personal relationships	Transurethral catheterization	64.44	18.94	63.33	18.77	66.67	20.53	0.782
	Suprapubic catheterization	65.59	22.33	70.43	21.82	66.67	19.25	0.235
	Clean intermittent catheterization	65.56	21.41	66.11	20.29	68.33	21.15	0.554
		0.971		0.393		0.935		
KHQ-Emotions	Transurethral catheterization	34.81	12.96	32.96	13.52	35.19	13.71	0.399
	Suprapubic catheterization	35.84	13.67	39.43	13.10	31.54	11.86	**0.005**
	Clean intermittent catheterization	38.15	13.59	33.33	13.05	36.30	13.03	0.235
		0.617		0.105		0.324		
KHQ-Sleep/ Energy	Transurethral catheterization	55.56	19.25	50.00	20.06	50.56	17.77	0.771
	Suprapubic catheterization	48.39	15.73	54.84	16.21	45.16	15.03	0.132
	Clean intermittent catheterization	50.00	15.78	49.44	14.17	50.00	15.16	0.788
		0.232		0.396		0.354		
KHQ-Severity Measures	Transurethral catheterization	45.33	10.12	46.44	10.72	42.00	8.95	0.887
	Suprapubic catheterization	49.03	10.41	45.81	10.29	47.96	10.81	0.772
	Clean intermittent catheterization	46.23	10.32	46.30	10.63	44.69	10.35	0.556
		0.162		0.948		0.041		
KGQ-Symptom Severity Scale	Transurethral catheterization	15.20	2.02	15.50	2.047	15.73	1.856	0.988
	Suprapubic catheterization	15.35	1.98	14.77	1.892	15.52	1.913	0.799
	Clean intermittent catheterization	15.27	1.95	15.50	1.907	15.57	1.832	0.881
		0.954		0.248		0.894		

ANOVA test and dependent sample t-test

When the quality of life of the patients was compared, in the within-group evaluation of patients who underwent suprapubic catheterization, the mean KHQ-Emotional status sub-dimension scores at the 6th month were significantly lower compared to the first and third months (1st month=35.84±13.67, 3rd month=39.43±13.10, 6th month=31.54±11.86; p=0.005) (Table-3).

The mean KHQ symptom severity sub-dimension scores were significantly lower in patients who underwent transurethral catheterization compared to the patients in the other group at the sixth month (TC=42.00±8.95, SC=47.96±10.81, CIC=44.69±10.35; p=0.041) (Table-3).

DISCUSSION

This study explores how different urinary catheterization practices influence the incidence of urinary complications and their subsequent impact on patients' quality of life. At the end of the study, when the catheterization preferences of patients who needed urinary catheterization due to urinary retention were compared, it was seen that patients who used CIC and suprapubic cystostomy had less UTI and hematuria decreased over time in patients who used CIC. In addition, when their quality of life was compared, it was observed that the social and emotional quality of life of patients who used suprapubic cystostomy improved as the time of use progressed.

The choice of urinary catheterization method—transurethral catheterization (TC), suprapubic cystostomy (SC), or clean intermittent catheterization (CIC)—can significantly impact both urinary complications and the quality of life of patients (12). Each method presents unique advantages and disadvantages, influencing patient outcomes and experiences (13, 14).

Transurethral catheterization, while commonly used, has been associated with a range of complications, including urinary tract infections (UTIs), urgency, incontinence, and hematuria. According to a study, patients who underwent TC reported a higher incidence of UTIs and irritative urinary symptoms when compared to those using other catheterization methods (15). However, a systematic review suggest that while TC may initially present challenges, it may provide better symptom management over time for some patients, indicating a need for individualized assessments for catheter selection (16).

Suprapubic cystostomy has been demonstrated to decrease UTI rates significantly. A study by Krebs et al. (17) reported that patients with SC showed lower UTI rates and fewer complications compared to TC. Nonetheless, despite these benefits, emotional status scores were reported to decline for patients with SC, highlighting the necessity for comprehensive management strategies to address the psychological impact of this procedure (11, 18). This emphasizes the importance of emotional support and education about living with a suprapubic catheter in improving overall patient experience. In our study, it was determined that patients using SC and CIC had fewer UTIs over time. This situation is thought to be related to both the learning of SC catheter care under the supervision of a specialist nurse. In addition, SC is easy to use and, especially, it leads to improvements in quality of life because it is in a position that allows sexual intercourse.

Clean intermittent catheterization has emerged as a favorable option, particularly regarding reducing hematuria and UTI rates (16, 19). A study by Fumincelli et al. found that patients using CIC reported lower complication rates and better quality of life outcomes, especially in emotional and physical health domains (14). As indicated by a systematic review by Kinnear et al., CIC allows for greater autonomy and control over bladder management, which correlates with enhanced patient satisfaction and overall well-being (16). The results of our study showed that patients using CIC experienced fewer complications over time (especially UTI and hematuria). The decrease in complications can be explained by following the correct application steps under the supervision of a specialist nurse and paying attention to hygiene. The use of informational materials such as videos and brochures that aim to review the application steps for CIC use reduces complications related to CIC (4).

The role of nursing in urinary catheter management is critical to optimizing patient outcomes. According to a qualitative study, nurses are vital in educating patients about the different catheterization methods, their associated risks, and the importance of proper catheterization techniques (20). Nursing assessments and interventions play a significant role in monitoring for signs of infection or complications, providing timely interventions, and ensuring emotional support. By fostering a therapeutic relationship, nurses can help patients overcome the challenges of catheterization and

improve their quality of life (21).

Moreover, nursing interventions can significantly influence the quality of life for patients undergoing catheterization. Regular assessments and patient education on hygiene practices can mitigate the psychological burden associated with urinary complications (22). Nurses facilitate communication between patients and healthcare providers, ensuring that concerns are promptly addressed, which can further enhance satisfaction and quality of life.

There are some limitations to the study. The first of these is that the follow-up period was limited to six months. Longer follow-ups are needed to better evaluate the effects of catheterization methods on quality of life. Catheterization preferences were left to the patients' preference and not every patient tried all catheterization methods. Another limitation is that the applied catheter thickness was thicker in the TC group.

CONCLUSION

In conclusion, the choice of urinary catheterization method profoundly impacts urinary complications and patient quality of life. While TC, SC, and CIC each offer advantages and challenges, CIC appears to provide the best long-term outcomes regarding symptom management and patient autonomy. The nursing role is integral in this context, as effective nursing care has been shown to significantly reduce complications and enhance overall quality of life for patients. Continued research is essential to explore the long-term effects of these catheterization methods and the evolving role of nursing in improving patient outcomes.

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RESEARCH ARTICLE

Which Surgical Decompression Method to Choose for Acute Upper Urinary Obstruction Due to Stones? A Comparison of JJ Stenting and Percutaneous Nephrostomy

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Abstract

Objective: Acute upper urinary tract obstruction due to stones is treated with surgical decompression with percutaneous nephrostomy catheter (PNC) or retrograde ureteral stent (RUS). There is not enough data to show the superiority of these two treatments. In this study, we aimed to compare the two treatment approaches in terms of success and complications.

Material and Methods: Between January 2017 and January 2022, patients who underwent emergency JJ stent and emergency nephrostomy catheter insertion due to ureteral stones in a tertiary healthcare institution were retrospectively analyzed. Patients who underwent intervention for reasons other than ureteral stones, pregnant patients, patients under 18 years of age, patients with coagulopathy and patients with chronic renal failure were excluded. A total of 131 patients, including 112 patients in the JJ stent group and 19 patients in the nephrostomy group were included in the study.

Results: Statistically higher creatinine levels were found in the JJ stent group in the 12th hour post-treatment comparison (p=0.042). There was no difference between the groups in creatinine values at the 48th hour after treatment (p=0.579). The intraoperative complication rate was 14.3% in the JJ stent group, compared to 10.5% for the nephrostomy group. There was no statistically significant difference between the groups (p=0.660). Postoperative complication rates were statistically similar between the groups (p=0.490).

Conclusion: In cases where urgent surgical decompression is required, PNC or RUS placement are equally effective and reliable treatments for the management of the disease. There is no significant difference between the two treatment approaches in terms of complications.

Keywords: urinary obstruction, acute obstruction, renal colic, nephrostomy, jj catheter, ureter stone, hydronephrosis

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INTRODUCTION

In today's urology practice, acute upper urinary tract obstruction caused by stones and its management occupies a significant place. In the United States, more than one million emergency department visits annually are attributed to urinary stones (1). In Türkiye, urolithiasis remains a significant health issue, with a prevalence of 11.1%, and the lifetime incidence of at least one colic episode reported as 2.1% (2).

Ureteral stones are responsible for a substantial portion of cases involving acute upper urinary tract obstruction and the associated renal colic (3). Patients with acute upper urinary tract obstruction due to ureteral stones typically present with flank pain radiating to the groin, vomiting, and, less frequently, fever (4). The standard diagnostic modality is non-contrast computed tomography (CT) (5).

Acute upper urinary tract obstruction can lead to complications such as persistent pain, acute kidney injury (AKI), which is characterized by a sudden decline in kidney function indicated by an increase in serum creatinine or decreased urine output, and, if untreated, renal failure. If obstruction is accompanied by infection, it may progress to urosepsis and septic shock, a life-threatening condition caused by an unregulated host response to infection, which carries a high mortality risk (6).

Although conservative management may be an option in certain cases of acute upper urinary tract obstruction due to stones, surgical decompression is performed via percutaneous nephrostomy catheter (PNC) or retrograde ureteral stenting (RUS) (7). However, there is insufficient data to determine the superiority of one approach over the other in terms of success rates and complications (8,9).

In this current study, we aimed to compare these two treatment modalities in terms of success and complication rates. In addition,we hope to gather more definitive evidence on the management of cases involving acute kidney injury, refractory colic, and urosepsis treated with surgical decompression.

MATERIAL AND METHODS

Between January 2017 and January 2022, patients who underwent emergency JJ stent and emergency nephrostomy catheter insertion due to ureteral stones in a tertiary healthcare institution were retrospectively analyzed. The study was approved by Ethical Board (Meeting Decision No:112-2022). Patients who underwent intervention for reasons other than ureteral stones, pregnant patients, patients under 18 years of age, patients with coagulopathy and patients with chronic renal failure were excluded from the study. A total of 131 patients, including 112 patients in the JJ stent group and 19 patients in the nephrostomy group, were included in the study.

The preoperative demographic data of the patients, stone characteristics, emergency intervention indications and laboratory values were recorded. Operation data, postoperative follow-up results, perioperative complications and postoperative complications were evaluated. Postoperative creatine follow-ups were noted.

Surgical Technique

The procedure was performed in the lithotomy position under sedo-analgesia in patients who underwent JJ stent placement. After entering the bladder with the 8Fr ureterorenoscope, a guide-wire was sent to the obstructed ureter. After imaging the pelvicalyceal system with opaque material, the JJ stent was placed in the renal pelvis over the guide-wire under fluoroscopy. In cases where the guide-wire or JJ stent did not pass proximal due to stone, the ureter was entered with the ureterorenoscope, and the guide-wire was sent from the stone edge. The operation period for JJ stenting includes the time from initial ureterorenoscopic access to successful stent placement and verification under fluoroscopy.

Nephrostomy catheter placement procedure was performed by interventional radiologists. In the prone position, under sedo-analgesia, the pelvicalyceal system was entered with an accessory needle under the guidance of USG. The pelvicalyceal system was visualized under fluoroscopy with opaque material. After re-accessing the appropriate calyx, a 14Fr nephrostomy catheter was placed with serial dilatations. The location was checked with fluoroscopy. The operation period for nephrostomy catheter placement includes the time from initial percutaneous puncture to proper catheter positioning and confirmation under fluoroscopy.

Statistically Analysis

The Statistical Package for the Social Sciences version 25 (SPSS IBM Corp., Armonk, NY, USA) program was used. Normality of distribution of the variables was checked by Shapiro-Wilk test. Independent student t test was used for comparison of the normally distributed variable between the groups, and Mann Whitney u test was used for non-normally distributed data. Quantitative data are given as mean ± standard deviation values. Categorical variables were grouped and compared using the $\chi 2$ test or Fisher's exact test. Creatinine change graph was generated by repeated measures ANOVA test. The data were analyzed at a 95% confidence level, and a P value of less than 0.05 was accepted as statistically significant.

RESULTS

The demographic data and kidney stone characteristics of the patients included in the study were compared in Table 1. The mean age was 48.1 years in the JJ stent group and 45.8 years in the nephrostomy group (p=0.565). Gender, BMI, previous stone surgery, and grades of hydronephrosis were statistically similar between the groups (p=0.574, 0.081, 0.147 and 0.104, respectively). The mean stone size was 8.9±4.4 in the JJ stent group and 9.6±3.1 in the nephrostomy group, and there was no statistical difference between the groups (0.492). The stone localizations were evaluated as anatomically distal, mid and proximal ureter, and no statistical difference was found in the comparison between the groups (p=0.299). Thirteen patients in the first group and 1 patient in the second group had solitary kidneys (0.691). The reasons requiring intervention were similar between the groups (0.073).

Table 1. Comparison of demographic data between groups

	JJ stent (n=112)	Nephrostomy (n=19)	P value
Age (years)*	48.1±15.9	45.8±16.9	0.565[a]
Sex (Male/Female)	63/49	12/7	0.574[b]
BMI (kg/m^2) *	27.8±3.4	26.3±4.3	0.081[a]
Previous stone surgery	29 (25.9%)	8 (42.1%)	0.147[b]
Grade of hydronephrosis			0.104[b]
Grade 1	31 (27.7%)	3 (15.8%)	
Grade 2	70 (62.5%)	11 (57.9%)	
Grade 3-4	11 (9.8%)	5 (26.3%)	
Stone size (mm)*	8.9±4.4	9.6±3.1	0.492[a]
Stone localization			0.760[b]
Distal	57 (50.9%)	6 (31.6%)	
Mid	23 (20.5%)	5 (26.3%)	
Proximal	32 (28.6%)	8 (42.1%)	
Solitary kidney	13 (11.6%)	1 (5.3%)	0.691[b]
Side			0.155[b]
Right	51 (45.5%)	7 (36.8%)	
Left	53 (47.3%)	8 (42.1%)	
Bilateral	8 (7.2%)	4 (21.1%)	
Reason			0.073[b]
Renal colic	49 (43.8%)	3 (15.8%)	
Acute kidney injury	34 (30.3)	9 (47.4%)	
Infection/Sepsis	29 (25.9%)	7 (36.8%)	

*mean±standard deviation, BMI: Body Mass Index

[a]: Independent student t test, [b]: $\chi 2$ test

The mean creatinine levels before treatment were found to be similar between the groups (p=0.345). Statistically higher creatinine levels were found in the jj stent group in the 12th hour post-treatment comparison (p=0.042). There was no difference between the groups in creatinine values at the 48th hour after treatment (p=0.579). Pretreatment WBC and pretreatment CRP values were similar between the groups (p>0.05). The mean procedure time for JJ stent insertion was significantly longer than the mean time for nephrostomy application (17.9±4.6 min and 13.7±3.7 min, p=0.001). The duration of fluoroscopy was similar between the groups. The length of hospital stay was statistically significantly longer in the nephrostomy group (p=0.001) (Table 2). The changes in creatinine values before the treatment and at the 12th and 24th hours after the treatment are shown in figure 1.

Intraoperative complications, postoperative complications and final treatment modalities are shown in Table 3. The intraoperative complication rate was 14.3% in the JJ stent group, compared to 10.5% for the nephrostomy group. There was no statistically significant difference between the groups (p=0.660). Postoperative complications were classified as pain, fever, sepsis, and hematuria. Postoperative complication rates were statistically similar between the groups (p=0.490). The procedure was unsuccessful in 9 patients (8.0%) in the JJ stent group and 1 patient (5.3%) in the nephrostomy group (p=1.000). The number of patients who received eswl and urs as the final treatment was statistically similar between the two groups (p=1.000). The mean time between the emergency admission and the last treatment was found to be statistically longer in the nephrostomy group compared to the jj stent group (37.6 days and 23.3 days, respectively) (p=0.019).

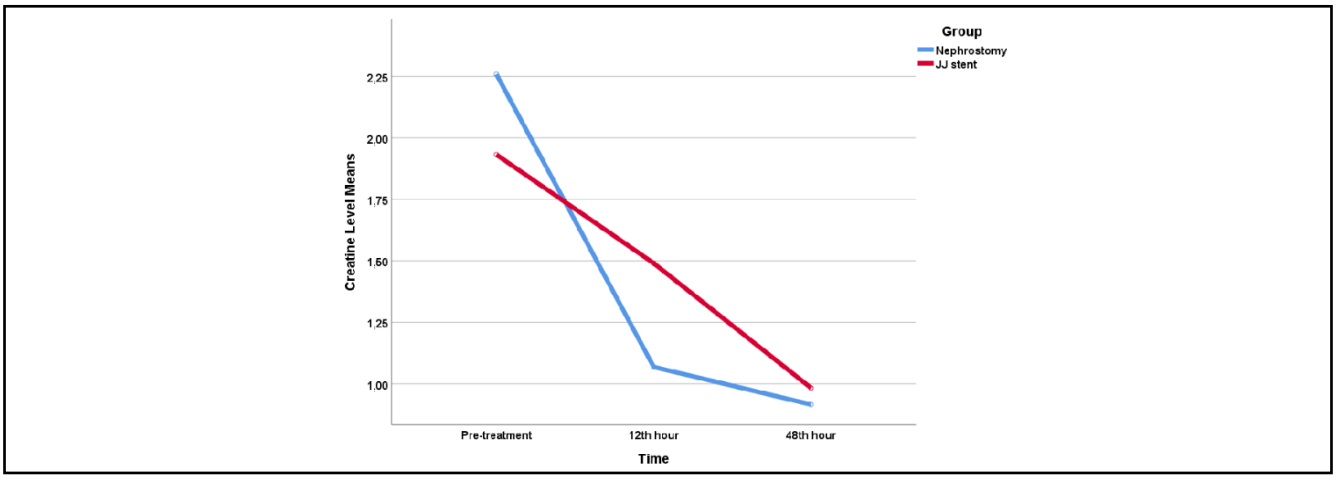

Figure 1. Graph of change of creatinine values before and after treatment

Table 2. Comparison of preoperative and postoperative laboratory values and operation data.

	JJ stent (n=112)	Nephrostomy (n=19)	P value
Creatine level			
Before Treatment	1.9±1.3	2.2±1.6	0.345[c]
Posttreatment 12[th] hour	1.5±1.1	1.1±0.6	***0.042***[c]
Posttreatment 48[th] hour	1.0±0.4	0.9±0.2	0.579[c]
Pretreatment CRP (mg/L)**	75 (21 - 130)	120 (58 - 96)	0.073[b]
Pretreatment WBC (10^3uL)*	11.3±5.6	11.1±3.0	0.814[a]
Operation time (min)*	17.9±4.6	13.7±3.7	***0.001***[a]
Fluoroscopy time (sec)*	16.9±7.6	20.1±6.0	0.091[a]
Hospitalization time (hours)**	48 (24 - 72)	96 (48 - 96)	***0.001***[b]

*mean±standard deviation, ** median (IQR), CRP: C-reactive protein, WBC: white blood cell,

[a]: Independent student t test, [b]: Mann Whitney u test, [c]: repeated measures ANOVA test

Table 3. Comparison of complications and recent treatment modalities between groups.

	JJ stent (n=112)	Nephrostomy (n=19)	P value
Intraoperative Complications	16 (14.3%)	2 (10.5%)	0.660[b]
Mucosal injury	7 (6.3%)	-	
Bleeding	2 (1.8%)	2 (10.5%)	
Stone migration	7 (6.3%)	-	
Postoperative Complications	38 (33.9%)	8 (42.1%)	0.490[b]
Pain	24 (21.4%)	2 (10.5%)	
Fever	10 (8.9%)	2 (10.5%)	
Sepsis	1 (0.9%)	1 (5.3%)	
Hematuria	3 (2.7%)	3 (15.8%)	
Procedure failure	9 (8.0%)	1 (5.3%)	1.000[b]
Final Treatment			1.000[b]
SWL	22 (19.6%)	4 (21.0%)	
URS	90 (80.4%)	15 (79.0%)	
Time between emergency admission and final treatment (days)*	21 (12 - 31)	35 (16 - 42)	***0.019***[a]

*median (IQR), SWL: Shock Wave Lithotripsy, URS: Ureteroscopy

a: Mann Whitney u test, b: $\chi 2$ test

DISCUSSION

Ureteral stones, the most common etiology causing acute upper urinary obstruction and they are a frequent reason for emergency department visits. Most cases can be managed conservatively (10).

In cases of persistent colic pain or recurrent colic attacks where medical analgesia fails to provide relief, surgical intervention via stenting, percutaneous nephrostomy, or stone removal becomes necessary (11). Indeed, a study by Eaton H. et al. revealed that refractory colic attacks lead to repeated admissions, increasing costs and causing loss of work productivity (12).

In cases accompanied by infection, decompression must be performed due to the risk of developing urosepsis, which may progress to septic shock—a condition with a current mortality rate of 30–40% (13).

Acute kidney injury due to obstructive uropathy, which can arise from acute upper urinary obstruction, has the potential to progress to end-stage renal disease. Untreated or inadequately managed cases can result in tubular damage, inflammation, and interstitial renal fibrosis, leading to permanent kidney damage (14). In our clinical practice, given the emphasis on nephron preservation, surgical decompression is generally preferred over conservative management in cases with elevated creatinine levels suggestive of acute kidney injury.

Placement of ureteral stents was unsuccessful in 9 patients, while percutaneous nephrostomy failed in 1 patient. These rates did not show a significant technical difference. Similarly, the literature reports technical success rates of up to 99% for percutaneous nephrostomy and approximately 98% for ureteral stents (15,16).

In patients undergoing PNC, a significantly faster reduction in creatinine levels was observed at 12 hours post-procedure. However, by the 48th hour, creatinine levels had returned to normal ranges in both groups, and no significant difference was detected. Similarly, Yang S. et al. reported that 1–5% of acute upper urinary obstruction cases presented to the emergency department with acute kidney injury, with renal function recovery primarily depending on the severity and duration of the obstruction and infection (17).

The length of hospital stay was significantly longer in the PNC group. We attribute this to the tendency to use PNC in patients with higher grades of dilation and the prolonged antibiotic therapy necessitated by concomitant urinary infections in this group.

Although there was a tendency to use RUS in distal stones, stone location did not significantly influence the choice of procedure. Similarly, Sivalingam et al. reported that the use of percutaneous nephrostomy and stents was comparable for proximal stones (18% and 16%, respectively), while stents were preferred for mid and distal stones (18).

At our clinic, RUS procedures are performed in the operating room under optimal sterilization conditions to minimize complication rates. In contrast, PNC placement is conducted in the interventional radiology clinic under local anesthesia. The mean operation time for JJ stent insertion was significantly longer than the mean time for nephrostomy application (17.9±4.6 min and 13.7±3.7 min). Both procedures utilized fluoroscopy, and no significant difference in fluoroscopy times was observed between the groups.

Intraoperative complications are shown in Table 3. As expected, complications such as stone migration and ureteral mucosal damage were observed in the RUS group due to intraluminal manipulation, while bleeding occurred in both groups. However, no significant difference in complication rates was detected between the groups. This finding aligns with the study by Pearle M.S. et al., which also found no significant difference in overall complication rates between RUS and PNC (19).

The time from surgical decompression to final treatment was significantly longer in the PNC group. This may be attributed to the extended duration of antibiotic therapy and the need to wait for sterile urine cultures before the final treatment, particularly in patients with infection or sepsis, which were more prevalent in the PNC group. However, the difference between the groups was not statistically significant.

The limitations of our study include its retrospective design and the absence of randomization in case selection. Additionally, performing both procedures by the same surgical team might have provided more definitive insights. Besides the study was conducted at a single center, limiting it's generalizability. The sample size of the nephrostomy group was relatively small, which may have affected statistical power. Long-term follow-up data on renal function and stone recurrence were not included, which could provide a more comprehensive assessment. Nevertheless, given the lack of sufficient evidence regarding procedure selection in emergency upper urinary obstruction cases, we believe the findings of this study will contribute valuable information to the literature regarding disease management.

CONCLUSION

Percutaneous nephrostomy and retrograde ureteral stent placement are equally effective and reliable treatment options for the emergency management of acute upper urinary obstruction due to stones. There are no significant differences in complication rates between the two approaches. The choice of procedure should consider factors such as the patient's infection status, renal function, suitability of anesthesia and operating room conditions at the time of emergency admission, and the type and timing of the final treatment.

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CASE REPORT

Lipoma in the Bladder Mucosa with MRI Supported: Case Report

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Abstract

Lipomas are typically encapsulated benign tumors found in the skin, central nervous system, or gastrointestinal system. Lipomas of the bladder wall are rare tumors with limited reported cases. We present a case of a 62-year-old male patient who presented to our outpatient clinic with complaints of hematospermia. During two pelvic magnetic resonance imaging (MRI) scans conducted ten months apart and a diagnostic cystourethroscopy, a 7 mm lesion was incidentally found on the dome of the bladder and was resected for further examination. Follow-up MRI revealed that the size of the lesion remained unchanged. In spite of their rarity, bladder wall lipomas should be considered in the differential diagnosis of bladder tumors.

Keywords: bladder lipoma, hematospermia, tumor

INTRODUCTION

Lipomas are adipose tissue-based benign neoplasms. According to histopathology, they are divided into visceral and conventional lipomas. Conventional lipomas are primarily superficial tissues containing well-encapsulated mature adipose tissue. Lipomas are usually asymptomatic, slow-growing, nontender, round masses with soft consistency. Deep visceral lipomas may cause a variety of symptoms depending of their site and size. The lesion can show endophytic or exophytic, and sessile or pedunculated growth. All tumors had a yellowish color.

Although much less common, visceral lipomas have the same histopathological features (1). The most frequent benign mesenchymal tumor in the urinary bladder is leiomyoma. Bladder lipomas are rare tumors (2). There are fewer than 20 reported cases of lipomas originating from the bladder wall in the worldwide literature, making them rare (3). We presented a 62-year-old male patient who came to our outpatient clinic with a complaint of hematospermia, during the follow-up of a lesion was incidentally found in the bladder.

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CASE REPORT

A 62-year-old male patient presented to our clinic with intermittent hematospermia recurring every 2-3 months. The patient also complained of nocturia, post-micturition residual urine sensation, and intermittent urination. His IPSS score was 19. The patient was on regular tamsulosin and dutasteride therapy. Prostate volume was 45 cc on ultrasound, and digital rectal examination of the prostate was benign with no palpable nodules. The patient had no history of smoking or alcohol use, no anticoagulant or antiplatelet medication use, and no other comorbidities. The only past surgical history was a right orchiectomy performed in 2003, which resulted in benign pathology. The patient's body mass index was 23.5 kg/m2. Total PSA 1.09 ng/mL. Laboratory tests and urine analysis were within normal limits and no hypercholesterolemia. Taking into consideration the patient's age, pelvic MRI was performed to evaluate potential tumor pathologies in the prostate and seminal vesicles. On pelvic MRI, a nodular lesion 7 mm in size was detected incidentally, within the bladder wall at the dome of the bladder. The lesion was homogenously hyperintense on T2 weighted image (Figure 1a), hypointense on fat saturated T1 and T2 weighted sequences with no prominent contrast enhancement. No obvious focal lesions were identified in the prostate and seminal vesicles. Radiologic diagnosis is suspicious for intramuscular lipomatous lesion. The patient had another pelvic MRI that was performed 10 months before. The lesion was same in size and signal intensity in retrospective evaluation (Figure 1b). Cystourethroscopy was performed, revealing a well-defined, yellow-colored, benign-looking lesion measuring 7 mm on the dome of the bladder (Figure 2a). No additional pathology was observed. For further investigation, it was completely resected (Figure 2b). following hemostasis, and a three-way Foley catheter was placed. No additional pathology was observed in the postoperative period. The catheter was removed on the first day after surgery, and the patient was discharged. During the 6-month follow-up period, the patient was observed to be asymptomatic regarding the lesion excised from the bladder. No other hematospermia was observed. Lower urinary tract symptoms remained the same and the IPSS score did not change. The specimen was examined by an experienced pathologist, and a diagnosis of lipoma was made. Microscopically; it showed a well-confined, oval, large nodule of mature adipose tissue surrounded by a fine fibrous capsule in limited areas in the TUR material, with a maximum diameter of 0.7 cm, located in the lamina propria of the mucous layer without any evidence of malignancy or bladder wall invasion. The lesion was covered with a thin urothelial mucosal margin. Findings consistent with mucosal lipoma were identified based on clinical and cystoscopic data (Figure 3a and 3b).

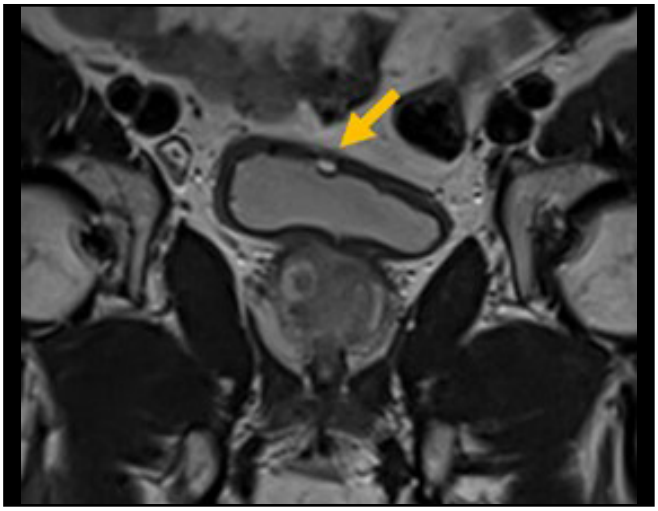

Figure 1a. On coronal T2 weighted image, a small hyperintense lesion is seen within the bladder wall (yellow arrow)

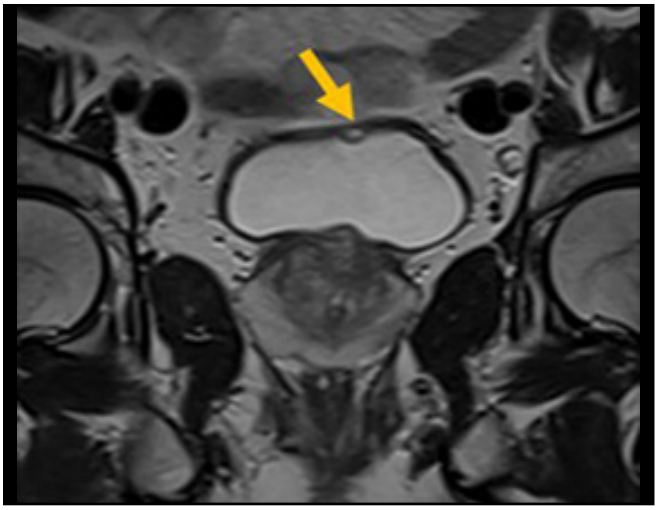

Figure 1b. The lesion was same in size and signal intensity on pelvic MRI that was performed 10 months before (yellow arrow).

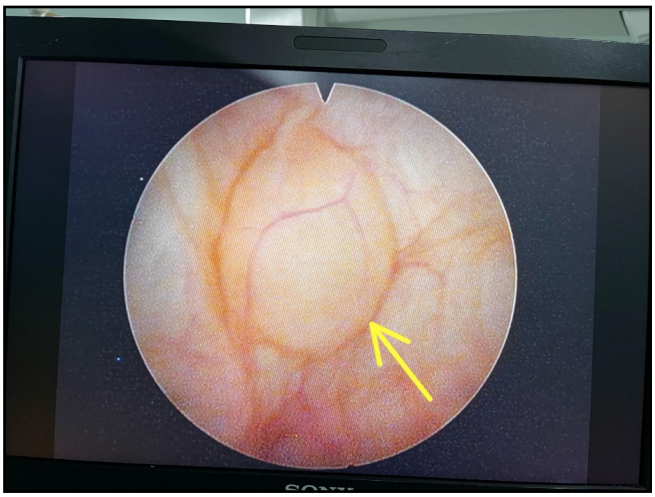

Figure 2a: Lipoma on the dome of the bladder before resection.

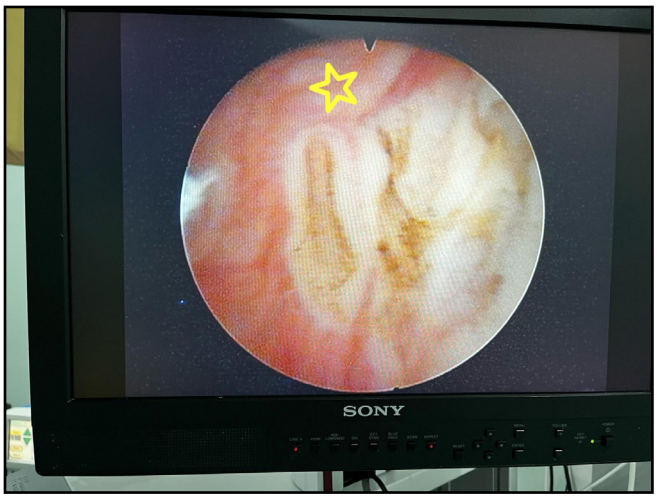

Figure 2b: Post-resection view.

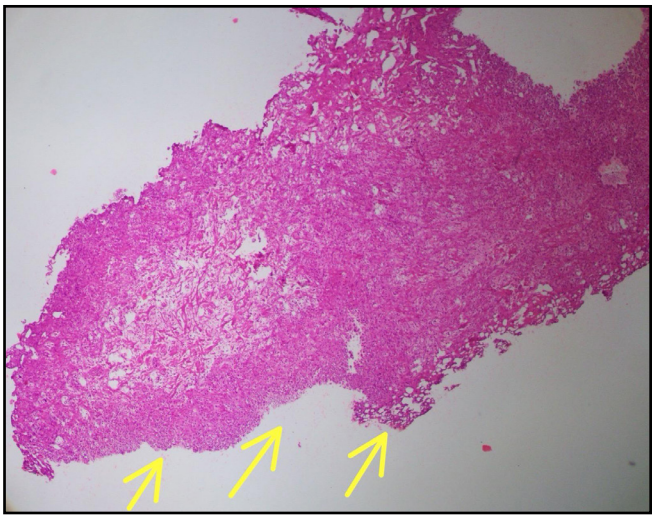

Figure 3a: Histological image of lipoma with urothelial epithelium and lipocytes at x40 magnification with H&E staining.

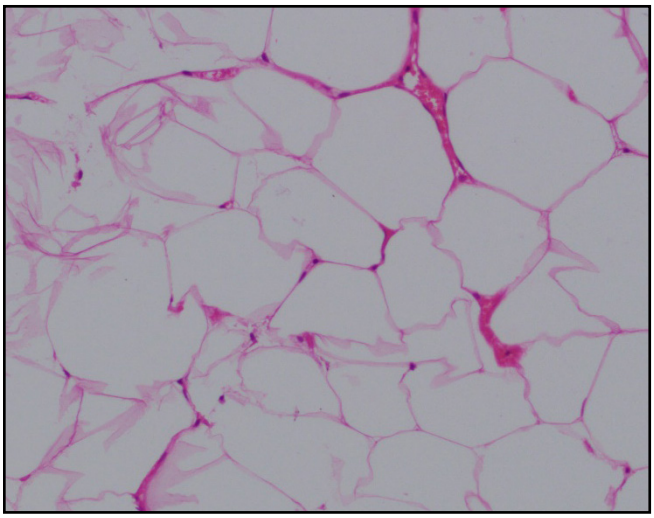

Figure 3b: Image of lipocytes at x200 magnification with H&E staining

DISCUSSION

Benign tumors encapsulated in lipomas usually originate from the skin, central nervous system, or gastrointestinal tract. In the community, these are typical lesions. Although they can occur at any age, lipomas typically affect people between the ages of 40 and 60. Obese patients with diabetes mellitus or hypercholesterolemia, as well as those in families, have a notably elevated incidence of lipomas (4). Lipomas are adipose tissue-based benign neoplasms. According to histopathology, they are divided into visceral and conventional lipomas. Conventional lipomas are primarily superficial tissues containing well-encapsulated mature adipose tissue. Although much less common, visceral lipomas have the same histopathological features (1).

95 percent of bladder tumors had epithelium as their primary source and were frequently malignant. Mesenchymal tumors account for 5% of cases. The most prevalent of these, making up 35% of cases, are leiomyomas (5). There are fewer than 20 reported cases of lipomas originating from the bladder wall in the worldwide literature, making them rare (3). The most common symptom is hematuria in bladder lipoma(6). In our

case, it was detected accidentally during the examinations performed for hematospermia. The bleeding may be attributed to the stretching of the mucosa over the lipoma. Additionally, bladder wall lipomas can cause pollakiuria, nocturia, and urinary tract infections(7). Bladder lipomas described in the international literature are typically smaller than 2 cm and endophytic. Rarely, they can be exophytic, which may present as a retroperitoneal mass(8). Lipomas can occur anywhere in the bladder, but in our case, it was located on the dome of the bladder. Bladder lipomas share common histopathological features with other tissue lipomas. Microscopically, lipomas are well-circumscribed neoplasms consisting of mature adipose tissue without atypia (1). Lipomas are benign tumors, and malignant transformation has not been reported in the literature. CT and MRI are useful in diagnosis (9). Our case not only supports the use of MRI but also represents the first report in the literature demonstrating that the lesion's size did not increase during MRI follow-up.

CONCLUSION

The clinical presentation in our case is not specific due to the patient's reason for referral to a urologist, the absence of comorbidities, and the low body mass index. Therefore, it differs from other bladder lipomas found in the literature. To confirm the diagnosis and provide necessary treatment after the episode of gross hematuria, cystoscopy is necessary to evaluate the bladder for urothelial tumors.

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Consent of Informed: Written informed consent was obtained from the patients for publication of these reports and accompanying images.

Authors' Contributions: YYK and DM, as pathologists, identified the pathological findings. FDA contributed to the identification of radiological findings. TA, AT, and EA made significant contributions to the writing of the case report. All authors read and approved the final manuscript.

Inform of Publication: The results of the study were not published in full or in part in the form of an abstract.

Compliance with ethical standards: This article does not contain any studies with human participants or animals performed by any of the authors.

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REVIEW ARTICLE

The Role of Prophylaxis for Preventing Venous Thromboembolism in Major Urological Surgery and Nursing Management

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Abstract
Venous thromboembolism (VTE) that includes both pulmonary embolism (PE) and deep vein thrombosis (DVT), is a common complication in major urological oncology surgery and it is one of the significant causes of mortality and morbidity. Effective and quality nursing care and practices at every stage of the perioperative process, from the patient's initial clinical admission to post-discharge home care can prevent potential complications. The most effective and the easiest way to prevent VTE is to perform a proper risk assessment. Nurses providing care to patients undergoing major urological surgery should conduct a risk assessment through an effective nursing anamnesis in the preoperative period and take necessary precautions for individuals at risk for VTE. These precautions should be planned to encompass the intraoperative and postoperative periods as well. The primary reasons that increase susceptibility to VTE include the pelvic region being the focus of urological surgeries, the majority of patients being elderly, surgeries typically being performed in the lithotomy position, and the relatively extended period of postoperative immobilization. Risk classification, according to national and international guidelines, is categorized as 'high' or 'very high' risk, with prophylaxis post-discharge considered only for a subset of patients at 'very high risk.' VTE prevention is generally achieved through two main approaches: pharmacological and non-pharmacological prophylaxis. Pharmacological prophylaxis reduces the likelihood of VTE, but it is crucial to balance the risk of bleeding with the patient's experience. Therefore, this review aims to evaluate the role of prophylaxis and nursing management for preventing VTE in major urological surgical procedures.

Keywords: major urological surgery, venous thromboembolism, nursing management.

INTRODUCTION

Venous thromboembolism (VTE), encompassing both pulmonary embolism (PE) and deep vein thrombosis (DVT), is a common complication in major urological oncology surgery and it is a significant cause of mortality and morbidity. Postoperative VTE is defined as venous thrombus (DVT) in the deep pelvic or lower extremity veins or as pulmonary embolism (PE). There are many risk factors for VTE. The most common that are included active cancer, pelvic surgery, advanced age, and consequent immobility. In

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addition, immobilities that are associated with drains and catheters placed during surgery are other significant risk factors in the postoperative period. Currently, in patients with active urological cancer, recent surgical intervention remains the most common risk factor for developing VTE in the postoperative period (1).

It was reported that approximately 200,000 major urological cancer surgeries were performed annually in the United States about 10 years ago, and while VTE (Venous Thromboembolism) presents a significant risk within urology, this risk increases 5-7 times in major oncological surgical procedures (2). The global burden of urologic cancer, especially in aging societies, has led to a substantial impact on public health worldwide. Nearly 13% of all cancers are urologic cancers, which primarily include prostate, bladder, kidney, and testicular cancers. According to the World Cancer Research Fund International, prostate cancer is the 2nd most frequent cancer in males, with nearly 1.4 million new cases in 2020. Bladder, kidney, and testicular cancer were ranked as the 10th, 14th, and 20th most common cancers worldwide, with nearly 573,000, 430,000, and 74,500 new cases in 2020 (3). Moreover, VTE continues to be one of the most common causes of death in the 30-day postoperative period for urological cancers not only in the United States but globally. In the cohort study by Logan et al. (2023), VTE is similarly reported as the fifth most common cause of perioperative mortality (4). Recent evidence points out that the majority of thromboembolic events occur after discharge. This evidence highlights the necessity of extending the traditional duration of VTE prophylaxis in this patient group undergoing major urological cancer surgery (1).

Each surgical procedure poses a risk for venous thromboembolism (VTE) for patients. The primary risk factors for VTE in surgical patients include the type of surgery (cardiothoracic, orthopedic), the duration of the surgery, use of a tourniquet, patient positioning during surgery, and immobility of the lower extremities (5). In the study by Edeer et al. (2018), it is reported that 62.1% of patients in surgical clinics are at high risk for VTE (6). Among patients undergoing major abdominal surgery without prophylaxis, 15-40% develop asymptomatic deep vein thrombosis (DVT) detected through screening. For major surgeries, the rate is 40-60% (7).

The National Institute for Health and Care Excellence (NICE), in its 2018 guidelines, recommends extended thromboprophylaxis. According to this guideline, patients undergoing major abdominopelvic cancer surgery should receive low molecular weight heparin treatment for 28 days postoperatively. The European Association of Urology (EAU) Guidelines also recommend 28 days for certain procedures, but the recommended duration of prophylaxis varies depending on the procedure (8). Additionally, the current EAU guidelines define major bleeding as bleeding that requires reoperation or intervention (e.g., angioembolization). Changes in hemoglobin levels or the need for transfusion are not considered major bleeding. When selecting prophylaxis, factors other than the risk of major bleeding should be taken into account, including the patient's clinical condition, the complications of the method, the patient's preference and compliance, and the level of VTE risk. In the European Association of Urology guidelines, a VTE risk classification model for urological, general, and gynecological surgeries is proposed based on high-evidence studies. Patients are classified as low, medium, and high risk. Similarly, the guidelines of other key national bodies, such as the American Urological Association (AUA), emphasize the need for risk assessment when deciding to implement VTE prophylaxis. It is recommended that post-discharge prophylaxis should only be considered for some of the 'high-risk' patients. The risk classification can be found in Table 1 (1).

Despite the presence of international and national guidelines for the implementation of VTE (Venous Thromboembolism) prophylaxis, these guidelines recommend assessing the patient's VTE risk and identifying risk factors in the preoperative period (5). Advanced age, the presence of surgical procedures, and malignancies are major risk factors for VTE. Among VTE complications, pulmonary embolism (PE) is a rare but feared major complication. Patients undergoing major urological cancer surgery are at high risk for VTE (9).However, adherence to these guidelines is weak (10). Identifying VTE risk factors begins from the patient's initial outpatient visit and continues through the preoperative, intraoperative, postoperative periods, and even into the discharge and home care process. According to the National Venous Thromboembolism Prophylaxis and Treatment Guidelines (2010), 64% of hospitalized surgical patients are reported to be at risk for DVT (Deep Vein Thrombosis), but only 59% receive thromboprophylaxis (1). Petrozzello (2017) states that 25% to 60% of patients undergoing surgery without appropriate VTE prophylaxis develop DVT (11). VTE, which has high mortality and morbidity rates and it is one of the postoperative complications, is extremely important in major

urological surgical procedures. Therefore, early diagnosis of VTE can prevent many issues since it is preventable. The risk of developing VTE should be distinguished with a reliable risk assessment system to avoid health problems and financial burdens caused by VTE. Various risk assessment models are available for classifying the degree of risk. The main ones include Rogers, Padua, and Khorana, with the Caprini risk assessment scale being frequently used (12). Risk assessment scales are commonly used to diagnose the disease. Such risk assessment scales can quickly and effectively identify a high-risk group from a large patient population, allowing for appropriate medical treatment to be implemented. VTE is one of the postoperative complications with high mortality and morbidity, it is also highly significant in major urological surgeries. Therefore, there is a need for current reviews and research articles on this topic to prevent VTE and emphasize the importance of evidence-based nursing care practices. This review was planned to highlight the role of prophylaxis in preventing VTE, one of the critical postoperative complications, and to emphasize nursing management.

Incidence of Venous Thromboembolism

VTE occurs in men and women at approximately equal rates, with an incidence of 160 per 100,000 across all age groups. VTE is responsible for about 10% of hospital deaths. A systematic review by Geerts et al. reported a VTE incidence of 13-31% without prophylaxis. Additionally, approximately 30% of VTE cases recur within 10 years (13). In a cohort study conducted by Logan et al. in 2023, it was reported that the incidence of VTE was 1.3%, with 0.7% occurring during hospitalization and 0.6% developing after discharge, and that 64.1% of patients with VTE were diagnosed with pulmonary embolism (PE). The same study found that among a total of 377 patients who died within 30 days after surgical procedures 1.3%, 5.7% were diagnosed with VTE, with 5 having deep vein thrombosis (DVT) and 17 having PE. Additionally, it was determined that the lowest incidence of VTE was in patients undergoing prostate 1.1% and kidney 0.9% procedures, while the highest incidence was in those undergoing bladder procedures 2.6% (4).

In the literature, the VTE risk for radical cystectomy ranges from 1.5% to 17.6% (14,15). Tikkinen et al. (16), reported a VTE incidence of 2.9-11.6% for open radical cystectomy and 2.6-10.3% for robotic radical cystectomy.

The study conducted by Naik et al. (2019), the incidence of VTE in patients undergoing radical prostatectomy is reported to be between 0.2% and 16.8%; for minimally invasive radical prostatectomy, it is 0.7%, and for robotic radical prostatectomy, it ranges from 0.2% to 0.9% (1). Additionally, for kidney procedures, the VTE incidence is between 0.7% and 11.6%. Specifically, for open partial nephrectomy, it is 1.0% to 3.9%; for robotic partial nephrectomy, it is 1.0% to 3.9%; and for laparoscopic partial nephrectomy, it is 1.1% to 4.2%. The VTE incidence for open radical nephrectomy is reported to be 1.1% to 4.4%, and for laparoscopic radical nephrectomy, it is 0.7% to 2.6%. It is noted that the majority of VTE cases occur after discharge, with the average time to VTE diagnosis being 14 to 20 days post-surgery (16).

Risk Factors

The most important factor for VTE is the reduction in venous return and the slowing of blood flow following prolonged immobilization (17). In cancer patients, the risk of VTE is significantly increased. It is shown that the highest rates of VTE occur in patients whose primary cancer originates in the pancreas, stomach, bladder, kidney, and hematological malignancies. Anemia, leukocytosis, thrombocytosis, and systemic therapies further increase the risk of VTE in cancer patients. The risk factors for thrombosis, such as hypercoagulability, hemodynamic stasis, and endothelial dysfunction (Virchow's triad), can persist for weeks following surgical intervention. General risk factors for VTE are listed in Table 2. (17).

Table 1. VTE Risk Model Based on Patient-Related Factors (9)

Risk Classification	Risk	Probability of VTE
Low Risk	Risk faktörü (-)	1x
Moderate Risk	Presence of at least one of the following risk factors: Age ≥ 75 BMI ≥ 35 VTE in first-degree relative (mother, father, sibling)	2x
High Risk	|History of VTE or presence of two or more risk factors	4x

Table 2. General Risk Factors for VTE (17)

Risk Factors	Description
Advanced Age	Increased age is associated with a higher risk of VTE.
Malignancy	Presence of cancer, especially pancreatic, gastric, bladder, kidney, and hematologic cancers.
Trauma	Physical injury that increases the risk of clot formation.
Immobility	Prolonged immobility slows blood flow, increasing the risk of clot formation.
History of DVT	Previous episodes of deep vein thrombosis.
Medications	Certain medications, such as hormone replacement therapy or oral contraceptives, increase VTE risk.
Surgical Procedures	Particularly major surgeries, which can cause endothelial damage and immobility.
Anemia	Lower than normal red blood cell count, associated with higher VTE risk in cancer patients.
Leukocytosis	Elevated white blood cell count, indicating inflammation, which can increase VTE risk.
Thrombocytosis	Elevated platelet count, contributing to a hypercoagulable state.
Systemic Therapies	Treatments such as chemotherapy, which can increase the risk of clot formation.
Endothelial Dysfunction	Damage to the inner lining of blood vessels, which can promote clot formation.
Hemodynamic Stasis	Reduced blood flow, often due to immobility or other factors, leading to clot formation.

Standard and Extended Thromboprophylaxis

Appropriate prophylaxis for VTE is the best way to reduce costs for both patients and healthcare institutions. A multicenter study by Lee et al. (2014) reported that only 67.5% of patients in medical intensive care settings received prophylactic treatment. The goal of VTE prophylaxis is to prevent VTE in high-risk patient groups before it occurs (18). A VTE risk assessment must be performed in the preoperative period (5). The American Heart Association states that, in addition to the VTE risks associated with major surgical procedures and underlying malignancy, additional factors such as previous VTE, age, obesity, immobility, and family history should also be taken into consideration (19). The treatment used to prevent VTE is called thromboprophylaxis, which can be applied through both mechanical and pharmacological methods. Pharmacological thromboprophylaxis agents include warfarin, standard heparin, low molecular weight heparin, and new oral anticoagulants. Mechanical prophylaxis can be used in addition to pharmacological prophylaxis or alone in patients with a low risk of VTE but a high risk of bleeding. The main mechanical methods used for VTE prophylaxis include early postoperative mobilization, foot and leg exercises, graduated compression stockings, and intermittent pneumatic compression devices. EAU and NICE guidelines reports that both mechanical compression and anticoagulation methods reduce the risk of postoperative DVT. Despite the guidelines published to prevent VTE, thromboprophylaxis is often inadequately or incorrectly applied (20). In the study by Logan et al. (2023), which examined venous thromboembolism chemoprophylaxis adherence rates after major cancer surgery, it was reported that the highest rates of chemoprophylaxis administration were observed in patients undergoing procedures in general surgery (10,102 out of 10,301 patients [98.1%]), while the lowest rates were in patients undergoing procedures in urology (11,471 out of 17,089 patients [67.1%]) (4).

The VTE risk for each patient should be assessed preoperatively (5). Pharmacological prophylaxis for VTE includes agents such as warfarin, standard heparin, low molecular weight heparin, and new oral anticoagulants. Mechanical prophylaxis can be used alone in patients with low VTE risk and high bleeding risk or in addition to pharmacological prophylaxis. Mechanical methods for VTE prophylaxis include early postoperative mobilization, foot and leg exercises, graduated compression stockings, and intermittent pneumatic compression devices (20).

According to the guidelines of the American College of Chest Physicians (ACCP) (2012), early mobilization and foot/leg exercises are recommended for surgical patients with a low risk of developing VTE (21). For patients in the moderate and high-risk groups, elastic bandages or mechanical compression devices are recommended to reduce venous stasis. These risk groups are presented in Table 3. This preventive measure taken before the occurrence of VTE is referred to as "primary prophylaxis." Primary prophylaxis is reported as the most effective way to prevent mortality in high-risk patient groups. Both mechanical and/or pharmacological methods can be used in VTE prophylaxis (22).

Table 3. Venous Thromboembolism (VTE) Risk Stratification in Surgical Patients (19)

Level of risk	Defining factors	Incidence of VTE, %		
		DVT	PE	Fatal PE
Low	Minor surgery in patients < 40 yr old without risk factors	2,5	0.2	0.002
Moderate	Minor surgery in patients with risk factors Minor surgery in patients 40–59 yr without risk factors Major surgery in patients < 40 yr or with risk factors	12–25	1-2	0.1–0.4
High	Minor surgery in patients > 60 yr Major surgery in patients > 40 yr or with risk factors	25–50	2-4	0.4–1.0
Highest	Major surgery in patients > 60 yr Major orthopedic surgery Spinal cord injury Trauma	50–70	4–10	0.2–5.0

DVT = deep vein thrombosis, PE = pulmonary embolism

Extended vs Standard-Duration Thromboprophylaxis (UTP vs STP) refers to the duration of preventive treatments used to reduce the risk of venous thromboembolism (VTE), including deep vein thrombosis and pulmonary embolism. Thromboprophylaxis is typically administered after surgical operations or in patients with a high risk of clotting to prevent blood clot formation (23).

Standard-Duration Thromboprophylaxis (STP): This refers to anticoagulant treatment administered for a fixed period based on a specific medical condition or surgical procedure. For example, short-term treatment may involve using low molecular weight heparin or similar blood-thinning medications for several days or weeks following surgery (23).

Extended-Duration Thromboprophylaxis (UTP): When the risk of clotting persists beyond the standard duration after surgery or illness, the treatment may need to be extended. Extended-duration thromboprophylaxis can last for months and is often applied to high-risk groups, such as cancer patients, those undergoing orthopedic surgery, or major urological surgery (23).

The choice between these two approaches depends on factors such as the patient's overall condition, clotting risk, type of surgery, and other considerations.

It has been proven that the risk of VTE after radical cystectomy is lower in patients using extended thromboprophylaxis compared to those using standard thromboprophylaxis. Studies comparing standard and extended thromboprophylaxis report that the incidence of VTE increases from 5.06% to 17.6% (90-day follow-up), from 2% to 6% (90-day follow-up), and from 11% to 23% (365-day follow-up) (1).

The study that is conducted by Kukreja et al. (2015), the VTE risk in patients undergoing open radical cystectomy versus robotic radical cystectomy was reported to be 8% with extended thromboprophylaxis versus 11% with standard thromboprophylaxis for open radical cystectomy, and 7% with extended thromboprophylaxis versus 22% with standard thromboprophylaxis for robotic radical cystectomy (24). In the cohort study conducted by Logan et al. (2023), it was reported that among hospitalized patients, the lowest thromboprophylaxis rates were observed in kidney (68.3%) and prostate (62.9%) procedures, while the highest rate was in bladder procedures (96.9%) (4). In a systematic review by Abdullah et al. (2022) evaluating the rate of venous thromboembolism (VTE) in bladder cancer patients based on treatment type, the overall VTE rate in these patients was reported to range between 1.9% and 4.7%, while it varied from 3% to 17.6% in patients undergoing cystectomy. The same study indicated that in patients receiving extended thromboprophylaxis, the VTE rate decreased from 17.6% to 5% (25).

In the cohort study conducted by Logan et al. (2023), it was reported that extended prophylaxis was administered

to 2.5% of patients undergoing kidney procedures, 37.6% of those undergoing bladder procedures, and 7.2% of those undergoing prostate procedures (4).

Prevention of VTE

The increased susceptibility to VTE in urological surgeries is primarily due to several factors: the pelvic location of the surgeries, the advanced age of most patients, the use of the lithotomy position for operations, and the relatively long period of postoperative immobilization. Mechanical prophylaxis does not increase the risk of bleeding, making it a favorable option. Chemical prophylaxis reduces the likelihood of VTE, but balancing the risk of bleeding with patient experience is not as straightforward as with mechanical prophylaxis (26).

Before the introduction of heparin prophylaxis, the incidence of DVT in pelvic surgery ranged between 10-30%. Although there are studies in the literature that include the use of aspirin, the evidence suggests that its effectiveness in reducing VTE events is insufficient. The American College of Chest Physicians (ACCP) and National Institute for Health and Care Excellence (NICE) guidelines recommend administering low molecular weight heparin for VTE prophylaxis via subcutaneous injection once daily. However, for patients with a body mass index (BMI) >40 kg/m², twice-daily injections are advised (27).

The most critical questions regarding VTE prophylaxis are when to start and when to stop it. Although the American College of Chest Physicians (ACCP) recommends initiating chemical prophylaxis preoperatively, guidelines suggest starting prophylaxis 4-6 hours before surgery to reduce the risk of bleeding (26).

In the literature, some studies implement chemical prophylaxis for a total of 28 days post-discharge, while others apply it for 28 days post-surgery(4, 25). In a study by Pariser et al. (2017), subcutaneous heparin was administered every 8 hours from before the induction of general anesthesia until discharge, followed by daily enoxaparin for 28 days postoperatively. This regimen reduced VTE incidence from 12% to 5%. Additionally, the overall finding of the study indicated that extended thromboprophylaxis reduced the likelihood of VTE by 77% (28).

For patients with conditions like heparin-induced thrombocytopenia, fondaparinux is reported as a well-tolerated alternative for urological oncology patients (29). Extended thromboprophylaxis is not only life-saving but also effective in reducing costs.

Morbidity and Bleeding

Anticoagulant medications are generally safe for use in patients undergoing surgical procedures, but the risk of bleeding is always a concern(4,25). According to Naik et al. (2019), bleeding events are classified based on severity, including those requiring transfusion, causing changes in management, necessitating re-intervention, being fatal, and leading to a decrease in hemoglobin of more than 2 g/dL (1).

In the literature, Phillips (2010) reported the risk of bleeding after radical prostatectomy to be 4% (30). Tikkinen et al. (2020) indicated that the bleeding risk in open radical prostatectomy varies between 0.1% and 0.2%, while this risk is reported to be 0.7%–1.4% in laparoscopic surgery and 0.4%–0.8% in robotic surgery (9). In the study by Wani et al. (2023), it was noted that anticoagulants like low molecular weight heparins reduce the relative risk of VTE by approximately 50%, but simultaneously, the administration of low molecular weight heparin increases the relative risk of major bleeding by about 50% (19).

There are no direct studies comparing bleeding risk between extended and standard thromboprophylaxis for radical prostatectomy in the literature. However, studies reporting absolute risk for bleeding are available. Phillips (2010) reported a post-radical prostatectomy bleeding risk of 4% (30). Additionally, in the study by Tikkinen et al. (2018), the bleeding risk for open radical prostatectomy ranged from 0.1% to 0.2%, while for laparoscopic surgery it was between 0.7% to 1.4%, and for robotic surgery it ranged from 0.4% to 0.8% (16).

These findings highlight the importance of balancing thromboprophylaxis to prevent VTE with the risk of bleeding complications in surgical patients, particularly in procedures like radical cystectomy and radical prostatectomy.

Studies examining post-nephrectomy bleeding risk are limited in the literature. According to Tikkinen et al. (2018), the risk of bleeding varies depending on the type of nephrectomy procedure:

For partial nephrectomy:

- ✓ Open surgery: 0.1%
- ✓ Laparoscopic surgery: 1.7%

- ✓ Robotic surgery: 0.5%

For radical nephrectomy:

- ✓ Open surgery: 0.05%
- ✓ Laparoscopic surgery: 0.5%
- ✓ Radical nephrectomy with thrombectomy: 2%

These findings indicate that differing bleeding risks associated with various surgical approaches in nephrectomy (16).

Mortality

It is emphasized that extended thromboprophylaxis after radical cystectomy does not lead to a statistically significant reduction in all-cause mortality (3% with standard thromboprophylaxis vs. 1% with extended thromboprophylaxis). Assessing all-cause mortality across urological surgical interventions, there is no significant difference in mortality between extended and standard thromboprophylaxis (1). In the study by Kukreja et al. (2015), overall mortality was reported as 17% with extended thromboprophylaxis and 24% with standard thromboprophylaxis (24).

Radical Cystectomy

The International Agency for Research on Cancer (IARC), known for its studies on assessing the global cancer burden, stated in its updated estimates in the GLOBOCAN 2020 report that bladder cancer is the 10th most commonly diagnosed cancer type worldwide. It is estimated that 573,000 new cases of bladder cancer could be diagnosed globally in 2020. Radical cystectomy remains the gold standard for patients with muscle-invasive bladder cancer; however, this surgical procedure can lead to various postoperative complications such as intestinal anastomotic leaks, wound infections, pneumonia, and venous thromboembolism (VTE) (29). VTE is a significant complication following radical cystectomy for bladder cancer, with an incidence reported in the literature ranging from 3% to 11%. Additionally, it contributes to substantial morbidity and mortality in the postoperative period (2,31). Considering the increased healthcare costs associated with VTE care, the seriousness of the issue is further underscored (32). Since more than 50% of VTE events occur after hospital discharge, the benefit of extended pharmacological prophylaxis following radical cystectomy becomes prominent (33,34). In the study by Cihang et al. (2020), it was reported that the implementation of a comprehensive VTE prophylaxis program as part of the ERAS protocol reduced VTE rates from 6.2% to 0.9% (35).

Radical Prostatectomy

With approximately 1.4 million new cases and 375,000 deaths, prostate cancer was the second most common cancer among men and the fifth leading cause of cancer-related deaths in 2020. Incidence rates are three times higher in developed countries compared to developing nations (37.5 per 100,000 versus 11.3 per 100,000), while mortality rates show less variation (8.1 per 100,000 versus 5.9 per 100,000, respectively). In about 60% of countries worldwide, prostate cancer is the most commonly diagnosed cancer in men. Prostate cancer ranks third globally among 185 countries with an estimated 1,276,106 new cases and eighth with 358,989 deaths annually (36). Each year, more than 75,000 radical prostatectomies are performed in the United States and over 7,000 in the United Kingdom, with the majority being performed robotically. Despite advancements in preoperative care for oncologic surgical interventions, surgical morbidity remains prevalent, with clinical venous thromboembolism (VTE) being the most commonly encountered cause of morbidity and mortality (37).

According to data from the American College of Surgeons National Surgical Quality Improvement Program (NSQIP), the 30-day readmission rate for patients undergoing radical prostatectomy is 4.1%, with VTE being the most frequent reason for readmission (accounting for 13.6% of readmissions). In addition, VTE leads to substantial cost increases for patients and the healthcare system. Patients with VTE experience higher rates of hospital readmissions (1.07% vs. 0.15%), emergency department visits (0.31% vs. 0.05%), and overall costs ($28,353 vs. $17,712) compared to those without VTE (38). Therefore, improving patient care and management during the perioperative period is crucial for reducing the incidence of VTE.

The literature reveals that the risk of venous thromboembolism (VTE) in patients undergoing radical prostatectomy surgery varies based on factors such as lymph node dissection and surgical approach (19). According to Eifler et al. (2011), in a study involving 773 patients who underwent laparoscopic radical prostatectomy with a 90-day follow-up period, simultaneous pelvic lymph node dissection was performed in 468 patients (60.8%) (39). Among these patients, VTE occurred in 1.5% of cases, while no VTE cases were observed in patients who did not undergo pelvic lymph node dissection. Similarly, another study analyzed 3,544 patients, of whom 547 (15.4%) underwent pelvic lymph node dissection. It reported that these patients faced an 8-fold higher risk of deep vein

thrombosis and a 6-fold higher risk of pulmonary embolism compared to those who did not undergo pelvic lymph node dissection. Furthermore, among patients who did not undergo pelvic lymph node dissection, those who underwent open radical prostatectomy were reported to have an increased risk of VTE compared to those who underwent robotic radical prostatectomy (40).

Tikkinen et al. (2018) also highlighted that patients undergoing open radical prostatectomy face a 2-4 times higher risk of VTE compared to those undergoing laparoscopic or robotic radical prostatectomy. They emphasized a direct correlation between the prevalence of pelvic lymph node dissection and the risk of VTE (16).

These findings underscore the significant impact of surgical factors, such as lymph node dissection and surgical approach, on the incidence of VTE following radical prostatectomy. Identifying and mitigating these risks through appropriate prophylactic measures are crucial in managing postoperative complications effectively.

Radical and Partial Nephrectomy

Renal cell carcinomas (RCC) account for approximately 3% of all cancers and are more common in Western countries. The countries with the highest incidence of RCC in the world are the Czech Republic and Lithuania. Over the past twenty years, there has been a 2% increase globally. In developed regions such as North America, Europe, and Australia, the incidence of RCC has risen more sharply compared to other parts of the world. RCC is the most common solid lesion in the kidney, comprising about 90% of all renal malignancies. RCC is 1.5 times more common in men and typically affects individuals between the ages of 55 and 75, with various histopathological and genetic subtypes. Venous thromboembolism (VTE) can also occur after kidney surgery. VTE incidence is 0.4% following nephrectomies performed for benign reasons, while it rises to 2% after nephrectomies for malignancy (41). In a study by Pettus et al. (1989-2005) involving 2,208 patients who underwent radical or partial nephrectomy, the incidence of VTE was reported as 1.5% during the period without prophylaxis, and 0.6-0.9% during the period with prophylaxis. Therefore, routine prophylaxis is recommended for patients who are undergoing radical or partial nephrectomy today (41).

Evidence-Based Nursing Practices in Preventing VTE

Radical Cystectomy

Radical cystectomy is classified as major surgery, with a high risk of postoperative bleeding and thrombosis. Due to its classification as major surgery, it poses risk factors for venous thromboembolism (VTE) (3). Furthermore, patients who develop VTE post-surgery contribute to increased healthcare costs due to the burden of care, loss of workforce, and prolonged hospital stays (9). Therefore, it is crucial to implement and monitor necessary precautions for VTE. Studies show that that the incidence of VTE ranges from 3% to 11%, with the majority of these cases developing after patients are discharged from the hospital (42). In a prospective study conducted by Clement et al., the effects of early ambulation, leg compression, and 15 days of low molecular weight heparin use on the development of postoperative deep vein thrombosis (DVT) were evaluated in 583 patients undergoing urological cancer surgery (29). Doppler ultrasound was performed on patients on the 7th postoperative day, revealing DVT and pulmonary embolism (PE) rates of 7.4% and 2.2%, respectively. Multivariable analysis identified renal surgery as a risk factor for the development of DVT and PE (43). Venous thromboembolism (VTE) is a complication that can be prevented through nursing interventions, emphasizing the necessity of evidence-based practices. The following evidence is presented:

- It is recommended to establish an institution-specific protocol that includes early mobilization, pharmacological thromboprophylaxis, and mechanical thromboprophylaxis for the prevention of VTE (Evidence Level IB) (44).
- In patients at moderate to high risk of surgical complications, routine use of simple compression stockings without pharmacological thromboprophylaxis is not recommended for VTE prevention (Evidence Level IB) (44).
- For patients contraindicated for pharmacological thromboprophylaxis, mechanical prophylaxis, such as intermittent pneumatic compression devices or simple compression stockings, is recommended. The use of intermittent pneumatic compression devices is preferred over simple compression stockings (Evidence Level IB, 2B) (44).
- In patients at low risk and contraindicated for pharmacological thromboprophylaxis, prophylaxis with

only simple compression stockings is not recommended (Evidence Level 2C).

- In patients with a very high risk of VTE undergoing pharmacological thromboprophylaxis, routine use of mechanical thromboprophylaxis (such as simple compression stockings or intermittent pneumatic compression devices) is not recommended (Evidence Level IB) (44).
- In patients with a very high risk of surgical complications related to VTE, the combined use of mechanical and pharmacological prophylaxis is recommended. In patients at high risk of VTE, intermittent pneumatic compression devices are preferred in addition to pharmacological thromboprophylaxis over simple compression stockings (Evidence Level 2B) (45).

Radical Prostatectomy

The risk of venous thromboembolism (VTE) is high following radical prostatectomy, and evidence-based nursing practices play a crucial role in mitigating this risk. Current studies confirm that early mobilization is effective in reducing the incidence of VTE. Additionally, compression stockings and intermittent pneumatic compression devices, monitored by nurses, are frequently utilized to prevent VTE (19). Pharmacological prophylaxis, particularly with low molecular weight heparin, is implemented to further decrease the risk of VTE (46). Nurses' patient education and postoperative follow-up care are critical components in the prevention of VTE after surgery (46). Therefore, the use of preventive evidence-based practices is essential. These practices include:

- Early mobilization of patients after surgery is one of the most effective methods to reduce the incidence of VTE. Mobilization increases blood flow, thereby preventing thrombus formation (Evidence Level IA) (46).
- The use of anti-embolic stockings helps prevent thrombus formation by enhancing venous blood flow in the lower extremities. It is essential to ensure that these stockings are applied correctly and that their usage duration is appropriately monitored (Evidence Level IB) (47).
- Informing patients about the risk of VTE, its symptoms, and the importance of prophylactic treatments can help prevent complications. Patient education plays a critical role in reducing VTE risk, especially in the postoperative period (Evidence Level II) (47).

Radical and Partial Nephrectomy

The risk of venous thromboembolism (VTE) is quite high in patients undergoing radical and partial nephrectomy, making evidence-based nursing practices critically important. It has been proven that early mobilization significantly reduces the risk of VTE in this patient population. Additionally, compression stockings and intermittent pneumatic compression devices used under the supervision of nurses play a vital role in preventing VTE. Pharmacological prophylaxis, particularly with the support of low molecular weight heparin, further reduces the risk of VTE. Nurses' patient education and postoperative follow-up are essential components in preventing VTE after surgery (48). In this context, implementing evidence-based practices is crucial for preventing VTE, reducing healthcare costs, and improving patients' quality of life post-surgery (49). These evidence-based practices include:

- Early mobilization increases blood flow after surgery, thereby reducing the risk of VTE. Nurses facilitate patients' movement shortly after surgery and monitor this process (Evidence Level IA) (50).
- The use of anti-embolic stockings enhances venous blood flow in the lower extremities, preventing thrombus formation. It is essential to ensure that these stockings are applied correctly and that their duration of use is appropriately monitored (Evidence Level IB) (50).
- Intermittent pneumatic compression (IPC) devices apply mechanical pressure to the lower extremities, accelerating venous circulation and preventing thrombus formation. Nurses guide patients on the use and effectiveness of these devices (Evidence Level IA) (50).
- Low molecular weight heparin (LMWH) is a commonly used anticoagulant to prevent VTE in patients following nephrectomy. Nurses take responsibility for the correct timing and dosage of the medication, ensuring the patient's adherence to treatment (Evidence Level IA) (50).
- Nurses educate patients about the symptoms of VTE, risk factors, and prophylactic measures, thus supporting risk management. Post-discharge follow-up is a critical measure in monitoring and controlling the development of VTE (Evidence Level IIA) (50).

One of the simplest ways to prevent VTE is through thorough preoperative assessment and a complete medical history for every patient undergoing surgery. Effective healthcare and

reliable nursing anamnesis, starting from the patient's initial contact with the nurse upon admission to the surgical clinic, can prevent complications. By obtaining a comprehensive and accurate medical history, VTE risk can be assessed, and necessary pharmacological and/or mechanical preventive measures can be implemented. Using a specific risk assessment tool is crucial as it creates a common language in nursing care and management. During the nursing diagnosis process, assessing risks and taking patient-specific preventive measures based on a risk scale is vital for VTE prevention.

CONCLUSION

To conclude, it is crucial to develop institution-specific protocols integrating early mobilization, pharmacological thromboprophylaxis, and mechanical thromboprophylaxis for preventing DVT in patients undergoing major urological surgical procedures, as outlined in the literature. Achieving collaboration through a multidisciplinary team approach is essential. Nurses who are integral parts of this team and pivotal in patient care, should be actively involved. In surgical clinics, emphasizing the importance of early ambulation during in-service training, ensuring standardization of ambulation practices, and utilizing evidence-based approaches with checklists for VTE prevention are all significantly important.

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THE
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AIM

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The purpose of the New Journal of Urology is to contribute to the literature by publishing urological manuscripts such as scientific articles, reviews, letters to the editor, case reports, reports of surgical techniques, surgical history, ethics, surgical education and articles of forensic medicine.

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