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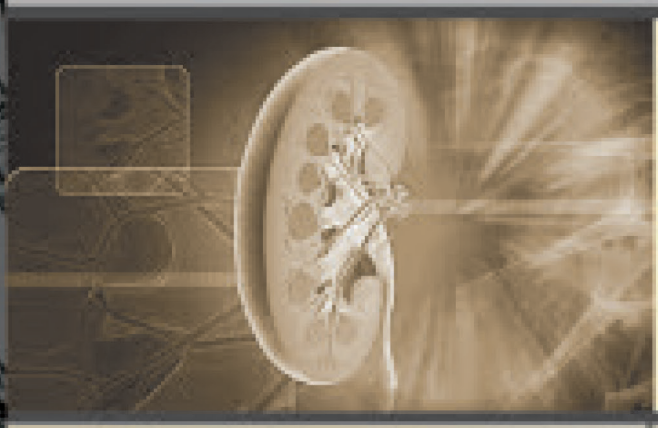

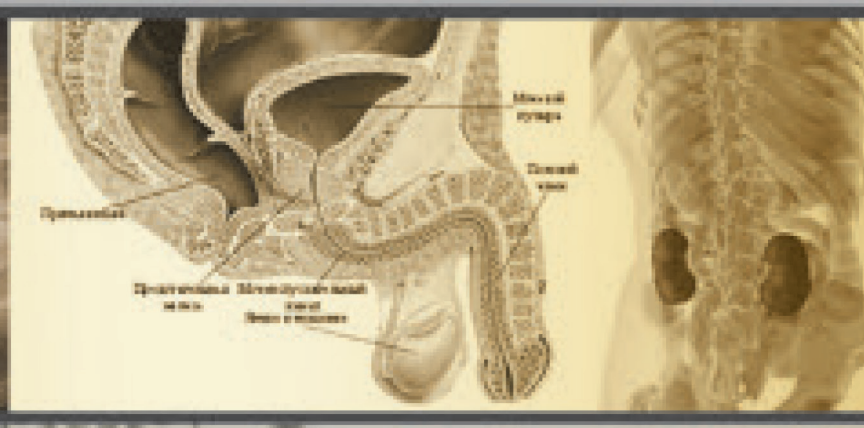

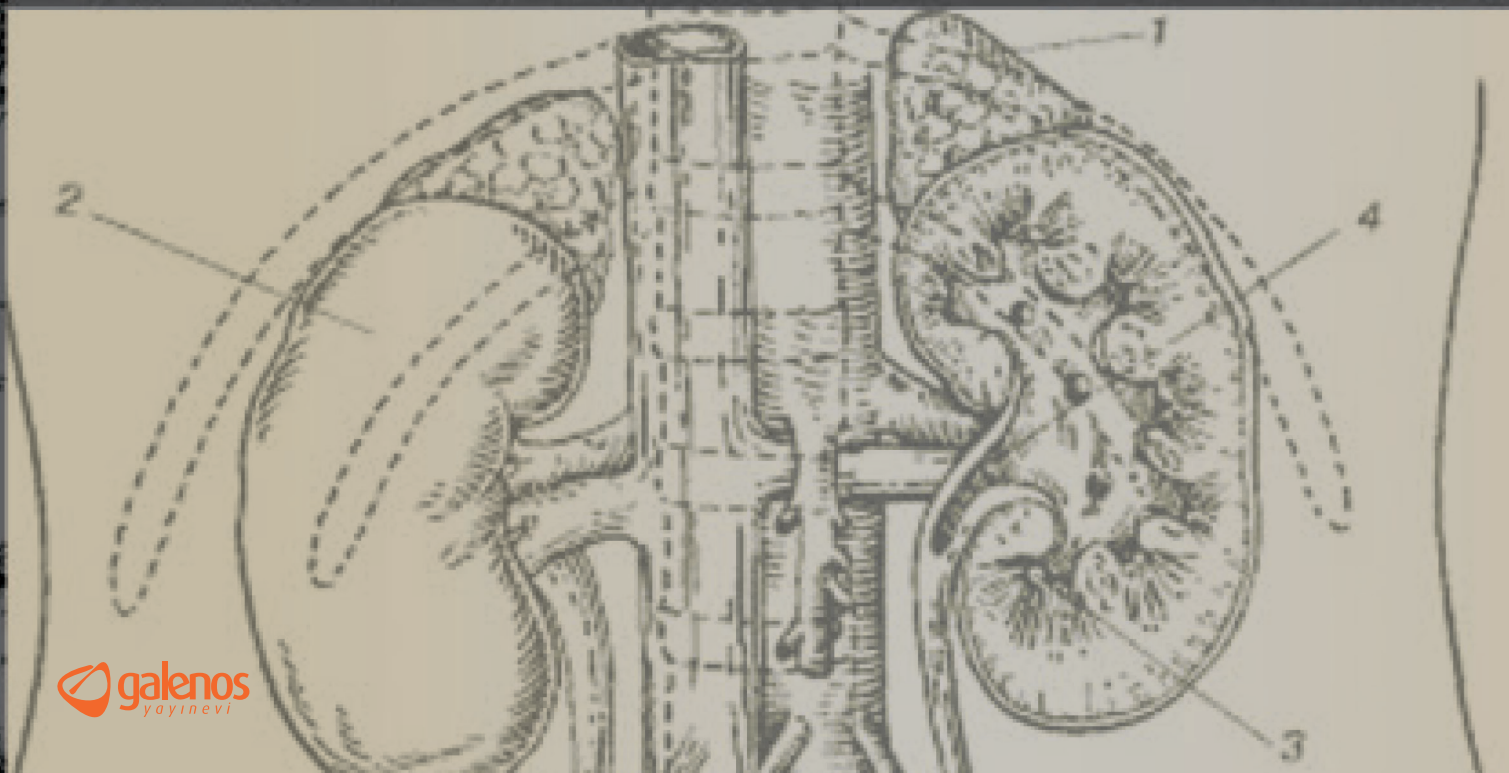


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ORIGINAL RESEARCH
Pediatric Urology

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J Urol Surg 2024;11(1):1-6

# Factors Affecting Stone-freeness in the Initial Session of RIRS in Childhood Kidney Stones

Onur Kaygısız, Yavuz Mert Aydın, Levent Turan, Burhan Coşkun

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**What's known on the subject? and What does the study add?**

The Stone-Kidney index was described as a straightforward method for predicting the success of pediatric percutaneous nephrolithotomy. In this study, we examined the Stone-Kidney index in pediatric retrograde intrarenal surgery for the first time to the best of our knowledge. The identified threshold value for a successful outcome was 1.96.

## Abstract

**Objective:** To determine, the factors affecting stone-freeness in children after one session of retrograde intrarenal surgery (RIRS).

**Materials and Methods:** The data of 102 children who applied RIRS in our clinic between February 2012-January 2022 were retrospectively evaluated. Eleven children were excluded. Ninety-one children were divided into two groups according to stone-free status in the first session. Factors affecting stone freeness were analyzed with univariate and multivariate analyses. The stone-kidney index was calculated using the stone size/kidney long muscle formula, and receiver operating characteristic (ROC) analysis was performed to determine the cut-off point of the presence of residue stone.

**Results:** Forty-seven (51.6%) children were girls. The median age, stone size, and stone-kidney index were 7 (1-17), 11 mm (4-30), and 1.4 (0.24-3.6), respectively. Stone-free status was achieved in 74 patients (group 1) and residual stones were present in 17 patients (group 2). There was a significant difference between the two groups in terms of stone localization, stone size, stone-kidney index, power of the laser device, and operation time. According to multivariate analysis, multiple calyces' stones [p=0.015, odds ratio (OR): 6.37] and stone size ≥2 cm (p=0.006, OR: 16.96) were factors that predicted residual stones. ROC analysis showed that the stone-kidney index at values above 1.96 was significantly associated with an increased risk of residual stone.

**Conclusion:** Stone size ≥2 cm, and multiple calyx stones were risk factors for residual stones after one session of RIRS in children. Stone-kidney index values higher than 1.96 are associated with lower stone-free rates.

**Keywords:** RIRS, laser lithotripsy, pediatric kidney stone, stone-freeness

## Introduction

The more frequent recurrence rate of stone disease in children and the differences in anatomical features from adults make stone treatment more challenging in pediatric patients (1). For this reason, the recommendations for treating kidney stones are different between children and adults in the guidelines. In the European Association of Urology/European Society for Pediatric Urology (EAU/ESPU) guidelines, shock wave lithotripsy (SWL) is recommended as the first-line treatment for stones smaller than 2 cm, except including the lower pole (2). However, SWL has limitations such as high retreatment rates, requiring anesthesia in each session, and decreased success in hard and multiple stones (2-4). In the adult guidelines, retrograde intrarenal surgery (RIRS) is recommended as the first-line treatment for stones smaller than 2 cm; however, pediatric RIRS is not recommended for this type of stone due to the lack of data in the literature (5). On the other hand, laser lithotripsy applied with

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RIRS is used in children with high efficacy and low complication rates (3,6-9). There is still a conflict about this issue. For this reason, we shared our 10-year single-center pediatric RIRS data and to determine the factors affecting stone-free (SF) status in a single session in this study.

## Materials and Methods

### Study Population and Design

The data of 102 pediatric patients who underwent RIRS between February 2012 and January 2022 were retrospectively evaluated. Eleven patients with renal anomaly (n=7), skeletal deformity (n=2), and SF status that could not be evaluated due to nephrocalcinosis (n=2) were excluded from the study. A total of 91 patients (47 girls and 44 boys) were included in the study. Children whose SF status was achieved after the first session of RIRS were defined as group 1, and those with residual stones as group 2 (Figure 1).

SF status was defined as the absence of stone fragments larger than 2 mm in urinary ultrasonography and X-ray of the kidney at postoperative third-month follow-up without additional treatment. The stone-kidney index was calculated using the "the stone longest axis/kidney longest length" formula (10). The complications were recorded according to The Clavien-Dindo classification for the postoperative period and the Satava system for the perioperative period (11,12).

### RIRS Procedure

Sterile urine culture was observed in all patients before surgery. Ceftriaxone prophylaxis was administered to each patient during the induction of general anesthesia. The procedure was performed in the lithotomy position, and a sensor guide (Boston Scientific nitinol guidewire with hydrophilic) and safety catheter were inserted into the renal pelvis via 6.0 F semirigid ureterorenoscope (R. Wolf™ Germany). 7.5 F Flex X2 (Flex-X2, Karl Storz, Tuttlingen, Germany) flexible ureterorenoscope (FURS) was placed in the kidney through the sensor guide. In cases where FURS did not pass through the distal ureter, active dilatation was not applied, and pre-stenting was preferred. 273 nm Ho-YAG laser probe was used. Laser device settings were 0.8-1.5 Joule (J) pulse energy, 8-15 Hertz (Hz) pulse rate on the 30-W laser system, and 0.6-0.8-J pulse energy, 8-12 Hz pulse rate on the 15-W laser system. An angiocath catheter was placed supra-pubically to drain the urine accumulated in the bladder. Before ending the process, a JJ stent was placed in all the patients. In cases where SF status was achieved, a string JJ stent was placed to prevent re-anesthetizing.

The Clinical Research Ethics Committee of the Bursa Uludağ University approved the study (approval number: 2022-20/26, date: 20.12.2022).

### Statistical Analysis

Statistical analysis was performed using SPSS software (IBM Corp. IBM SPSS Statistics for Windows, version 28.0, Armonk, NY: IBM Corp.) The Shapiro-Wilk test was used to test the normality of variables. Variables that were not normally distributed have been presented as a median (minimum-maximum) and were compared using the Mann-Whitney U test. Nominal data have been presented as numbers and percentages and compared with chi-square and Fisher's Exact tests. P<0.05 was considered significant. Logistic regression analysis was performed to determine the factors affecting stone-freeness. Receiver operator characteristics curve (ROC) analysis was performed to determine the cut-off point of the stone-kidney index measurement to predict the presence of residue.

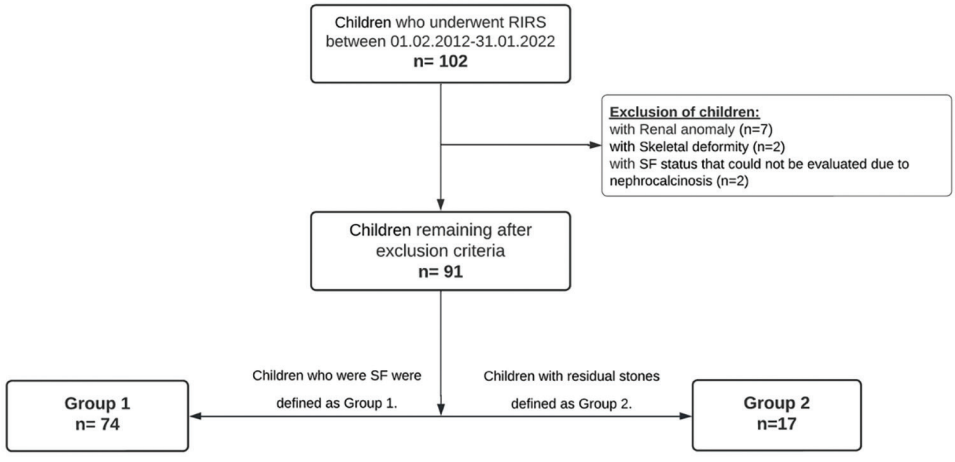


**Figure 1.** Study design chart

RIRS: Retrograde intrarenal surgery, SF: Stone free

## Results

The median age and body mass index were 7 (1-17) years and 16.5 (11.5-39.2) kg/m², respectively. The median follow-up time was 24 (1-132) months. The mean size of the lower pole stone was 10.3 mm, and the standard deviation was 5.4 mm. The SF rate after initial RIRS was 81.3% (74 children). Fourteen of 17 children with residual stones received additional SWL or RIRS treatment, whereas three children had asymptomatic stones, and follow-up was recommended.

SF status was achieved in 74 children (group 1), and 17 had residual stones after one session of RIRS (group 2). No significant differences were found between the groups regarding age, gender, side, stone density, JJ insertion before RIRS, and fluoroscopy time (Table 1). The median stone size [17.1 versus (vs.) 10.5 mm], stone-kidney index (2.08 vs. 1.25), and operation time (85 vs. 50 minutes) were significantly higher in group 2 than in group 1 (p<0.001, 0.001, <0.001, respectively). All children with stones in multiple localizations, except one, included the lower pole. The success rate was 89% for non-lower pole single calyx stones, 88.8% for lower pole stones, and 50% for multiple calyces. Group 1 had a higher rate of 30W laser device use (p=0.048) (Table 1).

In the multivariate analysis, multiple calyces (6.37 times higher than single calyx, p=0.015) and stone size equal to or larger than 2 cm (16.96 times higher than stones smaller than 1 cm, p=0.006) were significant independent predictors of residual stone after one session RIRS. Data on multivariate analysis are given in Table 2. ROC analysis showed that the stone-kidney index at values above 1.96 was significantly associated with an increased risk of residual stone (area under the curve: 0.75 and sensitivity 52.94%, specificity 87.84%, p<0.001) (Figure 2).

In the perioperative period, contrast extra-lumination was observed in retrograde pyelography in two children aged 2 and 5 years. JJ stent was placed in a five-year-old child, and the urethral stent was removed on the first postoperative day, no extrarenal fluid was observed at an ultrasound examination, and the child was discharged. (Satava 2a complication). In the other child, laparotomy was required due to abdominal distension during the operation, and the fluid in the abdomen was drained (Satava 3 complication). A drain was placed at the end of the laparotomy and removed on the first postoperative day. The child's urethral catheter was removed on the third postoperative day, and the child was discharged with recovery. The urinary tract infection

**Table 1. Factors affecting stone-freeness in the initial RIRS**

| | | Group 1 (n=74) | Group 2 (n=17) | p |
|---|---|---|---|---|
| Age | | 7 (1-17) | 9 (2-16) | 0.430 |
| Gender (girl) | | 41 (55.4%) | 6 (35.3%) | 0.180 |
| Side (right) | | 31 (41.9%) | 8 (47.1%) | 0.790 |
| Stone location | Single calyx (except lower calyx)<br>Lower calyx<br>Multiple calyces (with lower calyx) | 49 (89.1%)<br>16 (88.9%)<br>9 (50%) | 6 (10.9%)<br>2 (11.1%)<br>9 (50%) | **<0.001** |
| Multiple stones | | 34.2% | 58.8% | 0.096 |
| Stone size (mm, min-max) | | 10.5 (8-135) | 17.1 (7-30) | **<0.001** |
| Stone size | <10 mm | 26 (92.9%) | 2 (7.1%) | **<0.001** |
| | ≥10 mm, <20 mm | 43 (86.0%) | 7 (14%) | |
| | ≥20 mm | 5 (38.5%) | 8 (61.5%) | |
| Stone density (HU, min-max) | | 908 (340-1668) | 862 (378-1786) | 0.863 |
| Stone-kidney index (min-max) | | 1.25 (0.2-3.6) | 2.08 (0.7-3.5) | **0.001** |
| JJ insertion before RIRS (available/none) | | 41/33 | 9/8 | 1 |
| Laser power 15/30 W-30 W<br>Rate | | 20/54<br>69%/87.1% | 9/8<br>31%/12.9% | **0.048** |
| Operation time (minutes) | | 50 (8-135) | 85 (30-120) | **<0.001** |
| Fluoroscopy time (seconds) | | 35.05±28.34 | 63.8±47.1 | 0.052 |
| Complication<br>Clavien 2: Urinary tract infection<br>Satava 2a: Fornix rupture<br>Satava 3: Fornix rupture causing abdominal distension | | 7 (9.5%)<br>6 (8.1%)<br>1 (1.4%)<br>None | 2 (11.8%)<br>1 (5.9%)<br>None<br>1 (5.9%) | 0.673 |

mm: Millimeter, min: Minimum, max: Maximum, HU: Hounsfield unit, W: Watt, RIRS: Retrograde intrarenal surgery

| Table 2. Multivariate analysis of factors affecting stone-freeness | | | | | | |
|---|---|---|---|---|---|---|
| | | RC | p | OR | Lower 95% CI | Upper 95% CI |
| Age (years) | | | 0.365 | 1.07 | 0.92 | 1.25 |
| Laser power 15W | | 30 W | 0.067 | 3.71 | 0.91 | 15.09 |
| Stone location | Lower calyx | Single calyx | 0.877 | 1.16 | 0.17 | 7.79 |
| | Multiple calyces | | 0.015 | 6.37 | 1.44 | **28.19** |
| Stone size (cm) | ≥1 cm, <2 cm | <1 cm | 0.402 | 2.14 | 0.36 | 12.75 |
| | ≥2 cm | | 0.006 | 16.96 | 2.25 | **128.07** |
| Hosmer and Lemeshow test: p=0.577, Logistic regression model significance: p<0.001, RC: Reference category, cm: Centimeter, W: Watt, OR: Odds ratio, CI: Confidence interval | | | | | | |

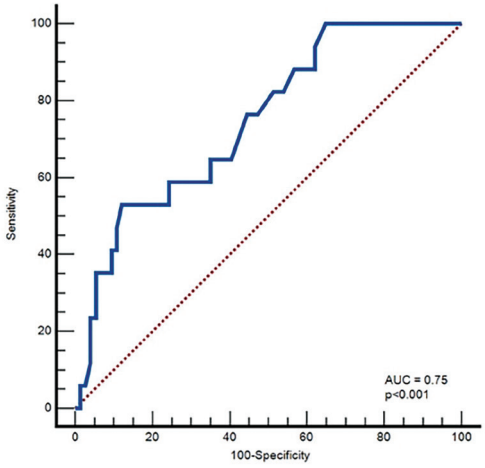


**Figure 2.** ROC analysis for stone-kidney index

AUC: Area under the curve, ROC: Receiver operating characteristic

(Clavien 2 complication) rate is 6 (8.1%) and one (5.9%) child in group 1 and group 2, respectively. While 5 of them received oral antibiotic treatment, 2 of them required intravenous antibiotic treatment.

## Discussion

This study showed that larger stone size and multiple stone localization were related to residual stones after one session of RIRS. Additionally, the operation time was longer in children with residual stones. The children with residual stones had larger stones, including multiple calyces, so prolonged operation time could be a predicted finding. The fluoroscopy time was insignificantly higher in children with residual stones, according to children with SF status.

The current study demonstrated that stone size and localization were risk factors for residual stones after RIRS. In the current study, 19 of 20 children with multiple localization stones included the lower pole. Xiao et al. (13) showed that stone size and the presence of staghorn stones were related to the SF rate in the multivariate analysis. Moreover, in a multicenter study based on pediatric patients, stone size and multiple stones were shown to be risk factors for residual stones (14). Similar to the aforementioned study, the success of RIRS decreased in multiple calyxe stones containing the lower pole and ≥2 cm stones in our study.

The treatment of lower pole stones is more complex than other localizations in adults and children (2,15). EAU/ESPU 2022 guidelines recommend percutaneous nephrolithotomy (PNL) as the first-line treatment for lower pole stones in children (2). Stone size, presence of a lower pole, and multiple stones were found to be significant predictors of residual stone on multivariant analysis in a study including adult patients, 20% of whom were pediatric patients (16). In our study, the success rate of single non-lower pole calyx and lower pole calyx stones was similar, with 89.0% and 88.8%. Kahraman et al. (17) reported that stone localization did not affect the SF rate and suggested that it was due to the improved deflection abilities of flexible ureterorenoscopes. The high success rate of these stones may be due to the displacement of a single lower calyx stone with a small size to the appropriate position with a basket catheter. Also, the decrease in the success rate in larger stones in multiple localization, including the lower pole where a basket catheter cannot be used, supported our mentioned opinion.

Çitamak et al. (10) suggested that the stone-kidney index has a predictive value on the success of PNL. The authors reported that a stone-kidney index greater than 2.95 predicted the risk of residual stones (10). The current study showed that the stone-kidney index in the residual stone group was significantly higher than that in the SF group (2.08 vs. 1.25, p<0.001). Additionally, in our study, it was found that a stone-kidney index greater than 1.96 increases the risk of residual stones with a specificity of 87.84%. According to Çitamak et al.'s (10) results, our cut-off value seems lower; it may be due to the fact that our study is focused on RIRS. The failure of RIRS in stones larger than 2 cm in our study mainly explains the difference between the cut-off values that PNL was recommended as the first choice in these stones. To the best of our knowledge, this is the first study

that evaluates the stone kidney index for pediatric RIRS cases in predicting residual stone risk.

In this study, we found that the SF rate was significantly higher at a 30W power laser device (87.1) than 15W power laser device (69%). However, we found that using 15W laser power did not predict the risk of residual stones in multivariate analysis. It has been shown that high laser-powered devices have the advantage of short operation time, but it does not significantly contribute to the single-session SF rate (18).

The success rates of the initial RIRS have been reported to be 50 to 100%. Consistent with the literature, we found the success of the initial RIRS to be 81.3% and 96.7% after additional treatment (RIRS and SWL). Tanaka et al. (19) reported a retreatment rate of 37% for 6-10 mm kidney stones and 71% for over 10 mm kidney stones. These retreatment rates were higher than that in our study. The mentioned study was one of the first studies on pediatric RIRS. Therefore, the difference might be due to the development of surgical skills and technological progress.

A systematic review reported the complication rate as 10.5% (6). Similarly, our complication rate was 9.9% (7.7% Clavien 2, 1.1% Satava 2a and 1.1% Satava 3). Fornix rupture occurred in 2 children in our study. While one of these children was managed with JJ insertion (Satava 2a), the other child developed abdominal distension caused fluid leakage that required laparotomy (Satava 3). It has been shown that complications are more common in children under five years of age when performing RIRS in pediatric patients (14). In our series, children who developed fornix rupture were under five years old. Because of these findings, it can be said that RIRS is preferable in treating kidney stones in children with acceptable success and complication rates. However, considering the higher incidence of complications in young patients.

### Study Limitations

This study had some limitations. Although the retrospective design is a limitation, patient data were kept prospectively in the datasheet in this study, minimizing the data loss. The absence of stone analysis is another limitation. However, the density of stones to predict stone hardness was measured from computed tomography. The large sample size was the strength of our study.

## Conclusion

RIRS is a minimally invasive surgical modality that can treat kidney stones with high success and low complication rates in children. The large stone size and multiple calyx stones are associated with lower SF rates after one session RIRS. The stone kidney index, with a threshold value of 1.96, can be used as an easy method for SF estimation after the first RIRS session.

### Acknowledgments

We would like to thank Prof. Gökhan Ocakoğlu for his statistical support in this study.

### Ethics

**Ethics Committee Approval:** The Clinical Research Ethics Committee of the Bursa Uludağ University approved the study (approval number: 2022-20/26, date: 20.12.2022). The study protocol is in accordance with the international agreements from the Declaration of Helsinki.

**Informed Consent:** The Clinical Research Ethics Committee of the Bursa Uludağ University waived informed consent due to the retrospective nature of the study.

### Authorship Contributions

Surgical and Medical Practices: O.K., Concept: O.K., B.C., Design: O.K., Data Collection or Processing: O.K., L.T., Analysis or Interpretation: O.K., Y.M.A., Literature Search: O.K., B.C., Y.M.A., L.T., Writing: O.K., B.C., Y.M.A., L.T.

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

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

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ORIGINAL RESEARCH
Endourology

Doi: 10.4274/jus.galenos.2023.2023-6-3
J Urol Surg 2024;11(1):7-13

# Comparison of Retrograde Intrarenal Surgery with and Without Fluoroscopy for Renal Stone Treatment

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**What's known on the subject? and What does the study add?**

Fluoroscopy is used when placing an access sheath in kidney stone surgery. In our study, we contributed to the literature by comparatively showing that operations can be performed effectively and safely without using fluoroscopy.

## Abstract

**Objective:** To compare fluoroscopy-free retrograde intrarenal surgery (RIRS) with routine RIRS with fluoroscopy for urolithiasis treatment in terms of efficacy and safety. Prospective quasi-experimental study. Hitit University Çorum Erol Olçok Training and Research Hospital, Department of Urology, Çorum, Turkiye August 2019-2020.

**Materials and Methods:** Pre-operative and postoperative data for 98 patients who underwent RIRS using fluoroscopy and 100 patients who underwent RIRS without fluoroscopy were prospectively assessed. Patients who did not provide preoperative consent, were pregnant, or had a clotting disorder, active urinary system infection, or anatomic abnormalities such as ectopic kidney were excluded from the study. In the technique without fluoroscopy, the fluoroscopic device was ready for use in surgery; however, all manipulations were performed by all-seeing access without fluoroscopy. Patients beginning without fluoroscopy who required fluoroscopy were not included in the study.

**Results:** The mean stone size was 18.5±2.31 (5-30) mm (in the fluoroscopy group 17.2±25.3 mm, in the non-fluoroscopy group 19.8±20.9). Stone-free rates were similar between the groups (91% in the fluoroscopy group and 90% in the non-fluoroscopy group) (p=0.683). The mean duration of fluoroscopy use in the fluoroscopy group was 8.76±9.50 s. A Clavien 3b complication (perirenal hematoma) was observed in one patient (in the fluoroscopy group), which regressed with observation. Minor complications were observed in both groups: fever in 7 patients (3.6%), hematuria in 7 patients (3.6%), and steinstrasse in 1 patient (0.5%).

**Conclusion:** Fluoroscopy-free RIRS may be applied effectively and safely by endourologists for patients with urolithiasis, similar to the routine method with fluoroscopy.

**Keywords:** Renal calculi, endourology, fluorroscopy-free retrograde intrarenal surgery

## Introduction

While urinary system stone disease is observed at rates of approximately 12%, the recurrence rate is 50% within 5-10 years (1). With today's technological developments, retrograde intrarenal surgery (RIRS) may be used effectively and reliably for the treatment of stones of various sizes in urinary tract stone disease (2). When compared with open and laparoscopic surgery and percutaneous nephrolithotomy, this technique is less invasive, has high success rates, and has become popular (3).

This commonly used surgical technique involves some potential risks such as complication risks linked to the use of the ureteral access sheath (UAS), and cancer and genetic mutations linked to fluoroscopy use (4). In recent studies, it has been aimed to

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use fluoroscopy at a minimal level to protect the healthcare staff and the patient in RIRS, but as the number of operations is rapidly increasing, the cumulative doses of radiation are becoming an increasingly important issue.

With the aim of reducing radiation received during operations, we previously developed a fluoroscopy-free RIRS technique called "all-seeing access" and presented it for use (5). In this study, we compared fluoroscopy-free (all-seeing access) and fluoroscopy RIRS in terms of success, complications, and fluoroscopy duration.

We showed that RIRS without fluoroscopy can be performed safely, effectively, and with low complication rates.

## Materials and Methods

The study included 198 patients scheduled to undergo RIRS for kidney and proximal ureter stones from August 2019 to August 2020 at the Clinic of Urology Hitit University Faculty of Medicine Çorum Erol Olçok Training and Research Hospital, who read the voluntary consent form and agreed to participate. The study was conducted prospectively after ethics committee permission was obtained (Hitit University Faculty of Medicine Clinical Research Ethics Committee decision no: 47, date: 18.09.2019).

Patients who did not provide consent before the operation, who were pregnant, or who had a clotting disorder, active urinary tract infection, or anatomic anomalies such as ectopic kidney were excluded from the study.

The patients were divided into two groups (groups were determined by simple randomization): group 1 (non-fluoroscopy group, n=100) underwent surgery without fluoroscopy and group 2 (fluoroscopy group, n=98) were operated on using fluoroscopy. For all patients, demographic features, stone side and location, stone dimensions, preoperative imaging method, operation and fluoroscopy durations, preoperative Double J (DJ) stent and intraoperative UAS insertion, stone-free rates, pre- and postoperative creatine variations, hematocrit levels, number of sessions, and complication data were recorded.

Preoperatively, the patients were assessed by full blood count, serum creatinine, bleeding parameters, full urine test, and urine culture. Patients positive for urine culture were given antibiotic treatment for sufficient duration and had the procedure performed after a clean urine culture was obtained. All patients were assessed preoperatively using spiral non-contrast tomography. All patients had kidney, ureter, and bladder X-rays taken preoperatively and postoperatively. The stone size was recorded by calculating the largest diameter of the stone in millimeters.

In the first month postoperatively, kidney ureter-bladder (KUB) X-ray was performed for opaque stones; otherwise, urinary ultrasonography or non-contrast tomography was performed to assess residual stone status. If appropriate, DJ stents were removed from the patients, while a second session of RIRS was performed in patients with residual stones (larger than 4 mm).

### Technique

In the operating room, a C-arm fluoroscopy device was always ready when the procedure began. All patients undergoing RIRS were administered general anesthesia by intubation or laryngeal mask. The operation was performed in the supine lithotomy position. All patients were initially entered with a 9.5 FR semirigid ureteroscope (Storz, Tuttlingen, Germany), and the lower end of the ureter was observed. The ureter was entered with the aid of a guide wire (0.035-inch hydrophilic material coated flexible tip guide wire, Cook Medical, Limerick, Ireland). The ureter was assessed in terms of width and narrowness up to the final point that the ureteroscope could access (preferably the renal pelvis). The patient group without fluoroscopy first had a flexible renoscope (Storz Flex-X2, Tuttlingen, Germany) passed through an access sheath (9.5 Fr), and thus the access sheath was on the flexible renoscope. Then, with all-seeing access, the flexible renoscope was sent into the ureter through the guide wire and to the kidney. The access sheath was inserted into the ureter above the flexible renoscope (Figure 1). The stones were fragmented using a laser (Sphinx 30 Litho, Holmium-YAG laser, pulse energy 0.5-4.0 J, frequency single 4-20 Hz pulse peak power 15 kW). At the end of laser lithotripsy, the stones were left to pass spontaneously, and a DJ stent was inserted. The flexible renoscope and access sheath were removed together under all-seeing access to assess possible ureter injury. Three weeks later, the DJ stents were removed under mask anesthesia.

For the patient group in which fluoroscopy was used, they were entered with the renoscope, and a guide wire was inserted into the ureter. After diagnostic renoscopy was performed by entering the ureter, the access sheath was advanced along the ureter under fluoroscopy above the guide wire using the classic method. After the routine stone-fracture procedure, a DJ stent was inserted under fluoroscopy, and the procedure was completed.

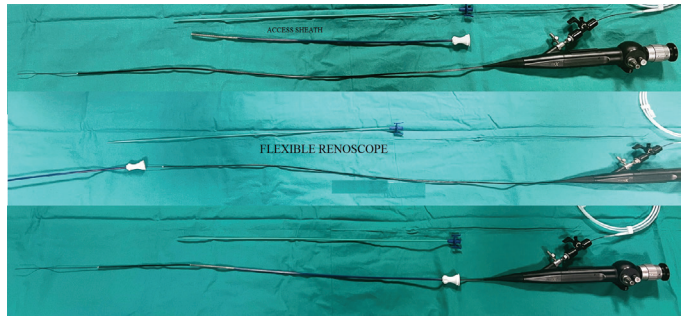


**Figure 1.** All-seeing access sheath insertion method

All patients underwent KUB X-rays on postoperative day 1, with hemogram and biochemistry examinations. Fever, pain, and hematuria were assessed. In the first postoperative month, a KUB X-ray was taken during the clinical check-up. If the stones were non-opaque, urinary ultrasound or tomography was performed, and residual stone presence was assessed. Complication and success rates were compared according to the use of the methods with and without fluoroscopy.

### Statistical Analysis

Statistical analyzes were conducted using SPSS (Version 22.0, SPSS Inc., Chicago, IL, USA). The Kolmogorov-Smirnov test was used to determine the normality of distribution. Descriptive statistics for continuous data normally distributed are given as mean ± standard deviation, whereas continuous data not normally distributed are given as median (min-max), and categorical data are presented as number and percentage (%). Comparison of numerical variables between two independent groups used the independent groups t-test (Student's t-test) for data normally distributed and the Mann-Whitney U test for data not normally distributed. Relationships between categorical variables were examined using the chi-square test or Fisher's exact test linked to the number of data in the cells of cross tables. Statistical significance was assessed at $p<0.05$.

## Results

In our research, among the 198 patients, the fluoroscopy group (n=98) comprised 33 women and 65 men, whereas the non-fluoroscopy group (n=100) comprised 36 women and 64 men. The mean age of the patients in the study was 48.22±14.42 (18-84) years. None of the patients received additional treatment. One patient had an ankylosing spondylitis diagnosis and 3 patients had a solitary kidney.

There were similar distributions for male and female rates in the research groups (p=0.731) (Table 1). The relationships between American Society of Anesthesiologists, previous stone surgery, stone localization, side, preoperative DJ stent placement, access use, and session numbers were not significant between the groups (p=0.058, p=0.375, p=0.671, p=0.306, p=0.958, p=0.277, p=0.078, respectively).

Patient age significantly differed between the groups (p=0.025) (Table 2). Stone sizes also significantly differed between the groups (p=0.002), as did operation duration (p=0.019). the number of stones was not significantly different between the groups (p=0.358).

The mean duration of fluoroscopy use in the fluoroscopy group was 8.76±9.50 (in non-fluoroscopy group was 0 s).

**Table 1. Comparison of demographic data**

| | | With fluoroscopy (n=98) | Without fluoroscopy (n=100) | p-value |
|---|---|---|---|---|
| | | n (%) | n (%) | |
| **Sex** | Male | 65 (50.4%) | 64 (49.6%) | 0.731[a] |
| | Female | 33 (47.8%) | 36 (52.2%) | |
| **ASA** | 1 | 20 (69%) | 9 (31%) | 0.058[a] |
| | 2 | 58 (47.9%) | 63 (52.1%) | |
| | 3 | 20 (41.7%) | 28 (58.3%) | |
| **Previous stone surgery** | Yes | 60 (52.2%) | 55 (47.8%) | 0.375[a] |
| | No | 38 (45.8%) | 45 (54.2%) | |
| **Stone localization** | Prox ureter | 59 (51.8%) | 55 (48.2%) | 0.671[b] |
| | Pelvis-upper pole | 33 (45.2%) | 40 (54.8%) | |
| | Lower pole | 4 (66.7%) | 2 (33.3%) | |
| | Pelvis-lower pole | 2 (40%) | 3 (60%) | |
| **Side** | Left | 46 (49.5%) | 47 (50.5%) | 0.306[b] |
| | Right | 51 (51.5%) | 48 (48.5%) | |
| | Bilateral | 1 (16.7%) | 5 (83.3%) | |
| **Preoperative DJ** | Inserted | 12 (50%) | 12 (50%) | 0.958[a] |
| | Not inserted | 86 (49.4%) | 88 (50.6%) | |
| **Session number** | 1 | 96 (51.3%) | 91 (48.7%) | 0.078[b] |
| | 2 | 2 (20%) | 8 (80%) | |
| | 3 | 0 (0%) | 1 (100%) | |

[a]: Chi-square test, [b]: Fisher's exact test, DJ: Double J, ASA: American Society of Anesthesiologists

| Table 2. Comparison age, stone sizes, the number of stones, the operation duration | | | |
|---|---|---|---|
| | **With fluoroscopy (n=98)** | **Without fluoroscopy (n=100)** | **p-value** |
| **Age** | 45.90±13.97 | 50.49±14.55 | **0.025**[a] |
| **Stone sizes** | 1.72±2.53 | 1.98±2.09 | **0.002**[b] |
| **The number of stones** | 1.35±0.73 | 1.29±0.65 | 0.358[b] |
| **The operation duration** | 42.62±14.75 | 46.29±15.75 | **0.019**[b] |
| [a]: Chi-square test, [b]: Fisher's exact test | | | |

| Table 3. Stone-free comparison | | | |
|---|---|---|---|
| | **With fluoroscopy (n=98)** | **Without fluoroscopy (n=100)** | **p-value** |
| | **n (%)** | **n (%)** | |
| Stone Free | 90 (91%) | 90 (90%) | 0.653 |
| Residual stone | 8 (9%) | 10 (10%) | |
| Fisher's exact test | | | |

A comparison of stone-free rates between the research groups is presented in Table 3. The relationship between being stone-free and the groups was not statistically significant (p=0.683).

A comparison of complication rates between the research groups is shown in Table 4. The relationship between hematoma (p=1.000), hematuria (p=0.27), fever (p=0.71), and steinstrasse (p=1.000) with the groups was not statistically significant.

Variations in hematocrit and creatine measurements before and after RIRS were not significantly different between the research groups (p=0.377, p=0.975, respectively).

Stone situation was evaluated with KUB in 150 patients, USG in 10 patients, and CT in 30 patients.

## Discussion

Fluoroscopy is an important tool required in the operating room to safely perform endoscopic interventions. This tool is frequently used to insert a guide during renoscopy, insert and direct a UAS, and determine the location of renal stones in RIRS and other endoscopic operations (6). Despite these advantages during endoscopic surgery, ionizing radiation affects both the patient and operation room staff (surgeon, nurse, and anesthesiologist). With longer duration and higher dose, working in close proximity with continuous fluoroscopy may cause genetic changes and even cancer due to the cumulative radiation effect (7).

In the USA, cumulative radiation was shown to increase cancer risk by 0.4-0.9% (7,8). Another study by Hellawell et al. (9) showed very low radiation of 11.6 Gy for urologists during interventions; however, considering that an actively working surgeon may perform 500 operations per year, this rate reaches 5.6 Gy. They stated that this calculated radiation dose is more than half that of non-contrast tomography. Therefore, the issue of less frequent use of fluoroscopy has been raised with the aim of protecting both the patient and the surgical team from these harmful effects of radiation.

There are many publications with this aim in the literature. A 76-patient study by Kirac et al. (10) applied a reduced fluoroscopy method. With a direct view of the ureterorenoscope above the guide wire, the patients entered the renal pelvis and then inserted a UAS above the guide wire by tactile sensation. In 4 patients (5.4%), UAS placement could not be confirmed; therefore, single-shot fluoroscopy was used, and the mean fluoroscopy duration was 5.27±1.8 s. They reported complications in 5 patients (6.5%), with urinary tract infection in 2 patients, ureter injury in 1 patient, hematuria in 1 patient, and fever in 1 patient (10).

In another study by Hsi and Harper (11), in which 162 patients were operated on for 94 kidney stones, 26 proximal ureter stones, and 49 distal stones, tactile sensation and endoscopy

| Table 4. Comparison of complications | | | | |
|---|---|---|---|---|
| | **Complications** | | | |
| **Operation method** | **Hematoma number (n)** | **Hematuria number (n)** | **Fever number (n)** | **Steinstrasse number (n)** |
| With fluoroscopy n=98 (49%) | 0 | 5 (2.5%) | 4 (2%) | 0 |
| Without fluoroscopy n=100 (51%) | 1 (1%) | 2 (1%) | 3 (1.5%) | 1 (0.5%) |
| Total (n=198) | 1 (0.5%) | 7 (3.5%) | 7 (3.5%) | 1 (0.5%) |
| p-value | >0.99 | 0.27 | 0.72 | >0.99 |
| Fisher's exact test | | | | |

were used in an attempt to use less fluoroscopy. In 117 cases (75%) fluoroscopy was not used, while in 54% of cases with fluoroscopy used to confirm the stent placement, less than 2 s of fluoroscopy was used, while in 17 cases (11%) more than 5 s of fluoroscopy was used. In that study, 85% of fluoroscopy needs were reduced using tactile sensation and endoscopy, and they stated that this method could be used effectively and reliably (11).

Thus, attempts were made to perform surgery without fluoroscopy in several studies. However, UAS insertion with blind tactile sensation caused complications. With the "all-seeing access" method we developed, the UAS is not inserted with tactile sensation but with direct observation. Due to this method, in one group fluoroscopy was not used, whereas in the other group fluoroscopy was used for 8.76±9.50 s.

When the RIRS success rate was examined, stone-free rates were reported to be 73.6-94.1% in the literature (12). A 132-patient RIRC study by Fabrizio et al. (13) in India found that the success rate was 83% for upper calyx stones, 90% for middle calyx stones, 65% for lower calyx stones, and 87% for pelvic stones. A prospective study by Redondo et al. (14) evaluated 50 patients undergoing RIRS within 1 year and stated that the full stone-free rate after RIRS was 89.7%. Hyams et al. (15) reported that the stone-free rate was 95% with flexible ureteroscopy for proximal ureter stones smaller than 2 cm.

To determine the success and efficacy of RIRS, it was observed that the number of studies with lower success rates was particularly high for lower pole stones Fuchs and Fuchs (16) reported 60-80% stone-free rates for the treatment of lower pole stones with RIRS.

As shown by the studies, the full stone-free rates for adult patients after RIRS vary from 50% to 90%. This broad interval may be due to the radiological imaging method used to declare stone-free rates after operations and the lack of a standard definition for stone dimensions. In our study, when the stone-free rates in our patients were compared between the two methods, the difference was not significant. The group in which fluoroscopy was not used had a rate of 90%, whereas the rate for the group in which fluoroscopy was used was 91% (p=0.683). The reason for these success rates, which are similar and even better than those in the literature, may be that patients with lower pole stones, which have lower success rates, comprised only 6% of all patients.

A 635-patient RIRS study by Goldberg et al. (17) found that the operation duration was 53±19.4 min for stones smaller than 15 mm, whereas the duration for stones larger than 15 mm was significantly longer at 73.6±29.9 min. The size of the stone is stated to be a factor that lengthens the operation duration. In our study, the operation duration for the fluoroscopy group with stone size 17.2 (±25.3) mm was 42.62 min, whereasfor the non-fluoroscopy group with stone size 19.8 (±20.9) mm, the operation duration was 46.29 min. In our study, as the stone size increased, the operation duration was longer by a statistically significant degree (p=0.019).

A total of 11,885 prospective RIRS studies published by CROES were identified to have a general complication rate of 3.5%. According to the modified Clavien classification, 2.8% of these complications were degree 1 and 2 complications. In that study, mortality was reported in 5 cases due to sepsis, pulmonary embolism, multiple organ dysfunction, and cardiac reasons (18).

Xu et al. (19) published a 375-patient retrospective study assessing complications using the Clavien rating system for the effects of various factors. They stated that positive preoperative urine culture and lengthened operation duration were factors affecting complications. The mean case duration was 40 min, with fever observed in 13%, intraoperative hematuria in 7.7%, and significantly elevated creatinine in 6 patients.

In our study, preoperative routine urine cultures were obtained to verify a sterile urine and the patients were operated on. The mean operation duration was 40 min in both groups. Postoperatively, fever was observed in 7 patients (3.5%). They were treated with simple antipyretics. There was no significant difference between the groups (p=0.7195). Clavien grade 1 hematuria was observed in 23 patients (11%) and there was no significant difference between the groups for this complication (p=0.2766). Hematuria was observed in 5 patients in the group in which fluoroscopy was used (2.5%) and in 2 patients in the group in which it was not used (1%). Although there was no significant difference between the two groups (p=0.2766), we believe that inserting a UAS under all-seeing access is safer. Based on our clinical experience, stenosis of the ureter and kinking can be observed by eye when inserting the UAS using all-seeing access, and thus, the use of unnecessary force is avoided. In conclusion, the complication rates were lower. None of our patients had no significant changes in preoperative or postoperative creatinine or hematocrit levels (p=0.975).

The important complication, steinstrasse (Clavien 3b), was observed in 9 patients (0.6%) in a study including 1571 patients. The only variable affecting this complication was stone size (20). Again, another study of patients with 2-4-cm stone sizes observed that stone size being 4 cm or above and fragments larger than 1-2 mm were risk factors for the formation of steinstrasse. In our study, consistent with the literature, steinstrasse was observed in 1 patient (0.6%) with stones larger than 3 cm. The patient was treated by extraction of the stones endoscopically.

A subcapsular hematoma was observed in 1 patient (0.5%). An examination of the literature revealed that there was a probability of incidence in patients over 70 years of age, using anticoagulants, and with chronic renal disease, and this probability was less than 1%. It has been stated that the formation of abscesses, growth of hematoma, and disrupted hemodynamics should be corrected with open surgery (21). Contrary to the literature, despite our patient being young, having no comorbidity, and not using anticoagulants, subcapsular hematoma developed (22). The patient described flank pain on the first postoperative day, and non-contrast tomography imaging showed a hematoma. The patient was monitored with bed rest and empirical antibiotic treatment. The hematoma was reabsorbed without additional intervention. The reasons for this complication are considered to be that the stone was in the lower pole, parenchymal thinning occurred in the region linked to the stone, the stone was larger than 2 cm, and the operation lasted longer than 1 hour. In the literature, parenchymal rupture was emphasized to generally occur when working with high intrapelvic pressure (23). For this reason, a UAS should be used if possible, during RIRS, and high pressure should be avoided.

Because of this technique, it is thought that there is protection from the harmful effects of fluoroscopy and prevention of complications occurring due to blind UAS use during RIRS. When we prospectively investigated our patients undergoing RIRS with and without fluoroscopy, we did not find any statistically significant differences in terms of efficacy or complications between the methods. Thus, we showed that operations can be performed effectively and safely without using fluoroscopy. In addition, we protected the surgical team and the patient from the damaging effects of ionizing radiation.

### Study Limitations

A limitation of this study is the small number of patients. Further prospective, randomized controlled studies are needed for RIRS without fluoroscopy to become more popular. Finally, multicenter studies will increase the evidence level.

## Conclusion

In our study, groups operated on with and without fluoroscopy were prospectively investigated. Similar success and complication rates to those reported in the literature were obtained for our patients.

In RIRS without fluoroscopy, the f-URS acts as a guide to visually insert the UAS with all-seeing access, and it was concluded that it may be safely and effectively performed to protect the entire surgical team and the patient from the damaging effects of fluoroscopy.

RIRS without fluoroscopy was shown to be a method that may be chosen in clinics with high experience in the topic. With randomized, multicenter studies including more patients that will be performed on this topic, non-fluoroscopy RIRS may become a method that is routinely applied.

### Ethics

**Ethics Committee Approval:** The study was conducted prospectively after ethics committee permission was obtained (Hitit University Faculty of Medicine Clinical Research Ethics Committee decision no: 47, date: 18.09.2019).

**Informed Consent:** Retrospective study.

### Authorship Contributions

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

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

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# Effect of Tissue Densities at the Skin-to-Stone Distance on the Success of Shockwave Lithotripsy

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**What's known on the subject? and What does the study add?**

Skin stone distance is one of the many factors affecting the success of extracorporeal shock wave lithotripsy. The shock waves pass through different tissues from skin to stone. In this study, we investigated the effect of the thickness and density of the tissues on the path of shock waves from the skin to the stone.

## Abstract

**Objective:** There are several factors affecting the success of shockwave lithotripsy (SWL), which is still one of the first-line treatments for renal stones smaller than 2 cm. The aim of this study was to evaluate the effect of thickness and density measurements obtained by computed tomography (CT) for various tissues within the route of shockwaves on the outcome of SWL treatment success.

**Materials and Methods:** The data of 89 patients who underwent SWL for renal pelvic stones smaller than 2 cm between July 2020 and September 2021 were prospectively evaluated. Age, sex, body mass index, stone volume, stone density, skin-to-stone distance, tissue thickness and density, hydronephrosis, number of shockwaves, and SWL success were recorded. Patients were divided into two groups according to SWL success: SWL success and SWL failure groups. Demographic data and CT parameters were compared between the groups.

**Results:** Stone-free status (<4 mm residual stone) was achieved in 70 patients. Mean subcutaneous adipose tissue density was -97 Hounsfield unit (HU) in group 1 and -101 HU in group 2 (p=0.575). Mean muscle tissue density was 32 HU in group 1 and 31 HU in group 2 (p=0.843). Perinephric adipose tissue density was calculated as -93 HU in group 1 and -98 HU in group 2 (p=0.621). Skin-to-stone distance, tissue thickness, and tissue density findings failed to effect stone-free status.

**Conclusion:** According to the results obtained in this study, tissue thickness and density in a CT scan did not affect treatment success. Only stone density and size in a CT scan can help to decide SWL treatment success, as suggested in previous studies.

**Keywords:** Hounsfield unit, extracorporeal shockwave lithotripsy, renal stone, non-contrast computed tomography

## Introduction

First introduced by Chaussy et al., shockwave lithotripsy (SWL) still maintains its place as a non-invasive method for treating renal stones smaller than 2 cm (1). SWL is frequently used around the world, and the treatment success rate is reported to be between 47-91%. Various features of a stone, such as density, size, and location, its skin-to-stone distance; and the device used, can affect success rates (2). Non-contrast computed tomography (CT) is the most used radiologic imaging modality in the evaluation of urinary tract stones. CT is the preferred radiological evaluation method because it provides more information about stone-related data such as stone location, density, size and skin-to-stone distance; and information about renal anatomy such as infundibulopelvic angle and hydronephrosis (3).

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In addition, the subcutaneous adipose tissue, muscle tissue, perinephric adipose tissue, and renal parenchymal thickness and density can be measured by CT. To date, there is no study in the literature evaluating the effect of tissue density on SWL success. The aim of this study was to evaluate the effect of thickness and density measurements obtained by CT for various tissues within the route of shockwaves on the outcome of SWL treatment success.

## Materials and Methods

This was a single-center prospective study that was approved by the Institutional Ethics Review Board and was conducted in accordance with the good clinical practice guidelines (decision no: 2020/514/182/5, date: 22.07.2020 - Kartal Dr. Lütfi Kırdar City Hospital). Between July 2020 and September 2021, a total of 94 patients who underwent SWL for renal pelvic stones were included in the study. Five patients were excluded from the study; three could not tolerate the procedure, two were lost during follow-up. A total of 89 patients who underwent SWL treatment for renal pelvic stones smaller than 2 cm in diameter were included in the study. Abdominal non-contrast CT, urinalysis, urine culture, complete blood count, and coagulation tests were performed on all patients before the procedure. The same Dornier Compact Sigma (Med Tech, Munich, Germany) device in our institution was used for the SWL treatment of all patients. Exclusion criteria were anatomical disorders, coagulation disorders, active urinary infection, and distal obstruction and a treatment of more than three sessions. All SWL procedures were performed without anesthesia by the same doctor and technician. During 1 extra SWL session, a maximum of 3000 shocks were delivered at the energy level of 2 to 4, corresponding to 14 to 15 kV. All of them had radiopaque stones. One month after the end of treatment, patients with ≥4 mm stones confirmed by CT or direct urinary tract radiography were considered unsuccessfully treated (4).

Skin-to-stone distance was measured at 0°, 45° and 90° in the axial section of a non-contrast CT scan and then averaged (5). Parenchymal thickness at the skin-to-stone distance, perinephric adipose tissue, muscle tissue, and subcutaneous adipose tissue were also calculated (Figure 1). Tissue densities were marked as region of interest in a circular pattern with a 1 cm diameter on CT and calculated as mean Hounsfield unit (HU) [Infinitt Pacs 3.0.11.4 (BN11)] (Figure 2). Stone volume was calculated using the formula (0.523 × length × width × height) (6). Stone density, the number of shockwaves, body mass index (BMI), degree of hydronephrosis, side, and patients' age and sex were included in the analysis. Patients were divided into two groups as SWL success and SWL failure groups, and their demographic data and CT findings were compared.

### Statistical Analysis

Statistical analyzes were performed using the software SPSS version 20.0. The conformity of the variables to a normal distribution was examined visually (histogram) and analytically (Kolmogorov-Smirnov and Shapiro-Wilk tests). All continuous variables are presented as mean and standard deviation. Student's t-test was used to compare continuous variables between groups. Continuous variables with abnormal distribution were evaluated with the Mann-Whitney U test. Chi-square test was used to compare categorical variables. P-values <0.05 were interpreted as statistically significant.

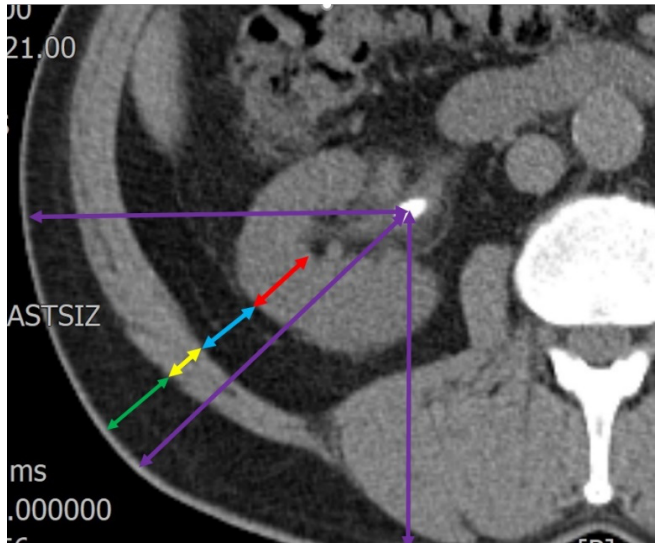


**Figure 1.** Skin-to-stone distance and tissue thicknesses. Purple arrow: skin-to-stone distance, red arrow: Renal parenchyma thickness, blue arrow: Perinephric adipose tissue thickness, yellow arrow: Muscle tissue thickness, green arrow: Subcutaneous adipose tissue thickness

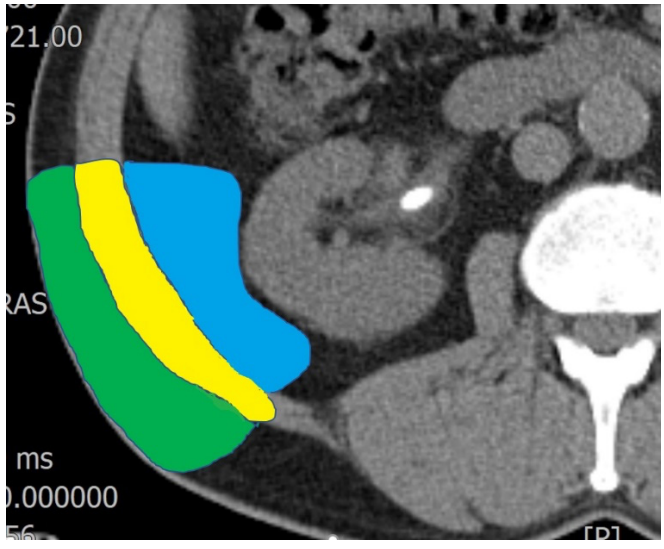


**Figure 2.** Measurement of tissue densities. Blue area: Perinephric adipose tissue, yellow area: Muscle tissue, green area: Subcutaneous adipose tissue

## Results

A total of 89 patients who underwent SWL for renal pelvic stones were included in the study. Patients defined as stone-free were included in group 1 (n=70) and patients with residual stones were included in group 2 (n=19). Of the 89 patients, 60 were male and 29 were female (group 1: 48/22, group 2: 12/7). BMI (kg/m$^2$) was 26.41 for group 1 and 25.02 for group 2. There was no statistically significant difference between the groups in terms of age, sex, side and BMI (Table 1). The mean stone volume was 500 mm$^3$ in group 1 and 694 mm$^3$ in group 2. Stone volume was significantly higher in group 2 (p=0.041). Stone density was significantly higher in group 2 (732 HU in group 1 vs. 888 HU in group 2, p=0.005). The total number of shockwaves was 5797 in group 1 and 7142 in group 2. The number of shockwaves was significantly higher in group 2 (p=0.032). Mean subcutaneous adipose tissue density was -97 HU in group 1 and -101 HU in group 2. Mean muscle tissue density was 32 HU in group 1 and 31 HU in group 2. Perinephric adipose tissue density was calculated as -93 HU in group 1 and -98 HU in group 2. There was no statistically significant difference between the groups in terms of skin-to-stone distance, tissue thickness, and tissue density (Table 2). Multivariate analysis revealed that none of the variables were predictive for stone-free rate (Table 3).

## Discussion

The effect of shockwaves may decrease as they cross through different tissue types, and this may affect SWL success. At this point, SWL success may be affected as the thickness and density of the tissues between the stone and skin vary. In vitro studies in the literature reported no significant difference in the transmission of shockwaves in different tissues, however, only animal tissues were used in these studies (2,7). Ng et al. (8) reported that thicker renal parenchyma increased SWL success, whereas success decreased in thinner or scarred parenchyma. In this study, although renal parenchymal thickness was high in the successful SWL group, no statistically significant difference was observed. Juan et al. (9) reported that the rate of failure was high in patients with more visceral and perirenal adipose tissue. Another study reported that abdominal adipose tissue

**Table 1. Demographic data**

| | Group 1 (n=70) | Group 2 (n=19) | p-value |
|---|---|---|---|
| **Gender (male/female)** | 48/22 | 12/7 | 0.783 |
| **Age (years)** | 43.43 (±13.15) | 43.32 (±13.06) | 0.974 |
| **BMI (kg/m²)** | 26.41 (±4.23) | 25.02 (±3.48) | 0.192 |
| **Side (right/left)** | 37/33 | 12/7 | 0.450 |

BMI: Body mass index

**Table 2. Computed tomography and extracorporeal shockwave lithotripsy data**

| | | Group 1 | Group 2 | p-value |
|---|---|---|---|---|
| **Stone volume (mm³)** | | 500 (±345) | 694 (±416) | 0.041 |
| **Stone density (HU)** | | 732 (±222) | 888 (±151) | 0.005 |
| **Skin-to-stone distance (mm ± SD)** | | 98.60 (±20.81) | 98.95 (±18.28) | 0.948 |
| **Muscle tissue (mm ± SD)** | | 13.26 (±3.55) | 13.05 (±4.02) | 0.829 |
| **Subcutaneous adipose tissue (mm ± SD)** | | 24.11 (±15.04) | 26.26 (±13.67) | 0.575 |
| **Perinephric adipose tissue (mm ± SD)** | | 15.13 (±8.0) | 13.11 (±5.34) | 0.302 |
| **Parenchymal thickness (mm ± SD)** | | 26.2 (±4.19) | 24.58 (±6.57) | 0.194 |
| **Subcutaneous adipose tissue density (HU)** | | -97 (±37) | -101 (±16) | 0.644 |
| **Muscle tissue density (HU)** | | 32 (±13) | 31 (±15) | 0.843 |
| **Perinephric adipose tissue density (HU)** | | -93 (±45) | -98 (±16) | 0.621 |
| **Number of shockwaves** | | 5797 (±2495) | 7142 (±1922) | **0.032** |
| **Degree of hydronephrosis** | Grade 0 | 3 (4.3%) | 1 | 0.068 |
| | Grade 1 | 22 (31.4%) | 3 | |
| | Grade 2 | 34 | 10 | |
| | Grade 3 | 11 | 3 | |
| | Grade 4 | 0 | 2 | |

SD: Standard deviation, HU: Hounsfield unit

**Table 3. Evaluation of predictive variables for stone free status on multivariate analysis**

| | Odds ratio (95% CI) | p-value |
|---|---|---|
| **Skin-to-stone distance (mm ± SD)** | 1.023 (0.963-1.087) | 0.464 |
| **Muscle tissue (mm ± SD)** | 1.007 (0.851-1.192) | 0.936 |
| **Subcutaneous adipose tissue (mm ± SD)** | 0.993 (0.927-1.065) | 0.853 |
| **Perinephric adipose tissue (mm ± SD)** | 0.929 (0.831-1.038) | 0.191 |
| **Parenchymal thickness (mm ± SD)** | 0.917 (0.817-1.030) | 0.143 |
| **Subcutaneous adipose tissue density (HU)** | 0.995 (0.962-1.028) | 0.750 |
| **Muscle tissue density (HU)** | 0.995 (0.957-1.034) | 0.786 |
| **Perinephric adipose tissue density (HU)** | 0.998 (0.971-1.026) | 0.893 |

SD: Standard deviation, HU: Hounsfield unit, CI: Confidence interval

areas had no effect on stone-free status (10). In this study, subcutaneous adipose tissue, muscle tissue, and perinephric adipose tissue thickness had no effect on stone-free status. To the best of our knowledge, there are no previous studies on the effect of tissue density in the literature. We calculated and analyzed the average density of tissues at the skin-to-stone axis. Accordingly, subcutaneous adipose tissue, muscle tissue, and perinephric adipose tissue densities had no effect on stone-free status. Furthermore, we evaluated the association of skin to stone distance, tissue density and tissue thickness with stone - free status using multivariate analysis and found that none of these variables were predictive of stone-free status.

CT is a rapid and reliable imaging modality for the diagnosis of urinary tract stones. Furthermore, CT is critical to treatment planning by revealing the location, size, and density of the stone; obstruction status; and presence of urinary anomalies. There are many factors affecting the success of SWL; and various findings on CT may be useful in predicting the success of SWL treatment (11).

Previous studies evaluated the association between patent characteristics and SWL outcome. Graversen et al. (12) found that BMI had an effect on SWL success in their study. BMI was thought to be influential at two points: skin-to-stone distance and adipose tissue thickness. It was concluded that the increased adipose tissue may be an obstacle in the transmission of shockwaves. In another study conducted by Pareek et al. (5), BMI was found to be an important parameter in predicting stone-free status in SWL. However, skin-to-stone distance and stone density were reported to be more important parameters. In this study, BMI was not identified as an effective parameter in predicting stone-free status. This may be due to the small sample size and the fact that only patients with renal pelvic stones were included in the study.

There are studies reporting both positive and negative results of the effect of skin-to-stone distance on SWL success. Jacobs et al. (13) found that skin-to-stone distance had no effect on SWL success, whereas El-Nahas et al. (14) found that skin-to-stone distance was associated with SWL success. Similarly, Patel et al. (15) identified skin-to-stone distance as an independent predictor on multivariate analyzes in their study. Interstingly, Weld et al. (16) found that skin-to-stone distance only had an effect on SWL success in calcium stones when renal pelvic stones were excluded from analysis. There are studies in the literature reporting cut-off values of 9-11 cm for skin-to-stone distance. Pareek et al. (5) reported a cut-off value of 10 cm. These authors concluded that a more than 10 cm distance was related to lower SWL success rates. In this study, the mean skin-to-stone distances was similar for both groups. Mean skin-to-stone distance was lower than 10 cm for both groups, so we think that skin-to-skin distance was less importantin our study. SWL success decreases as stone size increases. Therefore, SWL is not recommended for stones larger than 2 cm (17). Some studies have reported that stone volume is more important than the maximum length of the stone (18). Concordant with the literature, in our study, a higher mean stone volume rate was determined in "unsuccessfully" treated patients.

Stone density is an important predictor of SWL success. Gupta et al. (19) reported that patients with stone density >750 HU had more residues and required more sessions. In another study, El-Nahas et al. (14) found that SWL failure increased when stone density was more than 1000 HU. These authors concluded that stone density is an independent predictor of stone fragmentation. Different from these studies, a high failure rate with increasing stone size was demonstrated in patients with stone density above 1000 HU (20). Although no cut-off value was calculated in this study, stone density was found to be higher in the unsuccessful SWL group than in the other.

In this study, a maximum of 3000 shockwaves per session was administered, and patients received a maximum of three sessions. Patients in whom fragmentation could not be achieved or those who had residual stones were rescheduled for the treatment. The number of shockwaves was higher in the unsuccessful SWL group than in the other. Joseph et al. (21) reported that the number of shockwaves was high in patients with residual stones or in patients in whom fragmentation was not achieved.

### Study Limitations

There are certain limitations to this study. First, the small patient number is a weakness of the study. More reliable results could be achieved with a larger patient cohort. The results of stone analysis and metabolic evaluations of patients were not included. In addition, only patients with renal pelvic stones were included. Therefore, the results cannot be generalized and may differ in other renal stones.

## Conclusion

CT parameters before SWL can predict stone-free status. Stone density and volume are important parameters to be considered in patient selection. Based on the results obtained in the present study, no effect of skin-to-stone distance and the thickness and density of the tissues at this distance on stone-free status could be determined. Further studies should be conducted to evaluate these parameters in larger patient groups.

### Ethics

**Ethics Committee Approval:** This was a single-center prospective study that was approved by the Institutional Ethics Review Board and was conducted in accordance with the good clinical practice guidelines (decision no: 2020/514/182/5, 22.07.2020 - Kartal Dr. Lütfi Kırdar City Hospital).

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

### Authorship Contributions

Surgical and Medical Practices: C.Ç., B.Ş., O.Ö., Concept: C.Ç., Y.T., Design: U.C., Y.T., Data Collection or Processing: C.Ç., E.D., A.C., Analysis or Interpretation: O.Ö., Y.T., Literature Search: C.Ç., E.D., U.C., Writing: C.Ç., B.Ş.

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

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ORIGINAL RESEARCH
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# Examination of the Hemoglobin, Albumin, Lymphocyte, and Platelet Score of Testicular Tumor: Comparison of Pre- and Postoperative and Non-Cancerous Patients

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**What's known on the subject? and What does the study add?**

The purpose of this study was to determine whether the hemoglobin, albumin, lymphocyte, and platelet (HALP) score, which includes hemoglobin, albumin, lymphocyte, and platelet levels, is a significant parameter in the diagnosis of testicular tumors. The study included patients who underwent orchiectomy at our clinic with a preliminary diagnosis of testicular tumor and whose diagnosis was confirmed after the pathological examination. Preoperative and postoperative HALP scores were calculated and analyzed. The cases were compared based on their pathological diagnosis and tumor node metastasis staging. Additionally, the scores of all patients with testicular tumors were compared to those of the non-cancerous control group. Consequently, a significant cut-off value for the HALP score in testicular tumors was obtained, and this value suggests that the HALP score can be a useful diagnostic tool for testicular tumors.

## Abstract

**Objective:** To determine and compare the pre-and post-operative hemoglobin, albumin, lymphocyte, and platelet (HALP) scores of patients who underwent radical orchiectomy for testicular tumor based on pathology and stage with those of patients without a testicular tumor.

**Materials and Methods:** One hundred nineteen patients diagnosed with testicular tumor between 2017 and 2022 were retrospectively analyzed. Patients' pre- and post-op HALP, neutrophil-lymphocyte ratio, and platelet-lymphocyte ratio values were saved. In the control group, 100 varicocelectomy patients aged 19 to 56 between 2018 and 2022 were questioned. The data were analyzed based on pathology and stage; tumor patients were compared with the control group.

**Results:** The tumor and control groups had mean ages of 31 and 30 years; the seminoma group had a pre-op HALP score of 59, while the mixed germ cell tumor (MGCT) group had a score of 55 (p=0.283). There was no statistical difference in HALP scores between pathological groups before and after surgery (p=0.327, 0.510). The testicular tumor group's mean pre-op HALP value was 57.75, whereas the control group's was 70.85 (p=0.000). There were 28 embryonal carcinomas among the 54 MGCT group patients. The pre-op and post-op HALP scores of both pathological groups were not significant (p=0.162, 0.104).

**Conclusion:** The HALP score is an important parameter that is higher in testicular cancer patients than in non-cancerous patients. There was no statistically significant difference in HALP scores based on pathological subtype, tumor stage, or lymph node metastasis status.

**Keywords:** Biomarker, hemoglobin, albumin, lymphocyte, platelet (HALP) score, nomogram, testicular cancer

## Introduction

Testicular tumors comprise 1% of all adult neoplasms and 5% of all urological tumors (1). Its prevalence has risen in recent years, particularly in developed countries (2,3). Because it is diagnosed relatively early in life and develops silently, it can metastasize quickly. Only 1-2% of cases are diagnosed bilaterally, and germ cell tumors are the most common histological type (1).

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Recent research has focused on the nutritional status of patients and the hemoglobin, albumin, lymphocyte, and platelet (HALP) score, a new inflammation index that measures the immune system by proportionally combining hemoglobin, albumin, lymphocytes, and platelets. The HALP score has been identified as a prognostic predictor in patients with malignant tumors such as renal cell carcinoma, genitourinary cancer, and lung cancer (4-6).

There has been no study on whether the HALP score is significant in testicular tumor cases. We designed this study to obtain a new parameter that will help in the differential diagnosis of testicular tumors other than known tumor markers. We retrospectively analyzed patients who underwent orchiectomy for testicular tumors and patients who underwent varicocelectomy for primary infertility as controls.

## Materials and Methods

### Study Design

One hundred fifty two patients aged 20-65 years diagnosed with testicular tumors and who underwent orchiectomy at Kartal City Hospital between 2017 and 2022 were retrospectively analyzed.

### Exclusion Criteria

Patients who were not pathologically diagnosed with testicular tumor (n=14), who had advanced comorbidities (n=9), and chronic disease anemia (n=10). Thus, 119 testicular tumor patients were included in the study, among whom there were no bilateral testicular tumors or solitary testicle.

Age, pre-operative and postoperative HALP, neutrophil-lymphocyte ratio (NLR), and platelet-lymphocyte ratio (PLR) levels were all measured. The hemograms obtained in the first three months after orchiectomy were used to calculate postoperative data. The control group included 100 patients aged 18 to 37 who had varicocelectomy for primary infertility and had no comorbidities. These patients' pre-op HALP score, NLR, and PLR values were calculated. The postoperative HALP score could not be calculated in the control group because the hemogram was not checked during the patients' routine follow-up.

### Calculation

The HALP score was calculated as hemoglobin level (g/L) albumin level (g/L) lymphocyte (/L)/platelet count (/L). PLR and NLR were accounted for by dividing the platelet count by the lymphocyte count and the neutrophil count by the lymphocyte count (7).

### Statistical Analysis

All data were analyzed using the SPSS IBM 25 program. According to their pathology, the patients were divided into seminoma and mixed germ cell tumor (MGCT) groups. In addition, two different groups formed testicular tumors and control patients. MGCT patients were analyzed according to the predominant type of pathology (based on tumor percentage). In addition, all testicular tumor patients were compared by calculating pre-operative and postoperative HALP, NLR, and PLR values according to tumor node metastasis staging. Paired samples t-test, Wilcoxon signed-rank test, Student's t-test, Mann-Whitney U test, receiver operating characteristic (ROC) curve analysis, and One-Way ANOVA tests were used for statistical analysis.

## Results

There were 119 testicular tumors and 100 control group patients. The median age of the tumor patients was 31 (seminoma; 34, MGCT; 28), and the control group was 30 (p=0.352). Also, these patients, 65 were seminoma, and 54 had MGCT.

The median pre-operative and postoperative HALP scores in the seminoma group were 59 and 57, respectively (p=0.327), as opposed to 55 and 57.2 in the MGCT group (p=0.510). In terms of HALP scores, there was no discernible difference between the two groups before and after surgery (Table 1).

Seminoma patients' pre-operative and postoperative mean NLR values did not substantially differ; however, there was a significant difference between the pre-operative and postoperative NLR values for the MGCT group (p=0.008). In either diseased group, however, there was no statistically significant difference between pre- and postoperative PLR values (Table 1).

**Table 1. Age, pre-op and post-op HALP, NLR and PLR values of the Seminoma and MGCT Group**

| | Seminoma (n=65) | | MGCT (n=54) | |
|---|---|---|---|---|
| | Mean | p | Mean | p |
| HALP 1 | 59 (15-133) | 0.327* | 55 (13-113) | 0.510* |
| HALP 2 | 57 (12-134) | | 57.2 (10-111) | |
| NLR 1 | 2.95 (1.1-7.7) | 0.441** | 3.71 (0.8-17.7) | 0.008** |
| NLR 2 | 2.98 (1-10.9) | | 2.83 (0.32-11.7) | |
| PLR 1 | 129.9 (55-305) | 0.953** | 152.8 (39.8-376) | 0.512* |
| PLR 2 | 133.5 (53.6-364) | | 146.3 (56-390) | |

*Paired Samples t-test, **Wilcoxon signed-rank test, MGCT: Mixed germ cell tumor, HALP: Hemoglobin, albumin, lymphocyte, and platelet score, NLR: Neutrophil-lymphocyte ratio, PLR: Platelet-lymphocyte ratio, 1: Preoperative, 2: Postoperative

Another comparison was obtained by comparing all tumor patients with the control group. The HALP score of testicular tumor patients was 57.7, but it was 70.8 in the control group (p=0.000). A significant difference was observed when the NLR and PLR values of the tumor group and the control group were compared (p=0.000) (Table 2). Furthermore, ROC curve analysis revealed that the optimal cut-off value for the HALP score was 62 (Table 3) (Figure 1).

When seminoma and MGCT patients were pathologically classified, there was no significant difference in HALP, NLR, and PLR scores pre- and postoperatively (Table 4). If the patients in the MGCT group were classified within themselves, we obtained four groups: 28 embryonal carcinoma, 14 teratoma, 7 seminoma, and 5 Yolk-Sac predominant. In the MGCT group, there was no pathology, with choriocarcinoma predominating. There was no significant difference in HALP, NLR, or PLR values between the groups before and after surgery (Table 5).

All testicular tumor patients were classified according to T staging; there were 37 testicular intraepithelial neoplasia, 67 T1, 14 T2, and 1 T3. According to the T staging of the patients, the HALP, NLR, and PLR values did not differ significantly (Table 6).

**Table 2. Comparison of testicular tumor and control group patients**

| | Testicular tumor (n=119) | Control group (n=100) | p |
|---|---|---|---|
| Age (year) | 31.9±9.05 | 27.9±5.4 | 0.001* |
| HALP | 57.75±24.8 | 70.85±21.3 | 0.001* |
| NLR | 3.29±2.27 | 1.80±0.68 | 0.001* |
| PLR | 140±58.3 | 100.7±29.5 | 0.001* |

*Student's t-test, HALP: Hemoglobin, albumin, lymphocyte, and platelet score, NLR: Neutrophil-lymphocyte ratio, PLR: Platelet-lymphocyte ratio

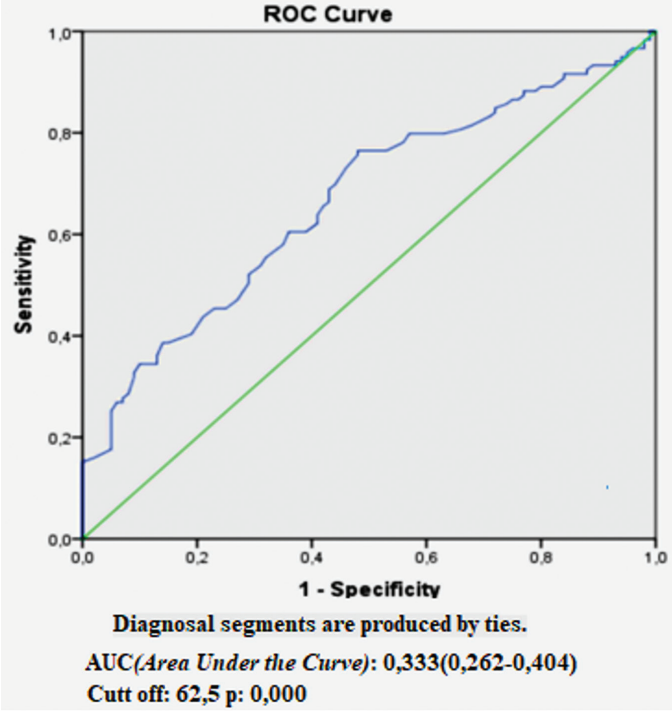


**Figure 1.** Determination of the optimal threshold value of the HALP score by ROC analysis

HALP: Hemoglobin, albumin, lymphocyte and platelet; ROC: Receiver operating characteristic

## Discussion

Hemoglobin and albumin levels are associated with the nutritional status of the body, whereas lymphocytes and platelets are related to the immune system. The HALP score system has typically been used to estimate the prognosis of patients with cancer. This scoring system was initially developed by Chen et al. (8) to determine the prognosis of stomach cancer. The importance of the HALP score as a risk biomarker in various malignancies has also been established. Gao et al. (9), conducted in 2022, suggested that patients with non-metastatic ureteral tumors with a preoperative HALP score below 28 were an independent risk factor for overall survival. We discovered an optimal HALP score of 62 (Figure 1).

In another study by Kaya et al. (10), the HALP score study conducted in 2020 in prostate cancer and benign prostatic hyperplasia patients, the HALP index did not have a diagnostic role.

Unlike previous studies, we aimed to compare HALP, NLR, and PLR scores with the normal population as well as pre- and postoperative pathological diagnosis and stage in our study. In the testicular tumor group, statistical data revealed no significant difference between the seminoma and non-seminoma groups in terms of both pre- and postoperative HALP scores. The most important finding of our study, and the one that most surprised us numerically, is the difference between the HALP scores of the testicular tumor and control groups.

When the data were analyzed according to the pathology and staging, there was no statistical difference between the mean HALP scores. In the foreground, we thought that HALP, NLR, and PLR values would differ before orchiectomy due to tumor burden. However, we noticed no significant difference between the seminoma and MGCT groups regarding both pre- and postoperative HALP scores. We want to note the same result in the "T" staging.

Our study is not the first to examine NLR and PLR levels in patients with testicular tumors. There are studies in the literature that show that NLR and PLR values are helpful for testicular tumor diagnosis, staging, and metastasis. Wealso found a significant difference in NLR and PLR values between tumor patients and the control group (11-13). However, there has been no published research on the relationship between HALP score and testicular

| Table 3. Receiver operating characteristic curve parameters of positive prognostic factors for testicular cancer | | | | | |
|---|---|---|---|---|---|
| | **AUC (95%)** | **Cut-off** | **p** | **Sensitivity (%)** | **Specifity (%)** |
| Age | 0.625 (0.551-0.699) | 28.5 | 0.001 | 59.7 | 37 |
| HALP | 0.333 (0.262-0.404) | 62.5 | 0.000 | 39.5 | 61 |
| NLR | 0.782 (0.843-0.722) | 2.06 | 0.000 | 70 | 30 |
| PLR | 0.723 (0.655-0.790) | 110.3 | 0.000 | 66.4 | 32 |
| AUC: Area under the curve, HALP: Hemoglobin, albumin, lymphocyte, and platelet score, NLR: Neutrophil-lymphocyte ratio, PLR: Platelet-lymphocyte ratio | | | | | |

| Table 4. Comparison of HALP, NLR, PLR values of seminoma and MGCT | | | |
|---|---|---|---|
| Age | Seminoma (19-58) | 34 | p |
| | MGCT (18-58) | 28 | 0.001* |
| HALP 1 | Seminoma | 59.9 | 0.283* |
| | MGCT | 55.0 | |
| HALP 2 | Seminoma | 57.4 | 0.959* |
| | MGCT | 57.2 | |
| NLR 1 | Seminoma | 2.95 | 0.056** |
| | MGCT | 3.71 | |
| NLR 2 | Seminoma | 2.98 | 0.193** |
| | MGCT | 2.83 | |
| PLR 1 | Seminoma | 129.9 | 0.077** |
| | MGCT | 152.2 | |
| PLR 2 | Seminoma | 133.5 | 0.913** |
| | MGCT | 146.3 | |
| *Student's t-test, **Mann-Whitney U test, MGCT: Mixed germ cell tumor, HALP: Hemoglobin, albumin, lymphocyte, and platelet score, NLR: Neutrophil-lymphocyte ratio, PLR: Platelet-lymphocyte ratio, 1: Preoperative, 2: Postoperative | | | |

| Table 5. Pre-op and post-op HALP, NLR, PLR comparison of MGCT patients by dominant Tm type | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Dominant pathology type** | **Number of patients (n=54)** | **HALP 1** | **HALP 2** | **NLR 1** | **NLR 2** | **PLR 1** | **PLR 2** |
| Seminoma | 7 | 46.2 | 44.4 | 3.53 | 2.73 | 169.6 | 167.8 |
| Teratoma | 14 | 60.1 | 66.0 | 4.13 | 2.55 | 140.2 | 130.9 |
| Embryonal carcinoma | 28 | 51 | 52.4 | 3.69 | 3.11 | 161.8 | 156.5 |
| Yolk-Sac | 5 | 75.6 | 77.2 | 2.86 | 2.22 | 108 | 102.2 |
| Mean | | 55 | 57.2 | 3.71 | 2.83 | 152.2 | 146.3 |
| p: | | 0.162* | 0.104* | 0.852* | 0.814 | 0.302* | 0.439 |
| *One-Way ANOVA, HALP: Hemoglobin, albumin, lymphocyte, and platelet score, NLR: Neutrophil-lymphocyte ratio, PLR: Platelet-lymphocyte Ratio, 1: Preoperative, 2: Postoperative | | | | | | | |

tumors. We would like to emphasize that our study is the first of its kind. We should also mention that our HALP value was higher in both the testicular tumor and non-cancerous groups than in previous studies (5,14).

### Study Limitations

Include the fact that it is retrospective, single-center, and the time determined for the postoperative HALP score is limited to the first three months; it is unclear whether the patients will receive chemotherapy or radiation therapy. We also accept that some patients underwent retroperitoneal lymph node dissection (RPLND) during the follow-up period after orchiectomy, and no cancer-specific mortality information that was not reported in the trial.

It is possible that patients who have undergone RPLND have different HALP scores than those who have not. However, if we make an average comment based on T staging, we should state that the results were not statistically significant (p=0.187). Another notable finding was that there was no significant difference in HALP scores between the seminoma group and the non-seminomatous testicular tumor group, which has a worse prognosis.

| Table 6. Pre-op and post-op HALP, NLR, PLR scores according to T staging | | | | | | | |
|---|---|---|---|---|---|---|---|
| **TNM** | **n=119** | **HALP 1** | **HALP 2** | **NLR 1** | **NLR 2** | **PLR 1** | **PLR 2** |
| TIN | 37 | 62.8 | 59.2 | 2.65 | 2.39 | 130.4 | 122.5 |
| T1 | 67 | 57.2 | 57.6 | 3.44 | 3.07 | 137.1 | 142.1 |
| T2 | 14 | 46.0 | 51.2 | 4.38 | 3.59 | 181.2 | 170.7 |
| T3 | 1 | 64 | 52 | 2.29 | 2.47 | 113.3 | 138.2 |
| Mean | | 57.7 | 57.374 | 3.29 | 2.91 | 140 | 139.3 |
| p | | 0.187* | 0.783* | 0.081* | 0.219* | 0.037* | 0.171* |

*One-Way ANOVA, HALP: Hemoglobin, albumin, lymphocyte, and platelet score, NLR: Neutrophil-lymphocyte ratio, PLR: Platelet-lymphocyte ratio, 1: Preoperative, 2: Postoperative, TNM: Tumor node metastasis, TIN: Testicular intraepithelial neoplasia

There is a study in the literature that a new index called "HALPA" is created by combining the HALP score and the anesthesiologists grade of the patient. In a study by Peng et al. (5) in 2018, they stated that the HALPA score is associated with decreased survival after radical cystectomy. Again, Ornaghi et al. (15), in a study conducted in 2020, emphasized that preoperative HALP and HALPA scores are independent risk factors for postoperative complications and mortality in patients who underwent radical cystectomy. In this regard, we accept the lack of data on the mortality status of the patients in our study. There is yet to be a study on the HALPA score and testicular tumor. From this perspective, the absence of a HALPA score in our data is another shortcoming of our study. In the other process, a study on the relationship between the HALPA score and testicular tumor can be planned.

## Conclusion

The HALP score of testicular tumor patients is lower than that of the non-cancerous population, according to our findings. However, we should note that the HALP score does not yield significant staging and pathological typing results. It is currently not possible to calculate a standard HALP score and predict whether it is critical for survival. Multicenter and long-term studies with a larger patient population may produce different results.

The HALP score of patients with testicular cancer is lower than that of the non-cancerous population. However, it should be noted that the HALP score does not provide significant results for staging and pathological typing. It is currently not possible to calculate a standard HALP score and predict whether it is critical for survival. Multicenter and long-term studies with a larger patient population may provide different results.

### Ethics

**Ethics Committee Approval:** The study was initiated with the approval of the Kartal Dr. Lütfi Kırdar City Hospital Clinical Research Ethics Committee (date: 29.09.2021, approval no: 2021/514/210/1).

**Informed Consent:** Retrospective study.

### Authorship Contributions

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

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

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# Comparison of Penile Block and Caudal Block Applications in Patients Undergoing Circumcision Surgery

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**What's known on the subject? and What does the study add?**

A lot of medical agents and anesthetic methods are available to control pain during circumcision surgery and in the postoperative period, but no specific agent or method has been defined in the literature. In addition, the number of studies comparing the superiority of the agents and methods given for pain control in circumcision surgery is limited. Therefore, we aimed to compare the effectiveness of caudal block and penile block methods applied under general anesthesia with different pain scoring methods in preventing postoperative pain in patients undergoing circumcision surgery.

## Abstract

**Objective:** To evaluate the effectiveness of caudal block and penile block methods, in patients who underwent circumcision surgery in preventing postoperative pain.

**Materials and Methods:** Patients who underwent elective circumcision surgery between January 2019 and May 2022 were retrospectively evaluated. After the exclusion criteria, 56 patients were included in the study. They were divided into two groups as penile block (group P, n=31) and caudal block (group C, n=25). Anesthesia technique applied, anesthesia duration, postoperative first micturition time, postoperative complications, time of first analgesia, analgesia need in the first six hours, observer pain score and Modified Pediatric Objective Pain Scale scores (MPOPS) were scanned.

**Results:** When the first micturition time in the postoperative period was compared, it was found that group P took a significantly shorter time than group C (p=0.001). It was determined that group C needed analgesia in a shorter time than group P (p=0.028). When the MPOPS at 30$^{th}$ min (p=0.031), 90$^{th}$ min (p=0.043) and 6$^{th}$ hour (p=0.016) were compared, group C higher scores than group P.

**Conclusion:** As a result, both methods can be used effectively and safely for appropriate pain control in patients who will undergo circumcision surgery. Both methods have advantages and disadvantages over each other. The choice of methods may vary with the experience of the surgeon and anesthetist.

**Keywords:** Caudal anesthesia, dorsal penile nerve block, male circumcision

## Introduction

The aim of ideal anesthesia is to provide motor block and analgesia with the least damage to the patient's physiology and metabolism and to return the patient to normal life in the earliest period (1,2). Nowadays, plenty of agents are available at different doses to control pain during circumcision surgery and in the postoperative period. Many techniques such as caudal block, penile block, and pudendal nerve block can be listed with these agents (3). No specific agent or method has been defined in the literature for pain control during circumcision surgery (3,4). In addition, the number of studies comparing the superiority of the agents and methods used for pain control

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in circumcision surgery is limited. Therefore, in our study, we aimed to compare the effectiveness of caudal and penile block methods applied under general anesthesia with different pain scoring methods in preventing postoperative pain in patients undergoing circumcision surgery.

## Materials and Methods

### Patients Selection and Study Design

The study was initiated with the approval of the University of Health Sciences Turkiye, Ankara Dışkapı Yıldırım Beyazıt Training and Research Hospital Ethics Committee (date: 18/07/2022, approval no: 142/02). Patients who underwent elective circumcision surgery between January 2019 and May 2022 were retrospectively evaluated. Age, body weight, anesthesia technique applied, duration of anesthesia, duration of surgical procedures, surgical technique, postoperative first micturition time, postoperative complications, time to first analgesia, whether analgesia is needed in the first 6 h, observer pain score (OPS) and Modified Pediatric Objective Pain Scale (MPOPS) (30-60- 90 minutes and 3-6-12 hours) were scanned and recorded retrospectively from our hospital's electronic database and past patient files.

Presence of known allergy to medical agents to be used during anesthesia, presence of infection in the area to be anesthetized, American Society of Anesthesiologists score of 3 and above, history of bleeding diathesis, presence of neurological disease, presence of bone deformity, patients undergoing circumcision under local anesthesia, and patients who underwent surgery other than the sleeve method. The proksimal and distal parts of the skin is marked with a pen to determine the circumcision boundaries. The skin is incised with the help of a scalpel over the marks. The part between the incisions is circumferentially excised. The remaining part of the proximal skin is sutured to the remaining skin in the distal part (5) and parents who did not agree to provide detailed informed consent were the exclusion criteria of our study.

### Anesthesia Method and Equipment

All patients were evaluated in the anesthesia outpatient clinic at least one day before the planned operation. Detailed information about the anesthesia method to be applied was provided by the anesthesiologist, and informed consent was obtained. All patients were premedicated by an anesthesiologist 20 min before the surgical procedure (0.5 mg/kg-1 peroral midazolam, maximum 15 mg). During the premedication waiting period, one of their parents and a nurse accompanied the patients. Routine monitoring was performed with peripheral oxygen saturation, 3-lead electrocardiogram, and non-invasive blood pressure in the operating room. Intravenous propofol (2 mg/kg-1) was administered at the beginning of anesthesia to patients with peripheral vascular access. In patients who could not obtain peripheral vascular access, a laryngeal mask was placed according to the weight of the patient, following the application of 6-8% sevoflurane to a mixture of 50% $O_2$ and 50% $N_2O$. As a maintenance anesthetic, 3% sevoflurane was added to a mixture of 50% $O_2$ and 50% $N_2O$.

Anesthesiologists work in rotation at our hospital. The choice of postoperative analgesia was determined on the basis of the experience of the anesthesiologists responsible for the operation on the caudal block. Caudal block was applied to patients who received postoperative analgesia by specialist physicians with caudal block experience. Penile block was preferred in patients because experts without caudal block experience did not prefer this method.

In patients who applied caudal block, a lateral decubitus position and a sterile area were provided, and the sacral hiatus was entered with a 22G caudal needle. Caudal block was achieved with 1 mg/kg of 0.25% bupivacaine (maximum 20 mL). The patient was then placed in a supine position, and after the sterile field was provided, the surgical procedure was performed.

In patients undergoing penile block, after providing a sterile field in the supine position, 0.5 mg/kg1 0.5% bupivacaine was applied using a 23G needle equally to the root of the penis at 10 o'clock and the other half at the 2 o'clock position. The procedure was performed by an experienced surgical team.

If the blood pressure and heart rate increased by 20% or more from the basal value after the procedure was started, the block was considered unsuccessful, and 15 mg/kg acetaminophen was intravenously administered for rescue analgesia in these patients.

At the end of the surgical procedure, the anesthetic administered for inhalation is stopped. The durations of anesthesia and surgery were recorded. The patient was taken to the recovery unit after spontaneous opening of his eyes. One of his parents and a nurse accompanied him in the recovery unit. Patients who did not develop any complications in the recovery unit were taken to their rooms in the inpatient clinic.

### Post-Procedure Follow-up and Forms Used

All patients were dressed with skin ointment after surgery (Basitrasin 15000 U.I., Neomycin Sulfate 150 mg). The penis was wrapped with a lightly pressed coban bandage. After surgery, patients come to the inpatient clinic. The doctors of the inpatient clinic, 30-60-90 min and 3-6-12 h, evaluated patients with OPS and MPOPS over time periods. In addition, the patient's first micturition time and first analgesia need time were recorded. At the same time, complications that may develop in the patients (such as headache, urinary retention,

bleeding, agitation, fever, nausea-vomiting) were followed up and recorded. Complications were evaluated according to the Clavien-Dindo classification. Patients who did not need analgesia within the first 6 h were noted. The ward physician who followed the patient was blinded to the type of block applied before surgery.

OPS (1-5 points) and MPOPS (0-10 points) were determined as a result of the evaluation of patients with five criteria, including movements, crying, anxiety, pain localization, and posture.

Analgesics were administered if the OPS or MPOPS score was 4 during the inpatient clinic follow-up of the patients. The patients were given 15 mg/kg acetaminophen peroral as a postoperative analgesic (maximum 90 mg) by the inpatient clinic doctor. It was repeated every 4 h if necessary. The patients were followed for 12 h in the inpatient clinic. After the 12$^{th}$ hour records were taken by the inpatient clinic doctor, patients who did not develop any complications were discharged by removing the lightly compressed coban bandages.

### Statistical Analysis

The analysis of the data was performed using the "IBM SPSS Statistics 22" package program. Descriptive statistics are shown as mean ± standard deviation (mean ± SD) for variables with a normal distribution, median (minimum-maximum) for variables with a non-normal distribution, and number of cases (n) and percentage (%) for nominal variables. The significance of the difference between the groups in terms of the means t-test was investigated. Nominal variables were evaluated using Pearson's chi-square or Fisher's exact test. The significance level was specified as <0.05.

To determine sufficient patients, the effect size was calculated in the G*Power 3.1.9.4 program using the mean ± SD values of the MPOPS scoring in comparison with a similar study published in a reliable journal (6). The minimum sample size was calculated with a significance level of 0.05 and a power value of 0.9. The sample size in our study was found to be statistically sufficient.

## Results

After the exclusion criteria, 56 male patients aged 2-12 years were included in the study. The patients were divided into two groups: Those who underwent penile block under general anesthesia (group P, n=31) and those who underwent caudal block (group C, n=25). During the postoperative period, the need for analgesia developed in 26 (46%) patients. Of these patients, 23 (41%) required analgesia in the first 6 h. No complications occurred during surgery in either group. Complications that could be improved with medical treatment or follow-up developed in 7 (13%) patients in the postoperative inpatient clinic follow-up. Nausea vomiting developed in 2 patients and agitation developed in 1 patient in group C. In group P, nausea-vomiting developed in 2 patients, severe headache in 1 patient, and agitation in 1 patient. All complications were found to be grade 1 according to the Clavien-Dindo classification. There was no difference between the two groups in terms of complications. When the mean ± SD first micturition time was compared between the two groups in the postoperative period, it was found that group P (81.3±23.2 min) took a significantly shorter time than group C (113.2±39.4 min) (p=0.001) (Table 1). Postoperative analgesia needs developed in 18 (58%) patients in group P and in 8 (32%) patients in group C, and there was no statistical difference. In addition, there was no difference between the patients who received analgesia in the first 6 h [group P; 15 (48%); group C, 8 (32%)]. However, when the postoperative mean ± SD first analgesia times were compared, it was found that group C (93.8±54.2 min) needed analgesia in a shorter time than group P (196.7±166.9 min) (p=0.028) (Table 1).

The mean ± SD OPS scores of group P were evaluated at 30-60-90 min and 3-6-12 h postoperatively, and no statistical difference was found in mean ± SD OPS scores at the same time intervals. Mean ± SD MPOPS scores for group P and group C were also evaluated at the same time intervals. When the mean ± SD MPOPS scores of both groups at the 30$^{th}$ min (p=0.031), 90$^{th}$ min (p=0.043) and 6$^{th}$ hour (p=0.016) were compared, it

**Table 1. Analysis of demographic and clinical characteristics of all patients and groups *p<0.05**

| | Total (n=56) | Group P (n=31) | Group C (n=25) | p |
|---|---|---|---|---|
| Age (year) | 6.1±2.2 | 6.3±2.2 | 5.72±2.2 | 0.319 |
| Weight (kg) | 23.2±8.4 | 24.8±9 | 21.2±7.2 | 0.111 |
| Anesthesia time (min) | 51.1±9 | 50.8±7.4 | 51.5±10.8 | 0.773 |
| Surgery time (min) | 34.3±9.3 | 33±7.8 | 36±10.8 | 0.224 |
| Complications (%) | 7 (13%) | 4 (13%) | 3 (12%) | 0.919 |
| Postoperative first micturition time (min) | 95.6±35.1 | 81.3±23.2 | 113.2±39.4 | 0.001* |
| Need for postoperative analgesia (%) | 26 (46%) | 18 (58%) | 8 (32%) | 0.064 |
| Postoperative first analgesia administration time (min) | 165±148.7 | 196.7±166.9 | 93.8±54.2 | 0.028* |
| Analgesia requirement in the first 6 hours postoperatively (%) | 23 (41%) | 15 (48%) | 8 (32%) | 0.215 |

was found that group C had higher MPOPS scores than group P (Table 2, Figure 1).

## Discussion

The most common surgery performed by men in childhood is circumcision. Pain often develops in the postoperative period after circumcision surgery; it can cause many complications and problems such as bleeding, agitation, delay in mobilization, increased need for secondary surgery, prolonged hospitalization, and increased costs. Therefore, reducing pain circumcision surgery is very important (7).

It should not be forgotten that pediatric patients also feel pain in the postoperative period, at least as much as adults. There are many medical agents that can prevent or relieve pain in the postoperative period. Penile block or caudal block is one of the successfully applied methods for the prevention of pain in the postoperative period in penile surgical procedures that cover a large part of pediatric surgery (4).

In many studies, caudal and penile block applications have been compared for variables such as postoperative pain, complications, first micturition time, and effectiveness (1,3,4,6-13). Both techniques have potential complications. Penile block may cause local complications such as hematoma, edema, and absorption-related systemic side effects, whereas caudal block may cause complications such as nausea-vomiting, urinary retention, and motor block (1).

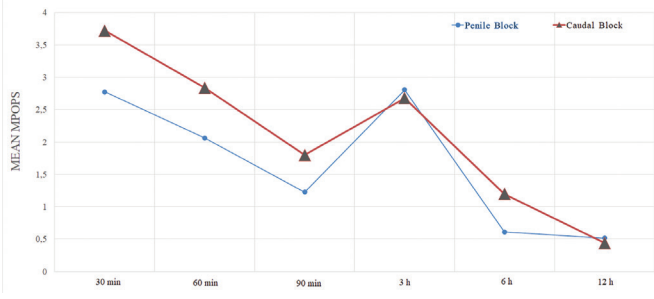


**Figure 1.** Comparison of postoperative MPOPS scores of the groups

MPOPS: Modified Pediatric Objective Pain Scale

In our study, nausea-vomiting developed in 2 patients in group C, agitation in 1 patient, nausea-vomiting in 2 patients in group P, severe headache in 1 patient, and agitation in 1 patient. All complications were found to be grade 1 according to the Clavien-Dindo classification, and we did not observe any difference between the two groups. Although the complications are similar in the comparison of the two groups in the literature (1,3,4,6-9), there are studies indicating that fewer complications developed in the penile block group (10,11). In addition, when the first micturition times in both groups were compared, it was determined that the patients who underwent caudal block urinated later than the patients who underwent penile block. Vater and Wandless (11) reported that patients with caudal block had delayed micturition, similar to our study. However, there are also studies stating that there is no statistical difference (4,6).

According to the results of our study, the need for analgesia developed in 26 (46%) patients. There was no difference between the two groups in terms of postoperative analgesia and the need for analgesia within the first 6 h. However, it was determined that the patients who underwent caudal block needed first analgesia in a shorter time than the patients who underwent penile block. When we look at the literature, there are publications stating that there is no difference between the two groups in terms of first analgesic need (7,9,11). There are also publications stating that patients who underwent caudal block needed analgesics after a longer period of time, which is inconsistent with our study (3,6,12). These incompatibilities may

**Table 2. Comparison of postoperative pain scores of the groups *p<0.05**

| Pain follow-up scale | Time | Group P (n=31) | Gorup C (n=25) | p |
|---|---|---|---|---|
| OPS | 30. min | 3.1±0.9 | 3.3±1.1 | 0.468 |
| | 60. min | 2.8±0.9 | 2.7±0.9 | 0.729 |
| | 90. min | 2.3±0.6 | 2.4±0.8 | 0.562 |
| | 3. hour | 2.6±1 | 2.6±0.6 | 0.935 |
| | 6. hour | 1.7±0.6 | 1.9±0.7 | 0.356 |
| | 12. hour | 1.7±0.7 | 1.4±0.5 | 0.078 |
| MPOPS | 30. min | 2.8±1.4 | 3.7±1.8 | 0.031* |
| | 60. min | 2.1±1.8 | 2.8±1.4 | 0.078 |
| | 90. min | 1.2±0.9 | 1.8±1.2 | 0.043* |
| | 3. hour | 2.81±2 | 2.7±1.4 | 0.783 |
| | 6. hour | 0.6±0.9 | 1.2±0.9 | 0.016* |
| | 12. hour | 0.5±0.8 | 0.4±0.6 | 0.684 |

MPOPS: Modified Pediatric Objective Pain Scale, OPS: Observer pain score

be due to patient and parent anxiety. Studies have shown that both methods can be used effectively and safely in circumcision surgery (1,3,4,6-12).

Considering the postoperative MPOPS and OPS scores of the patients, we found that group C had a higher mean score than group P in the MPOPS scores in the 30$^{th}$ minutes, 90$^{th}$ minutes and in the 6$^{th}$ hour. There was no significant difference in the OPS scores in our study. Kazak Bengisun et al. (6) in their study using the Facial Pain Rating scale, OPS, and MPOPS scores, they reported that the caudal block group had lower scores in different time periods. In a similar study, patients with caudal block had lower scores in the FLACC scoring system (1). Yıldırım Güçlü al. (4) in their study using Face Scale, OPS, and MPOPS scores, they showed that there was no difference in the mean scores of both groups. Polat et al. (3) in their study with MPOPS and Ramsey Sedation scoring, Yıldırım Güçlü et al. (4) similarly reported that there was no difference between the two groups.

In the results of our study, we found that the patient group who underwent penile block required later analgesia, shorter first micturition times, and lower MPOPS score averages in certain periods compared with the patients who underwent caudal block. We observed that the two techniques used for circumcision surgery can be used safely and effectively, although the patient group with penile block appears to be superior to the patient group with caudal block.

In a meta-analysis that included randomized controlled studies and included 574 patients, it was revealed that the efficacy of both groups was similar and that although the patients in the caudal block group had longer analgesia, it was associated with prolonged urinary retention and gait delay (13).

### Study Limitations

The limitations of our study can be considered as the fact that the anxiety levels of the patients and their parents before and after surgery can change the pain levels of the patients, and our study is retrospective. Although different pain scoring scales, such as MPOPS and OPS, are widely used, their accuracy is uncertain.

## Conclusion

In conclusion, as a result, both methods can be used effectively and safely for appropriate pain control in patients who will undergo circumcision surgery. Both methods have advantages and disadvantages over each other. The choice of methods may vary with the experience of the surgeon and anesthetist.

### Ethics

**Ethics Committee Approval:** The study was initiated with the approval of the University of Health Sciences Turkiye, Ankara Dışkapı Yıldırım Beyazıt Training and Research Hospital Ethics Committee (date: 18/07/2022, approval no: 142/02).

**Informed Consent:** Retrospective study.

### Authorship Contributions

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

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# Hypogonadism Prevalence and Correlation with Aging Male Symptoms and International Index of Erectile Function Scores

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**What's known on the subject? and What does the study add?**

With a high prevalence rate of Hypogonadism (HG), particularly pronounced in obese individuals, the research emphasizes the lack of a clear correlation between T levels, age, and symptom scores. It underscores the complexity of HG's diagnosis, given the absence of a universal T level threshold and the variable symptom presentation. By integrating commonly used symptom scores (IIEF-5 and AMS) for evaluation, the study contributes critical insights into the nuanced relationship between HG and obesity, advocating for targeted screening and management strategies in older males with high BMI. This research bridges existing knowledge gaps by clarifying the role of obesity as a key risk factor and questioning the reliance on age as a determinant of HG, thereby guiding more effective clinical assessments and interventions.

## Abstract

**Objective:** To detect the prevalence and associated factors of hypogonadism (HG) among men, who were admitted to urology outpatient clinics for reasons other than sexual dysfunction.

**Materials and Methods:** This is a multicentric study designed and conducted by the Turkish Society of Urological Surgery, Andrology Study Group. Male patients between 50 and 75 years of age who were admitted to the urology outpatient clinic for complaints other than sexual dysfunction and whose total testosterone value was measured were included in the study. The correlation between testosterone value and aging male symptoms (AMS) and the international index of erectile function (IIEF) were evaluated. Patient-related factors such as age and comorbidities were also compared between patients with low testosterone values and normal testosterone values.

**Results:** A total of 1021 patients were included in the study. The mean patient age was 69.9±8.6. The most common complaint was non-neurogenic male lower urinary tract symptoms (52.3%). HG prevalence was 38.5% according to the threshold provided in the European Association of Urology guidelines (<12 nmol/L) There was no statistically significant correlation between HG and AMS or IIEF scores. In our study, the body mass index (BMI) was found to be the most strongly correlated factor with serum testosterone levels (r=-0.183, p<0.001) Subgroup analysis revealed the prevalence of HG as 44.9% in men with BMI ≥30 kg/m$^2$.

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## Abstract

**Conclusion:** Our results suggest that BMI may be a risk factor for HG, and obese patients may require routine assessment of HG, including serum testosterone measurement and application of symptom questionnaires.

**Keywords:** Andrology, testosterone, hypogonadism, IIEF, AMS

## Introduction

Hypogonadism (HG) is defined as low blood testosterone (T) level. Although there is no well-defined cut-off level for normal total T values, it is known that low T levels could be the cause of sexual disorders, increased cardiac risk, diminished bone density, and many other medical conditions (1-3). Also it is a known fact that advanced age is associated with HG, which is also defined as late-onset HG, and HG-related symptoms (4).

With the increased mean age and life expectancy of males management of low T had become important on which all the physicians should be aware of the general principles. Since not all of the senior male population experience a decrease in T levels and not all low T levels do cause symptoms (5), it could be challenging for a physician to decide when to start T replacement therapy.

To assess patients in a more objective manner, some symptom scores can be used in outpatient clinics for evaluating symptoms caused by low T levels. Those symptom scores could be specialized in one symptom group such as erectile functions [i.e., The international index of erectile function (IIEF)] or could be general-purpose [i.e., aging male symptoms (AMS), androgen deficiency in aging males] The aim of this multi-institutional study is to investigate the prevalence of low T levels in the senior male population in Turkiye and to determine the association of T levels with two commonly used symptom scores, which are IIEF and AMS.

## Materials and Methods

This study is conducted by the Andrology Working Group of the Society of Urological Surgery in Türkiye. The study was designed as a retrospective case series, and patients who were investigated with morning total T on their primary admission to the urology outpatient clinic were included in the study. Patients who were younger than 50 years of age and whose primary complaint was sexual function disorders were excluded from the study. All participating centers were regarded as referral centers in their region with an on-site laboratory for blood work.

General patient characteristics and routine symptom scores evaluated in the outpatient clinic were also recorded, and their relationship with T levels was investigated. Total T values less than 12 nmol/L, which was suggested as the threshold for T replacement treatment in the European Association of Urology (EAU) guidelines, were regarded as low T values. For symptom score comparison Turkish validated form of the IIEF-5 and AMS were chosen as they were the most frequently used symptom scores in the study cohort (6).

The study was approved by the Marmara University Faculty of Medicine Clinical Research Ethics Committee with the decision number: 09.2022.1498 and date: 04.11.2022.

### Statistical Analysis

Statistical analyses were performed with a python programming language using pandas, (7,8) NumPy (9), and SciPy (9) libraries. JupyterLab (10) was used as the coding interface. The scaler variables were investigated using visual (Histograms, QQ Plots) and analytical methods (Kolmogorov-Smirnov, Shapiro-Wilk, D'Agostino's K2 tests) to determine whether they are normally distributed. Independent samples t-test was used for the comparison of two groups if the variable is normally distributed in each group; otherwise, the Mann-Whitney U test was used. Categorical variables were compared with the chi-square test if the assumptions of the test are met. When the assumptions of the chi-square do not hold, for two groups Fisher's Exact test and for more than

**Table 1. Comparison of general patient characteristics and symptom scores between groups**

| | | HG (+) | HG (-) | p-value[1] |
|---|---|---|---|---|
| **IIEF-5 score** | **Median (IQR)** | 15.0 (11.0-20.0) | 16.0 (12.0-20.0) | 0.167 |
| **AMS score** | **Median (IQR)** | 33.5 (26.0-43.0) | 32.0 (25.0-42.0) | 0.139 |
| **Patient age** | **Median (IQR)** | 60.0 (55.0-66.0) | 59.0 (54.0-65.0) | 0.145 |
| **AACCI** | **Median (IQR)** | 2.0 (1.0-3.0) | 2.0 (1.0-3.0) | 0.137 |

IIEF: International index of erectile function, AMS: Aging male symptoms, HG: Hypogonadism (total T <12 nmol/L), IQR: Interquartile range, AACCI: Age-adjusted Charlson comorbidity index, [1]: Mann-Whitney U

| Table 2. Comparison of comorbidities between groups | | | | |
|---|---|---|---|---|
| | | HG (+) n (%) | HG (-) n (%) | p-value[1] |
| **Diabetes mellitus** | - | 305 (80.47) | 511 (84.46) | 0.106 |
| | + | 74 (19.53) | 94 (15.54) | |
| **Chronic liver disease** | - | 375 (98.94) | 593 (98.02) | 0.263 |
| | + | 4 (1.06) | 12 (1.98) | |
| **Chronic renal disease** | - | 370 (97.63) | 588 (97.19) | 0.679 |
| | + | 9 (2.37) | 17 (2.81) | |
| **Hypertension** | - | 358 (94.46) | 583 (96.36) | 0.155 |
| | + | 21 (5.54) | 22 (3.64) | |
| **Coronary artery disease** | - | 330 (87.07) | 537 (88.76) | 0.426 |
| | + | 49 (12.93) | 68 (11.24) | |
| **Malignancy** | - | 353 (93.14) | 574 (94.88) | 0.257 |
| | + | 26 (6.86) | 31 (5.12) | |
| **Cigarette** | - | 273 (72.03) | 434 (71.74) | 0.920 |
| | + | 106 (27.97) | 171 (28.26) | |
| **Obesity (BMI ≥30 kg/m²)** | - | 199 (69.34) | 382 (77.96) | 0.008 |
| | + | 88 (30.66) | 108 (22.04) | |

HG: Hypogonadism (total T <12 nmol/L), BMI: Body mass index, [1]: Chi-square

two groups likelihood ratio was used to compare categorical variables. Numbers are given in mean and standard deviation for normally distributed variables and median and interquartile range for non-normally distributed variables. For categorical variables, case number and percentage were given for each category. The correlation between scaler variables is investigated with Spearman correlation. For all statistical analyses, p-values, less than 0.05 were regarded as statistically significant.

## Results

In total, 1.021 patients from all regions of Turkiye were included in this study. The mean patient age was 59.9±8.6. The most frequent symptom of patients on admission was lower urinary tract symptoms (52.3%). The prevalence of patients whose total T level was lower than 8 nmol/L and who were candidates for medical treatment based on EAU guidelines was 13.0%. If the total T threshold is taken as 12 nmol/L and HG prevalence is calculated including patients who are deemed in the gray zone for treatment, the HG prevalence would be 38.5%. Obesity was higher in patients with HG (total T <12 nmol/L) compared to patients with normal T values (p=0.008). Other comorbidities, age of patients, and symptom scores were similar between the two groups (Tables 1, 2). The prevalence of HG was even higher (44.9%) in obese patients.

The total T value of the patients had a statistically significant positive correlation with body mass index (BMI). On the other hand, there was no statistically significant correlation between total T levels and age, age-adjusted Charlson comorbidity index, IIEF-5 and AMS score, and subdomains of the AMS score (Figure 1).

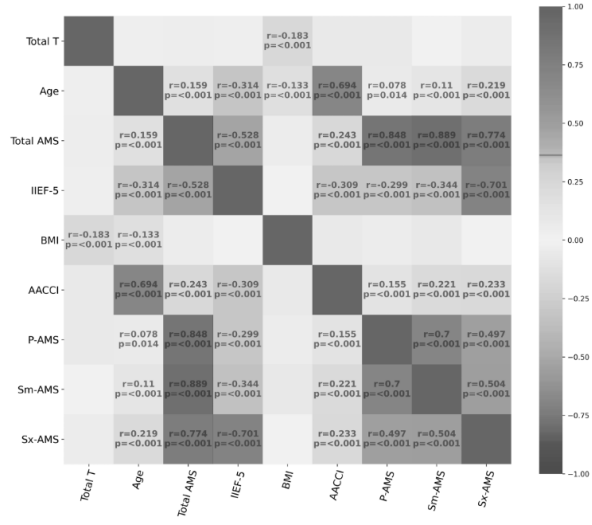


**Figure 1.** Correlation of total T levels with symptom scores, BMI, age, and comorbidity index

T: Testosterone, AMS: Aging male symptoms, IIEF: International index of erectile function, BMI: Body mass index, AACCI: Age-adjusted Charlson comorbidity index, P-AMS: AMS score psychological subdomain, Sm-AMS: AMS score somatic subdomain, Sx-AMS: AMS score sexual subdomain, r: Spearman correlation coefficient

## Discussion

Studies show that the prevalence of HG increases with age, especially in obese and men with diabetes with overall poor health (11). Mulligan et al. reported the prevalence of HG in the United States as 38.7% for the general population. The HG prevalence in our study was 38.5% and was quite similar to their study. Although HG prevalence is seen as higher if the total T value is taken as the only determining factor for the diagnosis, it is known that the prevalence of symptomatic HG ranges between 2.1-5.7% (3,12). We also observed that not every man with HG exhibits symptoms, in our study, which was consistent with previous studies.

Normal levels of T and threshold T values for the diagnosis of HG are still not clearly defined in the literature. Different organizations such as the EAU and the American Urological Association have different approaches to the cut-off value of T for the diagnosis of HG (13,14). Some studies demonstrate that total T values decrease with age, making HG a primary healthcare concern in aging populations (11). Although the relationship between age and total T values is well defined, all patients with low T values do not have symptoms related to this and they do not need treatment. In the Massachusetts male ageing study, it is demonstrated that total T levels are decreased with chronic disease and obesity, and the healthy men had significantly higher hormone levels (15). In this study, we could not demonstrate a definitive correlation between age and T levels. Since our study has a high patient number with a vast geographic distribution, it clearly shows that age may not be the only determining factor for T levels, which was also emphasized by past studies (5).

One of the main challenges in a patient with a low T value is the timing of the replacement therapy. A symptomatic patient with a total T level below 12 nmol/L is considered a good candidate for testosterone replacement therapy (TRT) (13). In order to evaluate the symptoms of the patients in a more objective manner some questionnaires have been developed and used for both diagnosis and follow-up of HG patients (16,17). The studies of these questionnaires also demonstrated that there is no definitive correlation between symptom scores and T levels and these questionaries are not specific tools for the diagnosis of HG (18). In our study most of the patients were evaluated with the AMS questionnaire which is also considered a suitable screening tool for the evaluation of HG symptoms in previous studies (18) and in concordance with previous studies there was no statistically significant correlation between symptom score and T level.

The effect of body fat and thus BMI on T metabolism is well documented (19). Studies highlight obesity with or without metabolic syndrome as a major risk factor for HG (20,21). Studies also confirm that with TRT, the percentage of body fat, BMI, and waist circumference decreases (22,23). These findings also confirm that high BMI is not only a cause of low T but also a result of it. The results of this multi-institutional population-based study also confirmed previous studies and demonstrated obesity as the major risk factor for low T levels.

T has a critical role in every aspect of male sexual function. The European aging male study demonstrated that low T values with advanced age caused decreased libido, erectile dysfunction, and decreased frequency of morning erections (3). In another study, patients admitted to urology outpatient clinics for erectile dysfunction are found to have lower sexual desire and less frequent morning erections (24). In this study, we were unable to demonstrate a close correlation between total T levels and sexual function. This is mainly because in our research, we tried having a more population-based approach and included patients with non-sexual function-related symptoms.

### Study Limitations

Our study is not without limitation. This is a retrospective study conducted on the data of patients admitted to urology outpatient clinics. Since the study population is selected from a limited group, this may make it difficult to generalize the results of the study to the entire population. To overcome these authors included as many patients as possible in the study and the study population had a wide variety of geographic distributions. It is known that liquid chromatography-tandem mass spectrometry is the gold standard technique for sex steroid evaluation (25). Since this is a multi-centric study and the T values are evaluated in different laboratories, it was possible to standardize the T measurement procedure. Unfortunately, there is no way to overcome this in a multicentric retrospective study, but the authors paid great attention to ensuring all tests are taken in the morning, which could provide some level of standardization.

## Conclusion

Our study showed that HG in the male population over the age of 50 is a frequent condition with 38.5 prevalence. All the patients with low T levels do not show symptoms, but our study clearly demonstrates that obesity is a major risk factor for HG, and elder males with high BMI should be carefully evaluated for HG and related symptoms. This patient group may require routine assessment of HG, including serum T measurement and application of symptom questionnaires.

### Acknowledgments

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### Ethics

**Ethics Committee Approval:** The study was approved by the Marmara University Faculty of Medicine Clinical Research Ethics Committee with the decision number: 09.2022.1498 and date: 04.11.2022.

**Informed Consent:** Retrospective study.

### Authorship Contributions

Surgical and Medical Practices: B.Ş., Concept: B.Ş., Y.K., Ö.Y., C.Ş., İ.O.K., A.C., B.D., Ş.O., İ.Ü., H.D., Ö.Ç., Ü.G., T.T., H.Ö., Design: B.Ş., Y.K., Ö.Y., C.Ş., İ.O.K., A.C., B.D., Ş.O., İ.Ü., H.D., Ö.Ç., Ü.G., T.T., H.Ö., Data Collection or Processing: B.Ş., Analysis or Interpretation: B.Ş., Y.K., Ö.Y., C.Ş., İ.O.K., A.C., B.D., Ş.O., İ.Ü., H.D., Ö.Ç., Ü.G., T.T., H.Ö., Literature Search: B.Ş., Y.K., Ö.Y., C.Ş., İ.O.K., A.C., B.D., Ş.O., İ.Ü., H.D., Ö.Ç., Ü.G., T.T., H.Ö., Writing: B.Ş., Y.K., Ö.Y.

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ORIGINAL RESEARCH
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# Heavy Scarring in the Unilateral Refluxing Kidney May Sign of Contralateral Reflux After Reimplantation

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**What's known on the subject? and What does the study add?**

It has been reported that vesicoureteral reflux is associated with primary trigonal disease. In this study, we demonstrated that kidney dysplasia, as a component of primary trigonal disease, was related to contralateral reflux.

## Abstract

**Objective:** The aim of this study was to investigate the role of heavy ipsilateral scarring in the development of the contralateral reflux after unilateral reimplantation.

**Materials and Methods:** The study included 43 patients (24 male, 19 female) who had undergone unilateral reimplantation. Heavy scarring was defined as the presence of multiple central scars on renal scan and differential function of less than 30% with diffuse paraenchymal damage. Postoperative voiding cystourethrography was performed to evaluate febrile urinary tract infection or hydronephrosis during follow-up. The development of the contralateral reflux was compared based on the type of reimplantation, age, preoperative renal scar status, and reflux grade.

**Results:** Contralateral reflux developed in 6 children. No significant relationship was found between the pre-operative grade, type of reimplantation, and incidence of the contralateral reflux. However, *de novo* contralateral reflux was significantly higher in children with heavy scarring on the ipsilateral kidney. Among the five children with heavy kidney scarring and aged 4 years or younger, contralateral reflux was found in three children. Reflux was resolved within 24.6±12.2 months on average although one child recovered with Dx/HA implantation.

**Conclusion:** We found that the presence of heavy scarring in the ipsilateral kidney may play a role in the prediction of contralateral reflux development.

**Keywords:** Child-preschool, renal scarring, vesicoureteral reflux

## Introduction

The ureteroneocystostomy (UNC) procedure is currently the most effective treatment for vesicoureteral reflux (VUR) in children, with a high success rate. However, the literature reports a contralateral reflux rate of 5.6-19% after unilateral UNC, with most cases showing spontaneous resolution during follow-up (1-4).

With the high success rate and the reported spontaneous resolution of contralateral reflux during follow-up, asymptomatic children undergoing the UNC procedure are not routinely recommended to undergo control voiding cystourethrography (VCUG). However, in children who have experienced febrile urinary tract infections, performing a follow-up VCUG is important to identify those at risk of developing scar tissue.

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An increased incidence of contralateral reflux in cases of multicystic dysplastic kidney may suggest a relationship between renal dysplasia and contralateral reflux (5). The presence of heavy scarring tissue suggests that renal dysplasia is related to the histological composition of the distal ureter, which can be related to the morphological and functional integrity of the ureteral-trigonal unit (6,7). Furthermore, while heavy renal damage indicates congenital involvement with higher degree reflux, it may also affect the contralateral orifice in relation to developmental deterioration or bladder dysfunction (8).

The objective of this study was to examine the factors that influence the development of *de novo* contralateral reflux following unilateral UNC and to investigate the potential association between heavy scarring indicative of renal dysplasia and contralateral reflux.

## Materials and Methods

Fifty-eight patients who had unilateral UNC in the Hacettepe University Pediatric Urology Section with unilateral reflux on the VCUG between May 2001 and January 2008 were retrospectively investigated in their postoperative control visits.

A retrospective analysis was conducted on 58 patients who underwent unilateral UNC at the Hacettepe University Department of Urology Pediatric Urology section for a unilateral reflux on VCUG between May 2001 and January 2008. The Clinical Research Ethics Committee of the Bursa Uludağ University approved the study (approval number: 2023-2/18).

Patients who underwent ureteral reimplantation for obstruction, had associated neurological disorders, contralateral renal agenesis, undergone contralateral nephrectomy, or previously undergone DxHA implantation in the contralateral orifice, as well as those for whom preoperative renal scan could not be obtained, were excluded from the study. One patient who had undergone Boari flap and psoas hitch for ectopic ureter had recurrent bilateral reflux and another patient had recurrent ipsilateral reflux, both of whom were also excluded from the study. A total of 43 patients remained in the study group.

All children had a unilateral reflux at the time of the operation. Duplicated collecting systems were in 2 patients, Hutch diverticulum in 2 patients, and ectopic ureter with duplicated collecting system in 1 patient. Nineteen children had grade 3 reflux, 15 had grade 4 reflux, and 9 had grade 5 reflux before undergoing UNC.

The preoperative evaluation consisted of at least one VCUG, urinary ultrasound, urinalysis, urinary culture, and dimercaptosuccinic acid (DMSA) renal scintigraphy. The presence of multiple central scars on renal scintigraphy with global renal function less than 30% and diffuse parenchymal damage was accepted as heavy scarring. All children underwent a lower urinary tract dysfunction evaluation after toilet training. Of these, six children were found to have bladder dysfunction, and all received treatment before surgery. Five patients underwent DxHA implantation in the same orifice before UNC.

UNC was performed intravesically using the Cohen technique in 28 children, while extravesically using the Lich Gregoir technique in 15 children.

Prophylactic antibiotics were administered for one month in the postoperative period. Urinalysis was performed monthly for the first three months and then quarterly for the first year. Urinary ultrasound was performed at the end of the first and third months and then at the end of the first year. VCUG or video urodynamics was performed only for patients who developed urinary tract infection and/or hydronephrosis during the follow-up period. Patients with postoperative reflux were followed up with VCUG. The complete resolution of VUR in the ipsilateral system following unilateral UNC was considered a success.

### Statistical Analysis

Statistical analysis was performed using the SPSS version 20 software (SPSS, Inc. Chicago, Ill, USA). The Shapiro-Wilk test was used to test the normality of variables. The variables are presented as mean $\pm$ standard deviation for normally distributed data and as median (minimum-maximum) for non-normally distributed data. Number and percentage were used for nominal data. Mann-Whitney U test was used for non-normally distributed variables, while Fisher's Exact test was used for nominal variables, and a p less than 0.05 was considered significant.

## Results

Twenty-four of the children included in the study were boys and 19 were girls, while the mean age was $5.52\pm3.22$ years. The urethral catheter was removed on average after $3.26\pm0.83$ days. The resolution rate of reflux after UNC was 95.3% for the ipsilateral unit. During the follow-up period, 16 children underwent VCUG and 2 underwent video urodynamics. Contralateral reflux was found in 6 patients with *de novo* reflux being grade 1 in one child, grade 2 in two children, and grade 3 in three children. No recurring reflux was observed in children with bladder dysfunction. There was no significant difference in *de novo* contralateral reflux between genders.

No significant relationship was found between the pre-operative grade and contralateral kidney reflux (p=0.7) (Table 1). The rates of contralateral reflux were similar for both intravesical and extravesical UNC procedures at 14.3% and 13.3%, respectively, and this difference was not statistically significant (p=1) (Table 1).

| Table 1. Comparison of patient characteristics between groups | | | | |
|---|---|---|---|---|
| | | **No contralateral reflux** | **Contralateral reflux +** | **p** |
| **Age*** | | 6 (1-13) | 3.75 (1-7) | 0.312 |
| **Gender (girl/boy)** | | 16/21 | 3/3 | 1 |
| **UNC type (Int/ext)** | | 24/13 | 4/2 | 1 |
| **Ipsilateral reflux grade** | **3** | 17 (89.5%) | 2 (10.5%) | 0.7 |
| | **4** | 13 (86.7%) | 2 (13.3%) | |
| | **5** | 7 (77.8%) | 2 (22.2%) | |
| Int: Intravesical UNC, Ext: Extravesical UNC, *: Mann-Whitney U test, others: Fisher's Exact test | | | | |

Eight patients had a contralateral renal scar on the pre-operative DMSA and no recurring contralateral reflux was observed.

Contralateral reflux was observed in 4 out of 18 children 4 years of age or younger and 2 of the 25 children older than 4 years; however, the difference was not significant. While heavy scarring was present in 5 out of 18 children aged 4 years or younger and in 6 out of 25 children older than 4 years, there was no significant difference. The contralateral reflux rate was higher in children with heavy ipsilateral scarring (6-36%) (p=0.029) (Table 2). Contralateral reflux was significantly higher in the heavy ipsilateral scarring group in children aged 4 years or younger (60-7.7%) (p=0.044) (Table 2); however, for children older than 4 years the difference was not significantly higher (16.7-5.3%) (p=0.43) (Table 2).

Five patients with contralateral reflux recovered within an average of 24.6±12.2 months (ranging from 7 to 41 months), while one patient achieved recovery of contralateral reflux after undergoing a single session of Dx/HA implantation.

## Discussion

In this study, we found the rate of the contralateral reflux developing after unilateral UNC to be 15.8%, consistent with other studies. Operative trigonal distortion, pop-off mechanism, reflux missed in VCUG, and the natural course of the disease have been emphasized in the literature for the development of contralateral reflux following unilateral UNC (2-4). In our study, we reported a distinct result from previous studies, demonstrating the development of *de novo* contralateral reflux, particularly in young children, after unilateral UNC in the presence of dysplasia as a trigonal uretoral unit.

Minevich et al. (2) and Badawy et al. (9) found that contralateral reflux rates following open and laparoscopic extravesical UNC were 5.6% and 5.9 %, respectively. In another study, Kumar and Puri (10) reported 7% contralateral reflux rate following the sub-ureteric Teflon (polytetrafluoroethylene) injection (STING). These rates found in the abovementioned studies were lower than those in other series (2,9,10). These differences may be due to the operative distortion. However, Shapiro et al. (11) reported that contralateral reflux was 13% following Dx/HA implantation, while Diamond et al. (3) suggested that UNC type does not affect the risk of contralateral reflux. In addition, a series by McCool et al. (12) found only 1 to 5.6% reflux rate after unilateral Cohen UNC in patients with contralateral VUR, which resolved during the follow-up. These studies did not support the operative distortion hypothesis.

Several studies have determined the relationship between high-grade reflux and contralateral reflux to show the pop-off mechanism, but there are conflicting results about this relation in the literature (3,8,10,13). In the current study, no association was observed between VUR grade and *de novo* contralateral reflux, possibly due to the high frequency of high-grade VUR cases. The finding of a high rate of contralateral reflux in patients undergoing nonoperative follow-up in the study by Sparr et al. (14) showed that newly developing reflux may be related to the natural course of the disease or the reflux missed during voiding cystourethrography. However, in their series, Barroso et al. (15) found developing contralateral reflux in 21% of the patients during follow-up and only medium- and high-grade reflux as risk factors, which may be due to a combination of natural course and pop-off mechanism. Furthermore, developmental deterioration of the trigone may also play a role in this relationship.

| Table 2. Relation of presence of heavy scar tissue in scintigraphy on ureteroneocystostomy side and contralateral reflux in different age groups | | | | | | |
|---|---|---|---|---|---|---|
| | **4 years old and younger** | | **Older than 4 years** | | **Total** | |
| | **HS -** | **HS+** | **HS-** | **HS+** | **HS-** | **HS+** |
| Contralateral reflux rate | 7.7% | 60% | 5.3% | 16.7% | 6.3% | 36.4% |
| p | 0.044 | | 0.43 | | 0.029 | |
| HS+: Children with heavy scarring on the ipsilateral kidney, HS-: Children without heavy scarring on the ipsilateral kidney, Fisher's Exact test | | | | | | |

Ross et al. (16) showed that *de novo* contralateral reflux is more significant in children with a history of resolved contralateral reflux. McCool et al. (12) confirmed this result by showing reduced contralateral reflux while performing bilateral UNC. The relationship shown by Liu et al. (17) between contralateral scarring and *de novo* contralateral reflux can be related to the increased pressure with the disappearance of the pop-off mechanism re-appearing of reflux. These mentioned studies, contrary to our study, supported the pop-off mechanism.

While the mentioned studies focused on passive valve function, they did not consider the developmental deterioration of the trigone and the active valve mechanism. Some literature has emphasized the importance of active valve function and the histological composition of the distal ureter (6,18-21).

In the study by Andrioli et al. (7), it was suggested that congenital renal damage in infants with VUR, diagnosed before the first urinary tract infection, is related to urinary reflux during fetal development. Dysplasia, which is characterized by more severe scarring, was frequently observed in children, especially infants, with high-grade reflux (7,22-24). Therefore, we examined the effect of heavy scarring on the development of *de novo* contralateral reflux that may be associated with the trigone and contralateral ureteral developmental deterioration.

Izol et al. (21) demonstrated that refluxing ureters exhibit immunohistopathological abnormalities, particularly in high-grade reflux. Godley et al. (8) reported reduced resolution of reflux in infants with kidney parenchymal anomalies due to VUR, with a higher resolution rate in those with normal bladder function. This may be attributed to developmental disorders associated with bladder dysfunction and primary trigonal disease, as stated by Tanagho et al. (25). In this study, severe renal damage suggestive of congenital damage could also affect the contralateral orifice related to primary trigonal disease and developmental deterioration. Moreover, multicystic dysplastic kidney is associated with severe dysplasia, which may be due to the ureteral-trigonal developmental deterioration. The contralateral reflux rate in multicystic dysplastic kidney has been reported as 10-17%, which supports the hypothesis of this study (5,26).

The higher incidence of contralateral reflux with heavy scarring in children aged four years and younger and the recovery in all patients over time suggested the effect of developmental deterioration. Although the contralateral reflux was more frequent in patients aged four years or younger (25-8%), this difference was not statistically significant in our limited sample size. Hubert et al. (27) reported similar results in their series. In the current study, no significant differences were found between age groups in terms of heavy scarring rates; however, higher rates of contralateral reflux were found in younger patients with heavy scarring. The occurrence of *de novo* contralateral reflux in three out of five patients aged four years or younger with heavy scarring emphasizes the clinical importance of this finding.

### Study Limitations

The small sample size is a limitation of this study; however, the use of open surgery for all patients provides a standardized group. Ethical issues precluded the performance of VCUG in all patients. Since UNC has a high success rate, VCUG may not have been necessary for every patient. As this study is retrospective, histological examination of ureter tissue to elucidate the underlying mechanism could not be performed. Further studies with the histological examination could provide a definitive explanation of the mechanism.

## Conclusion

This study highlights the need for further investigations into the active mechanisms and primary trigonal disease. A future study examining the relationship between renal dysplasia and histological composition of the ipsilateral and contralateral ureters may provide more definitive findings. The high incidence of contralateral reflux in children with ipsilateral heavy scarring suggests the importance of close monitoring contralateral reflux.

### Ethics

**Ethics Committee Approval:** The Clinical Research Ethics Committee of The Bursa Uludağ University approved the study (approval number: 2023-2/18; date: 24.01.2023).

**Informed Consent:** Retrospective study.

### Authorship Contributions

Surgical and Medical Practices: S.T., H.S.D., O.K., A.C.B., F.Ç., Concept: S.T., O.K., Design: S.T., O.K., Data Collection or Processing: O.K., A.C.B., Analysis or Interpretation: O.K., Literature Search: O.K., H.S.D., A.C.B., F.Ç., Writing: O.K., H.S.D., S.T.

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# Circumcision Surgery on YouTube™: A Quality Assessment

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**What's known on the subject? and What does the study add?**

The study assesses the quality and reliability of YouTube™ videos on the "circumcision" procedure. The study emphasizes the necessity for professionals to contribute better-quality, reliable content on YouTube™ for improved educational value regarding circumcision surgery.

## Abstract

**Objective:** With numerous informative videos for patients and surgeons, Youtube™ is the most popular video sharing website worldwide. The aim of this study was to evaluate the quality and reliability of videos related to the "circumcision" procedure on Youtube™.

**Materials and Methods:** The keyword "circumcision" was searched on the Youtube™ search engine, and those in English were included according to the inclusion criteria sorting by relevance. Basic data (such as number of views and upload sources) of these videos were recorded. Videos were assessed by four independent urologists using the global quality scale (GQS) for quality and the validated 5-question Modified DISCERN scoring for reliability.

**Results:** A search for "circumcision" on Youtube™ search engine identified 800 videos, of which 155 videos were included in the study. Most videos were uploaded by individual users/patients (42.6%). The mean GQS score of the videos was low (2.30±0.99) and the mean modified DISCERN score was also low (1.71±1.10). The GQS and modified DISCERN scores of videos uploaded by physicians/professional organizations/universities were significantly higher than those of other uploaders ($p<0.01$). There was no correlation between GQS and modified DISCERN scores and duration, number of views, and number of likes of the videos ($p>0.05$).

**Conclusion:** Most of the videos related to circumcision surgery on Youtube™ platform were uploaded by patients, and the upload rate of healthcare professionals was significantly low. The uploaded videos are of poor quality, and healthcare professionals should produce better quality, reliable, and up-to-date content.

**Keywords:** Youtube™, circumcision, quality, reliability, global quality scale, modified DISCERN

## Introduction

The Internet provides quick access to information to patients and clinicians. In the last quarter of the last century, with the discovery of the internet, various social media platforms emerged, and the most widespread and fastest information was accessed from these platforms. One of the most frequently used social media applications is Youtube™, created in 2005 and has more than 1 billion current users (1). On this platform, users upload videos related to different content from all over the world, and billions of hours of video content are watched every day. Youtube™ platform is frequently preferred to obtain visual and auditory information about surgical procedures and other medical issues. However, some videos uploaded to this platform contain unnecessary information and mislead the viewers.

Circumcision is defined as the surgical cutting of the preputium surrounding the glans penis to expose the glans. Dating back at least 6.000 years, circumcision can today be performed for medical indications and for religious and cultural reasons. Although circumcision is considered a simple surgical procedure, it may result in serious complications, and additional interventions may be required. Therefore, parents should have access to quality and accurate information about the risks and benefits of circumcision (2).

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In many previous studies, the content and quality of videos on Youtube™ related to urological problems were evaluated, and it was observed that the existing videos were deficient in terms of providing accurate and necessary information to people (3,4).

Because Youtube™ is the most frequent reference source by both patients and clinicians, in this study, we aimed to evaluate the quality and reliability of circumcision videos on Youtube™ platform.

## Materials and Methods

After the Non-Interventional Clinical Research Ethics Committee of Kütahya Health Sciences University has granted ethical approval; on 1st March 2022, we searched the Youtube™ search engine using the keyword "circumcision". No filter was used while sorting the videos, and the sorting was performed according to the "relevance" level. The exclusion criteria used in previous similar studies were also applied in our study (5,6). Accordingly, 800 videos, sorted by relevance, were reviewed by 4 independent urologists. Non-English, repetitive, irrelevant, and soundless videos were excluded from the study. Finally, 155 videos were included and further analyzed (Figure 1). Upload source, number of views, likes or comments, length, upload time, and number of views, comments and likes of each video were recorded. The videos were categorized into four categories according to their sources;

1. Physicians/professional organizations/universities,

2. Stand-alone health information websites,

3. Medical advertisements/for-profit organizations,

4. Individual users/patients.

In addition, the videos were grouped into three different categories according to the content of the topics: Those related to treatment, those containing general information about circumcision, and those containing both treatment and general information. In the evaluation of the reliability of the videos, the validated 5-question Modified DISCERN scoring was used (7,8). The original DISCERN scoring is a 15-question questionnaire developed by Charnock et al. (9) to assess the quality of information about health problems and treatment options. In the modified DISCERN scoring, 5 questions with yes/no answers and 1 point for each "yes" answer are asked. Because of the scoring, the reliability of the videos is evaluated as "high" if the score is above 3, "intermediate" if the score is 3, and "low" if the score is below 3.

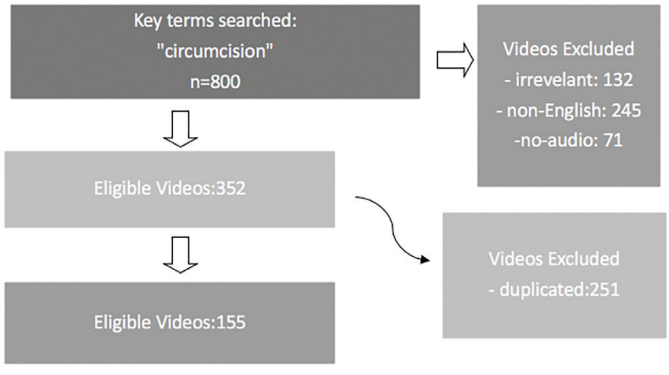


**Figure 1.** Selection of appropriate Youtube videos for the study

The global quality scale (GQS) is a scale that evaluates the quality, flow, and benefit of the information in the videos for patients and was preferred in our study. In this scale, which has 5 different levels and each video is scored from 1 to 5, 4 and 5 points indicate high quality, 3 points indicate medium quality, and 1 and 2 points indicate low quality (5,10).

### Modified DISCERN Scale

(1 point for every Yes, 0 point for No)

*Are the aims clear and achieved?

*Are reliable sources of information used?

*Is the information presented balanced and unbiased?

*Are additional sources of information listed for patient reference?

*Are areas of uncertainty mentioned?

### Global Quality Scale (GQS)

### Description

1. Poor quality, poor flow of the video, most information missing, not at all useful for patients.

2. Generally poor quality and poor flow, some information listed but many important topics missing, and of very limited use to patients.

3. Moderate quality, suboptimal flow, some important information is adequately discussed but others poorly discussed, somewhat useful for patients.

4. Good quality and generally good flow. Most of the relevant information is listed, but some topics not covered, useful for patients.

5. Excellent quality and flow, very useful for patients.

### Statistical Analysis

Statistical analysis was performed using SPSS software version 26 (IBM SPSS Corp.; Armonk, NY, USA). The normality test of continuous variables was analyzed using the Kolmogorov-Smirnov test. Also, skewness and kurtosis values of GQS and

DISCERN scores were used to analyze if they were normally distributed (between 0.25 and -0.85, between 1.98 and 2.17, respectively). Number, percentage, mean, and standard deviation were used for descriptive statistics. The ANOVA test was used to compare the groups according to the modified discern score. The Pearson correlation test was used to analyse the relationship between the Modified Discern score and GQS score. For statistical significance, p<0.05 was accepted.

## Results

In the study, 155 videos were analyzed. The general characteristics of the videos are presented in Table 1. Most videos (42.6%) were uploaded by individual users/patients. There were mostly treatment-related videos (51%). When the scores evaluating the quality and content of the videos were analyzed, the mean GQS score was 2.30±0.99 and the mean-modified DISCERN score was 1.71±1.10. The GQS and modified DISCERN scores of videos uploaded by physicians/professional organizations/universities were significantly higher than those of the others (p<0.01). The lowest scores were found in videos uploaded by individual users/patients (Table 2).

When we classified the videos as low, intermediate, and highly reliable according to modified DISCERN scoring, 128 (82.58%) of the videos were evaluated as low quality, 8 (5.16%) as intermediate quality, and 19 (12.25%) as high quality. According to these scoring groups (low, intermediate and high quality), the video durations of the groups were similar (p=0.290). Similarly, the number of views (p=0.911) and comments (p=0.538) were similar. The number of likes was significantly higher in the videos evaluated in the intermediate quality group (p<0.001) (Table 3).

A positive correlation was found between GQS and modified DISCERN scores (r=0.85, p<0.01). No significant correlation was found in the correlation analysis between GQS and modified DISCERN scores and video duration, number of views, and number of likes (Table 4).

**Table 1. General information of circumcision videos on YouTube**

| **Source of video** | **n** | **%** |
|---|---|---|
| • Physicians/professional organisations/universities | 40 | 25.8 |
| • Stand-alone health information websites | 33 | 21.3 |
| • Medical advertisements/for-profit organisations | 16 | 10.3 |
| • Individual users/patients | 66 | 42.6 |
| **Video content** | | |
| • Treatment | 79 | 51.0 |
| • General information | 57 | 36.8 |
| • Both of them | 19 | 12.3 |
| **Features of video** | **Mean ± SD** | **Min-Max** |
| • Duration (second) | 477.65±45.40 | 28-4865 |
| • Time since upload (month) | 46.74±3.32 | 1-186 |
| • Number of views | 540.283±188.115 | 1145-182.000.000 |
| • Number of comments | 917.03±118.10 | 0-14.860 |
| • Number of likes | 1680.93±304.81 | 1-28.000 |
| • GQS score | 2. 30±0. 99 | 1-5 |
| • Modified DISCERN score | 1.71±1.10 | 0-4.5 |

GQS: Global quality score, SD: Standard deviation, Min-Max: Minimum-Maximum

**Table 2. Quality and reliability assessment of videos according to their sources**

| | **Physicians/professional organisations/ universities** | **Stand-alone Health information websites** | **Medical advertisements/for -profit organisations** | **Individual users/patients** | p |
|---|---|---|---|---|---|
| **GQS score** | 2.98±0.68[a] | 2.67±0.57[a] | 2.19±0.94[b] | 1.73±0.99[b] | <0.001* |
| **Modified DISCERN score** | 2.49±0.86[a] | 2.19±0.66[a] | 1.78±1.10[a] | 0.96±0.93[b] | <0.001* |

*: One-Way ANOVA, GQS: Global quality score, [a-b]: Tukey test was used for Post-hoc test. Individual users/patients were compared to other groups

| Table 3. Comparison of the sources and characteristics of the videos according to the modified DISCERN classification | | | | |
|---|---|---|---|---|
| **Source of video (n)** | **Modified DISCERN classification** | | | |
| | **Low** | **Intermediate** | **High** | |
| • Physicians/Professional organisations/Universities | 26 | 4 | 10 | |
| • Stand-alone health information websites | 26 | 2 | 5 | |
| • Medical advertisements/for-profit organisations | 13 | 1 | 2 | |
| • Individual users/patients | 63 | 1 | 2 | |
| Total | 128 | 8 | 19 | |
| **Features of videos (mean ± SD)** | | | | p |
| Duration | 466.51±575.43[a] | 282.00±168.77[a] | 634.52±570.87[a] | 0.290* |
| Number of views | 576.828±239.24[a] | 312.530±355.550[a] | 377.754±666.553[a] | 0.911* |
| Number of comments | 986.25±231.42[a] | 989.75±158.89 [a] | 320.46±92.01[a] | 0.538* |
| Number of likes | 1592.24±3439.70[a] | 5799.43±8314.76[b] | 680.44±763.16[a] | <0.01* |

*: One-Way ANOVA, [a-b]: Tukey test was used for Post-hoc test, SD: Standard deviation

| Table 4. Correlation analyses for modified DISCERN scores and GQS score with features of video | | | | |
|---|---|---|---|---|
| | **GQS score** | | **Modified DISCERN score** | |
| | **r** | **p** | **r** | **p** |
| GQS | - | - | 0.85 | <0.01** |
| Modified DISCERN | 0.85 | <0.01 | - | - |
| Video duration | 0.02 | 0.728 | -0.01 | 0.893** |
| Number of view | 0.09 | 0.277 | 0.12 | 0.161** |
| Number of likes | 0.1 | 0.228 | 0.01 | 0.851** |

**Pearson correlation, GQS: Global quality score

## Discussion

Circumcision is one of the most common surgical procedures, and it is estimated that 38% of men are circumcised worldwide (11). In Muslim and Jewish societies, circumcision is usually performed for religious reasons. Apart from religious and cultural reasons, circumcision is also performed for medical purposes in the presence of pathological phimosis and paraphimosis, recurrent urinary tract infections, urological congenital anomalies (vesicouretheral reflux, posterior urethral valve, congenital hydronephrosis), and after some penile traumas. Although circumcision is performed using different surgical techniques, complications develop at a rate of 1-4% (12). For this reason, parents want to be informed about the circumcision procedure before the operation, and the internet is their first choice as a source of information.

Youtube™ is an open-access video-sharing platform that is the most widely known worldwide and contains educational content on different subjects for individuals. More than 1 billion hours of content are watched and thousands of content are produced on this platform every day (6). While searching on the Youtube™ platform, there are comprehensive filters and their relevance, upload date of the videos, number of views, and rating. Apart from this, filtering can be done with image quality such as 4K and HD. There are also many videos on Youtube™ related to healthcare topics, but these videos are controversial in terms of quality and reliability because they are easily uploaded by individuals and institutions in a non-standardised manner (13).

Thus far, many studies have been conducted to evaluate the quality of urology-related videos on Youtube™. To the best of our knowledge, our study is the second in the literature evaluating the quality of circumcision-related videos on Youtube™ (14). In this study, we aimed to answer the following questions: What are the most common sources of circumcision-related videos? What do the videos include as subjects? Is there a relationship between the sources of the videos and their quality? Do features such as the number of views, comments, and likes reflect the quality of the videos?

In a study evaluating Youtube™ videos on male infertility, 72% of the videos were uploaded by healthcare organizations and practitioners, whereas 28% were uploaded by patients and individual users (15). In another study evaluating videos on bladder cancer, it was observed that 57% of the videos were uploaded by doctors/health professionals (16). In a Youtube™ video analysis study on the surgical treatment

of benign prostatic hyperplasia, 69.2% of the videos were provided by healthcare professionals (doctor, clinic, hospital or university) (17). Interestingly, in contrast to other studies, in our study, we found that the most common source of circumcision-related videos was individual users/patients (42.6%), followed by physicians/professional organizations/universities with 25.8% and standalone health information websites with 21.3%. The rarest video source was medical advertisements/for-profit organizations (10.3%). Unlike other studies, the fact that the most frequent video uploaders in this study were individual users/patients suggests that circumcision is of great importance in society and that there is a need to share it.

In a study in which videos related to nocturnal enuresis were evaluated, it was observed that the most common video content was general information (symptoms, etiology and treatment) (33.3%) (18). In nephrolithiasis videos, the most common content was related to medical treatment and passage of stones (36%), followed by prevention, diet, and hydration (28%) (19). There are many treatment options for circumcision surgery, and parents frequently question the method of circumcision. In our study, in support of this, it was observed that videos related to treatment were the most common content (51%), followed by general information videos with a rate of 36.8%.

In our study, we used Modified DISCERN and GQS scoring systems, which are also used in other Youtube™ quality and reliability studies. In the reliability analysis according to modified DISCERN scoring, most of the videos had low quality (82.58%). In the study of Duran and Kizilkan (5) on video analysis related with testicular cancers, the rate of high-quality videos was 9.9%, which was similar to the results in our study. In another study by Fode et al. (20), in which erectile dysfunction-related videos were evaluated, more than 80% of the videos were of low and moderate quality. In our study, the primary source of the videos evaluated as high quality according to GQS and modified DISCERN scores was found to be physicians/professional organizations/universities. The lowest scores were obtained for videos uploaded by individual users/patients. In Youtube™ studies on different topics, it was determined that videos uploaded by physicians, universities, and academic sources were of higher quality and more reliable (21,22). The results of these studies show us that when using Youtube™ as a source of information, the uploaders of the videos should also be considered to obtain accurate and high-quality information. However, 20.3% of the low-quality videos in our study were uploaded by physicians/professional organizations/universities. Accordingly, it should be kept in mind that the sources of the videos are not always decisive, and videos uploaded by healthcare professionals may also be of low quality.

In our study, no correlation was found between the number of views and likes of the videos and GQS and modified DISCERN scores. In addition, the durations of the videos were similar in all three quality groups as low, intermediate, and high quality according to modified DISCERN scoring. Similar to our study, Culha et al. (23) and Selvi et al. (24) showed that there was no significant difference between the quality scores and duration of the videos. On the contrary, there were studies in the literature showing that videos evaluated as high quality were longer (5,21).

### Study Limitations

The results related to video duration show that although the longer the video duration, the more likely it is that the video will be explained in more detail, it should also be considered that the viewers may be distracted and bored. What is important for a patient information video is to explain the most detailed and reliable information at the most appropriate time. In our study, there were some limitations, one of which was that the evaluated videos were selected only from English videos. Youtube™ is a dynamic platform and new content is constantly being uploaded. However, another limitation was that the characteristics of the videos evaluated in our study reflected the current situation. Using only "circumcision" as a keyword was another limitation. Videos related to the circumcision procedure could also be accessed by typing different keywords in the search engine.

## Conclusion

Youtube™ is an important source of information for those who want to obtain information about circumcision surgery. However, many of these videos on Youtube™ contain incorrect and incomplete information, and the videos are generally evaluated as low and medium quality. Therefore, better quality content should be produced by physicians and academic institutions, and patients should be provided with information from more reliable sources.

### Ethics

**Ethics Committee Approval:** The Non-Interventional Clinical Research Ethics Committee Chairmanship of Kütahya Health Sciences University has granted ethical approval (date: 06.04.2022; approval number: 2022/04-06).

**Informed Consent:** It is an online data screening study. Patient consent is not required.

### Authorship Contributions

Surgical and Medical Practices: Ş.C., İ.G.K., H.İ.İ., O.A., Ö.K., M.S., B.A., Concept: Ş.C., İ.G.K., H.İ.İ., O.A., Ö.K., M.S., B.A., Design: Ş.C., İ.G.K., H.İ.İ., O.A., Ö.K., M.S., B.A., Data Collection or Processing:

Ş.C., İ.G.K., H.İ.İ., O.A., Ö.K., M.S., B.A., Analysis or Interpretation: Ş.C., İ.G.K., H.İ.İ., O.A., Ö.K., M.S., B.A., Literature Search: Ş.C., İ.G.K., H.İ.İ., O.A., Ö.K., M.S., B.A., Writing: Ş.C., İ.G.K., H.İ.İ., O.A., Ö.K., M.S., B.A.

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

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CASE REPORT
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# High-Flow Priapism and the Importance of the Piesis Maneuver: A Case Report

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## Abstract

High-flow priapism (HFP) during childhood is a very rare condition. Low-flow priapism (LFP) is an urological emergency, but HFP is not. Thus, it is important to make a differential diagnosis between LFP and HFP. The Piesis Maneuver can be used as a physical examination for differential diagnosis between LFP and HFP, as well as to roughly locate the arteriocavernosal fistula in childhood HFPs.

**Keywords:** Physical examination, priapism, ultrasonography

## Introduction

Priapism, a prolonged penile erection lasting more than 4 h, is a rare condition in childhood (1). Priapism can be of three types: low-flow (ischemic), stuttering, and high-flow (non-ischemic) (1). High-flow priapism (HFP) is a rare condition usually caused by perineal trauma with the formation of an arteriocavernosal fistula (ACF) between the cavernosal artery and the lacunar spaces of the penis (2). Low-flow priapism (LFP) is a medical emergency; therefore, the differentiation between LFP and HFP is essential for proper treatment. With video footage, we would like to present the Piesis Manuever in a 10-year- old boy with HFP.

## Case Report

A 10-year-old boy presented with a painful, persistently rigid penis without a history of trauma. He was evaluated by the pediatric hematology department for LFP. During the work-up, penile color Doppler ultrasonography (PCDUS), which was performed from the penoscrotal region, yielded HFP without ACF. The patient was then transferred to the urology department for further evaluation and treatment. His medical history was unremarkable, but he remembered a straddle-type injury while biking about 3 weeks ago. The piesis maneuver was performed, and penile detumescence was achieved while compressing the perineum. However, penile tumescence recurred when compression was released (Video 1; 00:11-04:23) (3). His initial PCDUS only evaluated the cavernosol artery velocities, which confirmed HFP. After the piesis maneuver, a more detailed perineal evaluation with color Doppler ultrasonography (CDU) showed bilateral ACFs (Video 1; 04:24-04:32). Ultrasound-guided compression was performed using a sandbag to achieve penile detumescence (4). Detumescence was achieved for 48 h, with twoepisodes of morning erections. After termination of compression, penile tumescence recurred. Thus, the patient was evaluated for super-selective fistula embolization (5). Pelvic digital angiography/ digital subtraction angiography (DA/DSA) was performed to identify ACF (Video 1; 04:33-04:42). The DSA also confirmed very narrow bilateral ACFs, which were evaluated as unsuitable for super-selective embolization. Tranexamic acid treatment was started at a dose of 3x25 mg/kg. The parents were instructed to apply compression to the perineum with their hands for 30 min/h. After 24 h of this treatment, penis detumescence was achieved for almost 23 h. However, penile tumescence formed again after a morning erection. Although control perineal CDU yielded no visible fistula, penile tumescence was persistent (Video 1; 04:43-04:50). Therefore, under tranexamic acid treatment, 1 mL of 1/100.000 epinephrine solution was administered to the corpus cavernosum under sedoanalgesia.

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After the administration of epinephrine, penile detumescence was achieved. The patient was observed for an additional 24 h, and penile detumescence was persistent except for an approximately 15-min morning erection, and his pain resolved. The patient was discharged and followed up at 2-day intervals for one week. And then weekly for one month. His family and the patient himself declared no pain and no recurrent penile tumescence except for the morning erections.

## Discussion

Non-ischemic, HFP is a rare etiology of priapism and occurs secondary to congenital malformation on from the development of arteriovenous malformation due to genital trauma (2). The fistula between the corpus cavernosum and the cavernosal artery, which is a branch of the internal pudental artery, is the most common physiopathological condition to develop HFP, as described in our patient. LFP is an urological emergency that can cause cavernosal necrosis and fibrosis; however, HFP is not a medical emergency (5). Thus, differential diagnosis between LFP and HFP is mandatory. Clinical diagnosis of HFP is based on a history of perineal trauma, physical examination showing a nontender, rigid/semi-rigid penis, and cavernosal blood gas analysis. The history of a straddle-type injury must be repeatedly questioned because the clinical features of HFP can be evident 2 or 3 weeks after the trauma, as seen in our case (6). The piesis maneuver determines whether it is HFP or LFP. After applying gradually increasing pressure on the perineal part of each corpora cavernosa for 2-5 min, if penile detumescence is achieved and after releasing the pressure, the penile tumescence resumes within 1 min, the piesis maneuver is positive (3). The affected corpora cavernosa can also be identified using the piesis maneuver. In our case, both corpora cavernosa were affected, which was later confirmed with penile CDUS and penile arterial angiography.

The routine procedure of PCDUS is performed from penoscrotal bulging of the corpora cavernosa, which may overlook perineal ACF, as in this study. The first PCDUS yielded high cavernosal artery velocities, which indicated HFP but did not identify ACF. After the positive piesis maneuver, evaluation of the perineal corpora cavernosum with CDUS identified ACFs in both corpora cavernosa.

The treatment of HFP can be performed using conservative methods such as perineal or penile compression or ultrasound-guided compression therapy (4). In this study, we applied ultrasound-guided compression, and penile detumescence was achieved for almost 48 h. In case of failure of conservative methods, selective arterial embolization may be another option (6). Thus, in this study, after unsuccessful conservative treatment, we performed penile arterial angiography. Penile angiography yielded ACFs in both corpora cavernosa, which were very narrow and considered unsuitable for super-selective embolization by the interventional radiologist. Therefore, we attempted conventional angiographic fistula treatment with tranexamic acid, and to construct a cavernosal artery, we administered adrenaline into the corpora cavernosa. This treatment was successful, and persistent penile tumescence ended except for the morning erections. During the 1-month follow-up period no recurrence of HFP or LFP occurred, and the patient had successful morning erections.

## Conclusion

In this HFP case, the piesis maneuver helped us to identify the location of the ACF despite routine PCDUS not confirming the ACF. The piesis maneuver can be performed in every childhood priapism case for differential diagnosis.

### Ethics

**Informed Consent:** Informed consent was obtained from the patient.

### Authorship Contributions

Surgical and Medical Practices: M.R.G., Concept: M.R.G., M.V.K., Design: M.V.K., C.Ö., Analysis or Interpretation: G.E., Ç.A., Literature Search: C.Ö., Writing: M.R.G.

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

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J Urol Surg,
024;11(1):46-48

**Video 1.** Table of contents of the video

00:11-01:28 Perineal compression

01:29-03:04 Penile detumescence

03:05-04:02 End of penile erection

04:03-04:23 Penile tumescence and full erection

04:24-04:32 Initial penile color Doppler ultrasonography (PCDUS) image indicating an arteriocavernosal fistula

04:33-04:42 Digital angiography and digital subtraction angiography images of arterio-cavernosal fistula

04:43-04:50 Post-treatment PCDUS image indicates no visible fistula

CASE REPORT
General Urology

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# Sequential Ureterocalicostomy for An Adult Patient with Bilateral Ureteropelvic Obstruction Complicated with Kidney Stones

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## Abstract

Ureterocalicostomy is generally known as a salvage procedure performed for indications of ureteropelvic junction stricture recurrence and/or upper ureteric injury that precludes dependent ureteropelvic anastomosis. Here we report a patient with bilateral ureteropelvic junction obstruction and an intrarenal pelvis anomaly complicated with pelvic and lower calyceal kidney stones treated with bilateral sequential ureterocalicostomy with successful outcomes at the 1-year follow-up.

**Keywords:** Ureterocalicostomy, ureterocaliceal anastomosis, ureteropelvic junction obstruction

## Introduction

Open, laparoscopic, and robotically assisted laparoscopic approaches can be used for ureterocalicostomy (UC) in both pediatric and adult patients (1-5). Recent reports have revealed that UC may also be useful as a primary procedure for treatment-naïve pediatric patients with ureteropelvic junction strictures and some patients with anatomical variations, such as giant hydronephrosis and/or intrarenal pelvis with or without kidney malrotation (6-9).

## Case Presentation

A 32-year-old man was admitted to our outpatient clinic with sonographic findings of bilateral nephrolithiasis and high-grade hydronephrosis. His past medical history and physical examination did not reveal any pathological conditions. Computed tomography without contrast enhancement and serum biochemical evaluation revealed a mildly decreased glomerular filtration rate (e-GFR=88 mL/min) with bilateral nephrolithiasis, with a diameter of 13 mm at the right ureteropelvic junction (UPJ), three other stones in the lower calyxes up to 6 mm in diameter in the right kidney, a stone with a diameter of 23 mm at the left renal pelvis, and a second 14 mm stone in the left lower pole calyx. The measured stone densities for the right and left kidneys were 906 and 1422 HU, respectively. Bilateral hydronephrosis (SFU grades 4 and 3, respectively) in the right and left kidneys was also reported, as shown in Figure 1. Therefore, retrograde intrarenal surgery for the right-sided stones and simultaneous endoscopic combined intrarenal surgery on the left side were offered to the patient as an initial treatment. In the first session of the surgery, despite the difficult anatomy of the right upper ureter, right flexible ureteroscopic lithotripsy with a Holmium-Yag laser was

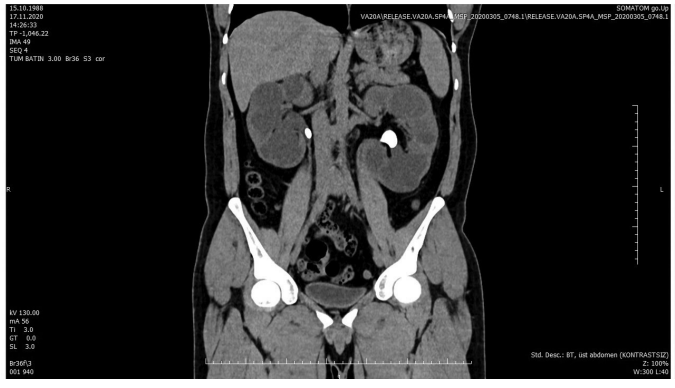

**Figure 1.** Preoperative coronal image of computerized tomography that demonstrates bilateral giant hydronephrosis and kidney stones in the case

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completed, and a Double-J (DJ) stent was inserted as planned. However, surgery for the left kidney stone was unsuccessful. The intrarenal anatomy of both the pelvis and the stone, with a very long segment and dilated infundibular anatomy of the left kidney, precluded access for lithotripsy. However, a DJ stent was inserted. The postoperative course was uneventful. Within three months after the first surgical session, the patient underwent three sessions of extracorporeal shock wave lithotripsy for the left pelvic stone with the aim of fragmenting the impacted stones in the UPJ that precluded contrast passage to stone-bearing calyces, followed by one session of supine percutaneous nephrolithotomy. The bilateral DJ stents were then removed and renal scintigrams were obtained when the patient retained stones only in the lower pole calyxes. Bilateral obstructive renography patterns with split functions of 34% and 66% for the right and left kidneys, respectively, were reported. Thus, the final diagnosis was congenital bilateral UPJ obstruction with an intrarenal pelvis accompanied by residual stones at the lower pole calyxes (up to 5 mm on the right side and up to 18 mm on the left side). The renal cortical thickness measurements were 3 and 5 mm for the right and left kidneys, respectively.

We proceeded with planning for two additional consecutive surgical treatment sessions. In the first session, the left kidney was treated with nephropyelolithotomy, accompanied by UC and DJ stent insertion via a left lumbotomy incision. We performed a 2 cm incision in the lower pole of the kidney and ureterocalyceal anastomosis with a 3.0 absorbable suture in an interrupted fashion. The operative procedure lasted four hours. Two months after the left-sided surgery, right-sided retroperitoneoscopic UC with DJ stent insertion was performed laparoscopically in the same manner. The operative time was three hours. Lower pole parenchymal resection was not required to establish appropriate ureterocalyceal anastomosis. No complications occurred in either the perioperative or postoperative periods of the surgical sessions. The DJ stents were removed cystoscopically 4 weeks after each surgery. At the 12-month follow-up visit, the patient was asymptomatic, and the hydronephrosis of both kidneys was reduced (Figure 2). Residual fragments were observed only in the lower pole calyces with diameters <5 mm. The analysis of the removed stones by X-ray diffraction revealed the whewellite content. The patient's GFR had improved to 111 mL per minute.

## Discussion

To the best of our knowledge, this is the first case in the literature in which bilateral UC procedures were performed sequentially. The patient was initially diagnosed with bilateral renal pelvic and lower pole stones with giant hydronephrosis. Following the routine initial treatment sessions for both kidneys, we noticed a bizarre anatomy that precluded routine intraoperative surgical procedures. Following three endourological surgical sessions for stone fragmentation and removal from both kidneys, the final diagnoses were bilateral ureteropelvic junction obstruction with intrarenal pelvis and giant hydronephrosis. Therefore, we performed bilateral UC (open procedure on the left side and retroperitoneoscopic procedure on the right side) sequential. Subsequent workup revealed good outcomes without any complications at 12 months.

The indication for UC in the current case was bilateral giant hydronephrosis with intrarenal pelvic variation, which was concordant with previously reported findings in the literature (6-8). Recent case reports and comparative studies support this policy in patients with giant hydronephrotic kidneys and/or intrarenal pelvis with comparable results (9).

The presence of a low preoperative GFR (less than 20 mL per minute) and a thinned-out cortex (less than 5 mm) has been reported to be an independent predictor of poor surgical outcomes (2). Although the renal parenchymal thickness measurements for both kidneys were in the marginal zone in our case, preoperative GF was good, and we achieved good surgical outcomes by symptomatic and functional healing at the 12$^{th}$ month. In the current report, the shortness of the

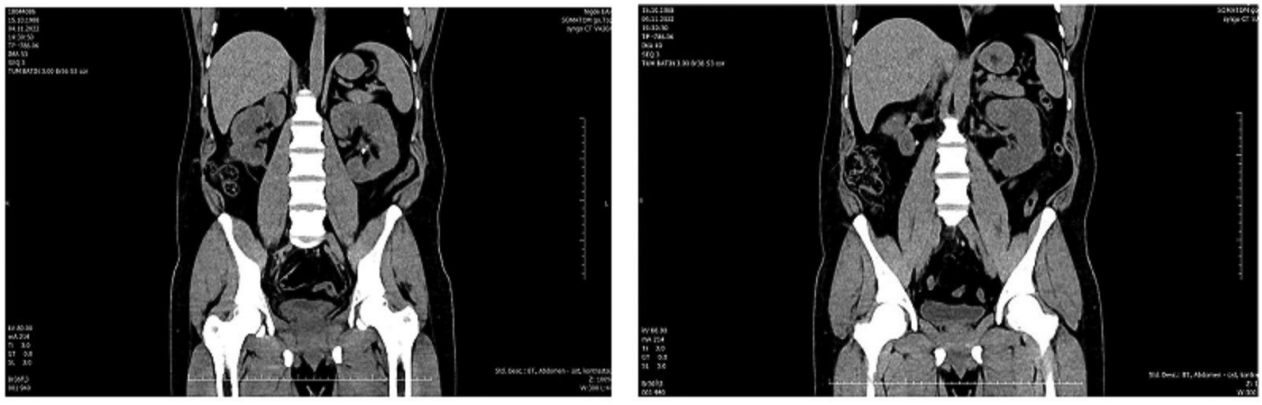

**Figure 2.** Postoperative coronal image of computerized tomography obtained at one-year follow-up demonstrates resolved hydronephrosis and ureterocaliceal anastomosis of both kidneys of the case

follow-up evaluation is a limiting factor in establishing an overall conclusion.

## Conclusion

In conclusion, with appropriate indications, bilateral sequential UC for ureteropelvic junction obstruction may be performed with good surgical outcomes. Bilateral renal involvement or accompanying kidney stones may not interfere with treatment results.

### Ethics

**Informed Consent:** Informed consent was obtained for this report from the patient.

**Financial Disclosure:** The author declared that this study received no financial support.

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VIDEO ARTICLE
Urooncology

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# Management of a Major Complication of Robotic Partial Nephrectomy

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## Abstract

Robotic partial nephrectomy (RPN) offers faster recovery time, shorter hospital stays, and decreased intraoperative blood loss. Thus, it has become a frequently preferred technique. Different major and minor complications may occur in RPN. However, there are insufficient data regarding the management of robotic surgery-related complications. A 62-year-old man presented with an incidental left renal mass. Magnetic resonance imaging demonstrated a 3.3x3.1x3.8 cm solid and contrast-enhanced renal mass localized at the lower pole of the left kidney. The PADUA score was 7. We performed robotic left partial nephrectomy (PN). Perioperative bleeding, warm ischemia time, and operation time were 100 cc, 26 min, and 180 min, respectively. There were no unexpected events during the operation. During the postoperative 2nd hour in the recovery room, the patient had syncope, hypotension, and tachycardia. Urgent ultrasonography demonstrated a 7x6 cm retroperitoneal hematoma. The selective renal angiography and embolization (SRAE) technique was preferred to manage the complication. Intra-arterial access was provided by femoral artery cannulation in the supine position under local anesthesia. Pseudoaneurysm was observed as a sign of bleeding in the lower pole segmental artery. An endovascular coiling procedure was performed on the pseudoaneurysm originating from the lower pole renal artery. The patient's post-angioembolization course was uneventful, with no other complications after the intervention. The patient was discharged after five days of follow-up. Complications following RPN performed by experienced surgeons can be acceptably low. However, postoperative arterial malformation leading to hemorrhage can be life-threatening. It has been reported that minimally invasive PN increases the risk of arterial malformation compared with open PN, and the reported incidence varies by approximately 3-10%. In our case, we preferred SRAE because surgical exploration had a potential risk of nephrectomy. SRAE is a technically feasible and safe option for managing arterial hemorrhage after RPN.

**Keywords:** Arterial embolization, complication, endourology, radiology, robotic partial nephrectomy, urooncology

## Introduction

Partial nephrectomy (PN) is the surgical method of choice for small renal masses, and it has been applied for larger and complex renal masses recently (1). Robotic partial nephrectomy (RPN) has become a more beneficial and frequently preferred technique because it offers faster recovery time, shorter hospital stays, and decreased intraoperative blood loss (2). It has been reported that complications following RPN are approximately 30%, with a major (Clavien ≥3) complication rate of 3-6% (3). However, there are insufficient data regarding the management of robotic surgery-related complications. Therefore, it is crucial to determine the perioperative and postoperative management of complications in robotic surgery.

In this video presentation, we present our initial experience with managing a major complication in a patient with a segmental artery hemorrhage after a robotic PN.

## Case Presentation

From 2018 to 2022, robotic PN was performed on 40 patients (24 males, 16 females). The mean age was 52.75 (34-72) years. There were no other complications other than hemorrhage (in 3 patients). A 62-year-old man presented with an incidental left renal mass. The patient had no other disease or drug use. The patient's physical examination was normal. The preoperative hemoglobin/hematocrit (Hgb/Hct) was 11.3/34. Magnetic resonance imaging demonstrated a 3.3x3.1x3.8 cm solid and

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contrast-enhanced renal mass localized at the lower pole of the left kidney. The PADUA score was calculated as 7. Preoperative preparations were completed. We performed robotic left PN. Perioperative bleeding, warm ischemia, and operation time were 100 cc, 26 min, and 180 min, respectively. There were no unexpected events during the operation. The postoperative Hgb/Htc was 10.7/32. During the postoperative 2nd hour in the recovery room, the patient had syncope, hypotension, and tachycardia. Urgent ultrasonography demonstrated a 7x6 cm retroperitoneal hematoma. After the evaluation of the hemodynamic parameters and radiological findings, an emergency intervention was planned. The selective renal angiography and embolization (SRAE) technique was preferred to manage this complication. The patient was transferred to the interventional radiology clinic. Intra-arterial access was provided by femoral artery cannulation in the supine position under local anesthesia. A microcatheter was placed distal to the renal artery, and renal angiography was performed. Transfemoral renal angiogram demonstrated a small renal artery pseudoaneurysm arising from a small, laterally directed branch of the left interlobar artery. A microcatheter was advanced into the pseudoaneurysm, and contrast was injected to better define the anatomy. The endovascular coiling procedure was applied to the pseudoaneurysm originating from the lower pole segmental artery. No further extravasation was observed, and only minimal parenchyma was sacrificed. The patient's post-angioembolization course was uneventful, with no other complications after the intervention. The patient was discharged after five days of follow-up. The pathology report showed a clear cell type of renal cell carcinoma with a negative surgical margin (T1N0M0). There was no recurrence or metastasis during the first 18 months of postoperative oncological follow-up. It was observed that renal function was also preserved.

## Discussion

SRAE is an effective treatment option in patients with hemorrhagic complications after RPN. RPN is the increasingly preferred surgical technique for small renal masses, allowing the surgeon to approach relatively complex masses and providing the advantages of minimally invasive surgery (4). Complications following RPN performed by experienced surgeons can be acceptably low (5). However, postoperative arterial malformation leading to hemorrhage can be life-threatening. It has been reported that minimally invasive PN increases the risk of arterial malformation compared with open PN, and the reported incidence varies by approximately 3-10% (6). In our series, the incidence of hemorrhage was similar to that reported in the literature, with a rate of 7.5%.

It is crucial to determine the postoperative management of complications following robotic surgery. The majority of acute postoperative bleeding cases can be managed with transfusion and follow-up. Additional interventions, such as surgical exploration or SRAE, may be required in relatively few cases. Acute abdominal signs, high-volume drainage, and hemodynamic instability may indicate additional interventions. Because surgical exploration mostly results in the completion of nephrectomy, SRAE may be preferred in selected cases because of the low incidence of adverse effects (7). In this study, we preferred SRAE because surgical exploration had a potential risk of nephrectomy.

## Conclusion

The video demonstrates that SRAE effectively treats major bleeding, avoiding aggressive approaches. SRAE is a technically feasible and safe option for managing arterial hemorrhage after RPN.

**Video 1.**

### Ethics

**Informed Consent:** Patient consent was obtained.

### Authorship Contributions

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

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

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VIDEO ARTICLE
General Urology

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# Penil Entrapment with A Steel Nut and Its Treatment with A Dental Micro Motor

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## Abstract

Entrapment or strangulation of the penis is an uncommon condition that requires prompt medical intervention to avoid mechanical and/or vascular injuries. Severe complications such as edema, necrosis, skin infection, penile amputation, and urethral fistula may occur. There is no universally accepted method for treatment, and medical treatment can be delayed due to feelings of humiliation or self-attempt to release the entrapment. Intracavernosal aspiration is a surgical procedure used to evacuate blood from the obstructed corpus cavernosum. This procedure reduces penile size making it easier to remove the ring. However, it does not alleviate the inflammatory idea in the interstitial spaces and penile skin. This paper describes a case study of a 34-year-old male patient who was evaluated in the department of emergency with penile entrapment in a thick steel ring that was placed for prolonged erection. Removing the ring manually was attempted in the emergency department but failed, causing more engorgement in the distal part of the penis. The following admission, the patient was expeditiously transferred to the operating room where the surgical team interposed a wooden tongue depressor between the penile shaft and the ring. Subsequently, a manual hacksaw was used to excise the constriction device. Nevertheless, owing to the substantial diameter of the ring, the hacksaw became fractured and subsequently, a micromotor was employed for the ring removal procedure. Throughout the cutting process involving the micromotor, the ring was continuously cooled with an iced isotonic solution. Within thirty minutes, the ventral and dorsal sides of the steel ring were cut, and it was removed in two pieces.

**Keywords:** Steel ring, penil entrapment, treatment, micro motor

## Introduction

Entrapment of the penis with metal or nonmetal objects is a rare condition that needs immediate treatment to prevent mechanical and/or vascular injuries. Due to prolonged entrapment, the anatomical integrity of the penis in addition to the voiding and erectile functions would be damaged. The first case was reported by Gauthier (1) in the 18$^{th}$ century. These objects are used to prolong the erection duration and increase the sexual pleasure of adults. In the pediatric population, the strangulation of the penis is generally caused by occult materials like long pieces of hair and treads (2).

Penile strangulation causes edema distally to the constricting object due to the obstruction of the venous and lymphatic flow. In hours, compartment syndrome of the penis, which would cause ischemia and tissue necrosis, occurs because of arterial obstruction. Skin ulceration, urethral injury, damage to the corpus spongiosum, cavernosum, and urethral fistulas are the long-term consequences of this condition. The duration and the severity of the constriction are the major factors that affect the complications (3).

This paper presents the treatment process of a young male with penile entrapment in a thick steel ring.

## Case Presentation

The patient was 34-year-old circumcised male, and he was admitted to the emergency service with penile entrapment in a metallic nut that had been placed for a prolonged erection. After sexual practice, the steel nut could not be removed from the penile shaft due to swelling of the distal part. Approximately 4 h later, the patient attended the hospital. He had no co-morbidities and no history of earlier surgeries. Also, his laboratory values were within the normal range.

Genital examination revealed stuck thick (6 mm) steel ring surrounding the shaft of the penis. The penis was ecchymosed

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and swollen at the end of the metal ring secondary to the congestion (Figure 1). At first, manually removing the ring was attempted by the emergency staff with the aid of lubricants and blood aspiration with two 16-gauge needles, but failed. This attempt caused more engorgement in the distal part or penis (Figure 2). After that, the patient was immediately transferred to the operating room, which was prepared for ambulatory patients. The patient was placed in a supine position and dorsal penile block with lidocaine was used for anesthesia. The surgical team interposed a wooden tongue depressor between the penile shaft and the steel ring, in addition, the ring was stabilized with a wrench to prevent accidental damage to the penile tissue. After that, a manual hacksaw was used to cut through the steel ring; however, after one hour of hard labor and two broken pieces of the hacksaw, little progress could be made. The search for a more effective and faster method resulted in the discovery of a micromotor that is used for shaping dental prosthesis. The ring was cooled with an iced isotonic solution while cutting with a micromotor. Within thirty minutes, the ventral and dorsal sides of the steel ring were cut, and it was removed in two pieces (Figure 3). After the ring was successfully removed, the penile color returned to its normal state, and after being monitored for 6 h, the patient was discharged.

**Figure 1.** The 6 mm steel ring surrounding the penile shaft

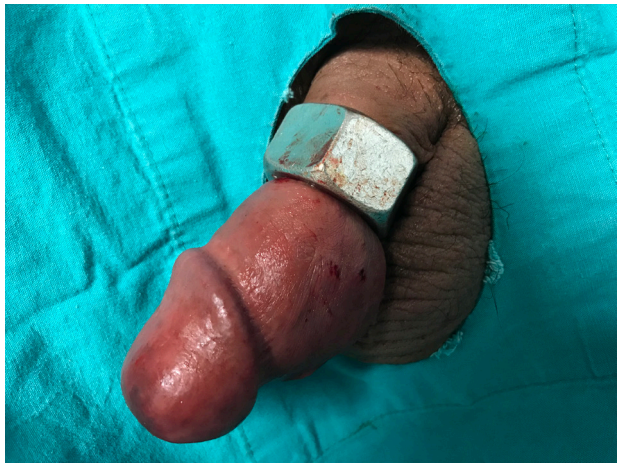

**Figure 2.** The engorgement of the penis after the failed attempt of blood aspiration with two 16-gauge needles

## Discussion

Penile entrapment and/or strangulation, which would require immediate intervention, is a rare urological condition. The reason behind this condition varies according to age groups. The leading cause in adult males is the intention to increase sexual pleasure, self-treating of erectile dysfunction and psychiatric diseases (4). The most common object that is used for enhancement is a metal ring in elderly males. However, the strangulation is usually accidental in the pediatric population, and the objects that cause the entrapment could be hair, string, tread or a rubber band (5,6). The medical treatment could be delayed because of feeling humiliation or self-attempts of release of the entrapment. The patient in this report used a thick steel ring to enhance sexual pleasure and promptly sought medical attention.

There is a wide range of complications caused by penile strangulation, which could be affected by factors such as the object that is used, the level of compression, and especially the duration of the entrapment. A study conducted by Koifman et al. (4) demonstrated that following penile entrapment with a foreign body, complications such as edema, necrosis, and skin infection, decreased/lost penile sensation, abscess/cellulitis, penile amputation, and urethral fistula may occur. However, in the presented case, no complications were observed after treatment, likely due to early intervention and prompt medical attention. A classification scheme comprising five categories has

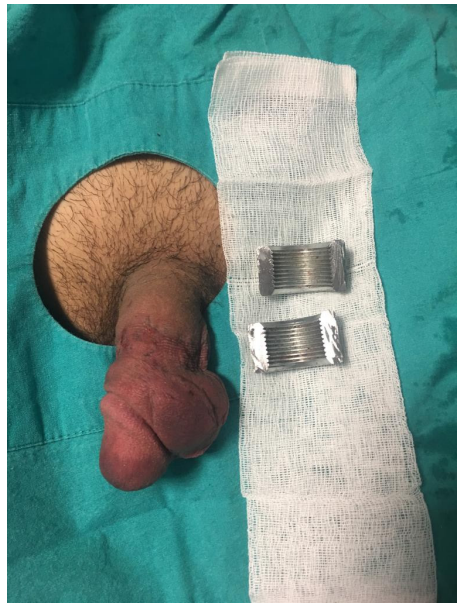

**Figure 3.** The penis and the parts of the steel ring after the cutting with a dental micro motor

been established to grade penile strangulation injuries by Bhat et al. (7). In addition, a simplified grading system with just two distinct categories was proposed by Silberstein et al. (8) in 2008. In that system, decreased penile sensation, penile edema, and even skin ulceration (without urethral fistulae) were included in the low-grade injuries. The high-grade category consisted of injuries that usually need surgical correction.

Intracavernosal aspiration is a surgical procedure used to evacuate blood from the obstructed corpus cavernosum. This procedure reduces penile size making it easier to remove the ring. However, it does not alleviate the inflammatory edema in interstitial spaces and the penile skin, and thus should be used in conjunction with different methods. In a case study published by Simlawo et al. (9) in 2018, a 10-year-old patient who had a 3 cm metal ring attached to his penis was treated with intracavernosal aspiration and removal of the ring by lubricating it with povidone-iodine.

In addition to medical devices, assistance from different fields of expertize may be required to use tools to remove a foreign body. Furthermore, when using electrical devices, it is recommended to use a barrier between the penis and the foreign object to prevent injuries caused by medical intervention. Although cutting poses a risk of penile injury, it is the most common method used for removal of foreign bodies. Using an orthopedic cutting tool under the ring can be the quickest way of removal, but it may not be the safest method, particularly when dealing with a thick metal ring. The use of an iron saw, angle grinder, or gigli saw for cutting the ring has been reported. Insufficient protection within the limited operating space and heat production can result in potential injuries. Using ice-filled normal saline can help minimize heat production and mitigate the risk of thermal injury (10). In a case report published by Patel et al. (11) in 2018, lubrication and cutting with a gigli saw were attempted to remove a ring around the scrotum and penis. When these methods failed, an attempt was made to cut the ring with an electric saw, but burn damage occurred due to the high heat despite continuous normal saline irrigation. As a result, an industrial bolt cutter was brought in, and the ring was cut and removed (11).

## Conclusion

In conclusion, in the rare occurrence of penile constriction caused by a foreign object, there are different treatment options available for the preservation of penis structure and function. However, what matters most is the prompt application of the available treatment option. Acquiring skill in possible treatment options will accelerate the application.

**Video 1.**

### Ethics

**Informed Consent:** Informed consent was obtained from the patient.

### Authorship Contributions

Surgical and Medical Practices: İ.A., H.T., H.Ş., Concept: İ.A., F.K., H.T., H.D., H.Ş., Design: İ.A., H.T., H.Ş., Data Collection or Processing: İ.A., H.T., H.D., Literature Search: İ.A., F.K., H.T., H.D., H.Ş., Writing: İ.A., F.K., H.T., H.Ş.

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

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