

## The Efficacy of Simultaneous Ureterorenoscopy for Ipsilateral Ureter and Kidney Stone: A Single-Center Experience

İpsilateral Üreter ve Böbrek Taşlarında Eş Zamanlı Üreterorenoskopinin Etkinliği: Tek Merkez Deneyimi

İlkin Hamid-Zada<sup>\*</sup> , Özgür Arıkan , Talha Nuroğlu , Elbrus Fehruzlu , Ferhat Keser , Asif Yıldırım 

Department of Urology, İstanbul Medeniyet University, İstanbul, Türkiye

### ABSTRACT

**Objective:** This study aimed to evaluate the efficacy and safety of simultaneous endourological management of ureteral and ipsilateral renal stones and to identify predictive factors associated with stone-free outcomes.

**Materials and Methods:** A retrospective analysis was conducted on seventy-nine patients who underwent single-session treatment for concurrent ureteral and ipsilateral renal stone. Demographic data, stone characteristics, operative details, and postoperative outcomes were collected. Stone-free rates (SFR) were assessed on postoperative day 1 and at 1 month. Comparative analyses were performed to determine factors associated with 1-month SFR.

**Results:** The overall 1-month SFR was 75.9%. Renal stone size, ureteral stone density (HU), hydronephrosis grade, and number of stones were significant predictors of SFR ( $p < 0.05$ ). Patients who were stone-free on postoperative 1 day were significantly more likely to remain stone-free at 1 month ( $p < 0.001$ ). Larger renal stones and a higher number of stones were associated with decreased success rates. Complication rates were low, with 6.3% experiencing postoperative events, most of which were minor. Auxiliary procedures were required in 16.5% of patients during follow-up.

**Conclusion:** Simultaneous management of ureteral and ipsilateral renal stones is a safe and effective treatment option, providing high SFR with low morbidity. Stone size and number of stones are the key determinants of postoperative success and should be considered during preoperative planning.

**Keywords:** lithotripsy, simultaneous treatment, ureteral and renal stone, ureteroscopy

**Cite As:** Hamid-Zada I, Arıkan O, Nuroglu T, Fehruzlu E, Keser F, Yıldırım A. The Efficacy of Simultaneous Ureterorenoscopy for Ipsilateral Ureter and Kidney Stone: A Single-Center Experience. Endourol Bull. 2026;18(3):117–125. <https://doi.org/10.54233/endourolbull-1840851>

**Corresponding Author:** İlkin Hamid-Zada, MD, İstanbul Medeniyet University, İstanbul, Türkiye

**e-mail:** [ilkin081994@gmail.com](mailto:ilkin081994@gmail.com)

**Received :** December 12, 2025

**Accepted :** May 11, 2026



**ÖZET**

**Amaç:** Bu çalışma, üreteral ve ipsilateral renal taşların eşzamanlı endoürolojik tedavisinin etkinliğini ve güvenliğini değerlendirmeyi ve taşsızlık sonuçlarıyla ilişkili prediktif faktörleri belirlemeyi amaçlamıştır.

**Gereç ve Yöntemler:** Üreteral ve ipsilateral renal taşın eşzamanlı olarak tek seansta tedavi edildiği yetmiş dokuz hastaya ait retrospektif bir analiz gerçekleştirildi. Demografik veriler, taş özellikleri, operatif detaylar ve postoperatif sonuçlar kaydedildi. Taşsızlık oranları (SFR), postoperatif 1. gün ve 1. ayda değerlendirildi. Bir aylık taşsızlık ile ilişkili faktörleri belirlemek amacıyla karşılaştırmalı analizler yapıldı.

**Bulgular:** 1 aylık taşsızlık oranı %75,9 olarak saptandı. Renal taş boyutu, üreteral taş yoğunluğu (HU), hidronefroz derecesi ve taş sayısı SFR için anlamlı prediktörlerdi ( $p < 0.05$ ). Postoperatif 1. günde taşsız olan hastaların 1. ayda da taşsız kalma olasılığı anlamlı olarak daha yüksekti ( $p < 0.001$ ). Daha büyük renal taşlar ve daha yüksek taş sayısı başarı oranlarının azalmasıyla ilişkili bulundu. Komplikasyon oranları düşük olup, hastaların %6.3'ünde çoğunluğu minör olan postoperatif olaylar izlendi. Takip sürecinde hastaların %16.5'inde ek girişimlere ihtiyaç duyuldu.

**Sonuç:** Üreteral ve ipsilateral renal taşların eşzamanlı yönetimi, yüksek taşsızlık oranı ve düşük morbidite ile güvenli ve etkili bir tedavi seçeneğidir. Taş boyutu ve taş sayısı, postoperatif başarının temel belirleyicileridir ve preoperatif planlama sürecinde dikkate alınmalıdır.

**Anahtar kelimeler:** litotripsi, eş zamanlı tedavi, üreter ve böbrek taşı, üreteroskopi

**INTRODUCTION**

Urolithiasis is becoming increasingly common worldwide and currently affects approximately 20% of the population. This rising prevalence has established urolithiasis as one of the most common urological conditions (1). Urinary system stones can be asymptomatic for long durations or pass spontaneously, but they are also capable of presenting symptoms such as pain, hematuria, infection, and damage to renal function (2). New endoscopic equipment and laser devices with powerful and functional optics have revolutionized kidney stone treatment and made RIRS safe and efficient (3). According to European Association of Urology (EAU) recommendations, ureteroscopy (URS) is the first-line treatment for ureteral stones measuring greater than 10 mm in the proximal or distal ureter. If the stone is less than 10 mm, either URS or extracorporeal shockwave lithotripsy (ESWL) can be used for initial management (4).

Several investigations have reported that performing endoscopic procedures—such as URS and percutaneous nephrolithotomy within the same session may reduce the number of anesthetic exposures, shorten hospitalization, and increase overall efficiency (5–6). Despite these potential advantages, single-session procedures may prolong operative time and increase intrarenal pressures, which may lead to infectious complications, postoperative discomfort, or, in some cases, bleeding and ureteral injury (7,8).

Given these considerations, further evaluation is required to clarify the safety and effectiveness of simultaneous stone removal. The present study aims to assess the outcomes of treating ureteral and ipsilateral renal stones during the same operative session.

**MATERIALS AND METHODS**

We retrospectively analyzed seventy-nine patients treated with flexible URS / Retrograde Intrarenal Surgery (RIRS) for simultaneous ureteral and ipsilateral renal stones from January 2024 to May 2025. The study was in accordance with the Declaration of Helsinki, and ethical approval was obtained from the Medeniyet University Ethics Committee (Approval no.: 2025/0300, Date: 2025-11-11). All patients were assessed by non-contrast spiral computed tomography (CT) scanning. Exclusion criteria included the ureteropelvic junction obstruction, ureteral strictures, presence of congenital renal anomalies, and the presence of a urinary tract infection. Prior to the procedure, patients underwent routine laboratory evaluations comprising a complete blood count, urine culture, and serum creatinine measurement. A single dose of a second-generation parenteral cephalosporin was administered to all patients preoperatively for

antibiotic prophylaxis. Patients were placed in the lithotomy position under general anesthesia. Ureter stones were treated using a 9.5 French (Fr) ureteroscope (Richard Wolf, Knittlingen, Germany). Following the complete removal of the ureteral calculus, 11.5 Fr Ureteral Access Sheath (UAS) of appropriate length was inserted to facilitate the RIRS procedure. The flexible ureteroscope (7.5 Fr Karl Storz Flex-X2, Tuttlingen, Germany) was advanced through the access sheath to reach the renal pelvis. In patients in whom the UAS could not be advanced, direct visualization was achieved by advancing the flexible ureteroscope over the guidewire. The renal stones were fragmented using a Holmium YAG laser probe. Following a detailed inspection of the collecting system to ensure no residual fragments remained, a double-J (DJ) stent was placed and left in situ for 2 to 4 weeks.

Preoperative and postoperative characteristics, Hounsfield unit (HU), complication rate, hospital duration, and Stone-free rate (SFR) were evaluated. Postoperatively, patients underwent radiographic assessments, X-ray, or non-enhanced CT scan at 1 day and 1 month for follow-up. SFR was defined as residual stones <2 mm on a postoperative imaging study.

Statistical analyses were performed using IBM SPSS Statistics version 22 (IBM Corp., Armonk, NY, USA). Descriptive statistics for patient demographics and baseline characteristics are presented in Table 1. Continuous variables are reported as mean  $\pm$  standard deviation. Comparisons between SFR-positive and SFR-negative groups are presented in Table 2. Continuous variables were compared using the independent samples t-test. Categorical variables were analyzed using the chi-square test or Fisher's exact test, as appropriate (particularly when expected cell counts were <5). Patient follow-up data are summarized in Table 3. A p value <0.05 was considered statistically significant.

## RESULTS

Seventy-nine patients were included in the study. The mean ureteral stone size was  $8.66 \pm 2.8$  mm, while the mean ipsilateral renal stone size measured  $10.47 \pm 6.1$  mm. The average HU were  $985 \pm 267.1$  for ureteral stones and  $1101 \pm 235.8$  for renal stones. Regarding stone location, 48.8% of ureteral stones were in the proximal ureter, 39% in the distal ureter, and 20.2% in the mid-ureter. Renal stones were most frequently identified in the lower pole (35.4%), followed by the renal pelvis (26.6%), middle pole (22.7%), and upper pole (15.3%). The median number of stones per patient, including both renal and ureteral stones, was 3.16 (range 2–10). Hydronephrosis was present in varying degrees, with Grade 2 being the most common (41.7%), whereas only 1.6% of patients demonstrated Grade 4 hydronephrosis. The mean operative time was  $50.06 \pm 13.1$  minutes. UAS was used in 53.2% of cases. Intraoperative complications were rare, observed in only 2 patients (2.6%). Postoperative complications were recorded in 5 patients (6.4%). SFR on postoperative day 1 was 53.2%, increasing substantially to 75.9% at 1 month follow-up.

Patients were categorized into two groups according to their 1-month stone-free status: SFR-positive (n=60) and SFR-negative (n=19). Ureteral stone HU was significantly lower in the SFR-positive group compared to the SFR-negative group ( $981.8 \pm 263$  vs.  $842 \pm 256.4$  HU,  $p = 0.047$ ). Patients with SFR-negative outcomes had significantly larger ipsilateral renal stones than those in the SFR-positive group ( $14.74 \pm 7.5$  mm vs.  $11.2 \pm 4.8$  mm,  $p = 0.018$ ). Hydronephrosis severity demonstrated a statistically significant distribution between groups ( $p = 0.010$ ), with  $\geq$  Grade 2 hydronephrosis being more significant in the SFR-positive group. The mean number of stones per patient was significantly higher in the SFR-negative group compared with the SFR-positive group ( $4.1 \pm 2.4$  vs.  $2.8 \pm 1.6$ ,  $p = 0.037$ ). Lateralization, prior surgical intervention history, ureteral and renal stone localization demonstrated no statistically significant differences between the groups.

The mean follow-up duration was  $14.1 \pm 5.7$  months. Thirteen patients (16.5%) required an auxiliary procedure. Among these interventions, five patients (38.4%) underwent URS, four patients (30.8%) underwent RIRS, and four patients (30.8%) were treated with ESWL. Postoperative complications occurred in five patients (6.3%). Of these, two patients (40%) developed fever or infection requiring antibiotic therapy, two patients (40%) experienced stent

migration necessitating reinsertion, and one patient (20%) presented with postoperative hematuria. According to the Clavien–Dindo classification, complications were distributed as follows: one patient (20%) had a Grade I event, two patients (40%) had Grade II events, and two patients (40%) experienced Grade III complications. No Grade IV complications were observed. The mean time to DJ stent removal was  $2.8 \pm 0.9$  weeks.

**Table 1.** Descriptive Statistics of Patient Demographics and Clinical Outcomes

| Variables                             | Patients, n (%)  |
|---------------------------------------|------------------|
| Age (years), (mean $\pm$ SD)          | 48.3 $\pm$ 15.7  |
| Gender, n (%)                         |                  |
| Male                                  | 60 (75.9)        |
| Female                                | 19 (24.1)        |
| Ureteral stone size, (mean $\pm$ SD)  | 8.66 $\pm$ 2.8   |
| Ureteral stone HU, (mean $\pm$ SD)    | 985 $\pm$ 267.1  |
| Kidney stone size, (mean $\pm$ SD)    | 10.47 $\pm$ 6.1  |
| Kidney stone HU, (mean $\pm$ SD)      | 1101 $\pm$ 235.8 |
| Operative Time (min), (mean $\pm$ SD) | 50.06 $\pm$ 13.1 |
| Lateralization, n (%)                 |                  |
| Right                                 | 41 (51.9)        |
| Left                                  | 38 (48.1)        |
| Prior surgery, n (%)                  |                  |
| No                                    | 43 (54.4)        |
| Yes                                   | 36 (45.6)        |
| Ureteral stone location, n (%)        |                  |
| Distal                                | 30 (39)          |
| Mid-ureter                            | 16 (20.2)        |
| Proximal                              | 33 (48.8)        |
| Kidney stone location (%), n (%)      |                  |
| Renal Pelvis                          | 21 (26.6)        |
| Upper calyx                           | 12 (15.3)        |
| Middle calyx                          | 18 (22.7)        |
| Lower calyx                           | 28 (35.4)        |
| Grade of Hydronephrosis (SFU), n (%)  |                  |
| Grade 0                               | 22 (27.8)        |
| Grade 1                               | 15 (18.9)        |
| Grade 2                               | 33 (41.7)        |
| Grade 3                               | 8 (10)           |
| Grade 4                               | 1 (1.6)          |
| Usage of UAS, n (%)                   |                  |
| None                                  | 37 (46.8)        |
| Yes                                   | 42 (53.2)        |
| Peroperative complications, n (%)     |                  |
| None                                  | 77 (97.4)        |
| Yes                                   | 2 (2.6)          |
| SFR postoperative 1.day, n (%)        |                  |
| None                                  | 37 (46.8)        |
| Yes                                   | 42 (53.2)        |
| SFR postoperative 1. month, n (%)     |                  |
| None                                  | 19 (14.1)        |
| Yes                                   | 60 (75.9)        |
| Number of stones, median (min-max)    | 3.16 (2-10)      |

UAS: Ureteral access sheath; SFR: Stone-free rate; SFU: Society of Fetal Urology; HU: Hounsfield Unit

**Table 2.** Comparison of Demographic and Operative Outcomes between Stone-Free Positive and Stone-Free Negative Patient Groups

|                                        | SFR 1. month<br>(Negative)<br>(N=19) | SFR 1. month<br>(Positive)<br>(N=60) | P value          |
|----------------------------------------|--------------------------------------|--------------------------------------|------------------|
| Age (years), (mean ± SD)               | 42 ± 17.6                            | 45.3 ± 14.6                          | 0.466            |
| Gender, n (%)                          |                                      |                                      |                  |
| Male                                   | 14 (73.7)                            | 46 (76.7)                            | 0.767            |
| Female                                 | 5 (26.3)                             | 14 (26.3)                            |                  |
| Ureteral stone size, (mean ± SD)       | 9.2 ± 3.5                            | 8.4 ± 2.6                            | 0.367            |
| Ureteral stone HU, (mean ± SD)         | 981.8 ± 263                          | 842 ± 256.4                          | <b>0.047</b>     |
| Kidney stone size, (mean ± SD)         | 14.74 ± 7.5                          | 11.2 ± 4.8                           | <b>0.018</b>     |
| Kidney stone HU, (mean ± SD)           | 1101.3 ± 241.6                       | 1101.2 ± 235.7                       | 0.998            |
| Operative Time (min), (mean ± SD)      | 53.16 ± 13.1                         | 49.08 ± 13.03                        | 0.239            |
| Lateralization, n (%)                  |                                      |                                      |                  |
| Right                                  | 8 (42.1)                             | 33 (55)                              | 0.431            |
| Left                                   | 11 (57.9)                            | 27 (45)                              |                  |
| Preoperative surgical procedure, n (%) |                                      |                                      |                  |
| No                                     | 8 (42)                               | 35 (58.3)                            | 0.216            |
| Yes                                    | 11 (58)                              | 25 (41.7)                            |                  |
| Ureteral stone location, n (%)         |                                      |                                      |                  |
| Distal                                 | 4 (21)                               | 26 (43.3)                            | 0.071            |
| Mid-ureter                             | 7 (36.8)                             | 9 (15)                               |                  |
| Proximal                               | 8 (42.2)                             | 25 (41.7)                            |                  |
| Kidney stone location (%), n (%)       |                                      |                                      |                  |
| Renal Pelvis                           | 4 (21)                               | 17 (28.3)                            | 0.641            |
| Upper calyx                            | 2 (10.5)                             | 10 (16.6)                            |                  |
| Middle calyx                           | 4 (21)                               | 14 (23.3)                            |                  |
| Lower calyx                            | 9 (47.5)                             | 19 (31.8)                            |                  |
| Grade of Hydronephrosis (SFU), n (%)   |                                      |                                      |                  |
| Grade 0-1                              | 4 (21)                               | 33 (55)                              | <b>0.010</b>     |
| ≥ Grade 2                              | 15 (79)                              | 27 (45)                              |                  |
| Usage of UAS, n (%)                    |                                      |                                      |                  |
| None                                   | 7 (36.8)                             | 30 (50)                              | 0.317            |
| Yes                                    | 12 (63.2)                            | 30 (50)                              |                  |
| Perioperative complications, n (%)     |                                      |                                      |                  |
| None                                   | 19 (100)                             | 58 (96.7)                            | 0.420            |
| Yes                                    | 0                                    | 2 (3.3)                              |                  |
| SFR 1.day, n (%)                       |                                      |                                      |                  |
| None                                   | 18 (94.8)                            | 20 (33.3)                            | <b>&lt;0.001</b> |
| Yes                                    | 1 (5.2)                              | 40 (66.7)                            |                  |
| Number of stones, (mean ± SD)          | 4.1 ± 2.4                            | 2.8 ± 1.6                            | <b>0.037</b>     |

UAS: Ureteral access sheath; SFR: Stone-free rate; SFU: Society of Fetal Urology; HU: Hounsfield Unit

**Table 3.** Follow-up data of patients

| Variables                                    |                |
|----------------------------------------------|----------------|
| Follow-up (mo.), (mean $\pm$ SD)             | 14.1 $\pm$ 5.7 |
| Patients required auxiliary procedure, n (%) | 13 (16.5)      |
| Auxiliary procedures, n (%)                  |                |
| URS                                          | 5 (38.4)       |
| RIRS                                         | 4 (30.8)       |
| ESWL                                         | 4 (30.8)       |
| Postoperative complications rate, n (%)      | 5 (6.3)        |
| Postoperative complication, n (%)            |                |
| Fever/Infections requiring antibiotics       | 2 (40)         |
| Stent migration requires reinsertion         | 2 (40)         |
| Postoperative hematuria                      | 1 (20)         |
| Clavien Dindo                                |                |
| Grade 1                                      | 1 (20)         |
| Grade 2                                      | 2 (40)         |
| Grade 3                                      | 2 (40)         |
| Grade 4                                      | 0              |
| Removal of DJ stent (week), (mean $\pm$ SD)  | 2.8 $\pm$ 0.9  |

URS: Ureteroscopy; RIRS: Retrograde Intrarenal Surgery; ESWL: Extracorporeal Shock Wave Lithotripsy; DJ: Double-J

## DISCUSSION

In this single-center study, we evaluated the outcomes of simultaneous endourological management of ureteral and ipsilateral renal stone, demonstrating that this combined approach is both feasible and effective, with acceptable complication rates. Our findings support previously published literature suggesting that advances in flexible ureteroscopy, improved laser technologies, and optimized intrarenal pressure control have facilitated comprehensive single-session stone management (9).

The overall 1-month stone-free rate (SFR) of 75.9% in our cohort is comparable with earlier reports demonstrating SFR values between 70–85% for simultaneous stone removal for ureteral and ipsilateral renal stone (10-11). Ozden et al., who reported SFR rates between 72–81% in patients undergoing combined ureteroscopy and renal stone treatment (5). Similarly, Zhu et al. observed that single session ureteroscopy for multi-level stones yielded high success rates with minimal morbidity, supporting the feasibility of treating both ureteral and renal stones concurrently (12).

Importantly, our comparative analysis identified several predictive factors influencing surgical success. Patients in the SFR-negative group had significantly larger renal stones, higher stone burden, and more advanced hydronephrosis. Our findings are consistent with prior studies of stone size and hydronephrosis as major determinants of SFR (13). Increasing stone size has been consistently associated with longer operative times, less effective fragment clearance and making complete stone removal more difficult. Patients with larger renal stones had significantly lower SFR rates, which provides evidence to indicate that stone size remains one of the strongest determinants of endourological success (8).

Some studies have similarly demonstrated the benefits of combining URS and Percutaneous Nephrolithotomy (PCNL) for patients with complex stone burdens. Desai et al. reported that synchronous URS and PCNL reduced overall anesthesia exposure and shortened hospital stay without compromising safety or efficacy (14). Their findings also highlighted that combined treatment is particularly advantageous in patients with high stone burden, in our study, where patients with larger renal stones showed lower SFR, emphasizing the importance of stone size in predicting outcomes. Zeng et al. showed that synchronous intrarenal surgery and ureteroscopy improved operative efficiency in

patients with multiple stones and avoided the need for staged procedures (15). Our findings are consistent with this observation, as 16.5% of patients required additional procedures during follow-up, comparable to the auxiliary rates in combined URS/PCNL series that reported 12–20% secondary intervention rates (16).

Multiple stones increase laser fragmentation time and elevate the risk of residual fragments. Therefore, in patients with multiple stones, the complete removal of stones has decreased, and our findings are agree with previously published studies (17).

Despite the inclusion of patients with high stone burdens, the procedure demonstrated a low perioperative (2.6%) and postoperative complication rate (6.3%). These rates are similar to those found in recent multicenter studies, indicating that performing simultaneous procedures does not increase complication risks when conducted by experienced surgeons (11-12). Additionally, the mean operative time of approximately 50 minutes remained within the acceptable range for combined ureteroscopic and intrarenal procedures.

The primary limitation of this study is its retrospective nature. Another limitation is that the procedures were performed by multiple experienced endourologists. Although this helps maintain consistent and high-quality surgical results, it may limit the generalizability of the findings to centers with less experienced surgeons. Other limitations were the small number of patients and a single center study. Future prospective, multicenter studies with larger cohorts are needed to confirm and expand upon these findings to provide more robust and generalizable evidence

## CONCLUSIONS

Simultaneous treatment of ureteral and ipsilateral renal stones was found to be an effective and safe approach, achieving high SFR with low complication rates. Stone size and number of stones, were the strongest predictors of postoperative success. Although these results support the use of single-session management in appropriately selected patients, larger prospective and multicenter studies are needed to confirm these findings and guide optimal clinical decision-making.

**Funding:** No funding was received for this research.

**Conflicts of Interest:** There are no conflicts of interest to declare.

**Ethical Approval:** The study was conducted by the Helsinki Declaration, and ethical approval was obtained from the İstanbul Medeniyet University Ethics Committee (Approval no.: 2025/0300, Date: 2025-11-11).

## Author's Contributions;

**Study concept and design:** Ilkin Hamid-Zada, Ozgur Arikan

**Data acquisition:** Talha Nuroglu, Elbrus Fehruzlu

**Data analysis:** Ilkin Hamid-Zada, Ozgur Arikan, Ferhat Keser

**Drafting of manuscript:** Ilkin Hamid-Zada, Talha Nuroglu, Elbrus Fehruzlu,

**Critical revision of the manuscript:** Ilkin Hamid-Zada, Ozgur Arikan, Asif Yildirim

## REFERENCES

1. Saeed S, Ullah A, Ahmad J, Hamid S. The prevalence of incidentally detected urolithiasis in subjects undergoing computerized tomography. Cureus. 2020;12(9):e10374. <https://doi.org/10.7759/cureus.10374>
2. Marchini GS, Vicentini FC, Monga M, Torricelli FC, Danilovic A, Brito AH, et al. Irreversible renal function impairment

- due to silent ureteral stones. *Urology*. 2016; 93:33–9. <https://doi.org/10.1016/j.urology.2016.02.042>
3. Selmi V, Sarı S, Çakıcı MÇ, Özdemir H, Kartal İG, Özok HU, et al. Does previous failed shockwave lithotripsy treatment have an influence on retrograde intrarenal surgery outcome? *J Laparoendosc Adv Surg Tech A*. 2019;29(5):627–30. <https://doi.org/10.1089/lap.2018.0487>
  4. Skolarikos, A., Geraghty, R., Somani, B., Tailly, T., Jung, H., Neisius, A., Petřík, A., Kamphuis, G. M., Davis, N., Bezuidenhout, C., Lardas, M., Gambaro, G., Sayer, J. A., Lombardo, R., & Tzelves, L. (2025). European Association of Urology Guidelines on the Diagnosis and Treatment of Urolithiasis. *European urology*, 88(1), 64–75. <https://doi.org/10.1016/j.eururo.2025.03.011>
  5. Ozden E, Mercimek MN, Bostanci Y, Yakupoglu YK, Sirtbas A, Sarikaya S. Long-term outcomes of percutaneous nephrolithotomy in patients with chronic kidney disease: a single-center experience. *Urology*. 2012;79(5):990–4. <https://doi.org/10.1016/j.urology.2011.10.066>
  6. Pan D, Zhang L, Pan J, Yang B, Gao P, Zhang K. A retrospective analysis on the effect of single-channel minimally invasive percutaneous nephrolithotomy combined with retrograde flexible ureteroscopy using the completely lateral decubitus and semi-lithotomy positions to treat complex kidney stones. *Transl Androl Urol*. 2021;10(9):3638–45. <https://doi.org/10.21037/tau-21-635>
  7. Hyams ES, Monga M, Pearle MS, Antonelli JA, Semins MJ, Assimos DG, et al. A prospective, multi-institutional study of flexible ureteroscopy for proximal ureteral stones smaller than 2 cm. *J Urol*. 2015;193(1):165–9. <https://doi.org/10.1016/j.juro.2014.07.002>
  8. Traxer O, Wendt-Nordahl G, Sodha H, Rassweiler J, Meretyk S, Tefekli A, et al. Differences in renal stone treatment and outcomes for patients treated either with or without the support of a ureteral access sheath: the Clinical Research Office of the Endourological Society Uteroscopy Global Study. *World J Urol*. 2015;33(12):2137–44. <https://doi.org/10.1007/s00345-015-1582-8>
  9. Kronenberg P, Somani B. Advances in lasers for the treatment of stones: a systematic review. *Curr Urol Rep*. 2018;19(6):45. <https://doi.org/10.1007/s11934-018-0807-y>
  10. Zeng G, Zhong W, Mazzon G, Choong S, Pearle M, Agrawal M, et al. International Alliance of Urolithiasis (IAU) guideline on percutaneous nephrolithotomy. *Urology Herald*. 2022;10(4):179–200. <https://doi.org/10.21886/2308-6424-2022-10-4-179-200>
  11. Taylor E, Miller J, Chi T, Stoller ML. Complications associated with percutaneous nephrolithotomy. *Transl Androl Urol*. 2012;1(4):223–8. <https://doi.org/10.3978/j.issn.2223-4683.2012.12.01>
  12. Zhu Z, Chi W, Zhang C, Jia W, Sun G. Utilization of flexible ureteroscopy in conjunction with flexible and navigable suction ureteral access sheaths for the management of 1–2 cm complex lower calyceal calculi. *BMC Urol*. 2025;25(1):290. <https://doi.org/10.1186/s12894-025-01987-1>
  13. Resorlu B, Unsal A, Gulec H, Oztuna D. A new scoring system for predicting stone-free rate after retrograde intrarenal surgery: the Resorlu–Unsal stone score. *Urology*. 2012;80(3):512–8. <https://doi.org/10.1016/j.urology.2012.02.072>
  14. Desai M, Grover R, Manohar T, Ganpule A. Simultaneous bilateral percutaneous nephrolithotomy: a single-center experience. *J Endourol*. 2007;21(5):508–14. <https://doi.org/10.1089/end.2006.0401>
  15. Zeng G, Zhu W, Li J, Zhao Z, Zeng T, Liu C, et al. The comparison of minimally invasive percutaneous nephrolithotomy and retrograde intrarenal surgery for stones larger than 2 cm in patients with a solitary kidney: a matched-pair analysis. *World J Urol*. 2015;33(8):1159–64. <https://doi.org/10.1007/s00345-014-1420-4>
  16. Marguet CG, Springhart WP, Tan YH, Patel A, Undre S, Albala DM, et al. Simultaneous combined use of flexible

ureteroscopy and percutaneous nephrolithotomy to reduce the number of access tracts in the management of complex renal calculi. BJU Int. 2005;96(7):1097–100. <https://doi.org/10.1111/j.1464-410X.2005.05808.x>

17. Ghani KR, Wolf JS Jr. What is the stone-free rate following flexible ureteroscopy for kidney stones? Nat Rev Urol. 2015;12(5):281–8. <https://doi.org/10.1038/nrurol.2015.74>