



## Comparison of Percutaneous Nephrolithotomy and Flexible Ureterorenoscopy in the Treatment of Single Upper Ureteral Calculi Measuring 1 to 2 cm

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### Declaration

#### Authors' Contribution

All authors equally contributed to the study and approved the final manuscript

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### ABSTRACT

**Background:** To compare the efficacy and safety of percutaneous nephrolithotomy (PCNL) and flexible ureterorenoscopy (FURS) in the treatment of single upper ureteral calculi measuring 1–2 cm. **Methods:** This randomized controlled trial was conducted at the Department of Urology, Institute of Kidney Diseases, Peshawar, over a period of three months from February 2025 to May 2025. A total of 104 patients meeting the inclusion criteria were enrolled and randomly assigned into two equal groups: Group A underwent PCNL, while Group B underwent FURS. Preoperative evaluation included non-contrast CT scan, serum creatinine, urine culture, and other routine investigations. Stone clearance at 3 months (confirmed by CT scan) was defined as the primary outcome, while secondary outcomes included operative time, intraoperative and postoperative complications. Data were analyzed using SPSS version 26, with  $p < 0.05$  considered statistically significant. **Results:** The mean operative time was significantly shorter in the PCNL group compared to FURS ( $74.2 \pm 12.4$  vs.  $89.6 \pm 14.1$  minutes,  $p < 0.001$ ). The stone-free rate was markedly higher in the PCNL group (90.4%) compared to the FURS group (67.3%,  $p = 0.004$ ). Overall complication rates were similar between groups (28.8% vs. 23.1%,  $p = 0.52$ ), with fever, hematuria, and urinary tract infection being the most frequent events. Stratified analysis showed consistently superior clearance with PCNL across subgroups defined by age, gender, BMI, and urine culture status. **Conclusion:** PCNL provides superior stone clearance and shorter operative times compared to FURS in patients with single upper ureteral stones measuring 1–2 cm, while both procedures are safe and associated with acceptable complication rates. PCNL should be considered the preferred approach in this clinical scenario, whereas FURS remains a reasonable alternative for selected patients.

### INTRODUCTION

Urolithiasis continues to be one of the most common urological disorders worldwide, with ureteral stones accounting for a significant proportion of cases. The clinical burden of upper ureteral calculi is substantial, as untreated stones can result in persistent pain, urinary tract infections, hydronephrosis, and eventual loss of renal function (1). Stones measuring 1–2 cm represent a particularly challenging subset, since they are often too large for spontaneous passage yet small enough to be treated by multiple minimally invasive modalities (2, 3).

Several surgical approaches are available for managing upper ureteral stones. Percutaneous nephrolithotomy (PCNL) is traditionally preferred for larger and complex stones due to its superior stone clearance rates (4, 5). However, PCNL is invasive, requiring percutaneous renal access and postoperative nephrostomy drainage, which can be associated with

morbidity. On the other hand, flexible ureterorenoscopy (FURS) has gained popularity in recent years with advancements in flexible endoscopes, improved deflection mechanisms, and Holmium:YAG laser technology. FURS allows retrograde access to the ureter and renal pelvis, enabling stone fragmentation with minimal incisions, shorter recovery times, and reduced hospital stay (6, 7).

Despite these advantages, studies have reported conflicting evidence regarding the comparative outcomes of PCNL and FURS in stones measuring 1–2 cm. Some analyses favor PCNL for higher stone-free rates, while others suggest that FURS offers comparable efficacy with reduced invasiveness. For example, He et al. (2024) reported a significant advantage of PCNL in stone clearance (8), while Kang et al. (2020) demonstrated consistent superiority of PCNL in systematic reviews and network meta-analyses (9). Conversely, FURS has been shown to be safer in terms of postoperative recovery in selected patients (10).

Given this ongoing debate, there is a need for well-designed comparative trials that address both efficacy and safety outcomes in this patient population. The present study was therefore designed to compare the stone clearance rates, operative times, and complication profiles of PCNL and FURS in the management of single upper ureteral calculi measuring 1–2 cm, with the aim of guiding evidence-based clinical decision-making in urological practice.

## METHODOLOGY

This randomized controlled trial was conducted in the Department of Urology at the Institute of Kidney Diseases, Peshawar, after obtaining ethical clearance from the Institutional Review Committee. The study duration was three months from February 2025 to May 2025 following official approval of the synopsis by the College of Physicians and Surgeons Pakistan (CPSP). The study protocol was reviewed and approved by the Institutional Research and Ethical Committee of the Institute of Kidney Diseases, Hayatabad Medical Complex, Peshawar.

(Ref No: 504/Chairman/R&E/Committee/IKD, dated 28/11/2024). The committee verified the relevance of the methodology and confirmed that the informed consent form was attached and validated. It was also confirmed that the research conformed to the principles of the Declaration of Helsinki. The ethical board declared that the study fulfilled all parameters of biomedical ethics and raised no objection to its initiation and later publication.

Written informed consent was obtained from all participants after explaining the purpose, procedure, risks, and benefits of the study in their preferred language (Urdu, Pashto, or English). Participants were assured of confidentiality and informed that their decision to participate or withdraw would not affect their standard medical care.

The study was designed to compare the outcomes of PCNL and URS in the treatment of single upper ureteral calculi measuring 1–2 cm. A total of 104 patients were included in the trial, with 52 patients randomly assigned to each treatment group.

The sample size was calculated using the WHO sample size calculator, considering stone clearance rates of 90.4% for PCNL and 68% for FURS as reported in earlier studies. With an 80% power of the test and a 95% confidence interval, the minimum required sample size was 104 participants, equally divided across the two study groups.

Patients were selected using consecutive non-probability sampling. Eligible patients presenting to the outpatient or inpatient urology services were assessed against inclusion and exclusion criteria.

### Inclusion Criteria

- Adults above 18 years of age
- Both male and female patients
- Patients with a single upper ureteral stone measuring between 1–2 cm, confirmed on non-contrast CT scan and fulfilling the operational definition

### Exclusion Criteria

- Patients with a solitary kidney or congenital renal anomalies
- Severe comorbidities or coagulation disorders contraindicating surgery
- Patients with ureteropelvic junction obstruction
- Prior ipsilateral renal or ureteral surgery
- Bilateral ureteral stones or associated renal calculi

Block randomization was applied to allocate patients into two groups of equal size. Group A underwent PCNL, while Group B underwent FURS. Randomization ensured comparability between groups and minimized selection bias.

All patients underwent a standardized preoperative evaluation including:

- Non-contrast CT scan for confirmation of stone size and location
- Serum creatinine levels to assess renal function
- Urine culture and sensitivity testing to identify infection risk
- Routine hematological investigations Prophylactic antibiotics were prescribed according to urine culture results. In complicated cases assigned to FURS, a passive ureteral stent was placed two weeks before the definitive procedure to facilitate dilation.

### Group A (PCNL)

Procedures were performed under general anesthesia. Patients were placed in the lithotomy position followed by prone positioning. After ureteric catheter insertion, renal access was obtained under ultrasound guidance. Stone fragmentation was achieved using a Holmium laser. A nephrostomy tube was placed postoperatively, and stents were removed within 2–4 weeks.

### Group B (FURS)

Under anesthesia, a flexible ureteroscope was advanced through the urinary tract. Laser lithotripsy was performed to fragment the stones, and a double-J stent was inserted at the end of the procedure.

The primary outcome was stone clearance rate, defined as the absence of stones or significant fragments on a CT scan performed three months after surgery. Secondary outcomes included operative time, intraoperative complications, postoperative complications (fever, hematuria, urinary tract infection), and overall hospital stay.

All patient information was recorded on a predesigned proforma, which included demographic variables (age, sex, BMI, residence, socioeconomic status), clinical findings, operative details, and postoperative outcomes. Each procedure was performed under the supervision of a consultant urologist monitored by a senior consultant possessing more than five years of post-fellowship expertise.

Data were analyzed using SPSS version 26. Quantitative variables such as age, BMI, and operative duration were 'expressed as mean  $\pm$  standard deviation or median (IQR)' depending on distribution. Normality of continuous data was assessed using the Shapiro–Wilk test.

Categorical variables such as gender, stone clearance, and complications were presented as frequencies and percentages. The Chi-square test or Fisher's exact test was applied to compare categorical variables between groups, while independent t-test or Mann-Whitney U test was used for continuous data. A p-value of <0.05 was considered statistically significant. Effect modifiers including age, BMI, gender, urine culture, and residence were controlled by stratification, followed by post-stratification statistical testing.

## RESULTS

The study included 104 patients, equally divided into PCNL and FURS groups. On average, patients were aged comparable across the two study groups ( $41.6 \pm 11.2$  years vs.  $40.3 \pm 10.8$  'years,  $p=0.54$ ') Males were more common in both groups, though the gender distribution did not differ significantly ( $p=0.68$ ). Residence (rural vs. urban) and socioeconomic status also showed no significant variation across the two study groups ( $p=0.72$  and  $p=0.89$ , respectively). Mean BMI remained slightly higher in the PCNL group but without statistical significance ( $p=0.47$ ). Overall, baseline demographic and clinical characteristics were evenly matched, ensuring comparability across the two study groups.

**Table 1**  
Demographic Characteristics of the Study Population (n = 104)

Variable	PCNL 'Group (n=52)'	FURS 'Group (n=52)'	p-value
Mean Age (years $\pm$ SD)	41.6 $\pm$ 11.2	40.3 $\pm$ 10.8	0.54
Gender (Male/Female)	33 / 19	31 / 21	0.68
Residence (Rural/Urban)	29 / 23	27 / 25	0.72
Socioeconomic status			
• Low	21 (40.4%)	20 (38.5%)	
• Middle	20 (38.5%)	22 (42.3%)	0.89
• High	11 (21.1%)	10 (19.2%)	
Mean BMI (kg/m <sup>2</sup> $\pm$ SD)	25.3 $\pm$ 3.1	24.9 $\pm$ 3.4	0.47

The mean duration of surgery differed significantly between the groups. Patients undergoing PCNL had a shorter operative time ( $74.2 \pm 12.4$  minutes) compared to those in the FURS group ( $89.6 \pm 14.1$  minutes), and this difference was highly significant ( $p<0.001$ ). Intraoperative complications occurred in 7 patients in the PCNL group and 5 in the FURS group, but this difference was not statistically significant ( $p=0.54$ ). These findings suggest that PCNL is a quicker procedure, while both techniques have a comparable intraoperative safety profile.

**Table 2**  
Operative Parameters

Variable	PCNL 'Group (n=52)'	FURS 'Group (n=52)'	p-value
Mean duration of surgery (minutes $\pm$ SD)	74.2 $\pm$ 12.4	89.6 $\pm$ 14.1	<0.001
Intraoperative complications (Yes/No)	7 / 45	5 / 47	0.54

At 3 months follow-up, stone clearance was significantly higher in the PCNL group compared to the FURS group. A stone-free status was achieved in 90.4% of PCNL patients versus 67.3% of FURS patients ( $p=0.004$ ). Residual stones were observed in 9.6% of PCNL patients and 32.7% of FURS patients. This indicates that PCNL offers superior stone clearance rates for upper ureteral calculi measuring 1–2 cm.

**Table 3**  
Primary Outcome – Stone Clearance Rate

Outcome (3 months CT scan)	PCNL 'Group (n=52)'	FURS 'Group (n=52)'	p-value
Stone-free (Yes)	47 (90.4%)	35 (67.3%)	0.004
Residual stones (No)	5 (9.6%)	17 (32.7%)	

The overall postoperative complication rate was slightly higher in the PCNL group (28.8%) compared to the FURS group (23.1%), but this difference was not statistically significant ( $p=0.52$ ). Fever, hematuria, and urinary tract infections were the most common complications in both groups. While PCNL tended to have a higher rate of hematuria, FURS had slightly more cases of urinary tract infection. However, none of these individual complications showed a significant difference (all  $p>0.05$ ), highlighting that both procedures are relatively safe with manageable risks.

**Table 4**  
Postoperative Complications

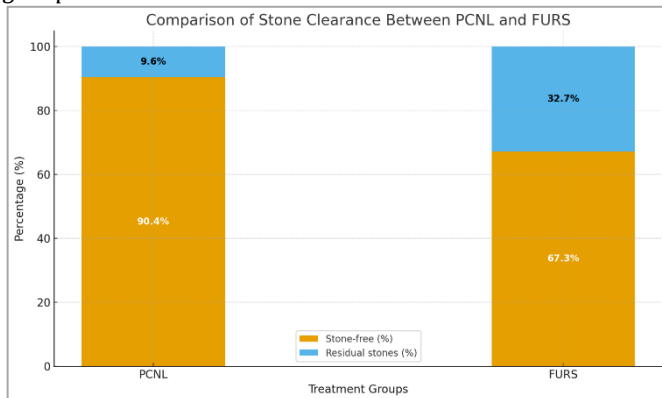
Complication	PCNL 'Group (n=52)'	FURS 'Group (n=52)'	p-value
Fever	6 (11.5%)	4 (7.7%)	0.52
Hematuria	5 (9.6%)	3 (5.8%)	0.46
Urinary Tract Infection	4 (7.7%)	5 (9.6%)	0.73
Overall complication rate	15 (28.8%)	12 (23.1%)	0.52

When stratified by age, gender, BMI, and urine culture status, the advantage of PCNL over FURS remained consistent across all subgroups. Patients below and above 40 years, males and females, as well as those with normal or high BMI, all demonstrated significantly higher stone clearance with PCNL. Similarly, patients with both positive and negative urine cultures benefited more from PCNL, with statistically significant differences in each subgroup (all  $p<0.05$ ). This robust superiority across subgroups strengthens the evidence for PCNL as a more effective treatment option for stones of 1–2 cm.

**Table 5**  
Stratified Analysis of Stone Clearance by Effect Modifiers

Effect Modifier	PCNL Clearance Rate	FURS Clearance Rate	p-value
Age <40 years	92.3%	70.0%	0.01
Age $\geq$ 40 years	88.9%	64.7%	0.02
Male	90.9%	68.0%	0.01
Female	89.5%	66.7%	0.02
BMI <25	91.7%	69.2%	0.01
BMI $\geq$ 25	88.0%	65.0%	0.02
Positive urine culture	85.7%	62.5%	0.03
Negative urine culture	91.9%	70.0%	0.01

**Figure 1**  
Stone clearance and residual stone rates in PCNL and FURS groups.



## DISCUSSION

This randomized controlled trial compared the outcomes of PCNL and FURS in the management of 'single upper ureteral stones measuring 1–2 cm'. The main findings were that PCNL achieved significantly higher stone clearance rates than FURS, while both procedures had comparable complication profiles. These results provide important insights for urologists selecting the most effective and safe intervention for patients with upper ureteral calculi.

In this study, the stone-free rate at 3 months was 90.4% in the PCNL group compared to 67.3% in the FURS group ( $p=0.004$ ). This was consistent with the study reported superior clearance with PCNL (90.4%) compared to FURS (68%) in patients with upper ureteral stones measuring 1–2 cm (11). Similarly, studies showed that PCNL, including mini-PCNL variants, had significantly higher stone-free rates than FURS and extracorporeal shockwave lithotripsy (ESWL), reinforcing PCNL's advantage in achieving complete clearance (12, 13).

Our results also align with the European Association of Urology (EAU) guidelines, which recommend PCNL as the preferred option for stones larger than 2 cm but recognize its utility in selected cases with smaller yet complex stones (14). Even though FURS has advanced with improvements in flexible scopes and Holmium laser lithotripsy, the limitations of stone migration, access difficulties, and longer operative times often reduce its clearance rates (15). This was also evident in our trial, where mean operative time was significantly shorter for

PCNL (74 minutes) compared to FURS (90 minutes), supporting previous findings by Chen et al., 2024 (16).

Complications in our study were comparable across the two study groups. The PCNL group showed slightly more hematuria, while FURS had a marginally higher incidence of urinary tract infection. However, these differences were statistically insignificant, consistent with findings by study comparing PCNL, retrograde intrarenal surgery (RIRS), and ESWL (17). Importantly, both PCNL and FURS were found to be safe with acceptable complication rates, echoing the conclusions of Rao et al. (2020), who noted that while PCNL carries slightly higher risks of bleeding, overall morbidity remains low (18).

Stratified analysis in our trial demonstrated that the superior efficacy of PCNL persisted across subgroups, including age, gender, BMI, and infection status. This robustness of PCNL is also supported by studies highlighted that the benefits of PCNL over minimally invasive alternatives were consistent across patient populations. Nonetheless, it is worth noting that FURS may still be preferable in patients where reduced invasiveness is prioritized, especially those at higher risk of bleeding or prolonged recovery (19, 20).

Overall, our findings suggest that while both procedures are effective and safe, PCNL provides superior stone clearance and shorter operative times, making it a more reliable option for single upper ureteral stones measuring 1–2 cm. However, FURS remains a valid alternative in carefully selected patients, particularly those seeking shorter hospital stays or when PCNL expertise and equipment are unavailable.

## CONCLUSION

This randomized controlled trial demonstrated that percutaneous nephrolithotomy (PCNL) achieved significantly higher stone clearance rates compared to flexible ureterorenoscopy (FURS) in the treatment of single upper ureteral calculi measuring 1–2 cm. Although operative time was shorter with PCNL, complication rates were similar between the two techniques. These findings support PCNL as the more effective choice for ensuring complete stone clearance in this patient population, while FURS remains a safe and less invasive option for selected cases. Future multicenter studies with longer follow-up are recommended to further evaluate recurrence rates, quality of life outcomes, and cost-effectiveness of both procedures.

## REFERENCES

- Li, Z., Zhang, H. R., Chen, W. D., Luo, H., Xu, W. J., Gao, Q. G., ... & Lei, M. H. (2023). Comparison of efficacy and safety of flexible ureteroscopy and mini-percutaneous nephrolithotomy for 2-3 cm renal calculi in women: a single-center study. *European Review for Medical & Pharmacological Sciences*, 27(22). <https://www.europeanreview.org/wp/wp-content/uploads/11115-11121.pdf>
- Xuan, H., Du, Z., Xia, L., Cao, Y., Chen, Q., & Xue, W. (2022). Comparison of outcomes between flexible ureteroscopy and mini-percutaneous nephrolithotomy in the management of upper calyceal calculi larger than 2 CM. *BMC Urology*, 22(1). <https://doi.org/10.1186/s12894-022-01142-0>
- Lv, G., Wang, K., Zhang, Z., Zhou, C., Li, Y., & Zhang, D. (2022). Comparison of flexible ureteroscopy and mini-percutaneous nephrolithotomy in the treatment for renal calculi larger than 2 CM: A matched-pair analysis. *Urolithiasis*, 50(4), 501-507. <https://doi.org/10.1007/s00240-022-01336-z>
- Guo, Y., Yang, L., Xu, X., & Li, C. (2022). Clinical comparative study of standard channel percutaneous nephroscope combined with flexible ureteroscope and traditional standard channel combined with microchannel percutaneous nephrolithotomy in the treatment of multiple renal calculi without hydrone. *Pakistan Journal of Medical Sciences*, 38(7). <https://doi.org/10.12669/pjms.38.7.5526>

5. Lv, G., Zhang, Z., Du, F., Qi, W., Zhong, M., Zhou, Y., Zhou, C., Li, Y., & Zhang, D. (2022). Comparison of flexible ureteroscopy and mini-percutaneous nephrolithotomy in the treatment for multiple nephrolithiasis. *Frontiers in Surgery*, 9. <https://doi.org/10.3389/fsurg.2022.1004432>
6. Jia, H., Li, J., Liu, B., Zhang, P., Yusufu, A., Nan, Y., Li, X., Wen, B., Pu, C., Du, W., & Wang, S. (2020). Comparison of super-mini-PCNL and flexible ureteroscopy for the management of upper urinary tract calculus (1–2 CM) in children. *World Journal of Urology*, 39(1), 195-200. <https://doi.org/10.1007/s00345-020-03150-x>
7. Meng, C., Peng, L., Li, J., Li, Y., Li, J., & Wu, J. (2021). Comparison between single-use flexible Ureteroscope and reusable flexible Ureteroscope for upper urinary calculi: A systematic review and meta-analysis. *Frontiers in Surgery*, 8. <https://doi.org/10.3389/fsurg.2021.691170>
8. He, Q., Wei, X., Wu, E., Luo, R., Yu, L., & Liang, W. (2024). Comparison of percutaneous nephrolithotomy and flexible ureterorenoscopy in the treatment of single upper ureteral calculi measuring 1 to 2 centimeters: A retrospective study. *BMC Urology*, 24(1). <https://doi.org/10.1186/s12894-024-01408-9>
9. Kang, D. H., Cho, K. S., Chung, D. Y., Jeong, W. S., Jung, H. D., Kim, D. K., & Lee, J. Y. (2020). Comparison of the stone-free rates of mini-percutaneous nephrolithotomy, standard percutaneous nephrolithotomy, and retrograde intrarenal surgery for renal stones: A systematic review and network meta-analysis. <https://doi.org/10.21203/rs.3.rs-16120/v1>
10. Cosmin, C., Georgescu, D. A., Geavlete, P., Popescu, R., & Geavlete, B. (2023). Comparison between retrograde flexible Ureteroscopy and percutaneous Nephrolithotomy for the treatment of renal stones of 2–4 CM. *Medicina*, 59(1), 124. <https://doi.org/10.3390/medicina59010124>
11. Zhang, Y., Li, J., Jiao, J. W., & Tian, Y. (2021). Comparative outcomes of flexible ureteroscopy and mini-percutaneous nephrolithotomy for pediatric kidney stones larger than 2 CM. *International Journal of Urology*, 28(6), 650-655. <https://doi.org/10.1111/iju.14532>
12. Lv, G., Zhou, Y., Qi, W., Zhong, M., Li, R., & Zhu, Y. (2023). Comparison of flexible ureteroscopy in the treatment of 1–2 cm single nephrolithiasis and multiple nephrolithiasis. *Frontiers in Surgery*, 10. <https://doi.org/10.3389/fsurg.2023.1114206>
13. Doizi, S., Uzan, A., Keller, E. X., De Coninck, V., Kamkoum, H., Barghouthy, Y., Ventimiglia, E., & Traxer, O. (2020). Comparison of intrapelvic pressures during flexible ureteroscopy, mini-percutaneous nephrolithotomy, standard percutaneous nephrolithotomy, and endoscopic combined intrarenal surgery in a kidney model. *World Journal of Urology*, 39(7), 2709-2717. <https://doi.org/10.1007/s00345-020-03450-2>
14. Huang, X., Zhong, L., Huang, Z., & Lai, H. (2024). A retrospective comparison of sun's tip-flexible semirigid ureterorenoscopy, super-mini percutaneous nephrolithotomy and flexible ureteroscopy applied to treat upper urinary tract calculi. *BMC Urology*, 24(1). <https://doi.org/10.1186/s12894-024-01412-z>
15. Fankhauser, C. D., Weber, D., Müntener, M., Poyet, C., Sulser, T., & Hermanns, T. (2021). Effectiveness of flexible Ureterorenoscopy versus extracorporeal shock wave lithotripsy for renal calculi of 5–15 mm: Results of a randomized controlled trial. *European Urology Open Science*, 25, 5-10. <https://doi.org/10.1016/j.euros.2021.01.001>
16. Chen, Y., Xi, H., Yu, Y., Cheng, X., Yang, H., Deng, W., Liu, W., Wang, G., & Zhou, X. (2023). Flexible ureteroscopy with novel flexible ureteral access sheath versus mini-percutaneous nephrolithotomy for treatment of 2–3 cm renal stones. *International Journal of Urology*, 31(3), 281-286. <https://doi.org/10.1111/iju.15347>
17. Wang, Q., Liu, J., Cao, J., & Ding, J. (2024). Clinical efficacy and safety of flexible ureteroscopy and percutaneous nephrolithotomy for large kidney stones: A retrospective comparative study. *World Journal of Clinical Cases*, 12(21), 4483-4490. <https://doi.org/10.12998/wjcc.v12.i21.4483>
18. Rao, P., Li, J., Shen, S., & Zhao, H. (2020). A research on flexible ureteroscope lithotripsy versus percutaneous nephrolithotomy for upper urinary tract calculi. *Int J Clin Exp Med*, 13(2), 1115-1122. <https://e-century.us/files/ijcem/13/2/ijcem0104169.pdf>
19. Chen, Y., Wen, Y., Yu, Q., Duan, X., Wu, W., & Zeng, G. (2020). Percutaneous nephrolithotomy versus flexible ureteroscopic lithotripsy in the treatment of upper urinary tract stones: A meta-analysis comparing clinical efficacy and safety. *BMC Urology*, 20(1). <https://doi.org/10.1186/s12894-020-00677-4>
20. Wang, J., Wang, Y., Yin, J., & Xia, L. (2024). Efficacy of flexible Ureteroscopy lithotripsy and percutaneous Nephrolithotomy in the treatment of patients with kidney stones and their impact on inflammatory response and renal function. *Annali Italiani di Chirurgia*, 95(2), 220-226. <https://doi.org/10.62713/aic.3175>