E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.31838/ijprt/15.02.44

Research Article

A Forward-Looking Study on the correlates of Postoperative Pain after Retrograde Intrarenal Surgery with FANS for Kidney Stones

Dr. Kaustubh Gupta[1], Dr. Akash Verma[2], Dr. Nishant Ranjan[3], Dr. Nikhil Kumar Gupta[4*]
[1]Assistant Professor, GMC Kannauj.
[2]Assistant Professor, GMC Kannauj.
[3]Assistant Professor, GMC Kannauj.
[4*]Assistant Professor, GMC Kannauj.
*__Corresponding Author__-Dr. Nikhil Kumar Gupta
Received: 09.05.25, Revised: 12.06.25, Accepted: 14.07.25

ABSTRACT
Background: Retrograde Intrarenal Surgery with FANS (flexible and navigable suction ureteric access sheath) is increasingly favored for treating renal calculi due to its minimally invasive nature and high stone-free rates. Despite reduced morbidity compared to traditional methods, postoperative pain remains a challenge. This prospective study aimed to evaluate patient-related, stone-related, and operation-related factors that predict severe postoperative pain following RIRS with FANS.
Methods: A total of 97 patients (aged 18–65) with radiologically confirmed renal stones underwent RIRS at our center between March 2021 and September 2022. Preoperative data included demographics, stone characteristics (number, size, location, density), hydronephrosis, and stent status. All procedures utilized a 7.5 Fr flexible digital ureteroscope, Holmium:YAG laser lithotripsy and 10/12 fr flexible and navigable suction ureteric access sheath . Postoperative pain was assessed via the Visual Analogue Scale (VAS) at 6, 12, and 24 hours. Patients requiring additional analgesia with VAS ≥7 were categorized as having severe pain (Group II), whereas those with VAS <7 were grouped as mild pain (Group I). Associations between potential predictors and pain scores were analyzed using SPSS version 25 ($p<0.05$ was considered significant).
Results: Among the 97 participants, 84.5% had VAS <7 (Group I) and 15.5% reported VAS ≥7 (Group II). No significant differences were noted in age, gender, stone location, stone size, or preoperative hydronephrosis between the groups ($p>0.05$). Two operation-related factors emerged as significant: smaller-diameter ureteral access sheaths ($p=0.027$) and prolonged sheath indwelling time exceeding 60 minutes ($p=0.043$) correlated with higher postoperative pain.
Conclusion: Technical factors—namely ureteral access sheath size and sheath indwelling time—were key predictors of postoperative pain following RIRS with FANS. Identifying high-risk patients preoperatively may guide refined surgical approaches and more targeted analgesic protocols, ultimately improving patient comfort and overall satisfaction.

Keywords: Retrograde Intrarenal Surgery, Flexible and Navigable Suction Ureteric Access Sheath, Kidney Stones, Postoperative Pain, Sheath Indwelling Time.

INTRODUCTION

Retrograde Intrarenal Surgery (RIRS) with FANS has gained growing acceptance as a first-line treatment for renal stones, offering reduced morbidity compared to open and percutaneous surgeries [1,2]. Despite these advantages, postoperative pain remains an important clinical concern that can impair patient comfort, prolong hospital stays, and reduce satisfaction [3]. The etiology of this pain is multifactorial, involving patient characteristics, stone factors, and surgical techniques [4,5].

Some evidence suggests that demographics—such as female gender or younger age—may influence pain thresholds and the perception of pain [6]. Stone-related parameters like stone size, number, and location have also been

traditionally implicated in increasing operative complexity, potentially leading to increased postoperative discomfort [7]. Nonetheless, the extent to which these stone characteristics directly affect pain in RIRS with FANS patients has not been conclusively determined.

Beyond patient and stone factors, the role of surgical and device-related elements is receiving heightened attention. The introduction of a flexible and navigable suction ureteric access sheath has enabled enhanced visualization and scope protection during flexible ureteroscopy. However, variations in sheath diameter and its indwelling duration might contribute to localized irritation of the ureter, leading to inflammatory responses that increase postoperative pain [8]. Prolonged procedure times and repeated ureteral manipulation can exacerbate tissue injury, further contributing to postoperative discomfort.

Although large-scale studies have examined the success rates and complication profiles of RIRS with FANS, relatively few have focused explicitly on correlating specific preoperative or intraoperative variables with postoperative pain severity. Establishing which factors are most predictive of severe pain is essential for guiding operative decisions—such as sheath selection and limiting the duration of its use—and for optimizing pain management strategies. These refinements could ultimately enhance patient recovery and minimize analgesic requirements.

Against this backdrop, the present prospective study was undertaken to identify and evaluate the factors associated with significant postoperative pain (VAS ≥7) in patients undergoing RIRS with FANS at our institution. By simultaneously examining patient-, stone-, and operation-related parameters, our objective was to furnish urologists with a comprehensive understanding of risk factors for postoperative discomfort, thereby paving the way for tailored interventions and improved patient outcomes.

MATERIALS AND METHODS

Study Design and Setting

A single-center, prospective study was conducted in the Department of Urology at Fortis Hospital, Mohali, Punjab. Ninety-seven adult patients (aged 18–65) diagnosed radiologically with renal stones and scheduled for RIRS with FANS between March 2021 and September 2022 were enrolled.

Ethical Considerations

Ethical approval was granted by the Institutional Ethical Committee. Written informed consent was obtained from every participant. Study objectives and procedures were explained, and participation was entirely voluntary.

Inclusion and Exclusion Criteria

- **Inclusion Criteria**
  1. Patients aged 18–65, with radiologically confirmed renal stones.
  2. Patients undergoing Retrograde Intrarenal Surgery (RIRS) with Flexible and navigable suction ureteric access sheath.
  3. Willingness to participate in the study.
- **Exclusion Criteria**
  1. Diabetes or diabetic nephropathy.
  2. RIRS performed without a ureteral access sheath.
  3. Concomitant ureteric stones managed endoscopically in the same session.
  4. Current use of medications affecting pain perception.
  5. Active urinary tract infection.

Preoperative Evaluation

All participants underwent a thorough assessment, including Non-Contrast Computed Tomography (NCCT) of the Kidney, Ureter, and Bladder (KUB) region to characterize stone size, location, and density. Demographic data (age, gender) and clinical information (preoperative hydronephrosis, presence of a double-J [DJ] stent, and renal anomalies) were also recorded.

Surgical Technique

Patients received general anesthesia before RIRS with a 7.5 Fr (INDOSCOPE SLEEK, Bioredmedisys, length 670 mm) flexible digital disposable ureteroscope. A Holmium:YAG laser was employed for stone fragmentation. Flexible and navigable suction ureteric access sheath of

varying diameters (10–12 Fr) and lengths (35–45 cm) was routinely used to facilitate scope passage and reduce intrarenal pressure.

Following stone disintegration, a DJ stent (6 Fr, 26 cm) was placed in each patient, with proper positioning confirmed on fluoroscopy. A Foley catheter was placed overnight, and anticholinergic medications were administered to minimize stent- and catheter-related discomfort. Analgesia, predominantly paracetamol, was managed intraoperatively by the anesthesiology team.

Pain Assessment

Postoperative pain was recorded at 6, 12, and 24 hours post-surgery using a 10-cm Visual Analogue Scale (VAS). Patients reporting severe flank pain (VAS ≥7) that required additional analgesics were assigned to Group II, while those with VAS <7 were designated as Group I. Pain arising from other etiologies (e.g., suprapubic pain, dysuria) was not included in the evaluation of flank pain severity.

Follow-up

At 21 days postoperatively, imaging (X-ray KUB, ultrasonography) was performed to assess stone clearance. For radiolucent stones or unclear findings, low-dose CT scans were utilized to minimize radiation exposure. Successful clearance was defined as the absence of stones or residual fragments ≤3 mm.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 25.0 (IBM Corp., Armonk, NY). Categorical variables were presented as frequencies and percentages. Chi-square or Fisher's exact tests were used to identify associations between potential predictors and VAS scores. A p-value <0.05 was deemed statistically significant.

RESULTS

Overview of Study Participants

Ninety-seven patients participated and were grouped according to postoperative VAS scores:

- **Group I (VAS <7):** 82 patients (84.5%)
- **Group II (VAS ≥7):** 15 patients (15.5%)

The primary objective was to identify the demographic, stone-related, and operation-related factors that correlated with severe postoperative pain.

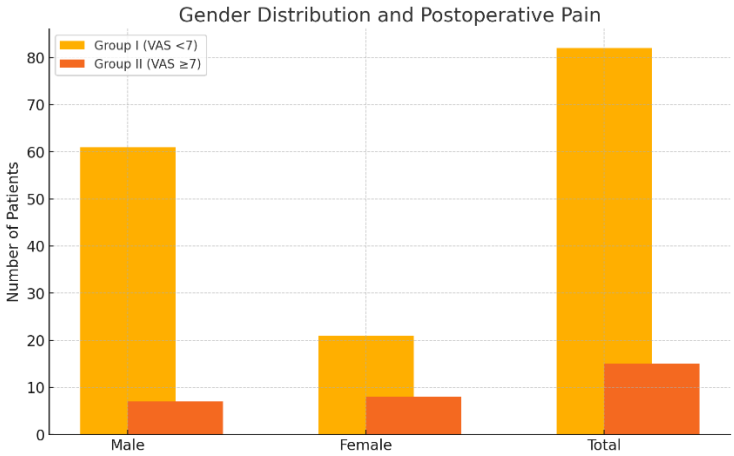
Key Observations in Pain Distribution

- **Demographic Factors and Stone Characteristics**
  Age, gender, number of stones (single vs. multiple), and stone location (upper/middle pole, pelvis, or lower pole) did not significantly differ between Groups I and II ($p>0.05$). Stone size (<10 mm vs. ≥10 mm) and density also failed to demonstrate a statistically significant association with higher pain scores.
- **Influence of Preoperative Conditions**
  Preoperative hydronephrosis, renal anomalies, and anticoagulant therapy showed no significant impact on postoperative pain levels. Similarly, neither preoperative DJ stenting nor minor perioperative complications (e.g., slight bleeding, transient fever) correlated significantly with a VAS ≥7.
- **Operation-Related Predictors**
  Two main factors exhibited significant associations with elevated VAS score.

1. **Flexible and navigable suction ureteric access sheath Size (p=0.027)**
   A smaller-diameter ureteral access sheath (10 Fr) was used more frequently in Group II, suggesting that narrower sheaths might lead to increased ureteral manipulation or higher intrarenal pressure, thereby exacerbating postoperative discomfort.
2. **Sheath Indwelling Time (p=0.043)**
   Extended sheath indwelling (>60 minutes) was significantly correlated with severe pain. Thirty-three percent of patients in Group II exceeded 60 minutes, compared to only 9.8% in Group I.

Table 1. Gender Distribution and Postoperative Pain

Gender	Group I (VAS <7), n (%)	Group II (VAS ≥7), n (%)	Total, n (%)	p-value
Male	61 (74.4)	7 (46.7)	68 (70.1)	0.124
Female	21 (25.6)	8 (53.3)	29 (29.9)	
Total	82 (100.0)	15 (100.0)	97 (100.0)	

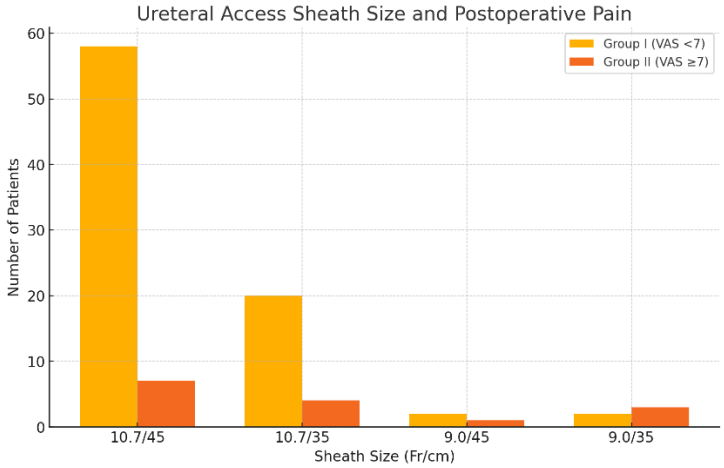


This bar chart shows the distribution of patients by gender across the two groups with different pain levels.

Table 2. Flexible and Navigable Suction Ureteric Access Sheath Size

Sheath Size (Fr/cm)	Group I (VAS <7), n (%)	Group II (VAS ≥7), n (%)	p-value
10/45	58 (70.7)	7 (46.7)	0.027*
10/35	20 (24.4)	4 (26.7)	
12/45	2 (2.4)	1 (6.7)	
12/35	2 (2.4)	3 (20.0)	

*Statistically significant



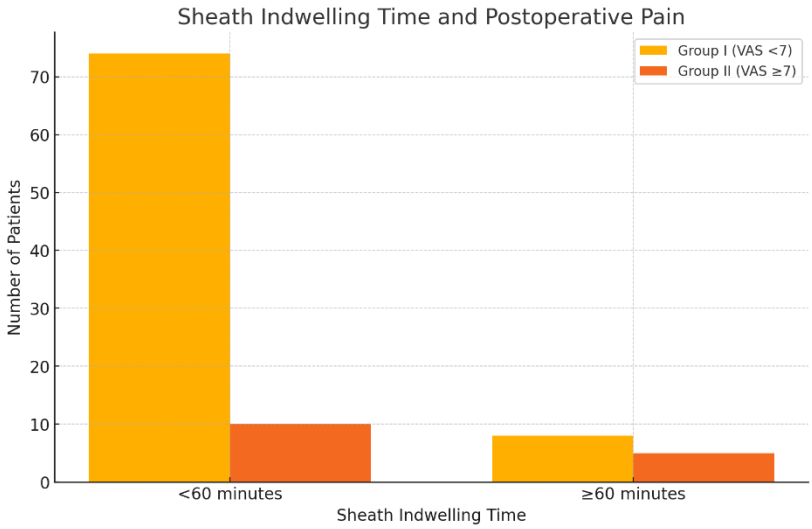
This bar chart compares the sheath sizes used across the two groups, highlighting differences in preferences that correlate with pain levels.

Table 3. Sheath Indwelling Time

Sheath Time	Group I (VAS <7), n (%)	Group II (VAS ≥7), n (%)	p-value
<60 minutes	74 (90.2)	10 (66.7)	0.043*

≥60 minutes	8 (9.8)	5 (33.3)	

*Statistically significant



The final chart shows the duration of sheath indwelling and its association with pain levels across the groups.

DISCUSSION

This prospective study demonstrates that although multiple patient- and stone-related variables have been posited to influence postoperative pain following RIRS with FANS, specific technical factors—particularly smaller-diameter access sheaths and prolonged sheath indwelling time—play a decisive role in exacerbating discomfort [9,10]. Modern urological practice recognizes that excessive ureteral manipulation or high intrarenal pressure due to narrow sheath diameter can provoke tissue trauma and inflammatory changes, thereby increasing postoperative pain [11,12].

Our findings on stone size, location, and number align with recent observations suggesting that improvements in endoscopic instrumentation and laser technology mitigate the impact of stone characteristics on patient discomfort [13]. For instance, high-powered Holmium:YAG lasers can fragment stones quickly and efficiently, potentially limiting the operative duration and reducing the cumulative trauma inflicted on the ureter [14]. Therefore, stone-related variables may have a limited influence on postoperative pain when contemporary surgical protocols are carefully followed.

Prolonged sheath indwelling time emerged as another key determinant of pain. An extended dwell time can irritate the ureteral lining and generate mucosal edema, increasing the likelihood of flank pain in the postoperative period [15]. Surgeons can consider optimizing technique—limiting scope exchange and fragmentation time—to reduce how long the sheath remains in situ. Similarly, preoperative hydration or appropriate stenting protocols might lessen ureteral irritation, though the present study did not find a statistically significant effect of preoperative DJ stenting on pain.

Furthermore, neither preoperative hydronephrosis nor minor procedural complications (e.g., slight bleeding, transient fever) had a significant association with severe postoperative pain. This underscores that patient-focused measures such as controlling infection risk, managing comorbidities, and providing balanced analgesia all contribute to relatively uniform postoperative outcomes, irrespective of small differences in clinical presentation [16,17].

Given these findings, clinicians should pay close attention to operative details, emphasizing the selection of an appropriate sheath size and minimizing ureteral manipulation time.

Targeted analgesic regimens may benefit patients identified preoperatively as high-risk for greater pain—particularly those requiring narrower sheaths or lengthier procedures. Future large-scale or multicenter studies are encouraged to confirm these results and to assess whether novel devices, modified anesthesia protocols, or advanced imaging techniques might further reduce the incidence of severe postoperative pain.

CONCLUSION

In conclusion, this prospective study highlights the importance of technical factors—especially smaller-diameter ureteral access sheaths and prolonged sheath indwelling time—in predicting severe postoperative pain following RIRS with FANS. Traditional patient- and stone-related factors, including stone size, number, or location, did not show a strong correlation with elevated pain scores. Surgeons should therefore focus on operative strategies, such as minimizing intraoperative ureteral trauma, to optimize patient comfort. Identifying high-risk cases preoperatively enables tailored approaches to both surgical technique and analgesic management, thereby improving overall outcomes and patient satisfaction.

REFERENCES

1. Agarwal R, Srivastava A, Jain SK, et al. Renal Stones: A clinical review. EMJ Uro. 2017;5(1):98-103.
2. Turk C, Petrik A, Sarica K, et al. EAU Guidelines on Urolithiasis. Eur Assoc Urol. 2015;69(3):475-482.
3. Teichman JM, Joel MH. Acute renal colic from ureteral calculus. N Engl J Med. 2004;350(7):684–693.
4. Sigurjonsdottir VK, Runolfsdottir HL, Indridason OS, et al. Impact of nephrolithiasis on kidney function. BMC Nephrol. 2015;16(1):149.
5. El-Zoghby ZM, Lieske JC, Foley RN, et al. Urolithiasis and the risk of ESRD. Clin J Am Soc Nephrol. 2012;7(9):1409–1415.
6. Worcester EM, Coe FL. Nephrolithiasis. Prim Care. 2008;35(2):369–391.
7. Taylor EN, Stampfer MJ, Curhan GC. Obesity, weight gain and the risk of kidney stones. JAMA. 2005;293(4):455-462.
8. Turney BW, Reynard JM, Noble JG, et al. Trends in urological stone disease. BJU Int. 2012;109:1082-1087.
9. Rajamahanty S, Grasso M. Flexible ureteroscopy update: indications, instrumentation and technical advances. Indian J Urol. 2008;24:532-537.
10. Eken A, Soyupak B. Retrospective analysis of retrograde intrarenal surgery results and factors affecting success rate. Pam Med J. 2018;11(1):49-55.
11. De Sio M, et al. Recent advances in percutaneous lithotripsy techniques. Curr Opin Urol. 2021;31:24–28.
12. Kyriazis I, et al. Complications in percutaneous nephrolithotomy. World J Urol. 2015;33:1069–1077.
13. Wu H, Ding T, Yan S, Huang Z, Zhang H. Risk factors for moderate-to-severe postoperative pain after percutaneous nephrolithotomy: a retrospective cohort study. Sci Rep. 2022;12(1):8366.
14. Wendt-Nordahl G, Mut T, Krombach P, Michel MS, Knoll T. Do new generation flexible ureterorenoscopy offer a higher treatment success than their predecessors? Urol Res. 2011;39:185-188.
15. Lim SH, Jeong BC, Seo SI, Jeon SS, Han DH. Treatment outcomes of retrograde intrarenal surgery for renal stones and predictive factors of stone-free. Korean J Urol. 2010;51:777-782.
16. Cansino Alcaide JR, Reinoso Elbers J, López Sánchez D, et al. Flexible ureterorenoscopy (URS): technique and results. Arch Esp Urol. 2010;63:862-870.
17. Schoenthaler M, Wilhelm K, Katzenwadel A, et al. Retrograde intrarenal surgery in treatment of nephrolithiasis: is a 100% stone-free rate achievable? J Endourol. 2012;26:489-93.