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Original Research Article

Retrospective Analysis of Initial Experience and Outcomes of Retrograde Intrarenal Surgery for Renal Stones at Tertiary Care Centre

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Abstract:

Objectives: To retrospectively analyse the clinical outcomes and safety of retrograde intrarenal surgery (RIRS) for renal stone management at a tertiary care centre.

Methods: This retrospective study included 40 patients who underwent RIRS for renal stone management between December 2023 to November 2024 at Madurai medical college. Data were collected on patient demographics, stone characteristics (Size, Location and Hardness), procedural time, stone-free rates, complications, and post-operative recovery (hospital stay). Statistical analyses were performed to evaluate clinical outcomes.

Results: The mean procedural time was 57.8 ± 10.5 minutes. Stone-free rates on postoperative day 2 was 80%, which increased to 95% by postoperative day 30. Complication rates were 17.5%, including postoperative fever, haematuria, urosepsis requiring additional antibiotics, steinstrasse, and no major complications like ureteral injuries or septic shock. The mean length of hospital stay was 2.3±0.6 days.

Conclusion: RIRS is a safe and effective modality for managing renal stones with high stone clearance rates and minimal complications. Careful case selection and preoperative preparation are essential to achieving optimal outcomes in the early phase of implementing RIRS in a tertiary care setting.

Keywords: Retrograde intrarenal surgery, Outcomes, Renal stones, Stone-free rates.

Introduction

Retrograde intrarenal surgery (RIRS) has become a preferred modality for the management of renal stones ≤2 cm in size due to its minimally invasive approach and superior safety profile compared to percutaneous nephrolithotomy (PCNL) or extracorporeal shock wave lithotripsy (ESWL). The European Association of Urology (EAU) guidelines recommend RIRS as a first-line treatment for selected patients with renal stones [4] [6].

RIRS offers significant advantages such as shorter hospital stays, reduced blood loss, and minimal postoperative complications [1] [7]. However, achieving optimal stone-free rates (SFR) and minimizing complications depend on factors like stone size, location, and density [5] [7].

Flexible ureteroscopes and holmium lasers have played pivotal roles in improving RIRS outcomes by enabling precise stone fragmentation and efficient removal [8] .Despite these advancements, challenges persist, including a steep learning curve and cost of flexible instruments [2] [9]. This retrospective study aims to evaluate the initial outcomes of RIRS for renal stones at a tertiary care center. The focus is on assessing parameters such as operative time, stone-free rates, complication rates, and postoperative recovery. By analysing our centre's initial experience, we seek to contribute valuable insights into the growing body of evidence supporting the role of RIRS in managing renal calculi.

Aims and Objectives

The aims of this retrospective study was to evaluate the initial experience and outcomes of RIRS at a tertiary care center, focusing on stone-free rates, complications, and safety.

The objectives of this study are:

1. To determine the stone-free rates (SFR) achieved with RIRS.

2. To analyze operative time and hospital stay associated with RIRS.
3. To assess intraoperative and postoperative complications.
4. To identify factors affecting surgical outcomes in the initial phase of RIRS implementation.

Inclusion criteria

1. Patients with age group between 18-70 years.
2. Patients with unilateral renal calculi of size 1-2 cm.
3. Patients who had a complete set of pre-operative, intra-operative, and post-operative data available.

Exclusion criteria

1. Patients with age <18 and > 70 years.
2. Patients with bleeding disorders or coagulopathy.
3. Patients who underwent bilateral RIRS procedure.
4. Presence of urinary tract anatomical abnormalities.

Materials and Methods

Study Design and Setting: This retrospective, single-centre study was conducted at department of urology, Madurai medical college and included 40 patients who underwent retrograde intrarenal surgery (RIRS) for renal stone management between December 2023 to November 2024.

Surgical Procedure: All RIRS procedures were performed by a single experienced surgical team to ensure consistency. We placed Double J stent in all the patients two weeks prior to surgery.

After satisfactory general anaesthesia was administered, the patient was positioned in lithotomy. Under the guidance of a hydrophilic 0.032 inch guide wire, an 8/9.5 Fr semi-rigid ureteroscope was placed into the ureter and retrograde to the renal pelvis. The ureteroscope was withdrawn, leaving the guide wire in the upper urinary tract. Next, a 9/11 Fr Ureteral access sheath (UAS) (Figure 1) was inserted into the upper ureter. Two types of UAS were used based on intraoperative factors: Flexible ureteral access sheath (Figure 1A), which provides enhanced maneuverability and reduced trauma during repeated instrument exchanges. Traditional ureteral access sheath (Figure 1B), which maintains a stable working channel for stone retrieval. A Flexible Ureteroscope (7.5Fr) was inserted via the UAS. A comprehensive inspection of the mucosa of the renal collecting system was performed to localise the stones (Figure 2 and 4). Then, a 270 µm laser fibre was inserted through the working channel of the Flexible URS for lithotripsy. Holmium:YAG laser was applied to pulverize calculi by interchangeably setting different parameters for fragmentation and dusting mode (Figure 3). The Flexible URS and the UAS were removed, and a 4.5 Fr/26cm double-J (DJ) stent was inserted routinely.

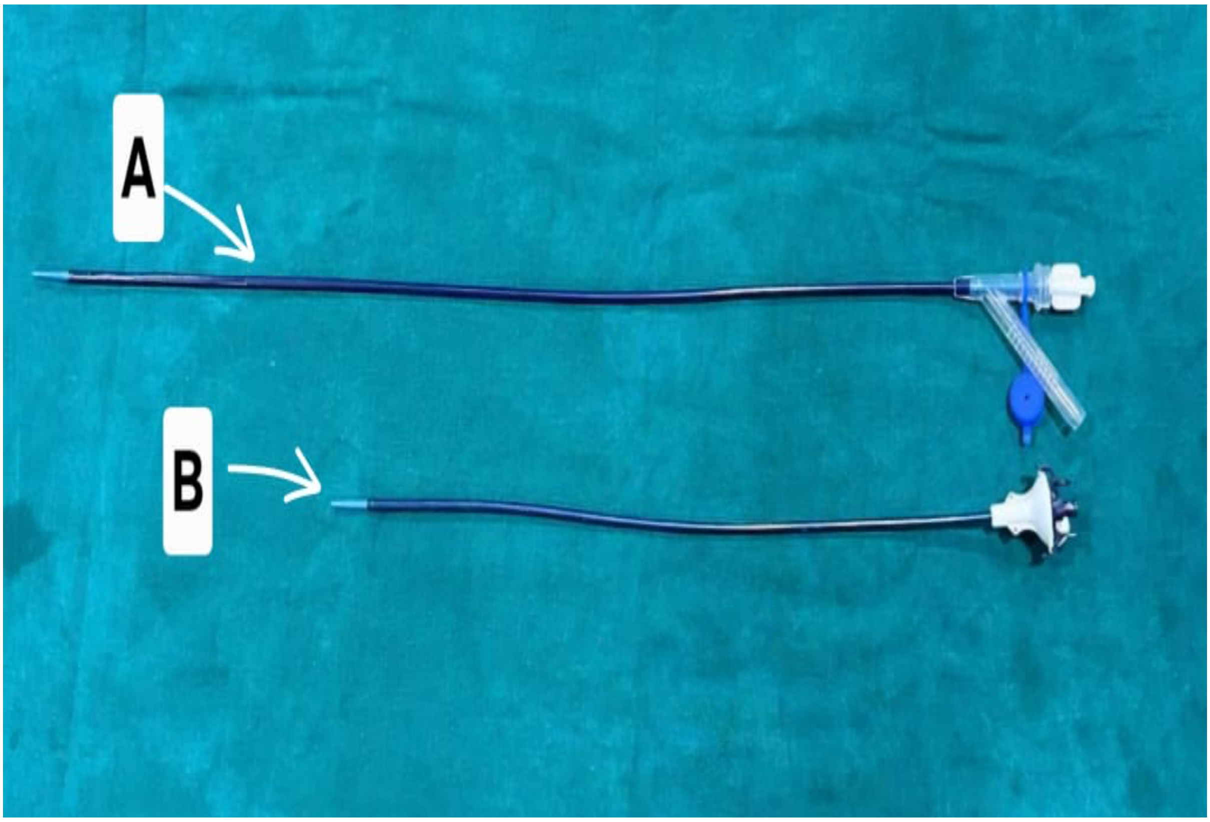

Figure 1: A) Flexible access sheath B) Traditional access sheath

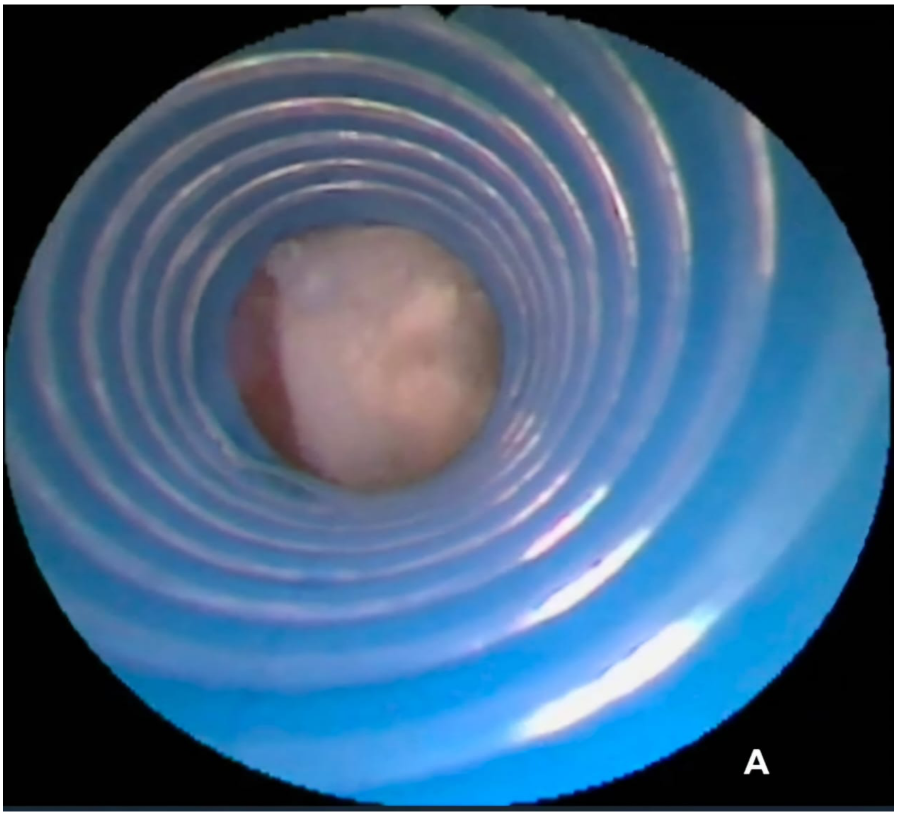

Figure 2: Stone localisation using Flexible ureteroscope

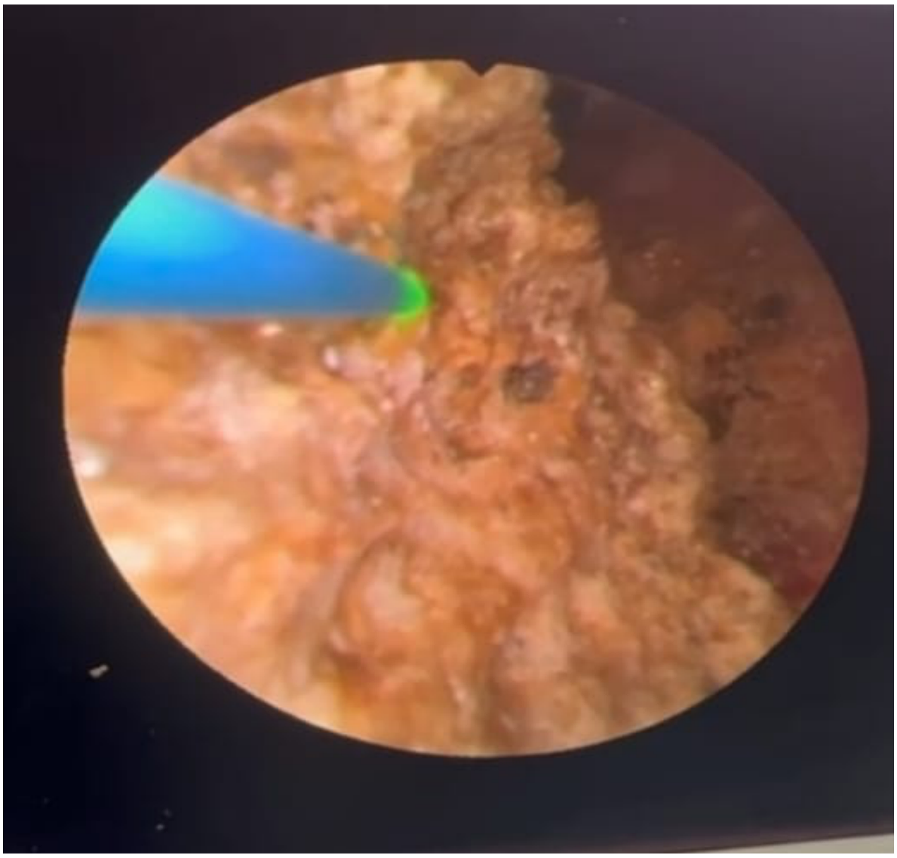

Figure 3: Stone fragmentation using Holmium: YAG laser.

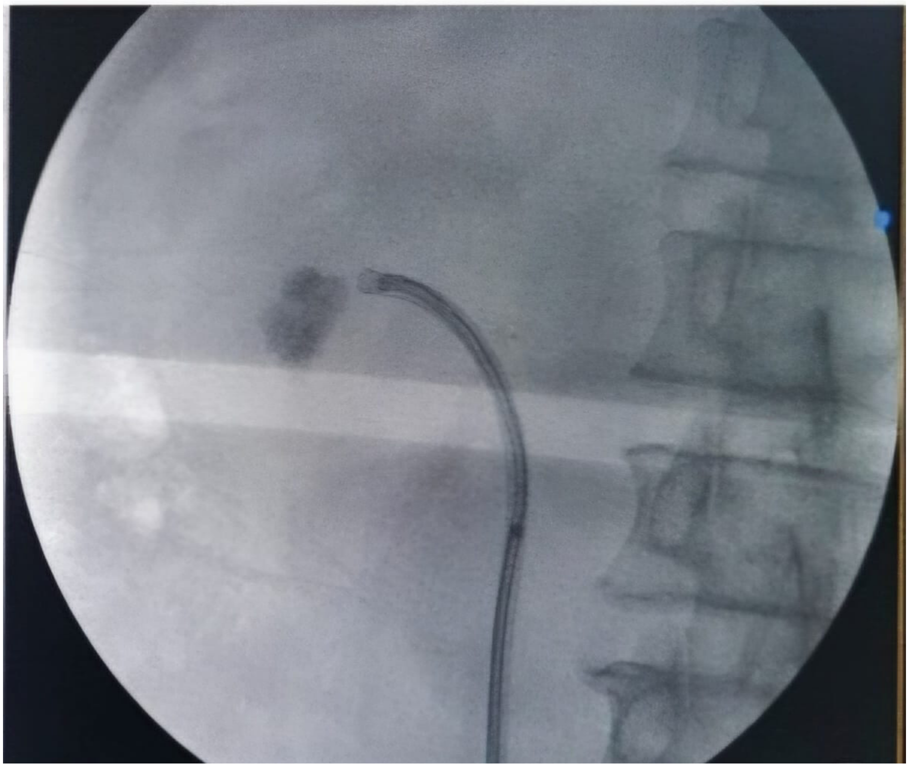

Figure 4: Stone located at middle calyx using C-arm.

Operation time was calculated from the time of insertion of the scope to the time of successful placement of the double-J stent. Double-J stent was routinely left in place for 4 weeks. Non-contrast CT-KUB was performed on postoperative day 2. Stone-free status was defined as radiological residue fragments <2 mm.

All patients were routinely followed up in the outpatient clinic at 1 and 3 months postoperatively. At 1 month postoperatively, a non-contrast CT KUB was performed to assess stone clearance, with stone-free status defined as radiological fragments <2 mm. The DJ stent was removed as a day care procedure. During the subsequent follow-up period, patients underwent B-scan Ultrasound KUB to monitor their progress.

Data Collection

Patient data were collected from medical records and included:

Demographics: Age, gender, BMI, ASA and comorbidities.

Stone Characteristics: Size, Side, Number, Hardness and location of stones.

Operative Parameters: Procedural time (minutes), Haemoglobin loss, and intraoperative complications.

Post-Operative Outcomes: Stone-free rate, Length of hospital stay (days), post-operative complications (based on the Clavien-Dindo classification), need for additional interventions.

Results

The demographic characteristics, baseline data and preoperative variables including gender, age, BMI, ASA score, comorbidities, operative side, stone size, stone hardness, stone location, hydronephrosis were analysed. (Table 1).

The mean operative time was 57.8 ± 10.5 minutes. Haemoglobin loss was −0.6 ± 0.3 g/dl. Stone-free status was achieved in 80% of patients on postoperative day 2 and 95% of patients by day 30. The average duration of postoperative hospital stay was 2.3 ± 0.6 days. Overall complications occurred in 17.5% of patients. (Table 2).

There were no intraoperative complications. The incidence of infectious complications, such as postoperative fever and urosepsis requiring additional antibiotics was 7.5% and 2.5% respectively. The incidence of haematuria was 5% which resolved spontaneously. One patient developed steinstrasse, which was managed with ureteroscopic lithotripsy. No other complications, such as ureteral injury, rupture, severe bleeding, or acute renal failure, Septic shock were observed (Table 3).

Table 1: Patient Demographics and Stone Characteristics

Variables	Patients (n=40)
Age (years)	46.9 ± 11.4
Gender (Male/female)	28/12
BMI(kg/m2)	24.8 ± 3.4
Co-morbidities	13 (32.5%)
ASA score	
ASA 1	24 (60%)
ASA 2	12(30%)
ASA 3	4 (10%)
Operative side	
Left	21 (52.5%)
Right	19 (47.5%)
Stone size (mm)	12.3 ± 2.6
Stone location	
Renal pelvis	10 (25%)
Lower pole	12 (30%)
Upper/mid pole	18 (45%)
Hydronephrosis (HUN)	13(32.5%)
Renal stone hardness (HU)	910 ± 170

Table 2: Perioperative outcomes

Variables	Values (mean±SD or %)
Operative time (minutes)	57.8 ± 10.5
Haemoglobin loss(g/dl)	-0.6 ±0.3
Postoperative hospitalisation(days)	2.3 ± 0.6
Stone free rate Day-2	32(80%)
Stone free rate Day-30	38(95%)
Overall complications	7 (17.5%)

Table 3: Complications

Complications	Number (%) (N=40)
Overall complications	7 (17.5%)
Postoperative fever	3 (7.5%)
Haematuria	2 (5%)
Urosepsis requiring additional antibiotics	1 (2.5%)
Steinstrasee	1(2.5%)
Septic shock	0(0%)

Discussion

Retrograde intrarenal surgery (RIRS) has gained widespread recognition as a primary treatment modality for managing renal stones ≤2 cm, given its minimally invasive nature and favourable safety profile compared to PCNL and open surgery [1] [4]. The European Association of Urology also endorses RIRS as a first-line treatment for renal stones of this size, reinforcing its growing acceptance [4].

In our study, the mean operative time was 57.8 ± 10.5 minutes, aligning with findings from Ho et al., who reported similar operative times for renal stones treated via RIRS [1] [10]. The procedural efficiency reflects advancements in flexible ureteroscope technology and surgical expertise, as highlighted in the literature [6]. The stone-free rate (SFR) in our study was 80% on postoperative day 2, which increased to 95% by day 30. These results are comparable to those reported by Hasan et al., who observed high SFRs in their initial RIRS experience at a tertiary care centre [2]. Additionally, studies like Giulioni et al. have consistently demonstrated the high efficacy of RIRS in achieving optimal stone clearance, particularly for anatomically challenging stones in the lower pole [7].

Our average hospital stay was 2.3 ± 0.6 days, comparable to findings by Eissa A et al., who reported an average stay of 2.3 ± 1.4 days for RIRS patients [5].This shorter duration underscores the benefits of minimally invasive approaches, which reduce recovery times and improve patient outcomes.

The overall complication rate in our study was 17.5%, with minor issues such as transient fever (10%) and haematuria (5%) being the most common. These findings align with reports by Lim et al. and Mahmood et al., who documented similar complication rates between 8% and 24% [6] [13]. Importantly, no major complications, such as ureteral injuries or septic shock, were observed in our study. Preoperative double-J stenting, used in all our cases, likely contributed to the reduced complication rate by optimizing ureteral conditions prior to the procedure, as suggested by Troy et al [8].

Clinical Implications

The findings from our study, combined with comparative data, highlight the safety, efficacy, and adaptability of RIRS, even in centers newly adopting the procedure. RIRS is particularly beneficial for managing stones in anatomically challenging locations, such as the lower calyx, where flexible ureteroscopes and holmium laser lithotripsy allow for precise stone fragmentation and removal. Additionally, minimal postoperative discomfort and rapid recovery make RIRS a favourable option for both clinicians and patients. Our study utilized both flexible and traditional UAS, with selection based on anatomical factors and surgeon preference. Future studies comparing outcomes between these two sheath types may further refine best practices for RIRS.

Limitations: While our study provides important insights into the outcomes of RIRS, its retrospective design and relatively small sample size limit the generalizability of the findings. Larger, prospective, multicentre studies are essential to confirm the reproducibility of these results and to assess long-term outcomes such as stone recurrence and renal function preservation.

Conclusion

This study highlights the effectiveness and safety of retrograde intrarenal surgery (RIRS) for managing renal stones ≤2 cm. With a high stone-free rate of 80% on postoperative day 2 and 95% day 30, RIRS demonstrates excellent outcomes in stone clearance. This procedure was associated with a short operative time and minimal postoperative complications, emphasizing its utility as a preferred treatment option. The low complication rate, absence of major adverse events, and reduced hospital stay further support the growing adoption of RIRS. Future research with larger cohorts and long-term follow-up is necessary to validate these findings and explore their implications for broader patient populations.

References

1. Ho CCK, Hee TG, Hong GE, Singam P, Bahadzor B, Md Zainuddin Z. Outcomes and Safety of Retrograde Intra Renal Surgery or Stones Less than 2cm in size.Nephro-Urol Mo n.2012; 4(2) 454-7. DOI 10.5812/numonthly .2211
2. Arshad Hasan, Md Zaid Imbisat, Rakesh Kumar Anand, Ahsan Ahmad. Initial Experience of Retrograde Intrarenal Surgery (RIRS) for renal stones in a tertiary care centre. Int J Acad Med Pharm 2023; 5 (5); 1048-1051. DOI: 10.47009/jamp.2023.5.5.205
3. Ram Dhayal I, Gupta R, Srivastava A, Rai P. A Comparative Study on Outcomes of Retrograde Intrarenal Surgery (RIRS), Mini Percutaneous Nephrolithotomy (PCNL), and Extracorporeal Shock Wave Lithotripsy (ESWL) for Lower Pole Renal Calculi of < 1.5 cm. Nephro-Urol Mon. 2023;15(1):e128168.
4. Türk C, Knoll T, Petrik A, Sarica K, Seitz C, Straub M, et al. Guidelines on urolithiasis. European Association of Urology; 2010 [updated 2010; cited]; Available from: http://www. uroweb.org/gls/ pdf/Urolithiasis%202010.pdf % A0.
5. Eissa A, Ragab M, Bianchi G, Hassan A. Retrograde intrarenal surgery in the management of solitary large renal stones, 2-3 cm: a single centre experience. Int Surg J 2021; 8:939-43.
6. 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(11):777-82.
7. Giulioni C, Castellani D, Somani BK et al. The efficacy of retrograde intra-renal surgery (RIRS) for lower pole stones: results from 2946 patients. World J Urol 41, 1407–1413 (2023).
8. Troy AJ, Anagnostou T, Tolley DA. Flexible upper tract endoscopy. BJU Int. 2004; 93(5):671-9.
9. Mahmoud MA, Shawki AS, Abdallah HM et al. Use of retrograde intrarenal surgery (RIRS) compared with mini-percutaneous nephrolithotomy (mini-PCNL) in paediatric kidney stones. World J Urol 40, 3083–3089 (2022).
10. Ho CC, Hafidzul J, Praveen S, Goh EH, Bong JJ, Lee BC, et al. Retrograde intrarenal surgery for renal stones smaller than 2 cm. Singapore Med J. 2010;51(6):512-5.
11. Niwa N, Matsumoto K, Ohigashi T, et al. Clinical Outcomes of Retrograde Intrarenal Surgery as a Primary Treatment for Staghorn Calculi: A Single-Centre Experience. Clinical Medicine Insights: Urology. 2019; 12.
12. Pearle MS, Lingeman JE, Leveillee R, Kuo R, Preminger GM, Nadler RB, et al. Prospective, randomized trial comparing shock wave lithotripsy and ureteroscopy for lower pole caliceal calculi 1 cm or less. J Urol. 2005; 173(6):2005
13. Mahmood SN, Babarasul MH, Fakhralddin SS et al. Retrograde intrarenal surgery for the treatment of renal stones in patients with a solitary kidney: Does access sheath matter? Afr J Urol 27, 35 (2021).

14. 14. Bozkurt OF, Resorlu B, Yildiz Y, Can CE, Unsal A. Retrograde intrarenal surgery versus percutaneous nephrolithotomy in the management of lower-pole renal stones with a diameter of 15 to 20 mm. J Endourol. 2011; 25(7):1131-5.