Journal for ReAttach Therapy and Developmental Diversities
eISSN: 2589-7799
2023 November; 6(1): 2179-2186

Retrograde Intra-Renal Surgery: A Prospective Observational Study At A Tertiary Care Hospital In Kashmir Valley- Our Initial Experience

Dr. Haamid Hassan Bhat[1], Prof. (Dr.) Syed Sajjad Nazir[2], Dr Tanveer Iqbal[3], Dr. Naveed Khan[4], Dr. Javaid Magray[5], Dr. Yasir Qadri[6], Dr. Shabir Ahmad Mir[7], Dr. Sheikh Riyaz Ahmad[8*]

[1]Dr NB, Department of Urology, Government Medical College, Srinagar, India.
[2]Professor and Head Department of Urology, Government Medical College, Srinagar, India.
[3]Associate Professor, Department of Urology, Government Medical College, Srinagar, India.
[4]Assistant Professor, Department of Urology, Government Medical College, Srinagar, India.
[5]Consultant, Department of Urology, Government Medical College, Srinagar, India.
[6]Consultant, Department of Urology, Government Medical College, Srinagar, India.
[7]Consultant, Department of Urology, Government Medical College, Srinagar, India.
[8*]MCh, Department of Urology, Government Medical College, Srinagar, India.

***Corresponding Author**: Dr. Sheikh Riyaz Ahmad
*MCh, Department of Urology, Government Medical College, Srinagar, India, Mail id: dr.riyaz10000@gmail.com

Abstract:

Background: Urinary calculi is a common affliction of the urinary tract, removal of which is one of the most important clinical aspect of a urologist. A variety of procedures like shockwave lithotripsy (SWL), flexible ureterorenoscopy (FURS) and percutaneous nephrolithotomy (PCNL) have been employed for removal of stones. A new procedure in this list is Retrograde intrarenal surgery (RIRS).
Aims: To describe our experience and outcome of RIRS for the treatment of Urolithiasis and to assess its effectiveness and safety in terms of Stone Free Rate/ Operation Time/ Hospital Stay/ Post-Operative blood Transfusion/ Sepsis/ Need For Second Session of RIRS/Auxiliary Procedures.
Methods: Prospective observational study of 23 months duration (March 2021 to January 2023) which included patients presenting with single stones ≤ 2 cm or multiple stones with conglomerate diameter ≤2 cm or unsuccessful ESWL for stones ≤ 2cm or residual stone after PCNL ≤ 2cm or based on patient preference. Patients who were pregnant, with active urinary tract infection or uncorrected coagulopathy were excluded from the study. Pre-operative stenting was done using 5F/26cm DJ stent within 2 weeks of the date of procedure Standard surgical procedure of RIRS/ FURSL was done. Follow up was done after 1 week and 4 weeks. After 4 weeks NCCT KUB was done. If stone was cleared, DJ stent was removed. Demographic parameters, Side/ number/ size/ location/ anatomy/ HU characteristics of stones were noted. Indication of RIRS, pre-op stenting duration, ease of access were noted. Main outcome was stone clearance. Other parameters noted were sepsis, bleeding, duration of hospital stay, findings on follow Up NCCT for residual stones, management of residual stone and post-operative stent duration were all noted.
Results: Majority Of the patients had no comorbidities (59%) among the study population. Stones were more right sided than left side (59.8% vs 40.2%), single (72%) and had an average stone size of 14.86+6.2 mm, with 52.6% belonging to 15-20 mm group and 42.1% belonging to 10-15mm group. Common location of the stones were pelvis (26.3%), upper ureter (21%), lower calyx (19.7%) followed by other locations. Majority of the patients had normal anatomy (63.15%). Bifid PCS was noted in 2.63%, blocked infundibulum noted in 3.94% and narrow infundibulum noted in 3.28%. RIRS was done as a primary procedure in majority of the cases (81%). There was difficulty encountered in access sheath placement in 3% of the patients. The average time taken for operative procedure was 78.51±27.2 minutes. Complete stone clearance was obtained in 93% of the patients. (141/152).
Conclusion: RIRS is applicable to wide range of location of stones and characteristics of stones. Only minor complications like mild-grade sepsis and haemorrhage are expected in a small group of patients. Patients undergoing RIRS require only minimal hospital stay (2-3 days). RIRS appears to be an excellent modality for treatment of renal stones.

Keywords: RIRS, Urological stones, Renal stones, Stone clearance.

Introduction:

Urinary calculi is a common affliction of the urinary tract. The lifetime prevalence of renal stone related disease is estimated to be between 1% and 5 %. Removal of such calculi is one of the main competencies of a urologist.

A basic tenet of renal stone surgery is to maximize stone removal while simultaneously minimizing morbidity. Over the many years, treatment for renal stones has changed greatly. The options for the same include shockwave lithotripsy (SWL), flexibleureterorenoscopy (FURS) and percutaneous nephrolithotomy (PCNL) being the most commonly used minimally invasive treatment modalities with relatively high stone-free rates (SRF) and having quite a minimal morbidity pattern.[1,2]

A more recent introduction is the retrograde intrarenal surgery (RIRS). This is performed by utilizing a flexible ureterorenoscopic approach, heralding a new era in urologic procedures. RIRS gives possibility of accessing much smaller kidney stones using minimally invasive approach.The first flexible ureteroscopic procedure was introduced in1960. [3,4]

Retrograde intrarenal surgery (RIRS) is now being popularized as one of the best for the surgical management of upper urinary tract pathology. This owes to the improvements in the surgical instruments with better mechanisms for deflection, higher quality visualization and duration. The expansion of the role of RIRS to include treatment of calculi located in the upper urinary system makes RIRS an effectivealternative to SWL and PCNL. Flexible ureterorenoscopy has developed into a standard diagnostic and treatment modality for upper urinary stone disease, transitional cell carcinoma and ureteral strictures. [5]

Today reaching the stone via a natural route and achieving a high success rate with a lower morbidity have led RIRS to become a commonly used and important treatment modality. [6]

Considering all these exciting improvements occurring in the urological world, it is imperative that contemporary research should analyze the relevance of the RIRS procedure in the local geographic context. However, it is noted that very few studies have been performed in the Indian context. Srivastava et al, [7] in their review regarding management of 1-2 cm renal stones (Indian Journal of Urology,2013) noted that there were no large scale studies of RIRS in India.

MATERIALS AND METHODS

This was a Prospective observational study that was conducted in the Department of Urology (Super Speciality Hospital), GMC Srinagar over a period of 23 months from March 2021 to January 2023. After taking proper approval from the institutional ethical committee, patients admitted with renal stones and fitting the inclusion criteria were taken as subjects. Patients who were pregnant, with active urinary tract infection or uncorrected coagulopathy were excluded from the study. Each patient was given brief introduction about the study, the success rate, possible complications of the operation and informed written consent was obtained from all participants.

All patients were assessed by elaborate history taking and thorough clinical examination. Patients underwent routine investigations, Urine Culture, Ultrasonography, X-ray KUB, CT Urogram (as standard of care) Pre-operative stenting was done using DJ stent minimum 2 weeks before the date of procedure Surgical procedure done was RIRS/ FURSL.

Follow up was done after 1 week and 4 weeks. After 4 weeks NCCT KUB was done. If stone was cleared, DJ stent was removed.

SURGICAL TECHNIQUE

- Pre-operative ureteral stenting (DJ stent) was done in all patients within 2weeks before RIRS/FURSL.
- Intravenous antibiotic (Inj Piperacillin Tazobactum) was given approximately 30 minutes prior to surgery and continued for 24 hrs postoperatively.
- The procedure was performed under GA in dorsal lithotomy position. Cystoscope was introduced and DJ stent was removed. An initial evaluation of the ureter was carried out by a semi-rigid ureteroscope followed by insertion of 0.035" terumo guide wire through the ureteroscope under C-arm guidance up to the ureteropelvic junction. Thereafter semi-rigid ureteroscope was withdrawn leaving the guide wire inside the renal collecting system. Flexor Ureteral Access Sheath 10/12 was placed under C-arm guidance and guide wire was removed. Olympus Flexible ureterorenoscope (Urf V3, Ventral deflection 275 degree, dorsal deflection 275 degree, working channel 3.6Fr, Tip 8.5Fr, Shaft 8.4Fr) was introduced through the access sheath. Collecting system was observed under direct vision until the stone was visualised. Sometimes fluoroscopic vision or addition of a contrast agent facilitated access to the stone. Especially repositioning of lower calyx stones brought to more accessible calyx (either middle or upper) with a basket catheter facilitated access to the stone. Stone was ablated using 230 μm Holmium laser by fragmentation or dusting technique. The power of holmium laser was generally set at 0.6-1.2 Joule and 5-15 Hertz (10-15 Watt), settings were changed according to the desired lithotripsy method.

Different Laser Settings:

	Energy(Joules)	**Frequency(Hz)**
Fragmentation	**High0.7-1.5**	**Low10-12**
Dusting	**Low0.2-0.5**	**High15-20**
Pop Corning	**High1.0-1.5**	**High20-40**

The stone was fragmented with the laser until clinically insignificant residual fragments were left. Once stones not visualized under C Arm, flexible ureterorenoscope was removed slowly inspecting the whole ureter for any calculi or fragment and any significant trauma. Finally, double J stent was inserted over 0.035" terumo guide wire and left indwelling for 4-6 weeks. Patients were catheterised using 14 or 16 Fr Foley's catheter after removing0.035" terumo guide wire.

POST-OPERATIVE CARE

- Patients were encouraged to ambulate on same day.
- Pain management was done by NSAIDs.
- Foley's catheter was removed on 1st post-operative day.
- Orals were started after 6 hours of procedure.
- X-ray KUB was taken within first 24 hours.

FOLLOW UP

- After 1 week: For any complication like pyelonephritis, fever, sepsis.
- After 4 Weeks: Along with NCCT KUB to check stone clearance
- Patients who did not display any significant residual fragment (≤ 4mm) on non-contrast CT after 4 weeks were considered stone free, hence in them DJ stent was removed.

STATISTICAL METHODS

Data recorded in the case record format were entered onto an excel sheet. Being a descriptive study, data was presented in terms of proportions where applicable. Continuous data was presented as mean+standard deviation, range as appropriate. Percentages were reported as appropriate. Microsoft excel was used to design tables ,graphs, pie-charts as appropriate.

Results:

A profile of 152 patients (average age of 39.28+12 years, majority belonging to 31-45 patients; males -57.88% (88/152) and females 42.1% (64/152) were studied. Demographics of the study population are depicted in [Table 1].

Table 1: Demographic of the study population

Variables	Mean±SD (%)
Age (years)	39.28±12.12
Sex M/F	88/64
Side of stone Left/ Right	61/91
Stone size (mm)	14.86 +2.98

Maximum number of stones was seen in Pelvis 26.3% followed by Upper ureter 21% [Table 2].

Table 2: Stone location distribution

Stone location	%
Pelvis	26.3
Superior Calyx	17.1
Middle Calyx	15.7
Inferior Calyx	19.7
Upper Ureter	21.0

Majority of the patients had normal anatomy (63.15%). Diverticular stones in 6.5%, Bifid PCS was noted in 2.63%, blocked infundibulum noted in 3.94% and narrow infundibulum noted in 3.28%. These abnormalities and others also, were very few in number [Table 3].

Table 3: Abnormal anatomy distribution of the stones

Type	%
Normal Anatomy	63.15
Bifid Pcs	2.63
Blocked Infundibulum	3.94
Compound Calyx	0.65
Diverticulum	6.5
Ectopic Kidney	1.97
Horse Shoe Kidney	2.63
Impacted Stone	3.28
Narrow Infundibulum	3.28
Post Pyeloplasty	1.31
Narrowing at PUJ	3.28
Partial Duplex System	1.31
Solitary functioning kidney	1.97
Pelvic Kidney	0.65
RCC with Stone	1.31
Retrorenal Colon	1.97

RIRS was done as a primary procedure in majority of the cases (81%). Post ESWL Residual and post PCNL Residual cases constituted the remaining group, followed by Post-Pyelolithotomy and Post Lap Ureterolithotomy residual [Table 4].

Table 4: Indication of RIRS among the study population

Indication of RIRS	%
Primary	80.92
Post ESWL Residual	7.23
Post PCNL Residual	5.26
Post Pyelolithotomy Residual	4.6
Post Lap Ureterolithotomy Residual	1.97

The average duration of hospital stay was 2.68 +/- 1.36 days. Majority of the patients were admitted for 2 days [Fig 1].

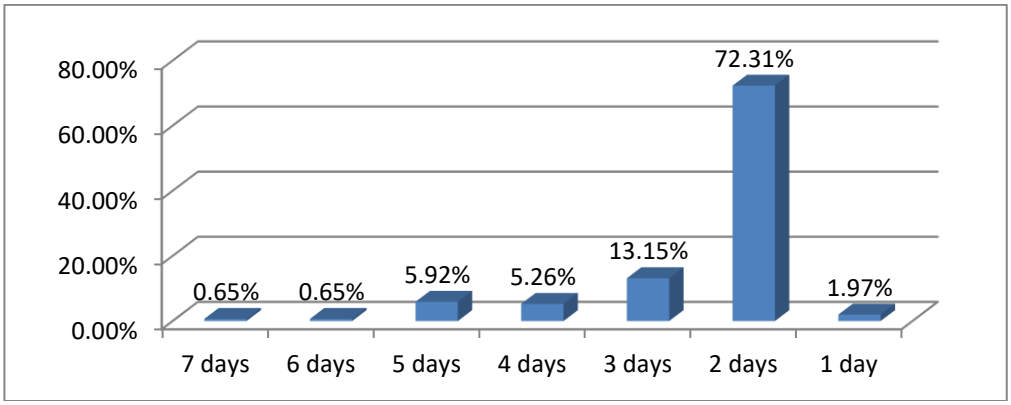

Fig 1.

Postoperative sepsis was noted in 5 patients (3.18%). Remaining 152 patients (96.81%) did not show any signs of sepsis. All patients with fever underwent routine investigations, urine and blood cultures were obtained. The patients with postoperative sepsis were administered antibiotics as per culture sensitivity [Fig 2].

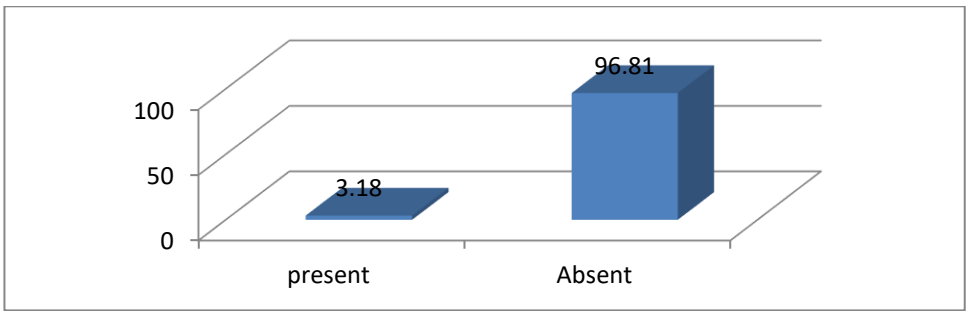

Fig 2.

Complete stone clearance was obtained in 93% of the patients (141/152) in single stage [Fig 3].

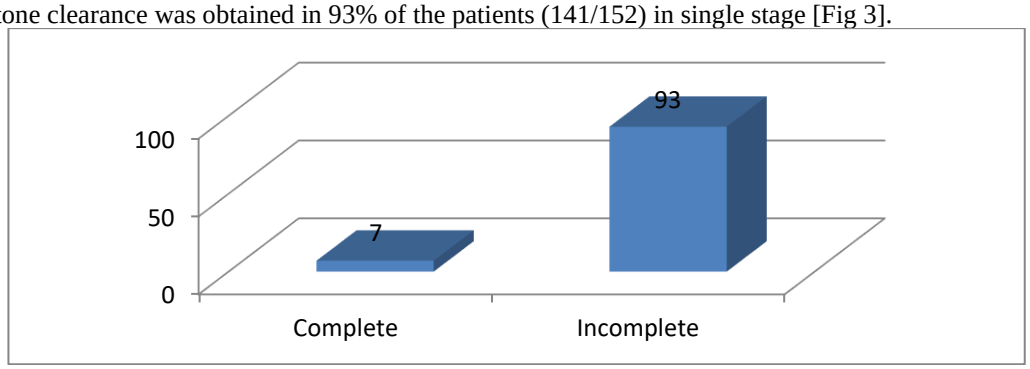

Fig 3.

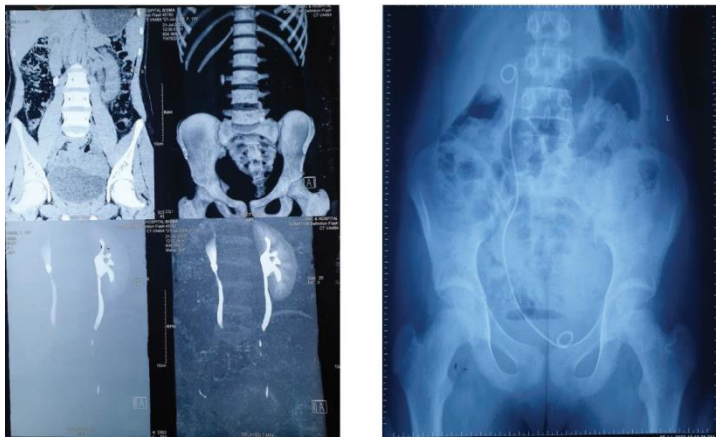

Fig 4: Right upper ureter impacted stone before and after RIRS

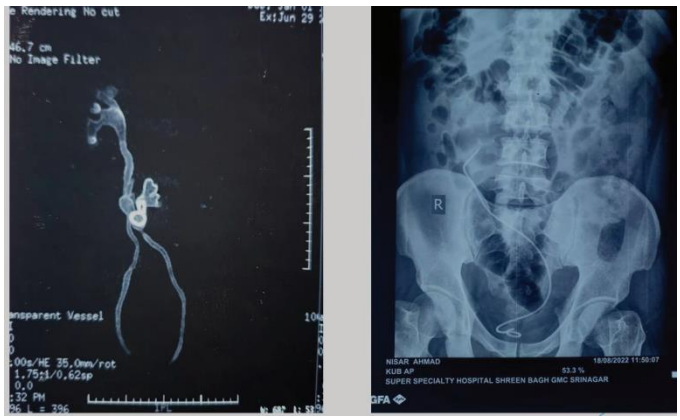

Fig 5: Left ectopic kidney with nephrolithiasis before and after RIRS

Discussion:

In recent era of minimally invasive techniques for stone diseases, RIRS has become increasingly popular treatment. PCNL is worldwide approach for stone treatment but is not without morbidity. Postoperative complications in PCNL is proclaimed up to 20%.[8] RIRS has excelled with better scope and technical improvements in the size of the scope, the degree of deflection and the quality of the fibre optics during the past few years.[9,10] This outdistanced PCNL in terms of decreased morbidity with
acceptable success rate.[11,12] RIRS has reported the success rate above 90% for renal stone and 85% for lower calyceal stone depending on stone bulk and calyceal anatomy.[13]
In our study, we noted renal pelvic stones to be of highest proportion. This is similar to most of the other studies. Only Parikh et al, [14] showed lower calyx to be contributing more. This study (Parikh et al) had higher contribution of multiple stones. Study by CC Ho et al, [15] also simply reported that Lower pole stones (with or without others) constituted 58.5% while other groups constituted 41.5%. Upper calyx and middle calyx stones constituted much lesser to the final number in almost all the studies, which is consistent with the findings of the present study.
The average stone size in our study (14.86 mm) was comparable to that of Carikogluet al (14.4mm). [16] Uddin et al, [17] (13mm), maugeri et al, [18] (13 mm) and that of Most of the other studies Gyawali et al, Bansal et al, Joshi et al, have reported in the similar range. [19,20] However, Prabhakar et al, [21] reported a much higher average stone size (2.5cm). The large international database results (reported by Gauhar et al, n = 6669 patients) showed an average size of 10.04 with considerably high SD (6.84). [22] In our study, a large majority was constituted by stones >10mm. This is similar to that of Uddin et al.[17] However, Gyawali et al noted a much lesser proportion (41.4%) of stones>10mm.[19] Stone size appears to be an important predictor of outcomes (though analyzing this was not the objective of our study). Venkatachalapathy et al, [23] noted that a cut-off stone size of 30 mm (area under the curve 0.720, sensitivity of 57.1% and specificity of 81.0%) predicted postoperative complications. They also noted a cut-off stone size of 31 mm (with AUB of 0.767, sensitivity of 70.0% and specificity of 81.5%) predicted residual stones on ROC curve analysis.
Most studies have not reported the HU value of the stones. In our study, the value was 1171.86+/- 174.83. In the study by Joshi et al, 50, mean hardness was 1208. In the study by Maugeri et al, [18] the average was 859 (range being 436 - 1674 HU). The high standard deviation suggests that RIRS is effective across a wide range of hardness of stones.
The proportion of primary RIRS being more than 80% was noted in our study, and also with Gyawali et al, Uddin et al and Venkatachalapathy et al, .[19,17,23] CC Ho et al and Lim et al reported a smaller proportion of patients with primary RIRS. Lim et al [24] had elaborated that the reason for primary RIRS were combined with ureteral stone (19.7%), Anomaly of urinary tract6 (9.1%), Upward migrated stone (4.5%), Coagulopathy (3.1%), with diagnostic ureteroscopy (4.5%) and others (4.5%).
The performance of RIRS in our study is comparable to that of most other studies. While Bansal et al, [20] report a slightly shorter duration (51 minutes), Venkatachalapathy et al, [23] and Joshi et al, [25] have reported slightly higher times (117 minutes and 124 minutes respectively). RIRS is a relatively new procedure. Though not technically very challenging, a learning curve does exist, and time durations are expected to reduce over years of performance by the same operating surgeon/ team.
In our study the average duration of hospital stay was 2.68 +/- 1.36 days. Carikoglu et al, Bansal et al and Uddin et al, had a mean hospital stay duration of less than 2 days. [16,20, 17] In a study , Joshi et al and Gauhar et al (multicentric study, n=6669) showed a higher duration of hospital stay. [25, 22] In the study by Prabhakar et al, [21] it has been reported that all the patients were discharged after 24 hours of the procedure and 29 out of 30 patients could resume normal work after two days of the procedure. Overall, it may inferred that RIRS does not require prolonged hospital stay.
Stone-free rate is the most important outcome of the study. In the present study, stone free rate was achieved in 93%. This is comparable to the results of most of the other studies, Parikh et al [14], Gauhar et al [22], Bansal et al [20] and Uddin et al [17]. Lim et al, [24] analyzed the factors influencing stone free rate and found the following results. SFR were statistically lower with stone burden >1.5 cm, lower calyceal stones and single stones with stone burden >1.5 cm. It is reasonable to conclude that RIRS gives an effective stone free rate.
In our study, there were no major postoperative complications. Sepsis was noted in 5/152 (3%) patients and minor bleeding was noted in 1/152 (0.65%). This is comparable to the rates of postoperative complications mentioned in most of the comparable studies. Joshi et al, [25] reported only minor peri-operative complications. Hematuria in 21.43%, fever in 21.43%, Septicemia in 14.28% were the complications noted. Bansal et al [20] reported minor complications only in 0.8% of the patients. Clavien level 1 and 2 complications were noted in 5.42%. No major complication (Clavien 3 and 4) was noted. Five patients had fever postoperatively and were treated with antibiotics. Three other patients showed features of bleeding but did not require transfusion.

Conclusion:

- RIRS appears to be an excellent modality for treatment of stones.
- A stone-free-rate of 93% is obtained with RIRS in stones up to 2cm size.
- RIRS is applicable to wide-range of location of stones and characteristics of stones.
- The high efficacy and lower rate of complications have positioned this technique as the treatment of choice for renal stones up to 20 mm and it must also be considered as an option for treating bigger stones.
- Only minor complications like mild-grade sepsis is expected in a small group of patients.
- Patients undergoing RIRS require only minimal hospital stay (2-3days).

Conflict of interest: Nil

Funding: Nil

References:

1. Wendt-Nordahi G, Mut T Krombach MS, Knoll T. Do new generation flexible ureterorenoscopes offer a higher treatment success than their pedecessors? Urol Res 2011;39;185-8.
2. Bozkurt of Resorlu B, Yildiz Y, Can CE, Unsal A. Retrograde intra-renal surgery versus percutaneous nephrolithotomy in the management of lower-pole renal stones with a diameter of 15 t0 20 mm J Endourol 2011;25;1131-5.
3. Marshall VF. Fiber optics in urology. J Urol. 1964; 91:110–114.
4. Bush IM, Goldberg E, Javadpour N, Chakrobortty H, Morelli F. Ureteroscopy andrenoscopy: a preliminary report. Chic Med Sch Q. 1970; 30:46–49.
5. Andonian S, Okeke Z, Smith AD: Digital ureteroscopy: the next step. J Endourol 2008; 22:603–606.
6. Weizer AZ, Springhart WP, Ekeruo WO et al. Ureteroscopic management of renalcalculiin anomalous kidneys. Uro 2005; 65:265-9.
7. Srivastava A, Chipde SS. Management of 1-2cm renal stones. Indian J Uro 2013;29:195-9.
8. Labate G, Modi P, Timoney A, Cormio L, Zhang X, Louie M. The percutaneous nephrolithotomy global study: Classification of complications. J Endourol. 2011 Aug;25(8):1275-80.
9. Al-Qahtani SM, Gil-Deiz-de-Medina S, Traxer O. Predictors of clinical outcomes of flexible ureterorenoscopy with holmium laser for renal stone greater than 2 cm. Adv Urol. 2012;2012:543537.
10. Galvin DJ, Pearle MS. The contemporary management of renal and ureteric calculi. BJU Int. 2006 Dec;98(6):1283-8.
11. Dave S, Khoury AE, Braga L, Farhat WA .Single-institutional study on role of ureteroscopy and retrograde intrarenal surgery in treatment of pediatric renal calculi. Urology. 2008 Nov;72(5):1018-21.
12. Zhong W, Zhao Z, Wang L, Swami S, Zeng G. Percutaneous based management of Staghorn calculi in solitary kidney: Combined mini percutaneous nephrolithotomyversus retrograde intrarenal surgery. Urol Int. 2015;94(1):70-3.
13. Hyams ES, Bruhn A, Lipkin M, Shah O. Heterogeneity in the reporting of disease characteristics and treatment outcomes in studies evaluating treatments for nephrolithiasis..JEndourol. 2010 Sep;24(9):1411-4.
14. Parikh KP, Jain RJ, Kandarp AP. Is retrograde intrarenal surgery the game changer in the management of upper tract calculi? A single-center single surgeon experience of 131 cases. Urol Ann. 2018 Jan-Mar;10(1):29-34.
15. Ho CC, Hee TG, Hong GE, Singam P, Bahadzor B, Md Zainuddin Z. Outcomes and Safety of Retrograde Intra-Renal Surgery for Renal Stones Less Than 2 cm in Size. Nephrourol Mon. 2012 Spring;4(2):454-7.doi: 10.5812/numonthly.2211.
16. Cakiroglu B, Tas T, Aksoy SH, Arda E. Could "Retrograde Intrarenal Surgery" be Used as an Efficient Technique in the Treatment of Calyceal Diverticula Stones. J Coll Physicians Surg Pak. 2022 May;32(5):623-626.
17. Uddin AN, Enayetullah I, Razzaque KZ et al. An Early Experience of Retrograde Intrarenal Surgery (RIRS) in National Institute of Kidney Diseases and Urology. Bangladesh J. Urol. 2020; 23(1): 3-10.
18. Maugeri O, Dalmasso E, Peretti D, Venzano F, Chiapello G, Ambruosi C, et al. Stone free rate and clinical complications in patients submitted to retrograde intrarenal surgery (RIRS): Our experience in 571 consecutive cases. Arch Ital UrolAndrol. 2021 Oct 1;93(3):313-317.
19. Gyawali PR, Luitel BR, Luitel BR. Retrograde intrarenal surgery in Nepal: an early experience. Nepal Med Coll J. 2013 Jun;15(2):137-9. PMID: 24696935.
20. Bansal P, Bansal N, Sehgal A, Singla S. Bilateral single-session retrograde intra-renal surgery: A safe option for renal stones up to 1.5 cm. Urol Ann. 2016 Jan-Mar;8(1):56-9. doi: 10.4103/0974-7796.163793.

21. Prabhakar M. Retrograde ureteroscopic intrarenal surgery for large (1.6-3.5 cm) upper ureteric/renal calculus. Indian J Urol. 2010 Jan-Mar;26(1):46-9.
22. Gauhar V, Chew BH, Traxer O, Tailly T, Emiliani E, Inoue T, et al. Indications, preferences, global practice patterns and outcomes in retrograde intrarenal surgery (RIRS) for renal stones in adults: results from a multicenter database of 6669 patients of the global FLEXible ureteroscopy Outcomes Registry (FLEXOR). World J Urol. 2023 Feb;41(2):567-574.
23. Venkatachalapathy VSS, Palathullil DG, Sam DM, Prasad A, Abraham GP. Outcomes of retrograde intrarenal surgery in renal calculi of varying size. Indian J Urol. 2022 Apr-Jun;38(2):128-134.
24. 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 Nov;51(11):777-82.
25. Joshi R. Early experience of Retrograde Intrarenal Surgery for Renal stone: A Descriptive Cross-sectional Stud.JNMA J Nepal Med Assoc. 2020 Jul; 58(227): 465-469.