International Surgery Journal
Sharma A et al. Int Surg J. 2022 Feb;9(2):331-335
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: https://dx.doi.org/10.18203/2349-2902.isj20220320

Original Research Article

Outcome of retrograde intrarenal surgery in the management of urolithiasis in a tertiary care centre in North India

Ankitkumar Sharma*, Tanisha Dhar

Department of Surgery, Government Medical College, Jammu, Jammu and Kashmir, India

Received: 20 December 2021
Revised: 13 January 2022
Accepted: 18 January 2022

***Correspondence:**
Dr. Ankitkumar Sharma,
E-mail: dr.ankitkumarsharma@gmail.com

ABSTRACT

Background: Nephrolithiasis is the most common presenting pathology to the urology clinic. Retrograde intrarenal surgery (RIRS) has made the treatment of upper ureteral and renal calculi a relatively atraumatic affair. We undertook a study to analyse the outcomes of RIRS performed at our institute.
Methods: All patients undergoing RIRS at Government Medical College and Associated Hospitals, Jammu from November 2015 to October 2016 were included in the study population and the data prospectively collected. Patients were followed up till 6 months.
Results: 62 patients underwent the procedure during the study period. Majority of the patients were of the younger age group with 56.45% patients being females. 41.9% (n=26) patients had ureteric calculi which were pushed back while 12.9% (n=8) patients had concurrent ureteral and renal calculi. One patient had a malrotated kidney with calculus, which could be cleared. The median stone size was 12 mm (range 7-18 mm). 87% were stone free at the end of the procedure. 6% procedures had to be abandoned, and 6% patients underwent follow on extracorporeal shock wave lithotripsy (ESWL). The overall stone free rate was 93.54%. The mean post-operative pain score was 2.8. Five patients developed post-operative pyelonephritis and none developed ureteric injury, avulsion or collection. At 6 months, no patient had stone recurrence or hydronephrosis.
Conclusions: RIRS is a relatively safe procedure with good stone clearance. Minimal post-operative pain, with >90% stone clearance make it the cornerstone in the management of renal calculi. Our study shows that RIRS can be safely performed with minimal long term complications.

Keywords: RIRS, Nephrolithiasis, Minimally invasive

INTRODUCTION

Urinary stone disease has been known since the Egyptian era with the earliest reported bladder stones in a 5000 year old mummy discovered by the English Archaeologist E. Smith. The surgical treatment for stone disease has been known since the era of Sushruta who described in detail the anatomy and surgery for the same in his writings, the Sushruta Samitha in the 8th century B.C. The drastic changes in the treatment of stone disease stands witness to the significant disease burden, morbidity and mortality caused by stone disease. Each year, worldwide people make almost 3 million visits to health care providers and more than half a million patients go to emergency room with urolithiasis.[1]

Urolithiasis is becoming a significant healthcare burden to the modern world with stone prevalence increasing worldwide. Stone incidence depends on geographical, climatic, ethnic, dietary and genetic factors. According to the National Health and Nutrition Examination Survey, as of 2012, 10.6% of men and 7.1% of women in the United States are affected by renal stone disease, compared to just

6.3% of men and 4.1% of women that were affected in 1994.[2] For some areas an increase of more than 37% over the last 20 years is reported.[3] Further, within the affected population the gender gap has narrowed substantially and the incidence of stone disease in paediatric patients continues to be on the rise. The recurrence risk is determined by the disease or disorder causing the stone formation. Accordingly, the prevalence rates for urinary stones vary from 1% to 20%.[4]

The first account of an operation performed on the kidney was around the time during renaissance. Cardan of Milan operated a lumbar abscess in the year 1550 and discovered 18 stones. However, there was no further mention of this procedure for many years. Gustav Simon performed the first planned nephrectomy for a fistula in 1869. In 1873, Ingalls from Boston carried out the first nephrotomy. The first pyelotomy was performed by Heinecke in 1879, and the first nephrolithotomy was carried out in 1881 by Le Dentu. Czerny is credited with being the first to suture a nephrotomy incision in 1887. Kummel and Bardenheuer carried out the first partial nephrectomies for stone disease in 1889. Max Brodel described the avascular area of the kidney in 1901. Lower revived interest in pyelolithotomy by suggesting that it may be a safer and easier method for removing renal stones than nephrolithotomy in 1913. Another important advance in open renal stone surgery was intrasinusally extended pyelolithotomy, pioneered by Gil-Vernet in 1965. Fitzpatrick et al from England further suggested the combination of extended pyelolithotomy with multiple radial nephrotomies for the treatment of large, complex staghorn stones (1974). On the other hand, Smith and Boyce from United States of America (USA) introduced and popularized anatrophic nephrolithotomy for the treatment of staghorn stones in 1967.[5]

With the interest in minimally invasive surgery, urologists endeavoured to develop instruments and techniques for treatment of stone disease. The first ureteroscopic procedure was performed by Hugh Hampton Young in 1912 and was later reported in 1929.[6,7] In 1977, Goodman and Lynn, et al. independently reported purposeful rigid ureteroscopy.[8] The development of the flexible ureteroscope was only possible after fiberoptics became available. In 1964, Marshall and colleagues reported the first flexible ureteroscope.[6,9] This was a 9F flexible scope with fiberoptic light transmission and imaging bundles. However, there was no method of deflecting the tip and no working channel for irrigation to provide a clear field. Dr. Marshall's associate passed this flexible ureteroscope through a 26F cystoscope into the distal ureter where a ureteral stone was visualized at 9 cm.[6] It was not until the late 1980s, when flexible, actively deflectable ureteroscopes with an irrigation channel were clinically trialed in a meaningful way. In 1989, Kavoussi and colleagues reported 76 flexible ureteroscopic procedures in 68 patients using four different models.[10] The models ranged in diameter from 9.8F to 12.3F and they were able to access the area of interest in 96% of patients. Diagnostic and therapeutic manoeuvres were successful in 84% of the patients treated, thereby demonstrating the usefulness of these instruments.[6] Further development of the flexible ureteroscope centred on reduction of diameter and larger range of deflection. In 1994, Grasso and Bagley reported their early experience with a 7.5-F diameter flexible ureteroscope with a 3.6-F working channel. Ureteral dilation was not necessary in 48% of patients, due to the ureteroscope's relative small diameter.[11]

Digital flexible ureteroscopes have also been recently developed and they have been shown by Zilberman et al to have improved resolution and colour representation, as well as 5.3 times larger image size compared with the standard fiberoptic flexible uretersocopes.[12] Other developments in the flexible ureteroscope have been the addition of a second working channel, which was demonstrated by Haberman et al to provide similar deflection characteristics to the current single-channel scope, as well as increased overall irrigation flow. [13] With this vast improvement of flexible ureteroscopic technology, there has been an expansion in indications for treatment of intrarenal diseases. The advances in the manufacturing and design of thinner calibre scopes with double active deflection and the development of the Holmium: YAG laser have extended the scope of the endourologist by allowing diagnosis as well as management of intra-renal pathologies using retrograde techniques, the retrograde intrarenal surgery.

With RIRS, a significant segment of difficult and complex cases with upper tract pathology have become routine indications for this new minimally invasive treatment.[14] RIRS can be used for the concomitant management of ureteral and renal calculi as well as for the management of lesions within the pelvi-calyceal system.

Although a breakthrough treatment modality it is associated with its own set of complications. Ureteric injury with long term development of stricture are known to occur. Although ureteric avulsion has been seen, but is rare in occurrence. Inability to progress due to hampered visibility due to haemorrhage is not uncommon. The most common complication following RIRS is pyelonephritis presenting with fever in the post-operative period. We undertook this study to assess the outcome of the procedure in day to day clinical practice.

METHODS

Our prospective, observational study was conducted in Government Medical College and Associated Hospitals, Jammu, a tertiary care hospital in Northern India. All patients within the age group of 18-60 years, presenting with renal calculi less than 2.5 cm and concomitant renal and ureteral calculi who were candidates for the procedure between November 2015 and October 2016 were included in the study population. Patient with upper ureteric calculi which could not be retrieved or fragmented ureteroscopically and were retro pulsed were also included in the study group. Elderly patients were excluded from

the study, to exclude the possibility of failed access to ureteric orifice due to prostatic enlargement.

Demographic data of all patients, indication for procedure, stone size, any variant anatomy, post-operative pain scores, period of admission, and any complication were recorded.

All patients were stented (5 Fr, 26 cm JJ stent) 3 weeks pre operatively as a day case procedure to cause passive dilatation of the ureter, making the passage of ureteric access sheath easier. Urine cultures were performed before the procedure as routinely practiced. Post procedure DJ stenting was done as routinely practiced. Stents were removed 3 weeks later as an outpatient department (OPD) procedure.

On the day of the procedure, third generation cephalosporin ceftriaxone 1 gm was administered. All patients underwent procedure under general anaesthesia.

During the procedure, the preoperatively placed stent was removed and 10.7 Fr (Cook Medical Systems, USA) ureteral access sheath was passed. Using a 7.5 Fr ureterorenoscope (Flex X2, Karl Storz, Germany), endoscopy was performed and the stone visualised. Stones were fragmented using Ho: YAG laser (VersaPulse Powersuite, Lumenis, Israel) with 200 nm fibre. All fragments were retrieved or powdered. Post-operative DJ stenting was performed. Post-operative pain scores and requirement of analgesia was noted. X-ray of kidneys, ureters, and urinary bladder (KUB) for radiopaque and ultrasonography (USG) KUB for radiolucent stones was performed 3 weeks after the procedure to assess clearance. In case of residual fragments, non-contrast computerized tomography (NCCT) KUB was performed to quantify size. Clearance was considered as residual fragments <3 mm in size.

The patients were followed up with USG KUB at 3 months and 6 months and any residual fragment or hydronephrosis indicating ureteric narrowing were noted.

Institutional ethics committee approval was taken prior to the initiation of the study. Written consent for the procedure and data collection were obtained.

A sample size of convenience was chosen. Variables was analysed using statistical package for the social sciences (SPSS) software. Socio-demographic and other basic variables was expressed in proportions. Mean±2 SD was used to express continuous variables.

RESULTS

A total of sixty two patients underwent the procedure.

Nineteen patients (31%) were in the age group of 18 to 30 years, twenty (32%) were in the age group of 31 to 45 years and twenty three (37%) were between the ages of 46 to 60 years.

The mean age of the patients undergoing the procedure was 40.33 years.

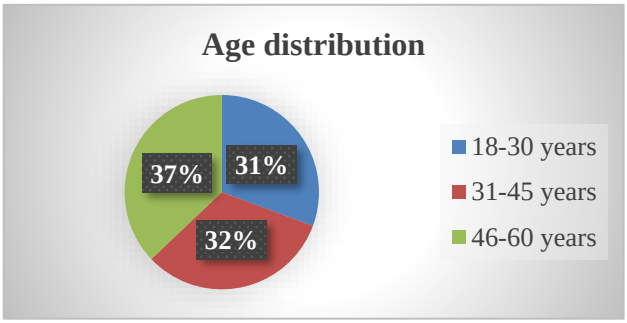

Figure 1: Age distribution of the patients incorporated in the study.

Amongst the patients in the study group thirty five (56.45%) were females and twenty seven (43.54%) were males.

The male to female ratio in the study population was 1: 1.3.

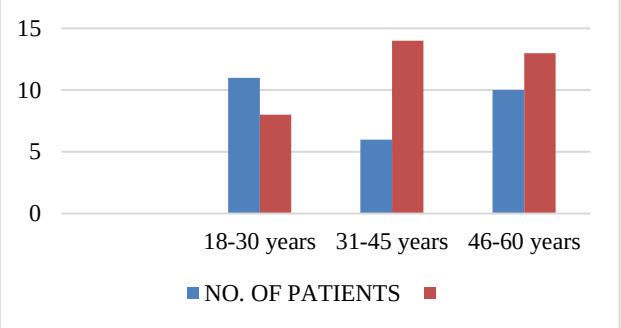

Figure 2: Age and sex distribution of the study group.

In the study group twenty one (33.9%) had comorbid conditions, namely Hypertension, type II diabetes mellitus, hypothyroidism and a combination of the above. The most common comorbid condition in the study group was hypertension, accounting for 17.74% of the group.

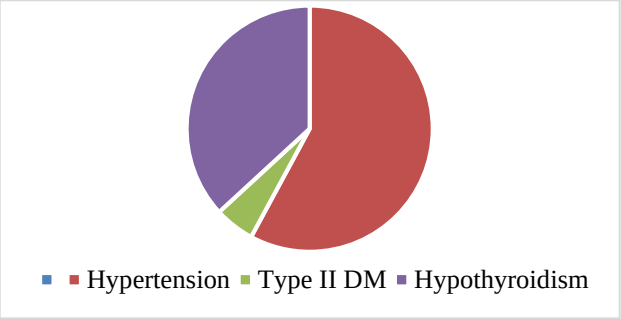

Figure 3: Distribution of the comorbid conditions in the study group.

Twenty six (41.9%) patients had ureteral stones whereas thirty six (58.1%) patients had renal stones, with eight patients (12.9%) having concomitant ureteral and renal calculi.

Amongst the patients with renal calculi, eighteen (50%) patients had calculi in the middle calyx.

One patient in the study group had a malrotated kidney which could be evaluated and cleared of the stone burden.

The mean stone size in the study population was 11.9 mm (range 7–18 mm).

The mean operative time was 35.16 minutes (range 15–55 minutes). The operative time was not only influenced by the stone size but also by the location of the stone and the presence or absence of concomitant ureteral stones.

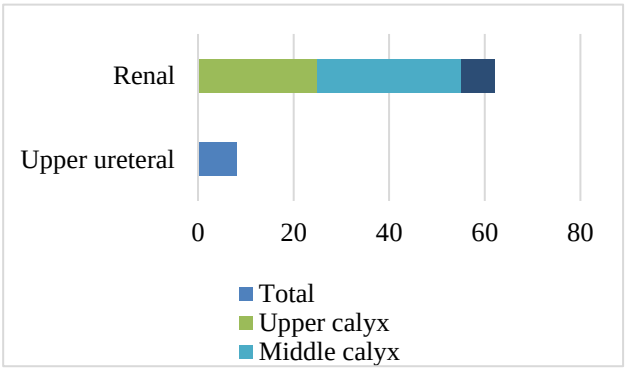

Figure 4: Distribution of calculi according to stone location.

In the study group, 87% patients were completely stone free at the end of the 1st procedure.

Four procedures were abandoned due to intra-operative haemorrhage, and had to be reattempted at a later date, following which they attained complete stone clearance.

Four (6%) patients had residual stones >4 mm on follow up requiring ESWL.

The overall stone free rate achieved was 93.54%.

The mean post-operative pain score assessed on the first postoperative day was 2.80 as measured by the visual analogue scale. As depicted in Figure 6, the postoperative pain score was not only influenced by the operative time but also by the location of the stone which required manipulation in the pelvicalyceal system and by the degree of dilatation achieved by the ureteral access sheath.

Nine (14.51%) patients developed complications during hospital stay which can be classified as grade II as per the standard Clavien-Dindo classification system. Amongst the patients developing complications, five patients (56%) developed pyelonephritis and four patients (44%) developed haemorrhage intra operatively.

There were no patients who developed ureteric injury or ureteric avulsion. There were no reported cases of renal hematoma formation or perinephric collection.

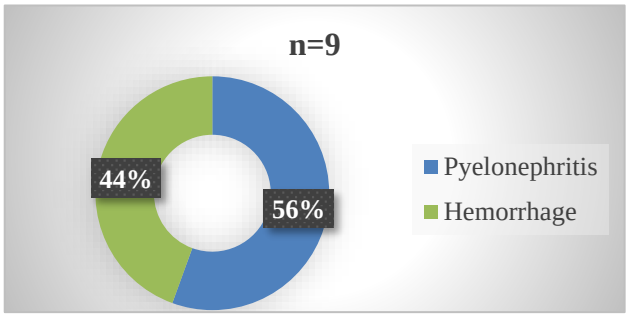

Figure 5: Pie diagram depicting the complications in the study group.

The mean post- operative hospital stay was 2.06 days (range 1–5 days).

DISCUSSION

The mean age of patients in the study was 40.33 years (SD±13.50). In the study by Stav et al the mean age was 53 years with a male to female ratio of 1.9:1, whereas in the study by Alkan et al the mean age of the patients was 41 years.[15,16]

In the present study, 62 patients had renal calculi with 8 patients having concomitant upper ureteral and renal calculi. Stav et al performed the study with a mean stone size of 9.2 mm, whereas the study by Alkan et al the mean stone size was 21 mm, with the study by Francesco et al had a mean stone size of 12.5 mm.[15-17]

The mean postoperative pain score was 2.80 (SD±0.81). Babak et al performed a study with post-operative pain score as an outcome of measure with a result of 3.1±2.7.[18]

In the present study 87.09% patients attained complete stone clearance, whereas, 4 procedures were abandoned due to intraoperative haemorrhage and 4 patients were detected to have residual stone fragments >4 mm on follow up. Of these patients, 4 patients attained stone clearance after a redo procedure whereas 2 patients underwent observant treatment and 2 patients refused for a redo procedure. The study by Alkan et al obtained an overall stone free rate of 85.1%.[16] Francesco et al performed a multicenter study in Europe and attained a stone free rate of 73.6% in the first procedure and 78.9% in the second procedure which could be attributed to assumption of stone clearance to be adequate for fragments <2 mm.[17]

The overall complication rate in the study was 14.51% with 56% of the complications attributable to Acute Pyelonephritis and 44% attributable to intraoperative

hemorrhage. Stav et al attained a complication rate of 16%, whereas Alkan et al obtained a complication rate of 14%. The study by Francesco et al had a complication rate of 15.1%. The rate of complication in the present study is thus comparable to the studies performed previously.

Our study is limited by the single center nature of study and the relatively short duration of follow up. Further, as all patients were pre-stented, the possible failures due to inadequate dilation of the ureter during index case were eliminated, which may not be the standard practice in all centers.

CONCLUSION

Retrograde intrarenal surgery is a cornerstone in the management of urolithiasis, as it is truly a minimally invasive scar-less procedure. Advances in fibreoptic and laser technology have helped it become a first line procedure for small renal calculi. There have been various studies in international institutions to evaluate its outcome in management of urolithiasis, however, there is a paucity of studies performed in tertiary care institutions in India.

Our study aimed to evaluate the role of RIRS in management of renal as well as ureteral calculi with a target to eliminate confounding factors like difficult instrumentation due to lower urinary tract obstruction and inadequate ureteral dilatation. Although similar studies have been performed in the western world, there is a dearth of data from our country. The study affirms that the procedure can be safely performed in pre-stented individuals with renal stones up to 2 cm and has good outcomes with minimal morbidity.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Kshetrimayum BS, Saitluangpuii S Understanding epidemiology and etiologic factors of urolithiasis: an overview. Science Vision. 2013;13(4).
2. Scales CD, Smith AC, Hanley JM, Saigal CS. Prevalence of kidney stones in the United States.
3. Eur Urol. 2012;62(1):160-5.
4. Stamatelou KK, Francis ME, Jones CA, Nyberg LM, Curhan GC. Time trends in reported prevalence of kidney stones in the United States: 1976-1994. Kidney Int. 2003;63(5):1817-23.
5. Trinchieri A CG KS, Jun Wu K. Epidemiology. Stone Disease. 2003;13-30.
6. Ahmet T, Fatin C. The History of Urinary Stones: In Parallel with Civilization. Scientific World J. 2013;423964.
7. Conlin MJ, Marberger M, Bagley DH. Ureteroscopy. Development and instrumentation. Urol Clin North Am. 1997;24:25-42.
8. Young HH, Mckay RW. Congenital valvular obstruction of the prostatic urethra. Surg Gynecol Obstet. 1929;48:509-35.
9. Goodman TM. Ureteroscopy with pediatric cystoscope in adults. Urology. 1977;9:394.
10. Marshall VF. Fiberoptics in urology. J Urol. 1964;91:110-4.
11. Kavoussi L, Clayman RV, Basler J. Flexible actively deflectable fiberoptic ureteronephroscopy. Urology. 1989;142:949-54.
12. Grasso M, Bagley D. A 7.5/8.2 F actively deflectable, flexible ureteroscope: A new device for both diagnostic and therapeutic upper urinary tract endoscopy Urology. 1994;43:435-41.
13. Zilberman DE, Lipkin ME, Ferrandino MN, Simmons WN, Mancini JG, Raymundo ME. The digital flexible ureteroscope: In vitro assessment of optical characteristics. J Endourol. 2011;25:519-22.
14. Haberman K, Ortiz-Alvarado O, Chotikawanich E, Monga M. A dual-channel flexible ureteroscope: Evaluation of deflection, flow, illumination, and optics. J Endourol. 2011;25:1411-4.
15. Hemal AK, Kumar R. Retrograde intrarenal surgery. Indian J Urol. 2000;16:83-7.
16. Stav K, Cooper A, Zisman A, Leibovici D, Lindner A, Siegel YI. Retrograde intrarenal lithotripsy outcome after failure of shock wave lithotripsy. J Urol. 2003;170(6):2198-201.
17. Alkan E, Arpali E, Ozkanli AO, Basar MM, Acar O, Balbay MD. RIRS is equally efficient in patients with different BMI scores. Urolithiasis. 2015;43(3):243-8.
18. Francesco B, Silvia P, Luca C, Fabrizio P, Roberto P, Hennessey D, Orietta D, Luigi S, Guido G . A prospective multicenter European study on flexible ureterorenoscopy for the management of renal stone. Int Braz J Urol. 2016;42(3):479-86.
19. Babak J, Amir HK, Mohammad MM, Anahita AJ, Saeed A. Retrograde Intrarenal Surgery Versus Shock Wave Lithotripsy for Renal Stones Smaller Than 2 cm: A Randomized Clinical Trial. Urol J. 2016;13(5):2823-8.

Cite this article as: Sharma A, Dhar T. Outcome of retrograde intrarenal surgery in the management of urolithiasis in a tertiary care centre in North India. Int Surg J 2022;9:331-5.