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Original article

Outcomes of Retrograde Intra-Renal Surgery

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ABSTRACT

Introduction: Miniaturization of endoscopic instruments has gained wide popularity in the treatment of renal calculi. Retrograde intra-renal surgery and holmium laser in combination has already proven its superiority when compared to other modalities in the treatment of renal calculi. This study was conducted to assess the outcome of retrograde intra-renal surgery in renal stone disease.

Materials and Methods: This retrospective study analyzed the outcome of retrograde intra-renal surgery in renal stone less than 2 cm size in the adults above 18 years of age from September 2018 to August 2019 at Patan Hospital, Nepal. The outcome was assessed descriptively on postoperative pain and fever, stone localization, stone size, stone clearance, urosepsis, operative time, hospital stay, mortality, need of the second procedure.

Results: A total of 62 patients underwent retrograde intrarenal surgery, out of which 48 cases were included. The mean age of the study population was 32.4± 14 years (19-68 years). Similarly, the mean operative time was 68± 12 (48-124 minutes) and mean hospital-stay was 3.2± 1.1 days. Postoperative pain and fever were observed in 14 (29.16%) & 4(8.33%) patients respectively. Hematuria occurred in 6(12.50%) and urosepsis in 2(4.16%) of the patients. Complete stone clearance was achieved in 34(70.83%) and residual stones were present in 8(16.66%) and clinically insignificant radiological fragments were present in 6(12.50%) patients.

Conclusions: Retrograde intrarenal surgery is a technically safe and effective procedure for the treatment of renal calculi, with minimal post-surgical morbidity.

Keywords: Flexible ureteroscopy; Holmium laser; Renal calculus.

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INTRODUCTION

With the advent of newer technologies and miniaturization of the endoscopic instrument along with different energy sources, the treatment of renal stones has changed significantly in recent years. The prevalence of stone disease has been reported as 2.8% in the USA, 1.5% in Europe and 14.8% in other countries.[1,2] Unlike in the past years when open surgeries were the mainstay for removal of kidney stone, less invasive surgical methods are now frequently used, including percutaneous nephrolithotomy, extracorporeal shock wave lithotripsy (ESWL), and retrograde intrarenal surgery (RIRS).[3]

Every treating urologist aims to achieve maximum stone-free status with minimal complications at the end of surgery. The choice among renal stone treatments depends on the size, and location of the stone, preference, and experience of the surgeon.[4] Development of various caliber flexible ureteroscope with its deflecting angle at the tip with a better optical system renders easy access to all the pelvicalyceal stone treatment[5]. However its long learning curve, expensive and delicate equipment and increase cost for the patients still remain a challenge for the treating surgeon. In this study, we aim to analyze the outcome of RIRS in the treatment of renal stone disease.

MATERIALS AND METHODS

This retrospective cross-sectional study was conducted at Patan Hospital, Patan Academy of Health Sciences, Lalitpur, Kathmandu, Nepal, from September 2018 to August 2019. Presented Double- J (DJ) stent placed 2 weeks earlier of RIRS) adult patients with renal stone size less than 2 cm who underwent RIRS were included. Patients whose case files couldn't be retrieved were not analyzed.

At Patan Hospital RIRS is done with a standard technique under general anesthesia. Prophylactic antibiotics (inj. Amikacin & ceftriaxone) are routinely given. In lithotomy position, removal of DJ stent followed by routine semi-rigid ureteroscopy is done. A 0.035-inch tip hydrophilic glide wire is passed through ipsilateral ureteric orifice upwards and ureteral access sheath of 10/12 Fr or 12/14 Fr is railroaded up to proximal ureter under C-arm guidance. A flexible ureteroscope is introduced via access sheath up to the renal pelvicalyceal system (PCS) and renal calculi are localized. Laser fiber of 200 µm or 365 µm connected to 100 watt Holmium laser machine is passed via a flexible ureteroscope to fragment the stones. The energy level of 0.4–1.5 J and a rate of 10-20 Hz is used for stone. At the end of the procedure, the flexible ureterorenoscopy is pulled out under visualization while the ureter is observed so that no possible injury is missed. Depending on the stone fragment size, dormia basket and other ancillary devices are used to retrieve stones out. At the completion of the procedure, C-arm is used to visualize residual stones, if any.

After removal of ureteral access sheath, DJ stent is placed routinely in all the patients, to assist the passage of small stones or clinically insignificant radiological fragments (CIRF), to assist ureteral edema to resolve and to minimize the probability of ureteral stricture development. The DJ stent is removed at four weeks after surgery when X-ray of kidney ureter bladder (KUB) or CT KUB reveals CIRF or no significant residual stones or complete stone clearance.

Clinically insignificant radiological fragments 'CIRF' is defined as a stone fragment size of less than 4 mm seen in X-ray KUB or CT KUB. A stone fragment size of larger than 4 mm is considered as residual stones. Complete stone clearance is defined as an absence of radio-opaque shadow in the renal area on X-ray KUB or CT KUB in the 4th week of surgery.

Operation room register was used to obtain the patient file numbers. Data were collected from the patient's files kept in the hospital record section. The variables analyzed were age, gender, renal stone location and stone clearance, laterality, stone size, operative time, hematuria, postoperative pain & fever, urosepsis, hospital stay, residual stones and need of an adjunctive procedure to achieve residual stone clearance.

Sepsis was defined as postoperative fever (temperature more than 38^{o}C or less than 36^{o}C), pulse more than 100/minute, the respiratory rate more than 20/minute, total leukocyte count more than 12000/mm^3 or less than 4000/mm^3. Outcome of RIRS was assessed by stone clearance, perioperative complications, residual stones, hospital stay and mortality. The SPSS version 22.0 was used for descriptive data analysis.

RESULTS

A total of 62 patients underwent RIRS, out of which only 48 cases (file retrieved) were included and analyzed. The mean age of the patient was 32.4± 14 years (19-68 years) with 26 male (54.16%) and 22 female (45.84%) patients. The mean stone diameter was 8.2 ± 4 (7–20) mm and the mean operation time and mean hospital stay was 68± 12 (48-124) minutes and 3.2± 1.1 days respectively (Table 1).

Table 1: Demographic and clinical data

Variables		No. of cases (%)	Mean ± SD range
Age			32.4± 14 (19-68 years)
Sex	Male	26(54.16%)	
	Female	22(45.84%)	
Laterality	Right	16(33.33%)	
	Left	24(50.0%)	
	Bilateral	8(16.66%)	
Stone size			8.2± 4 (7-20mm)
Stone Location	Pelvis	8(16.66%)	
	Lower calyx	4(8.33%)	
	Middle calyx	12(25.0%)	
	Upper calyx	24(50.0%)	

Analysis of perioperative parameters (Table 2) viz; Postoperative flank pain was present in 14 (29.16%) patients, postoperative fever was observed in 4 (8.33%) patients, hematuria occurred in 6(12.50%) patients and in 2(4.16%) patients urosepsis occurred. Complete stone clearance was seen in 34(70.83%), residual stones in 8(16.66%) and CIRF in 6(12.50%) on X-ray KUB, at one month of surgery. No intraoperative complications were seen in any of the patients. There was no mortality among the study population.

Table 2: Perioperative outcomes of the pateient undergoing RIRS

Variables		No. of cases (%)	Mean ± SD ranges
Operative time			68± 12 (48-124 minutes)
Hospital stay			3.2± 1.1 days
Stone clearance		34(70.83%)	
CIRF		6 (12.50%)	
Residual stones		8 (16.66%)	
Postoperative complications	Flank pain	14(29.16%)	
	Fever	4(8.33)	
	Hematuria	6(12.5%)	
	Urosepsis	2(4.16%)	

Out of 8 patients with residual stones, 6 patients opted to undergo the second session RIRS and they achieved complete stone clearance. The other 2 patients denied for second session RIRS and opted for conservative measures.

The success rate of RIRS according to the site of stone in the kidney is shown in table 3. The overall complete stone clearance

Table 3: Success rate according to stone location

	Complete clearance (%)	CIRF (%)	Residual stone (%)	Total (%)
Renal pelvis	4(50%)	2(25%)	2(25%)	8
Lower calyx	1(25%)	1(25%)	2(50%)	4
Middle calyx	8(66.66%)	2(16.66%)	2(16.66%)	12
Upper calyx	21(87.50%)	1(4.16%)	2(8.33%)	24
Total (%)	34(70.83)	6(12.50%)	8(16.66%)	48(100%)

rate was 70.83% (34/48 cases). Complete stone clearance is noted among patients with stones located at the upper calyx (n=21; 87.50%) followed by middle calyx (n=8; 66.66%).

DISCUSSION

Nowadays, RIRS is considered as a primary procedure in the treatment of stone size less than 2 cm, owing to the technical advancement of flexible ureteroscope and its size, the degree of deflection and the quality of fibre optics.[6] RIRS has been reported as an effective and definitive therapeutic option for renal stones.[7,8] It has been shown to achieve high stone-free rate (SFR) with a low rate of complications compared.[7]

The mean operation time and mean hospital stay was 68 ± 12 (48-124) minutes and 3.2 ± 1.1 days respectively. This was comparable to a study done by Elbir et al[9], where the median operative time was 62.5 (40-180 min) and hospitalization of 26.4 (12-120) hours. Relatively longer hospital stay seen in our study was probably because of the tendency to overstay at the hospital by our patients even after discharge order, owing to fear of any untoward complication that may happen back home. In terms of operative time, our finding was comparable to the study of other authors[9]. which obviously is a benefit of RIRS for treating stones less than 20 mm.[10] In the study of Binbay et al.[10], a significant decrease in surgical time has been demonstrated. With further experience, we believe we do achieve shorter operative time with a better outcome in the days to come.

Location, size of renal stones and surgeon expertise usually decide treatment modality. In their study of RIRS for stone size less than 2 cm, Ho CCK et al[6] found a significantly higher success rate of 75% clearance of stone. Elbir et al[9] in their study found complete stone-free rates of 67.8%, while in 10.7% patients clinically insignificant residual stones were detected compared to our study where the mean stone diameter was 8.2 +/- 4 (7-20mm) with a stone clearance of 70.83% and 12.50 % of CIRF. We acknowledge that the relatively better stone clearance rate in our study was probably due to the selection of upper and middle calyx solitary stone at our initial phase of career to built expertise in RIRS.

Distribution of success rates according to the location of stones was detected as follows: lower pole 25%; middle pole, 66.66%; upper pole, 87.50%, comparable to study done by Elbir et al.[9] Similarly, Zilberman et al[11] reported only 19% clearance of lower calyx stone with first session RIRS. Lower calyx stones are believed to be more difficult to tackle compared to stone located to other regions because of technical difficulty to access them hence stone-free clearance rate decreases.

We had 16.66% of the case with bilateral renal calculi addressed with RIRS successfully during the same setting. Only a few studies have examined the safety and efficacy of RIRS in treating bilateral renal stones. In 2005, Chon et al. first reported the efficacy of simultaneous bilateral RIRS.[12] In another study by the same investigators assessed the outcomes of simultaneous bilateral RIRS and observed no major complications.[13] Bilateral single-session RIRS can be performed safely and effectively with a high success and low complication rate in patients with bilateral renal stones.

The potential infections should be treated with appropriate antibiotics, and the procedure should be conducted after sterilization of urine[14]. In our study, all patients received appropriate antibiotic prophylaxis. However, postoperative fever and urosepsis were noted with overall complications of 12.5% which was completely treated with antibiotics, analgesics and antipyretics. Fan S et al[15] in their study found complications of around 8-10 percent. Similarly, Castro et al found an overall complication rate after RIRS about 9% to 25 percent.[16,17] Usually, serious complications are not frequently seen following retrograde intrarenal surgery. Complication following RIRS is similar to those seen in with other endourological interventions.

In this regard, we would like to mention one of our patients, who had persistent flank pain and fever during the postoperative period. Ultrasound of the abdomen demonstrated perinephric collection, which was successfully treated with percutaneous nephrostomy (pigtail drainage). The perinephric collection usually occurs, if irrigation fluid is under high pressure or if there are pelvicalyceal injuries that cause fluid/urine to extravasate.

The limitations of this study include its retrospective nature and the small sample size from a single center. It may contain unavoidable institutional bias. A randomized study with a large sample size with a longer follow-up would be much more desirable.

CONCLUSIONS

RIRS is a technically effective procedure in the treatment of renal stone disease. Maximum stone clearance, shorter operative time with decrease hospital stay is possible in properly selected patients. This study shows that RIRS is safe and applicable to our general population with minimal morbidity. There was no mortality.

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