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SAFETY AND EFFICACY OF SEMI-RIGID URETEROSCOPE IN RETROGRADE INTRARENAL SURGERY FOR RENAL PELVIC STONES UPTO 2 CM

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ABSTRACT

Objectives: *To determine the efficacy and safety of RIRS with rigid URS for renal pelvis stone between 1 to 2cm.*

Materials and Methods: *This is a prospective observational case series of 48 patients who under RIRS at Institute of Kidney Diseases, Peshawar during 1st January 2022 and 31st December 2022. The primary indication was single renal pelvic calculi of up to 2 cm diameter in patients with previously failed treatment modalities or as primary cases. Data was analysed regarding patient demographics, stone size, surgery time, complications and clearance rates within a 2 months follow-up period.*

Results: *Total of Forty-eight patients with 29 (60.4%) males and 19 (39.6%) females in a ratio of 1.5 to 1. The mean age was 38.7 ± 10.8 years (range: 19 – 60 years). Mean stone diameter was 15.3 ± 2.6 mm. Early postoperative complications included fever, haematuria and retained stones. There were 12 (25%) cases of postoperative fever who resolved without any major sequelae, and 11 (22.9%) cases of early postoperative haematuria of which 4 (8.3%) patients received blood transfusions. The overall clearance rate after first RIRS was 87.5% (n = 42) with a P value of 0.01 and is clinically significant. Six (12.5%) patients were found to have stone fragments retained. The clearance rate after 2nd look RIRS was 95.83% (n = 46).*

Conclusion: *Retrograde intrarenal surgery using semi-rigid ureteroscope for renal pelvic stones has favourable stone free rates and the results are comparable to percutaneous nephrolithotripsy. Complications requiring intervention are below ten percent and are non-fatal.*

Key words: *Urolithiasis, retrograde intrarenal surgery, semi-rigid ureteroscopy*

INTRODUCTION

Retrograde intrarenal surgery (RIRS) has witnessed tremendous technological improvements during the last two decades due to the introduction of semi-rigid and flexible ureteroscopes. Initially it was primarily a diagnostic modality because the working channels were not suitable for therapeutic intervention. The recent introduction of new generation semi-rigid ureteroscopes with improved optics, hydrophilic coated sheaths, effective irrigation pumps have broadened the range of possibilities in endourological approach to stones in upper urinary tract[1].

Currently, the gold standard for mid to large kidney stones is percutaneous nephrolithotomy (PCNL)[2,3]. The European Association of Urology (EAU) guidelines indicate the use of shockwave lithotripsy (SWL) for stones <20 mm. Disadvantages of PCNL are its invasiveness with postoperative morbidity due to bleeding, difficulty in obese individuals, fever, urinary leak, pleural and bowel injury and rarely sepsis. Weaknesses of SWL include its variable success rate (75% to 95%) which is dependent

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on many factors, ranging from stone characteristics to local renal tract anatomy. Further SWL requires multiple session to fragment the stones[4,5].

In light of the weaknesses of PCNL and SWL, it is imperative to keep RIRS in the list of available modalities of treatment for mid to larger size upper renal tract calculi[6,7]. Currently, there are no standardised indications for RIRS, however, the list of possible and currently practiced indications is long and is continuing to grow[4,8]. Patients with midsized stones who are not suitable for SWL or PCNL and those who have failed previous SWL or PCNL are the best candidates for RIRS[9].

Keeping in view the rather limited number of scientific reports for RIRS in upper renal tract calculi, we undertook this study to document the role this minimally invasive procedure can play in the treatment of these patients. It will be a step forward in understanding the benefits and weaknesses of this procedure and broaden our knowledge base, hence improving patient outcomes.

MATERIALS AND METHODS

Patients who underwent RIRS procedure between 1st January 2022 and 31st december 2022 at Institute of Kidney Diseases, Peshawar for renal pelvic stones between 10 and 20 mm dimension were included in this study and were followed-up prospectively for upto two months postoperatively. An informed consent was obtained before the procedure according to the declaration of Helsinki and approval for the study was obtained from the hospital ethical committee before commencement. Patients between age 18 and 65 years from both genders with renal pelvic stones between 10 mm and 20 mm irrespective of past history of surgical or non-surgical therapies for renal stones. Patients with multiple stones, renal failure, coagulopathy, decompensated cardiac disease or patients who wished to pursue other modalities of renal stone treatment were excluded.

All patients were admitted from the outpatient department (OPD) after detailed history and examination. We measured the stone size using ultrasound and x-ray KUB. The stone was measured in its largest dimension. CT KUB was performed along with all baseline investigations such as compete blood picture, urinalysis, and urine culture (in case of UTI). All patients underwent the procedure under general anaesthesia.

Consultant urological surgeons performed all procedures. Periprocedural broad-spectrum antibiotics (Cefoperazone plus sulbactam 2 g i.v.) were administered to all patients. After induction of general anaesthesia, the patient was placed in lithotomy position. Cystoscopy was performed at the outset. Ureteroscopy using a 6.5-8.5 F semi-rigid ureteroscope (Richard Wolf, Germany) was done after cystoscopy. After ureteric orifice dilation a retrograde pyelogram under fluoroscopy was performed. This was followed by insertion of a safety guidewire under fluoroscopic guidance using a ureteral access catheter (12/16 F). Ureteral access catheter placement improves visualisation and also facilitate stone fragment extraction. This was followed by insertion of the semi-rigid ureteroscope. The stones were fragmented using the Swiss lithoclast. After insertion of a COOK guidewire under fluoroscopy through the ureteroscope up to the renal pelvis, a hydrophilic sheath (9.5/11.5 F or 12/14 F) was inserted up to the pelviureteric junction (PUJ). The sheath was used to facilitate stone fragment extraction using tri-radiate forceps. The scope was negotiated up to the renal pelvis which was followed by removal of the guidewire. Continuous irrigation was used to keep the surgical field clear.

Semi-rigid ureteroscope was used to inspect the pelvicaliceal system and to ensure complete stone removal. This was followed by fluoroscopic examination with injection of contrast in a retrograde fashion and insertion of a ureteral double-J stent (6.0 Fr DJ stent; Cook Medical, USA) to facilitate fragment expulsion.Postoperatively, all patients were given broad-spectrum antibiotics (Cefoperazone plus sulbactam 2 g i.v. bid) for three doses. Postoperatively, intravenous paracetamol infusion (1000 mg i.v. qid) was used to provide background analgesia and breakthrough pain was treated with intravenous tramadol (100 mg i.v. bid). At the time of discharge i.v. antibiotics were switched to oral (ciprofloxacin 500 mg bid) and oral paracetamol 1 g qid for pain relief plus SOS use of tablet tramadol 50 mg (up to qid) for pain not relieved with paracetamol alone. Patients were followed-up weekly for first 2 weeks and then biweekly for up to two month. The DJ stent was removed at first follow-up after radiological assessment for retained stones with x-ray KUB,

non-enhanced CT and ultrasound of renal tract. Stone clearance was defined as no detectable calculi by any radiological investigations. Patients who were found to have left over stone fragments were listed for repeat RIRS and were followed-up as the rest. Data was collected about patient demographics, past history of therapeutic procedures for renal stones, stone size and burden, baseline investigation, change in haemoglobin concentration, procedure length, length of stay (LOS), time for return to work (TRW) and complications.Data was entered and analysed using SPSS version 22.0. Univariate and multivariate analyses were performed to determine the significance of association between patient demographics, stone characteristics and laboratory findings for stone clearance rates, procedure times and complications.

RESULT

Total of Forty-eight patients with 29 (60.4%) males and 19 (39.6%) females in a ratio of 1.5 to 1. The mean age was 38.7 ± 10.8 years (range: 19 – 60 years). Mean stone diameter was 15.3 ± 2.6 mm (range: 10 – 20 mm). Four (8.3%) patients with previous history of PCNL and 10 (20.8%) patients, who had a history of SWL were treated through the same procedure. Grade 1 hydronephrosis was the most common (n = 26, 54.2%). The mean pre-operative haemoglobin level was 11.9 ± 0.86 mg/dL (range: 10.5 – 13.9 mg/dL). The mean procedure length was 79.5 ± 8.1 minutes (range: 65 – 95 minutes).Mean postoperative haemoglobin level was 11.4 ± 1.2 mg/dL (range: 9.0 – 13.4 mg/dL). The mean paracetamol dose during postoperative period was 3197 ± 552 mg and mean tramadol dose was 146.8 ± 95.3 mg.Early postoperative complications included fever, haematuria and retained stones. There were 12 (25%) cases of postoperative fever who resolved without any major sequelae, and 11 (22.9%) cases of early postoperative haematuria. Out of the 11 patients who experienced significant haematuria, 4 (8.3%) patients received blood transfusions postoperatively.The overall clearance rate after first RIRS was 87.5% (n = 42) with a P value of 0.01 and is clinically significant. Six (12.5%) patients were found to have stone fragments retained within their urinary tracts when they were evaluated at first week postoperatively. All of these patients were admitted for a second look RIRS. Of those six patients who underwent a second look procedure, two (4.2%) patients were again found with residual stones (1 in lower calyx on right side and 1 at pelviureteric junction). One of the patient later underwent PCNL while the other one passed the stone spontaneously within 1 month (9 mm). The clearance rate after 2nd look RIRS was 95.83% (n = 46). Table 1Late complications, which were reported during the first two week follow-up included stent dysuria (n = 7, 14.6%) and significant flank pain (n = 9, 18.8%). Both of these complaints gradually resolved after removal of the DJ stents. The mean LOS was 2.1 ± 0.8 days (range: 1 – 5 days) while mean time until return to work was 3.4 ± 1.0 days. Chi-square analysis showed that patients with single and smaller stones (≤ 15 mm) as well as those with lower stone burdens (≤ 80 mm) were more likely for high clearance rates after RIRS, early discharge (≤ 2 days) and early return to work (≤ 3 days).

DISCUSSION

PCNL was the only procedure as a minimally invasive surgical procedure for upper renal tract stones before the introduction of RIRS,. Huffman et al[10] performed first renal pelvic stone removal, using a rigid ureteroscope, in 1983. Later, Grasso et al[11] showed that ureteroscopic removal of stone is feasible for severely ill or obese patients, where

Table 1: Comparative frequency distribution of patients according to stone free rates after first and second sitting of retrograde intrarenal surgery

Variable	Stone free rates		P value
	After first sitting (n = 42)	After second sitting (n = 4)	
Age (years)	38.2 ± 11.16	43.5 ± 7.2	0.45
Gender			
Male	25 (59.5%)	4 (100%)	0.73
Female	17 (40.5%)	-	
Previous surgery	4 (9.5%)	-	0.43
Previous SWL	8 (19%)	2 (50%)	0.42
Stone size			
≤ 15 mm	20 (47.6%)	3 (75%)	0.38
> 15 mm	22 (52.4%)	1 (25%)	
Hydronephrosis grade			
Grade 1 – 2	33 (47.6%)	3 (75%)	0.52
Grade 3 – 4	9 (21.4%)	1 (25%)	
Procedure time			
≤ 80 min	27 (64.3%)	-	0.15
> 80 min	15 (35.7%)	4 (100%)	

performing PCNL is risky or contraindicated. Others have recommended that if PCNL is not possible or contraindicated, then ureteroscopic removal of stones can be supplemented with SWL to remove stones from upper urinary tract[1,12,13].

Stone fragmentation can be improved with the use of several different techniques, in order to improve immediate clearance after RIRS. Most of the time during RIRS is consumed by fragmentation of stones in the lower or middle renal calyces. If the stone is repositioned in the upper calyx early during visualisation, it will cut the time spent in fragmenting large and difficulty location stones[3,4,5]. This may lessen strain on the semi-rigid ureteroscope and improve manoeuvrability. During the fragmentation process, it is very much important to continue irrigation, so that fragments and stone dust is washed away promptly[6,14]. Many authors have compared RIRS to PCNL and favoured the high clearance rate plus lower postoperative morbidity of RIRS[9,12,15]. In a retrospective study by Sofer and associates[16], analysis of RIRS was performed and they reported a clearance rate of 84% for upper pelvicaliceal stones. Similarly, Grasso and co-workers[17] analysed their results in the treatment of stones larger than 2 cm and reported a stone free rate of 93% for intrarenal stones and 100% clearance rate for upper ureteric calculi. In another retrospective review of RIRS by Ricchiuti et al[18] showed a clearance rate of 74%. The interesting point in this study was that they analysed the results for patients who were selected for RIRS because they were unfit for PCNL due to several different reasons (obesity, anatomical problems, previous PCNL failure, comorbids)[18]. These authors showed 74% clearance rate for lower pole intrarenal stones while 83% stone clearance rate for stones in locations other than the lower pole. They also showed that stone free rate is directly proportional to the stone size in millimetres. Another similar study by Hafron and associates[19] showed results on the basis of stone size and the total stone burden. They showed an overall stone free rate of 77%. In a prospective series of 30 cases, Prabhakar M4 has shown a clearance rate of 86.6% after the first sitting while overall 100% clearance rate using a flexible ureteroscope. They showed that all of their patients were discharged within 24 hours of the surgery and nearly 97% of them resumed their daily activities at the third postoperative day. No major complication was reported[4].

In our study, the stone free rate after initial sitting was more than 87% while overall stone free rate was more than 95%. This is in agreement with most of the above-mentioned studies. A study by Lee et al[20] have shown that stone free rate is affected by the size of the stone. Takazawa et al[21] also reported similar findings in a study involving patients with stones greater than 2 cm. They reported 100% stone free rate for stones 2-4 cm and 67% for stones > 4 cm in size. Our findings are in agreement with the above study, where we observed that the number, size and overall stone burden affect stone free rate. Resorlu and associates[22] have proposed a scoring system where depending on preoperative stone parameters, the stone free rate can be predicted. According to Takazawa et al[21], stone size is more predictive of a staged RIRS against a failed RIRS while Lee et al in agreement with Resorlu et al[22] and Ito et al[23] have reported that stone number (single vs multiple) is a possible predictor of a good stone free rate.The overall complication rates for RIRS are in the range of 5% – 10%. In our series, we observed haematuria requiring transfusion in 8.3% (n = 4) and stone retention in up to 12% of patients after the initial sitting. Other minor complications such as dysuria or flank pain associated with a DJ stent is spontaneously resolved once the stent was removed.

Further research is still required in the form of large, multicentre randomised controlled trials to illuminate the true role of RIRS in the management of upper renal tract calculi and to standardize this procedure and its indications so that it can be used for the betterment of patients.

CONCLUSION

Retrograde intrarenal surgery for renal pelvic stones using semi-rigid ureteroscope has a favourable stone free rate and the results are comparable to percutaneous nephrolithotripsy. It is suggested to be included in the armamentarium of an endourologist for the management of calculi in the upper urinary tract.

REFERENCES

1. Cho SY. Current status of flexible ureteroscopy in urology. Korean J Urol. 2015;56(10):680-8.
2. Aboumarzouk OM, Somani B, Monga M. Safety and efficacy of ureteroscopic lithotripsy for stone disease

in obese patients: a systematic review of the literature. BJU Int. 2012;110(8 Pt B):E374-80.

3. Zengin K, Tanik S, Karakoyunlu N, Sener NC, Albayrak S, Tuygun C, et al. Retrograde intrarenal surgery versus percutaneous lithotripsy to treat renal stones 2-3 cm in diameter. Biomed Res Int. 2015;2015:914231.
4. Prabhakar M. Retrograde ureteroscopic intrarenal surgery for large (1.6-3.5 cm) upper ureteric/renal calculus. Indian J Urol. 2010;26(1):46-9.
5. Mi Y, Ren K, Pan H, Zhu L, Wu S, You X, et al. Flexible ureterorenoscopy (F-URS) with holmium laser versus extracorporeal shock wave lithotripsy (ESWL) for treatment of renal stone <2 cm: a meta-analysis. Urolithiasis. 2016;44(4):353-65.
6. Lai D, Chen M, He Y, Li X. Simultaneous retrograde intrarenal surgery for ipsilateral asymptomatic renal stones in patients with ureteroscopic symptomatic ureteral stone removal. BMC Urol. 2015;15:22.
7. Karakoc O, Karakeci A, Ozan T, Firdolas F, Tektas C, Ozkaratas SE, et al. Comparison of retrograde intrarenal surgery and percutaneous nephrolithotomy for the treatment of renal stones greater than 2 cm. Turk J Urol. 2015;41(2):73-7.
8. Giusti G, Proietti S, Luciani LG, Peschechera R, Giannantoni A, Taverna G, et al. Is retrograde intrarenal surgery for the treatment of renal stones with diameters exceeding 2 cm still a hazard? Can J Urol. 2014;21(2):7207-12.
9. Donaldson JF, Lardas M, Scrimgeour D, Stewart F, Maclennan S, Lam TB, et al. Systematic review and meta-analysis of the clinical effectiveness of shock wave lithotripsy, retrograde intrarenal surgery, and percutaneous nephrolithotomy for lower-pole renal stones. Eur Urol. 2015;67(4):612-6.
10. Huffman JL, Bagley DH, Lyon ES. Extending cystoscopic techniques into the ureter and renal pelvis. Experience with ureteroscopy and pyeloscopy. JAMA. 1983;250(15):2002-5.
11. Grasso M, Conlin M, Bagley D. Retrograde ureteropyeloscopic treatment of 2 cm. or greater upper urinary tract and minor Staghorn calculi. J Urol. 1998;160(2):346-51.
12. Goldberg H, Holland R, Tal R, Lask DM, Livne PM, Lifshitz DA. The impact of retrograde intrarenal surgery for asymptomatic renal stones in patients undergoing ureteroscopy for a symptomatic ureteral stone. J Endourol. 2013;27(8):970-3.
13. Cocuzza M, Colombo JR, Jr., Ganpule A, Turna B, Cocuzza A, Dhawan D, et al. Combined retrograde flexible ureteroscopic lithotripsy with holmium YAG laser for renal calculi associated with ipsilateral ureteral stones. J Endourol. 2009;23(2):253-7.
14. Akman T, Binbay M, Ozgor F, Ugurlu M, Tekinarslan E, Kezer C, et al. Comparison of percutaneous nephrolithotomy and retrograde flexible nephrolithotripsy for the management of 2-4 cm stones: a matched-pair analysis. BJU Int. 2012;109(9):1384-9.
15. Bryniarski P, Paradysz A, Zyczkowski M, Kupilas A, Nowakowski K, Bogacki R. A randomized controlled study to analyze the safety and efficacy of percutaneous nephrolithotripsy and retrograde intrarenal surgery in the management of renal stones more than 2 cm in diameter. J Endourol. 2012;26(1):52-7.
16. Sofer M, Watterson JD, Wollin TA, Nott L, Razvi H, Denstedt JD. Holmium:YAG laser lithotripsy for upper urinary tract calculi in 598 patients. J Urol. 2002;167(1):31-4.
17. Grasso M. Experience with the holmium laser as an endoscopic lithotrite. Urology. 1996;48(2):199-206.
18. Ricchiuti DJ, Smaldone MC, Jacobs BL, Smaldone AM, Jackman SV, Averch TD. Staged retrograde endoscopic lithotripsy as alternative to PCNL in select patients with large renal calculi. J Endourol. 2007;21(12):1421-4.
19. Hafron J, Fogarty JD, Boczko J, Hoenig DM. Combined ureterorenoscopy and shockwave lithotripsy for large renal stone burden: an alternative to percutaneous nephrolithotomy? J Endourol. 2005;19(4):464-8.
20. Lee SH, Kim T-H, Myung SC, Moon YT, Kim KD, Kim JH, et al. Effectiveness of Flexible Ureteroscopic Stone Removal for Treating Ureteral and Ipsilateral Renal Stones: A Single-Center Experience. Korean J Urol. 2013;54(6):377-82.
21. Takazawa R, Kitayama S, Tsujii T. Appropriate kidney stone size for ureteroscopic lithotripsy: When to switch to a percutaneous approach. World J Nephrol. 2015;4(1):111-7.
22. Resorlu B, Unsal A, Gulec H, Oztuna D. A new scoring system for predicting stone-free rate after retrograde intrarenal surgery: the "resorlu-unsal stone score". Urology. 2012;80(3):512-8.
23. Ito H, Kawahara T, Terao H, Ogawa T, Yao M, Kubota Y, et al. The most reliable preoperative assessment of renal stone burden as a predictor of stone-free status after flexible ureteroscopy with holmium laser lithotripsy: a single-center experience. Urology. 2012;80(3):524-8.