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Original Research Article

Retrograde intrarenal surgery vs mini percutaneous nephrolithotripsy for lower pole stones less than 2cm

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Abstract

Aim: To assess the efficacy of retrograde intrarenal surgery (RIRS) in lower pole stones less than 2cm as compared to mini percutaneous nephrolithotripsy (mPCNL)

Materials and Methods: Between Jan 2013 and April 2016, 172 patients who had renal stones ranging from 7mm to 2 cm in lower pole were alternatively allotted to be treated with RIRS and mPCNL. Stone free status, post operative complications, Operative time and Hospitalisation were analysed in both groups. Stone free rate was defined as residual calculi less than 3mm on ultrasound scan.

Results: Both the groups were matched in mean age, sex, stone laterality and stone size. In mPCNL group the stone free status was 93.02% compared to 95.34% in RIRS. Bleeding requiring blood transfusion was observed in 1.16% mPCNL group compared to none in RIRS group.

Conclusion: RIRS is safe and comparable to mPCNL in lower pole stones less than 2cm.

Keywords: Retrograde intrarenal surgery, mini percutaneous lithotripsy, lower pole stone.

1. Introduction

Lower pole renal calculi are one of the challenging cases to manage in urological practice. [1] Treatment options vary from extra corporeal shock wave lithotripsy (ESWL) to retrograde intrarenal surgery (RIRS).[2] Percutaneous nephrolithotripsy (PCNL) has got better stone free rates, but there are several disadvantages associated with it such as invasiveness, bleeding, adjacent organ injury, partial renal loss, urinary extravasation and long hospitalisation. [3, 4] Majority of the complications associated with PCNL including bleeding, infundibular and calyceal tear, nephron loss and persistent urine leak can be attributed to the size of the tract.[5,6] Now, with the advent of smaller sheaths it has been found that mini-PCNL or "mini-perc" (mPCNL) can be performed with minimal damage to renal parenchyma, thereby reducing the procedure related morbidity without compromising its efficacy.[6,7] But no matter what form of PCNL is undertaken, there is still some amount of renal parenchyma damage with it.

With the advancement of technology introduction of flexible ureteroscope was a boon for treatment of renal calculi. More and more urologists now turn towards flexible ureteroscopy for managing renal calculi because of its non invasive nature and less morbidity. Advancement in flexible ureteroscopy has now enabled unrestricted access to calculi at virtually all locations in the urinary tract.[8] Studies have shown better efficacy of RIRS in lower pole stone.[9]

In this study our aim was to compare the efficacy of mPCNL and RIRS for lower pole stone of 7mm -2 cm in size.

2. Materials and Methods

This was a prospective study of all patients who underwent mPCNL and RIRS for solitary lower pole stone of less than 2 cm at our institute between January 2013 and April 2016. Patients with stone size less than 7 mm and more than 2 cm were excluded from the study. Also, patients with anomalous kidney, solitary kidney, who have undergone previous renal surgery, ureteral stricture, coagulopathies and who did not give consent were excluded.

Patients who gave consent to be included in the study were alternatively assigned to undergo either RIRS or mPCNL.

A total of 172 patients underwent either RIRS or mPCNL for solitary lower pole stone less than 2 cm during the study period. They were alternatively allotted mPCNL and RIRS. As a result 86 underwent mPCNL and remaining 86 RIRS.

The detailed history of all patients was recorded. Apart from routine haematological investigations, all patients were evaluated with X-ray KUB (kidney, ureter and bladder), Ultrasonography (USG), and computed tomography (CT), to determine the exact size, number and location of the renal stones.

Stone size was assessed as the longest axis of the stone.

The parameters like the size, number and location of the stones as well as age, gender, need for blood transfusion, complication rates, post-operative pain, postoperative hospital stay, stone clearance and need for auxiliary procedures were compared for in both the groups.

All patients underwent X-ray KUB and ultrasound abdomen to evaluate the presence of residual stones at one month post operatively.

2.1 mPCNL Technique

Mini-PCNL was performed after cystoscopically placing 5Fr ureteric catheter in the affected side ureter and patient was catheterized. Single puncture was done in prone position with fluoroscopic imaging and serially dilated with 12Fr and 14Fr dilators to place a 15Fr sheath. 14Fr nephroscope (Richard Wolf, Germany) with 12 degree angle was used to visualize the stones, which were dusted using 100W Holmium laser system (VersaPulse Power Suite, Lumenis) employing 365 micron end-firing fibre to deliver the laser energy. Fragments were removed with two-pronged forceps. 5Fr DJ stent was placed after removing the ureteric catheter, and 12Fr nephrostomy tube was placed. On the first post-op day, patients underwent X-ray KUB to document the stent and the tube, following which the nephrostomy tube was removed. Foley's catheter was removed on second or third post-op day, after the nephrostomy site became dry, and discharged.

2.3 RIRS Technique

RIRS was performed using 6-8.8Fr flexible ureteroscope (Viper, Richard Wolf, Germany), after placing 12Fr access sheath (Cook Medical) on the affected side ureter, post serial dilatation (Teflon ureteral dilators). Stones were dusted using 100W Holmium laser system (VersaPulse Power Suite, Lumenis) employing 200 micron end-firing fibre to deliver the laser energy. 5Fr DJ stent was placed post procedure and patient catheterized. On the first post-op day, patients underwent X-ray KUB to document the stent, and Foley's catheter was removed and subsequently discharged.

Both the above procedures were performed under general anaesthesia. All patients were called for review after one month for stent removal, and were evaluated with X-ray KUB and USG KUB to look for residual stones, if any. Residual stones were defined as one greater than 3mm in size.

3. Results

Between January 2013 and April 2016, 648 patients of renal stones were admitted in our institute, but only 172 patients met our inclusion criteria and were alternatively allotted to be treated with RIRS (n=86) and mPCNL (n=86) (Figure 1). Patients' age, sex distribution and stone size, number were all comparable in both the groups (Table 1).

Figure 1: CONSORT Diagram of the Study

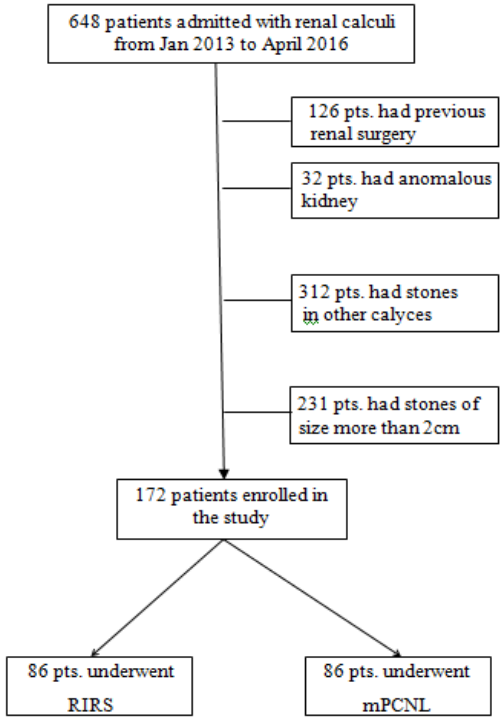

Table 1: Patients Demographics

Variable	RIRS	mPCNL
Number	86	86
Sex		
Male	49 (56.98)	52 (60.47)
Female	37 (43.02)	34 (39.53)
Age in years	42.2±8.3 (25.0–77.0)	44.1±9.1 (26.0–76.0)
Stone number	1.6±1.2 (1.0–3.0)	1.5±1.5 (1.0–3.0)
Stone size, mm	15.1±2.3 (7.0–20.0)	15.8±3.1 (7.0–20.0)
Stone Laterality		
Right	47	49
Left	39	37

Data presented as n (%) or mean ±SD (range).

The mean operative duration was longer in the RIRS group (70.2±10.3 mins) compared to the mPCNL group (38.7±9.8 mins), which was statistically significant (P<0.0001). However, the stone clearance was marginally

better in the RIRS group (95.34%) compared to that achieved in the mPCNL group (93.02%) (Table 2). Four patients in the RIRS group had residual fragments (4-6mm), in the proximal or mid ureter. Two patients fragment came out with the stent and the other two required semirigid URS (ureterorenoscopy) and basketing for their removal. In the mPCNL group, six patients had residual fragments at the end of one month (6-8mm). Of these, three patients who had the fragments in the kidney, underwent RIRS for their clearance, and the other three had the fragments in the ureter. Two underwent semirigid URS with basketing and the third one came out with the stent.

In terms of postoperative complications, one patient in the mPCNL group (1.16%), required blood transfusion. Two patients (2.32%) in the RIRS group and four patients (4.64%) in the mPCNL group had postoperative fever; all were managed conservatively with antibiotics as per urine culture. These postoperative complications were found to be statistically insignificant. The patients in the RIRS group experienced reasonably less pain postoperatively compared to those who underwent mPCNL (2.9±1.4 vs. 5.4±2.1, respectively), when measured on the visual analogue scale. Similarly the postoperative hospital stay was significantly lesser in the RIRS group compared to the mPCNL group (2.0±0.4 vs 3.5±1.3 days) (Table 2).

Table 2: Intra- & Postoperative characteristics

Variables	RIRS n= 86	mPCNL n=86	Statistical Significance
Operative duration, min	70.2±10.3	38.7±9.8	<0.0001
Stone clearance, %	95.34	93.02	0.05
Blood transfusion	0	1(1.16)	NS
Fever	2(2.32)	4(4.64)	NS
Postoperative pain, VAS*	2.9±1.4	5.4±2.1	0.05
Postoperative stay, days	2.0±0.4	3.5±1.3	<0.001
Second procedure	2(2.32)	5(5.81)	0.05

Data presented as mean ±SD (range) or n (%).
* Visual Analogue Scale

4. Discussion

PCNL is highly effective in intra renal calculi more so in lower pole stones. In a study, the stone free rate of PCNL was reported as 92% and 86% for lower pole stones 1 to 2 cm and more than 2cm, respectively.[3] But the invasiveness of this modality and associated post operative complications makes this procedure less appealing.

In the recent years, retrograde intrarenal surgery (RIRS) has emerged as an alternative therapy to treat renal calculi. Innovations in ureteroscopy has made possible unrestricted access to calculi at virtually all locations in the urinary tract.[8] Failed SWL and the inability to undergo SWL (i.e., due to pregnancy, coagulopathy, or morbid obesity) are recognized as indications for ureteroscopy.[10] For renal stones measuring less than 2 cm, the stone clearance rate for RIRS is comparable to that for SWL as a primary procedure, and a good clearance rate has been achieved following the failure of SWL.[11] Presently RIRS is an excellent modality of treatment for intrarenal stones smaller than 2cm and reported stone free rates are higher.

Flexible ureteroscopy is limited by the narrow irrigation and the working channels. Development of new generation (bidirectional 270º flexion capacity, small calibre shafts, improved optics) flexible ureteroscopes, improved flexibility of holmium laser fibres, different and small diameter stone retrieval devices with the capability of facilitating intrarenal maneuvers have resulted in increased treatment success and decreased procedure related morbidity in the management of renal stones.[13,14] Other specific circumstances where flexible ureteroscopy might be useful are the stones in a caliceal diverticulum or in a horseshoe kidney, where SFRs with SWL are typically low due to poor clearance of fragments. [10]

Due to lack of standard equipment, surgical techniques, post-operative or follow up care paths it is very challenging to compare endourologic procedures. Though classical PCNL is typically not employed for the lower range of the stones, mini-PCNL and micro-PCNL have flourished in treating smaller stones percutaneously, especially when flexible instruments are not readily available. As such, practice patterns surrounding percutaneous surgery are evolving, and with that it is imperative to evaluate its benefits and limitations in comparison to RIRS.

Here in this study, we have tried to compare the outcomes of RIRS and mini-PCNL for stones in lower pole less than 2cm size. We achieved a stone clearance of 95.34% in the RIRS group and 93.02% in the mPCNL group. Our results were better when comparable to Kirac M *et al.*[15] who had evaluated, retrospectively, the records of 73 patients who underwent mini-PCNL and retrograde intrarenal surgery (RIRS) for lower pole calculi of less than 15 mm size and found the stone-free rates of 89.1% and 88.8 % for mini-PNL and RIRS groups, respectively; their mean operation time was 53.7 ± 14.5 in the mini-PCNL group and 66.4 ± 15.8 in the RIRS group (P = 0.01); the mean hospitalization times was significantly higher in the mini-PCNL group. Similar results were obtained by us with mean operative duration of 70.2±10.3 mins in RIRS group, but 38.7±9.8 mins in the mPCNL group, which was statistically significant

(P<0.0001), and a significantly longer hospital stay in the mPCNL group.

Similarly, Pan J *et al.*[16] compared the clinical outcome between RIRS and mini-PCNL for the management of single renal stone of 2-3 cm. They found that the initial SFR of RIRS group and mPCNL group was 71.4 and 96.6 %, respectively (P = 0.000); the operative time for RIRS was longer (P = 0.000) while the mean hospital stay was shorter (P = 0.000); there was no statistical difference in peri-operative complications between the groups.

In our study, we observed more complications in the mPCNL group compared to RIRS group with one patient in the mPCNL group requiring blood transfusion. These results were comparable to that obtained by Resorlu *et al* [17], who evaluated, retrospectively, the records of 201 pediatric patients who underwent mini-perc (n = 106) or RIRS (n = 95) for intrarenal stones of 10- to 30-mm size. They observed minor complications classified as Clavien I or II in 17% and 8.4% in mini-perc and RIRS, respectively. No major complications (Clavien III-V) occurred in either group. Overall, they observed that, complication rates in mini-perc were higher, but the differences were not statistically significant (P = 0.07). However, they found out that, 7 patients in the mini-perc group received blood transfusions, whereas none of the children in the RIRS group were transfused (P = 0.015). And, the mean hospital stay, fluoroscopy, and operation times were significantly longer in the mini-perc group.

5. Conclusion

RIRS for lower pole renal stones is a feasible, effective and safe treatment option for moderate size renal stones. Given the added morbidity in mPCNL, RIRS should be considered standard therapy in these patients.

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