

Retrograde Intrarenal Surgery vs. Miniaturised Percutaneous Nephrolithotomy to Treat Lower Pole Renal Stone < 2 cms Diameter in Western Part of Odisha

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ABSTRACT

BACKGROUND

We wanted to compare the outcomes of retrograde intrarenal surgery (RIRS) and miniaturized percutaneous nephrolithotomy (mini-PCNL) in treating lower pole (LP) renal stones with a diameter of < 2 cm in terms of safety, efficacy, and stone-free rate (SFR).

METHODS

In a retrospective analysis data of 39 patients who underwent mini-PCNL (N = 19) or RIRS (N = 20) for LP stones with a diameter of < 2 cm were reviewed between November 2018 and November 2020 at the Department of Urology in Veer Surendra Sai Institute of Medical Sciences and Research (VSSIMSAR), Odisha. The mean age, sex, stone size, operating time, complications, hospital stay, and SFR were compared between the groups. The success of the procedure was defined as the absence of residual stones or small residuals of size 3mm or less on computed tomography at 12 weeks postoperatively.

RESULTS

Significant differences were found in the hospital stay duration in hours (103.3 ± 11.7 vs. 145.2 ± 16.4 , $P < 0.028$) between the RIRS and mini - PCNL groups. The mean operation time (in minutes) was also significantly different between the RIRS group (82.5 ± 3.44) and mini PCNL group (86.21 ± 5.90 , $P = 0.021$). The stone-free rates in the postoperative period at three months (RIRS vs. mini - PCNL: 95 % vs. 94 %, $P = 0.47$) were not significantly different.

CONCLUSIONS

RIRS and mini-PCNL are both safe and effective methods for treating LP stones with a diameter of < 2 cm. RIRS can be considered as a less invasive alternative to PCNL for the treatment of LP stones of < 2 cm with reasonable SFR with shorter hospital stay.

KEYWORDS

Retrograde Intrarenal Surgery, Percutaneous Nephrolithotripsy, Lower Pole Kidney Stones, Miniaturized Percutaneous Nephrolithotomy

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BACKGROUND

Percutaneous nephrolithotomy (PCNL) is the gold standard treatment option for management of large renal stones (> 2 cm); however, it poses important risk factors of bleeding and renal parenchymal injury during dilation of tracts using larger sized sheath. Consequently, PCNL instruments miniaturization is going on to obtain the optimal balance between stone free rate (SFR) and complications. The introduction of the concept of mini-PCNL and fragmenting the stones using a holmium laser has dramatically decreased these complications.¹ With advancements in techniques and technologies, miniaturized PCNL (mini - PCNL), defined as a PCNL involving the use of smaller nephroscopes can be performed effectively to manage kidney stones with high stone free rates and low complications.² In the past few years, improvements in endoscopy technology make retrograde intrarenal surgery (RIRS) more attractive, even for special circumstances, which has been used as an alternative option to PCNL for renal stones with a low complication rate.³ In patients contraindicated for PCNL and with unfavourable treatment characteristics, such as morbid obesity, advanced vertebral deformities, serious cardiopulmonary diseases or those receiving anticoagulant treatment, RIRS is a reliable choice.⁴ Indeed, the European Association of Urology (EAU) guidelines mentioned that RIRS is a valid choice of some surgeons for the treatment of larger stones.⁵ The main drawbacks of RIRS include: the shorter lifespan of flexible scopes, limited visualisation, difficulty in retrieval of fragments and the need for laser fibres. The two surgical procedures have different advantages and disadvantages associated with the treatment of stones of different sizes affecting the urinary system. However, few studies have compared the results of mini-PCNL to RIRS for the treatment of lower pole stones (LPstones) with a < 2 cm diameter.

In this study, we wanted to compare the outcomes of retrograde intrarenal surgery (RIRS) and miniaturized percutaneous nephrolithotomy (mini-PCNL) like operation time, stone-free rate, complications, hospital stay, mean VAS (visual analogue scale for pain) score in patients in treating lower pole (LP) renal stones with a diameter of < 2 cm in terms of safety, efficacy, and stone-free rate (SFR).

METHODS

We performed a retrospective analysis of 39 patients who underwent mini- PCNL (N = 19) or RIRS (N = 20) for LP stones with a < 2 cm diameter by 1 urologist between November 2018 and November 2020 at the Department of Urology in VSSIMSAR, Odisha. All patients were evaluated by history taking, laboratory investigations including kidney and liver functions, complete blood count, fasting blood sugar, bleeding profile, urine analysis and culture. Radiological investigations included abdominal ultrasonography, multi-slice spiral CT to measure the stone size and plain abdominal radiograph of the kidneys, ureters and bladder (KUB). Patients with urine culture positivity have received parenteral antibiotics according to the sensitivity

report and the test was again repeated before the procedure. We determined the operation technique according to surgeon's and patient's choice. The exclusion criteria included: patients aged less than 18yrs., renal stones in anomalous kidney, bilateral renal stones, patients with renal failure, patients with bleeding tendency, and pregnant women.

RIRS Technique

All the patients undergoing the RIRS surgery were performed under general anaesthesia and in lithotomy position. First, a rigid ureteroscopy was used to passively dilate the ureter and to place a hydrophilic safety guidewire (0.035 inch) in to the kidney by fluoroscopic assistance. Then a ureteral access sheath (9.5 - 11 Fr) was placed through the guidewire up to the ureteropelvic junction. We used a flexible ureterorenoscope (URF P6 / P6R, OLYMPUS)) to negotiate into the renal pelvis within the ureteral access sheath under fluoroscopic guidance. Kidney stones were fragmented using a Ho YAG laser (Holmium 100W Versa Pulse Lumenis laser).

Mini-PCNL Technique

All procedures were performed with the patient under general anaesthesia. At the beginning of the procedure, placement of a 6 Fr ureteral catheter up to the renal pelvis was performed by means of rigid cystoscopy under fluoroscopic guidance. Subsequently, patients were placed in the prone position and percutaneous access was achieved under fluoroscopic guidance using an 18 - gaugeneedle and guidewire. We used a 0.038 - mm J-tipped guide wire to insert through the calyceal puncture into the renal pelvis. The first three Alken dilators were used to dilate the tract (8F - 14F). Next, we inserted a 15Fr and 17Fr sheath and introduced a rigid 12Fr nephroscope. The stone fragmentation was performed using a Ho: YAGlaser (365 - µm fibre; energy 2.5 Joule; frequency 20 - 25 Hz). A 12 Fr nephrostomy tube was inserted into the calyceal system at the end of the procedure which was removed in post operative day two or three depending upon the intra operative factors. The double J ureteral stent was removed under local anaesthesia at 2 - 4 wks.

Assessment of Outcomes

The outcomes including operative time, stone-free rate, complications, hospital stay, and mean VAS score for the patients who underwent these two minimally invasive methods were compared in this study. Patients were re-evaluated using low dose Helical CT after 3months of surgery to examine residual stone status. Residual stones size less than 3 mm in diameter were considered "clinically insignificant residues"

Statistical Analysis

In case of qualitative variables chi-square test was applied to compare the proportions between two groups.

Quantitative variables were presented as means $\pm$ SD and were compared using the Student's t-test. Statistical significance was defined as $P < 0.05$. All statistical analyses were performed using Statistical Package for the Social Sciences (SPSS) 17.0

RESULTS

The present comparative study was undertaken to compare the outcomes in 39 patients out of which 19 patients had undergone mini PCNL & 20 patients had undergone RIRS. This study compares the outcome in terms of stone free rate at 3 months in post-operative period, duration of stay in hospital, operative time, post-operative complication in both groups. It also aims at observing the demographic data of patient presenting to urology OPD with lower pole renal calculus. Age of patients included in this study ranged between 30 - 70 yrs. & mean age was 49.26 ± 9.23 yrs. Out of 39 patients 14 patients were females & 25 patients were males. BMI in this study was 21.74 ± 2.77 in which BMI in PCNL group was 21.19 ± 3.03 & BMI in RIRS group was 22.26 ± 2.12 with P value of 0.236. Out of 39 patients 17 were left sided & 22 were right sided. In mini PCNL group 8 were left sided & 11 were right sided.

Characteristics	Mini-PCNL Group	RIRS Group	P Value
Number	19	20	
Male / female	11 / 8	14 / 6	0.43
BMI (kg / m ²)	21.95 ± 3.3	22.26 ± 2.12	0.236
Side (right / left)	11 / 8	11 / 9	0.85
Stone size (mm)	17.42 ± 1.8	16.1 ± 2.29	0.51

Table 1. Stone Characteristics & Demographic Data of Patients

Variable	Mini-PCNL group	RIRS group	P Value
Operative time(in min)	86.21 ± 5.9	82.50 ± 3.44	0.021
SFR(At 3 month)	94	95	0.47
Hospital stays(hours)	145.2 ± 1.64	103.1 ± 11.74	0.001
No. of clavin complication			
Grade 0	17 (89.6 %)	19 (95 %)	
Grade 1	1 (5.2 %)	1 (5 %)	
Grade 2	1 (5.2 %)	0 (0.0 %)	
Grade 3	0	0	
Grade 4	0	0	
Pre op Hb	11.27 ± 0.27	11.87 ± 0.31	0.92
Post op Hb	10.71 ± 0.28	10.43 ± 0.30	0.51
Mean VAS score	5.94 ± 0.23	8.6 ± 1.97	0.39

Table 2. Intraoperative & Postoperative Parameters & Complications in Study Groups

In RIRS group 9 were left sided & 11 were right sided.

1. Duration of stay in hospital in mini PCNL ranges from 110-170 hrs with mean of 145.2 hours & in RIRS group ranges from 80 - 130 hrs with mean of 103.3 hrs with $P < 0.001$.
2. Operation time in mini PCNL and RIRS group was 86.21 ± 5.9 & 82.50 ± 3.44 minutes respectively with P value of 0.021.
3. Stone free rate after 3 months in mini PCNL group was 94 % & in RIRS group was 95 % with P value of 0.47
4. Out of 19 patients in mini PCNL group 17 patients (89.6 %) had grade 0 complication, 1 patient (5.2 %) grade 1 complication, 1 patient (5.2 %) had grade 2 complications. Out of 20 patients in RIRS group 19 patients (95 %) had grade 0 complication, 1 patient (5 %) had grade 1 complication.

5. VAS score in mini PCNL group ranged from 4 - 8 with mean 5.94 ± 1.02 & RIRS group ranged from 5 - 7 with mean of 5.65 ± 58

DISCUSSION

Urinary stones are a common condition in the Indian population. PCNL is recommended as the first line of therapy for treating large kidney stones by the EAU.⁶ Some studies of LP renal stones showed that there was a high success rate and a low complication rate for all stone sizes using PCNL.⁷ PCNL has the advantage of a high stone clearance rate.⁸ Despite advances in technology, PCNL is an invasive surgery with the potential to cause many serious complications.⁹ Although many studies have compared either PCNL or RIRS to shock wave lithotripsy to determine which is more suitable for patients with a diameter less than 2 cm, there are still relatively few studies comparing the results of mini - PCNL and RIRS in the treatment of LP renal stones.¹⁰ In this study, we evaluated two of these treatment modalities in the management of LP renal stones. Grasso reported that they treated LP renal calculi by retrograde ureteroscopy and the stone free rate was 82 % for patients with stones 0.1 - 1.0 cm, 71 % for patients with stones 1.1-2.0 cm, and 65 % for patients with stones > 2.0 cm.¹¹ Bosket et al.¹² showed that the stone-free rate was 94.6 % in patients who were treated (diameter 1.5 - 2.0 cm) using RIRS. Lee et al.¹³ conducted a study to compare mini PCNL and RIRS for managing patients with renal stones of >1.0 cm and came to the conclusion that both techniques are safe and equally effective, with a SFR following a single session at 12 weeks follow-up of 85.7 % in the mini-PCNL group and 97.0 % in the RIRS group ($P = 0.199$). Whilst Albala et al.¹⁴ and Carlsson and et al.¹⁶ studied stones of 3.0 cm, Pearle et al.¹⁵ conducted their studies on stones of 1.0 cm, and Kuo et al.¹⁶ studied stones of 1.1 - 2.5 cm. As regards the definition of their success, Albala et al.¹⁴ defined the success as stone free or residual fragments of 0.3 cm at 12 which we follow in our study also et al. Pearle et al.¹⁵ defined it stone free or residual fragments of 0.5 cm at 12 weeks. In our study the PCNL group and RIRS group showed a SFR of 94 % and 95 % respectively which was confirmed by low dose Helical CT three months after the procedure (P value - 0.47). In the near future, with the improvement of lasers and the combination of less invasive anterograde-retrograde techniques, the residual rate would be further reduced. The mean operating time was statistically significantly longer in PCNL group than the RIRS Group A (P), which correlates with the study of Sabnis et al.¹⁷ who reported a shorter operating time for RIRS as compared to PCNL. However, a significantly longer operating time for RIRS than for mini-PCNL was also reported by Bozkurt et al.¹⁸ and Kirac et al.¹⁹ In the present study, there were no major intraoperative complications that required surgical or radiological intervention. By contrast, Ozturk et al.²⁰ reported a case of ureteric injury during RIRS that required surgical repair and a case of significant bleeding in their mini PCNL group that required angioembolisation. The low complication rate in our study may be due to small number of cases and strict criteria

of case selection. In this study, the hospitalization stay was longer for patients in the mini-PCNL group than in the RIRS group. This apparent delay may be attributed mainly to the nephrostomy tube placement for drainage. Our results showed that RIRS had a clear advantage in postoperative hospital stay compared with mini-PCNL. Patient recovery tends to be faster with RIRS, which was also supported by the studies of Bay et al.²¹ and Alazaby et al.²² Our study added another argument for making RIRS the optimal choice in an increasing number of stone cases with availability of 100 watts Holmium Laser. Our results showed that RIRS is an effective treatment option for LP calculus with a diameter of < 2 cm.

CONCLUSIONS

Management of renal stones of 1.0 – 2.0 cm remains a challenge to attain the best SFR amongst the available techniques for all urologists. For lower calyceal stones of less than 2 cm, mini - PCNL and RIRS were comparable in terms of SFR, complications, and hospital stay. Our results suggest that both RIRS and mini - PCNL are safe and effective methods for treating LP stones with a diameter of < 2 cm. RIRS can be considered as a less invasive alternative to PCNL for the treatment of LP stones of < 2 cm with reasonable SFR with shorter hospital stay.

Limitations

However, this study has some limitation. First, the sample size was comparatively very small and there was lack of stratifications of groups according to stone sizes of 1 cm and 1 - 2 cm. Second, the clearance rate in both the groups depend on renal lower pole anatomy & stone characteristics, which is not taken into consideration in this study. Third, both the groups were taken on patient & surgeons choice, which may bias the result. Prospective studies controlling for such variables with large samples will allow a more detailed evaluation of these phenomena. Fourth average BMI in our study was 21.74 ± 2.77 which may be compounding factor.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.

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