

ROLE OF MINI PCNL AND RIRS IN THE MANAGEMENT OF MODERATE SIZE LOWER CALYX RENAL STONES : SKIMS EXPERIENCE

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Abstract

Background: RIRS has gained much attention because it can lower the risk of significant morbidities associated with percutaneous approach. Mini PCNL is widely executed in the recent years and is now used as an alternative to PCNL. Aim of this study is to compare outcome of Mini PCNL and RIRS for the management of lower calyx renal stones. **Materials and Methods:** It is a prospective observational study in which patients with solitary renal stone located in lower calyx up to 15 mm in size were included. Patients were divided in two groups and comparisons were made based on various parameters. For equal allocation to two groups, simple randomization was done. **Result:** Total 47 patients underwent Mini PCNL while 53 patients underwent RIRS. Mean size of stone was 13.81mm and 13.30 mm in Mini PCNL and RIRS groups respectively. Mean operative time was 59.70 and 87.81minutes in Mini PCNL and RIRS groups respectively. Mean radiation time in Mini PCNL group was 75.30 seconds while in RIRS group it was 32.87 sec. On Post op day 1 in Mini PCNL group complete clearance was achieved in 91% patients while in RIRS group complete clearance was achieved in 62% patients. In Mini PCNL group only 4 patients while in RIRS group 8 patients underwent ESWL. All patients in which complications occurred in both groups, were fell into Clavien -Dindo grade – II category. Mean duration of hospital stay was 1.21 days and 1.79 days in Mini PCNL and RIRS group respectively. **Conclusion:** Both procedures are equally efficacious with respect to stone clearance; however, before deciding the surgical procedure either Mini PCNL or RIRS, patient's factors, expectations, preferences, and surgeon's experience must be considered. Both Mini- PCNL and RIRS have excellent outcomes for lower calyx renal stones up to 15 mm in size.

INTRODUCTION

Urolithiasis has a long thousand-year history, worldwide spread, frequent recurrence and occupies a leading place in the structure of surgical diseases of the urinary system. Maximum stone-free rate (SFR) is a key parameter to evaluate the efficacy of stone surgery. The treatment options for small renal calculi (<1.5 cm) are ESWL, retrograde intrarenal surgery (RIRS), and percutaneous nephrolithotomy (PCNL).^[1] RIRS was considered a new era in the

minimally invasive treatment of renal stones and it has gained much attention because it can lower the risk of significant morbidities associated with percutaneous approach.^[1] On the other hand, high stone clearance rates of PCNL are associated with a significant risk of morbidity which can be decreased with reduction of tract size.^[2,3] Mini PCNL is widely executed in the recent years and is now used as an alternative to PCNL. This approach is being used to treat large stones, because of the fewer complications and reduced morbidity. The success rate of this

method has been reported in previous studies of 60 to 90%.^[4] It was reported that in general, stone clearance after Mini PCNL is comparable to PCNL with decreased morbidity due to the smaller tract size, and lower costs compared to ESWL and RIRS.^[5,6] In this study we compared outcome of Mini PCNL and RIRS for the management of renal calculi to determine effectiveness and Safety profile of Mini PCNL and RIRS.

MATERIALS AND METHODS

It is a prospective observational study in which patients of >18 years of age during the period From July 2021 to Jan 2023 with solitary, lower calyx renal stone up to 15 mm were included. Patients with congenital anomalies, pregnancy, active UTI, multiple stones, bleeding diathesis, calyceal diverticulum were excluded. Patients were divided in two groups and comparisons were made based on the parameters like stone size, stone site, operating time, radiation time, stone free rate on POD 1 and on one month, drop in Hb, rise in creatinine, need of auxiliary procedure, complications and duration of hospital stay. For equal allocation to two groups (Group A: Mini PCNL, Group B: RIRS), simple randomization was done. In the patients who are undergoing RIRS, DJS was placed one week prior to the surgery. Post op NCCT-KUB was done to assess stone clearance. Informed consent was taken. All the patients were regularly followed up for a period of four weeks (1, 2, 4) for the assessment of any residual stone, complications related to our procedure and success rate of our study. All statistical analyses were conducted using latest version of SPSS Software.

RESULTS

Out of 100 patients, 47 patients underwent Mini PCNL and 53 patients underwent RIRS. Mean age was 43.79 years (SD - 14.28) with the range of 19-78 years and 37.19 years (SD 10.65) with range of 19-59 years in Mini PCNL and RIRS group respectively. In Mini PCNL group 32 (68.1%) patients were male and 15 (31.9%) patients were female while in RIRS group 28 (52.8%) patients were male and 25 (47.2%) patients were female. Mean size of stone in Mini

PCNL group was 13.81 mm (SD- 1.06) with range of 12-15 mm while in RIRS group mean size of stone was 13.30 mm (SD – 1.51) with range of 10-15mm. Mean operative time in Mini PCNL group was 59.70 minutes (SD- 10.42) with range of 43-80 minutes while in RIRS group it was 87.81 minutes (SD– 20.68) with range of 50-124 minutes. Mean radiation time in Mini PCNL group was 75.30 seconds (SD- 18.14) with range of 44-119 seconds while in RIRS group it was 32.87 seconds (SD– 19.34) with range of 13.4 – 98.0 seconds. On Post operative day 1 in Mini PCNL group out of 47 patients, complete clearance was achieved in 43 (91%) patient while in 4 (9%) patients complete clearance was not achieved. In RIRS out of 53 patients complete clearance was achieved in 33 (62%) patients while in 20 (38%) patients complete clearance was not achieved (p-value = 0.001469). In Mini PCNL group on one month out of 47 patients complete clearance was achieved in 45 (95.7%) patients while in 2 (4.3%) patients complete clearance was not achieved. In RIRS out of 53 patients complete clearance was achieved in 47 (88.7%) patients while in 6 (11.3%) patients complete clearance was not achieved (p-value = 0.3521). In Mini PCNL group mean drop in Hb was 0.70 g/dl (SD – 0.25) with range of 0.3-1.4g/dl while in RIRS group it was 0.58 (SD – 0.42) with range of 0.6-2.0 g/dl (p-value = 0.033.). In Mini PCNL group mean change in creatinine was 0.25 mg/dl (SD – 0.15) with range of -0.10 to 0.58 while in RIRS group it was 0.18 mg/dl (SD – 0.20) with range of -0.20 to 0.70. (p-value = 0.2998.). In Mini PCNL group out of 47 only 4 (8.5%) patients needed auxiliary procedure (ESWL) while in 43 patients no auxiliary procedure was not needed. Similarly, in RIRS group out of 53 patients 8 (15.1%) patients underwent ESWL as an auxiliary procedure while in 45 patients no auxiliary procedure was needed (p-value =0.4821). In Mini PCNL group complications occurred in 4 (8%) patients while in RIRS group 8 (16%) patients got complicated. All these patients in both groups were fell in to Clavien -Dindo grade – II category. (p-value – 0.3559). In our study, in Mini PCNL group mean duration of hospital stay was 1.21 days (SD - 0.55) with the range of 1-3 days while in RIRS group mean duration of hospital stay was 1.79 days (SD -0.99) with range of 1-5 days. (p-value= 0.0005667).

Table 1: Consolidated Results

Parameter	PCNL	RIRS	p-value	
1	Age		0.04083	
	Mean (in years)	43.79		37.19
	SD	14.28		10.65
2	Gender		0.1771	
	Males (%)	68.1		52.8
	Females (%)	31.9		47.2
3	Stone Size		0.01407	
	Mean (in mm)	13.8		13.28
	SD	1.03		1.55
4	Operating time		0.04666	
	Mean (in minutes)	60.12		89.08
	SD	10.3		20.57

5	Radiation Time			0.1839
	Mean (in seconds)	75.84	29.78	
	SD	17.99	14.66	
6	Stone Free rate on POD1			0.001469
	Number	46	30	
	Percentage	92	60	
7	Stone Free rate on 1 month			0.3521
	Number	48	44	
	Percentage	96	88	
8	Drop in Hemoglobin			0.033
	Mean (in g/dL)	0.7	0.58	
	SD	0.25	0.42	
09	Change in Creatinine			0.2998
	Mean (in mg/dl)	0.26	0.17	
	SD	0.15	0.2	
10	Need for Auxiliary Procedure			0.4821
	Number	4	8	
	Percentage	8	16	
11	Complications			0.3559
	Number	4	8	
12	Duration of Hospital Stay			0.0005667
	Mean (in days)	1.24	1.8	
	SD	0.59	0.99	

DISCUSSION

There has been a growing interest in techniques such as Mini PCNL and RIRS. In this study the outcomes of Mini PCNL and RIRS in the management of lower calyx renal stone of moderate size up to 15 mm have been reported and compared with other reported studies.

In our study, in Mini PCNL group mean age was 43.79 years while in RIRS group mean age was 37.19 years. In Mini PCNL group 32 patients were male and 15 patients were female while in RIRS group 28 patients were male and 25 patients were female. In our study mean size of stone in Mini PCNL group was 13.81 mm (SD- 1.06) while in RIRS group mean size of stone was 13.30 mm (SD – 1.51). Various studies have been reported throughout the globe comparing efficacy and safety profile of Mini PCNL and RIRS for the management of renal calculi of different size ranging from 10 mm to 30mm. Rakib et al [7] reported the comparable results. In their study mean age was 40.12 years and 38.20 years and the mean of stone size was 1.15cm and 1.30cm in Mini PCNL and RIRS groups respectively. In various studies reported in the literature stone size is different although in most of the studies authors have compared Mini PCNL and RIRS for the management of lower calyceal stone. The duration of the operation is an important factor in determining and comparing various procedural techniques.^[8] In our study mean operative time in Mini PCNL group was 59.70 minutes (SD- 10.42) while in RIRS group it was 87.81 minutes (SD– 20.68). Jain et al,^[9] reported that operative time is significantly less in Mini PCNL group (51.58 vs. 69.75 min; P < 0.003), similarly Akman et al,^[10] observed that the mean operative time for the RIRS and PCNL groups were 58.2 ± 13.4 (range 30 – 85) and 38.7 ± 11.6 (range 14 – 60) mins,

respectively (P < 0.001). In most of the studies mean operative time is more in RIRS group probably due to longer time required for stone vaporization.

Fluoroscopic guidance is routine for endourological procedures. In our study mean radiation time in Mini PCNL group was 75.30 seconds (SD- 18.14) while in RIRS group it was 32.87 seconds (SD– 19.34). Chhetri et al,^[11] reported that for Mini PCNL and RIRS group, mean fluoroscopic time was 117.95 s (range 24-350) and 31.83 s (range 3-103); respectively, they further concluded that RIRS was associated with less fluoroscopic hazard than Mini PCNL. In our study the radiation time was less than the radiation time observed by Chhetri et al,^[11] may be larger stone size in their study is the probable explanation for this.

Primary aim of stone related surgeries is to achieve highest stone clearance with minimal or no morbidities.^[12] As CT provides the most accurate way to assess the presence of residual fragments to determine SFR, we used NCCT KUB as imaging modality to follow the patients. In our study on post operative day 1 in Mini PCNL group, complete clearance was achieved in 91% patients while in RIRS group complete clearance was achieved in 62% patients and on one month in Mini PCNL group complete clearance was achieved in 95.7% patients while in RIRS complete clearance was achieved in 88.7% patients. Karakoç et al,^[13] Stone-free rates after one session were 66.6% and 91.8% of the RIRS and Mini PCNL groups, respectively. Kirac et al,^[11] reported similar stone free rate. The final success rate and stone-free rate were 94.4 and 88.8 % in the postoperative third month, respectively.

In our study in Mini PCNL group mean drop in HB was 0.70 g/dl while in RIRS group it was 0.58. Similarly, Coskun et al,^[14] reported that decrease in hematocrit values were less for the RIRS group. Other studies also showed that the rate of the Hb drop

was relatively higher in Mini PCNL group when compared with RIRS.^[15,16] In our study in Mini PCNL group mean change in creatinine was 0.25 mg/dl (SD – 0.15) while in RIRS group it was 0.18 mg/dl (SD – 0.20). The impact of standard percutaneous nephrolithotomy on short or long-term renal function has been evaluated in many studies. Hosseini et al,^[17] evaluated the effect of tubeless PCNL on early renal function. A total of 117 patients posted for PCNL were evaluated. Serum creatinine and Hb levels were measured before PCNL and 6, 24, 48, and 72 h after the operation. The mean creatinine level elevated in the first 48 hr after PCNL but it started to reduce on the 3rd day (mean preoperative creatinine level: 1.32 ± 0.18 mg/dL, mean creatinine level after 48 h: 1.59 ± 0.24 mg/dL, creatinine level after 72 h: 1.42 ± 0.21245 mg/dL) (P < 0.0001). GFR values had the same rise and fall pattern as serum creatinine level (mean preoperative GFR: 74.89 mL/min, mean GFR after 48 hr 64.04 mL/min, GFR after 72 h: 69.54 mL/min, P < 0.0001). Significant deterioration of renal function is not reported after RIRS, although for patients with potential deterioration of renal function postoperatively Liu Y et al,^[18] suggested that urologists could shorten flexible ureteroscopic time to prevent the occurrence of this outcome.

Need of auxiliary procedure depends on the stone clearance. With higher stone clearance rate need of auxiliary procedure will be less. In our study in Mini PCNL group out of 47 only 4 patients needed auxiliary procedure (ESWL) while in 43 patients no auxiliary procedure was needed. Similarly, in RIRS group out of 53 patients 8 patients underwent ESWL as an auxiliary procedure while in 45 patients no auxiliary procedure was needed. These results are comparable with other studies.^[19] Goal of any surgery should be the complete eradication of disease with minimum post operative discomfort to the patients. A study published by Jain et al,^[9] shows that mini- PCNL group had 2 Grade I, 3 Grade II, and 4 Grade III complications; while RIRS group had 4 Grade I, 7 Grade II, and 5 Grade III complications. The outcome was statistically significant (P = 0.03), with RIRS group encountering more complications. In our study in PCNL group complication occurred in 4 patients while in RIRS group 8 patients got complicated. All these patients in both groups were fell into Clavien-Dindo grade – II category. Most of the patients had postoperative fever/urosepsis within 48h of surgery. Possible explanations of these symptoms are raised intrarenal pressure and infective stone. All the patients in our study in both groups were managed by upgrading antibiotics and none of the patients had need of ionotropic support. After any surgery duration of hospital stay is one factor that leave remarkable impact on the financial status of both, patients as well as the hospital budget. In Mini PCNL group mean duration of hospital stay was 1.21 days while in RIRS group mean duration of hospital stay was 1.79 days. Similar findings were reported by Coskun et al.^[14] In their study the period in hospital

demonstrated that the average value was 1,2 ± 0.59 and 4,6 ± 3,5 days in RIRS and Mini PCNL groups, respectively, with a statistically significant difference among the two groups. (p < 0.05). Mean hospital stay was almost same in both arms (2.85 days in mini-PCNL vs. 2.45 days in RIRS) in a study reported by Jain et al.^[9]

CONCLUSION

Our study demonstrated that Operative time was little more and stone free rate slightly less in RIRS group but RIRS has less radiation exposure. Mini PCNL has a better single step stone- free rate, lesser operative time, and lesser postoperative complications. Both procedures are equally efficacious with respect to stone clearance; however, before deciding the surgical procedure either Mini PCNL or RIRS, patient factors, expectations, preferences, and surgeon's experience must be considered. Both Mini- PCNL and RIRS have excellent outcomes for lower calyx renal stones up to 15 mm in size.

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