

Original Research Article

Comparison of effectiveness of percutaneous nephrolithotomy versus retrograde intrarenal surgery

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ABSTRACT

Background: Treatment of renal stones depends upon the stone size, location, symptoms and any other anatomical variation in the calyceal system of the kidney. Percutaneous nephrolithotomy (PCNL) is a highly effective operation with consistently high stone-free rates; it delivers good stone clearance with minimal problems and a lower retreatment rate, while it is associated with higher morbidity. Retrograde intrarenal surgery (RIRS) is a less invasive and practical therapeutic option with a short hospital stay, minimal morbidity, and a low complication rate. Objectives were to compare the effectiveness of PCNL and RIRS in the treatment of renal stones.

Methods: 50 patients with renal stones with no comorbidities were divided into 2 groups. Group-1 was treated with PCNL, while group-2 underwent RIRS. The outcomes of both procedures were compared based on the operating time, duration of hospital stay and stone-free rate.

Results: The mean duration of hospital stay was higher in the PCNL group (4.37 ± 2.11 days) than the RIRS group (2.84 ± 0.98 days). The stone free rate was more in the PCNL group (96%) as compared to the RIRS group (84%). The PCNL group (78 ± 12.75 minutes) had a longer operative time than the RIRS group (70.59 ± 10.09 minutes). Blood loss was more in the PCNL group.

Conclusions: RIRS is an effective and safe alternative to PCNL in the treatment of renal stones. The choice of surgical approach between PCNL and RIRS should be based on the surgeon's experience and preference and the patient's financial means.

Keywords: Kidney stones, Flexible ureteroscopy, PCNL, RIRS

INTRODUCTION

Nephrolithiasis is the condition in which stones are formed within the kidneys. Urolithiasis occurs when these stones move into remainder of urinary collecting system, including ureters, bladder and urethra.¹ It causes severe pain in flank/abdomen that may be accompanied by blood in urine, vomiting/painful urination.² In addition, urinary stones have a 1-year recurrence rate of 7% and a 10 year recurrence rate of 50%.³

The main treatment aims are the complete clearance of calculi without any residual fragments, pain management and complete removal of the causative micro-organisms.

Minimally invasive procedures such as PCNL, RIRS, and extracorporeal shock wave lithotripsy (ESWL) have been the treatments of choice in the case of urolithiasis.⁴

European urology guidelines recommend ESWL as the first line of treatment in renal stones smaller than 2 cm in size and PCNL in stones larger than 2 cm.⁵

With advancing technology, new generation flexible ureteroscopes with safe and effective lithotripters such as holmium LASER have been developed, and RIRS has become an important alternative in the treatment of large urinary stones.⁶

In this study, we prospectively analyzed and compared the outcomes of patients who had PCNL or RIRS with renal stones sized greater than 2 cm.

METHODS

A total of 50 patients admitted to the urology department with kidney stones of our hospital PESIMSR, Kuppam between January 2013-May 2017 were selected for this study.

Ethical consent was obtained from the institutional ethics committee. Written informed consent was taken from all the participants of this study.

Inclusion criteria

Patients reporting with a renal stone greater than 2 cm (confirmed by diagnostic imaging) above the age of 18 years of both genders were selected for this study.

Exclusion criteria

Patients with body mass index (BMI) ≥ 30 , comorbidities, renal failure, previous history of pyelonephritis, preoperative diagnosis of a renal scar, patients with abnormal renal anatomy such as ectopic or horseshoe kidneys and a stone burden of more than 700 mm² were excluded from the study.

A convenient sample size was taken. All patients were randomly and equally divided into 2 groups; group 1 patients with renal stone underwent PCNL using 26 French Karl-Storz nephroscope and pneumatic lithotripter and group 2 patients with renal stone underwent RIRS using Karl-Storz 7.5 French flexible ureterorenoscope and 30 W holmium LASER.

Demographic data of the patients, the duration of operation, stone-free rates, and the duration of the hospital stay were analyzed. The stone-free rate was determined by computed tomography.

All data were collected and analyzed.

RESULTS

The mean age of patients in the PCNL group was 55.25 years and in the RIRS group was 54.51 years. In the PCNL group, 15 were male and 10 females, and in the RIRS group, 17 male and 8 female patients were included. The mean stone size in the PCNL group was 24.66mm and RIRS was 25.12mm. The majority of the stones were located in the renal pelvis, in the PCNL group 52% and in RIRS group 56% (Table 1).

The mean hospital stay was longer in the PCNL group (4.73 \pm 2.11 days) than in the RIRS group (2.84 \pm 0.98 days). There was a higher stone-free rate in the PCNL group (96%) than in the RIRS group (84%). The mean

operating time is lesser in the RIRS group (70.59 \pm 10.09) than in the PCNL group (78 \pm 12.75). There was no blood transfusion requirement in the RIRS group, 2 patients were transfused in the PCNL group (Table 2).

Table 1: Distribution of study parameters.

Parameters	PCNL	RIRS
Age (years)	55.25	54.51
Gender	Male	15
	Female	10
Stone size (mm)	24.66	25.12
Stone location	Pelvis	13
	Upper calyx	3
	Lower calyx	5
	Multiple calices	4

Table 2: Distribution of study outcome parameters.

Outcome parameters	PCNL	RIRS
Mean duration of hospital stays (days)	4.37 \pm 2.11	2.84 \pm 0.98
Stone free rate	96%	84%
Mean operative time (min)	78 \pm 12.75	70.59 \pm 10.09
Blood transfusion	2	0

DISCUSSION

Minimally invasive techniques like RIRS and PCNL are the most prevalent urological procedures. Many studies have confirmed the efficacy and safety of these two surgeries for upper urinary tract stones.

This hospital based prospective study provides an overview of the effectiveness of PCNL and RIRS in treating nephrolithiasis. Success rates are important factors to be considered when choosing the optimal treatment; however, it is quite difficult to make conclusions on superiority of nephrolithiasis treatments according to their success rates.⁷

In the present study, the operating time in the PCNL procedures was more than the time taken in the RIRS group. Similar findings were seen in a study by Singh et al.⁸ On the contrary, in a meta-analysis performed with the objective of comparing clinical outcomes between RIRS and PCNL for the management of renal stones, there was no significant difference between the two groups in terms of operation time.⁹ Karakoç et al also found that the duration of surgery was 75.55 \pm 21.5 min for PCNL and 100.26 \pm 33.26 min for RIRS, which showed statistically significant differences between them. The difference in the time taken in different studies can be attributed to the skills of the surgical team, as well as the time taken to achieve sedation.⁶ In a meta-analysis, the operative time was shorter for RIRS when compared with PCNL, with a mean difference of 7.46 minutes based on data pooled from 4 studies.¹⁰

In our study, the post operative hospital stay was lesser in the RIRS group (2.84±0.98 days) than the PCNL (4.37±2.11 days) group. In a similar study, Karakoç et al the mean hospital stay was significantly shorter in the RIRS group (1.56±0.8) days in the RIRS group and 4.57±2.1 days in the PCNL group) (p<0.001). Wang et al also reported that in terms of the duration of hospital stay, the RIRS group was shorter than the PCNL group.¹¹ According to Resorlu et al the average hospital stay for PCNL was 2.6 days and 1.3 days for RIRS.¹² The differences in hospital stay could also be due to the healthcare system in the country where the research is being conducted. The most important cause for delayed hospitalization in PCNL can be attributed to the nephrostomy catheter placed for drainage, the need for analgesia, and the need for follow-up after blood transfusion. Current research shows that PCNL procedures performed without tubes decreased hospital stay significantly.^{13,14}

Urinary stone treatment aims to achieve the highest stone-free rate with the least amount of morbidity. The post-operative stone-free rate in our study was confirmed by computed tomography (CT scan). The stone-free rate was higher in the PCNL group (96%) than in the RIRS group (84%). Singh et al found no difference in the stone-free rate of both procedures.⁸ In another study, Garg et al found that the stone clearance rate was much higher in the PCNL group, with 95.7% of the patients requiring only a single procedure and in the RIRS group, it was 64.52%.¹⁵

Blood transfusion was required by 2 patients in the PCNL group, while none of the patients in the RIRS group required blood transfusion. Mami et al had similar findings.¹⁶ Hemorrhage is one of the most troublesome PCNL consequences. During PCNL procedures, direct access to the pelvicalyceal system and intrarenal manipulation can cause injury to the renal vasculature, notably the segmental and interlobar arteries; hence bleeding is common during PCNL.¹⁷ RIRS triumphs in this aspect as it rarely calls for transfusion.

CONCLUSION

PCNL is currently the gold standard treatment for kidney stones larger than 2 cm in diameter, but it has disadvantages of longer hospital stay, more blood loss, and a higher requirement for transfusions. However, RIRS can provide satisfactory results in treating 2-3 cm renal stones. Furthermore, RIRS can considerably reduce hospital stay and PCNL morbidities. As a result, in carefully selected instances, RIRS with a holmium LASER may be a useful alternative to PCNL. However, further prospective randomized studies are needed to corroborate these findings.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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