RESEARCH

STUDY OF SAFETY AND OUTCOME OF PERCUTANEOUS NEPHROLITHOTOMY AT A TERTIARY HOSPITAL

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Abstract

Background: Since PCNL allows for a direct route to the calculus while causing less harm to the kidney and surrounding structures than the open method, percutaneous access to the kidney and stone removal need a high level of surgical competence. The purpose of the current study was to examine the outcomes and safety of percutaneous nephrolithotomy at a tertiary hospital. **Materials and Methods:** The current analysis was a hospital-based, prospective, observational study that involved patients who had PCNL at our hospital and had renal stones larger than 1.5 cm in diameter that had either failed conservative therapy or were refractory to ESWL. The current analysis was a hospital-based, prospective, observational study that involved patients who had PCNL at our hospital and had renal stones larger than 1.5 cm in diameter that had either failed conservative therapy or were refractory to ESWL. **Result:** In this inquiry, 156 patients who met the study's requirements were considered. With a mean age of 36.4 11.8 years and a mean BMI of 28.5 5.2 kg/m2, the majority (73.72%) were males. Compared to the left kidney (45.51%), the right kidney (54.49%) had a higher prevalence of stone placement. The average stone measured 2.8 x 1.2 cm. Common stone type was single stone (62.82 %), followed by multiple non-staghorn stones (23.08 %), complete staghorn stone (8.97 %) & partial staghorn stone (5.13 %). In present study single, two & three punctures were required in 92.95 %, 6.41 % & 0.64 % patients respectively. Majority patients had primary clearance of stone (78.21 %) followed by clearance in second sitting (12.18 %) & 7.05 % had residual stone. Failure was noted in 4 case (2.56 %). Major complications noted were fever (23.72 %) & transient haemorrhage (12.18 %), managed conservatively. Other complications were urinary leakage (5.13 %), bleeding (3.85 %), urinary tract infection (3.85 %) & track failure (2.56 %). **Conclusion:** PCNL is a safe, feasible, and very effective method for treating nephrolithiasis that has the advantages of a great outcome, little morbidity, and a shorter hospital stay.

INTRODUCTION

In the general population, urolithiasis affects 2 to 3 percent of people, and the lifetime risk of kidney stone development is thought to be around 12 percent.[1] For men and women, the lifetime chance of developing kidney stones is approximately 11% and 7%, respectively; this risk tends to rise with dietary and environmental changes.[2]

The goal of treatment is to completely remove calculi from the body without any remaining fragments, as well as to manage discomfort and completely eradicate the causing microorganisms. The development of minimally invasive procedures has revolutionised the management of urolithiasis and led to a decline in open surgical methods for treating urinary stones. Examples of these procedures include ureteroscopy, extracorporeal shock wave lithotripsy, percutaneous nephrolithotomy, and laparoscopic stone surgery.[3]

High surgical skill is required for percutaneous access to the kidney and stone removal since PCNL enables direct approach to the calculus while inflicting less damage to the kidney and surrounding structures than an open approach. The purpose of the current study was to examine the outcomes and safety of percutaneous nephrolithotomy at a tertiary hospital.

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MATERIALS AND METHODS

The current investigation was an observational, prospective, hospital-based study carried out in the Urosurgery Department at RGSSH Medical College & Hospital, RIMS, Raichur, India. A three-year study was conducted (January 2019 to December 2021). The institutional ethical committee gave its approval to the study protocol.

Inclusion Criteria

- Patients with renal stones sized >1.5 cm (failed conservative management or resistant to ESWL), underwent PCNL at our hospital, willing to participate

Exclusion Criteria

- Active urinary tract infection
- Patients of renal stone with indwelling nephrostomy / ureteric stent,
- Patients with bleeding diathesis,
- Patients with bilateral renal stones and azotemia
- Patients with significant coagulopathy
- Patients nit willing to participate
- Renal calculi in ectopic kidneys

Study was explained in local language & an informed consent was taken for participation. Patient demographic information, medical history, and examination results were recorded in a proforma. The standard diagnostic tests (CBC, LFT, RFT, PT/INR), urinalysis, urine culture-sensitivity, X-ray KUB, USG abdomen, and IVP were performed. The degree of hydronephrosis was examined by excretory urography or USG, and the size of the calculus and stone was assessed by measuring their biggest dimension on X-ray KUB film and USG. Only required radioisotope scans and CT abdominal scans were performed.

Before the procedure, patients were informed about the PCNL technique, its respective advantages and disadvantages, as well as the available alternative treatment options, and signed consent was obtained. A preventative antibiotic dose was administered 30 minutes prior to surgery. Following lithotomy for cystoscopy, the patient is placed in a prone position. Renal access tract was by single step dilatation upto 21 Fr, Pneumatic Lithoclast and a stiff 18.6 Fr Dresden nephroscope were used for PCNL. The usual post-operative treatment was given.

A follow-up KUB was performed after one week to determine the condition of any remaining stone particles. To ascertain the success rate and any potential delayed problems, an abdominal USG and X-ray KUB were acquired at 3 weeks. At three weeks, the Double-J (DJ) stent was removed.

Microsoft Excel was used to collect and compile the data, and SPSS 23.0 was used to analyse it. Descriptive statistics were used in the statistical analysis.

RESULTS

In this, 156 patients who met the study's requirements were considered. The majority (73.72%) were men, with a mean age of 36.4 11.8 years and a mean BMI of 28.5 5.2 kg/m2. The right kidney (54.49 percent) exhibited a higher prevalence of stone implantation than the left kidney (45.51 percent). The average stone measured 2.8 x 1.2 cm. Common stone type was single stone (62.82 %), followed by multiple non-staghorn stones (23.08 %), complete staghorn stone (8.97 %) & partial staghorn stone (5.13 %).

In present study single or two punctures were required in 92.95 % and 6.41 % patients respectively. Common locations were lower calyx (62.82 %), middle calyx (21.79 %) & upper calyx (8.33 %). Mean operation time was 36.28 ± 11.54 mins & mean duration of hospitalization was 4.12 ± 1.2 days.

In present study, majority patients had primary clearance of stone (78.21 %) followed by clearance in second sitting (12.18 %) & 7.05 % had residual stone. Failure was noted in 4 case (2.56 %).

Major complications noted were fever (23.72 %) & transient haemorrhage (12.18 %), managed conservatively. Other complications were urinary leakage (5.13 %), bleeding (3.85 %), urinary tract infection (3.85 %) & track failure (2.56 %).

Table 1: Patient Demographics and Stone Characteristics (N = 320)

Characteristics	Number of patients/ means ± SD	Percentage
Age, (in years)	36.4 ± 11.8	
Gender		
Male	115	73.72%
Female	41	26.28%
BMI (kg/m^2),	28.5 ± 5.2	
Stone location		
Right kidney	85	54.49%
Left kidney	71	45.51%
Stone size (in cms)	2.8 ± 1.2	
Stone type		
Single stone	98	62.82%
Multiple non-staghorn stones	36	23.08%
Complete staghorn stone	14	8.97%
Partial staghorn stone	8	5.13%

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Table 2: Number and Distribution of Access Puncture

Characteristics	Number of patients	Percentage
Puncture details		
Single puncture	145	92.95%
• Lower calyx	98	62.82%
• Middle calyx	34	21.79%
• Upper calyx	13	8.33%
Two punctures	10	6.41%
• Lower and middle calyx	5	3.21%
• Lower and upper calyx	3	1.92%
• Upper and middle calyx	2	1.28%
Three punctures	1	0.64%
Operation time (mins)	36.28 ± 11.54	
Hospitalization (days)	4.12 ± 1.2	

Table 3: Success rates

Success rates	Number of patients	Percentage
Primary clearance	122	78.21%
Clearance in second sitting	19	12.18%
Residual stone	11	7.05%
Failure	4	2.56%

Table 4: Complications

Complications	Number of patients	Percentage
Fever	37	23.72%
Transient haemorrhage	19	12.18%
Urinary leakage	8	5.13%
Bleeding	6	3.85%
Urinary tract infection	6	3.85%
Track failure	4	2.56%

DISCUSSION

After the development of minimally invasive procedures like ESWL and PCNL, the surgical management of renal tract stone disease has changed over the past 20 years. PCNL is advised for cases with stones larger than 20 mm^2, cases with struvite or cystine stones, cases where ESWL failed to remove the stone, and cases where anatomical malformation is present.[4,5]

Patients with complicated and sizable kidney stones are now being provided percutaneous nephrolithotomy (PCNL) or RIRS as therapeutic options. PCNL has essentially replaced open stone surgery due to its affordability, decreased morbidity, quicker recovery time, and fewer post-operative problems.[6,7] The patient's preferences, the surgeon's preferred surgical position, surgical expertise, and the anticipated treatment duration based on the size, number, and location of the stones all play a significant role in determining the anaesthetic chosen. Sushant D et al,[8] analysed 320 people, of which 246 (76.87%) were men and 74 (23.13%) were women, making a male to female ratio of 3.32:1. The median age was 36.4 11.8 years (range: 18 - 74). An procedure typically took 120 to 40 minutes. The radiation exposure lasted between 1 minute 30 seconds and 30 minutes, with a mean (SD) of 8.2 minutes (3.6). The typical hospital stay was 3.2 +/- 1.6 days long. SFRs, which are determined by the lack of any identifiable stones on plain radiographs or ultrasounds, or by residual fragments less than 5 mm, were 95.93%, while complete stone clearing was 92.18%. Complication rates were 11.8 percent.

The average age in the Ahmad I et al.9 study was 42.46 11.29 years. The majority of the stones in our study—nearly 60%—were between 21 and 30 mm in diameter, with a mean stone diameter of 24.56 7.809 mm. Following the operation, the mean haemoglobin level decreased by 1.35 0.843 g/dl. The average operation lasted 93.56 9.90 minutes. Our study had an overall success rate of 83.5 percent. ESWL (10 instances), second look PCNL (3 cases), and open surgery were used to treat 14 failed cases (1 case). No serious or long-term side effects were noticed, despite an increased prevalence of minor problems including transient mild hematuria (37.6%), mild puncture site pain (55.3%), or low-grade fever (24.7%).

The mean age of the 70 adult patients investigated by Udaya Man who had lower pole calyceal stones was 32. The average stone size ranged from 15.6 to 28 mm.[9,10] A 4.1-day hospital stay and a mean operation duration of 62 minutes (48–124 minutes) were recorded (4-8 days). The stone removal rate for stones under 20 mm and over 20 mm was 92.6 percent and 90.7 percent, respectively. Fever (8.5%), temporary haematuria (20%), urine leak (5.7%), blockage by leftover pieces (5.7%), and 1

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pseudoaneurysm were the consequences identified (1.42 percent). Ten percent, or 7 patients, required blood transfusions.

Osman Murat Pek,[11] evaluated 928 individuals, with a mean age of 41.9 years (628 male and 383 female). Of the surgeries that were assessed, 185 had mild or serious problems, whereas 826 had none. The modified Clavien grading system is used to categorise complications in the PNL procedure: 23 complications (2.27%) in grade 1, 143 complications (14.14%) in grade 2, 11 complications (1.08%) in grade 3A, 6 complications (0.59%) in grade 3B, 4 complications (0.39%) in grade 4A, and 15 complications (4.48%) in grade 4B. According to grade 5, there was no difficulty. Statistical analysis revealed that stone size, preoperative hydronephrosis grade, operating time, fluoroscopy, length of hospital stay, and In all groups, SF rates were useful indicators of the development of problems (p 0.05). Age, gender, BMI, the number of access points for the kidneys, and postoperative issues were not found to be indicators of complications (p>0.05).

The updates to PCNL methodologies took into account the advancements in patient placement, safer and more accurate tract construction procedures, novel imaging modalities, development of intracorporeal lithotripters, and incorporation of flexible equipment for efficient collection system screening.[12]

Modern PCNL is a multi-tiered procedure that requires accuracy and technical skill to complete each phase. After gaining access to the kidneys, safely dilating the ureter, performing intracorporeal lithotripsy, and removing the fragments, the patient must be properly positioned and the upper system emptied. The primary benefit of PCNL is its increased success rate, which is independent of the weight or makeup of the stones.[13]

On the other hand, the usage of PCNL is significantly constrained by its technical difficulty and higher morbidity than SWL. The learning curve for gaining renal access is very steep.[14] PCNL is a tried-and-true approach for treating renal calculi. Tubeless PCNL is replacing conventional PCNL more frequently since it has a lower success rate, less morbidity, and a shorter postoperative hospital stay.[9]

CONCLUSION

For kidney stones larger than 2 cm, percutaneous nephrolithotomy (PCNL) is recommended as the initial course of treatment. Nephrolithiasis can be successfully treated with PCNL, which is a safe, practical, and highly effective treatment with minimal morbidity and a short hospital stay.

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