



ORIGINAL RESEARCH PAPER

Urology

COMPLICATIONS ASSOCIATED WITH PERCUTANEOUS NEPHROLITHOTOMY –AN INSTITUTIONAL OBSERVATIONAL STUDY

KEY WORDS: Percutaneous nephrolithotomy, renal calculi, clinically insignificant residual fragments.

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ABSTRACT

Introduction: Percutaneous nephrolithotomy (PCNL) is described as the treatment of choice for large, complex, multiple and lower calyceal stones. It has replaced open stone surgeries in all age groups and all types of stones. **Materials and methods:** A total of 335 cases of renal calculi who underwent PCNL from September 15, 2014, to March 30, 2023 were studied. Intraoperative and postoperative complications were noted. They were followed up after 1 month post-surgical procedure. **Results:** Mean age of cases was 45 years. Postoperative fever and haemorrhage occurred in 63.6% and 19.7% of patients. Stone clearance was done through a single tract in 83.9%. Additional tracts were made in 16.1%. Tubeless PCNL was done in 27.5%. **Conclusion:** Percutaneous nephrolithotomy has a low complication rate when performed by experienced urologists. PCNL is still associated with specific complications which can occur during percutaneous access, nephroscopy, lithotripsy, and postoperative management.

INTRODUCTION

Percutaneous nephrolithotomy (PCNL) is the treatment of choice for large, complex, multiple and lower calyceal stones. It has replaced open stone surgeries in all age groups and all types of stones. Percutaneous entry into the renal collecting system was first described in the 1950s but later percutaneous access to the renal collecting system was routinely utilized for the removal of nephrolithiasis^[1]. PCNL was established as a minimally invasive treatment option for the removal of kidney stones in the 1970s and was further developed in the ensuing years^[2-4]. Today this procedure should be the first option for the treatment of single large or multiple renal stones and those in the inferior calyx. Percutaneous stone removal was suggested as the first-line treatment option for the management of staghorn calculi by the American Urological Association Nephrolithiasis Clinical Guidelines panel^[5]. There has been an increase in the utilization of PCNL due to the limitations of newer extracorporeal shock-wave lithotripsy (ESWL) equipment, an increase in stone prevalence, and the refinement of PCNL indications, techniques, and instrumentation^[6].

At the beginning of the career, PCNL is associated with complications due to a stiff learning curve. PCNL provides an excellent stone clearance rate. There are some complications that are predictable or unpredictable, such as fever, hemorrhage, postoperative ileus, pulmonary complications, and post-obstructive diuresis. In this study, we evaluated the occurrence and types of complications. The purpose of this single-center study is to analyse complications associated with PCNL.

MATERIALS AND METHODS

An observational study of 335 patients of renal calculi who underwent PCNL in AJ Institute of Medical Science, Mangaluru from September 15, 2014, to March 30, 2023 was carried out. All patients between the age group of 18 and 75 years were included in this study. Patients with preoperative fever were excluded from the study. The technique of PCNL: All the patients admitted for PCNL were subjected to routine blood investigations, ultrasonography abdomen and pelvis, and CT kidney, ureter, and bladder (KUB) with dual-energy. Patients first underwent retrograde pyelography in the lithotomy position, the ureteric catheter was inserted in the

kidney to be punctured. A Foley catheter was inserted and patient was changed to a prone position. After retrograde instillation of radiopaque dye through a ureteric catheter the kidney was punctured with a three-part needle under C-arm guidance and in some cases ultrasonography guidance. The upper, mid, or lower calyx was punctured depending on the ease of access. Stones were fragmented using a lithotripter and extracted out using forceps. JJ stenting was done and were discharged on the third post-operative day in uneventful cases.

Patients were reviewed one month after surgical procedure with X-ray KUB or ultrasonography of KUB depending on the opacity of stones and the requirement of any additional procedure was noted. JJ stent removal was done after four weeks if no stones were visible. The success rate was defined as patients who were stone-free or had clinically insignificant residual fragments (CIRF). The cut-off point of 4 mm was used to define the size of CIRF. The data were analysed statistically using Statistical Package for the Social Sciences statistical software (version 26).

RESULT

The mean age of cases for the study purpose was 45 years, with males comprising 76.1% and females 23.9%. Right-side involvement was seen in 173 (51.64%) and 162 (48.35%) cases. Stone clearance was done through a single tract in 83.9%. Additional tracts were made in 16.1%. The average operative time required for PCNL was 90 minutes. The average time to puncture and entry into the pelvicalyceal system was 12 minutes. The average postoperative stay was 3 days in uneventful cases.

Tubeless PCNL was done in 27.5% and PCN was inserted in 72.5% cases. Postoperative fever was seen in 64.6% and haemorrhage occurred in 18.5% cases. Postoperative ileus, urinary leak, pulmonary complications, and post-obstructive diuresis were seen in 7.6%, 4.5%, 3%, and 1.5% respectively.

One patient had hemothorax which was managed with the placement of a chest tube. One patient had post-obstructive diuresis which was managed by giving intravenous fluids. Patients with residual stones underwent additional procedures in the form of RIRS/ ESWL in a separate sitting.

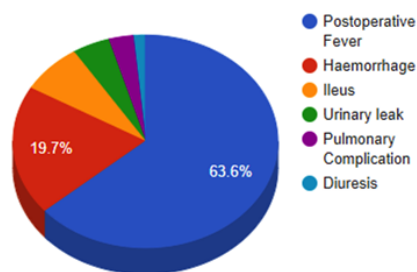


Fig-1 Postoperative complications

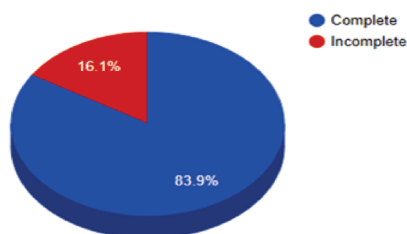


Fig-2 Rate of stone clearance

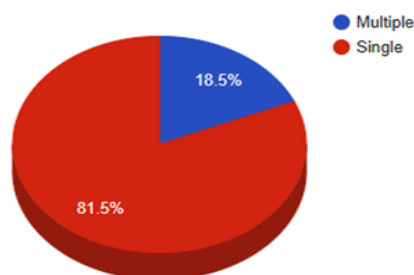


Fig-3 Number of tract punctured

DISCUSSION

Significant complications in PCNL can be due to incorrect patient selection, surgical skills, and technical errors. Post-PCNL fever is significantly higher and more common in patients with infected urinary stones^[7]. Hence prophylactic antibiotics are necessary prior to PCNL^[8]. Fever was strong indicator of urinary tract infection in culture positive cases. Patients who were treated for documented urine infection preoperatively had higher postoperative infectious complications. Urine culture and sensitivity is a widely used non-invasive preoperative investigation and antibiotics are started according to urine culture report. In our study, rate of post-PCNL fever was 63.6%. The total time of the procedure and the amount of irrigation fluid are major risk factors for the occurrence of postoperative fever^[9]. The fever usually resolves with continuing antibiotics for 48 hours. It is important to keep low pressure in the collecting system and restrict the duration of surgery to a minimum (< 90 minutes). In a study by Lee and colleagues on 500 patients who underwent PCNL, the most common complication was bleeding, with a 12% transfusion rate^[10]. Renal hemorrhage is the most worrisome and frequent complication of PCNL^[11]. The rate of renal hemorrhage in our study was 19.7%. Excessive bleeding during PCNL can be managed by the placement of a larger nephrostomy tube, hydration or balloon tamponade. Decreasing the total number of punctures can reduce the risk of damage to the renal vasculature^[12-13]. A study of Gupta et al where the stone clearance was 75%. Aron et al in 2004 found that stone clearance was seen in 72% patients^[14]. In our study stone clearance was done in a maximum number of cases through a single tract was 81.5%. Additional tracts were made to clear stones in 18.5%. The risk of injury to the pleura and lung increases (10%) if the puncture is above the 12th rib^[15]. If the puncture is through the pleura, a chest tube has to

be inserted for the prevention of hydrothorax or haemothorax. In our study pulmonary complication noted was 3%. Palnizkya, et al. reported the incidence of pleural complication in right and left kidney was 0% and 13.7%, respectively^[16]. A nephrostomy tube was inserted in 72.5% of the cases, while tubeless PCNL was done in 27.5%. Agrawal et al. compared tubeless percutaneous nephrolithotomy and standard PCNL procedure and reported significant reduction in urinary leakage, postoperative pain, need of analgesia, duration of hospital stay and faster post-PCNL recovery in the tubeless group^[17]. Karami et al. also documented that PCNL performed without nephrostomy tubes has positive impact on decreasing the duration of hospital stay^[18]. Post-PCNL radiographic imaging studies have been used to detect residual fragments (RF). Our study's method for detecting RF was either ultrasonography KUB or plain radiography KUB. The success rate is defined as the sum of CIRF and stone-free rates where 83.9% of the cases were stone free while only 16.1% had residual stones. In our study no mortality was noted. We attribute our high success rate to a well-organized team where the anaesthetist is prepared to deal with possible lengthy surgery and bleeding complications if any and working staff are well-trained with the equipment.

CONCLUSION

The findings of this study reveal PCNL as a first-line treatment modality for the management of renal calculi which offers the advantage of minimally invasive therapy with lower morbidity, shorter hospital stay, and higher stone-free rates without compromising patient safety. Percutaneous nephrolithotomy has low complication rate in experienced hands. Despite being a safe procedure, PCNL is associated with specific complications which can occur during percutaneous access, nephroscopy, and lithotripsy or postoperative management. Detailed knowledge of PCNL complications and their management is mandatory in order to reduce procedure-related morbidity without compromising patient outcomes.

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