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Original Article

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# Outcome of Percutaneous Nephrolithotomy (PCNL): Initial Experience in Rajshahi

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**Keywords:** Renal stone, percutaneous nephrolithotomy (PCNL), outcome.

*Abstract*

***Objective:*** *To assess the efficacy and safety of PCNL in the treatment of renal stone in Rajshahi.*

***Patients and methods:*** *The study was conducted in the department urology of Rajshahi medical college hospital from December 2016 to August 2021. Five hundred consecutive patients of Nephrolithiasis treated with PCNL were included in this study. Patients of Nephrolithiasis aged 18 years and above of both sex, with no bleeding disorder and fit for general anesthesia were treated with percutaneous nephrolithotomy. After PCNL patients were followed up for 3 months. Outcome was measured with stone clearance, blood transfusion, transient fever, UTI, urine leakage, other organ injury and hospital stay. Descriptive statistics was used to present the data.*

***Result:*** *Mean age of the patients was 40.46±10.64 years and mean size of the stone was 22± 8.50 mm. Stone clearance rate was 92.6% and residual stone was 7.4% cases. Overall complications were recorded in 26.60% cases. Hospital stay was 4.6±1.40, days.*

***Conclusion:*** *PCNL is a safe and effective procedure of renal stone surgery with few complications and short hospital stay.*

## Introduction

Kidney stone is very common worldwide.[1] Moreover; kidney stones are a recurrent disorder, with lifetime recurrence risks reported to be as high as 50%.[2] Urolithiasis causes physical suffering, organ damage, loss of working hour and expenditure of treatment. Therefore, urolithiasis is considered to be a disorder with significant social and economic burden. Suffering, organ damage, working hour loss and expenditure of treatment also vary according to mode of treatment. So, tremendous effort is continuing to overcome the burden associated with urolithiasis. Major technological advancement has improved the treatment modalities of kidney stones. Minimally invasive techniques, such as extracorporeal shock wave lithotripsy (ESWL), retrograde intrarenal surgery (RIRS), percutaneous nephrolithotomy (PCNL) and laparoscopic pyelolithotomy, have now largely replaced open surgery.[3] According to international guidelines; PCNL still remains the standard procedure for large and complex renal calculi. PCNL is the gold

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standard and the first choice for renal stones larger than 20 mm. It may also be an alternative to retrograde intrarenal surgery (RIRS) for the treatment of stones measuring between 10 mm and 20 mm due to better stone-free rates achieved by single procedure. Moreover, PCNL together with RIRS is an alternative option to SWL for lower pole stones measuring less than 10 mm. For lower pole stones 10-20 mm, PCNL is the first option together with RIRS in case of unfavorable factors for SWL. PCNL also should be one of the main options for the treatment of symptomatic calyceal diverticular stones. Large impacted proximal ureteric stones can also be treated by percutaneous ureterorenoscopy, especially in situations when the retrograde approach is not feasible or SWL has failed. The stone composition is another important factor that influences the treatment options. SWL-resistant stones such as brushite, calcium oxalate monohydrate and cystine should be alternatively treated by PCNL or RIRS. Contraindications for PCNL treatment according to EAU guidelines include ongoing anticoagulant therapy, untreated urinary tract infection (UTI), tumor in the presumptive access tract area, potential malignant renal tumor and pregnancy.[4,5] Percutaneous nephrolithotomy (PCNL) is practiced largely in many countries including Bangladesh. Recently, PCNL is introduced in Rajshahi but its efficacy and safety is not assessed in our setting. So there is an opportunity to assess the efficacy and safety of PCNL in Rajshahi and the present study was designed.

**Patients and methods:**

This descriptive observational study was carried out from December 2016 to august 2021in the department of urology of Rajshahi medical college, Rajshahi, Bangladesh. To conduct the study permission was taken from ethical committee of Rajshahi medical college. Patients of renal stone treated with PCNL in a private Hospital of Rajshahi included in the study. Patients aged 18 years and above of both sex having 20 mm and larger stone in renal pelvis, Staghorn stone, 10mm stone in lower pole, symptomatic diverticular stone and upper ureteral impacted stone were treated with PCNL and included in the study. Patients of nephrolithiasis with untreated urinary tract infection, suspected malignancy and pregnancy were excluded from the procedure and study. Patient was evaluated with urine for culture and sensitivity, coagulation profile, investigations for general anaesthesia fitness, Ultrasonogram, Intravenous urogram, and CT scan in some cases. Stone size was determined with USG, and CT scan if done. All patients were treated with prone PCNL under general anaesthesia or subarachnoid block. Puncture was done under fluoroscopic guidance. Standard procedure was done with 24-26 Fr tract dilatations whereas mini PCNL was with 16-18 Fr. Initially, single stone in renal pelvis with dilated calyceal system was selected for the procedure. After gaining expertise, confidence and armamentaria improvement complex renal stone was dealt with. Seventy four Patients with large pelvic stone were dealt with standard PCNL with shock pulse fragmentation and suction. Small stone in pelvis, calyces, symptomatic diverticular stone and upper ureteral impacted stone were dealt with mini PCNL with pneumatic lithotripsy. In 165 patients' more than on puncture were needed and dealt with in combination of standard and mini tract dilatation. Among them complete Staghorn stone was in 16 patients, partial Staghorn in 108 patients and multiple calyceal stone in 41 patients. Nephrostomy tube was used in 74 patients; and removed after 48 hours in 54 patients. In 20 patients nephrostomy tube was kept for second look procedure due to infection, residual stone or bleeding. Obstructing residual stone was cleared with second look surgery in 9 patients. Non-obstructing residual stones were managed with expectant therapy. DJ stent was used in 425 patients, ureteric catheter was kept for 48 hours in 13 patients and 62 patients were totally tubeless. Early in the practice, attempt to puncture were failed in 3 patients due to lack of expertise. Among them two patients were converted in open procedure and one patient was referred to other center. Outcome was measured with stone clearance, blood transfusion, transient fever, urinary tract infection, urine leakage, other organ injury and hospital stay. Stone clearance was declared with peroperative endoscopy and fluoroscopy findings, and postoperative USG, X-Ray or CT scan in some cases. Blood loss was determined peroperatively clinically and haemoglobin measurement after operation. Blood transfusion was given peroperatively on clinical assessment and postoperatively if haemoglobin dropped below 10g/dl. Transient fever and UTI was managed with appropriate drugs. Urine leakage was managed with conservative treatment. Evaluation for other organ injury was done with Ultrasonogram, x-ray chest and CT scan if suspected. Patient was discharged from hospital after control of haematuria and UTI if occurred. Usually D-J stent was removed after 3weeks but in some cases removed earlier where

UTI was not responding with antibiotics. After PCNL patients were followed up for 3 months with serum creatinine, urine for culture and sensitivity, USG, x-ray KUB and in some cases CT scan. Nine patients were failed to complete the follow-up. Data was collected and result was presented with descriptive statistics.

**Results:**

**Table –I :** *Distribution of patients by Age (n=500)*

| Age range (years) | Number of patients | Percentage (%) |
|---|---|---|
| < 30 | 21 | 4.20 |
| 31- 40 | 162 | 32.40 |
| 41- 50 | 169 | 33.80 |
| 51- 60 | 105 | 21.00 |
| >60 | 43 | 8.60 |
| Total | 500 | 100 |
| Mean±SD | 40.46±10.64 | |

In this study, age range of the patients was 18-75 years, mean age was 40.46±10.64 (Mean±SD) and majority (66.20%) of the patients was in 30-50 years' age group.

**Table –II :** *Distribution of patients by Sex (n=500)*

| Gender | Number of patients | Percentage (%) |
|---|---|---|
| Male | 374 | 74.80 |
| Female | 126 | 25.20 |
| Total | 500 | 100 |

Male female ratio was about 3: 1, (74.80% vs 25.20%).

**Table-III :** *Stone size distribution (n=500)*

| Stone size (mm) | Number of patients | Percentage (%) |
|---|---|---|
| <10 | 32 | 6.40 |
| 10- 20 | 198 | 39.60 |
| 21- 30 | 190 | 38.00 |
| 31- 40 | 46 | 9.20 |
| >40 | 34 | 6.80 |
| Total | 500 | 100 |
| Mean±SD | 22±8.50 | |

In the present study range of stone size was 8-55 mm and average size was 22±8.50 mm (Mean±SD), and most of patents had stone size 10 mm to 30 mm (77.60%).

**Table-IV:** *Table for location of stone (n=500)*

| Location of stone | Number of patient | Percentage (%) |
|---|---|---|
| Pelvis | 218 | 43.60 |
| Staghorn | 124 | 24.80 |
| Calyx | 41 | 8.20 |
| Upper ureter | 82 | 16.40 |
| Diverticula | 35 | 7.00 |
| Total | | 100 |

**Table-V:** *Stone clearance (n=500)*

| Status of clearance | Number of patients | Percentage (%) |
|---|---|---|
| Primary clearance | 463 | 92.60 |
| Secondary clearance | 9 | 1.80 |
| Total clearance | 472 | 94.40 |
| <4mm residual stone | 15 | 3.00 |
| >4mm residual stone | 10 | 2.00 |
| Failed to puncture | 3 | 0.60 |

Primary stone clearance was in 463 patients (92.60%), 9 patients needed second look surgery and over all clearance was 94.40%.

**Table-VI:** *Distribution of complications (n=500)*

Grading was done according to Clavien Dindo scale.

| Grade | Complications | Number of patients | Percentage (%) |
|---|---|---|---|
| I | Transient fever | 191 | 38.20 |
| | Temporary urine leakage | 31 | 6.20 |
| II | UTI | 83 | 16.6 |
| | Bleeding need transfusion | 54 | 10.80 |
| III | Pleura injury | 4 | 0.80 |
| | Other organ injury | 00 | 00 |
| IV | Sepsis | 5 | 1 |
| | Other (cardiac arrest) | 1 | 0.2 |
| V | Death | 00 | 00 |

In this study, in 54 patients (10.80%), mostly treated with multiple puncture, significant bleeding occurred and needed blood transfusion. The most common morbidity was postoperative fever in 38.20% of patients which was subsided after 1-2 day with routine

postoperative treatment. In 83 (16.6%) patients UTI were documented and managed with appropriate antibiotic according to culture sensitivity report. Unfortunately, 5 patients developed urosepsis which need vigorous treatment in ICU. Infection may be due to spread of previous UTI, organism harboured in the stone and from instruments .Temporary urine leakage from nephrostomy tract was 6.20% which was managed conservatively. Pleura injury occurred in 4 patients which were manage conservatively. No other organ injury was detected but in 1 patient developed cardiac arrest due to endotracheal tube malfunction and needed CPR. The patient was in ICU for 48 hours and recovered completely.

**Table-VII:** *Hospital stay*

| Days of hospital stay | Number of patients | Percentage (%) |
|---|---|---|
| 3 | 224 | 44.80 |
| 4 | 256 | 51.20 |
| >5 | 20 | 4.00 |
| Total | 500 | 100 |
| Mean (±SD) | 4.60±1.40 | |

Mean hospital stay was 4.6±1.40 days (Mean±SD).

**Discussion:**

Urolithiasis is generally a disease of the relatively younger people; this was also observed in the present study where the mean age of patients was 40.46 years. Urinary stone disease is common in male and the finding was similar with the present study; male female ratio 74.80: 25.20'

In this study, stone size was 22±8.50 mm (Mean±SD). In the present study, wide variation in the selection stone size was observed. Small stone (8mm) in calyceal diverticulum, lower polar stone, and impacted upper ureteral stone were selected for PCNL. On the other hand, initially large complete stag horn and multiple calyceal stone were excluded from the procedure. These selection criteria may affect the mean stone size and stone clearance rate. The goal of surgical stone management is to achieve maximum stone clearance with least morbidity to the patient.[6] In a community setting, approximately 90% of targeted stones can be removed successfully, and at experienced subspecialty care centers, this rate can approach to 100%.[7] In our study, stone clearance rate was 92.60% which was comparable with the study by Aarthy *et al.(* 91.4%), Ahmed Fahmy et al. (90.7%) and El Taby et al. (91.7%).[8,9,10] In studies by Iqbal Singh et al., and Sharma et al., 100% stone clearance was achieved.[11,12]

Percutaneous nephrolithotomy is generally accepted as a safe procedure.

The overall morbidity ranges from 7.5% to 18% depending upon the sample size and the presence of complicated renal stones.[13] In this study overall morbidity were recorded in 26.60% cases, which is higher than above mentioned studies, may due to initial lack of expertise and poor aseptic technique. Transfusion rate was 10.80% (n=54) which was comparable to studies done by Feng et al. and Türk C et al. (2% to 23%). [14,15]

Transient postoperative fever was observed in 38.20% cases which was similar to the study done by Shafiqul Azam et al.[16]In our study UTI was diagnosed postoperatively in 16.60% cases and among them 5 (1%) patients developed sepsis. These findings also comparable to Gerspach JM et al.[17]Injury to other organ is rare, colonic injury being the most common.[18] In this series, no patient had injury to colon, liver or spleen. Care was taken to avoid injury to surrounding organ by treating loaded colon with appropriate measures, and puncturing the calyx medially. Four (0.80%) patients developed hydrothorax where upper calyx was punctured supracostally. Hydrothorax was managed conservatively and recovered without seculae. Infracostal approach were used in most of the patients because rates of pleural injury in supra costal approach are three-fold greater, ranging from 23% to 100% for supra eleventh rib and 1 - 13% for supra twelfth rib.[19] Sepsis indicate a poor technique that has resulted in high pressure within the collecting system during manipulation. These problems can be avoided by using continuous flow instruments or an Amplatz system.[20]

Major bleeding during the procedure requires termination of the operation, placement of a nephrostomy tube, and secondary intervention at a later date. In most cases, venous bleeding stops when the nephrostomy tube is clamped for some hours. Persistent or late secondary bleeding is caused by an arterial injury and can be managed by selective therapeutic embolisation. Nephrectomy is rarely necessary, while major vascular injuries requiring further intervention occurs in only 2 - 3% of cases.[21-23] In this series, no patient needed nephrectomy or

intervention other than conservative treatment. Urinary fistulae are also reported in some studies but none was encountered in the present study. Thirty one patients (6.20%) in this study developed urinary leakage in early postoperative period, which were managed conservatively. The overall mortality of PCNL ranges from 0.5% to 1.1%, and is generally attributed to severe haemorrhage, urosepsis or pulmonary embolism. No surgery related mortality was recorded in the present study, but one patient needed CPR and ICU support for cardiac arrest due to malfunction of endotracheal tube.

**Conclusion and recommendation:**

Percutaneous nephrolithotomy (PCNL) is effective and safe procedure with few major complications. Urologist should be trained adequately and adopt the procedure.

**References:**

1. Romero V, Akpinar H, Assimos DG. Kidney stones: a global picture of prevalence, incidence, and associated risk factors. Rev Urol 2010;12(2-3):e86–e96
2. Prezioso D, Di Martino M, Galasso R, Iapicca G. Laboratory assessment. Urol Int 2007;79 Suppl 1:20 5.
3. Türk C, Knoll T, Petrik A, Sarica K, Skolarikos A, Straub M, *et al*. Guidelines on Urolithiasis. Arnhem (The Netherlands): European Association of Urology (EAU); 2013.
4. Turk C, Petrik A, Sarica K, et al. Urolithiasis. European Association of Urology. https://uroweb.org/guideline/urolithiasis/. Accessed: August 23, 2019 https://uroweb.org/guideline/2017 Nephrolithiasis guidelines/.
5. Assimos D, Krambeck A, Miller NL, Monga M, Hassan M, Nelson CP, et al. Surgical Management of Stones: AUA/Endourology Society Guideline. http://www.auanet.org/guidelines/surgical-management-of-stones-(aua/endourological-society-guideline-2016)/.
6. James E, Lingeman DA, Lifshitz AP, editors. Campbell's urology. 9th ed. Philadelphia: *Saunders;* 2007.
7. Rassweller JJ, Renner C, Eisenberger F. The management of complex renal stones. *Br J Urol* 2000; **86**:919-28.
8. Aarthy, P., Thangarasu, M., Prakash, J.S. *et al*. Safety and efficacy of mini-percutaneous nephrolithotomy as daycare procedure: a prospective observational study. *Afr J Urol* **27**, 9 (2021). https://doi.org/10.1186/s12301-020-00115-9
9. El-Tabey MA, Abd-Allah OA, Ahmed AS, El-Barky EM, Noureldin YA (2013) Preliminary study of percutaneous nephrolithotomy on an ambulatory basis. Curr Urol 7(3):117–121
10. Fahmy A, Rhashad H, Algebaly O, Sameh W (2017) Can percutaneous nephrolithotomy be performed as an outpatient procedure? Arab J Urol 15(1):1–6
11. Sharma AK, Nagabhushan M, Girish GN, Kamath AJ, Ratkal CS, Venkatesh GK (2013) Analysis of the feasibility and efficacy of ambulatory/day care percutaneous nephrolithotomy: an initial experience. UroToday Int J 6:44
12. Singh I, Kumar A, Kumar P (2005) "Ambulatory PCNL" (tubeless PCNL under regional anesthesia)—A preliminary report of 10 cases. Int Urol Nephrol 37(1):35–37.
13. Sahin A, Atsu N, Erdem E, Oner S, Bilen C, Bakkaloglu M, *et al*. Percutaneous nephrolithotomy in patients aged 60 years or older. *J Endourol* 2001; **15**:489-91.
14. Feng MI, Tamaddon K, Mikhail A, Kaptein JS, Bellman GC. Prospective randomized study of various techniques of percutaneous nephrolithotomy. *Urology* 2001; **58**:345-50.
15. Türk C, Knoll T, Petrik A, Sarica K, Seitz C, Straub M, *et al*. Guidelines on urolithiasis. *Eur Assoc Urol* 2010; **1**:28.
16. Md. Shafiqul Azam, Md. Abul Hossain, Md. Fazal Naser. outcome of percutaneous nephrolithotomy:our initial experiences Bangladesh J. Urol. 2019; 22(1): 80-84.
17. Gerspach JM, Bellman GC, Stoller ML, Fugelso P. Conservative management of colonic injury following percutaneous renal surgery. *Urology* 1997; **49**:831-6.
18. Healy KA, Ogan K. Pathophysiology and management ofinfectious stag horn calculi, *Urol Clin N Am* 2007; **34**:363-74.

19. Wen CC, Nakada SY. Treatment selection and outcomes: renal calculi. *Urol Clin N Am* 2007; **34**:409-19.

20. Reddy PK, Hulbert JC, Lange PH, Clayman RV, Marcuzzi A, Lapointe S, *et al*. Percutaneous removal of renal and ureter calculi: experience with 400 cases. *J Urol* 1985; **134**:662-5.

21. Mariappan P, Smith G, Bariol SV, Moussa SA, Tolley DA. Stone and pelvic urine culture and sensitivity are better than bladder urine as predictors of urosepsis following percutaneous nephrolithotomy: a prospective clinical study. *J Urol* 2005; **173**:1610-4.

22. Gupta R, Kumar A, Kapoor R, Srivastava A, Mandhani A.Prospective evaluation of safety and efficacy of supracostal approach for percutaneous nephrolithotomy. *BJU Int* 2002;**90**:809-13.

23. Munver R, Delvecchio FC, Newman GE, Preminger GM.Critical analysis of supra costal access for percutaneous renal surgery. *J Urol* 2001; **166**:1242-6.