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The Outcome of Percutaneous Nephrolithotomy (PCNL) in the Management of Large Upper Ureteric Stone

Md. Sayeef Ullah Sujan[*1], Muntasir Habib[2], Tasnim Alam Manzer[3], Laila Sabrina Shaharin[4], Sheikh Hasibur Rahman[5], Nakib Kamran Oni[6], Aslam Anjum[7]

Abstract

Introduction with objective: *Urolithiasis, a prevalent urologic condition affecting 10-15% of the population, poses significant challenges, particularly in impoverished nations where complications such as urosepsis and renal failure contribute to elevated morbidity rates. The surgical management of stone disease has evolved from traditional open procedures to include non-invasive and minimally invasive techniques, driven by factors such as stone location and size. Percutaneous nephrolithotomy (PCNL) introduced in 1955, revolutionized the approach to kidney stones, and its popularity has grown, especially for larger kidney stones and upper ureteric stones. The aim of this study was to observe and assess the outcomes of percutaneous nephrolithotomy in managing large upper ureteric stones.* ***Materials and Methods:*** *This prospective observational study was carried out among 35 patients attending at the department of Urology at Sir Salimullah Medical College Mitford Hospital, Dhaka for the treatment of upper ureteric stone within the defined period from January 2019 to December 2020. All the data were compiled and sorted properly and the quantitative data was analyzed statistically by using Statistical Package for Social Science.* ***Result:*** *The clinical features of patients who underwent PCNL were analyzed, revealing a mean stone size of 20.05 mm, an operative time of 90.17 minutes, and a postoperative hospital stay of 1.80 days. The distribution of stones on the right and left ureters was 51.40% and 48.60%, respectively, with a stone clearance rate of 97.1% and a 2.9% incidence of residual stones. The study further assessed postoperative complications, reporting per-operative complications in 28.6% of cases, including bleeding, pleural and renal pelvis injuries, and post-operative complications in 31.4%, such as fever, blood transfusion, and urinary leakage.* ***Conclusion:*** *Mean operative time, hospital stay was less. Comparative analysis revealed PCNL as a less morbid procedure, aligning with its established efficacy for stone clearance. The study contributes valuable insights into the clinical outcomes and complications associated with PCNL, offering considerations for its application in managing large upper ureteric stones.*

Keywords: *Percutaneous Nephrolithotomy (PCNL), Urolithiasis, Upper Ureteric Stones.*

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***1. Corresponding Author:**
Dr. Md. Sayeef Ullah Sujan
Assistant Professor
Department of Urology
Shaheed Monsur Ali Medical College
Dhaka, Bangladesh.
Email: sujan.ssmc@gmail.com
Contact: 01740973918

2. Dr. Muntasir Habib
Medical Officer
Department of Urology
Sir Salimullah Medical College and Hospital
Dhaka, Bangladesh.

3. Dr. Tasnim Alam Manzer
Associate Professor
Department of Urology
East West Medical College
Dhaka, Bangladesh.

4. Dr. Laila Sabrina Shaharin
MS Resident
National Institute of Opthalmology
Sher-E-Bangla Nagar, Dhaka, Banngladesh.

5. Dr. Sheikh Hasibur Rahman
Assistant Registrar
Internal Medicine
MAG Osmani Medical College Hospital
Sylhet, Bangladesh.

6. Dr. Nakib Kamran Oni
Senior House Officer
Emergency Department
Barking, Havering and Redbridge University Hospitals
NHS Trust, United Kingdom.

7. Dr. Aslam Anjum
Medical Officer
Feeali Health Center
F. Feeali, Maldives.

Introduction:

Urolithiasis, a benign urologic condition, with a frequency of 10-15% (Lopez and Hoppe, 2010). In impoverished nations, patients often have complications such as urosepsis and renal failure, leading to a large

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increase in morbidity rates. Stone disease is a significant proportion of the surgical effort for urologists in this region[1]. Stone disease may be treated using many types of surgical techniques, including non-invasive, minimally invasive, and open surgeries. The choice of method depends on the location and size of the stone[2]. The percutaneous method for accessing the kidney was first documented in 1955 by Goodwin and colleagues. The method used included the insertion of a nephrostomy tube to facilitate the drainage of a blocked renal unit. This instance prompted the realization that the same entry point may also serve as a functional pathway for the percutaneous extraction of the kidney stone. The age of percutaneous renal surgery started with the work of Deane and Clayman in 2007. Operative therapy of proximal ureteric stones is a significant challenge[3]. Proximal dilatation in ureteroscopic lithotripsy increases the likelihood of unintentional push back. In the past, urologists had limited surgical choices for treating bigger kidney stones, which mostly included open surgical procedures like pyelolithotomy and nephrolithotomy. However, these methods had their own drawbacks. With the growing use and refinement of these novel procedures, there has been a significant decrease in illness and death caused by renal urolithiasis. Percutaneous nephrolithotomy is increasingly being preferred for larger kidney stones, and there is also growing interest in using this surgery for upper ureteric stones as well[4]. PCNL, or percutaneous nephrolithotomy, is now being used and gaining popularity in several medical facilities around our nation.

Materials and Methods:

This prospective observational study was carried out among 35 patients attending at the department of Urology at Sir Salimullah Medical College Mitford Hospital, Dhaka for the treatment of upper ureteric stone within the defined period from January 2019 to December 2020. All patients admitted with ureteric stones were screened and those meeting the inclusion criteria were enrolled using a purposive sampling method. All the data were compiled and sorted properly and the quantitative data was analyzed statistically by using Statistical Package for Social Science. This study investigated the outcomes of percutaneous nephrolithotomy in the management of large upper uretericstone by comparing independent variables such as patient age, sex, and stone size with dependent variables including operative time, stone clearance rate, complications (per-operative and post-operative), hospital stay duration, and recovery time. Inclusion criteria: Age 15-70 years, Single, upper ureteric stone and Stone size > 1.5 cm. Exclusion criteria: Uncorrectable coagulopathy, End-stage renal disease (serum creatinine > 8 mg/dL), Pregnancy, Distal obstruction and Radiolucent stone.

Results:

Most of respondents (28.57%) were aged between 35 - 44 years. Mean age of the patients were 44.91 ± 13.92 (SD) years (Table I).

Table I: Age distribution of the respondents (n=35)

Age (in year)	n=35(%)
15-24	04 (11.43%)
25-34	05 (14.29%)
35-44	10 (28.57%)
45-54	08 (22.85%)
55-64	07 (20.00%)
65-70	01 (02. 86%)
Total	**35 (100)**
mean ± SD	**44.91 ± 13.92**

Most of the respondents (51.40%) were male (Table II).

Table II: Gender distribution of the respondents (n = 35)

Sex	Frequency n=35(%)
Male	18 (51.40)
Female	17 (48.60)
Total	**35 (100)**

The mean stone size was 20.05 mm, with a standard deviation of 1.34 mm, providing insight into the average dimension of stones treated. The average operative time for the PCNL procedure was 90.17 minutes, with a standard deviation of 8.27 minutes, indicating the typical duration of the surgical intervention. Postoperative recovery metrics were also elucidated, with patients staying in the hospital for an average of 1.80 days and taking approximately 1.98 weeks to return to normal activities, as reflected by mean values and standard deviations of 0.75 days and 0.91 weeks, respectively. Furthermore, the distribution of stones on different sides is presented, revealing that 51.40% of stones were located on the right ureter, while 48.60% were on the left ureter. Notably, the stone clearance rate after PCNL was high, with 97.1% of patients experiencing successful removal of stones. However, a small proportion, 2.9%, had residual stones post-procedure (Table III).

Table III: Distribution of clinical features of patients underwent PCNL (percutaneous nephrolithotomy

Characterestics	Mean ± SD
Stone Size (mm)	20.05 ± 1.34
Operative Time (min)	90.17 ± 8.27
Postoperative hospital stay (days)	1.80 ± 0.75
Time required to return normal activity (weeks)	1.98 ± 0.91
Stone Side	N (%)
Right Ureter	18 (51.40)
Left Ureter	17 (48.60)
Stone Clearance rate	34 (97.1)
Residual Stone	1 (2.9)

Per operative complications were observed in 28.6% of cases

(10 out of 35), encompassed instances of bleeding (14.3%) and renal pelvis injury (14.3%). Postoperative complications, affecting 31.4% of cases (11 out of 35), were diverse in nature. Fever emerged as the most prevalent postoperative issue, affecting 20% of patients. Additionally 11.4% patients required blood transfusions. No wound infections were documented in postoperative cases (Table IV).

Table IV: Distribution of patients according to preoperative and post-operative complications. (n=35)

	Per operative complications n=35(%)
With Complication	10 (28.6)
Bleeding	5 (14.3)
Pleural injury	0
Renal pelvis injury	5 (14.3)
	Post operative complications n=35(%)
With Complication	11 (31.4)
Fever	7 (20)
Urinary leakage	0
Blood transfusion	4 (11.4)
Wound infection	0

Discussion:

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[5]. According to the American Urological Association (AUA) guideline panel 2004 report, PCNL should be first line treatment for most patients with stag horn/large stones. Stone free rate of 78% (74 - 83%) which was equivalent to open surgery and superior to both shockwave lithotripsy (SWL) monotherapy (54%) and combination therapy SWL plus PCNL (66%). A success rate of 98.3% had been reported from Mayo Clinic in a series of 1000 patients for the small symptomatic calculi of upper ureter and renal pelvis [6]. In the present study, stone clearance rate by PCNL as mono-therapy was 97.1%. Only 2.9% of the patients in the present study have reported residual stone.In this study maximum patient were in 35 - 44 age group.A study done by Paryani et al., (2012) PCNL for proximal upper ureteric stone where maximum patient were aged 31-40 years[7]. Mean age of the patients was 44.91±13.92 years. Besides, 51.4% of the patients were male in the current study. In the present study the mean operative time was 90.17 ± 8.27min which as per Clinical Research Office of the Endourological Society (CROES) study comes under long time group[8]. Longer operative time increases anesthesia risks and respiratory complications, increased blood loss, and the need for transfusions[9,10]. The factors which affect the operative time are stone load and stone type, complexity of collecting system, obesity, and expertise of the surgeon[11]. Pulmonary complications, such as hydrothorax and pneumothorax are usually related to percutaneous renal access. Infracostal approach should be used when possible because complication rates of supra costal approach are three-fold greater, ranging from 23% to 100% for supra eleventh rib and 1 - 13% for supra twelfth rib. No such pulmonary complication was noted in this study but complications such as fever and blood transfusion were found in 20% and 11.4% of the patients respectively.

Conclusions:

Although percutaneous nephrolithotomy (PCNL) is a safe procedure for the treatment of upper ureteric calculus, it sometimes results in some complications. Bleeding after PCNL is generally self-limited and can be treated conservatively. However, it is important to determine the time for emergent intervention. The mean operative time was less in percutaneous nephrolithotomy and it is an effective and safe procedure with a high stone-free rate.

Conflict of Interest: None.

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