

# Complications of Percutaneous Nephrolithotomy Classified by the Modified Clavien Grading System: A single center's experience over 12 months

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## ABSTRACT

**Background:** Percutaneous nephrolithotomy (PCNL) is generally a very safe and well-tolerated procedure, but as with any surgical intervention, PCNL is not free of complications. It was very difficult to compare complications of PCNL with other hospitals data until the development of calvin grading system.

**Place and duration of study:** This study was conducted in Urology Department at Shaikh Zayed Hospital, Lahore from January 2017 to January 2018.

**Methods:** A total 190 cases of PCNL procedures were performed and complications were noted. Clavien grading system provides classification of complications of PCNL according to their severity in an excellent way.

**Results:** Out of the 190 patients, 130(68%) were male and 60(32%) female. The mean age of the patient population was 35.0±9.56 years (range: 10–65 years). The mean size of stones was 2.8cm (ranging from 1.5-4cm). 70(37%) patients had pelvic stones, 30(16%) patients had stag horn calculi, 40(21%) patients had upper pole calyces stones and 50(26%) patients had lower pole calyces stones.

**Conclusion:** Percutaneous nephrolithotomy is a gold standard treatment for renal stone disease. It is need of time to document complications of other urological procedures according to Calvin grading system so that outcomes of other urological procedures may improve.

**Keywords:** Percutaneous nephrolithotomy, Complications, Clavien Grading System.

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## INTRODUCTION

Urolithiasis is common urologic diseases with almost 10% of lifetime incidence.<sup>1</sup>In modern era development of newer minimally invasive technologies has revolutionized the management of urological diseases. There are dramatic changes for the management stone disease, a shift from open surgery to minimal invasive endourological options. First time percutaneous nephrolithotomy was described by Johansson and Fernstrom in 1976<sup>2</sup>, is now well established, well known and minimally invasive technique that is considered the gold standard treatment for larger renal and upper tract stones, in difficult situations such as calculi in anatomically abnormal kidneys for example horse shoe kidneys, ectopic kidneys and other difficult situations are previous history of pyelolithotomy, ESWL failure and cystine stones. With the invention of fine instruments, PCNL is now having modifications such as mini, ultra mini and micro PCNL. The idea behind all these innovation was to decrease complications because of dilatation of tract.

PCNL is generally well-tolerated and safe procedure, but as with any surgical intervention, PCNL is not free of complications.<sup>3</sup> It was very difficult to compare complications of PCNL with other hospitals data until the development of calvin grading system.<sup>4</sup> Overall complication rate of 20.5% was documented by an international multi-center study of 5,803 patients that underwent PCNL. The examination, led by the Clinical Research of the Endourological Society (CROES), used the adjusted Clavien framework for announcing intricacies.

Most of intricacies were minor, with paces of 11.1%, 5.3%, 3.6%, 0.5% and 0.03% of for grade I, II, III, IV and complexities, separately.<sup>5</sup>

## PATIENTS AND METHODS

After approval from ethical committee a study conducted between January 2017 and January 2018. Total 190 cases of PCNL procedures were performed at Urology Department Shaikh Zayed Hospital, Lahore and data was retrospectively reviewed and complications were noted.

Pre-operative assessment of all patients included complete medical history, examination and necessary investigations such as complete blood count, coagulation profile, complete urine examination, urine culture and sensitivity test, serum creatinine, blood urea nitrogen, serum uric acid and liver function test. Patient having radio opaque stones on X ray KUB were advised intra venous urography. Patients with radiolucent stones and suspected ureteric stones were advised CT KUB plain. Before proceeding for PCNL all patients underwent anesthesia fitness. Each case had a documented negative urine culture or treated with antibiotic according to the culture and sensitivity report. Informed and written consent regarding the procedure was taken from all the patients.

The patient was turned to prone position, to visualize and distend the collecting system in addition to identification the site, size and number of stones a retrograde pyelogram was performed in all cases. 16-gauge needle, under fluoroscopic guidance was used for percutaneous access into the calyx. During the PCNL tract dilatation, differentiate medium was infused through the cut needle to affirm the profundity of the dilators. Before

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position of an Amplatz sheath in the gathering framework, the percutaneous tract was widened upto 28-Fr. Unbending nephroscopy was performed with a pneumatic lithotripsy gadget being utilized to break the stones. Stone grasping forceps were used to retrieve the fragments. To confirm the complete stone clearance visualization of the whole accessible collecting system was done and further confirmed with fluoroscopy at the end of the procedure.

A double J stent was placed at the end of procedure. Nephrostomy tube was placed where there was suspicion of bleeding from the tract.

On first day post-operatively, the Foleys catheters was removed. AX-ray KUB was done after 24 hours to confirm the position of double J stent and to check residual stone fragments. Nephrostomy tube was also removed on second postoperative day. JJ stent was removed six weeks after the procedure, if complete stone clearance obtained. Patients with significant residual stones were advised ESWL and stent removed after complete stone clearance. Stone clearance status was confirmed after obtaining both X ray KUB and ultrasound KUB.

Peri and postoperative complications were documented using modified Clavien grading system. According to the modified Clavien classification system, perioperative complications were stratified into five grades (Table 1).

**Grade 1:** Any deviation from the typical postoperative course without the requirement for pharmacologic treatment or careful, endoscopic and radiologic mediations. Permitted restorative regimens are sedates as antiemetics, antipyretics, analgesics, diuretics, electrolytes, and physiotherapy.

**Grade 2:** Complications requiring pharmacologic treatment with drugs other than such took into account grade 1 intricacies. Blood transfusions and all out parenteral nourishment are additionally included.

**Grade 3:** Complications requiring surgical, endoscopic, or radiologic intervention.

**Grade 3a:** Mediation not under general sedation

Grade 3b: Intervention under general sedation

Grade 4: Life-undermining intricacies (counting focal sensory system difficulties) requiring emergency unit

Grade 4a: Single organ brokenness (counting dialysis)

Grade 4b: Multiorgan brokenness

Grade 5: Patients Death

## RESULTS

Total number of patients were 190. Out of the 190 patients, 130(68%) were male and 60(32%) female. The mean age of the patient population was 35.0±9.56 years (range: 10–65 years). The mean size of stones was 2.8cm (ranging from 1.5-4cm). Out of 190 patients, 70(37%) patients had pelvic stones, 30(16%) patients had stag horn calculi, 40(21%) patients had upper pole calyces stones and 50(26%) patients had lower pole calyces stones. Regarding operative approach, 110(58%) patients were approached via upper pole of calyces, 30(16%) patients via middle pole of calyces, 20(10%) via lower pole of calyces, and 30(16%) required more than one track. Mean hospital stay was

6.0±3.1 days (ranging from 3-10 days), including one day before surgery. Majority 155(81%) patients were primarily stone free while 25(13%) patients underwent ESWL for residual stones, 5(3%) were required RIRS and 5(3%) underwent redo PCNL.

Fig. 1: Gender distribution of patient

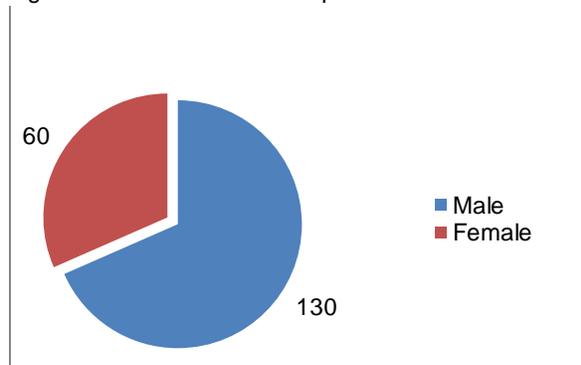


Table 1: Age Distribution of Patients (n=190)

Age (years)	No.	%
10–30	96	50.0
31–60	81	43.0
>60	13	7.0
Mean±SD	35.01±9.56	

Table 2: Frequency of Stone Size (cm) of Patients (n=190)

Stone Size	No.	%
1.5-2.5	84	44.0
2.6-3.50	93	49.0
>3	3	7.0
Mean±SD	2.8cm	

Table 3: Frequency of Type of Stones of Patients (n=190)

Type of Stone	No.	%
Pelvic stone	70	37.0
Stage horn calculi	30	16.0
Upper pole calyces tones	40	21.0
Low er pole calyces	50	26.0

Table 4: Frequency of Operative Approach of Patients (n=190)

Operative approach	No.	%
Upper pole of calyces	110	58.0
Middle pole of calyces	30	16.0
Low er pole of calyces	20	10.0
More than one track	30	16.0

Table 5: Frequency of Operative Time in Minutes of Patients (n=190)

Operative Time	No.	%
40-80	78	41.0
81-120	112	59.0
Mean±SD	90.60±60.2	

Table 6: Frequency of Hospital Stay (days) of Patients (n=190)

Hospital Stay	No.	%
3-6	116	61.0
7-10	74	39.0
Mean±SD	6.0±3.1	

Table 7: Frequency of Stone Clearance of Patients (n=190)

Type of Stone	No.	%
Primarily stone	155	81.0
ESWL for Residual stones	25	13.0
RIRS(Residual stones)	5	3.0
Redo PCNL for Residual stones	5	3.0

Table 8: Frequency of Complications of Patients (n=190)

Complications	No.	%
<b>Grade I</b>		
Transient fever >38 (atelectasis etc)	30	15.78
Transient pleural effusion or atelectasis without fever	8	4.21
Transient elevation of creatinine	3	1.57
<b>Grade II</b>		
Peri-nephrostomy catheter urine leakage <24 h (%)	18	9.47
Blood Transfusion (%)	14	7.36
Pneumonia (%)	4	2.10
<b>Grade IIIa</b>		
Renal hemorrhage requiring angioembolization (%)	3	1.57
Hemo/pneumothorax requiring chest tube insertion (%)	7	3.68
Retention due to blood clots (%)	2	1.05
<b>Grade IIIb</b>		
Collecting system perforation (%)	0	0
<b>Grade IVa</b>		
Bowel injury (%)	1	0.52
<b>Grade IVb</b>		
Sepsis (%)	4	2.10
<b>Grade V</b>		
Death	-	-

**DISCUSSION**

Percutaneous nephrolithotomy is gold standard technique for the management of renal calculi. There are various indications for PCNL in case of renal calculi, such as stone location, stone size, stone composition, history of previous open surgery and ESWL resistant stones.<sup>6</sup> In Pakistan, percutaneous nephrolithotomy is well established technique and evolved since one decade. Now various modifications of PCNL such as, mini, ultra mini and micro PCNL are being done in various urology setups.

Although PCNL is safe procedure with maximum stone clearance, but complications such as life threatening bleeding, infection and nearby viscera injury is troublesome, risks life of patient and difficult to manage. In every procedure there are two important components that should be addressed, one is success rate and other is complication rate. In case of PCNL success rate is measured by clinically insignificant residual fragments (CIRF). It was a difficult task to document and compare complications with other centers in case of PCNL because some factors such as urine leakage and fever were not properly documented. There was a need of time to develop a standard grading system, so that overall complications rate as well as severity of complications can be documented. Clavien grading system has been used already in the field of urology to document complications of radical prostatectomy<sup>7-8</sup> and radical cystectomy.<sup>9</sup>

First modified Clavien classification system was adopted by Tefekli et al to document complications of

PCNL in 2007.<sup>10</sup> Total numbers of PCNLs was 811 and Tefekli et al reported that overall complications in 29.2%.<sup>18</sup>

Most common complications in our study was transient fever (15.78%) followed by perinephrosyomy leakage (9.47%) and haemorrhage that needs blood transfusion (7.36%). As hemorrhage occurs due to tract dilatation and present in all cases but only documented those cases that require blood transfusion. In 1.57% patients hemorrhage was not controlled by conventional methods such as clamping of nephrostomy and there was need of renal artery angioembolization. In one study that was published in JCPSP in 2014 by Shahzad Ali et al<sup>11</sup> transient fever occurs in 55.43% of patient and hemorrhage occurs in 8.57% of patients. In their study there was no documentation of angioembolization due to severe uncontrolled bleeding but nephrectomy has to be done in one case (0.57%) because of severe bleeding. In another study, fever is reported in up to 32% of cases after PCNL.<sup>12</sup> In case of upper pole puncture there was haemo/pneumothorax in some cases (3.68%) and chest tube insertion was done in our study, while there was no need of chest intubation by Shahzad et al.

In another prospective study conducted by de la Rosette et from collected data by the Clinical Research Office of the Endourological Society (CROES) for large number of patients, 5803 who were treated with PCNL at centers around the world during November 2007 through December 2009.<sup>13</sup> de la Rosette used modified Clavien grade to document complications and according to data there was I (11.1%), II (5.3%), IIIa (2.3%), IIIb (1.3%), IVa (0.3%), IVb (0.2%) and V (0.03%).

Complication rates of every surgical procedure can be classified that would improve outcomes. The Clavien reviewing framework help us to assess the well being of methodology and look at changed strategies dependent on standard grouping framework. It also analyzes various surgical techniques; thereby improve patient care and better outcomes.

**CONCLUSION**

PCNL is gold standard treatment for renal stone disease. The modified Clavien grading system provides classification of complications of PCNL according to their severity in an excellent way. It is need of time to document complications of other urological procedures according to Calvin grading system so that outcomes of other urological procedures may improve.

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