



COMPLICATIONS OF PERCUTANEOUS NEPHROLITHOTOMY –AN INSTITUTE EXPERIENCE

Urology

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ABSTRACT

Objectives- To know the incidence of complications of percutaneous nephrolithotomy (PCNL) at our institute. **Materials And Methods-** From NOVEMBER 2021 to MAY 2023, 140 cases of PCNL were performed at our institute. A prospective study was done in view of complications occurred during the study period we analyzed 140 patients for complication rates & classified by the modified Clavien grading system. **Results-** In 140 patients, staghorn stone patients are 36. Bilateral staghorn calculus 3 cases. A total of 42 (30%) complications were documented in patients. According to the modified Clavien classification, grade I, II, IIIa, IIIb, IVa, IVb, and V complications were observed in 28 (20%), 6 (4.2%), 15 (10.7%), 3 (2.1%), 2 (1.4%), 1 (0.7%), and 1 (0.7%) patients, respectively. The most common complication was extravasation of irrigation fluid (11%) and postoperative fever. Bleeding & blood transfusion required in 10 (6.9%). Other individual complications occurred in less than 1.5% of cases. **Conclusions:** A shorter operation time is associated with less bleeding. Staghorn stones are significant contributing factors for developing postoperative fever and sepsis. Prolonged surgery and multiple punctures there is increased incidence of extravasation.

KEYWORDS

Percutaneous nephrolithotomy, Staghorn calculus Complications, Extravasation

INTRODUCTION-

The technique of percutaneous nephrolithotomy (PCNL) was first described by Fernström and Johansson in 1976 [1]. Since then, PCNL has established itself as a first line treatment for the management of upper urinary tract calculi, especially large and complex renal calculi [3]

Complication rates for PNL reportedly range from 20-83% (12-13).

The Standardized reporting of complications of PCNL by utilizing the modified Clavien grading system. Major complications (grade III, IV and V) of PNL are often associated with the performance of percutaneous access into the renal collecting system, and may include injury to adjacent organs, violation of the pleural space, bleeding or infection.

AIMS:

To Know The Overall Occurrence Of Complications In PCNL

OBJECTIVES:

- Rate of specific complications in PCNL
- Mortality rate
- Risk factors associated with increased incidence of complications

MATERIALS AND METHODS-

Study Design : prospective analytical study

Study Duration : 19 months

Study Population : All diagnosed cases of renal calculus underwent PCNL

Sample size : 140

Inclusion criteria:

- Age 14-70 years

- Renal Calculus of size > 1.5cm, multiple, staghorn
- PUJ calculus
- Proximal ureteric calculus cleared by push back PCNL

Exclusion Criteria :

- Age < 14 years
- Patient with bleeding disorders

From November 2021 to May 2023, 140 cases of PCNL were performed in our center. We prospectively analyzed 140 cases of PCNL in view of various complications occurred. All patients also underwent X-ray KUB, along with CT urogram. Third-generation oral cephalosporin or quinolone or culture sensitivity antibiotic was administered preoperatively.

With the patient under general endotracheal anesthesia, prone position. Under fluoroscopy, puncture & single step dilatation was performed with 26F Amplatz dilator. 24F nephroscope used for stone fragmentation using pneumatic lithotripter and the stone was removed by using forceps. In this study, we reviewed our experience with PCNL to grade perioperative complications according to the modified Clavien grading system.

RESULTS-

No. of patients	140
Mean age±sd (range) in years	45.8±2.7 (14-70)
Male:female (%)	90:50 (64:35)
Stone location (%)	
Staghorn stone	36 (25)
Renal pelvis	82 (58.5)
Renal calyx	10 (7.1)
Proximal Ureter	12 (8.5)
Mean stone burden±SD(range)	25±7mm (15-40mm)
BMI±SD (range)	24.3±3.5 (14.7-43.7)

Laterality	
Right (%)	88 (62)
Left (%)	43 (30)
Bilateral stone (%)	9 (6.4)
Preop pyuria (%)	7 (5)
Preop hematuria (%)	5 (3.5)
Previous stone history	22 (15.7)

Table 2. Peri- And Postoperative Data

Mean operation time±sd(range) in minutes	132.6±61.4 (55-540)
Puncture site and No. of attempts	
Multi-puncture>3 (%)	40(28.5)
Supracostal puncture (%)	6(4.2)
Ipsilateral URSL (%)	4(2.8)
Contralateral URSL	9(6.4)
Overall stone free rate (%)	98(70)
Mean hospital stay±sd (range) in days	5±2.6 (5-28)
nephrostomy placement ±sd(range) in days	7±1.6(1-7)
Ancillary procedures (%)	
Re-PCNL (%)	12(8.5)
ESWL (%)	20 (14.2)
URSL (%)	3 (2.1)
Drop in Hb (postop) ±SD(range) in g/dl	1.2±2.5 (1.9-4.5)
mean Increase in serum Cr (postop)±SD (range) in g/dl	0.5±1.5 (-0.85-2.5)

Table 3. Complications	
Grade I	
Transient fever>38 (atelectasis etc) (%)	17 (12.1)
Transient pleural effusion or atelectasis without fever (%)	3 (2.1)
Transient elevation of creatinine	10(7.1)
Grade II	
urine leakage<24 h (%)	5 (3.5)
Blood transfusion (%)	16 (11.4)
Pneumonia (%)	2 (1.4)
Total no. of Extravasations	21 (15)
Extravasation not requiring drainage	12 (8.5)
Grade IIIa	
Extravasation requiring drainage	9 (6.4)
Renal hemorrhage requiring Angioembolization (%)	0
Postoperative double-J stent placement for urine leakage (%)	0
Hemo/pneumothorax requiring chest tube insertion (%)	0
Retention due to blood clots (%)	3 (2.1)
Grade IIIb	
Collecting system perforation (%)	5 (3.5)
PUJO (%)	1(0.7)
Grade Iva	
Bowel injury (%)	0
Nephrectomy (%)	1(0.7)
Grade IVb	
Sepsis (%)	3(2.1)
Grade V Death	1 (0.7)

Overall, complications occurred in 30%of the PCNL (42 patients).the predominant complications in our study is Extravasations (15%), Transient fever(12.1%),Blood transfusion (11.4%), Transient elevation of creatinine(7.1%)

Major complications included septicaemia in (2.1%), Nephrectomy(0.7%) mortality rate was (0.7%),

Total of 21 patients developed Extravasation of them 12 managed conservatively 7 required percutaneous drainage and 2 patients required open drainage 1 patient developed sever intractable haemorrhage followingPCNL,and nephrectomy was done.

One patient with staghornstone died after PCNL.Went into AKI , continuous renal replace ment therapy given ,eventually patient developed hypoxemia and respiratory acidosis despite mechanical ventilation.

All the statistical data is computed ,analyzed and results are

obtained using IBM-SPSS-29 version software

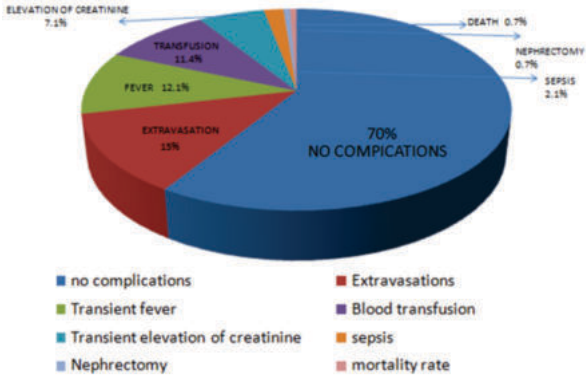


Fig. 1 Rate Of Complications

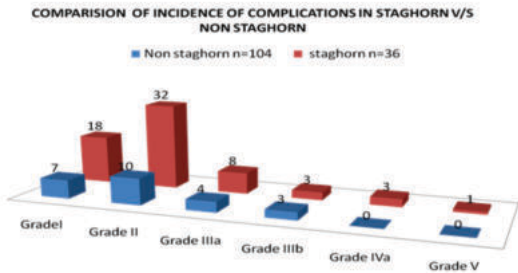


Fig. 2

Table.4

Grade	Non staghorn n=104	Staghorn n=36	P value	OR (CI for OR)
GradeI	7	18	<0.001	13.9(5.1-38.0)
Grade II	10	32	<0.001	75.2(22.0-256.5)
Grade IIIa	4	8	0.001	7.1(2.0-25.5)
Grade IIIb	3	3	0.164	3.1(0.6-16.0)
Grade Iva	1	3	0.022	9.4(0.9-93.1)
Grade V	0	1	0.088	-

Table.5

Relevant studies on complication of PCNL and comparission with our study									
Series (citation)	Shin 4	Mousavi-Bahar 5	El Naha 6	de la Rosette 7	Lee 8	Rana 9	Osman 10	Ourstudy	
Patient number	88	671	241	5,803	582	667	315	140	
Complication (%)									
Transfusion	6.9	0.6	16	5.7	11.2	1.49	0	11.4	
Hemorrhage requiring intervention	1.4	0.15	2	NA	NA	0.14	0.3	0.7	
Fever	11	1	1.2	10.5	22.4	NA	32	12	
Sepsis	0.6	0	0.4	NA	0.8	1.79	0.3	2.1	
Colonic injury	0.7	0.3	NA	NA	0.2	0	0	0	
Pleural injury	1.1	0.7	2.4	1.8	3.1	0.14	0	0	
Extravasation/urine leak	0.4	5.2	8	3.4	7.2	NA	NA	15	
Mortality	0.4	0.3	0.4	0.3	0.3	0	0.3	0.7	

DISCUSSION

Percutaneous nephrolithotomy is an established technique used to treat large and complex renal calculi [14]. The 2023 American Urological Association (AUA) and 2023European Association of Urology (EAU) guidelines on themanagement of staghorn calculi recommend PCNL as the first-line treatment for staghorn calculi, any renal stone that exceeds 20 mm in diameter, and lower calyceal stones[15,16].

Tefekli et al first adopted the modified Clavien classification system to stratify complications of PCNL in 2007 [17]. In their series of 811 PCNLs, Tefekli et al reported overall complications in 29.2% (vs. 30% in our study) [17].

de la Rosette et al(7) collected prospective data from the Clinical Research Office of the Endourological Society (CROES) for 5,803 patients the distribution of scores in the modified Clavien grade was I (11.1%), II (5.3%), IIIa (2.3%), IIIb (1.3%), IVa (0.3%), IVb (0.2%), and V (0.03%). In our study According to the modified Clavien dindo

classification, grade the rate of complications I, 28 (20%), II 6 (4.2%), IIIa 15 (10.7%), IIIb 3 (2.1%), IVa 2 (1.4%), IVb, 1(0.7%), and V 1(0.7%).

Overall occurred in 30% of the PCNL (42 patients) comparable with Mousavi-Bahar (5) is 30% & Adithya et al study of 29.9%. Total of 21 patients developed Extravasation of them 12 managed conservatively 7 required percutaneous drainage and 2 patients required open drainage 1 patient developed sever intractable haemorrhage following PCNL, and nephrectomy was done.

One patient with staghornstone died after PCNL. Went into AKI, continuous renal replacement therapy given, eventually patient developed hypoxemia and respiratory acidosis despite mechanical ventilation.

7 patients of 36 staghorn cases developed post operative fever and 3 needed ICU care for sepsis management. Extravasation is the most common complication in our study 15%. The common source for extravasation and fluid absorption is a perforation of the collecting system. Methods of prevention include manipulation only under X-ray or endoscopic control, use of an open or continuous flow system, and use of normal saline as irrigant. However, even with these precautions a high-fluid volume syndrome may develop. Therefore, if the fluid discrepancy (inflow/outflow) exceeds 500 ml, the procedure should be stopped and a nephrostomy placed. Monitoring of the serum electrolytes is mandatory.

Urine extravasation following PNL may occur in case of severe perforation of the collecting system or the nephrostomy tract (extraperitoneal). Problems are flank pain or signs of infections under antibiotic treatment. Percutaneous drainage of the urinoma and the collecting system (i.e., additional double-J stent) may become necessary [18].

Septicaemia can occur as a result of infection introduced via the access to the kidney or if the stones are infected. Following PCNL, fever is significantly higher and more frequent in patients with infected urinary stones than in those with sterile stones [19]. Renal insufficiency increases the risk. Prophylactic antibiotics and draining of a pyonephrotic kidney before performing PCNL is mandatory [20]. Antibiotics can be applied by single-dose or short-course prophylaxis protocols with no significant differences between them in case of sterile urine [21]. The duration of surgery and the amount of irrigation fluid are significant risk factors for postoperative fever [22]. It is also important to prevent a high pressure in the collecting system [19] and to keep the duration of operating time to a minimum (i.e., <90 min). Sepsis rates reported in the literature vary from 0.97% [23] to 4.7% [24]. In our series, 2.1% had urosepsis. In cases where septicaemia has occurred, the patient should receive intensive care therapy including forced diuresis, antibiotic treatment, optimal renal drainage, and electrolyte control [20].

Risk factors for increased occurrence of complications in Anastasiadis et al [25] study are Presence of staghorn calculi, Need of multiple tracts, Increase in operative time, Higher stone burden. Similar results are seen in our study. Moreno-Palacios et al. [26] in their study identified female gender, complex calculi and operative time >120 minutes as factors associated with severe complications. In the CROES study, fever of more than 38.5 degrees occurred in 10.5% of cases, similar to our study 12.1% [7]. In the literature, fever is reported in up to 32% of cases after PCNL [27]. Both the AUA and EAU guidelines recommend antibiotic prophylaxis for all patients who are undergoing PCNL [28,29]. The AUA guidelines report the benefits of a single dose of antibiotics. Blood transfusion, the third most common grade II complication, was necessary in 11.4% of cases in our study. Perhaps the most significant complication of PCNL, bleeding requiring transfusion has been reported to have an incidence as high as 23% [30]. In the CROES study, transfusion was administered in 5.7% of patients [20]. Bleeding can occur in every step of PCNL from percutaneous access to tract dilation to stone disintegration [31].

CONCLUSIONS:

The risks of developing clinically significant complications, such as bowel injury, sepsis, and death, remain low. Patients with staghorn stone are at risk of developing postoperative fever, sepsis and need of transfusion. Prolonged surgery and multiple punctures, large stone burden being the significant risk factors for Extravasation.

A shorter operation time, least manipulation of the pelvicalyceal system, controlled in and outflow of irrigation will decrease the incidence of extravasation and haemorrhage. Complications in Percutaneous nephrolithotomy can be avoided by proper technique & expertization but still complications can occur.

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