

COMPLICATIONS OF PERCUTANEOUS NEPHROLITHOTOMY SINGLE CENTER EXPERIENCE OF 103 CASES

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ABSTRACT

Objective: To present our complications of percutaneous nephrolithotomy (PCNL) during initial one year using modified Clavien system.

Study Design: Observational prospective cohort.

Place and Duration of Study: Armed Forces Institute of Urology (AFIU), Rawalpindi from 1st January 2014 to 31st December 2014.

Material and Methods: The study was conducted at AFIU, Rawalpindi from 1st January 2014 to 31st August 2014. All of the consecutive 103 patients who underwent PCNL were included. Single-stage PCNL was performed in all the cases under general anesthesia. Pneumatic and ultrasound probes (alone or in combination) were used to fragment the calculi. Stone fragments were removed using graspers. A 16 Fr Foley catheter was used as nephrostomy tube. It was clamped on the first postoperative day. Foley catheter and ureteric stent was removed one day later. Intravenous antibiotics were given during admission period, i.e. 3-5 days. The complications were classified according to modified Clavien system. The data was analysed using the Statistical Package for the Social Sciences (SPSS) version 16

Results: Sixty nine (67%) patients were males and thirty four (33%) were females. Their ages ranged from 7 years to 81 years with mean age 41.7 \pm 16.34 years. PCNL was performed on right side in 48 (46.6%) cases while 55 (53.4%) underwent PCNL on left side. Overall complication rate was 21.35%. Grade 1 complications in 7.7%, grade 2 in 7.8%, grade 3a in 2.8% and grade 4a complications in 2.9% were seen.

Conclusion: PCNL is associated with low incidence of major complications even in the hands of beginners when carefully performed.

Keywords: Modified Clavien system, Percutaneous nephrolithotomy, Renal stones.

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INTRODUCTION

Known since ancient times, renal stone disease constitutes a major burden of urology workload nowadays. Estimated life time prevalence of the disease is 1- 15%, males are affected two to three times more often than females¹. Pakistan falls amongst the areas of high stone prevalence². Treatment options available range from medical dissolution therapy through extra corporeal shockwave therapy (ESWL) and open surgery to minimally invasive surgery like percutaneous nephrolithotomy (PCNL). Advances in the ESWL and PCNL over the past several decades has not only revolutionized the treatment of

renal stones but also has facilitated the ease with which stones are removed². Since its first report in 1976³, PCNL has become standard of treatment for staghorn calculi, treatment failures of ESWL and difficult lower pole calculi. PCNL is cost effective as it requires a shorter hospital stay and allows early return to work⁴. The technique has a steep learning curve in traditional sense which implies large number of cases performed to master the technique. PCNL has certain complications specific to it. These include hemorrhage requiring transfusion, fever, sepsis, extravasation, pleural injury and colonic injury which can cause serious morbidity and mortality⁵. The true incidence of complications at different centers are difficult to compare due to lack of standardization, some authors have addressed the issue by using Clavien⁶ or modified Clavien⁷⁻⁹ system. In 2004 Dindo and Clavien

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proposed a modified complication grading system (table-1) which is reproducible and acceptable universally⁷.

MATERIAL AND METHODS

After getting the approval from Hospital ethical committee, an observational prospective cohort study was conducted at Armed Forces Institute of Urology, Rawalpindi from 1st January 2014 to 31st December 2014. Inclusion criteria were 2 to 5 cm sized calculi, moderate to severe dilatation of pelvicalyceal system, willingness of the patients to accept conversion

As per standard protocol for PCNL, all patients had routine laboratory investigations, particularly coagulation profile and urine culture / sensitivity, done. Two patients having hemoglobin below 12 gm% were transfused pre-operatively to achieve this level. All patients had either intravenous urography or plain CT KUB performed prior to the surgery. Single-stage PCNL was performed in all the cases under general anesthesia. Ureteric catheter 4 or 5 Fr was passed in lithotomy position under fluoroscopic guidance. All cases were performed in prone position. An 18 Fr

Table-1: Showing modified clavien systems.

Grade	Description
Grade 1	Any deviation from the normal postoperative course without the need for pharmacologic treatment or surgical, endoscopic, and radiologic interventions. Allowed therapeutic regimens are drugs as antiemetics, antipyretics, analgesics, diuretics, electrolytes, and physiotherapy. This grade also includes wound infections opened at the bedside.
Grade 2	Complications requiring pharmacologic treatment with drugs other than such allowed for grade 1 complications. Blood transfusions and total parenteral nutrition are also included
Grade 3	Complications requiring surgical, endoscopic, or radiologic intervention Grade 3a: Intervention not under general anesthesia Grade 3b: Intervention under general anesthesia
Grade 4	Life-threatening complications (including central nervous system complications) requiring intensive care unit stay Grade 4a: Single organ dysfunction (including dialysis) Grade 4b: : Multiorgan dysfunction
Grade 5	Death of the patient

into open surgical procedure in case of difficulty in achieving stone clearance with PCNL and acceptance by the patients to undergo subsequent ESWL with or without JJ stenting. The exclusion criteria were presence of urinary tract infection (UTI) documented on urine culture, coagulation disorder as well as use of any form of anticoagulant therapy including aspirin. A total of 103 consecutive cases that fulfilled the above criteria were included. The sampling technique was non probability purposive sampling. Data collection procedure was proforma based in which the patients were entered. The data collected by proformas was entered into SPSS 16 and the results were obtained, analyzed and interpreted.

spinal needle was used to gain access to the collecting system. Subsequently, a 0.032" guide wire was passed through it and needle was removed. Skin incision was made and tract was dilated over the guide wire using Olive tipped probe and Alken metallic telescopic dilators to 30 Fr. This allowed insertion of Amplatz sheath through which the rigid nephroscope was introduced. Pneumatic and ultrasound probes (alone or in combination) were used to fragment the calculi. Stone fragments were removed using graspers. A 16 Fr Foley catheter was used as a nephrostomy tube. Post operatively, Hb% and renal function tests were performed. Fall of Hb% up to or below 10 gm % was used as criterion for transfusion. X-ray chest PA was performed in cases of upper pole

access. Intravenous antibiotics were given during admission period. Nephrostomy was clamped on the first postoperative day. In those patients who did not have any complaint, the tube was removed after six hours. In case of discomfort, clamp was opened and removal of

with mean age 41.7+ 16.34 years. PCNL was performed on right side in 48 (46.6%) cases while 55 (53.4%) underwent PCNL on left side.

Overall complication rate was 21.35%. Fever was seen in 8 (7.76%). Extravasation and

Table-2: Showing complications according to modified clavien system (n=103).

Grade	Description	Number
Grade 1	Fever	8 (7.7%)
Grade 2	Blood transfusion	5 (4.9%)
	Urinary leakage less than 12 hours	3 (2.9%)
Grade 3	Grade 3a	
	Pneumothorax	1 (0.97%)
	JJ stenting	2 (1.9%)
Grade 4	Grade 4a	
	Sepsis	3 (2.9%)
Grade 5	Nil	0

Table-3: Showing comparison of complications of PCNL according to various studies (n=103).

Studies	Total cases (n)	Extravasation % (i)	Transfusion % (i)	Fever % (i)	Sepsis % (i)	Colonic injury % (i)	Pleural injury % (i)	Mortality % (i)
Mousavi Bahar ¹³	671	5.2	0.6	1	0	0.3	0.7	0.3
Shin ⁸	88	0.4	6.9	11	0.6	0.7	1.1	0.4
de la Rosette ⁴¹	5803	3.4	5.7	10.5	NA	NA	1.8	0.3
El Nahas ¹⁴	241	8	16	1.2	0.4	NA	2.4	0.4
Rana ¹⁵	667	NA	1.49	NA	1.79	0	0.14	0
Present Study	103	4.9 (5)	4.9 (5)	7.7 (8)	2.9 (3)	0	0.97(1)	0

tube was delayed for a day or two. Foley catheter and ureteric stent was removed one day later and the patients were discharged with oral ciprofloxacin for 10 days.

Complications like hemorrhage requiring transfusion, urinary extravasation after removal of nephrostomy, pleural injury requiring tube thoracostomy and sepsis requiring therapeutic intravenous antibiotics were noted. The complications were classified according to modified Clavien system. All complications in class 3 and 4 were intensively monitored.

RESULTS

A total of 103 patients were included in the study including 69 (67%) male and 34 (33%) females. Ages ranged from 7 years to 81 years

hemorrhage requiring transfusion was seen in 5 (4.9%) cases each. Sepsis requiring therapeutic intravenous antibiotics was observed in 3 (2.9%) of cases. One patient required tube thoracostomy for pneumothorax as a result of pleural injury resulting from upper pole access. Classification of complications is given in table-2.

DISCUSSION

Although commonly attributed to Goodwin and his colleagues, the first therapeutic percutaneous nephrostomy was performed by Thomas Hillier in 1865³. Rupel and Brown performed the first nephroscopy in 1941. Fernström and Johansson (1976) were the first to report the percutaneous removal of renal

stones and termed it "percutaneous pyelolithotomy"^{3,10}. Arthur Smith, in 1978 described the first antegrade stent placement. He along with Kurt Amplatz further advanced the technique of PCNL. By 1980s tremendous improvement was made in the process of calyceal access and tract dilatation. At present PCNL is considered as standard of care for staghorn calculus as well as treatment of large / hard stones, infected stones, obstructive stones, and in cases of SWL failure¹¹. It is associated with its particular set of complications due to percutaneous renal access, difficult or anomalous renal anatomy, complex stone burden and presence of infection. Reported incidence of complications in literature ranges from 20-83%^{9,12-15}. The two major complications associated with PCNL are hemorrhage and sepsis¹³. Hemorrhage can occur at any stage during PCNL and is mainly venous in origin but hemorrhage as a result of injury to major vessels is less common and is seen in 0.5% cases¹³. In our study the incidence of cases requiring transfusion was 4.9% against 0.6% to 6.9%^{8,13-15} reported in literature. In all cases hemorrhage was managed conservatively by placing nephrostomy tube.

Injury to collecting system from guide wire, Amplatz sheath or nephroscope can result in leakage of irrigation fluid per operative or extravasation post operatively with persistent drainage once the nephrostomy tube is removed. We had an incidence of 4.9%. An incidence of 0.4% to 8%¹³⁻¹⁵ is seen in the literature. Three of these cases were managed conservatively with nephrostomy tube drainage and retrograde double J stenting was performed in two cases. Sepsis is one of the major complications resulting from infection via the access track or operating upon the infected stones. In upto 30 % of cases transient post operative fever can occur. However, the incidence of sepsis is very low. Systemic inflammatory response syndrome (SIRS) may precede other features of severe infection and out of them around 30% will require intensive care¹⁶. Total stone burden greater than 10cm, female gender, multiple renal punctures, struvite calculi, and positive pelvic urine or stone culture are considered as risk factors¹⁷.

Shin⁸ reported an incidence of fever in 11% of cases, while Rana¹⁷ reported sepsis in 1.79% cases. We observed 2.9% cases of sepsis that were successfully managed with intravenous antibiotics given for 2 weeks. One of these patients had non-insulin dependent diabetes mellitus. The reported incidence of pleural injury is 0.14% to 2.4% in literature^{8,13-15}. We encountered only 1 (0.97%) case of pleural breach which was managed with tube thoracostomy. Colonic injury has a reported incidence of around 0.3%-0.7%^{8,13}. This may occur due to previous abdominal surgery, left sided procedure, colonic distension or retro renal colon. There was no case of colonic injury in our study. The comparison between various other and the present study with regard to PCNL related complications are given in table-3. Using the modified Clavien system we found our results to be comparable to those found in literature. In a study by Braticevici et al⁹, overall complication rate seen is 29.81%. In our study it was 21.35%. In the study quoted above, grade 1 complications were encountered in 9.42%, grade 2 in 14.03%, grade 3a in 5.22% and 3b in 3.17%, grade 4a in 0.61% and 4b in 0.51%. In our study, incidence of complications was 7.7%, 7.8%, 2.8%, and 2.9% respectively for grade 1, grade 2, grade 3a and grade 4a complications.

CONCLUSION

PCNL is associated with low incidence of major complications. In our study, we have found that complication rate is within acceptable limits even in the hands of beginners when carefully performed.

AUTHORS CONTRIBUTION

Muhammad Asghar, concept, design and data analysis, Muhammad Rafiq Zafar, intellectual input, Faran Kiani, data collection, analysis and manuscript, Arshad Mehmood, concept.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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