# Early Experience in Percutaneous Nephrolithotomy in Al-Jumhori Teaching Hospital Mosul City

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## ABSTRACT:

**BACKGROUND:**

Percutaneous nephrolithotomy **(PCNL)** mean extraction of renal calculi through nephrostomy tracts placed percutaneously ,it was reported in the early 1970s. Percutaneous nephrolithotomy is widely accepted, more safe and effective treatment modality and it is the procedure of choice for removing large, complex, and/or multiple renal PCNL has lower morbidity and postoperative patient discomfort.

**OBJECTIVE:**

To evaluate the initial experience of PCNL in al jumhoori teaching hospital, taking 21 patients with renal stones of different sizes ,with it is complications.

**METHODS:**

Between May 2012 and July 2013 a case series study was applied in AL- Jumhori Teaching Hospital, PCNL was used in 21 patients (Mean age was 55 years, ranging between 16-63 years, 15 men and 6 women) while only one child of 8 year old was enrolled. All cases have renal stone of different size varied from (21mm-60 mm). Preoperative evaluation included , history, clinical examination and routine labarotory investigation, all patients had intravenous urography( IVU), some of them have non contrast or enhanced CT scan of urinary tract to evaluate the cortical thick -ness of the kidney, anatomical abnormalities, stone location, burden and radiolucency of the stone. All patients submitted to PCNL in AL-Jumhoori teach ing hospital ,under general anesthesia in prone position, subcostal approach, using fluoroscopic guidance(c-arm.),and irrigation fluid **(0.9**% N.S.) at body tempreture was used . Steps of PCNL include(1) Ureteric and urethral catheterisation (supine)(2) Percutaneous renal access in the posterior axillary line ,guide wire must always be in place to maintain access and to get (3) Tract dilatation .A track has been dilated and a 34 F working sheath is being advanced over a 30F metal dilator. Tracts can be dilated with either metalic, telescopic, plastic or balloon dilators. Balloon dilatation is quicker and perhaps less traumatic(4) Endoscopic stone fragment extraction (rigid-flexible endoscopy)(5) Post-extraction drainage (nephrostomy, ureteric catheter or tubeless)(6) Wound dressing and care.

**RESULT:**

The mean age was (55 years), with a male to female ratio of 2.5:1. The stone burden varied from 21-60mm most of them were radio-opaque (85.7%). The range of operative time varied from 75-200 minutes with a mean of 120 minutes, including cystoscopic and stenting procedure. The duration of exposure to radiation was ranging from 1.1minutes - 4.5minutes, with a mean of 2.1 minutes. The mean ±SD value of irrigant fluid was19.00±3.98 liters ranging from 12 -25 liters. In the present study the clearance rate was 76%, where 16 patients out of 21 had complete clearance together with stone < 5 mm. In 5 patients (24%) ESWL sessions were needed since they were already have staghorn calculus > 3cm or renopelvic plus multiple stones. The clearance rate for staghorn (62%), non staghorn calculus varied between 75% - 100% .

Tow months later all patients except 2 became stone free;(one of them had multiple stone resist ESWL and other one had duplex of pelvicalyseal system and his residual stone was located in the upper mieoty) both of them probably need second PCNL. The range of hospital stay was 1-5 days, with a mean of 2.2 days. Nephrostomy tube were removed on 1$^{st}$, 2$^{nd}$ or even 3$^{rd}$ post operative day. All patients had double J (DJ) placement except 3 patients who regarded as tubeless PCNL.

**CONCLUSION:**

With the development of new devices for renal access, lithotripsy and renal drainage systems the procedure PCNL has become the first choice treatment modality for renal stones larger than 1.5 cm by the urologists worldwide. To avoid complications during the procedure and to gain successful outcomes after the procedure, proper patient selection, maintenance of available instruments, training and experience of the surgeon are critical.


**KEYWORD:** PCNL,percutaneous nephroliyhotomy,Tubeless PCNL,MiniPCNL.

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## INTRODUCTION:

The management of large upper renal tract stone

is evolving, open stone surgery now almost never used given the progress that has been made in extracorporeal shock wave lithotripsy (ESWL), flexable ureterorenoscope, and percutaneous nephrolithot-omy (PCNL). Each has a role depending on factors such as stone features, renal ana-tomy and patient characteristic and preferences. Percutaneous nephrolithotomy has the advantages of higher stone clearance and cost-effectiveness when comp- ared with other treatment alternatives such as ESWL and flexible ureteroscop- y. However, PCNL is associated with significant morbidity such as fever, urinary infection, septicemia and bleeding necessitating blood transfusion. Of these complications bleeding is the most unpredictable and dreaded, and can lead to significant morbidity. Moreover, blood transfusions have rare but potentially serious adverse effects including hemolytic reactions, acute lung injury, coagulopathic complications from massive transfusion, mistransfusion, nonimmune hemolysis and transfusion related infections.[1]

Sebnem et al.,[2] stated that percutaneous nephrolithotomy is minimal invasive surgery for renal calculi that was first reported by Fernstrom and Johannson in1976.

Most urologist believe that this operation is better than open sugery due to decreasing the length of stay, less morbidity, less pain and more preserved kidney function.[3] Percutaneous nephrolithotomy is usually done with the patient prone , it is believed that for puncturing, and tract dilatation of the kidney which is retroperiton- eal organ, the posterior approach provides a large working space with a lower incidence of splanchnic and vascular injury. However even in this position major complication, including haemorrhagic and organ injury, have been reported in 0.9- 4.7 % of cases.[4,5] The prone position is associated with patient discomfort, a compromised circul-ation and ventilation ,especially in obese patient , and it is also time consuming and increases the radiological hazard to the urologist.[5] So the complete supine PCNL is attempting substitute for prone PNCL with the potential advantages of less patient handling, a quicker operation, better drainage through the Amplatz sheath, and the ability to perform simultaneous PCNL and ureteroscopic procedures. [6,7]

The aim of the present study was to evaluate the current practice and outcomes of PCNL in AL-Jumhori Teaching Hospital in Mosul City.

## MATERIALS AND METHODS:

Between May 2012 and July 2013 a case series study was applied in AL- Jumhori Teaching Hospital, PCNL was used in 21 patients (Mean age 55 years, ranging between 16-63 years, 15 men and 6 women) while only one child of 8 year old was enrolled. Preoperative evaluation included , history, clinical examination and routine labarotory investigation, all patients had intravenous urography( IVU), some of them have non contrast or enhanced CT scan of urinary tract to evaluate the cortical thick -ness of the kidney, anatomical abnormalities, stone location, burden and radiolucency of the stone. The stone burden was determined by measuring the longest diameter on the preoperative investigation, if there were multiple calculi the burden was defined as the sum of the longest diameter of each one. Staghorn stone defined as a stone with branches from the pelvis into major calyces or pelvic stone with multiple stones, in at least two major calyceal groups[8]. The median size of stones found in present study was 30 mm .

Perioperative complications was classified according to the modified Clavien grading system,[9]. Grade 1: Is any deviation from the normal postoperative course without any need for pharmacological, surgical, endoscopic, or radiological intervene-tion. Grad 2: The criteria mentioned in Grade1 plus the pharmacological treatment or blood transfusion. Grade 3: Complications requiring surgical, endoscopic, or radiological intervention with no(grade 3a) or with(grade3b)general anaesthesia. Grad 4 in which there is life- threatening complications requiring a stay in an intensive care unit (grade 4a, single organ; grade 4b, multi-organ dysfunction). Grade 5 death.

All cases have renal stone of different size varied from (21mm-60 mm), 3 patients have bilateral renal stones, locations of stones were in the renal pelvis, middle and lower poles , while those of upper pole that necessitate intercostal access were excluded from the study. Patients with uncorrectable bleeding disorders, Body Mass Index(BMI) >35Kg/m2, stone without hydronephrosis, patients with co-morbidity were excluded, too.

Preoperative urine culture was done and patient with urinary tract infection was treated for 48 hrs before PCNL; if it was positive, treatment continued for 7 days afterwards, a third generation cephalosporin was given as a prophylaxis at the time of surgery .

## RESULT:

Table 1 shows basal charactaistic of study population. The mean age was (55 years), with a male to female ratio of 2.5:1. The stone burden

varied from 21-60mm most of them were radio-opaque (85.7%). The types and locations of stones were also included in this table.

**Table 1: Preoperative variables of the study.**

| | |
|---|---|
| Age (year) | |
| range | 16-63 |
| mean | 55 |
| | |
| M:F ratio | 2.5:1 |
| Stone site R/L | 8/13 |
| Stone locations | |
| pelvis | 4 |
| pelvis and calyces | 6 |
| staghorne | 8 |
| lower pole | 3 |
| Stone burden(mm) | |
| range | 21-60 |
| mean | 30 |
| Stone radiolucency | |
| radio-opaque | 18 |
| radio-olucent | 3 |

The range of operative time varied from 75-200 minutes with a mean of 120 minutes, including cystoscopic and stenting procedure. The duration of exposure to radiation was ranging from 1.1minutes - 4.5minutes, with a mean of 2.1 minutes. The mean ±SD value of irrigant fluid was19.00±3.98 liters ranging from 12 -25 liters. All cases had one puncture used to enter the collecting system except one case who had 2 accesses.

In the present study the clearance rate was 76%, where 16 patients out of 21 had complete clearance together with stone < 5 mm. In 5 patients (24%) ESWL sessions were needed since they were already have staghorn calculus > 3cm or renopelvic plus multiple stones. There was only one patient converted to open surgery who has nephroptosis which leads to loss of renal access, figure1 demonstrates the clearance rate for staghorn (62%), non staghorn calculus varied between 75% - 100%.

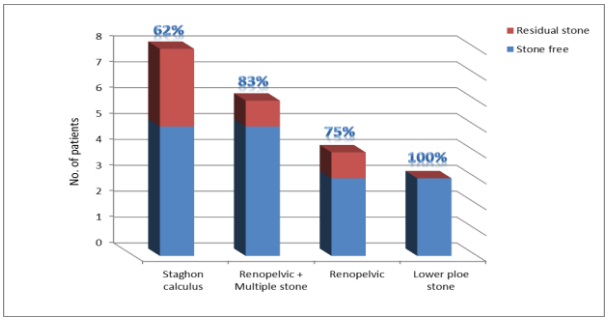


**Figure 1: Presents the stone-free rates in present study according to stone characteristics**

Tow months later all patients except 2 became stone free;(one of them had multiple stone resist ESWL and other one had douplix of pelvicalyseal system and his residual stone was located in the upper mieoty) both of them probably need second PCNL. Table 2 demonstrates out comes of the present study. The range of hospital stay was 1-5 days, with a mean of 2.2 days. Nephro-stomy tube were removed on 1st, 2nd or even 3rd post operative day. All patients had double J (DJ) placement except 3 patients who regarded as tubeless PCNL.

Unfortunately, one patient who was child need DJ stenting after 3weeks due to persistent urine leak from nephrostomy site who regarded as(G3b category) accor- ding to modified Clavien System.[10] Any reduction in haemoglobin level and the vital signs were recorded, the mean

haemoglobin level was 11.91±1.12gm /dl, with 6 patients (28.5%) had blood transfusion and were regarded as G2 category. In the present study the noticed complications were minor bleeding in 7 cases intra or post operatively; they need blood transfusion and regarded as category G2, one patient had hypoxia during procedure due to chest compression from prone position , which necessitated termination of procedure leaving residual stone and was shifted to ESWL, other 2 patients had post-operative fever classified as category G1, 4 patients got intraoperative perforation of the renal pelvis and DJ sufficient to stop extravasation. There was no evidence of organic injury or fistula. No intra operative complications were reported apart from minor bleeding that stopped few hours later. No one transmitted to ICU, so G4 category was 0 %, (Table2).

**Table 2 : Outcomes of the procedure used in the present study.**

| Variable | value |
|---|---|
| Operative duration(minute) | |
| Range | 75-200 |
| Mean | 120 |
| x-ray exposure(minute) | |
| Range | 1.1-4.5 |
| Mean | 2.1 |
| Access no<br>Single<br>multiple. | <br>20<br>1 |
| Irrigant fluid (Liter) | |
| Range | 12-25 |
| mean | 18 |
| Stone clearance n(%) | 16 (76%) |
| Complication n(%) | |
| G1 | 13 (61.9%) |
| G2 | 6 (28.5%) |
| G3b | 1 (4.7%) |
| Reduction in haemoglobin level( mean± SD) | 11.91±1.12gm/dl |
| Transfusion rate n(%) | 6 (28.5%) |
| Organ injury | 0 |
| Hospital stay(days) | |
| Range | 1-5 |
| mean | 2.2 |

## DISCUSSION:

Percutaneous nephrolithotomy is widely accepted as the treatment of choice for a large renal stones, including staghorn stones. It is less invasive, effective, safe and has a lower complication rate than open procedure. [11] Percutaneous nephrolithotomy is usually done with the patient prone, which carries several disadvantages to the patient, anaesthesiologist and urologist.

Although PCNL is a minimally invasive surgery, but it has several new techn-iques such as mini-PCNL and tubeless PCNL were reported to decrease morbidity, analgesic requirement and duration of hospitalization. The method of anaesthesia was reported to minimize morbidity following PCNL. The general anaesthesia compared to regional spinal anaesthesia leads to increase the incidence of anaphylaxis due to multiple medication usage and more pulmonary, vascular, neurologic complications and problems associated with the endotracheal tube during the change of position from lithotomy to prone.[12] In the present study general anaesthesia was applied, and it is worth noting that no significant anaesthetia problem were encountered apart from hypoxia which had been seen in one patient at the end of procedure probably from the prone position .

The mean operation duration, including the time of ureteric catheterization was 120 minutes with a range varies from 75-200 minutes. In comparison with other study, Hani et al.,[8] reported a range of (90-210) minutes, while Hoznek et al.,[13] reported a mean operative time of 123 minutes

with a range of (50-245)minutes. While Puttipannee et al.,[14] reported a duration of 120±49 minutes and 43% of these patients had an operative time >120 minutes. In the present study the amount of irrigant fluid during surgery varied from 15- 25 liters with a mean of 18 liters while in Puttipannee et al.,[14] it varied from 5- 97 liters with a mean ± SD of 24.1±16.36 liters. In the present study the overall stone clearance rate was 76 % (residual stone of more than 5mm is significant that need treatment) as shown in figure1, while Mohamed et al.,[15] found that 53% had complete clearance rate.

In Hani et al.,[8] report the clearance rate was 91%, while Hoznek et al., [13] and Falahatkar et al., [16] got a clearance rates of 81% and 77.5% respectively.

The mean value of duration of radiation in present study was 2.1 minutes ranging between 1.1-4.5 minutes, in comparison with that reported in Hani et al., [8] it was 10 minutes with variation of 4-19minutes, so in the present study the results were too much better.

When considering complications according to Clavien classification system in present study there were 13 patients of grade 1 and 6 patients of grade 2, only one patient of grade 3b that need DJ insertion under general anaesthesia, when this compared with that of Hani et al., [8] grade 3 was found in 3 patients, grade 2 in10 patients and grade 1 in 2 patients.

In the present study there was an 8 years old child underwent PCNL using same instrument of adult, the cause of persistent urine leakage, was intraoperative pelvic perforation with adhesion causing obstruction of the pelvis necessitated DJ insertion under general anaesthesia after 3weeks. In a study carried out by Williams et al., [17] who concluded that paediatric PCNL can be performed safely with minimal morbidity using the adult instruments for large stone burden, enabling rapid and complete stone clearance, in this study there were 31 patients included and got 84% complete clearance and no significant bleeding or sepsis were encountered. Recently Mahesh et al.,[18] used a new modality in PCNL called **Microperc** in which ***all-seeing needle*** used to achieve collecting system access under direct vision. It is done by 16 gauge needle, 4.8 F sheath with a 3-way connector allowing irrigation and passage of flexible telescope and 200um holmium :YAG Laser fibre. He reported a 88.9% stone free rate after one month, 10 patients were included in his study some of them were paediatric age group, with a hospital stay of 2.3±1.2 days as a mean ± SD which is comparable to the present study which was 2.2 days.

In the present case series the performance of procedure(duration of operation, time of radiation, clearance rate and hospital stay) were improved with progression of cases.

Complete stone clearance was recorded by Armitage et al.,[19] in 80% of cases, and this was confirmed in 68% with formal imaging on the first postoperative day. For staghorn calculi, figures for complete clearance were 59% intraoperatively and 47% on formal postoperative imaging; for non–staghorn calculi, these figures were 89% and 77%, respectively.

The same auther reported that 2.5% of patients required a blood transfusion, and 0.4% required selective arterial embolization. The incidence of postope-rative fever was 16%, and sepsis was recorded in 2.4%. Visceral injury was very rare 0.4% involving the pleura in three cases (all subcostal approaches) and the colon in one procedure.[19]

The present study concluded that with the development of new devices for renal access, lithotripsy and renal drainage systems, the procedure PCNL has become the first choice treatment modality for renal stones larger than 1.5 cm by the urologists worldwide. To avoid complications during the procedure and to gain successful outcomes after the procedure, proper patient selection, maintenance of available instruments, training and experience of the surgeon are critical.

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