ORIGINAL ARTICLE

Percutaneous nephrolithotomy for management of large renal stones, Experience at Prince Hussein Bin Abdullah Urology Center

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Abstract:

Objective: The aim of this study was to evaluate and to review our experience with percutaneous nephrolithotomy (PCNL) in management of large renal stones.

Material and Methods: Between January 2005 and December 2009, 786 patients underwent PCNL for treatment of renal stones at our center, 108 renal units were with big stone burden. All procedures were performed in prone position after retrograde insertion of ureteral catheter under fluoroscopic guidance for creating the PCNL tract. 27F rigid nephroscope was used to identify the stones, fragmentation was done using electrohydrulic or pneumatic lithoclast. Stones fragments were removed by forceps and suction. 20F foley catheter inserted in all cases as nephrostomy, and postoperative stone clearance was documented by plain abdominal X-ray KUB.

Results: 108 renal units of 92 patients were treated (67 men and 25 women) with mean age of 41 years (range 17- 74 years); the average stone size was 4.9cm (range 3.0-6.8cm). 83 renal units were treated with PCNL monotherapy (76.9%), with mean operative time of 75 minutes (range 55-100 minutes). 18 renal units required a second look for significant residual stones through the same tract after 72 hours (16.7%), 7 renal units required a second look through a different calyx (6.5%). Complete stone removal achieved by PCNL alone in 89 renal units (82.4%), with ESWL for the residual small stones we achieved 91.7% stone clearance rate. The mean hospital stay was 3.7 days (mean 3-8 days). No Serious complications were encountered, 9 patients required blood transfusion (8.3%), 18 patients developed transient post operative pyrexia (16.7%) and three patient had persistent urine leak (2.8%).

Conclusion: PCNL is the first line treatment option for management of large renal stones. Selection of the patient, establishing percutaneous renal access, a well standardized technique and post-operative follow up are mandatory for early detection of complication and achieving a high stone free clearance rate.

With significant residual stones in PCNL procedure, a second look at 48-72 hours interval is preferable in centers where flexible instruments and laser therapy are not available.

Key Words: Percutaneous nephrolithotomy (PCNL). Large stones.

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Introduction:

Urinary stones continue to occupy an important place in everyday urological practice, and in an active urologic department 30% of the surgical working load is known to be related to treatment of renal and ureteral stones[1]. Since the early 1980s when percutaneous nephrolithotomy (PCNL) was established for management of renal stones, open surgical procedures have virtually been replaced[2]. PCNL is a safe, effective and minimally invasive approach compared to open surgery for patients with large or staghorn stones[3,4,5]. Efforts have been made to decrease the procedure morbidity by improving the techniques and the equipments used in PCNL procedure[6].

The aim of our study is to present our experience

in management of large renal stones by PCNL at Prince Hussein Bin Abdullah urology center.

Patients and Methods:

Between January 2005 and December 2009, PCNL was performed for 786 renal units, 108 (13.7%) renal units were with large stone burden for 92 patients. Patient's pre-operative assessment included medical history, physical examination, urine analysis, urine culture, serum haematocrit, platelet count, coagulation profile, kidney function test, KUB and stone protocol renal CT scan. Each case had a documented negative urine culture or treated with antibiotic according to the culture sensitivity. The procedure was performed under general anesthesia with prophylactic intravenous antibiotic, in dorsal lithotomy position a retrograde catheter was inserted into the proper site using 21F cystoscope, fixed to a 16F Foley catheter and connected to a syringe containing contrast media. The patient was turned to prone position, a retrograde pyelogram was performed in all cases to visualize and distend the collecting system in addition to identification the site, size and number of stones. After mapping of the collecting system and the site of access of the desire calyx, percutaneous renal access was established by the interventional radiologist under fluoroscopic guidance in most of our cases, the initial puncture was done using chipa needle (18G) followed by floppy tip hydrophilic guide wire (0.038-in), the dilatation started using facial dilators from 6F to 12 F followed by balloon dilatation of the tract and insertion of Amplatz sheath size 30F over the Amplatz dilator through which a 26F nephroscope was introduced with help of isotonic saline for irrigation and clear visualization. Fragmentation of the visualized stones by pneumatic lithoclast was done followed by removal of pieces using stone grasping forceps and suction. The completeness of stone clearance was achieved by visualization the whole accessible collecting system and fluoroscopy at the end of the procedure. A Foley catheter size 20F was inserted in all cases as a draining nephrostomy and kept for 24-48 hours post-operatively.

On first day post-operatively, the Foley and ureteral catheters were removed, the antibiotic shifted from intravenous first generation cephalosporin to oral quinolones. KUB was obtained; the nephrostomy tube was removed on second postoperative day in absence of significant residual renal stones. A post-operative JJ stent was considered if persistent urine leak occurred after removal of nephrostomy tube. Second look PCNL through the same nephrostomy tract or establishing a new tract was considered if planned intra-operatively or if there was a significant accessible residual renal stones. Extracorporeal shock wave lithotripsy (ESWL) was considered as accessory treatment alternatives when indicated.

All patients were seen three months after discharge, KUB and ultrasound were requested to evaluate presence of residual significant stone and the condition of the kidneys.

Results:

108 renal units of 92 patients were treated for large renal stones, the mean age of these patients were 41 years (range 17- 74 years); of these patients 67 males and 25 females, the demographic data of the patients is showed in Table 1. The average stone diameter was 4.9cm (range 3.0-6 .8cm). PCNL access was made in lower group calyx for 82 renal units (75.9%), access through the middle group calyx in 22 renal units (20.4%) and four renal units required an upper group calyx access to establish the tract (3.7%).

83 renal units were treated with PCNL monotherapy (76.9%), the mean operative time was 75 minutes (range 55-100 minutes), another 18 renal units (16.7%) required a second look PCNL through the same tract for accessible significant residual stones after 72 hours from the first session PCNL. 7 renal units (6.5%) required a second look PCNL for significant re-

Table 1: *Demographic data of the patients*

Mean age (Range)	41 years (17- 74 years)
Male : Female	2.7 : 1
Average Stone size (Range)	4.9cm (3.0-6.8cm)
Left : Right site	1.2 : 1.0

Table 2: *Results of the PCNL procedure for large renal stones*

Mean operative time (Range)	75 minutes (55-100 minutes)
PCNL monotherapy	83 renal units (76.9%)
Mean operative time (Range)	75 minutes (55-100 minutes)
2nd look through same tract	18 renal units (16.7%)
2nd look through different access	7 renal units (6.5%)
Stone clearance with PCNL	89 renal units (82.4%)
Stone clearance rate with adjuvant ESWL	99 renal units (91.7%)
Mean hospital stay (Range)	3.7 days (3-8 days)
Mean drop in Hb (Range)	2g/dl (0.3-5.0g/dl)
Blood transfusion	9 cases (8.3%)
Duration of nephrostomy in PCNL Monotherapy	24-72 hours
Transient postoperative pyrexia	18 renal units (16.7%)
Postoperative urine leak	3 renal units (2.8%)

sidual stones but through a different calyx that was not accessible via the first tract.

Complete stone removal was achieved by PCNL alone in 89 renal units (82.4%), this percentage include the whole renal units that were cleared from stones by PCNL alone whether from PCNL monotherapy or after second session. Single session ESWL was performed for small residual stones during the hospitalized period 2-4 days pos-operatively, this was improving our stone clearance rate to 91.7% with adjuvant ESWL treatment.

The mean hospital stay for our patients was 3.7 days (mean 3-8 days). The mean drop in hemoglobin was 2g/dl (range 0.3-5.0g/dl), 9 patients required blood transfusion (8.3%), 18 patients developed transient post-operative pyrexia (16.7%), all occurred during the first day of surgery, this pyrexia respond well to hydration, antipyretics and antibiotics that was already started, three patient developed persistent urine leak (2.8%) after removal of nephrostomy tube the second or third day post-operatively due to small stone slipped into the ureter, the three patients were treated by ureteral stent (JJ stent), that were inserted under local anesthesia and usually we keep these stents for two weeks. Table 2 summarizes the results.

Stone analysis showed that mixed type of stones was the commonest and it occurred in 55% of the patients most of them containing calcium oxalate, calcium oxalate stones alone occurred in 30%, MAP (Magnesium Ammonium Phosphate) stones in 7%, cysteine stones in 5%, and uric acid stones in 3%.

Discussion:

The indications of percutaneous management of renal stones has been established and depending on the size, site, composition of renal stones and presence of distal obstruction, in addition to failure of fragmentation of stones after ESWL sessions or there is contraindication to ESWL procedure[7]. Also specific considerations are required for special group of patients with anatomical variants and morbid obesity in addition to the child age group[7].

PCNL monotherapy has advantages in removal of large renal stones and achieving excellent results with minimal morbidity, the point of transition for the term large renal stones is believed to be the 2cm[8]. The major and most difficult step in PCNL procedure is the ability to create a suitable access to the renal collecting system, with better stone clearance rate and minimal risk of vascular injury and other complications[9]. Traditionally, PCNL has been performed in the prone position like the approach in our cases as it considered by many urologist to be the safest approach to kidney which enable the surgeon or the radiologist to puncture the kidney through brodel's avascular renal plane without causing significant parenchymal bleeding or visceral injury[7,8,10]. However, other investigators described supine position approach with different techniques including the use of flexible ureterorenoscope, with comparable success and complication rates[11]. Valdivia et al[12] was the first described the supine position, Shoma et al[13] compared results of PCNL in supine and prone position in non-randomized study, they conclude that the success rate was 89% in supine and 84% in the prone position with the same complication rate. On the other hand Preminger et al[4] conclude in AUA guidelines on management of staghorn stones that in cases of complex renal stones, prone position is associated with stone free rates of 24-83%.

Regarding the type of anesthesia, our procedure was done with general anesthesia as most of the published literatures describe, on the other hand Aravantinos et al[14] described the use of local anesthesia in 24 patients and they conclude at their study that assisted local anesthesia is safe but with maximum stone diameter of 3.2cm, however the average stone diameter in our study was 4.9cm. About prophylactic antibiotics, all our patients received a full coarse antibiotics in case of proved growth in urine culture, and during induction of anesthesia as most of the protocols, however, Mariappan et al[15] in their study showed that one week oral ciprofloxacin in case of large renal stone more that 20mm or in case of hydronephrosis significantly reduced the risk of urosepsis after PCNL procedures.

Fluoroscopy and or sonography were done to monitor the access to the collecting system in all our steps of dilatation, few reports regarding the use of CT for percutaneous access guidance[16] which is not applicable in our cases of normal positioned renal units. Nephrostomy catheter was inserted by size 20F Foleys catheter at the end of our procedure, the aim is to tamponade venous bleeding, to prevent urine extravasations or allow healing of minimal pelvicalyceal system injury and allow an access for a second look PCNL through the same tract in case of significant residual stones. Bellman et al[17] describe the advantages of placement of nephrostomy tube after PCNL and demonstrated that the haemostatic process was easy, it provide an access if second look procedure is required and prevent urinary extravasation. Tubeless PCNL was found by Falahatkar et al[18] on 42 renal units for staghorn stones, they found that the procedure is safe and effective even with less complications.

The major concern in PCNL surgery involves serious post-operative complications such as blood loss, adjacent organ injuries and life threatening infection[19,20]. Lee et al[21] reported the complications of PCNL in 582 patients, they report major complications in 6.8% and minor complications in more than 50% with 11.2% requiring blood transfusion. In study by Osman et al[22], the complication rate was 50.8% with the most common complication being transient pyrexia in 27.6%, however we report 16.7% transient post-operative pyrexia and this is explained by the restriction to the selection of patients with pre-operative documentation of absence of infection or one week antibiotic treatment according to sensitivity in case of presence of urinary tract organism. The incidence of blood transfusion in our study was 8.3% and none of our patients had serious life threatening bleeding that requiring open surgery or angioembolization.

Regarding the stone clearance rate, Falahatkar et al[18] in their series, the achieved 87.5% stone clearance rate, Soucy et al[23] report 91% stone clearance rate at three months follow up for partial or complete staghorn stones using single or multiple tracts. Our study revealed 82.4% stone clearance rate in PCNL monotherapy, but with adjuvant ESWL session during hospitalization for the residual small stones the rate reached 91.6%.

Conclusion:

PCNL is the first line treatment option for management of large renal stones. Selection of the patient, establishing percutaneous renal access, a well standardized technique and post-operative follow up are mandatory for early detection of complication and achieving a high stone free clearance rate.

With significant residual stones in PCNL procedure, a second look at 48-72 hours interval is preferable in centers where flexible instruments and laser therapy are not available.

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CORRIGENDA

Afridi MR, Khan MI, Khalil J, et al. Radial artery internal diameter as a predictor of early failure of arteriovenous fistula in haemodialysis patients. Pak J Surg 2010; 26(2): 100-3.

The name of second author should read "Mohammad Imran Khan".

The authors regret the errors.

Sabbar S, Khan RA, Siddiqui MH, et al. Comparison of caudal bupivacaine with and without tramadol for postoperative analgesia in paediatric inguino scrotal surgeries. Pak J Surg 2010; 26(2): 155-9.

The name of third author should read "Munir Hussain Siddiqui".

The authors regret the errors.