OUTCOME OF PERCUTANEOUS NEPHROLITHOTOMY IN STAGHORN CALCULI

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ABSTRACT

Objective: To detrmine the outcome of percutaneous nephrolithotomy in the management of staghorn type calculi in adult patients.

Study Design: This is a descriptive study.

Duration: This study was carried out from October 2007 to April 2011.

Patients and Methods: This study was conducted at Shaikh Zayed Hospital, Lahore and included 100 cases of staghorn type calculi undergone PCNL. Those patients in whom PCNL was planned preoperatively but abandoned because of problem in access or incidental finding of any associated urinary tract anomaly requiring prior attention or an open approach were excluded from the study. Procedure (PCNL) was done under general anesthesia with patient in modified lithotomy position for retrograde insertion of ureteric catheter and to do pyelography during the procedure, than patient's position was changed to prone or prone oblique position for percutaneous renal stone fragmentation. Tract was made by the urologist, C-arm fluoroscope was used for imaging and access.

Results: In our study, their were 100 renal units. Out of these, 73 were males and 27 females. The mean age was 41.3±14.24 years. We dealt with a mean stone burden of 5.1±1.9cm, the size ranged from 3.3cm to 11.8cm. The overall stone clearance with PCNL only was 71% whereas it increased to 91% when combined with ESWL as dual therapy for residual stones. The mean length of hospital stay was 4.4 days. The overall complication rate was 9%.

Conclusion: Percutaneous nephrolithotomy is safe and effective procedure in staghorn type stones. Combining PCNL with ESWL for residual stones can remarkably increase stone clearance.

Key Words: Percutaneous Nephrolithotomy, Staghorn Type Calculi.

INTRODUCTION

The complete staghorn calculi fills the renal pelvis and all of the calyces, if it fills two calyces and renal pelvis then called partial staghorn. Most of the staghorn calculi are associated with infection and are composed of struvite (magnesium ammonium phosphate) with or without the presence of calcium containing compounds. Struvite stones usually occurs when urine is infected with urea splitting organisms, which includes certain species of proteus, klebsiella, pseudomonas, staphylococcus and ureaplasma. Pure calcium phosphate staghorn stones may occur in presence of Escherichia coli urinary tract infection. Staghorn calculi also may be purely metabolic in origin, being formed of calcium oxalate, uric acid, or cystine.[1] Generally there are clear indications for intervention in renal stone disease but there is no definite consensus regarding the most appropriate form of treatment for a particular case in renal stone disease.[2]

Fernstrom et al first described this procedure in 1976.[3] With cumulated experience and advances in technique and instrumentation, it has now become an established method in adults for managing renal stones. Rather certain conditions have specific indications for PCNL as in cystine stones.[4] Moreover, American Urology Association (AUA) Nephrolithiasis Clinical Guideline Panel has recommended PCNL as first line of treatment for staghorn calculi followed by ESWL or repeat PCNL as needed.[5]

Significant published local data for PCNL is lacking, however the procedure has been practiced for treating urolithiasis in adults for about a decade in Pakistan. In a local series[6], stone clearance or planned debunking by PCNL has been reported 97%.

This modality of therapy for urolithiasis is truly minimally invasive. It leaves patient with less or no morbid renal anatomy as compared to open surgery, minimal scar, early convalescence and shorter hospital stay.[7] All these qualities make it "cost effective".[8,9] The cost effectiveness should be our prime concern. It is equally valid for the management of stone disease in Pakistan because of our poor economic status and the problem of urolithiasis being densely prevalent here.

PURPOSE OF STUDY

To evaluate the outcome of percutaneous nephrolithotomy in the management of staghorn type calculi in adult patients.

MATERIAL AND METHODS

One hundred cases of PCNL in adult age group (above 14 years) are included in the study. All pa-

tients are with staghorn type stones admitted electively for PCNL at Urology Ward, Shaikh Zayed Hospital, Lahore.

Case sheets of included patients who underwent PCNL through the specified period were studied. A questionnaire was designed to evaluate stone profile regarding burden, location and any associated urinary tract anomaly, pre-procedure and post-procedure renal function, and stone clearance percentage with primary PCNL, rate of ancillary procedure requirement and rate of complications. Single respondent filled formatted questionnaire.

RESULTS

Out of total of 100 renal units, they were 73 in males and 27 in females with male to female ratio 2.70:1. The mean age in years in our study was 43.0±12.4. The mean stone burden dealt in the study population was 4.6±1.9cm. The size ranged from 3.3cm to 11.8cm. The access for PCNL was mainly through upper calyx 74%, than through lower calyx 30%, and the least puncture site was middle calyx 10%, mostly it was the second puncture. The overall clearance of stone with PCNL as 'Monotherapy' was 71% where as it increased to 91% when combined with ESWL as 'Dual therapy' for residual stones. Second sitting PCNL was done in six patients (6/100), out of which two were treated as sandwich therapy. Many patients requiring ESWL for residual stones acquired clearance with two or three sessions of ESWL.

The overall complication rate is 9.6%. Most frequent is the post PCNL pyrexia (36%) which is defined as any temperature greater than or equal to 38°C in first 48 to 72 hours of post operative period. In all cases it was not attended with any haemodynamic instability nor blood cultures sent at time of temperature rise showed any growth and all patients had negative preoperative urine culture. 8% (8/100) of patients received blood transfusion. Ureteric obstructions were seen in 18 out of 100 (18%) patients, because of stone fragment falling down in the ureter. Out of these fifteen required some kind of intervention, that include URS, DJ stenting, push back and ESWL. In postoperative period six patients were inserted chest tubes due to hydro- pneumothorax, all of these patients were entered supracostally through upper calyx for PCNL. There were 8 cases (8%) with culture proven UTI and 2 (2%) of puncture site infection. The mean follow up period was six months. In the follow up period 91% of the patients remained stone free.

Table 1: Sex distribution of patients

Sex	No. of patients	Percentage
Male	73	73.0
Female	27	27.0

M:F = 2.70:1

Table 2: Overall Stone clearance percentage acquired through PCNL as monotherapy and in combination with ESWL

No. of patients	Clearance % with PCNL only	Clearance % with PCNL + ESWL	Complication Rate
100	71%	91%	9%

Table 3: ESWL profile in overall patients who required ESWL after initial renal stone treatment with PCNL (n=100)

Number requiring ESWL	Number of sessions required	Time period for Clearance for residual stones (mth)	Stone Freed (percentage) dual therapy
29	2.2 (SD1.53)	3.6 (SD3.73)	91%

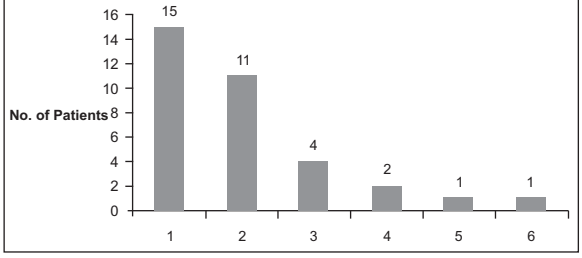
Table 4: Access for PCNL

Puncture Site	No. of Cases	Percentage
Upper System	74	74.0
Middle System	10	10.0
Lower System	30	30.0

Table 5: Complications

Complications	No. of Cases	Percentage
Post PCNL Pyrexia	36	36.0
Ureteric obstruction	18	18.0
Postoperative bleeding	8	8.0
Chest tube	6	6.0
Urinary tract infection	5	6.0
Wound infection	2	2.0
Electrolyte imbalance	2	2.0
Urinary retention	1	1.0

Figure 1: Number of patients in each ESWL Session Group (Requiring one session only, requiring 2, 3 4, 5 and 6 respectively.)



DISCUSSION

Percutaneous access to the renal calculi is the cornerstone of endourologic technique. The first "nephroscopes" were actually cystoscopes modified to avoid trauma to renal pelvis. In the early 1980s, specially designed rigid nephroscopes were produced with offset lenses and straight instrumentation ports to allow passage of alligator forceps and stone graspers. The combination of rigid and flexible endoscopes with ultrasound or electrohydraulic lithotripsy allows virtually all stones to be treated by percutaneous means. In comparison with open surgery, percutaneous nephrolithotomy offers a reduction in cost, discomfort, and recovery time.

The success of any treatment modality is based on its outcome. In this regard proper selection of patient is the crux to acquire positive outcome. Similar is the case with PCNL. The modality has been used best as planned debulking of very large burden of stones, complete clearance of large bulks, stone in anomalous system and stone not amenable to ESWL.

Any skill to be applied effectively requires sound knowledge of relevant anatomy. It is particularly essential in endourology. For this purpose before embarking on to the technical details of the procedure, it is prudent to revisit the renal anatomy and related vascular array. In this regard, Francisco JB Sampaio has significant contribution. Following description on internal anatomy is predominantly based on work with Mr. Sampaio as primary researcher.

After acquiring informed consent, patient is given general anaesthesia through endotacheal intubation or is given spinal regional anesthesia.[10] In our center we perform PCNL under general anaesthesia with endotracheal intubation.

After anaesthesia patient is first placed in lithotomy position for retrograde pyelogram and placement of ureteric catheter. Then the position is changed to prone or prone oblique as per preference. PCNL has also been performed in 'Lateral' and supine position[11], but in this study all the PCNL performed were done in prone position. Foam padding is placed under the knees and folded pillow under each foot at the ankle to afford slight flexion at knee thus reducing the risk of nerve palsy and pressure injury. Both arms are placed at arm rests with shoulders abducted and the elbows flexed to allow hands to rest palms down alongside the head.[11]

Ureteric catheter is positioned in situ in such a way that contrast can be filled in the target calyx while acquiring access. In most centers a No. 7 Fr, 11.5mm occlusion balloon catheter is passed over a guide wire through ureteric orifices into the pelvicalyceal system. Balloon is inflated and positioned snugging at UPJ region.[11] This prevents any fragment from falling down into the ureter. In our center we use ureteric 6Fr catheter for this purpose without occluding balloon.

Contrast Agent used in our center is an iodinated ionic one (Urografin) Urografin is the conventional High Osmolality Contrast Media (HOCM) containing sodium and meglumine salts of Tri-iodobenzoic acid. We used 76% solution and diluted it in distil water as 1:1. Clayman et al prefers 'air' as contrast agent to avoid confusion in case of any extravasation.[13]

Imaging can be done through fluoroscopy or ultrasound.[14] The latter has the advantage of dramatically reducing the radiation dose where as one has better spatial orientation with former. Majority of the centers uses C- arm flouroscopy including our center. The major advantage is its range of motion thus allowing multiple views while acquiring access for PCNL to estimate depth. This multiple view facility with C-arm fluoroscope disallows any maneuvering on an anaesthetized patient to acquire views of needle. Thus preventing the inherent problems like fracture dislocation associated in positioning an anaesthetized patient.

It has X-ray system beneath the patient as against the overhead system in Cephalocaudal moving and fixed units. Thus it reduces the radiation exposure by 40 fold to the patient and 150 fold to the operator as compared to overhead ones.[15] Still it is prudent to realize that studies have shown exceeding radiation dose limits in stone centers against the recommendation by International Commission on Radiation Protection.[15] Additional threat to this effect is the fact that wearing routine badges under the apron is an inadequate method of monitoring exposure. It is suggested that calibrated microchip TLD disks be worn on the index finger of both hands under latex gloves and between the eye.

Access into pelvicaliceal system is the key function in PCNL and intelligent placement of percutaneous tract can make the difference between success and frustrating failure. Initially PCNL was done as two-stage procedure, In first stage percutaneous nephrostomy is placed and then after maturation of tract in next stage, tract dilatation and subsequent stone removal is done. Later it was found that whole procedure could be done as single stage with similar efficacy and without additional morbidity.[16]

First puncture is with spinal needle size 22G followed by 19G Kellet needle or directly with 19G kellet needle. A guide wire sizing 0.032" is threaded into the Kellet needle preferably down to the ureter. Fascial Dilator pushed percutaneously over the guide wire, in the system while viewing at the C-arm fluoroscope monitor. In many centers two guide wires are placed, one as a 'Safety Guide Wire' and the other as a 'Working Guide Wire'.[17] We at Shaikh Zayed Hospi-

tal place only one wire to avoid unnecessary trauma to kidney and it saves time. We rarely lost tract and even if it is lost maneuvers explained in the section of procedure can be tried successfully. But certainly if the tract is lost then occasionally one might not get back and has to make another tract or abandon the procedure to be rescheduled after the puncture perforation in the system is healed.It is advisable for the beginners to have two guide wires in place the 'safety' and 'working'.

Different sizes of the nephroscope available are 16 Fr, 18 Fr, 26 Fr, and 30 Fr. Inaddition, Jackman et al use 7 Fr rigid cystoscope as nephroscope with 11 Fr ' peel away' vascular access sheath.[18]

Stone fragmentation can be done with Pneumatic Lithoclast, Electro-hydraulic System, Ultrasonic Lithotrite and Holmium: Yag Laser in our center we have facilities of all the above mentioned systems. Flexible nephroscope may be used for stones migrating into inaccessible calyces.[19]

CONCLUSION

PCNL is truly a minimally invasive procedure with early convalescence and effective clearance of stones, provided done with proper selection of patients and in best of hands. It is safe and effective procedure in partial staghorn type stones. Combining PCNL with ESWL for residual stones can remarkably increase stone clearance.

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