ORIGINAL ARTICLE

OUTCOMES OF PERCUTANEOUS NEPHROLITHOTOMY IN ELDER AGE PATIENTS-SINGLE CENTER EXPERIENCE

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Background: Urolithiasis is a prevailing ailment affecting all age groups across global population. In modern innovative industry endoscopic instruments alterations and miniaturization has simplified the interventional strategy for undertaking these procedures for renal stones. However, there has been paucity of studies regarding outcomes of Percutaneous Nephrolithotomy (PCNL) in elder age group. We aimed to report success rates and complications in elder age group. **Methods:** This was a retrospective review of the charts for subjects that underwent unilateral PCNL from 2012 till 2018 November at a tertiary care hospital at capital of Pakistan. Patients of age ≥60 years were chosen for this study. PCNL procedures were done in prone position. We implemented the Guy stone scoring (stone complexity) to forecast the net results of PCNL. Information regarding variables were recorded in specified proforma and then processed in SPSS version 16 for the statistical computations. **Results:** On the whole 79 patients were incorporated for this study. Most common presenting complaint in clinic was flank pain followed by haematuria and fever respectively. Mean age in this analysis was calculated as 63.36±5.19 years. Mean size for calculi was 449±163mm^2. One patient underwent transfusion after surgery while only 2.5% of these patients had sepsis (post PCNL procedure). Stone free rate was significantly affected by Guys stone score (GSS). **Conclusion:** PCNL can be undertaken safely and effectually for achieving treatment goals even in elder subjects. Stone free rates are higher in lower Guys stone score as compared to the higher scores.

Keywords: PCNL; Stone free rates; Elder age; Stone Complexity; Complications

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INTRODUCTION

Urolithiasis is a prevailing ailment affecting all age groups across global population. Various Studies across the globe have explained that there is a gradual trend of upper tract stones being on the rise during last fifty years.[1–4] Such trends have been noticed across various continents of world as the time has passed. According to an estimate global incidence of renal stones has been around one percent, approximately affecting in a range of up to ten percent individuals in most of the modern countries.[5,6] Owing to increase in overall life expectancy, stone disease is becoming relatively more common in the geriatric population as compared to the distant past. Some recent studies have shown that old age patients make almost approximately up to twelve percent of all patient's referrals to tertiary care hospitals for treatment of urolithiasis.[7,8] Owing to the excessive risk of urinary tract related infection and resultant renal dysfunction secondary to untreated renal stones, evading the idea of surgical intervention in elderly subjects might not be a pragmatic approach.[8,9]

It is evident from studies that prevalence of certain medical as well as surgical diseases such as presence of comorbid diseases and solitary kidney are higher in old age that can exert influence on the decision making for a surgical operation in this age group.[9] Percutaneous Nephrolithotomy in elderly patients poses a challenge owing sometimes to factors such as inferior cardiovascular reserve along with anaesthetic risks involved during the surgery.[10] Naturally, decline in the cardiovascular, locomotive, pulmonary, metabolic and nervous systems is rampant in the senior population and hence might put significant impact on decision regarding management plan and a strategy for surgical intervention. There were some reports, portraying the fact that even non-invasive stone procedures (shock wave lithotripsy) might show low effectiveness and safety, when it comes to geriatric patients. Some studies reported less optimal results regarding achieving post procedure stone-free status in elderly age patients after SWL.[11,12]

Data regarding dealing with renal stones pertinent to the elderly age group are lacking and has been reported by very few centers globally.[10–12] We studied productiveness and safety of PCNL in ageing

patients (age >60 years old). To best of our knowledge no local study has been reported in Pakistan regarding PCNL experience in old age patients.

MATERIAL AND METHODS

This was a retrospective review of the charts for subjects that underwent unilateral PCNL from 2012 till 2018 November at a tertiary care hospital at capital of Pakistan. Departmental and board review approval was obtained prior to start of this academic exercise. Patients of age ≥60 years were chosen for this study. Patients having positive urine cultures, age less than 60 years, history of open renal surgery on same side previously and bleeding disorders were kept out from the study.

To start with, patients were diagnosed after obtaining full history and physical examination. Radiological investigations used for renal stone encompassed X-ray KUB (Kidney ureter and Bladder), Ultrasound KUB (Kidney ureter and Bladder) and Computed tomography. Stone burden was computed as mm^2 after multiplying the two greatest dimensions of the stone seen on computed tomography images. Stone length was computed in cm. If there were cases of multiple stones, then all stones individual measurements were computed and their aggregate was used. Once option of percutaneous nephrolithotomy (PCNL) was decided, laboratory investigations including a complete blood count (CBC), electrolytes, renal function tests and PT/APTT were done for preoperative assessment (one day in advance of the PCNL procedure). Preoperatively one to two units of blood was arranged after doing blood cross match and grouping, if obligation for transfusion arise during the surgery or after PCNL. Subjects having positive urine cultures were managed preoperatively with antibiotics reported in the culture and sensitivity tests of urine. We did scrutiny of patients' files for variables, so data was extracted and then entered in proformas by the resident urology. After authentication the variables were entered in the SPSS version 16 for statistical analysis.

Various Patients' factors were recorded including age, BMI, gender, Stone size, location of the stone, number of stones, staghorn stones. Other variables related to Intraoperative data included approach (supracostal/infracostal) of entry, number of approach (entry) tracts, operative time and type of postoperative drainage (percutaneous nephrostomy/double J stent) utilized. Postoperative end results including attainment of status of patients being stone free (SFS), any residual fragments of stone, complications categorized on the basis of CCS, hospital stay and analgesic demands. CCS grades one and two constitute insignificant minor complications and grades three and four constitute major complications.

We had a departmental protocol of doing X Ray KUB and USG (renal ultrasound) KUB after 48–72 hours after PCNL. Patients were deemed to have attained Stone free status (SFS) in the event of complete stone clearance or absence of any residual stone's fragments of stone size more than 4mm on X Ray KUB (Kidney Ureter Bladder). We implemented the Guy stone scoring as propounded by Thomas et al to forecast the net results of PCNL.[13] It grades complexity of stones into 4 categorical grades. Grade one is assigned to a lone renal calculus located in lower/mid pole or if in renal pelvis with straight forward anatomy. Grade two signifies lone upper pole renal calculus or if there are numerous calculi in kidney with straight forward renal anatomy or if there is a solitary calculus present in a kidney having an aberrant anatomy. Grade three comprises of patients having multiple renal calculi in addition to abnormal anatomy. Grade 3 also includes calyceal diverticular and partial staghorn renal stones. While Grade IV comprises of staghorn stones or if there are renal stones in patients suffering from spina bifida and in case of history of spinal cord injury.[11]

After induction of general anaesthesia, patients' position was adopted in lithotomy, rigid cystoscopy (cystoscope; Karl Storz, made in Germany) was performed and the desired side ureteral opening was introduced with an open-end catheter (5Fr/ 70cm) and was pushed till it reached the renal pelvis over glide wire and with the help of contrast, retrograde pyelography was performed. A catheter was inserted alongside the open-end catheter and position of the open end was secured by adhering it to the foleys catheter with help of sunniplast (an adhesive tap). Patients' posture was converted to prone. Then with the help of the fluoroscopy, we used bull's eye technique, and the appropriate calyx was punctured by the surgeon with an 18G spinal. After puncturing the required calyx, a 0.032" hydrophilic guidewire was pushed into the renal pelvis through the needle. After that tract dilation was done upto 24 fr -30 fr using serial metallic dialtors over an olive tip. Then 22F or 26F nephroscope (Karl Storz made in Germany) was used. After visualizing the stone through the nephroscope a pneumatic lithotripter (Swiss lithoclast) was introduced to break the stone into pieces. Stone fragments were removed with help of three prong graspers. After completion of stone clearance process, percutaneous nephrostomy tube was placed in case of intraoperative factors (incomplete stone clearance, staghorn stones, intraoperative bleeding, pelvicalyceal injury and incomplete procedure and surgeon's choice).

Double J stent was placed in all patients. In case a nephrostomy tube was placed it was removed after 2 days if the patient didn't have any fever, haematuria or pain in the flank (after clamping the nephrostomy tube).

Data was collected in the proformas by the urology resident and then entered these values in the statistical analysis file. Analysis was accomplished by using SPSS version 16. Utilization of Mean and their standard deviation values was carried out for the continuous variables. While frequency and percentages were used for depicting categorical variables. We made use of one-way ANOVA test for comparing the continuous variables and Chi-square test was to be applied to compare categorical values across the different Guys stone score subgroups of this study. A *p* value of <0.05 was deemed as statistically significant value.

RESULTS

On the whole 79 patients were incorporated for this study. Mean age in this analysis was calculated as 63.36±5.19 years. Mean size for calculi was 449±163 mm^2. Mostly Patient were operated for left sided renal stones (Table-1). While gender wise males constituted approximately 69.6% of the individuals in the group study (Table-1). Most of the patients had hypertension as comorbid condition (53.1%) while diabetes mellitus stood as second most common comorbidity (Table-1). Two subjects were treated for urinary tract infection based on their urine culture reports and sensitivity results. Most common presenting complaint in clinic was flank pain followed by haematuria and fever respectively (Table-1).

Major proportion of the renal access tracts were attained through the lower pole in 79.74%. The overall mean operative time was computed to be 151.26±105 minutes (Table-2). In the end stone free rate of 63/79 (79.74%) was attained in this study (Table-2). Conversion to open procedure or requirement for renal angioembolisation (for bleeding) did not arise in the operated subjects. Eleven operated cases required ancillary shock wave lithotripsy (SWL) for attaining complete stone clearance (Table-2).

Complications were narrated as claimed by the Clavien-Dindo Classification. It is apparent from table 3 that most of these complications were of minor grades (Table-3). One patient underwent transfusion after surgery (Table-3). Only 2.5% of these patients had sepsis (post PCNL procedure). Grade 3 complication was observed in 1.2% of the subjects (Table-3). Apart from these there were no major complications (Table-3).

Stone free rates were importantly unalike when the four Guys stone score (GSS) subjects were compared (Table-4). Subjects' hospitalization duration computed in days outstretched up to three days in this study. Although hospital stay was a bit longer in Guy's score category 4 subjects but it was not statistically significant (Table-4). Overall, when compared, no notable difference in complications was observed across the four GSS categories patients (Table-4).

Table-1: Demographic variables

Variables		Values
Number		79
Mean Age		63.36±5.19
Male		55 (69.6%)
Female		24 (31.4%)
Mean stone size (mm^2)		449±163mm^2
Right Renal stone		33 (41.77%)
Left Renal stone		46 (58.27%)
DM (Diabetes Mellitus)		28 (35.31%)
HTN (Hypertension)		42 (53.16%)
IHD (Ischemic Heart Disease)		6 (7.35%)
Presenting symptoms	Pain	53 (67.3%)
	Hematuria	2 (2.53%)
	Fever	2 (2.53%)

Table-2: Details of procedure outcomes

Perioperative Variables	Results
Stone free rate	63/79 (79.74%)
Mean Operative time	151.26±105 minutes
Nephrostomy tube	(45/79) 56.96%
Double J stent	(61/79) 77.21%
Ancillary SWL≠ need	11/79 (13.92%)
Hospital stays	3±0.94
Re-admissions within 30 days of surgery	1/79 (1.26%)

≠Shock wave lithotripsy

Table-3: Complications*

Complication grade	Complication type	Results
1	Urine leak (Transient leak)	4 (5.06%)
1	Transient hematuria	9 (11.39%)
1	Perirenal hematoma	0 %
2	Transfusion	1 (1.26%)
2	Sepsis	2 (2.53%)
3	Puncture upper tract	1 (1.26%)
3	Perinephric collection	0%
3	Renal vascular injury needing angioembolisation	0%
4a	-	-
4b	-	-
5	Death	-

*(Clavien-Dindo Classification)

Table-4: Results according to Guys stone score (GSS) categorization

Variables	GSS-1	GSS-2	GSS-3	GSS-4	*p*-value
Stone free	49/54 (90.7%)	8/11 (72.7%)	4/6 (66.6%)	5/8 (62.5%)	0.001
Hospital stay	3±1.4	3±1.1	3±0.7	3.2±1.4	0.7
Minor≠ complication	9 (16.6%)	3 (27.2%)	2 (33.3%)	2 (25%)	0.9
Major* complication	-	1	-	-	0.8

≠ Minor complications=grade 1 and 2 (Clavien-Dindo Classification)

* Major complications=grade 3 and 4 (Clavien-Dindo Classification)

DISCUSSION

The treatment outcome in patients with urinary stones is affected by age factor. However, with the developments in endoscopic technologies and expertise, performing percutaneous nephrolithotomy (PCNL) and ureteroscopy (URS) in extremes of age has become easy to do and seem to be as effective and safe as it has been in the standard adult population. As far as ESWL and other minimal invasive surgeries are concerned, more precautions are advised to be taken for patients at extremes of age. In elderly patients, these procedures may give less satisfactory results as compared to the young age.[13,14] According to Stoller *et al* Eighty-two percent aged subjects (27 of 33) were found to have completely got rid of stone or had leftover fragments of <5 mm after 3 months following surgery. Older age patients had a relatively steeper transfusion rate after PCNL even with identical preoperative haemoglobin levels (twenty six percent versus fourteen percent in younger subjects, $p<0.01$). Regarding critical complications they noted that they were infrequent and no death was seen in elderly patients.[5] They had higher transfusion rates in elderly subjects. While we had only one patient who underwent transfusion after surgery (Table-3). Some of studies in near past mentioned elevated rates of transfusion reaching up to 12%.[16]

Study by Nakamon T *et al* observed that, the successfulness rate, extent of stay, auxiliary treatment, and decrease in haematocrit were not notably higher in elder subjects when compared to younger counterparts.[17] They further observed that sepsis incidence is more usual in the elderly group compared to youngsters (thirteen vs six percent, $p=0.007$). They observed higher occurrence of sepsis in senior group because of high preoperative urine culture to be positive compared to those in youngsters, however difference was not significant statistically. In this study no dissimilarity was observed in context of sepsis rates across different Guys stone score category groups (Table-4). Only 2.5% of our patients had sepsis (post PCNL procedure). It might be due to better preoperative preparation of elderly patients in our setup. Secondly subjects studied by Nakamon T *et al* had higher preoperative urine cultures to be positive in elderly group. Preoperative urine culture if positive has an impact on post-operative outcomes underscoring the fact that how much important it is to control infection preoperatively. It's vital to optimize patients suffering from chronic comorbid diseases in elderly age group before undergoing a surgical procedure and same holds true for PCNL. It helps in reducing the anaesthetic risks that might accompany surgery. Here it's important to note that the operating surgeon's experience with the procedure is also important.[18–20] Naturally, an experienced surgeon can handle PCNL (technically challenging task in elderly age patients). It's evident from our results that the complications and extent of hospital admission wasn't significantly dissimilar across the Guys stone score groups (Table 4). We have a high-volume surgery center and with time have gained comfortable outcomes in children and young age patients.[19] Present study aimed at looking the outcomes in elder subjects. Seitz *et al*. reported a systemic review on complications of PCNL. They were of the view that fever is frequent complication after PCNL procedure, with an overall incidence of 10.8%.[21] They deduced from their analysis the operation time and amount of irrigation fluid used to be influencing postoperative infection. It is apparent from table 3 that most of the complications were of minor grades in the present study. Sepsis was also not very frequent in our study as compared to other studies (Table-3). Rosette *et al.* employed postoperative hospital stay as a surrogate scale for the severity of complications and demonstrated that longer operative time led to increased rates of complications and thus prolonged length of hospital stay.[22] Lee *et al.* gave an account of complication rates of almost 15% in children and 17.9% in elderly. We had comparable rates of complications following PCNL in elder age subjects.[23] However most of our complications fell in the categories clavien grade 1 or 2 (Table-3). Sahin A *et al* noted that PCNL was equally effective in geriatric patients, in terms of success and complication rates.[24] However they had not done grading of their observed complications. We had categorized the complications according to clavien-dindo classification (Table-3). Safety of PCNL in recent past have been studied in some centers. In one study, hospital stay in elder age patients reached approximately 5 days as compared to 3 days in our patients.[25] In a recent study, it was concluded that performing tubeless procedure was as safe procedure in the old age population.[26] However they had comparatively smaller sample size. Furthermore, they didn't grade complications while reporting these. In addition, they didn't take into account stone complexity in their patients. We had categorized elder age subjects into Guys stone score groups to see variation in results based on these categories. We noted highest stone free rate for GSS-1 category group as compared to other Guy's score groups (Table 4). However, no dissimilarity in terms of hospital time duration and complications was observed in our study irrespective of the Guys stone score complexity (Table-4). Limitation of this study is that it was a retrospective study. Reason for this is that incidence of stones in such elder age subjects is low as compared to younger population. Having said that, this study had some positive aspects as categorization of complications was taken into account while describing complications incurred in subjects in present study (based on Clavien-Dindo Classification). Till date, no such study in

Pakistan has been conducted regarding PCNL experience and outcomes in elderly age group. In addition to this, elder subjects were categorized according to the Guys stone score (stone complexity) and main outcomes were recorded and compared across these sub categories. Multicenter prospective studies have not been conducted yet in this age group regarding PCNL outcomes and needs to be done in future.

CONCLUSION

PCNL can be undertaken safely and effectually for achieving treatment goals even in elder subjects. Stone free rates are higher in lower Guys stone score as compared to the higher scores. Guy's stone score had no significant impact on hospital stay and complication rates.

AUTHORS' CONTRIBUTION

NI: Design, Conception, Data collection, Analysis, writing. SI, AH, MM, MS: writing, Data collection, Analysis, Literature review. FK: Data collection, Analysis, Literature review. MAK: Literature review, Analysis, writing. SA: Supervision, Analysis, Literature review.

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