Original Article

PERCUTANEOUS NEPHROLITHOTOMY THROUGH UPPER CALYCEAL APPROACH FOR COMPLEX LOWER POLAR RENAL CALCULI

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ABSTRACT:

OBJECTIVE: To determine the efficacy of percutaneous nephrolithotomy through upper calyceal approach for removal of complex lower polar renal calculi.

STUDY DESIGN: Descriptive

PLACE AND DURATION OF STUDY: Departments of Urology and Renal Transplantation Allied Hospital and Madina Teaching Hospital Faisalabad, from March 2009 to February 2012.

METHODOLOGY: Fifty patients having complex lower polar renal calculi were selected by non-probability consecutive sampling. Percutaneous Nephrolithotomy (PCNL) was done by standard technique through upper calyceal approach and findings noted. Chi Square test for statistical analysis was applied.

RESULT: Stone clearance was achieved in 36 (72%) patients while 14 (28%) patients had significant residual fragments (>4mm size). In 40 (80%) patients, PCNL was done through a single percutaneous tract while in 10 (20%) patients; additional tracts were made in an attempt to clear the stones. The duration of surgery ranged from 2 – 4 hours (Mean 2.6 ± 0.64) and postoperative hospital stays varied from 2 – 9 days (Mean 3.28 ± 1.53). Haemorrhage (20%), pleural injury (10%) and both hemorrhage and pleural injury (4%) were main complications.

CONCLUSIONS: PCNL through upper calyceal access for treatment of complex lower pole renal calculi offers better stone clearance with chances of increased but manageable chest complications.

KEY WORDS: Percutaneous Nephrolithotomy (PCNL), complex lower pole renal calculi, stone clearance.

INTRODUCTION:

Urinary stone disease affects 5-15% of the people all over the world.[1] Open surgery was the main surgical therapy but has now been replaced by less invasive techniques including extracorporeal shock wave lithotripsy (ESWL), percutaneous nephrolithotomy (PCNL) and ureteroscopic intracorporeal lithotripsy.[2,3] PCNL is a technique of removing stone from the kidney via a nephroscope passed into the kidney.[3,4,5,6] It is the preferred treatment for large renal stones >2.5cm, stones resistant to ESWL and some upper ureteric stones.[6,7,8,9] The successful stone removal is only achieved by

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the accurate placement of a percutaneous tract. An ideal tract provides the straight access to all the calculi.[7,8,10,11] Superior calyceal puncture has been used for staghorn, large upper calyceal and upper ureteric stones. Inferior calyceal stones are usually removed through the inferior calyx.[12,13,14] However, in complex inferior calyceal calculi, complete stone clearance may often not be possible through a single tract in an inferior calyx. This is because of problems in negotiating the acute angles between calyces.[7,8,12] Superior calyceal approach can be used to clear such stones. The superior calyx is a compound calyx, so the target set for puncture is very large.[8,19] It also provides straight access to the inferior group of calyces.[7.8,9]

The disadvantages of superior calyceal puncture include risk of significant hemorrhage (causing difficulty in visualizing the stone) and injury to pleura or lung (resulting in pneumothorax, hydrothorax or haemothorax).[14,15,16,17,18]

METHODOLOGY:

Patients were admitted after making the diagnosis of complex lower pole calculi through out-patient department of Allied Hospital and Madina Teaching Hospital Faisalabad. Risk benefit ratio for inclusion in this study was explained to the patient to take informed written consent after approval by ethical committee. PCNL was performed by using rigid nephroscope under fluoroscopic guide through upper calyx approach. Peroperative findings like significant hemorrhage, number of additional tracts and duration of surgery were noted. After operation patients were examined to evaluate for other outcome measures such as pleural injury (pneumothorax, hydrothorax or haemothorax) and visceral injury clinically and on x-ray in suspected cases. Stone clearance was seen radiologically (x-ray KUB and abdominal ultrasound) after 24 hours. Number of repeat procedures and postoperative duration of hospital stay <2 or >2 days were noted. All this data was recorded on a proforma, entered into SPSS version 10 and analyzed through its statistical package. The study variables were stone size, number of additional tracts, operative time, complications (hemorrhage, pleural injury, and abdominal visceral injury) stone clearance and postoperative duration of hospital stay. The quantitative variables like stone size, operating time, number of additional tracts and postoperative duration of hospital stay were presented as mean and standard deviation. The qualitative variables like stone clearance and complications were presented as frequency and percentage. Chi Square test for statistical significance of outcomes was applied. $P<0.05$ or 5% was considered significant.

RESULTS:

Total number of patients was 50 (Fig-1). The age of the patients was from 18 to 65 years (Fig-2). Stone size varied from 2.5cm to 6.5cm (Fig-3). Operation time ranged from 2 - 4 hours (Mean 2.66 ± 0.642). In majority of patients (80%) stone removal was done through a single percutaneous tract. Postoperative hospitalization varied from 2 to 9 days (Mean 3.28 ± 1.53). (Table-1)

Haemorrhage and pleural injury were the main complications (Fig-4). Hydrothorax with minimal blunting of the costophrenic angle was seen in three patients, which was managed conservatively. One patient having significant hydrothorax required insertion of chest tube. Haemothorax developed in one patient due to injury of the intercostal vessels. This patient had smooth recovery after chest intubation. Visceral injury was not seen in any patient.

Stone clearance was seen in 36 (72%) patients and 14 (28%) patients had significant residual stone fragments (no clearance). These patients were subjected to either ESWL or repeat PCNL alone or ESWL followed by PCNL (sandwich therapy).

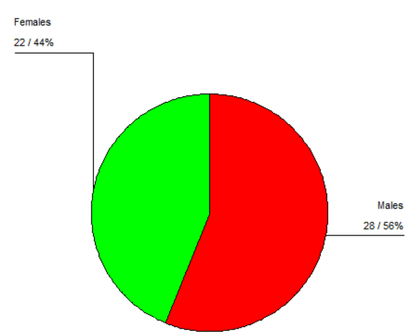

Fig-1: Distribution of sex

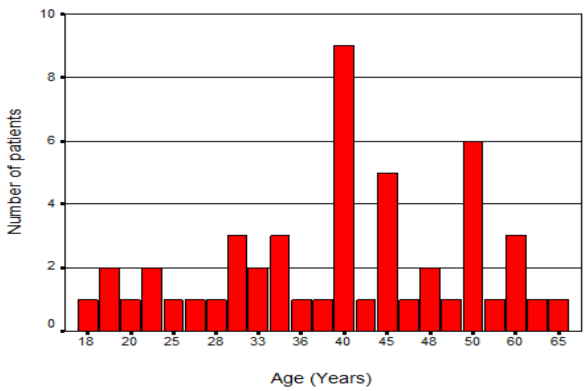

Fig-2: Distribution of age

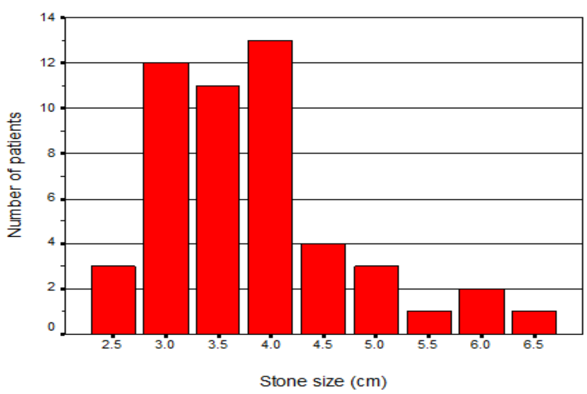

Fig-3: Distribution of stone size

Table-1: Correlation of stone size with other variables

Stone size		Operation time	No. of tracts	Post op. hosp stay
2.5	N	3	3	3
	Mean	2.000	1.00	2.33
	Std. Deviation	.000	.00	.58
3.0	N	12	12	12
	Mean	2.458	1.17	2.58
	Std. Deviation	.582	.39	.67
3.5	N	11	11	11
	Mean	2.318	1.09	2.64
	Std. Deviation	.405	.30	.50
4.0	N	13	13	13
	Mean	2.654	1.15	3.00
	Std. Deviation	.516	.38	.82
4.5	N	4	4	4
	Mean	3.250	1.50	4.00
	Std. Deviation	.500	1.00	.82
5.0	N	3	3	3
	Mean	3.333	1.33	4.00
	Std. Deviation	.577	.58	1.00
5.5	N	1	1	1
	Mean	3.500	2.00	7.00
	Std. Deviation	.	.	.
6.0	N	2	2	2
	Mean	3.500	1.50	7.00
	Std. Deviation	.707	.71	1.41
6.5	N	1	1	1
	Mean	4.000	2.00	9.00
	Std. Deviation	.	.	.
Total	N	50	50	50
	Mean	2.660	1.22	3.28
	Std. Deviation	.642	.46	1.53

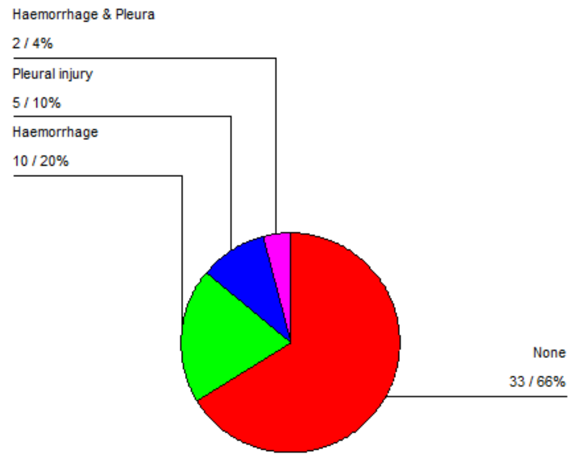

Fig-4: Distribution of complications

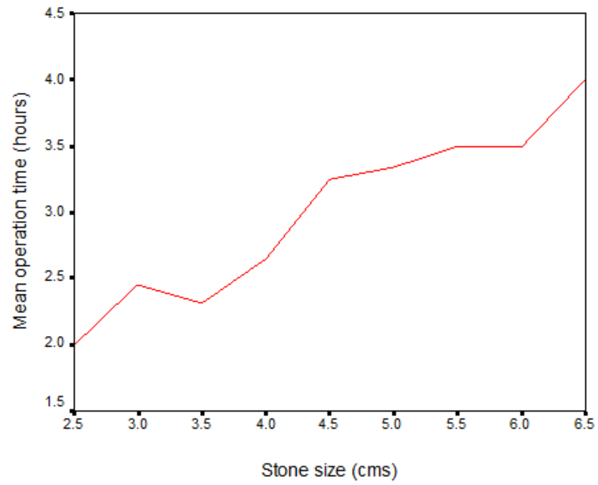

Fig-5: Relation between stone size and mean operation time

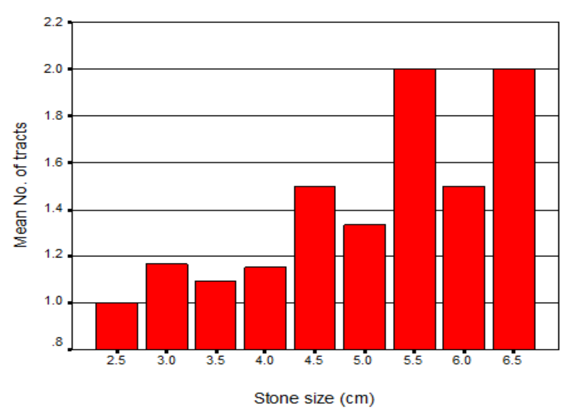

Fig-6: Relation between stone size and mean number of tracts

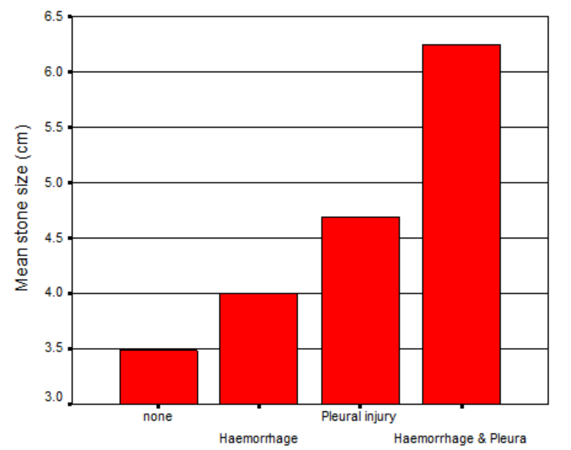

Fig-7: Relation between stone size and complications

Fig-8: Relation between stone size and stone clearance

DISCUSSION:

Management of renal stones has been revolutionized by the advent of ESWL and PCNL. The success of PCNL depends upon the formation of percutaneous tract.[2,3,4] Middle or inferior calyceal approach can be used for stones in these calyces or for renal pelvic stones. Upper ureteric, superior calyceal, complex lower polar and staghorn stones are easily approached through the superior calyx. Superior calyceal access provides a straight tract along the long axis of the kidney, with better visualization of the superior calyx, PUJ and lower pole calyces. It also favors easy manipulation of the rigid endoscopic instruments. Access through the middle or inferior calyx can lead to angulation between the working sheath and the pelvis.[2,7,8,9]

PCNL has been started in our institution a couple of years ago but we were bit reluctant to make upper calyceal puncture as it was thought to be associated with an increased number of complications especially chest complications despite its added benefits. This study was conducted to see the outcome of PCNL through upper polar access.

Pleural injury or injury to the lung are the major complications of upper pole access.[14,15,16] Entry through the pleural may lead to an accumulation of fluid, causing hydrothorax, which occurred in 14% of our patients which is quite high as compared to the study conducted by Monish et al where it was only 3%.[2] In another study by R. Gupta et al pleural injury was seen in 5% of the Patients.[10] Others have reported the incidence of hydrothorax to be 0–12%.[13,15] Pleural injury can be avoided by staying above the lateral half of the 12th rib.[10,11,12,13] Haemothorax secondary to the injury of the intercostal artery developed in one patient. This may be avoided by staying immediately above the upper border of the lower rib. Another potential complication of supracostal access is the risk of injury to the lung resulting in tension pneumothorax.[11,12,13] No such injury was seen in the present series and was not reported by others.

Visceral injury (spleenic or hepatic) may occur with the more cephalad puncture,[6,7] and thus we avoided access above the 11th rib. Therefore no visceral injury was seen in our study. Monish et al reported injury to an interlobar vessel in two-thirds of kidneys on puncturing the upper-pole infundibulum, while only 13% had an arterial injury when punctured through the lower-pole infundibulum.[2] However, no arterial lesions was seen when puncture was through the centre of calyceal papilla. This is also noted in the present series, where there was less blood loss when the puncture was end-on through the posterior upper pole calyx.

Mean operative time of our study was 2.6 hours which is comparable with a local study conducted by Qazi Fasihuddin et al.[19] Initially it took longer time to make a tract and clear stones but towards the end of the study, procedure was done earlier. Stone size and complications also affected operative time with patients having larger stone size (Fig-4) and more complications took more time.[20,21,22,23]

Monish et al. showed that in 4% patients more than one tract was made to clear the stones especially the larger ones.[2] In our study, 20% patients required additional tracts for stone clearance. This difference will hopefully be solved with time and practice as observed towards the end of the study.

Postoperative hospital stay varied from 2 to 9 days (Mean 3.28) which is a bit higher than observed in the work done by Carson Wong et al. where mean postoperative hospital stay was 2 days.[24] Longer postoperative stay was observed in patients who had complications especially the patients requiring chest intubation.

Stone clearance was seen in 72% patients. Our success rate is quite low as compared to the study of Monish et al. where it was 87%[2] but comparable with the work of R. Gupta et al. where it was 75%[10]. In another study by Ziaee S et al the success rate was 79%.[4] It was observed that as the size of the stone increases, and as the complexity of the situation increases, the stone free rate decreases.[25,26,27]

To conclude, the superior calyceal approach provides optimum access to complex lower polar renal calculi. Although the morbidity is slightly higher, to some extent this may be avoided by following the adequate precautions as outlined above. We have found this technique quite useful and hope that improvement in the learning curve will lead to better results.

CONCLUSION:

Percutaneous nephrolithotomy for removal of complex lower polar renal calculi through upper pole access offers good results. This is because of provision of an enhanced surgical field and greater maneuverability together with the treatable nature of the associated complications.

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