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Research Article

**PERCUTANEOUS NEPHROLITHOTOMY (PCNL); UPPER  
VERSUS LOWER POLE CALYX PUNCTURE****Dr. Zartashia Khan, Dr. Saman Maqbool, Dr. Aberah Azhar**  
Sheikh Zayed Medical College and Hospital, Rahim Yar Khan**Abstract:**

*Objectives: To assess the residual stone rate and associated chest complications in upper versus lower pole calyceal puncture PCNL. Materials & Methods: 474 patients having single stone in the renal pelvis, 21 to 50 years of age of both males and females were enrolled. Patients having multiple stones, pelvic kidney, staghorn stone, PUJO, and calyceal stones were not included in the study. Then selected cases were categorized randomly into two groups i.e. Group A was designated for (upper pole calyx) and Group B for (lower pole calyx), by using randomized control trial method. Postoperatively the cases were assessed for the residual stone. X-Rays KUB was taken on the 1<sup>st</sup> day postoperative. Patient remained admitted for at least 2 days after the surgery and was assessed for chest complications. Results: Mean age was  $34.57 \pm 6.21$  years. Out of 474 patients, 292 (61.70%) were males and 182 (38.30%) were females with 1.6:1 male to female ratio. This study shows the residual stone rate of 15.32% in the upper pole PCNL group and 26.81% in the lower pole PCNL group. The rate of Chest complications rate was seen in 2.13% in upper pole group and 5.96% in lower pole group. Conclusion: It is concluded that PCNL through upper pole calyx is superior in terms of results as compared to lower pole calyx PCNL.*

**Keywords:** Percutaneous Nephrolithotomy, Upper Pole, Chest Complications.

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**INTRODUCTION:**

The mankind has been affected by the urinary stones since long before (1-3). Egyptian Mummies are also found to have urinary stones.<sup>1</sup> furthermore, the renal stones formation is a recurrent disorder. The recurrence rate shows great variability in different reviews according to ethnicity and geography. In some case studies, it is reported to be up to 51% recurrent rate (4,5). The renal lithiasis is a disease with great socioeconomic and psychological impact, affecting significantly on quality of life. With the advancement in medical technology, new techniques are employed for the treatment of renal lithiasis. That include retrograde intracranial surgery (RIRS), extracorporeal shockwave lithotripsy (ESWL), laparoscopic ureter lithotomy and percutaneous nephrolithotomy (PCNL). Open surgery has largely been replaced by these techniques (6). For large renal calculi more than 20 mm PCNL is said to be as the therapy of choice and for smaller stones i.e 10–20 mm in the lower renal pole when ESWL is not favourable (1,3,7). For such stones, the extracorporeal shockwave lithotripsy (ESWL) success rate is less than 50% on the other hand, PCNL is very safe, effective and preferred way for the removal of such renal calculi (8,9). Different studies report stone clearance rate by PCNL ranging from 76% to 98% (6). However, PCNL is still a surgical technique that can face challenges and can be associated with multiple complications, that may compromise its efficiency (3). With the advancement in technique, instruments and position a great variation has been seen in PCNL (6,10,12). Puncturing technique, puncturing site, access and stone removal all have effect on complications rate (6). In the same way, the stone-free status or success affects complications rates (13) whereas, some reviews show that the rate of stone clearance has no impact on the complications rate. The complications of PCNL was an outcome independent of its success (14,15). Gaining the percutaneous access is the most critical step in the procedure (16,17) The surgeons prefer to obtain percutaneous access in different ways. Some obtain access via the upper pole calyceal puncture while some prefer lower pole calyceal puncture. It is assessed that the upper pole calyceal puncture technique resulted in superior stone clearance rate. But it has been feared for so long that upper pole calyceal puncture technique to gain access may result in chest complications (18). Different studies give different results for comparison of upper pole calyceal access versus lower pole calyceal access PCNL (19-20).

The focus of this study was to get the data on the residual stone rate and chest complications of upper

pole versus lower pole access and compare them. The previously available literature is not enough and also no further local data is available on the topic, so the study will not only be providing us the local statistics but also will give us the better access technique which may then be applied in general practice to reduce the complications.

**MATERIALS AND METHODS:**

The randomized controlled trial study was conducted on 474 cases (235 in both groups) with 1 stone in the renal pelvis area and age more than 20 years of both male and female's genders who presented at department of Urology Sheikh Zayed Hospital Rahim Yar Khan. The cases having multiple stones, pelvic kidney, staghorn stone, PUJO and calyceal stones and were not included. By taking 5% level of significance and 80% power of study, the size for was determined. The percentages of chest complications were 5.8% for upper pole and 1.5% for lower pole PCNL (19). The informed written consent was taken from the enrolled cases. Then they were asked to choose a slip from the box labeling A or B. In patients who patients who were placed in group A, upper pole calyx puncture access was used while in patients of group B lower pole was used. Detailed history was taken of complaints, systemic and general physical examination was done.

All these procedures were done by the consultant Urologist (with at least 5 years of experience, post-fellowship). patients were evaluated postoperatively for the residual stone. X-Rays KUB was performed on the 1st postoperative day. Patient remained admit for at least 2 days' post-operative and was assessed for chest complications. Patients with severe breathlessness, pneumothorax on X-rays chest, gross hem thorax and saturation below 85% during the 48 hours after surgery and require chest intubation were labelled as a case with chest complication. The information collected was analyzed by SPSS version 20. The Mean and standard deviation for age and duration of disease were calculated. For qualitative variables i.e., side effected (left / right), gender, chest complications and residual renal stones, Frequency and percentage were taken. Stratification was done of the effect modifiers and Chi Square test was applied to compare the frequency of chest complications and residual stones. P-value  $\leq 0.05$  was considered as significant.

**RESULTS:**

Age range of the cases enrolled in this study was from 21 to 60 years with mean of  $33.44 \pm 7.01$  years. Majority of the cases 206 (43.83%) were in between 21 to 30 years. Out of all 474 cases, 292 (61.70%)

were males and 182 (38.30%) were females with 1.6:1 male to female ratio. The mean duration of the disease in this study was  $5.11 \pm 2.07$  months. Most of patients 311 (66.17%) were having disease for less than 6 months' duration. The percentage of patients

according to affected side are shown in Table I. This study of ours, has shown the residual stone rate of 15.32% in the upper pole access group and 26.81% in the lower pole access group ( $p$ -value = 002). And the Chest complication rate as shown in Table II.

Table III: DISTRIBUTION OF PATIENTS ACCORDING TO SIDE AFFECTED IN BOTH GROUPS

Side affected	Group A (n=235)		Group B (n=235)		Total (n=470)	
	Frequency	%age	Frequency	%age	Frequency	%age
Right	123	52.34	125	53.19	248	52.77
Left	112	47.66	110	46.81	222	47.23

Table IV: COMPARISON OF OUTCOME BETWEEN BOTH GROUPS

Outcome		Group A (n=235)		Group B (n=235)		P-value
		Frequency	%age	Frequency	%age	
Residual stone rate	Yes	36	15.32	63	26.81	0.002
	No	199	84.68	172	73.19	
Chest complications	Yes	05	2.13	14	5.96	0.035
	No	230	97.87	221	94.04	

### DISCUSSION:

The treatment of choice for the upper ureteric stone and staghorn stones is Percutaneous nephrolithotomy (PCNL) (21). The success of this procedure varies depending upon the choice of renal calyceal approach. The lower calyceal approach does not provide proper access to major portion of the collecting system, and it could result in trauma to the renal parenchyma. The approach through the superior calyx is considered ideal to approach the renal system for managing the staghorn stones, proximal ureteric calculi, upper and lower calyceal calculi, and calculi associated with primary PU junctional obstruction (22,23). The supra costal puncture provides optimal access for large upper calyceal, staghorn and complex renal stone via posterior calyx (upper pole). The focus of this study to compare the rate of stone residue and chest complications of upper and lower pole calyceal puncture. The age group of the patients enrolled in the study is 21-50 years and mean age is  $34.57 \pm 6.21$ . Majority of the patients 210 (43.83%) were in 21-30 years' age group. Out of all 474 patients enrolled, 292 (61.70%) were males and 182 (38.30%) females with 1.6:1 ratio of male to female ratio. Our study has recorded the residual stone rate of 16.29% for upper pole PCNL and 25.62% for the lower pole.

Pulmonary complications were seen in 2.13% of patients undergoing intervention for upper pole and

5.96% for lower pole PCNL. Another study done showed the residual stone rate for the upper pole PCNL to be of 22.9% and for the lower pole 18.4% on PCNL. And the rate of chest complications was 5.8% for upper pole and 1.5% for lower pole (24). A retrospective study of 350 PCNLs done on 269 patients, of them, 125 patients underwent primary PCNL via a single tract though upper pole, while primary lower pole was utilized in 138 of the total patients. Patients who underwent the intervention through multiple access tracts ( $n=6$ ) were not included. The Baseline characteristics among groups were almost similar except for the age; patients with UPA were of older age group (52.6 vs. 46.2 years;  $p=0.003$ ). operative time, Stone burden, and initial stone-free rate were comparable among groups. furthermore, analgesic requirements were same on post-operative day 1 ( $p=0.54$ ) and day 2 ( $p=0.62$ ). And There was no difference recorded in the general complications ( $p=0.23$ ) as well as thoracic complications ( $p=0.43$ ).

Although after initial PCNL both groups had equivalent stone-free rates ( $p=0.78$ ), those having residual stones had got better stone-free rate after second-look PCNL by UPA (73.3% vs. 44.3%,  $p=0.035$ ) and a better stone-free rate overall. (94.4% vs. 86.2%,  $p=0.037$ ).<sup>25</sup>

In a study, the rate of success was 76.47% for those having in the lower, 90.70% for those who have in the upper calyceal access group. hydrothorax reported to occur 1 patient who was in upper calyceal supra costal access group. Blood transfusion was required by 5 patients who got stone in lower calyceal access group and 1 patient in upper calyceal access group (26). The prevalence the of thoracic complications during supra costal way in various studies was found to be between 3% and 16% (27-28,29). A retrospective study done by Golijan in et al (30) reported that a total of 104 patients enrolled who underwent 115 S-PCNL for treatment of 102 complete staghorn calculi, three large upper calyceal stones ,6 large semi-staghorn calculi and four significant volumes of residual stone fragments after ESWL. Further renal access was needed mainly for complete staghorn stones in 23 (20%) of cases. ESWL was required for the treatment of residual stones in 30.4% and a 'second-look' PCNL was needed in 15.6%. The stone free-rate after PCNL was recorded to be 67.8%, but after PCNL and followed by ESWL, second-look PCNL, or both modalities, the stone-free rate was increased to be 87%.

Gupta et al (23), in his study, reported 15 of 26 (58%) cases with staghorn calculi required a middle calyceal puncture as well, as the middle calyx area was difficult to reach from the superior calyceal access, because there is acute angle between the calyces. The supra costal access was used in only 11 renal units, and the stones were completely removed in 22 (85%), of which 7 required a repeat PCNL and 4 cases required ESWL for the removal of significant residual stones. Shaban et al (31), in his study, used PCNL in eleven cases with staghorn stones via two access tracts, one was supra costal and the other was through the middle or through lower calyx. in one session of PCNL all renal units were managed, eight were noted to be stone-free and 3 required ESWL.

In a study, the residual stone clearance was obtained in 36 (72%) cases whereas 14 (28%) cases had significant residual stones (>4mm size). In 40 (80%) cases, PCNL was done via a single percutaneous tract whereas in 10 (20%) cases; additional tracts were needed to clear the stones. The duration of surgical procedure ranged from 2 – 5 hours (Mean  $2.6 \pm 0.64$ ) and hospital stays was from 2 – 8 days (Mean  $3.28 \pm 1.53$ ). Hemorrhage was recorded to be (20%), pleural injury to be (10%) and both hemorrhage and pleural injury found to be (4%) (32). Another prospective study, 100 patients with lower calyceal calculi or lower calyceal calculi along with pelvic calculi were enrolled. In 50 of the patients designated as (Group 1), a fluoroscopy-assisted upper calyceal puncture

was done, and in remaining 50 patients designated as (Group 2), access was taken through a fluoroscopy-assisted lower calyceal puncture. The, operative duration, stone-free rates, requirement for additional tracts, complications, auxiliary procedures and hemoglobin drop in the two groups were recorded and analyzed. Hemoglobin drop and Stone clearance rates values were better in former, though they were found not to be statistically significant. The number of tracts required, mean operative duration, and the rate of relook procedure significantly favored Group 1. Only (2 %) 1 patient in Group 1 developed complication of hydro pneumothorax due to supra costal puncture and needed chest intubation for drainage. Upper calyceal puncture (supra costal or infra costal) provides favorable access to lower calyceal stones, providing faster and better clearance of stones with less requirements of auxiliary procedures and secondary tracts (33).

### CONCLUSION:

This study concluded that PCNL through upper pole calyx has better outcome (more stone free clearance rate and less chest complications) than lower pole calyx PCNL. So, we recommend that percutaneous nephrolithotomy through upper pole calyx approach should be used in every patient in order to reduce the complications.

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