PERCUTANEOUS NEPHROLITHOTOMY: UPPER VERSUS LOWER POLE CALYX PUNCTURE

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ABSTRACT

Objective: To compare the residual stone rate and chest complications of upper versus lower pole calyceal puncture in percutaneous nephrolithotomy (PCNL).

Methodology: Four hundred and seventy patients with single stone in the renal pelvis, of either gender were recruited in the study. Patients with multiple stones, staghorn stone, pelvic kidney, calyceal stones and pelviureteric junction obstruction (PUJO) were excluded. Selected patients were divided into two groups randomly i.e. Group A (upper pole calyx) & Group B (lower pole calyx) by using lottery method. Patients remained under indoor care for a minimum of 48 hours after surgery and were evaluated for residual stone and chest complications.

Results: Mean age was 33.44 ±7.01 years. Out of 470 patients, 290 (61.70%) were men and 180 (38.30%) were women with men to women ratio of 1.6:1. The residual stone rate was 15.32% for the upper pole PCNL and 26.81% for lower pole PCNL. Chest complication rate was seen in 2.13% and 5.96% for the upper and lower pole PCNL respectively.

Conclusions: This study concluded that PCNL through upper pole calyx has better outcome than lower pole calyx PCNL.

Key Words: Percutaneous nephrolithotomy, Renal stones, complications

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INTRODUCTION

Urinary stone disease has affected mankind since antiquity[1-3]. It has been even found in Egyptian mummies[1]. Moreover, renal lithiasis is a recurrent disorder. The lifetime recurrence rate has been reported with great variability in different studies according to geography and ethnicity. In some studies, it has been reported even up to 50%[4,5]. Therefore, kidney stones have great socioeconomic impact. With the advances in technology, new techniques have been evolved for treatment of kidney stones. These new techniques include extra corporeal shock wave lithotripsy (ESWL), retrograde intra renal surgery (RIRS), percutaneous nephrolithotomy (PCNL) and laparoscopic ureterolithotomy. These techniques have largely replaced open surgery[6].

PCNL is used as the therapy of choice for large renal calculi (>20mm) and also used for stones of smaller size (10–20 mm) of lower pole when non-favorable factors for ESWL are present[1,3]. For these stones the success rate of extracorporeal shock wave lithotripsy (ESWL) is less than 50% while PCNL is very safe, effective and preferred way to remove such urinary tract calculi[7,8]. Different studies report different stone clearance rate with PCNL ranging from 76% to 98%[6]. on the other hand, PCNL is a demanding surgical technique but also linked with certain complications, that may compromise its efficacy[3]. An increase in PCNL has brought great variation in the technique, position and instruments used for it[6,9-11]. Puncturing site, puncturing technique, access and stone removal, all affect the complication rate[6]. Similarly, the success or stone-free status affects complications and people with residual stone have higher complication rate[12]. Contrarily, some studies show that the stone clearance rate has no impact on the complication rate[13,14].

Gaining percutaneous access has much more importance and is critical in percutaneous nephrolithotomy[15,16]. Different people prefer to gain percutaneous access in different ways; through upper pole calyx puncture or lower pole calyx puncture. It is believed that upper pole calyx puncture technique results in better stone clearance rate. However, it has been feared since long that upper pole calyx puncture may result in pleural injury and chest complications[17]. Different studies

have given different results for the comparison of upper pole calyx versus lower pole calyx puncture PCNL[18-19]. There has always been a debate for choosing the best approach for PCNL, so the objective of this study was to find out the residual stone rate and chest complications of upper versus lower pole calyceal puncture PCNL. The results of our study will be a useful addition in the existing literature.

METHODOLOGY

After approval from ethics review committee, this randomized controlled trial was done on 470 patients (235 in each group) in the Department of Urology & Renal Transplantation Centre, Bahawal Victoria Hospital, Bahawalpur. Inclusion criteria were single stone in renal pelvis, age of more than 20 years, both genders, no urinary tract abnormalities and no pre-existing chest diseases. Patients with multiple stones, staghorn stone, pelvic kidney, calyceal stones and PUJO were excluded. The sample size was calculated by taking 5% level of significance, 80% power of study and percentage of chest complication rate of 5.8%. Written consent from all the patient was taken. Patients were offered a box with slips labeling A or B. In patients of group A, PCNL was done through upper pole calyx puncture while in patients of group B, PCNL was done through lower pole calyx puncture. All procedures were performed by the single consultant urologist (with at least 5 years of post-fellowship experience). Postoperatively patients were evaluated for residual stone. X-Ray KUB was completed at 1st postoperative day. Patients remained admitted for at least 48 hours after surgery and were evaluated for chest complications. Only those patients were labeled as having chest complications who required "chest intubation" within the first 48 hours after surgery (severe dyspnea, gross hemothorax or pneumothorax on X-ray, decreasing oxygen saturation below 85%).

Data were evaluated with SPSS version 20.0. Mean and SD were determined for age and duration of the disease. Percentage and frequency were calculated for qualitative variables i.e. gender, side affected (left / right), residual renal stones and chest complications. The outcome variables of the two groups were compared for differences. Chi square test was used to compare the frequency of residual stones and chest complication. P value ≤0.05 was regarded as significant. Effect modifiers like age, gender, obesity and side effects were managed through stratification. Post-stratification chi square was applied to check the effects on complication and p value ≤0.05 was regarded as significant.

RESULTS

Age range in the study was 20 to 60 years with mean age of 33.44 ±7.01 years. Most of the patients, 206 (43.83%) presented between 20 to 30 years of age. Out of 470 patients, 290 (61.70%) were men and 180 (38.30%) were women with men to women ratio of 1.6:1. Average duration of disease in our study was 5.11 ±2.07 months. Majority of patients i.e. 311 (66.17%) were having ≤6 months duration. Percentage of patients according to side affected are shown in table 1.

The residual stone rate was 15.32% for the upper pole PCNL and 26.81% for lower pole PCNL (p value =002). Chest complication rate was seen in 2.13% and 5.96% for the upper and lower pole PCNL respectively (P value =0.035) as shown in Table 2. We have found that there was no effect of age, gender and side on re-

Table 1: 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 2: 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	

sidual stones as the difference found was statistically insignificant. On the other hand, obesity and size of stone has shown significant effect on residual stone in both groups as more residual stone was seen in obese patients and in those patients with large stone size.

DISCUSSION

For treating large kidney stones, and some upper ureteric stones, PCNL is used[20]. The success of this procedure is based upon the suitable choice of renal calyceal approach. Superior calyceal approach is best for reaching the kidney system while managing staghorn stone, lower and upper calyceal complex calculi and calculi associated with pelvic- ureteric junction obstruction [21,22]. Our study has shown the residual stone rate of 15.32% for the upper pole PCNL and 26.81% for lower pole PCNL. Chest complication rate was seen in 2.13% and 5.96% for the upper and lower pole PCNL respectively. The study by Tefekli et al[23] has shown the residual stone rate of 22.9% for the upper pole PCNL and 18.4% for lower pole PCNL. The same study showed chest complications rate of 5.8% and 1.5% for the upper and lower pole PCNL respectively.

A retrospective review of 350 PCNL procedures reported overall complications rate of 74.3% versus 45.3%[24]. The incident of thoracic complications in most of the studies ranges between 3-16%[25-28]. Gupta et al[22] observed that among 25 patients of staghorn calculus, about 15 patients also needed central calyceal puncture, as it was not possible to reach the central calyx from upper calyx, due to acute angle between the two calyces. Supra-costal access was the only access in eleven kidney units, and 85% of stones were cleared out; among these 7 needed a repeat PCNL and 4 patients needed ESWL for significant residual stones.

Shaban et al[29] used PCNL in 10 patients having staghorn stones through 2 different tracts; one tract was upper calyx and one tract was middle or lower calyx. They showed that 8 were stone free and 3 required ESWL. Munvar et al[21] observed complication rate of sixteen percent for upper calyx punctures and 4.5% for sub-costal tract. Of the 98% of supra costal punctures, 27% were on the upper side of eleventh rib and 73% were above the 12th rib.

In another study, stone removal was observed in 72% patients and in 28% significant residual stones were observed. In about forty percent of patients, PCNL was completed through single tract, while in 20% patient additional tract was used to remove the stones. Hemorrhage (20%), pleural injury (10%) and both hemorrhage and pleural injury (4%) were main complications[30].

In another study, 100 patients having calyceal calculi were included. In about half of patients, upper calyx puncture was made; stone removal rate and hemoglobin drop values were better in this group, although they they were not statistically significant. Upper calyceal puncture facilitates good access to lower calyx stones, giving better and quick removal with less need of secondary tract[31].

CONCLUSION

This study concluded that PCNL through upper pole calyx has better results (more stone free removal rate and less chest complications) than lower pole calyx PCNL.

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CONTRIBUTORS

MSP conceived the idea, designed the study proposal and initial manuscript. MR helped collection of data, analyzed and compiled results and carried out bibliography. MSS critically appraised the draft and did corrections after revivers' suggestions. SAT supervised the whole project and carried out technical guidance. All authors contributed significantly to the submitted manuscript.