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To Evaluate the Rate of Stone Clearance of Supracostal and Infracostal Approaches and to Identify the Complications of Two Groups

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Abstract **Original Research Article**

Introduction: Renal stone disease is a challenging problem in urological practice because of large stone burden and high rate of recurrence. The primary goal of surgical stone management is to achieve maximum stone clearance with minimum morbidity to the patients. There are lot of uncertainty with renal stone management, many factors impact on management course, stone up to 10 mm can be pass on their own, roughly, the chance of a stone passing spontaneously is inversely to the size in millimeters. A 1mm stone passes 90% of the time, a 5 mm stone 50% of time, a 9 mm stone 10% of the time and so on. ***Objectives:*** The aim of this study was to evaluate the rate of stone clearance of supracostal and infracostal approaches and to identify the complications of two groups. ***Methods:*** This Quasi experimental study was carried out in the Department of Urology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Bangladesh Medical College Hospital, Popular Medical College and Hospital; and Barakah Kidney Hospital & Research Institute, Dhaka, during the period of February 2011 to January 2013, to compare the safety and efficacy between supracostal and infracostal upper pole approaches for PCNL. ***Results:*** Stone clearance was 94.29% in group I and 85.7% in group II, which was higher in group I but not statiscally significant (P>0.05). Hundred percent stone clearances were observed in patients who had stone size upto 3 cm in group I and 88.23% in group II. In patients who had stone size >3 cm the stone clearance was 89.4 % in group I and 83.33 % group II. Complications of percutaneous nephrolithotomy were found in 20.0% in group I and 22.9% in group II. ***Conclusion:*** In conclusion we can say that supracostal approach in a single session percutaneous nephrolithotomy is not safe and effective then infracostal approach.

Keywords: Nephrolithotomy, Supracostal, Infracostal.

INTRODUCTION

The introduction of ESWL as well as continuing advancement in the field of endourology have allowed most patients with renal stones to be treated in a minimally invasive fashion. Five minimally invasive treatment modalities are avialble for the treatment of patients with kidney stones: ESWL, PCNL ureteroscopy, Laparoscopic stone surgery and RIRS. Advances in endoscopic technology and surgical technique have dramatically reduced the need for open surgical procedures to treat patients with renal and ureteral calculi. Extracorporeal shock wave lithotripsy (ESWL) is most appropriate for small stone in the kidney or upper ureter. Uretero-renoscopy (URS) is the choice of procedure for stone in the ureter. The management of the staghorn calculi somewhat challenging, the most accepted choice at present a combination of percutaneous nephrolithotomy (PCNL) and ESWL, which is called sandwich therapy. Over time, modification of the techniques of percutaneuos renal access and improvement of the instrument PCNL is considered standard therapy for large and complex renal calculi [1].

Extracorporeal shock wave lithotripsy has problems of potential retained stones and residual fragments with subsequent “steinstrasse” formation. Conversely, percutaneous techniques have attained a stone free status up to 97.3% [2]. Access to the

collecting system and removal of the stone is the main parts of the PCNL procedure. Approach through the upper pole posterior calyx is useful for direct visualization to the superior calyx, inferior calyx, pelvis, PUJ and upper ureter. Successful removal requires the accurate placement of a percutaneous tract that provides direct access for stone manipulation. The pulmonary complications are a potential complication for supracostal approach because the anatomical relation of upper pole of the kidney to the diaphragm and the pleura. Supracostal supra 11th rib access has a particularly high rate of complications; haemo-pneumothorax and calyceal-pleural fistula have been reported in upto 23.1% [3]. The overall incidence of hydro-pneumothorax and pleural effusion in supracostal access has been reported in 4-15%; and in 8-12.5% respectively [2].

Another publication demonstrated that supracostal approach has less procedural complication especially procedural bleeding due to less angulations of amplatz sheath during stone manipulation. Traditionally most of the urologists in Bangladesh used infracostal route for upper pole puncture. Safety and efficacy of supracostal approach for PCNL is already mentioned in some of the studies, although it is avoided by many urologists because of potential pulmonary complications [4]. But meticulous assessment of diaphragm in inspiration and expiration to establish a safe and appropriate point of entry which may avoid the injury to pleura and lung at the time of supracostal puncture. The purpose of this study is to compare the safety and efficacy of upper pole access through supracostal approach with infracostal approach for PCNL.

OBJECTIVES

General Objective

- To evaluate the rate of stone clearance of Supracostal and Infracostal approaches and to identify the complications of two groups

Specific objectives

- To find out the stone clearance rate, complications, operating time and hospital stay in supracostal group.
- To find out the stone clearance rate, complications, operating time and hospital stay in infracostal group.

METHODOLOGY

Materials & Methods

Type of Study: Quasi experimental study

Study period: February, 2011 to January, 2012.

Place of study

Department of Urology, Bangabandhu Sheikh Mujib Medical University, Dhaka and Some other private hospitals in Dhaka City

Study population

Patients with renal stone admitted in the Department of Urology, Bangabandhu Sheikh Mujib Medical University, Dhaka and Some other private hospitals in Dhaka City, for PCNL according to inclusion and exclusion criteria.

SELECTION CRITERIA

Inclusion criteria

1. Age - 18 to 70 years.
2. Large (>20mm) or multiple calculi in upper calyx, lower calyx and renal pelvis
3. Staghorn stone

Exclusion Criteria

1. Patient with uncorrectable bleeding disorder.
2. Patient with anatomical abnormality of the kidney (horseshoe kidney, Malrotated kidney or pelvic kidney).
3. History of previous surgery on the proposed PCNL side.
4. Multiple puncture
5. Conversion to open

Study Procedure

A total of 105 patients with renal stone were admitted for PCNL via upper pole access during the study period, out of which 90 cases were enrolled in this study according to inclusion criteria (50 cases in Bangabandhu Sheikh Mujib Medical University and 20 cases other private hospitals). Among them 20 cases were excluded due to multiple puncture (14 cases) and conversion to open (6 cases). Finally, 70 cases were included in this study; out of them 35 patients were supracostal (Group I) and 35 patients were infracostal (Group II).

DATA COLLECTION

Patient's data collection form (Appendix-IV) includes along with address of the patient, age, sex, size and location of the stone and preoperative investigation findings were documented. Per operative events like operation time, blood transfusion requirements, procedural complications and stone clearance status were recorded. Complications encountered after the procedure like postoperative fever, haematuria, hospital stay and follow-up were documented. During postoperative period, all patients were seen with Hb%. S. Creatinine, plain X-ray KUB and urine culture 1 week and 4 weeks after the procedure. Groups were compared with respect to stone clearance, complications like- hemorrhage needed blood transfusion, hydrothorax, intercostal chest drainage and infection; operation time and hospital stay.

STATISTICAL ANALYSIS

Statistical analyses were carried out by using the Statistical Package for Social Sciences version 16.0

for Windows (SPSS Inc., Chicago, Illinois, USA). The mean values were calculated for continuous variables. The quantitative observations were indicated by frequencies and percentages. Chi-Square test with Yates correction was used to analyze the categorical variables, shown with cross tabulation. Student t-test was used for continuous variables. P values <0.05 was considered as statistically significant.

RESULT

Table-I: Distribution of the study patients according to age (n=70)

Age (years)	Group I (n=35)		Group II (n=35)		P value
	n	%	n	%	
≤30	4	11.4	6	17.14	
31-40	14	40.0	12	34.28	
41-50	10	28.75	10	28.75	
51-60	4	11.4	5	14.28	
>60	3	8.57	2	5.71	
Mean±SD	43.7	±9.1	41.5	±10.6	**0.359^{ns}**
Range (min-max)	(22	-68)	(26	-65)	

Group I- Supracostal
Group II- Infarcostal
s=significant
P value reached from unpaired t-test.

The study included 70 patients and the mean age was 43.7±9.1 years with ranged from 22 to 68 years in group I and 41.5±10.6 years with ranged from 26 to 65 years in group II. Maximum number was found in the age group of 31-40 in both groups. The mean age difference was not statistically significant (P>0.05) between two groups in unpaired t-test.

Table-II: Distribution of the study patients according to sex (n=70)

Sex	Group I (n=35)		Group II (n=35)		P value
	n	%	n	%	
Male	20	57.63	21	60.0	0.808^{ns}
Female	15	42.85	14	40.0	

Ns=not significant
P value reached from chi square test.

Regarding the sex distribution of the study patients, male were predominant in both groups, which was 20(57.63%) in group I and 21(60.0%) in group II. The difference was not statistically significant (P>0.05) between two groups.

Table-III: Stone clearance according to location (n=70)

	Group I (n=33)		Group II (n=30)	
Location of stone	**Number of stone**	**Stone clearence**	**Number of stone**	**Stone clearence**
	N	**n (%)**	**N**	**n (%)**
Staghorn	14	12(85.71%)	18	15(83.33%)
Upper calyceal stone	11	11(100.0%)	9	8(88.88%)
Lower calyceal stone	3	3(100.0%)	2	1(50.0%)
Renal pelvis stone	4	4(100.0%)	4	4(100.0%)
Renal pelvic+calyceal stone	3	3(100.0%)	2	2(100.0%)

The success rate of patients with staghorn calculi was 85.71% in group I and 83.33% in group II. 100% stone clearance was found in the upper calyceal, lower calyceal, renal pelvis and stone located in the renal pelvis+calyx in the group I and stone located in the renal pelvis and pelvic stone accompanying calyceal stones in group II.

Table-IV: Relation of stone size and clearance between study patients (n=70)

Stone size	Group I		Group II	
	No. of pt.	Stone clearance	No. of pt.	Stone clearance
	N	n (%)	N	n (%)
3 or <3 cm	16	16(100)	17	15(88.23)
>3 cm	19	17(89.47)	18	15(83.33)

Regarding relation of stone size and clearance between study patients. Stone size 3 or <3 cm with stone clearance 100% in group I and 88.23% in group II, and stone size >3 cm wtih stone clearance was 89.4 % in group I and 83.33 % group II.

Table-V: Complications of percutaneous nephrolithotomy of the study patients

Complication	Group I (n=35)	Group II (n=35)	P value
	n (%)	n (%)	
No complication	28 (80.0%)	27 (77.1)	0.770^{ns}
Complication	7(20.0)	8(22.9)	
Hemorrhage needed blood transfusion	3(8.57)	6(17.14)	
Hydrothorax	2(5.71)	0(0.0)	
Intercostal Chest Drainage	1(2.85)	0(0.0)	
Infection	1(2.85)	2(5.71)	

ns = not significant.

Table V shows the complications of percutaneous nephrolithotomy of the study patients. Complication of percutaneous nephrolithotomy was found in 7(20.0%) in group I and 8(22.9%) in group II. Hemorrhage needed blood transfusion complication was found 3(8.57%) in group I and 6(17.14%) in group II. Hydrothorax was 2(5.71%) in group I and not found in group II. Intercostal chest drainage needed 1(2.85%) in group I and not found in group II. Infection was found in 1(2.85%) in group I and 2(5.71%) in group II.

Table-VI: Distribution of the study patients according to operative time and hospital stay (n=70)

Variable	Group I (n=35)		Group II (n=35)		P value
	mean	±SD	Mean	±SD	
Operative time (min.)	80.9	±31.7	76.5	±29.2	0.547^{ns}
Range (min-max)	(60	-100)	(60	-93)	
Hospital stay (days)	3.98	±0.70	4.12	±0.65	0.587^{ns}
Range (min-max)	(3	-5)	(3	-5)	

Ns=not significant

P value reached from unpaired t-test.

Regarding the operative time and hospital stay of the study patients. Mean operative time was found 80.9±31.7 minutes in group I and 76.5±29.2 minutes in group II. Mean hospital stay was found 3.98±0.70 days in group I and 4.12±0.65 days in group II. The mean difference was not statistically significant (P>0.05) between two groups.

DISCUSSION

In specific conditions, such as staghorn calculi, large or multiple upper calyceal stones, calculi associated with ureteropelvic junction obstruction or upper ureteral pathology, large upper-ureteral calculi, and calculi in anomalous kidney access to the stones may require an upper-pole approach. The upper pole of the kidney is aligned medially and posterior to the lower pole, making a shorter and easier access route. The upper-pole approach provides a straight tract along the long axis of the kidney and ensures the ability to reach most of the collecting system while providing easier manipulation of the rigid nephroscope and other rigid instruments. The limitation of the lower-pole approach for the treatment of upper-calyceal and upper-ureteral calculi is difficulty of reaching the upper calyceal infundibulum and the upper ureter; such access may lead to trauma and bleeding during nephroscopy and stone fragmentation because of the angulation and torque on the kidney.

In this current study it was observed that the mean age were 43.7+9.1 with range from 22 to 68 years and 41.5+10.6 years with range from 26 to 65 years in Group-I and Group-II respectively, which was almost similar between two groups. A large number of the patients were in 4th decade in both groups that was 40.0% in group I and 34.28% in group II. Similarly, Sukumar et al. showed the mean age of their study was

44.2 years in supracostal and 43.34 years in infracostal group [2]. Hossain et al. and Gupta obtained the mean age were 39 years with ranged from 23 to 55 years and 44.5 years with range from 22 to 62 years respectively, which are closely resembled with the current study [4, 5]. The age range of the present study is comparable with the study done by John where the authors found the age range of the patients belonged to 22–76 years and 22 -81 years in group I and group II respectively [1]. In another study, Lojanapiwat and Prasopsuk showed the mean age was 51.64±11.93 years in group I and 52.05±12.52 years in group II, which is higher with the current study, this may be due to long life expectancy, geographical and racial influence had significant impact on development of renal stone of their study patients [6].

In this present study it was observed that male predominant in both group, which were 57.63% and 60.0% in group I and Group II. Male to female ratio was 1.4:1 in the whole study patients. Shaikh found male predominant in their study, where 70.7% and 29.3% patients were male and female respectively, which is closely resembled with the current study [7]. Similarly, Hossain; Gupta Lojanapiwat and Prasopsuk showed renal stone were more common in male subject, which is consistent with the current study [4-6].

Regarding the side of the stone, it was observed in this current series that renal stone was more common in left side, which was 62.86% in group I and 54.29% in group II. Stone found right side in 37.14% and 45.71% in group I and group II respectively, which was almost similar between two groups. On the other hand, Hossain found 57.0% and 43.0% renal stone were in right-sided and left-side respectively of their study patients [4].

In this present series it was observed that the complications of percutaneous nephrolithotomy was found in 20.0% in group I and 22.9% in group II, out of which hemorrhage needed blood transfusion 8.57% in group I and 17.14% in group II. Hydrothorax was 5.71% in group I and not found in group II. Intercostal chest tube drainage was needed 2.85% in group I and not needed in group II. Infection was found 2.85% in group I and 5.71% in group II. Lojanapiwat and Prasopsuk showed 15.4% in group I and 20.0% in group II needed blood transfusions [6]. There were 15.3% in group I and 1.4% in group II developed hydrothorax but only 5.3% of patients in group I needed intercostal chest drainage. Erich et al. reproted their study the blood transfusion needed for infracostal puncture was 16.7%. In another study, Gupta et al. found Hydrothorax developed in 5.0% of their study patients. Hossain et al. found the overall complications developed in 28.0% patients, with a chest complication in 14.0%. Among the chest complication 3 patients required insertion of chest tube [8, 4, 5]

In this series it was observed that the mean length of hospital stay was 3.98±0.70 days with range from 3 to 5 days in group I and 4.12±0.65 days with range from 3 to 5 days in group II. The mean hospoital stay was higher in group II but not statistically significant (p>0.05). Lojanapiwat and Prasopsuk reported that mean length of hospital stay (days) was 4.45±1.68 days and 4.29±1.29 days in supracostal group and infracostal group respectively [6]. Similarly, Liatsikos et al. observed that the mean length of hospital stay was 4.6 dyas with range from 3 to 14 days in their series. The above findings are consitent with the current study [9]. On the other hand, John found that the hospitalization time was 2.5±1.9 days in supracostal and 2.2±1.5 days in infracostal [1]. Muslumanoglu et al. reported in their study the mean hospital stay was 2.4+1.1 days with range from 1 to 7 days [10]. The findings of the current study is higher with the above-mentioned studies, may be due to most of the current study patients came from outside Dhaka. In another study, Singh et al. found the hospital stay of their patients was 6.8 days with range from 3 to 28 days, which was higher with the current study, which may be due to their patients had other comorbid condition.

CONCLUSION

This study was undertaken to compare the safety and efficacy between supracostal and infracostal upper pole approaches for PCNL. It can be concluded that supracostal approach in a single session percutaneous nephrolithotomy is not safe and effective then infracostal approach.

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