Original Article

Comparative Study between Exatracorporeal Shock Wave Lithotripsy (ESWL) and Percutaneours Nephrolithotomy (PCNL) for the Treatment of Lower Calyceal Stone

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Abstract:

Background: The main question when comparing ESWL and PCNL for lower pole stones is one of clinical effectiveness, which includes consideration of the stone-free rate, secondary procedure rate, complications, hospitalization, disability period and recurrent stone rate. Many factors are contributed to lower pole stones clearance such as size of stone, composition, infundibulo-pelvic angle and patient clinical factors should all be considered in conjunction with the various surgical modalities and the availability of equipment's before the preferred treatment option is selected. Stone-free rate with ESWL were inversely correlated to the stone burden treated.The introduction of ESWL in the early 1980s temporarily limited the indications for percutaneous procedures for stones but after limitations of shock wave lithotripsy were realized, percutaneous surgery regained its merited role in the stone management. On the other hand, lower pole stones contraindication for ESWL which were largely treated by open surgery in the past, now mostly replaced by PCNL. **Objectives:** To assess and compare relative efficacy and the overall lower calyceal stone clearance in between Percutaneous Nephrolithotomy (PCNL) and Extracorporeal Shock Wave Lithotripsy (ESWL). In relation to stone size.To compare the anatomical factor infundibulo-pelvic angle among, required adjuvant procedure and morbidity in between PCNL and ESWL in treating lower calyceal.Study Design: Hospital based prospective comparative interventional study. **Setting:** Study was carried out in the Department of urology, Bangabandhu Sheikh Mujib Medical University (BSMMU), and different private hospital of Dhaka city, during the period of January 2006 to July 2007. **Methods:** Purposive sampling method was followed as per inclusion and exclusion by criteria to select 60 patients. They were divided into two groups by alternate method, into PCNL and ESWL groups. **Result:** In this study, for the smaller stones <10mm, it was seen that the rate of stone clearance in PCNL and ESWL group were 85.71% and 77.77% respectively. Statistical analysis shows no significant difference of stone clearance between the two groups. (P>0.05). For treating larger stones >10-20mm, present study showed that the rate of stone clearance in PCNL and ESWL group were 93.75% and 41.66 % respectively. There are statistical analysis shows significant difference of clearance (P<0.05). **Conclusion:** Percutaneous Nephrolithotomy (PCNL) is better option than Extracorporeal Shock Wave Lithotripsy (ESWL) in treating lower calyceal stone.

Key words: Extracorporeal Shock Wave Lithotripsy (ESWL), Percutaneous Nephrolithotomy (PCNL)

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Introduction:

Urolithiasis is the third most common disease of the urinary tract, exceeded only by urinary tract infections and pathologic conditions of the prostate.The management of lower calyceal nephrolithiasis is challenging problem in urological practice. Stones located in the lower pole calyces are less likely to pass after shock wave breakup, particularly if the collecting system is grossly dilated or otherwise abnormal. The main question is when comparing ESWL and PCNL for lower pole stones is one of clinical effectiveness, which includes consideration of the stone-free rate, secondary procedure rate, complications, hospita lization, disability period and recurrent stone rate.

Many factors are contribute to lower pole stones clearance such as size of stone, composition, infundibulo-pelvic angle and patient clinical factors should all be considered in conjunction with the various surgical modalities.Since ESWL is an effective

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noninvasive procedure without the need for routine anesthesia and hospitalization and with prompt return of the patient to a normal life, It considered the method of choice for lower calyceal stones less than 2 cm. in diameter.However,percutaneous nephrolithotomy will continue to have a primary role in the management of larger stones. Many studies have been done in different parts of the world to compare the results of PCNL and ESWL in the management of lower calyceal stone. Recently PCNL has been introduced for the treatment of renal calculi in Bangladesh.

Rationale of the Study:

Percutaneous nephrolithotomy and extracorporeal shock wave lithotripsy can be used in treatment of lower calyceal calculi. Surgical removal of renal calculi is an essential element in the successful management of patients with calculus disease. Percutaneous nephrolithotomy is a safe and accepted technique. The lower calyceal system is responsible for common site of significant number of residual stone fragments after ESWL (Netto al.1991). Lower calyceal stones are considered to have a lower clearance rate after ESWL than stones located elsewhere in the kidney. This conclusion was based with an observation in a randomized prospective study comparing ESWL and PCNL and in a multi variable analysis.

Many studies have been done in different parts of the world to compare the results of PCNL and ESWL in the management of lower calyceal calculi. Although in Bangladesh, both the modalities have been practicing for lower calyceal stone management, no study has so far been conducted to assess the relative success rate between PCNL and ESWL. The present study has been desired to compare the results of treatment of lower calyceal stone up to 2 cm in size by PCNL and ESWL. Any superiority of one modality over the other will help us in popularizing it further among urologist of Bangladesh and this study may be the basis of further research in this field.

Objective:

To find out better treatment option in symptomatic lower calyceal stone.To assess and compare relative efficacy and the overall lower calyceal stone clearance in between Percutaneous Nephrolithotomy (PCNL) and Extracorporeal Shock Wave Lithotripsy (ESWL) in relation to stone size. To compare the anatomical factor infundibulo-pelvic angle among, required adjuvant procedure and morbidity in between PCNL and ESWL in treating lower calyceal.

Surgical Anatomy of Lower Pole Predicting Stone Clearance (Keeley, 1999, Hooda, 2005)

Lower pole renal stones are well known to show a poor stone clearance rate after ESWL. Successful ESWL is said to be highly sensitive to the anatomy of the lower pole of the kidney.

Anatomical factors of the lower pole that may predict stone clearance after ESWL are following:

1. Lower pole infundibular width.
2. Lower pole infundibular length.
3. Lower pole infundibulopelvic angle.

Methods:

This was hospital based prospective comparative interventional study. This study was carried out in the Department of urology, Bangabandhu Sheikh Mujib Medical University (BSMMU), and different private hospital of Dhaka city, during the period of January 2006 to July 2007. Hundred patients with lower pole stone referred from all parts of Bangladesh to this hospital were initially selected. A total of 100 patients having lower pole stones were initially selected for study After screening 60 patients were selected according to preselected criteria. Purposive sampling method was followed as per inclusion and exclusion criteria to select 60 patients. They were divided into two groups by alternate method, into PCNL and ESWL groups. PCNL Group: Included 30 patients for percutaneous nephrolithotomy.ESWL Group: Included 30 patients for extracorporeal shock wave lithotripsy.

Inclusion criteria:

- Stone size up to 20mm.
- Absence of complete urinary tract obstruction
- Excreting kidney

Exclusion criteria:

- Stone size > 20mm.
- Multiple calculi
- Urinary tract infection
- Pregnant women
- Bleeding disorder
- Severe cardiopulmonary disorder.

Results:

A total of 100 patients with lower calyceal stone were initially selected from out patients department of BSMMU and different clinic in Dhaka city for study. After taking consent and counseling and fulfilling the inclusion and exclusion criteria finally 60 patients were selected. They were divided in two groups. PCNL and ESWL groups and intervention in from of PCNL and ESWL were done accordingly. Patients were then

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visiting follow up schedule.After data collection and meticulous checking and rechecking, statistical analysis was done using computer SPSS 12.0 version and manually. Test of significance was done by using students t-test, z-test and λ^2 test. A probability value (p-value of <.05 was considered significant. In this study, the age distribution of the patients was 18 to 68 yearswith mean are 48.63±12.82 years. In PCNL group, the age range was 25 to 56 years with mean age 44.93 ±7.81 years. In ESWL group, the age range was 18 to 68 years with mean age 48.63 ±12.82 years. There was no significant difference (P>0.05) in age among the groups. The sex distribution of the sample did not have significant different between the groups. In PCNL group, male to female ratio was 2.33:1 and 2:1 in ESWL group.

Table-I: Distribution of the sample according to stone size.

Groups	Stone size				Total	λ^2	P value
	<10mm		>10mm to 20mm				
	No.	Percent	No.	Percent			
PCNL Group	14	46.67	16	53.33	30	1.06	>0.05
ESWL Group	18	60	12	40	30		

Table-II: Stone clearance in ESWL group: Comparison of clearance between smaller and larger stone.

Groups	Stone clearance				Total	λ^2	P value
	Cleared	%	Not cleared	%			
Smaller stone (<10mm)	14	77.77	4	22.23	18	0.77	>0.05
Larger stone (>10 to 20mm)	5	41.67	7	58.33	12		

Table-III: Stone clearance in PCNL group: Comparison of clearance between smaller and larger stone

Groups	Stone clearance				Total	λ^2	P value
	Cleared	%	Not cleared	%			
Smaller stone (<10mm)	12	85.71	2	14.29	14	0.49	>0.05
Larger stone (>10 to20mm)	15	93.75	1	6.25	16		

Table-IV: Stone Clearance in larger stone (<10 to 20 mm).

Groups	Stone clearance				Total	λ^2	P value
	Cleared	%	Not cleared	%			
PCNL Group	15	93.75	1	6.25	16	9.1006	>0.05
ESWL Group	5	41.67	7	58.33	12		

Table-V: Lower pole Infudibulo- pelvic angle predicting stone clearance in ESWL groups.

ESWL Groups			Stone clearance		λ^2	P value
	Angle	No pt	cleared	Not Cleared		
Infundibulo pelvic angle	$< 90^0$	4	3	1	1.153	>0.05
	$> 90^0$	26	24	2		

Discussion:

The present study has been designed to compare the outcome of PCNL and ESWL for the management of lower calyceal nephrolithiasis having stone size upto 2 cm.In this study, the age distribution of the patients was 18 to 68 years. In PCNL group, the age range was 25 to 56 years with mean age 44.93 ±7.81 years. In ESWL group, the age range was 18 to 68 years with mean age 48.63 ±12.82 years. There was no significant difference (P>0.05) in age among the groups. In a comparative study by Nett. et al. (1991) age range was reported Group 1 between 20-69 years in PCNL group and Group 2 age range between 18-78 years in ESWL group. In another study done by Lingemaen et al. (1994), mean age among the total study population PCNL group and ESWL group 48±16 years. Mean age of the patients between present study and other study (Lingemen et al. (1994) were almost similar and there was no singificant difference (P>0.05) in mean age among the groups.The sex distribution of the sample did not have significant different between the groups. In PCNL group, male to female ratio was 2.33:1 and 2:1 in ESWL group. This result close to well with results of Menonet al.1998), where male to female ratio was 2:1.

In present study, in PCNL group, 46.67% patients were in stone size <10mm and 53.33% were in stone size >10–20 mm. There was no significant different between the smaller and larger stone size distribution p > .05. The above distribution does not correlate with study done by McDougall et al 1989 but it correlate Netto et al 1991 and it correlate Albala et al 2001. having stone size respectively (<10mm, 11-19mm,> 20mm), (<10mm, 10 – 20mm and > 20mm) and (1–10mm, 11-20mm, 21-30mm and all stone sizes). In this study, stone clearance in ESWL group were

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77.77% and 41.66% for smaller stone (<10 mm) and larger stone (>10mm – 20mm) respectively. Though there is better clearance of smaller stones, statistical analysis shows no significant difference of clearance rate (P>0.05). The study done by Mcdougall et al. (1989) showed overall stone clearance is ESWL group was 86% and Lingeman et al (1994), showed the result of stone free rate were 74% and 56% for stone size <10mm and 11-20mm respectively. Study done by Kupeli et al (1998), Talic et al (1998), keeley et al (1999) reports showed similar results with stone free rates were 67.8% , 70% and 54.6% respectively. Netto et al (1991) showed reports stone free rate were 77.7% and 84.6% respectively stone size 10mm and 10mm-20mm. This stone clearance rate correlates with the present study.

In this study, for the smaller stones <10mm, it was seen that the rate of stone clearance in PCNL and ESWL group were 85.71% and 77.77% respectively. Statistical analysis shows no significant difference of clearance between the two groups (p<0.05).For treating larger stones >10–20mm, present study showed that the rate of stone clearance in PCNL and ESWL group were 93.75% and 41.66% respectively. There is statistical analysis shows significant difference of clearance (p < 0.05).Anatomical factor lower pole infundibulo -pelvic angle is the most important variable for lower pole stone clearance in ESWL group, but in PCNL stone clearance is independent for this infundibulo -pelvic angle. In the present study angle 90 degree and angle <90 degree in ESWL group stone free rate were 75% and 92.30% respectively and result statistical not singnificant (P >0.05). This correlates with study done by Albala et al (2001). But this result differ many study group as like Sampario et al (1995) reports showed with favorable anatomy had a 75% stone free rate after ESWL versus a 23% with unfavorable anatomy.

In the present study, complications were less in ESWL group than PCNL group. Loin pain and fever were less among patients of ESWL group than PCNL group. Haematuria and lower urinary tract symptoms were common in ESWL group. Steinstrasse was present only in ESWL group. Bleeding requiring transfusion and urinary cutaneous fistula were only present in PCNL group. All complications were treated conservatively. In this study complications were found bleeding during procedure, Loin pain, fever, haematuria, steinstrasse and urinary cutaneous fistula and more or less similar complications were found in the series of the study done by Netto et al (1991).

Conclusion:

Lower calyceal Stone clearance following shock wave lithotripsy and percutaneous nephrolithotomy are equal for smaller stone less than 10mm in diameter but calculi greater than 10mm in diameter are better managed by percutaneous removal in selected cases.

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