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Renal Stone Clearance Rates of PCNL and ESWL

Dr. Muhammad Haroon Ghous
Chair; Division of Urology, UCM
University of Lahore

Dr. Ali Hassan
Senior Registrar, UCM
University of Lahore

Dr. Sikander Afzal,
Associate Dean, Admin; UCM
University of Lahore

Abstract

➢ ***Objective:***

To compare the rate of stone free after one week in patients of renal stones (1-2 cm) by PCNL (Percutaneous Nephrolithotomy) versus ESWL (extracorporeal shock wave lithotripsy)

➢ ***Methodology:***

This Randomized Controlled Trial was conducted at Urology Department, Galway University Hospital, Galway, Republic of Ireland from 1st January 2018 to 31st December 2018. Total 104 patients were included. The patients were divided into two groups. Group-A (52 cases) with ESWL, while Group-B (52 cases) with PCNL. The patients were briefed about both the techniques, their likely consequences in terms of advantages and disadvantages. The procedure was considered successful if the patient will be stone free. Data were entered and analyzed in statistical software Statistical Package for Social Sciences (SPSS) v25.0. Data were stratified for age, gender and socio-economic status to address the effect modifiers. A p-value ≤0.05 was considered as a level of significance.

➢ ***Results:***

One hundred and four patients fulfilling the inclusion criteria were included in this study. Patients were divided in two groups i.e. Group-A (ESWL) and Group-B (PCNL). The mean age of patients in group-A was 43.5±12.5 years and in group-B was 45.8±15.3 years. In group-A, stone free rate was 39(75.0%), while 48(92.3%) in group-B with a p-value of 0.017, which is statistically significant.

➢ ***Conclusion:***

There is a difference of stone free rate at one week after extracorporeal shock wave lithotripsy (ESWL) versus Percutaneous Nephrolithotomy (PCNL) for renal stones of 1-2 cm

Keywords:- *Kidney Stone, ESWL, PCNL.*

I. INTRODUCTION

In worldwide renal stone is a significant health problem. In North America and Europe renal stone affects the population around 8%-15%.[1] In Pakistan renal stone is common disease in urological problems as Pakistan situated geographically in stone diseases distribution. The patients mean age is 40 years in Pakistan that affected by renal stone.[2] The most important treatment for renal stone is surgery and for complicated renal stones still open surgery performed.[3] The main objective or target for surgery is stone free patient as bacteria present in stone and it leads towards stone growth.[4] Stone site e.g. ureter or kidney and dimensions are the key parameters in the choosing of treatment.[5]

With the passage of time advances happened in the field of medicine also in stone management endoscopic that allows to treat with kidney stone easily than invasive techniques, which also increased rate of success than treatment morbidity in old methods. These includes SWL (lithotripsy shock wave), URS (ureterorenoscopic) and PCNL (nephrolithotomy percutaneous).[6] The PCNL endoscopic procedure is suitable for calculi stone of greater than 10 mm and for small size calculi SWL is suitable but SWL have significantly low clearance rate instead of many sittings.[7,8]

The patients feel discomfort in SWL due to its noninvasive nature.[9] With surgeon increasing experience, instruments miniaturization better imaging the PCNL become free from complications and minimal invasive.[8,10] In a study the clearance of stone by PCNL is higher 95.3% when compared with ESWL in which it was 79.2%.[11] In other study it was by PCNL was 97.4% and by ESWL it was 67.9%.[12]

Presently in our country no published study available on this topic due to lack of research sources and conflict with international literature. Therefore, the purpose of current study is to differentiate which treatment is a better option for the renal stone; PCNL or ESWL. The results of this study will be helpful for the management of renal stone patients with best technique. So the best technique is adopted in our current settings on the basis of these results.

➢ *Objective:*

To compare the rate of stone free after one week in patients of renal stones (1-2 cm) by PCNL (Percutaneous Nephrolithotomy) versus ESWL (extracorporeal shock wave lithotripsy)

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II. METHODOLOGY

The trial was Randomized Controlled that conducted at Urology Department, Galway University Hospital, Galway, Republic of Ireland from 1st January 2018 to 31st December 2018. Total 104 patients were included. The inclusion criteria was Age 18-70 years, Patients of both sex (male or female) and Patients with stone size upto 1-2cm. The exclusion criteria was Culture positive (urine c/s> 105 c/c), Patient having previous history of endoscopic surgery, Rental stone (radio opaque shadow in rental area on X-ray KUB), Pregnancy and Uncontrolled coagulopathy (INR>1.5). Renal calculi was defined as radio opaque shadow seen on X-ray KUB. Stone of size 1-2cm was included. Stone free rate was defined as number of patients that would be Stone free (absence of radio opaque shadow on x ray KUB) at first post operative week.

By using proforma the demographic information was collected. The patients were divided into two groups. Group-A (52 cases) with ESWL, while Group-B (52 cases) with PCNL. The patients were briefed about both the techniques, their likely consequences in terms of advantages and disadvantages. ESWL was performed by using the electromagnetic generator as an energy source. Stone was targeted with the help of fluoroscopy and 3000 shock waves given with rate of 60 – 90 waves per minute.

The level of shock wave energy was progressively stepped up till satisfactory stone fragmentation within the comfort of patients. All patients were previously well hydrated to improve the efficacy of ESWL. Fluoroscopy was used time to time during the procedure to see the cleavage of stone and re-targeting if required. The procedure was done as a daycare procedure. All patients were treated in supine position and received analgesia according to their body weight.

All patients were advised an oral analgesic and selective alpha-1 D adrenergic inhibitor agents on discharge to improve stone clearance. Under fluoroscopy, regional anesthesia control PCNL performed in cases. 22, 26 and 24 Fr Amplatz sheath and alken dilators as necessary was used. For twenty four hours 14 or 12 Fr cathater in all the patients was kept post-operatively. When necessary DJ stent was kept. If DJ stent was not used then catheter ureteric kept. For fragmentation pneumatic lithoclast used and tripronge forceps or alligator used for fragments retrieval. All the patients after operation on second day had X-ray KUB. If there was no stone then this procedure consider to be think safe and successful.

SPSS v25.0 was used for the analysis of data statistically. For categorical variables like genders the percentages and frequency was calculated, socio-economic status and stone free status. Mean and SD were computed for quantitative measurements like age and stone size. Data were stratified for age, gender and socio-economic status to address the effect modifiers. The p value of ≤0.05 was considered as a level of significance.

III. RESULTS

One hundred and four patients fulfilling the inclusion criteria were included in this study. Patients were divided in two groups i.e. Group-A (ESWL) and Group-B (PCNL). In group-A, there were 36(69.2%) were males and 16(30.8%) were females. In group-B, 38(73.1%) were males and 14(26.9%) were females.

The mean age of patients in group-A was 43.5±12.5 years and in group-B was 45.8±15.3 years. In group-A, there were 12(23.1%) in 18-30 years age group, while 18(34.6%) and 22(42.3%) were in 31-45 years and >45 years age groups respectively.

In group-B, there were 11(21.2%) in 18-30 years age group, while 18(34.6%) and 23(44.2%) were in 31-45 years and >45 years age groups respectively. According to socio-economic status (SES), in group-A, 17(32.7%) had low SES, while 19(36.5%) and 16(30.8%) had middle and high SES respectively, while in group-B, 11(21.2%) had low SES, while 28(53.8%) and 13(25.0%) had middle and high SES respectively.

In group-A, stone free rate was 39(75.0%), while 48(92.3%) in group-B with a p-value of 0.017, which is statistically significant.

Gender	**Groups**		**Total**	**p-value**
	Group-A (ESWL)	Group-B (PCNL)		
Male	36	38	74	0.665
	69.2%	73.1%	71.2%	
Female	16	14	30	
	30.8%	26.9%	28.8%	
Total	52	52	104	
	100.0%	100.0%	100.0%	

Table 1:- Comparison of Gender Distribution between Groups

Age groups	Groups		Total	p-value
	Group-A (ESWL)	Group-B (PCNL)		
18-30 years	12	11	23	0.968
	23.1%	21.2%	22.1%	
31-45 years	18	18	36	
	34.6%	34.6%	34.6%	
>45 years	22	23	45	
	42.3%	44.2%	43.3%	
Total	52	52	104	
	100.0%	100.0%	100.0%	

Table 2:- Comparison of Age Distribution between Groups

Socio-Economic Status (SES)	Groups		Total	p-value
	Group-A (ESWL)	Group-B (PCNL)		
Low (<20,000/month)	17	11	28	0.190
	32.7%	21.2%	26.9%	
Middle (20-50,000/month)	19	28	47	
	36.5%	53.8%	45.2%	
High (>50,000/month)	16	13	29	
	30.8%	25.0%	27.9%	
Total	52	52	104	
	100.0%	100.0%	100.0%	

Table 3:- Comparison of Socio-Economic Status between Groups

Stone Free	Groups		Total	p-value
	Group-A (ESWL)	Group-B (PCNL)		
Yes	39	48	87	0.017
	75.0%	92.3%	83.7%	
No	13	4	17	
	25.0%	7.7%	16.3%	
Total	52	52	104	
	100.0%	100.0%	100.0%	

Table 4:- Comparison of Stone Free Rate between Groups

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Gender	Stone Free	Groups		Total	p-value
		Group-A (ESWL)	Group-B (PCNL)		
Male	Yes	26	34	60	0.058
		72.2%	89.5%	81.1%	
	No	10	4	14	
		27.8%	10.5%	18.9%	
	Total	36	38	74	
		100.0%	100.0%	100.0%	
Female	Yes	13	14	27	0.088
		81.3%	100.0%	90.0%	
	No	3	0	3	
		18.8%	0.0%	10.0%	
	Total	16	14	30	
		100.0%	100.0%	100.0%	

Table 5:- Stratification of Stone Free Rate With Respect to Gender between Groups

Age groups	Stone Free	Groups		Total	p-value
		Group-A (ESWL)	Group-B (PCNL)		
18-30 years	Yes	8	11	19	0.035
		66.7%	100.0%	82.6%	
	No	4	0	4	
		33.3%	0.0%	17.4%	
	Total	12	11	23	
		100.0%	100.0%	100.0%	
31-45 years	Yes	16	17	33	0.543
		88.9%	94.4%	91.7%	
	No	2	1	3	
		11.1%	5.6%	8.3%	
	Total	18	18	36	
		100.0%	100.0%	100.0%	0.130
>45 years	Yes	15	20	35	
		68.2%	87.0%	77.8%	
	No	7	3	10	
		31.8%	13.0%	22.2%	
	Total	22	23	45	
		100.0%	100.0%	100.0%	

Table 6:- Stratification of Stone Free Rate With Respect To Gender between Groups

IV. DISCUSSION

For renal calculi PCNL is an endourological procedure.[13] PCNL is not useful in small size stone due to its complications, anesthesia needs and invasive nature.[15] After the results of this study we concluded that the rate of complications are increased when stone size increased and complications decreased and negligible when stone size small and RFT factors accepted.[14-15]

We selected infracostal puncture as increased chest complications, bacteremia, transfusion rate of blood, leak post op and long operative time, all are important when stone size is large.[14-15] In PCNL the complications happen not due to procedure itself but also due to patient's condition and stone size.[15] It is difficult to manage lower calculi with single procedure.[14]

The ESWL procedure is noninvasive the clearance rate is low instead of many sittings.[17-19] This thing is very discomfort for patients like infection, pain leads towards absent from job and towards thoughts that need not hospitalization.[17,20] For ESWL it is required to study lower calyx anatomy like diameter, infundibulopelvic angle[13, 20-21] and lower calyceal length infundibulum and parameters to be fair and suitable.[16]

The clearance rate is excellent if stone is 1-2 cm.[22] There are no standard parameters to study favorable and unfavourable anatomy.[21] PCNL does not need favorable anatomy knowledge it is uniformly successful in any type of stone and diversity of stone nature does not hamper clearance rate.[14] RIRS is nowadays getting popularity in the management of the lower calyceal calculi.[16] PCNL is single step, rapid, complication free and widely available procedure. The need for blood transfusion was is very less in small sized calculi. Mean operative time is also low with better instrumentation and imaging and experienced surgeon.[23-24] Complete clearance rate is very high (92.3%) which obviated need from another procedure and repeated clinic visits therefore it is widely accepted in society in all class of patients.[15] With increasing experience of the surgeon, miniaturization of instruments better imaging, PCNL is becoming minimal invasive and complication free.[8,10] In a study, Stone clearance rate was much higher in PCNL group with 95.3% as compared to ESWL as 79.2%.[11] In another study, Stone clearance rate was much higher in PCNL group with 97.4% as compared to ESWL as 67.9%.[12]

V. CONCLUSION

There is a difference of stone free rate at one week after extracorporeal shock wave lithotripsy (ESWL) versus Percutaneous Nephrolithotomy (PCNL) for renal stones of 1-2 cm.

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