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EXTRACORPOREAL SHOCKWAVE LITHOTRIPSY;

IMPACT OF DIURESIS ON THE CLEARANCE OF LOWER POLE RENAL CALCULI

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ABSTRACT... dr_muzamil@yahoo.com Treatment of renal stone is always a challenge. High incidence of recurrence of renal stone compels the treating physician to opt for minimally invasive treatment. With the advent of extra corporeal shock wave lithotripsy the treatment has been completely revolutionized. The treatment of lower polar stone is always tiring, and usually involves multiple modalities, the low lie of the stone, difficult clearance, narrow infundibulum, and higher incidence of regrowth make it difficult to treat. **Objectives:** We assessed the role of diuretic in the clearance of lower polar stone after shock wave lithotrispsy, (SWL). **Material and Methods:** 60 patients were selected from both sexes and divide them in two equal groups, with age 20-75 Y for group 1, and 5-72 Y for group II. Stone size from 5-20mm were included in our study. The patients underwent ESWL. The group I was offered inj Frusemide 20 mg intravenously after shock wave lithotripsy, while patients in group II were kept as control. **Results:** The stone clearance in group I was 73.3, and 60% in group II. Which is quite significant. **Conclusion:** The use of diuresis after ESWL significantly increases the clearance rate for lower polar stones.

Key words: Extra corporeal shock wave lithotripsy, Diuretics, Frusemide, Lower polar stones.

INTRODUCTION

Stone disease is common all over the world but in certain areas including, Pakistan, the incidence is much higher[13]. The proper management of lower calyceal calculi is one of the most controversial subjects among the stone disease centers. Although extracorporeal shockwave lithotripsy (ESWL) has been the therapy of choice for most lower pole renal stones, but certain factors determine its outcome.

Treatment of renal and ureteric calculi continues to be refined and improved. Majority of patients with upper urinary tract calculi are now treated with non-invasive or minimally invasive procedures. Current treatment modalities for upper urinary tract stones are extracorporeal shock wave lithotripsy (ESWL), percutaneous nephrolithotomy (PCNL), laparoscopic surgery and open surgery. Advent of ESWL as a noninvasive technique revolutionized therapy for urinary tract stones. It is safe and effective in 98 % patients[14].

In case of lower pole renal stone three variables are relevant to stone clearance: infundibulum length, width, infundibulo-pelvic angle, stone size and stone burden[5]. ESWL is safe and efficient first line therapy of small lower pole kidney stones with acceptable stone free rates, lower morbidity, complications and a low stone recurrence rate. ESWL stone clearance is not adversely affected by stone size up to 30 mm; however lower pole calyceal stones have relatively poorer clearance[17]. In the review of Lingeman and colleagues, this high failure rate is attributable mainly to retained stone fragments, which may reaggregate or constitute a nucleus for new stone formation[16]. There are different measures like mechanical percussion, diuresis, and inversion therapy to assist passage of lower pole renal calculi after shock wave lithotripsy[10].

The aim of this study was to determine outcome of patients undergoing extra corporeal shock wave lithotripsy (ESWL) for lower pole kidney stones and to assess the role of diuresis in stone clearance.

MATERIAL AND METHODS

We designed our study to see the effect of diuresis after Extra corporeal shock wave lithotripsy on lower polar stone. 60 Patients from both sexes with stone size 5mm to 20mm were selected, and divided in to two groups, of 30 each. Group one to whom inj Frusemide 20mg intravenously, (loop diuretic) was administered, and group two, to whom diuresis was not administered.

Patient with multiple stone, narrow infundibulum, patients having pregnancy, uncorrectable bleeding disorders, large abdominal aortic aneurysm, urinary tract infection, and distal obstruction, were excluded from study.

Patients were kept nil per oral for six hours before performing ESWL. Intravenous injection of pethedine (dose 1mg/kg) was given to all the patients of group I and group II as analgesia just before starting the ESWL. For both groups ESWL was performed in standard way employing electromagnetic lithotripsy (Modulith® SLX-Karl Storz) by same operator. Frusemide, a loop diuretic, 20 mg injection was given with 1000ml of normal saline solution intravenously immediate after each session of ESWL to group I. We did not give injection Frusemide and normal saline solution to group II patients after ESWL. We applied 2400 shock in every session of ESWL at rate 90 shocks per minute and power 7 kv. Maximum 3 sessions of ESWL were given (session 1st on day zero, session two day 10th and session three on day 20th.

Patients were evaluated for stone clearance with help of plain x-ray KUB and ultrasound kidney utreter and bladder after ten days following ESWL. Kidney was considered stone free, when size of residual stone following ESWL session was less than four millimeter. After every session of ESWL we noted complications like haematuria, pain and vomiting. If stone was not cleared in three sessions of ESWL, it was labeled failure of ESWL to clear the stone. ESWL in third session were performed when stone was not cleared after first and second session of ESWL in both groups.

RESULTS

We selected 60 Patients from both sexes, and divided in two equal segments, The age distribution was between 20 years to 75 years (mean age 41.33±14.65 years) in group I, 5 years to 72 years (mean age 35.77±13.76 years) in group II. The 21 patients (70%) were male and 9 (30%) were female in group I, 23 patients (76.7%) were male and 7 (23.3%) were female in group II.

Table-I. Size of stone (n=60)

Size of stone (mm)	Group-I	Group-II
5-10	07	11
11-15	09	09
16-20	14	10
Mean±SD	14.6±4.29	13.4±4.37

Table-II. Post-ESWL complications

Macroscopic haematuria				
Group I	17	09	01	27
Group II	18	10	01	29
Colic				
Group I	08	-	-	08
Group II	06	-	-	06
Fever				
Group I	01	-	-	01
Group II	02	-	-	02
Vomiting				
Group I	01	-	-	01
Group II	03	-	-	03

Table-III. Significance of Complete Stone Clearance in each Session within Group I

Stone size	Total Pts.	Session	Recovered Pts.	%age	P-value	95% CI
(5-10)mm	7 (23.33%)	1st	3**	42.86	0.000	(0.0989, 0.8159)
		2nd	2**	28.57	0.000	(0.0367, 0.8159)
		3rd	1**	14.28	0.007	(0.0036, 0.5787)
		Failure	1**	14.28	0.007	(0.0036, 0.5787)
(11-15)mm	9 (30.00%)	1st	3**	33.33	0.000	(0.0748, 0.7007)
		2nd	3**	33.33	0.000	(0.0784, 0.7007)
		3rd	1**	11.11	0.009	(0.0028, 0.4825)
		Failure	2**	22.22	0.000	(0.0281, 0.6001)
(16.20)mm	14 (46.70%)	1st	3**	21.43	0.000	(0.0466, 0.5080)
		2nd	6**	42.86	0.000	(0.1766, 0.7113)
		3rd	0	0.00	1.000	(N.A, 0.1926)
		Failure	5**	35.71	0.000	(0.1276, 0.6486)

*** Highly significant as the P-value <0.01,*   ** Significant as the P-value <0.05*

Table-IV. Significance of Complete Stone Clearance in each Session within Group II

Stone size	Total Pts.	Session	Recovered Pts.	%age	P-value	95% CI
(5-10)mm	11 (36.67%)	1st	3**	27.27	0.000	(0.0602, 0.6097)
		2nd	3**	27.27	0.000	(0.0602, 0.6097)
		3rd	2**	18.18	0.000	(0.0228, 0.5178)
		Failure	3**	27.27	0.000	(0.0602, 0.6097)
(11-15)mm	09 (30.00%)	1st	2**	22.22	0.000	(0.0281, 0.6001)
		2nd	1**	11.11	0.009	(0.0028, 0.4825)
		3rd	2**	22.22	0.000	(0.0281, 0.6001)
		Failure	4**	44.44	0.000	(0.1370, 0.7880)
(16.20)mm	10 (33.33%)	1st	2**	20.00	0.000	(0.0252, 0.5561)
		2nd	2**	20.00	0.000	(0.0252, 0.5561)
		3rd	1*	10.00	0.0001	(0.0025, 0.4450)
		Failure	5**	50.00	0.000	(0.1871, 0.8129)

*** Highly significant as the P-value <0.01, * Significant as the P-value <0.05*

Table-V. Significance of Complete Stone Clearance Comparison of Group I and Group II in each Session within Group II

Stone size	Group I		Group II		Estimate of Difference	P-value	95% CI
(5-10)mm	07	06	11	08	0.1299	0.491	(-0.2395, 0.4993)
(11-15)mm	09	07	09	05	0.2222	0.303	(-0.2011, 0.6455)
(16-20)mm	14	09	10	05	0.1429	0.483	(-0.2559, 0.5416)

*** Highly significant as the P-value <0.01, * Significant as the P-value <0.05*

Table-VI. Overall Significance of Complete Stone Clearance within both Groups

Groups	Status		P-value	95% CI
Group I	Success	22	0.000	(0.5411, 0.8772)
	Failure	08	0.000	(0.1228, 0.4589)
Group I	Success	18	0.000	(0.4060, 0.7734)
	Failure	12	0.000	(0.2266, 0.5940)

*** Highly significant as the P-value <0.01, * Significant as the P-value <0.05*

Table-VII. Overall Significance of Complete Stone Clearance between both Groups					
Groups	Total Pts.	No. of Pts.	Estimate of Difference	P-value	95% CI
I	30 (100%)	22 (73.33%)	0.1333	0.268	(0.1028, 0.3695)
I	30 (100%)	18 (60.00%)			
** *Highly significant as the P-value <0.01,*			* *Significant as the P-value <0.05*		

Fig-1. Percentage of success

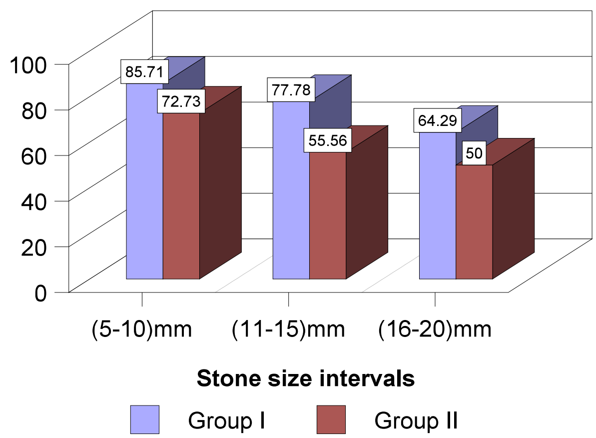
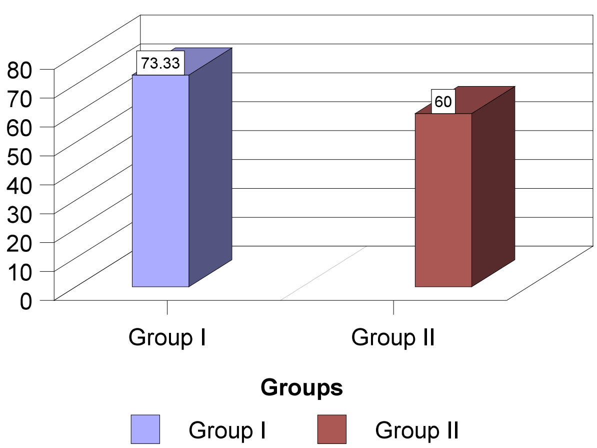


Fig-2. Overall success percentage



DISCUSSION

Although ESWL is the treatment of choice for approximately 90% of calyceal calculi, review of the literature nearly uniformly describes a low stone clearance rate for lower calyceal stones than for those in middle and superior calices[9]. In the study of Kupeli and Associates, the overall stone free rate for lower pole calculi was 53.3%[1]. Besides the numerous factors such as stone burden, stone composition, and anatomic abnormalities that have been demonstrated to affect the result of ESWL, stone location seems to be an important factor [2]. Lower calyceal location results in retention of fragments within the kidney after ESWL, and these can act as a nidus for further stone formation[15]. This is the major shortcoming of this form of stone treatment. Although patients with residual concrements of 5 mm or larger are treated again with ESWL, small stone fragments (<5mm) are considered to be clinically insignificant. However, studies of stream and colleagues have noted an increase in stone formation, growth of residual fragments, and symptomatic episodes in patients with residual calculi (<5mm) after ESWL[3]. To improve the success rate of ESWL, different maneuvers have been proposed for lower pole nephrolithiasis, such as inversion therapy, direct irrigation of the lower calyces during ESWL, or forced diuresis with percussion of the flank area[7,18].

ESWL has become established as the preferred treatment for most upper urinary tract calculi but as a primary treatment for inferior calyceal stone it remains controversial. The stone clearance rate after ESWL for inferior calyceal calculi is reportedly 25–85%[4]. Stones of >2 cm were excluded from the study, as reports show very poor results in this category,[5] thereby eliminating the effects of this population on the overall results.

There has been an emphasis on multiple sessions of inversion therapy for clearing retained residual fragments in gravity-dependent inferior calyces[18]. Several other methods, have been employed to clear the lower polar stones. Graham et al reported percutaneous irrigation of inferior calyces during lithotripsy for better clearance[6]. Nicely et al reported the use of a cystoscopically placed cobra catheter for direct irrigation of lower pole calyceal stones during ESWL[7]. We did not use any of these measures in any patient, to eliminate the effect of adjunctive treatment bias on the results.

In this study patients received 1–3 sessions of ESWL at 10 days interval, with 2400 shock waves at 7 kV in each. With an unlimited number of shock waves, most stones would break but an excess of shock waves may cause ill effects on the kidney and make the cost of stone treatment too high; trauma to the kidney may result in hypertension and loss of renal function[8].

The stone clearance rate decreases as the size of stone increases[4,19]. A meta-analysis, showed that the efficiency of ESWL rapidly decreases as stone size increases; stone clearance rates were 74% for stones of < 1 cm, 56% for 1–2 cm and 33% for stones of > 2 cm. The mean stone clearance rate in 73.3% in group I and 60% in group II in the present study is comparable to those reported previously;[10] the rate was 86% for stones < 1 cm and 74% for 1–2 cm, an insignificant difference, but stone size was a significant variable on univariate. Male to female ratio in three local studies were 4:1, 3.8:1, and 2.5:1[11,12]. In the present study, 46 patients were male and 16 were female showing the approximate ratio of 3:1 of males and females.

Stone size was defined as the maximum diameter in any direction. Which varied from 5 mm to 20 mm. The size of stone was recorded according to ultrasound and KUB x-ray. Stone size, the mean±SD 14.60±4.29 mm in group-I and 13.40±4.37 in Group – II. The p value was 0.268>0.05, indicating there was no statistically significant difference between two groups. (See table VII).

Group I, complete stone clearance was seen in 9 patients (30.0%) after the first session, 11 patients (36.7%) after the second session, 2 patients (6.7%) after the session three, and 8 patients (26.7%) failed to clear the stone. In group II, complete stone clearance occurred in 7 patients (23.3%) after the first session, 6 patients (20.0%) after the second session, 5 patients (16.7%) after the third session and 12 patients (40.0%) failed to clear the stone.

Stone clearance was 73.3% in Group I (IV injection of frusimide 20mg and 1000 ml normal saline given) and 60% in Group II (no diuretic given) patients respectively. Significantly more ESWL sessions were required for stone clearance in Group II. In current study, the mean success rate after three sessions, was 73.3, 60.0% in group-I, as the p-value<0.05 and group II, as the p-value<0.05 representing the statistical significance of the success in both groups. Also failure rate was 26.7% and the p-value<0.05 in group I and failure rate was 40% and the p-value<0.05 representing the statistical significance of the success in both groups. (See table VI)

The table III and table IV are indicating the statistical significant of complete stone clearance with respect to different stone sizes within both groups respectively as the p-value <0.05.

The table V compare complete stone clearance between two groups with respect to different stone sizes also the estimate of the difference and their corresponding confidence interval are presented. As the p-value >0.05 demonstrates that the both groups are statistically insignificant in stone clearance.

The figure 1 and 2 show that by using post ESWL diuretics in group I patients, less number of sessions of ESWL were needed and early stone clearance was seen as compared to group II patients in whom diuretics was not given in the treatment of lower pole renal stones.

CONCLUSION

By using post ESWL diuretics in group I patients, less number of sessions of ESWL were needed and early stone clearance was seen as compared to group II patients in whom diuretics was not given in the treatment of lower pole renal stones. This is small study, but we find this a useful adjuvant therapy for patients suffering from lower pole renal stones. So use of diuretics increase the clearance of lower pole renal stone following ESWL.

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