

Comparison of Intracorporeal (Pneumatic) Versus Extracorporeal Shockwave Lithotripsy (ESWL) in Proximal Ureteric Stone Management

AAMIR ALI SHAIKH¹, YASSIR HUSSAIN PATUJO², AHMED BUX SHAIKH³, *BENAZIR ABBASI*⁴

ABSTRACT

Background: After benign prostatic hyperplasia and urinary tract infections, urinary stones are common in urological practice. Ureteric stone can be managed by conservatively, extracorporeal shockwave lithotripsy, intracorporeal lithotripsy and laparoscopic and open surgery.

Aim: To compare efficacy of intracorporeal (pneumatic) versus extracorporeal shockwave lithotripsy in Upper ureteric stone management.

Methods: Randomized control trial of 94 patients with single upper ureteric stone was included in this study and patients were divided into two groups, A and B. Forty seven in group A treated with intracorporeal lithotripsy and 47 patients in group B were treated extracorporeal shockwave lithotripsy. Follow-up of the Patients was done with X-ray (KUB) on every 14 days. Patients with absence of radio-opaque stone were categorized as efficacy positive. On the final result which was at 08 weeks those patients will be considered efficacy positive who has no stone.

Results: All 94 patients with single ureteric stone < 10 mm were included in our study. Forty seven in group A treated with intracorporeal (pneumatic) lithotripsy and 47 patients in group B were treated extracorporeal shockwave lithotripsy. Efficacy of intracorporeal lithotripsy (group A) was 80.9% and extracorporeal shockwave lithotripsy was 83%.

Conclusion: Intracorporeal lithotripsy is equally effective as ESWL in management of proximal ureteric stone.

Keywords: Ureteric stone, ESWL and intracorporeal lithotripsy.

INTRODUCTION

After benign prostatic hyperplasia and urinary tract infections, urinary stones are common in urological practice^{1,2}. It constitutes 40-50% of urological work load in hospitals. Prevalence of urolithiasis is 12% in Pakistan^{2,3}. Ureteric stone can be managed by conservatively, extracorporeal shockwave lithotripsy, intracorporeal lithotripsy, laparoscopic and open surgery^{1,4,5}.

When patient is unable to pass stone spontaneously then either intracorporeal or extracorporeal shockwave lithotripsy are the effective treatment options in recent years for proximal ureteric stone management. Both options have gained popularity in modern practice due to their high effectiveness^{5,6}.

In past studies were conducted for comparing both modalities and shows high effectiveness but results were almost equivocal and most of studies were on lower ureteric stones except a few on proximal ureteric stone⁵.

Efficacy of shockwave lithotripsy in upper ureteric stone clearance is 73.8%, while Uretero-renaloscopic intracorporeal is 92.8%⁵.

Although different studies have been done and shows different outcome, according to Bozkurty et al⁵ efficacy of shockwave lithotripsy is 73.8% while uretero-renaloscope has 92.8%. While according to Kijvikai⁷ efficacy is 90% with shockwave lithotripsy and 73% with uretero-renaloscopy in upper ureteric stone clearance. Because of a lot of difference between two studies, therefore present study is designed to compare actual efficacy of two treatment modalities.

The objective of the study was to compare efficacy of intracorporeal (pneumatic) versus extracorporeal shockwave lithotripsy in Proximal ureteric stone management.

MATERIAL AND METHODS

Randomized control trial of 94 patients conducted among the outdoor patients in Urology department at Chandka Medical College Hospital, Larkana with single upper ureteric stone from 01-07-2016 to 31-12-2016. The equal distributions of patients were done in two groups. Forty seven respondents were treated with intracorporeal in A group and 47 patients in B

^{1,2}Consultant Urologist, CMC-SMBBMU Larkana.

³Assistant Professor Community Medicine CMC-SMBBMU Larkana

⁴SMBBMU, Larkana

Correspondence to Dr. Aamir Ali Shaikh, Email. a.aamir40@yahoo.com Cell no. 0331-5007860

group were treated extracorporeal shockwave lithotripsy. Age > 18 years, either gender single stone (Single radio-opaque stone Stone < 10 mm), upper ureteric radio-opaque stone on X-ray and Duration of stone > 6 weeks were included in study while Pregnancy, Uncontrolled coagulopathy, Severe hydronephrosis, Multiple or bilateral stone, Renal insufficiency, Urinary tract infection and ipsilateral lower ureteric stone excluded from the study, For the follow-up patients were called every 14 days with X-ray (KUB). Patients with absence of radio-opaque stone were considered (labelled) as efficacy positive. Outcome (final) was at 08 weeks, those will be considered efficacy positive that has no stone. All patients who met inclusion criteria, attending urology department, SMBBMU Larkana was enrolled in this study having ethical review committee approval. All patients were informed about study and consent was taken. The lottery method was used for randomization in two groups, slips were made equally and kept in one box, and all the respondents were requested to take one slip. Group-A, intracorporeal lithotripsy was done. Group-B, Extracorporeal shockwave lithotripsy was performed. For the follow-up of the patients, they were called every 14 days for X-ray (KUB). Patients with absence of radio-opaque stone were considered (labelled) as efficacy positive. Those will be considered efficacy positive that has no stone on final outcome which was at 08 weeks. Data was collected on study specific Performa and analyzed on SPSS version 22.0.

RESULTS

All 94 patients with single ureteric stone < 10 mm were included in our study. Forty seven in group A treated with intracorporeal lithotripsy and 47 patients in group B were treated extracorporeal shockwave lithotripsy. Average age was 35.31 ± 13.48 years in our study. Average age and duration of stone were not significant between groups as shown in table 1. Out of 94 cases, 61(64.9%) were female and 33(35.1%) were male. Duration of stone disease according to groups is also presented in figure 1. Efficacy of ureteric stone extraction (group A) was 80.9% and extracorporeal shockwave lithotripsy was 83%. Significant difference was not observed in efficacy of the treatment as shown in table 2. Efficacy was also not significant between groups for below 31 years of age and above 30 years of age. Similarly efficacy was also observed with respect to gender and duration of disease but insignificant difference was found in both groups while efficacy was significantly high in group A than group B for below 5mm stone size but it was not significant between

groups for above 5mm stone size as presented in table 3.

Table 1: Comparison of mean age and stone size between groups

Variables	Group A	Group B	P value
Age in years	34.57±13.30	36.04±13.75	0.60
Duration of stone (months)	3.2±0.77	3.34±1.01	0.46

Independent sample t test

Table 2: Compare the efficacy of intracorporeal versus ESWL: in upper ureteric stones

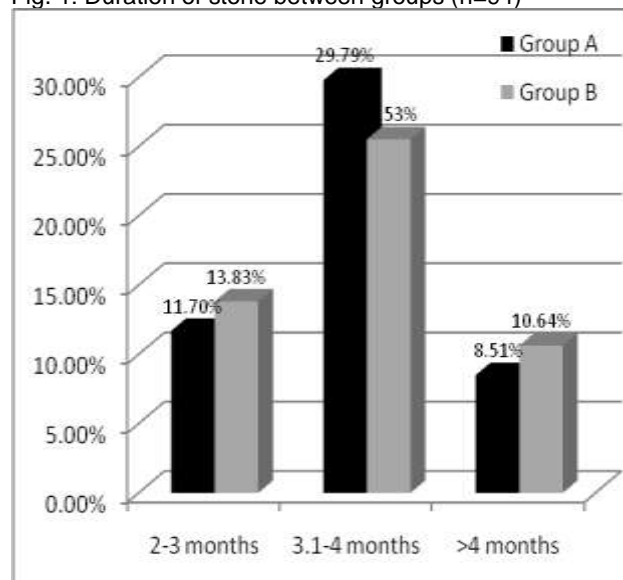
Efficacy	Group A	Group B	Total
Yes	38(80.9%)	40(85.1%)	78(83%)
No	9(19.1%)	7(14.9%)	16(17%)

P value 0.58 Chi-Square= 0.301

Table 3: Comparison of efficacy between groups with respect to duration of symptoms

Efficacy	Group A	Group B	P-Value
Stone size ≤5 mm			
Yes	10(90.9%)	5(41.7%)	0.013
No	1(9.1%)	7(58.3%)	
Total	11	12	
Stone size 5.1 to 8mm			
Yes	15(53.6%)	14(50%)	0.78
No	13(46.4%)	14(50%)	
Total	28	28	
Stone size 8.1 to 9mm			
Yes	5(62.5%)	1(14.3%)	0.057
No	3(37.5%)	6(85.7%)	
Total	8	7	

Fig. 1: Duration of stone between groups (n=94)



DISCUSSION

There are various treatment options to deal with ureteric stones and yet no one is gold standard, ranging from observation, medical therapy, non-invasive, minimal invasive to invasive. But among these intracorporeal and extracorporeal lithotripsy are mostly applied^{8,9}.

Extracorporeal lithotripsy require multiple sitting and regular follow-up in order to achieve complete stone clearance. It is non-invasive and day care procedure does not require anesthesia but has high retreatment rate¹⁰. On other side intracorporeal lithotripsy is minimal invasive, require anesthesia, complete stone clearance in single intervention and less follow-up. Research shows a lot of studies on comparison of both modalities but most of them are on lower ureteric stones.⁸⁻¹¹ In this study the average age of the patients was 35.31±13.48 years. Out of 94 cases, 61(64.9%) were female and 33(35.1%) were male.

Results of our study are comparable to Honecks et al that shows stone clearance rate of 84% and 98% with extracorporeal and intracorporeal lithotripsy versus 83% and 80.9% in our study, but Honeck study was on lower ureteric stone.¹² Significant difference was not observed in efficacy of the treatment. While according to Kijvikai⁷ efficacy is 90% with shockwave lithotripsy and 73% with ureteroscopy in upper ureteric stone clearance.

There is lack of literature comparing the intracorporeal versus extracorporeal lithotripsy in proximal ureteric stone. According to Karlsen et al stone clearance rate at 03 weeks for extracorporeal group was 58% and 78% in intracorporeal with stone size of 0.5cm to 1cm. In a same study clearance rate after 03 months was 88% and 89% respectively for extracorporeal versus intracorporeal. But in follow up postoperative flank pain, burning micturition, hematuria and pain killer requirement were significantly higher in extracorporeal group.

There was a large cohort study conducted in America including 18825 patients with ureteral stones at all level of ureter upper, middle and lower. In this study extracorporeal lithotripsy was applied to all patients and that shows overall the stone clearance rate of 84% with 77.4%, 80.3% and 79.9% for proximal, middle and lower ureter respectively^{11,13}.

In another study of Pearle, where he used ureteral stent in all patients with intracorporeal lithotripsy group and in 16% with extracorporeal group, there was no substantial difference postoperatively at 2 months. But in intracorporeal lithotripsy group there was less patient satisfaction, high analgesic requirement for longer time in comparison to extracorporeal lithotripsy group⁷. Wills

and Burns study shows that intracorporeal lithotripsy can be considered as day care procedure with re admission rate of 24% but mostly due to social circumstances¹⁴.

Ghalayini shows equal and high success rate for both modalities while comparing patient satisfaction rate, postoperative complications, treatment cost and outcome¹⁵.

Also there were 3 times less minor complications with extracorporeal lithotripsy and higher safety margin in long term. These complications were related to passage of fragmented segments of stone. But clearance of stone was inversely related to size of stone in proximal ureter¹⁵.

Rarely ureteral injury is seen after intracorporeal lithotripsy but according to Pearle and Peschel no case of ureter related injury and complication was reported in short term and long term follow up^{16,17}.

According to AUA stone guidelines 2013 intracorporeal lithotripsy is treatment of choice for stone more than 1cm in proximal ureter and extracorporeal for a size of 10mm and less respectively¹⁶.

In another large series, overall stone clearance rate was 80% with most of stones were less than 1.5 cm in proximal ureter. And in same study it reaches to 84.3% at 3 months follow up^{18,19,20,21,22,23}.

CONCLUSION

While comparing the intracorporeal versus extracorporeal lithotripsy in proximal ureter there is no dissimilarity in results. But we recommended extracorporeal because of non-invasiveness and higher safety margin at short term and long term follow up.

REFERENCES

1. Tanagho EA, McAninch JW, (editors). Urinary stone disease. In: Smith's general urology. California: McGraw-Hill; 2008. p.246-77.
2. Hossain MZ, Biswas NP, Islam MS, Hossain MZ, Shameem IA, Kibria S. Effect of Tamsulosin on Stone Clearance after Extra-corporeal Shock Wave Lithotripsy. *BMJ*. 2012;40:27-32.
3. Rahim J, Mehmood A, Ashraf S, Muzamil M, Tahir, Khan UM. Efficacy of Tamsulosin spontaneous expulsion in treatment of distal ureteric stones. *PJMHS*. 2012;6(1)191-95.
4. Alan JW, Louis RK, Andrew CN, Alan WP, Craig AP (editors). Urinary lithiasis and endourology. In: Campbell-Walsh urology. Elsevier saunders. 2012. p1257-410.
5. Bozkurt Y, Sancaktutar AA, Bostanci Y, Kapan M, Cayci HM. Comparison of extracorporeal shockwave lithotripsy versus ureteroscopic stone extraction in

- treatment of ureteral stones. *Eur J Gen Med.* 2010;7(1):29-34.
6. Wazir BG, Haq MI, Haque F, Nawaz A, Ahmed N, Ikramullah, Jamil M. Experience of extracorporeal shockwave lithotripsy for kidney and upper ureteric stones by electromagnetic lithotripter. *J. Ayub Med Coll Abbottabad.* 2010;22(2): 20-22.
 7. Kijvikai K, Helilian GE, Premier GM, Rossette JD. Shockwave lithotripsy or ureterorenoscopy for the management of Proximal Ureteric calculi. *J.Urol.* 2007;178:1157-63.
 8. Segura JW, Preminger GM, Assimos DG. Ureteral Stones Clinical Guidelines Panel summary report on the management of ureteral calculi. The American Urological Association. *J Urol.* 1997; 158:1915-19.
 9. Anderson KR, Keetch DW, Albala DM, Chandhoke PS, McClennan BL, Clayman RV. Optimal therapy for the distal ureteral stone: Extracorporeal shock wave lithotripsy versus ureteroscopy. *J Urol.* 1994;152: 62-5.
 10. Turk TM, Jenkins AD. A comparison of ureteroscopy to in situ extracorporeal shock wave lithotripsy for the treatment of distal ureteral calculi. *J Urol.* 1999;161:45-6.
 11. Karlsen SR, Renkel J, Tahir AR. Extracorporeal shock wave lithotripsy versus ureteroscopy for 5- to 10-mm stones in the proximal urethra. *J Endourol.* 2007;21:28-33.
 12. Calvo JLM, Martinez IH, Mendoza AR. Ambulatory ureteroscopy and pneumatic lithotripsy. Our experience after 1803 ureteral stones. *Arch Esp Urol.* 2004;57:539-44.
 13. Honeck P, Hacker A, Alken P, Michel MS, Knoll T. Shock wave lithotripsy versus ureteroscopy for distal ureteral calculi. *Urol Res.* 2006;34:190-2.
 14. Mobley TB, Myers DA, Jenkins JM, Grine WB, Jordan WR. Effects of stents on lithotripsy of ureteral calculi: treatment results with 18.825 calculi using the Lithostar lithotripter. *J Urol.* 1994;152:66-7.
 15. Wills TE, Burns JR: Ureteroscopy: an outpatient procedure? *J Urol.* 1994;151: 1185-7.
 16. Ghalayini IF, Al-Ghazo MA, Khader YS. Extracorporeal Shockwave Lithotripsy versus Ureteroscopy for Distal Ureteric Calculi: Efficacy and Patient Satisfaction. *International Braz J Urol.* 2006;32(6):656-667.
 17. Pearle MS, Nadler R, Bercowsky E, Chen C, Dunn M, Figenshau RS, et al. Prospective randomized trial comparing shock wave lithotripsy and ureteroscopy for management of distal ureteral calculi. *J Urol.* 2001;166: 55-60.
 18. Peschel R, Janetschek G, Bartsch G: Extracorporeal shock wave lithotripsy versus ureteroscopy for distal ureteral calculi: a prospective randomized study. *J Urol.* 1999; 62: 909-12.
 19. Coz F, Orvieto M, Bustos M, Lyng R, Stein C, Hinrichs A et al: Extracorporeal shockwave lithotripsy of 2000 urinary calculi with the Modulith SL-20: success and failure according to size and location of stones. *J Endourol.* 2000;14:239-43.
 20. Morgentaler A, Bridge SS and Dretler SP. Management of the impacted ureteral calculus. *J Urol.* 1990;143:263-65.
 21. Roberts WW, Cadeddu JA, Micali S, Kavoussi LR and Moore RG: Ureteral stricture formation after removal of impacted calculi. *J Urol.* 1998;159:723-26.
 22. Sinha M, Kekre NS, Chacko KN, Devasia A, Lionel G, Pandey AP, et al. Does failure to visualize the ureter distal to an impacted calculus constitute an impediment to successful lithotripsy? *J Endourol.* 2004;18:431-35.
 23. Drake T, Gravis N, Dabestani S. What are benefits and harms ureteroscopy compared with Shockwave lithotripsy in treatment of upper ureteral stone. *Eurourol.* 2017; 7343:15
 24. Torricelli FCM, Danilovic A, Marchini GS. extracorporeal shockwave lithotripsy in treatment of renal & ureteral stones. *Rev. Assoc. Med. Bras.* Vol.61 no.1 Jan/feb. 2015; 1590-95.