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Original Research Article

Treatment of Distal Ureteric Stones- Comparative Efficacy of Transurethral Pneumatic Lithotripsy and Extracorporeal Shock Wave Lithotripsy

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Abstract: *Ureteric stones are treated with two minimally invasive procedures: transurethral pneumatic lithotripsy and extracorporeal shock wave lithotripsy.* ***Objective:*** *This study aimed to find out the comparative efficacy of transurethral pneumatic lithotripsy and extracorporeal shock wave lithotripsy in the treatment of distal ureteric stones.* ***Method:*** *The present randomized controlled study was conducted at the Department of Urology, Postgraduate Medical Institute (PGMI), Quetta, from January 2025 to June 2025, after obtaining approval from the institute's ethical board. A total of 232 individuals presented to OPD, following a thorough clinical assessment (history, examination, pertinent tests such as urine culture, X-ray KUB, ultrasound KUB, and excretory urography) of different age groups and both genders who had distal ureteric stones ranging in size from 6 to 12 mm, were included in this study. The study participants were equally divided into two groups: Group A received TPL (transurethral pneumatic lithotripsy), and Group B received ESWL (extracorporeal shock wave lithotripsy) treatment. Two weeks following the procedure, each patient underwent monitoring with an ultrasound and a KUB X-ray. The procedure was considered effective if the X-ray KUB revealed no stones or fragments less than four millimeters in diameter, as these are meant to pass through the urine, or if the ultrasound revealed no stones. All of the data was entered into a pre-made pro forma. SPSS 10.0 was used to analyze the data. For quantitative characteristics, such as stone size and age, the mean ± SD was computed. For categorical factors, such as efficacy and gender, percentages and frequencies were calculated. The effectiveness of the treatment methods was compared using Fisher's exact test. A p-value of less than 0.05 was considered significant.* ***Results:*** *A total of 232 individuals were enrolled in this study. The overall male-to-female ratio was 2.2:1. The mean age in Group A was 46.74±16.24 years, and in Group B, it was 44±13.57 years. The study found that the majority of our ureteric stone participants (30.6%) were between the ages of 31 and 45. Groups A and B each had 38 (32.7%) and 35 (30.1%) stones that were 6–8 mm in size. Extracorporeal Shock Wave Lithotripsy was successful in 80 (69%) of the individuals at the 2-week follow-up, whereas transurethral pneumatic lithotripsy was effective in 111 (95%) of the participants. P-value was statistically significant (p < 0.0001).*
Conclusion: *The present study concluded that TPL was effective in 95% of participants, indicating it is superior to ESWL in treating distal ureteric stones.*

Keywords: ureteric stones, TPL, ESWL

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Introduction

Pakistan is located in the Afro-Asian stone belt, so ureteric calculi occur frequently there (1). It is more common in men (12%) than in women (6%), and the majority of those affected are in their prime working years. The symptoms of ureteric stones typically include severe pain, colicky, radiating down, burning micturition, dark urine, and occasionally nausea or vomiting, if sufficiently serious that it requires the use of analgesics. Fluids, antispasmodics, and painkillers are typically used to treat them; if these fail, extracorporeal shock wave lithotripsy (ESWL) and transurethral pneumatic lithotripsy (TPL) are the recommended treatments. Although they normally pass spontaneously, certain factors, such as local anatomy, stone size, associated spasms, hydration status, and infection, may influence this process. It is generally accepted that stones larger than 5 mm typically require some form of surgical treatment (2-3). ESWL is a simple, safe procedure that does not require anesthesia or painkillers. It utilizes concentrated sonic energy administered externally, directly on the skin, to break up stones by creating vibrations within their internal structure. ESWL is a straightforward treatment that can be performed in an outpatient setting with minimal difficulty. Transurethral pneumatic lithotripsy, on the other hand, requires aseptic precautions because a ureter scope is used to guide the instrument up the urethra into the bladder and then up to the ureter. A pneumatic lithotripter device then ascends the scope and breaks up the stones at the level of obstruction. This procedure is minimally invasive and involves all the necessary surgical complications (4). The question of whether to pursue TPL or ESWL remains open to debate. Because ESWL is minimally invasive, some people prefer it. Randomized controlled trials comparing interventional techniques such as TPL and ESWL have been strongly recommended by the American Urological Association and the European Association of Urology (5). In light of the ongoing discussion, the current study was conducted to compare the effectiveness of TPL with ESWL in treating distal ureteric stones.

Methodology

The present randomized controlled study was conducted at the Department of Urology, Postgraduate Medical Institute (PGMI), Quetta, from January 2025 to June 2025, following approval from the institute's ethics committee. A total of 232 individuals presented to OPD, following a thorough clinical assessment (history, examination, pertinent tests such as urine culture, X-ray KUB, ultrasound KUB, and excretory urography) of different age groups and both genders who had distal ureteric stones ranging in size from 6 to 12 mm, were included in this study. Individuals with obesity (BMI ≥29), current urinary tract infections, and renal insufficiency were excluded. The participants were equally classified into A and B groups. Under spinal or general anesthesia, Group A was treated with TPL (transurethral pneumatic lithotripsy and Group B received ESWL (extracorporeal shock wave lithotripsy) treatment. The energy of the shockwave was gradually raised until the fragmentation was

satisfactory. An experienced urologist performed all the surgeries. This investigation was carried out in the outpatient department. Two weeks following the procedure, each patient underwent monitoring with an ultrasound and a KUB X-ray. The procedure was considered effective if the X-ray KUB revealed no stones or fragments that were less than four millimeters in diameter, as these are meant to pass naturally, or if the ultrasound revealed no stones. All of the data was entered into a pre-made pro forma. SPSS 10.0 was used to analyze the data. For quantitative characteristics, such as stone size and age, the mean ± SD was computed. For categorical factors, such as efficacy and gender, percentages and frequencies were calculated. The effectiveness of the treatment methods was compared using Fisher's exact test. A p-value of less than 0.05 was considered significant.

Results

A total of 232 individuals were enrolled in this study. The study participants were divided into two groups, A and B, with an equal number of individuals. In group A male were 82(70%) and females were 34(30%) while in group B male were 85(73%) and females were 31(27%). The overall male-to-female ratio was 2.2:1. The mean age in group A was 46.74±16.24 years, and in group B, it was 44±13.57 years. Overall, the mean age was 46.36 ± 15.4 years. The left side of Group A had 62 stones, while the right side had 54 stones. However, 57 of the stones in Group B were on the right side, while 59 were on the left, as presented in Table 1. The study found that the majority of participants with ureteric stones were between the ages of 31 and 45, with 71 (30.6%) in this age group, followed by those above 60 years, with 61 (26.3%) in this group, as presented in Table 2. The average size of the stones was 9.17 ± 1.7 mm. Groups A and B each had 38 (32.7%) and 35 (30.1%) stones that were 6–8 mm in size. There were 52 (44.8%) stones in Groups A and B that were 9–10 mm in size, and 26 (22.4%) and 29 (25%), respectively, that were 11–12 mm in size. The stones, based on size, in both groups are presented in Table 3. Extracorporeal Shock Wave Lithotripsy was successful in 80 (69%) of the individuals at the 2-week follow-up, whereas transurethral pneumatic lithotripsy was effective in 111 (95%) of the participants. P-value was statistically significant ($p < 0.0001$) as presented in Table 4.

Table 1. Demographic features of the study population

Feature	Group A	Group B
Gender		
Male	82(70%)	85(73%)
Female	34(30%)	31(27%).
Mean age in years	46.74±16.24	44±13.57
No of stones		
Left side	62	59
Right side	54	57

Table 2. Age-wise lithotripsy procedure distribution

	Lithotripsy Procedure		Total
Age in years	Group A (TPL) N(%)	Group B (Extracorporeal Shockwave) N (%)	
Less than 30	21(81.1%)	19(16.3%)	40(17.2%)
31 to 45	30(25.8%)	41(35.3%)	71(30.6%)
46 to 60	29(25%)	31(26.7%)	60(25.8%)
Ab0ve 60	36(31%)	25(21.5%)	61(26.3%)
Total	116(100%)	116(100%)	232(100%)

Table 3. Size-wise distribution of stones

Stone size (millimeter)	Lithotripsy Procedure		Total
	Group A (Pneumatic)	Group B (Extracorporeal Shockwave)	
6-8	38(32.7%)	35(30.1%)	73(31.4%)
9-10	52(44.8%)	52(44.8%)	104(44.8%)
11-12	26(22.4%)	29(25%)	55(23.7%)
Total	116	116	232(100%)

Table 4. Comparative efficacy of the two groups

	Lithotripsy Procedure		P value
	TPL	ESWL	
Efficacy of treatment			0.0001
Yes	111(95%)	80(69%)	
No	5(5%)	36(31%)	
Total	116	116	

TPL=Transurethral Pneumatic Lithotripsy, ESWL= Extracorporeal Shock Wave Lithotripsy

Discussion

Stones in the urinary tract are quite prevalent and cause a significant burden on healthcare facilities. The conservative treatment of ureteric stones involves laparoscopic or open uretero-lithotomy, intracorporeal lithotripsy, ureterorenoscopy with intracorporeal lithotripsy, and extracorporeal shockwave lithotripsy, depending on the size, location, symptoms, and adverse effects on the renal tract (hydronephrosis, pyonephrosis, renal failure, septicaemia, etc.). Pneumatic, electrohydraulic, ultrasonic, and laser lithotripters can all be used for intracorporeal lithotripsy (6). Pneumatic is the most commonly utilized intra-corporeal lithium tripter (7-9). It is less damaging to the tissue,

powerful, and economical. For impacted ureteric stones, it works well (10). Piezoelectric, electromagnetic, and electrohydraulic lithotripters can all be used for extracorporeal shockwave lithotripsy. Electromagnetic is the most widely utilized form. It is more potent than piezoelectric lithium tripe and less stressful than electrohydraulic. ESWL is recommended for youngsters, those without impacted stones, those with uninfected urinary systems, and those who are not candidates for spinal or general anaesthesia (11) Given that ESWL may require multiple sessions with a chance of treatment failure, older patients would typically prefer a more conservative approach than those under thirty who are the ones making the cash and leading active lives. Senior individuals also typically prefer a one-time treatment. Anesthesia is not necessary for ESWL (in adults). Both the anesthesia-related and surgical procedure-related problems are avoided. The individual does not need to interrupt work hours, and it can be completed as an outpatient procedure. On the other hand, although TPL was performed as a day-case treatment, it requires spinal or general anaesthesia (12-13). Complications may include ureteric perforation, avulsion, hematuria, infection, and loin discomfort (14-15).

In our study, the male-to-female ratio overall was 2.2:1, and the mean age was 46.36±15.4 years. This is comparable to the study by Hong and Park, in which males were predominant over females (16). The present study found that the majority of our ureteric stone participants were between the ages of 31 and 45, with 71 (30.6%) in this age group, followed by those above 60 years, with 61 (26.3%) in this group. These results are similar to those reported in a study conducted by Ather et al. (17). In our investigation, the most prevalent stone size was 9–10 mm (44%). A similar randomized controlled study reported similar results (18). This study found that Extracorporeal Shock Wave Lithotripsy was successful in 80 (69%) of the individuals at the 2-week follow-up, whereas transurethral pneumatic lithotripsy was effective in 111 (95%) of the participants. The results of our research are similar to those of the trial conducted by Wazir et al., in which the success rates of TPL and ESWL were 92% and 67%, respectively, which strongly support our study. (18) The findings of our study were not similar to the study conducted by Ahmad et al (19). In which the outcomes of both procedures were the same. These variations in the results are due to the size of the stones. In their study, the size of the stone was greater than in the present study.

Conclusion

The present study concluded that TPL was effective in 95% of participants, indicating that it is superior to ESWL in treating distal ureteric stones. Even for larger stones, extracorporeal lithotripsy fragmentation yields good outcomes and remains a less invasive method.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-24)

Consent for publication
Approved

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Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

JAK (Associate Professor)
Manuscript drafting, Study Design,
Review of Literature, Data entry, Data analysis, and drafting an article.
Conception of Study, Development of Research Methodology Design,

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

References

1. Krambeck AE, Murat FJ, Gettman MT, Chow GK, Patterson DE, Segura JW. The evolution of ureteroscopy: a modern single-institution series. Mayo Clin Proc. 2006;81(4):468–73. https://doi.org/10.4065/81.4.468
2. Furyk JS, Chu K, Banks C, Greenslade J, Keijzers G, Thom O, et al. Distal ureteric stones and tamsulosin: a double-masked, placebo-controlled randomized, multicenter trial. Ann Emerg Med. 2016;67(1):86–95. https://doi.org/10.1016/j.annemergmed.2015.06.001
3. Bader MJ, Eisner BH, Porpiglia F, Preminger GM, Tiselius HG. Contemporary management of ureteral stones. Eur Urol. 2012;61(4):764–72. https://doi.org/10.1016/j.eururo.2012.01.064
4. Cui X, Ji F, Yan H, Ou TW, Jia CS, He XZ, et al. Comparison between extracorporeal shock wave lithotripsy and ureteroscopic lithotripsy for treating large proximal ureteral stones: a meta-analysis. Urology. 2015;85(4):748–56. https://doi.org/10.1016/j.urology.2014.12.056
5. Nomikos MS, Sowter SJ, Tolley DA. Outcomes using a fourth-generation lithotripter: a new benchmark for comparison? BJU Int. 2007;100(6):1356–60. https://doi.org/10.1111/j.1464-410X.2007.07117.x
6. Tipu SA, Malik HA, Mohhayuddin N, Sultan G, Hussain M, Hashmi A, et al. Treatment of ureteric calculi—use of Holmium: YAG laser lithotripsy versus pneumatic lithoclast. J Pak Med Assoc. 2007;57(9):440–3.
7. Elganainy E, Hameed DA, Elgammal MA, Abd-Elsayed AA, Shalaby M. Experience with impacted upper ureteral stones; should we abandon using semi-rigid ureteroscopes and pneumatic lithoclast? Int Arch Med. 2009;2:13. https://doi.org/10.1186/1755-7682-2-13
8. Tan PK, Tan SM, Consigliere D. Ureteroscopic lithoclast lithotripsy: a cost-effective option. J Endourol. 1998;12(4):341–4. https://doi.org/10.1089/end.1998.12.341
9. Nikoobakht MR, Emamzadeh A, Abedi AR, Moradi K, Mehrsai A. Transureteral lithotripsy versus extracorporeal shock wave lithotripsy in management of upper ureteral calculi: a comparative study. Urol J. 2007;4(4):207–11.
10. Brito AH, Mitre AI, Srougi M. Ureteroscopic pneumatic lithotripsy of impacted ureteral calculi. Int Braz J Urol. 2006;32(3):295–9. https://doi.org/10.1590/S1677-55382006000300006
11. Muslumanoglu AY, Tefekli AH, Altunrende F, Karadag MA, Baykal M, Akcay M. Efficacy of extracorporeal shock wave lithotripsy for ureteric stones in children. Int Urol Nephrol. 2006;38(2):225–9. https://doi.org/10.1007/s11255-005-4792-y
12. Bromwich EJ, Lockyer R, Keoghane SR. Day-case rigid and flexible ureteroscopy. Ann R Coll Surg Engl. 2007;89(5):526–8. https://doi.org/10.1308/003588407X187676
13. Chen JJ, Yip SK, Wong MY, Cheng CW. Ureteroscopy as an out-patient procedure: the Singapore General Hospital Urology Centre experience. Hong Kong Med J. 2003;9(3):175–8.
14. Hofmann R. Ureteroscopy (URS) for ureteric calculi. Urologe A. 2006;45(6):637–46. https://doi.org/10.1007/s00120-006-1035-5
15. Geavlete P, Georgescu D, Nita G, Mirciulescu V, Cauni V. Complications of 2735 retrograde semirigid ureteroscopy procedures: a single-center experience. J Endourol. 2006;20(3):179–85. https://doi.org/10.1089/end.2006.20.179
16. Hong YK, Park DS. Ureteroscopic lithotripsy using Swiss Lithoclast for treatment of ureteric calculi: 12-year experience. J Korean Med Sci. 2009;24(4):690–4. https://doi.org/10.3346/jkms.2009.24.4.690
17. Ather MH, Nazim SM, Sulaiman MN. Efficacy of semirigid

ureteroscopy with pneumatic lithotripsy for ureteral stone surface area greater than 30 mm². J Endourol. 2009;23(4):619–22. https://doi.org/10.1089/end.2008.0182

18. Wazir BG, Orakzai AN, Nawaz A. Treatment of distal ureteric stones—comparative efficacy of transureteral pneumatic lithotripsy and extracorporeal shock wave lithotripsy. J Ayub Med Coll Abbottabad. 2015;27(1):140–2.

19. Ahmad S, Shah A, Khan RA, Kalim M, Ali S. To compare the effectiveness of transurethral pneumatic lithotripsy and extracorporeal shock wave lithotripsy in the treatment of lower ureteric stones. J Saidu Med Coll Swat. 2021;11(4):223–9. https://doi.org/10.52206/jsmc.2021.11.4.683