



International Journal of Urology Research



ISSN Print: 2664-6617
ISSN Online: 2664-6625
Impact Factor: RJIF 5.28
IJUR 2023; 5(1): 10-14
www.urologyjournal.in
Received: 15-01-2023
Accepted: 23-02-2023

Dr. Houssam Aboutrabi
Specialist Urologist, NMC
Royal Hospital Khalifa City,
Abu Dhabi, United Arab
Emirates

Dr. Pranith Kumar Theegala
Junior Doctor, Shree
Sharanabasava Hospital,
Kalaburagi, Karnataka, India

A comparison of stented and non-stented techniques in extracorporeal shock wave lithoplasty for upper ureteral stones

Dr. Houssam Aboutrabi and Dr. Pranith Kumar Theegala

DOI: <https://doi.org/10.33545/26646617.2023.v5.i1a.25>

Abstract

Background and Objectives: The purpose of this matched-pair research was to examine patients with ureteric stones to identify the effect of a ureteric stent on the success rate of extracorporeal shockwave lithotripsy (ESWL). Upper ureteric calculus can be treated with extracorporeal shock wave lithotripsy, however complications have been reported.

Method: A prospective research was conducted in the NMC Royal Hospital Khalifa City, United Arab Emirates, Abu Dhabi and Shree Sharanabasava Hospital, Kalaburagi, Karnataka, India, from May 2018 to February 2022 patients who presented for treatment of upper ureteric calculus. Ethical standards set forth by the committee were adhered to. After being informed of the study's purpose and methods, each participant signed a consent form. Information was entered into a premade proforma.

Result: In our study, there were a total of 123 males and 37 females in group A, and 120 males and 40 females in group B. There were 106 patients in the group whose stones were 8–13 mm and 54 patients in the group whose stones were 14–19 mm in size. ESWL success was defined as patients who had undergone three ESWL sessions and were stone-free, while ESWL failure was defined as patients who were not stone-free after three months or who required any extra treatments. Although 13 patients in the stented group did not have stones, 22 had difficulty clearing them with ESWL. Seven patients in the stent-free group had successful ESWL treatment, while eleven others did not.

Conclusion: Low morbidity and excellent effectiveness are characteristics of ESWL treatment. Ureteral stenting prior to ESWL offers no advantages over ESWL performed in situ. Patients who receive ureteral stents often experience severe pain and morbidity. The use of ureteral stents to treat upper ureteric calculus led to fewer hospital readmissions than when no stent was used, despite the fact that they are linked to higher irritative symptoms.

Keywords: Extracorporeal shockwave lithotripsy, ureteral stones, calculus

Introduction

The aim of treating ureteral calculi is complete stone elimination with minimal patient morbidity. There are three main types of considerations to make when deciding how to treat patients with ureteric calculi: the patient's ability to tolerate symptomatic events, the patient's expectation, the presence of an associated infection, the presence of a single kidney, abnormal ureteral anatomy, and the technical factors (equipment available for treatment, costs). These elements might be thought of as therapeutic modulators. It is possible to remove stones from the upper ureter using one of several surgical procedures. Better ureteroscopes, novel intracorporeal stone fragmentation techniques, laparoscopic procedures, and current investigation into extracorporeal shock wave lithotripsy have revolutionised the treatment of ureteral stones. Extracorporeal shock wave lithotripsy (ESWL) is the least intrusive treatment option for stones in the upper urinary system. Large upper ureteral calculi have had varying degrees of success with ESWL [1, 2, 3].

Thanks to intracorporeal lithotriptors and the miniaturisation of flexible ureterorenoscopes, the success rate of treating upper ureteral calculi has increased. However, flexible ureteroscopes are still pricey and method-specific. Furthermore, these days patients tend to prefer less invasive surgical procedures. The use of stents during extracorporeal shock wave lithotripsy for renal or ureteral stones is still up for debate. The potential for problems is decreased when a stent is used to open the ureter and allow stone particles to pass through.

Corresponding Author:
Dr. Pranith Kumar Theegala
Junior Doctor, Shree
Sharanabasava Hospital,
Kalaburagi, Karnataka, India

While they may be effective in their intended function, stents are not without their own set of complications, including irritative sensations, bladder discomfort, and the possibility of stent migration, vesicoureteral reflux, and encrustation. It's concerning because there isn't any written guidance on how ureteric stents can influence ESWL outcomes. Although some writers have claimed that the insertion of ureteric stents does not alter the course of therapy, this does not mean that it is not considered a factor tied to the failure of ESWL or a factor linked to obstruction. There is a correlation between the stone's radio density on the plain X-ray KUB and its ESWL performance. Overall, the predictive accuracy of plain radiographs for the composition of calculi was only 39%, which is insufficient for clinical application [4, 5, 6].

Since Non Contrast Computed Tomography (NCCT) scans are so commonly used for evaluating flank discomfort, there have been a number of research comparing attenuation and stone composition *in vitro*. These results show that the NCCT's attenuation value can be utilised to evaluate different types of stone. The clinical outcome of ESWL is affected by the fragility of a calculus, as evaluated by the stone Hounsfield Unit (HU) of the NCCT, which changes with stone composition. Because of its ease of use, high sensitivity, and ability to provide crisp images, NCCT is a good method for evaluating stone density [7, 8, 9].

Material and Methods

Patients with upper ureteric calculi who had reported for treatment between. May 2018 to February 2022 conducted at NMC Royal Hospital Khalifa City, United Arab Emirates, Abu Dhabi and Shree Sharanabasava Hospital, Kalaburagi, Karnataka, India, were included in a prospective study. The rules set forth by the ethics committee were followed. Each patient signed a consent form after receiving information about the study and being given the opportunity to ask any questions. The data were entered into the proforma after it had initially been created.

Methodology

The several treatment options for upper ureteric calculus, such as percutaneous nephrolithotomy, open surgery, ureteroscopy with intracorporeal lithotripsy, extracorporeal lithotripsy, and extracorporeal lithotripsy, were explained to all of the patients. All patients had baseline tests for complete blood count, blood sugar, urea, serum creatinine, and urine routine, including culture and sensitivity, after thoroughly reviewing their medical histories and undergoing a thorough physical examination. An ultrasound, KUB, and plain X-ray were all taken in each case. An intravenous urogram or a CT KUB with contrast was done as a functional study. Largest dimension was measured for stone size using plain X-ray, KUB, and ultrasound in the study.

Inclusion criteria

1. Patients with unilateral upper ureteric calculus willing for extracorporeal shockwave lithotripsy.
2. Patients with renal parameters that are normal.
3. No previous treatments for the same ureteric calculus.
4. No anatomical anomalies in the urinary tract.

Exclusion criteria

1. Not willing for ESWL
2. Bilateral ureteric calculi

3. Coagulation disorder/patients on anticoagulation drugs
4. Pregnancy
5. Sepsis
6. End stage renal disease

320 patients were chosen, and they were split into two groups of 160 each. Two groups, designated Group A and Group B, were formed from the patients. They were asked to choose one of two folded pieces of paper with the letter A or B that were handed to them. People who chose option A were placed in group A and administered in situ ESWL without DJ stent, while people who chose option B were placed in group B. Gentamycin 80 mg IM was administered as a preventative injection to the patients who were chosen for DJ placement, and then a 5 Fr 26 cm DJ stent was inserted under local, regional, or general anaesthesia before to ESWL [10, 11].

Result

Table 1: Age distribution

Age (Yrs)	No. of patients	
	Stented	Non-stented
<20	4	6
21 to 40	97	99
41 to 60	44	49
>60	15	6
TOTAL	160	160

P=0.06 not significant

Table 2: Sex distribution

	No. of patients		Total
	Stented	Non-Stented	
Male	120	123	243 (75.93%)
Female	40	37	77 (24.07%)
Total	160	160	320

P=0.581 not significant

Table 3: Side distribution

Side	No. of patients		Total
	Stented	Non-stented	
Right	76	77	153 (48%)
Left	84	83	167 (52%)

P=0.817 not significant

Table 4: Stone size distribution

Size	No. of patients		Total
	Stented	Non-stented	
8 to 10mm	48	48	96 (30.0%)
11 to 13mm	58	58	116 (36.25%)
14 to 16mm	37	37	74 (23.12%)
17 to 19mm	17	17	34 (10.6%)

Table 5: Number of sittings

No. of sittings	No. of patients		Total
	Stented	Non-Stented	
1	79 (54.8%)	94 (62.2%)	173 (58.6%)
2	41 (28.4%)	50 (33.11%)	91 (30.8%)
3	11 (7.6%)	7 (4.6%)	18 (6.10%)
Total	144 (90%)	151 (99%)	295/320 (92.18%)

P= 0.235 not significant

Table 6: Success rate after 3rd sitting of ESWL

Size of Calculus	No. of patients			
	Stented		Non-stented	
	Success	Failure	Success	Failure
8 to 10mm	2	3	0	0
11 to 13mm	3	7	2	2
14 to 16mm	3	7	2	5
17 to 19mm	5	5	3	4
TOTAL	13	22	7	11

Stented - P=0.686 not significant

Non Stented - P=0.969 not significant

Table 7: Complications

Complications	No. Of patients		Total
	Stented	Non-stented	
Hamaturia	15(4.6%)	4(1.2%)	19 (5.9%)
Fever	8(2.5%)	3(0.9%)	11(3.4%)
Stienstrasse	10 (3.1%)	9 (2.8%)	19 (5.9%)
Ureteric colic	2 (6.2%)	15 (4.6%)	15 (4.6%)

P=0.000 significant

Discussion

ESWL has revolutionised the treatment of urolithiasis around the world, and it remains an important therapeutic option for the vast majority of stones found in the upper urinary system. Its non-invasive nature and high efficiency contribute to its high level of acceptance by both patients and surgeons. When it comes to removing stones from the upper ureter, both ESWL and ureteroscopy have both benefits and drawbacks. Proponents of ESWL argue that it is more effective than ureteroscopy, causes less complications, requires less anaesthetic, and can be performed with fewer incisions and fewer stents. Critics of the procedure argue that it has lower success rates than ureteroscopy, that the necessary equipment is not always readily available, that it can be difficult to see the stone, that it takes longer to achieve a stone-free condition and requires more follow-up, that the re-treatment rate is greater, and that it is more expensive. Proponents of ureteroscopy argue that it is both very successful and minimally invasive, that it causes minimum morbidity, that it may be used for larger and more stones, and that it has a high chance of producing stone-free results when conducted soon after. Detractors assert that it calls for more frequent ureteric stent placement, which requires more anaesthesia and specific training. Overall, 90.6% of people didn't have any stones. This research highlights the fact that excellent stone-free rates can be achieved without ureteroscopy and is in line with previous findings [12, 13, 14].

Previous experiments utilising a variety of lithotriptors have success rates between 80% and 90%. According to Gnanapragasam *et al.*'s research, 90% of patients with upper ureteric stones did not have any stones present. Patients with stones larger than 1.3 centimetres were shown to be unsuccessful with ESWL. Similarly, Mogensen and Anderson analysed the outcomes of SWL for 199 people with ureteral stones. Three and six months after SWL, nearly nine in ten patients who had upper ureteral stones were stone-free. Upper ureteral stones were found to be successful 98% of the time in a study conducted by Hofbauer *et al.* The percentage of patients who needed extra therapy increased to 8%, and our retreatment rate was 59%. Fetner *et al.* found that the size of the stone was significantly correlated with the success rate. The American

Ureteral Stones Clinical Guidelines Panel reported an 87% success rate for SWL for treating stones smaller than 1 cm in the proximal ureter. Our research found a 95% success rate even with 1 cm stones. This may be due to the fact that a conventional lithotripter (a Dornier Delta II) is being used in addition to improved stone localization techniques. We didn't use any "pushback" techniques on any of our patients. Without moving any of the stones from their original locations, we were able to cure them all. There is no discernible difference in success rates between in situ and pushback ESWL. The availability of macroscopic expansion space is not required for ureteric calculi to be successfully fragmented. There is a 5.1% perforation rate associated with ureteral manipulations using the pushback approach. We also found that when DJ stents are utilised, the success rates are drastically reduced [15, 16, 17].

Eight individuals (20%) required a further operation called a ureteroscopy after having DJ stents inserted preoperatively. Ryan *et al.* showed that in situ ureteric stents impede ureteric peristalsis and retain large fragments, which slows stone clearance. If a DJ stent is placed close to the stone, the shock wave may not penetrate it completely. Stents placed by a nephrologist (DJ) are required when stones are blocking a kidney or when only one kidney is functioning. Several authors have investigated the factors that contribute to the failure of ESWL treatment for ureteral stones. Predictors of ESWL failure identified by Abdel-Khalek *et al.* in a study of 938 patients included stent presence, stone placement, and stone transverse diameter more than 10 mm. Kim *et al.* analysed 369 patients to determine what characteristics affect the fragmentation of ureteric stones; they found that stone size, radio-opacity, and obstruction severity were significant predictors. High body mass index (BMI) and high Hounsfield units (HU) value were found to be independent predictors of the outcomes of ESWL for upper urinary tract stones in a study by Pareek *et al.* They also came up with an equation to determine the likelihood of treatment failure: $1/1 + 2.7(-z)$, where $Z = 0.294$ body mass index plus 0.13 body fat units minus 18 [18, 19, 20].

Treatment of disorders affecting the upper urinary tract often requires the use of a ureteral stent. When a single kidney is blocked, when the patient has a high temperature and is at risk for sepsis and protracted pain, and when renal function is declining, ureteral stents are often inserted. ESWL is commonly used to treat large stones (usually > 20 mm), but they are also utilised to treat steinstrasse and/or obstruction following the treatment. The effects of placing a stent in an ESWL have been the subject of significant debate. It was originally thought that stents helped stones pass more easily. Bierkens *et al.* randomised 64 patients with large renal stones (but no ureteric 55 stones) and found a difference in the stone-free rate in 3 months in favour of the stented population (44% vs 35%), whereas Pryor and Jenkins found a difference of 18% in the stone-free rate in favour of the unstented patients with ureteric stones. Later studies on the use of stents to treat ureteral stones found no difference in the stone-free rate. Discomfort and irritability are common side effects of stents, and there has been mixed research on the efficacy of ESWL in recent years [20, 21].

Musa found in 120 patients with renal stones that the unstented population had a stone-free rate of 91% vs 88% and that there was a slightly higher incidence of fever in stented patients, while El-Assmy *et al.* randomised 186 patients with ureteric stones and moderate to severe

hydronephrosis, with better but not statistically significant results for the unstented patients (91% vs 85% stone-free rate, $P = 0.25$). This could be because patients who received DJ stents had to undergo two additional procedures and a foreign object was introduced into an otherwise sterile system. Khaled conducted research into the causes of steinstrasse following extracorporeal shock wave lithotripsy and found an overall incidence of 3.97%. Stone size and placement, renal shape, and the intensity of the shock wave are the primary risk factors for developing steinstrasse. Patients at high risk for steinstrasse should be monitored closely and given the option of early intervention or prophylactic ureteral stenting prior to ESWL. Stone-free rates of over 80% have been found when considering SWL for proximal ureteral stones in a number of significant studies. Using a Modulith SL-20 lithotripter, 397 upper ureteral stones were extracted in a row. After 3 months, 91 percent of the treated stones were 14 millimetres or less in diameter, and 84 percent of patients were stone-free. Stent-related symptoms are extremely prevalent, affecting over 80% of patients. Symptoms including frequency, urgency, dysuria, and incomplete emptying can be very frustrating, as can pain in the flanks and suprapubic area, incontinence, and blood in the urine. Assessment tools are crucial for measuring their severity and making comparisons throughout time. For this purpose, the Urinary Stent Symptom Questionnaire (USSQ) is the most useful tool available [21, 22].

The primary goals of treatment should be to prevent complications and alleviate existing ones. Therefore, scientists have focused on discovering medicines that can enhance the bladder's sensitivity and motor responsiveness, and creating new stent materials and designs that are more suited to the urinary tract's physiologic properties. Our results also show that ESWL for ureteral stones is less successful when a ureteral stent is present. Possible causes include the stent's effect on ureteric peristaltic movements, which reduces fragment clearance, and targeting difficulties. Patients with sepsis, those whose renal function is failing due to obstruction, and those whose pain is severe all benefit from ureteric stents. Patients receiving ESWL for ureteric stones should be cautious of routinely using ureteric stents, regardless of the size or location of the stone. Most SWL issues, such as brief hematuria, pain, nausea, and vomiting, clear up on their own, but there are several case reports in the literature that depict potentially fatal scenarios. Study results by Nazim Mohayuddin *et al.* showed that lower urinary tract symptoms were more common in the stented group (45.5%, 12.5%, 47.5%, 57.5%, and 92.5%, respectively) compared to the non-stented group (7.5%, 2.5%, 10%, 15%, and 67.5%). Other studies found the same thing; for example, Preminger *et al.* found that there was a higher rate of LUTS in patients who received DJ stents compared to the control group (43% vs. 25%). In the study by Paramjit S *et al.*, the incidence of frequency, urgency, and dysuria was higher in the stented group. Musa also noted that there was an increase in the frequency of lower urinary tract symptoms among the stented group by 85% compared to the non-stented group. It was hypothesised that stents caused LUTS by irritating the trigone and the bladder neck due to the presence of a foreign body in the urine bladder. In a study involving 60 people, Islam AG discovered no statistically significant difference in the percentage of people who did not have stones. Significant

side effects were reported by patients in the stented group, however. These included dysuria, urgency, frequency, and suprapubic discomfort. Patients in our study who had lower urinary tract stenosis reported higher symptoms than those who did not [21, 22].

Conclusion

The ESWL treatment is highly effective with a minimal risk of side effects. Stenting the ureter before ESWL doesn't provide any noticeable benefits over doing it during the procedure. The use of ureteral stents is associated with a high probability of morbidity and significant patient suffering. It has been established that the use of ureteral stents reduces hospital readmissions, despite the fact that these devices are associated with an increase in irritating symptoms. This is in contrast to treatments in which a stent was not inserted to remove the upper ureteric calculus.

Funding support: Nil

Conflict of interest: Nil

References

1. Anagnostou T, Tolley D. Management of ureteric stones. *Eur Urol.* 2004;45:714.
2. Segura JW, Preminger GM, Assimos DG, Dretler SP, Kahn RI, Lingeman JE, *et al.* Ureteral Stones Clinical Guidelines Panel summary report on the management of ureteral calculi. The American Urological Association. *J Urol.* 1997;158:1915.
3. Liang ML, Clayman RV, Gittes RF, Lingeman JE, Huffman JL, Lyon ES. Treatment options for proximal ureteral urolithiasis: review and recommendations. *J Urol.* 1989;141:504.
4. Grasso M, Beagler M, Loisesides P. The case for primary endoscopic management of upper urinary tract calculi: II. Cost and outcome assessment of 112 primary ureteral calculi. *Urology.* 1995;45:372.
5. Saltzman B. Ureteral stents indications, variations, and complications. *Urol Clin North Am.* 1988;15:481.
6. 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;152:53-56.
7. Cass AS. Nonstent or noncatheter extracorporeal shock-wave lithotripsy for ureteral stones. *Urology* 1994;43:178-81.
8. Chaussy C, Brendel W, Schmiedt E. Extracorporeally induced destruction of kidney stones by shock waves. *Lancet.* 1980;2:1265-8.
9. Cleveland RO, McAteer JA. The Physics of Shock Wave Lithotripsy, in Smith's Textbook on Endourology, G.H.B. A. D. Smith, D. H. Bagley, R. V. Clayman SG, Docimo GH, Jordan, L. R. Kavoussi, B. R. Lee, J. E. Lingeman, G. M. Preminger, J. W. Segura, Editor., BC Decker: Hamilton, ON, Canada; c2007. p. 317-332.
10. Eisenmenger W, Du XX, Tang C, Zhao S, Wang Y, Rong F, *et al.* The first clinical results of wide focus and low pressure ESWL. *Ultrasound Med Biol.* 2002;28:769-774.
11. Thompson TJ, McLornan L, Tolley DA. Singlecenter experience using three shockwave lithotripters with

- different generator designs in management of urinary calculi. *J Endourol.* 2006;20:1-8.
12. Chaussy C. Extracorporeal shock wave lithotripsy: new aspects in the treatment of kidney stone disease. Basel, Switzerland: S Karager; c1982.
 13. Sass W, Braunlich M, Dreyer H-P, *et al.* The mechanisms of stone disintegration by shock waves. *Ultrasound Med Biol.* 1991;17:239-43.
 14. Cleveland RO, Sapozhnikov OA. Modeling elastic wave propagation in kidney stones with application to shock wave lithotripsy. *J Acoust Soc Am.* 2005;118:2667-76.
 15. Denstedt J, Clayman RV, Preminger GM. Efficiency quotient as a means of comparing lithotripters. *J Endourol.* 1990;4:100.
 16. Cass AS. Comparison of first generation (Dornier HM3) and second generation (Medstone STS) lithotripters: treatment results with 13,864 renal and ureteral calculi. *J Urol.* 1995;153:588.
 17. Matin SF, Yost A, Strem SB. Extracorporeal shock-wave lithotripsy: a comparative study of electrohydraulic and electromagnetic units. *J Urol.* 2001;166:2053.
 18. Crum LA. Cavitation microjets as a contributory mechanism for renal calculi disintegration in ESWL. *J Urol.* 1988;140:1587-90.
 19. Pishchalnikov YA, Sapozhnikov OA, Bailey MR, *et al.* Cavitation bubble cluster activity in the breakage of kidney stones by lithotripter shockwaves. *J Endourol.* 2003;17:435-46.
 20. Williams JC Jr, Saw KC, Paterson RF, *et al.* Variability of renal stone fragility in shock wave lithotripsy. *Urology.* 2003;61:1092-6.
 21. Dretler SP, Polykoff G. Calcium oxalate stone morphology; Fine tuning our therapeutic distinctions. *J Urol.* 1996;155:828-33.
 22. Green DF, Lytton B. Early experience with direct vision electrohydraulic lithotripsy of ureteral calculi. *J Urol.* 1985 May;133(5):767-70.

How to Cite This Article

Abouttrabi H, Theegala PK. A comparison of stented and non-stented techniques in extracorporeal shock wave lithoplasty for upper ureteral stones. *International Journal of Urology Research.* 2023;5(1):10-14.

Creative Commons (CC) License

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-Non Commercial-Share Alike 4.0 International (CC BY-NC-SA 4.0) License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.