

# A comparative study of supine-transgluteal extracorporeal shockwave lithotripsy and ureteroscopy for the management of distal ureteric stones

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## Abstract

**Background:** Urolithiasis one of the most common conditions encountered in daily urological practice. The mode of treatment for distal ureteric stones has classically been Ureterorenoscopic Lithotripsy (URSL). The use of Extracorporeal Shockwave Lithotripsy (ESWL) via transgluteal approach has been studied in recent times. The aim of this study is to study the outcome of supine transgluteal ESWL on distal ureteric stones and to compare the outcome of supine transgluteal ESWL with semi-rigid ureterorenoscopy in the management of distal ureteric stones. Our study was done over a period of 6 months in which a total of 120 patients selected were included, randomly divided into two groups by an independent observer. Group A was offered ESWL and Group B was offered URSL after obtaining consents, taking a detailed history and performing clinical examination as appropriate, and after the requisite biochemical and radiological investigations. The patients were followed up after 15 days post-procedure. We conclude that treatment with ESWL has a low morbidity and high effectiveness, and results are comparable with that of ureteroscopy with intracorporeal lithotripsy with specific advantages like outpatient procedure, no necessity of anaesthesia and DJ stents.

**Keywords:** Distal Ureteric Stones, URSL, Transgluteal ESWL, Stone clearance.

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## INTRODUCTION

The ureteric calculus in general presents as acute colicky pain and the aim of treatment is to achieve complete stone clearance with minimal morbidity for the patient.

Currently several surgical options are available for ureteric calculus management. Extracorporeal shock wave lithotripsy (ESWL) is the least invasive treatment for calculi of the upper urinary tract and it is recommended as first line therapy.<sup>1</sup> However, ESWL has a variable success rate.<sup>2,3</sup> The density of stone measured by NCCT, stone Hounsfield Unit (HU) varies with stone composition and determines the fragility of a calculus which ultimately governs the clinical outcome in ESWL. Majority of urinary tract stones are managed with ESWL in the western world. Initially ESWL was used in the treatment for renal and upper ureteric stones, but soon it became clear that the mid and distal ureteric calculi too can be managed with ESWL.<sup>4,5</sup> With regard to the patient positioning, the supine position was adapted for the renal and upper ureteric stones, with the shockwave head in contact with the

patient's loin. For the mid or distal ureteric stones the prone position was adapted, with shockwave head in contact with the patient's anterior abdomen. A safe and effective method of treating stones in the distal ureter with results inferior to that of supine ESWL for the renal and upper ureteric stones is yet to be determined.<sup>8,9</sup> The use of a transgluteal approach to the distal ureter has been described previously with the use of the Dornier HM- 3.<sup>10</sup> We adopted this approach in the treatment of patients with distal ureteric stones. The patient lies supine, and shockwave is delivered via the gluteus maximus muscle, through the greater sciatic foramen to the distal ureter, unimpeded by bony structures.

## MATERIAL AND METHOD

**Period of Study:** September 2014 – February 2015.

**Study Design:** Retrospective and Prospective study.

**Source of Patients:** The study was conducted in the Department of Urology, Rajiv Gandhi Government General Hospital and Madras Medical College, Chennai on the patients who presented for the management of distal ureteric stones. Guidelines of the ethics committee were followed. All the patients were informed about the study and a consent form was signed by them. All relevant data were collected and recorded.

**Method of Study:** All the patients were explained about the available modalities of treatments and their complications in them an agement of distal ureteric calculus – Medical expulsion therapy, ureteroscopy with intracorporeal lithotripsy, extracorporeal shock wave lithotripsy and laparoscopic/open surgery.

**Patient Evaluation:** A detailed history and a clinical examination was performed followed by baseline investigations including complete blood count, blood sugar, urea, serum creatinine, urine routine including culture and sensitivity were done in all patients. A plain X ray KUB and Ultrasound were done in all patients. Plain CT KUB was done to measure the exact size and location of the stone. Stone size measurements taken in the study – largest dimension in plain X-ray KUB, ultrasound and plain CT KUB.

**Inclusion Criteria:** Patients with radio-opaque stones. Previously untreated distal ureteric stones. Patients with solitary distal ureteric stones. Patients with normal renal parameters. No anatomical anomalies in the urinary tract.

**Exclusion Criteria:** Patients with percutaneous nephrostomy in-situ. Patients with ureteric stents in-situ. Bilateral ureteric calculi. Coagulation disorder / patients on anticoagulation drugs. Pregnancy. Sepsis. End stage renal disease.

A total of 120 patients selected were included in the study. They were randomly divided into two groups by an independent observer into group A (70 patients) and group

B (50 patients) during the period, September 2014 to February 2015. The patients in group A were managed by supine transgluteal ESWL and those in group B were managed by semi-rigid ureteros copy within tracorporeal pneumatic lithotripsy.

### Position of Patient

**ESWL:** Supine position with 40 degree tilt to focus the shockwaves through the greater sciatic notch.

**URS:** Supine lithotomy position.

### Post Procedure

**ESWL:** After each session of treatment patients were observed for 2 -3 hours and allowed to go home. Patients were explained about the post treatment hematuria, dysuria and passage of stone fragment in the urine. Patients advised to maintain adequate oral fluids. Patients were advised oral antibiotic, analgesic and H<sub>2</sub> blocker for 5 days.

**URS:** The next day patient was started on normal diet. Check X-ray KUB to ascertain the position of the stent. Foley catheter removed. Patients were given intravenous antibiotic, oral analgesic and H<sub>2</sub> blocker from the day of surgery. Discharge was done on second postoperative day with oral antibiotic, analgesic and H<sub>2</sub> blocker for 5 days. In case of patients developing complications in any of the two groups, were managed appropriately with or without admission with respect to the concerned complication.

### Follow-up

**ESWL:** Patients were followed up at 15 days, 30 days and 90 days or whenever patients had unusual urinary complaints after the procedure. If patient had inadequate fragmentation at 15 days visit, as evident by X-ray/ ultrasound, a second session of SWL is done.

**URS:** Patients were followed up at 15 days, 30 days and 90 days or whenever patients had unusual urinary complaints after the procedure. At the 15 days visit the stent was removed by cystoscopy under local anaesthesia using 19Fr sheath, if the stone were completely cleared on X-ray / ultrasound. If patient had larger fragment persisting at 15 days visit, as evident by X-ray/ ultrasound, a second procedure of URS is done. A total of 6 patients, 4 from ESWL group and 2 from URS group did not turn up for follow-up and hence were excluded from the study. Failure was defined as the presence of fragments of any size in the follow-up film 3 months after final ESWL session. The patients follow up was terminated if the patient cleared the stone with procedure or a secondary treatment was selected for the failure. For each group, hematuria, fever, stein Strasse, ureteric colic requiring hospital admissions, lower urinary tract symptoms, stone clearance, number of ESWL sessions, and secondary procedures were recorded. The DJ stent was removed when the stone disappeared or at three months whichever is earlier.

**Study Analysis:** Data was analyzed using SPSS software.

**OBSERVATIONS AND RESULTS**

The study comprised of 114 patients of distal ureteric calculus divided into two groups, 66 patients in ESWL group and 48 patients in URS group.

Age of the patients ranged from 18 -64 years and most patients were in 21 -40 years of age.

**Table 1.** Age distribution in both the groups

AGE (YRS)	NO. OF PATIENTS	
	ESWL	URSL
<20	2	1
21-40	32	28
41-60	25	15
>60	7	4
<b>TOTAL</b>	<b>66</b>	<b>48</b>

P=0.06 not significant

There were 54 male and 12 female patients in group A and 40 males and 8 females in group B our study.

**Table 2.** Sex distribution in both the groups

	NO. OF PATIENTS		TOTAL
	ESWL	URSL	
Male	54	40	94 (82.4%)
Female	12	8	20(17.5%)
<b>Total</b>	<b>66</b>	<b>48</b>	<b>144</b>

P=0.581, not significant

Left side stones predominated over right sided stones in both group A and B.

**Table 3.** Side distribution in both the groups

SIDE	NO. OF PATIENTS		TOTAL
	ESWL	URSL	
RIGHT	32	21	53 (46.5 %)
LEFT	34	27	61 (53.5%)

P=0.817 not significant

In our study size of the distal ureteric calculus ranged from 6mm-20mm. Both group A and Group B were matched to their stone sizes.

**Table 4:** Showing stone size in both age groups

SIZE	NO. OF PATIENTS		TOTAL
	ESWL	URSL	
6 - 10mm	38	26	64 (56.1%)
11 - 15mm	19	15	34 (29.8%)
16 – 20mm	9	7	16 (14%)

In our study overall stone-free rate at three months was 93.8% (107/114). Clearance in the ESWL group was 89.4% (59/ 66) and in the URS group was 100% (48/48).

**Table 5.** Number of procedures in both the groups

NO. OF SITTINGS	NO. OF PATIENTS		TOTAL
	ESWL	URSL	
ONE	52 (78.78%)	45 (93.7%)	97 (85%)
TWO	7 (10.6%)	3 (6.3%)	10 (8.8%)
<b>TOTAL</b>	<b>59(89.4%)</b>	<b>48 (100%)</b>	<b>107/114 (93.8%)</b>

P= 0.235, not significant

Clearance according to size: 6mm to 10mm were 100%, 11mm to 15mm were 88.2% and 16mm to 20mm were 81.2%. 6.2% patients did not have successful outcome. 10.6% patients did not have successful outcome in the ESWL group, had incomplete fragmentation. Two cases had effective fragmentation but incomplete clearance and so underwent URS with stone extraction.

**Table 6:** Stone free rate according to stone size

SIZE	NO. OF PATIENTS		TOTAL
	ESWL	URSL	
6-10mm	38/38 (100%)	26/26(100%)	64/64 (100%)
11-15mm	15/19 (79%)	15/15 (100%)	30/34 (88.2%)
16-20mm	6/9 (66.7%)	7/7 (100%)	13/16 (81.2%)
<b>TOTAL</b>	<b>59/66 (89.4%)</b>	<b>48/48 (100%)</b>	<b>107/114 (93.8%)</b>

P = 0.65, not Significant

**Table 7.** Showing the complications in both age groups.

COMPLICATIONS	NO. OF PATIENTS		TOTAL
	ESWL	URSL	
HEMATURIA	6(9.09%)	8(16.7%)	14 (12.3%)
FEVER	3(4.55%)	8(16.7%)	11 (9.6%)
STEINSTRASSE	7 (10.6%)	2 (4.2%)	9(7.9%)
URETERIC COLIC	4 (6.06%)	1 (2.08%)	5 (4.4%)

P=0.045 significant

Among the lower urinary tract symptoms (LUTS), frequency was seen in 75 (25%) cases, urgency in 84 (28%) cases, dysuria in 109 (36%) cases and nocturia in 21 (7%) cases. Most of the lower urinary tract symptoms were seen in stented (group A) patients.

**Table 8.** Showing the incidence of LUTS in both age groups.

LUTS	NO. OF PATIENTS		TOTAL
	ESWL	URSL	
FREQUENCY	3 (4.5%)	9 (18.7%)	12 (10.5%)
URGENCY	1 (1.5%)	4 (8.3%)	5 (4.4%)
DYSURIA	8 (12.1%)	5 (10.4%)	13 (11.4%)
NOCTURIA	2 (3.0%)	6 (12.5%)	8 (7.0%)

Since P=0, Frequency, Significant; Since P=0, Urgency, Significant; Since P=0, Dysuria, Significant; Since P=0.162, Nocturia, Not Significant

**Statistical Analysis of Results**

The SPSS Version 17 package was employed to find Pearson’s chi-square test and Fisher’s exact chi- square test for the statistical analysis.

Table 1- Table 5, shows that there is no association between age group, sex, side and number of sittings in the success of SWL and URS, since P value saregreaterthan0.05.

Table 6, infers a significant association in the stone free rate. In the SWL group stone free rates are equivalent to that of URS group.

Table 7-8, also shows that there is significant association in the complication (P=0.000) and LUTS (P=0) among SWL and URS group of patients.

## DISCUSSION

SWL has revolutionized the management of urolithiasis world-wide. Non-invasive method with high efficacy has made SWL gain rapid worldwide acceptance. The standard treatments for the distal ureteric stones not amenable to conservative approach are SWL and ureteroscopy.<sup>7,9</sup> Previously distal ureteric calculus managed by SWL was done in the prone position with discomfort to many patients. Supine position SWL was not considered because of hindrance by the pelvic bone preventing the shockwave from reaching the distal ureter. In prone position, the shockwaves need to travel through the abdominal wall, intestines and/or the bladder before reaching the target stone. Hence the distance travelled by the shockwaves measured as the skin-to-stone distance (SSD) is significantly greater. SSD is an independent predictor of outcome for SWL. Further the shockwave are attenuated by bowel gas as it traverses through them to reach the target stone.<sup>6</sup> The transgluteal supine SWL is ideal for targeting the distal ureter through the greater sciatic notch thus bypassing the bony impedance by the pelvis.<sup>10</sup> At times the shockwave may strike the sciatic nerve at the near the focal point and cause pain, which can be easily overcome by slight changes in patient positioning and the treatment angle. The success of management in this position is highly operator dependent. The supine position SWL is far comfortable for many patients, particularly for the elderly, the obese and those with physical disability / poor mobility. Comparing the patient and stone characteristics, no significant difference was observed between the two groups. Males form the majority of the patients in both the groups (82%). The stone free rates for the supine transgluteal SWL group was 89% and that for the URS group was 100%, in contrast to reported success of 69% by prone position SWL for the distal ureteric stones.<sup>9</sup>

The advantages of supine transgluteal SWL in adults are as follows:

1. Regional anaesthesia is not needed – hence fitness for anaesthesia and its complications are excluded
2. Non-invasive intervention – URS and ICL procedure related complications are avoided
3. Stents not needed – hence stent related LUTS complications are avoided and the need for a second procedure to remove them is also excluded
4. Can be satisfactorily contemplated in obese patients who have difficulties in patient positioning and the procedure.
5. Performed on an outpatient basis.

The failure of supine transgluteal SWL in our study was in 7 (10.6%) patients and they were managed by ureteroscopy and lithotripsy. Two of these patients' stones were fragmented but were not cleared successfully. The reasons

for other failures to SWL are not clear, but may be due to SSD, pain during treatment and the hardness of the stone. The success of transgluteal ESWL for distal ureteric stones has recently been reported by other studies worldwide. Lu *et al.*<sup>10</sup> and Sun *et al.* (11) have reported use of the technique in the treatment of distal ureteric stones in both children and adults. They did not, however, compare outcomes with those of the prone approach. Istanbuloglu *et al.*<sup>12</sup> did, however, retrospectively compare the supine and prone approaches and reported superiority of the supine approach as in the present series. The present study confirms that the outcome of ESWL via the transgluteal approach to the distal ureter was nearly equivalent to the Ureteroscopy and superior in terms of post procedure complications especially lower urinary tract symptoms.

## CONCLUSION

Treatment with SWL has a low morbidity and high effectiveness.

Supine transgluteal SWL for distal ureteric stones, the results are comparable with that of ureteroscopy within extracorporeal lithotripsy with specific advantages like: Outpatient procedure; Non-invasive intervention; Good analgesia sufficient - anaesthesia not necessary; No need for stents – hence no stent related LUTS complications and second procedure to remove them.

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