

## Comparative Analysis of the Efficacy of Extracorporeal Shockwave Lithotripsy vs. Ureteroscopy on Ureterovesical Junction Stones After Failed Medical Expulsive Therapy

John Ivan S. Alonzo, MD; David T. Bolong MD, FPUA and Jerry H. Santos, MD, FPUA

*Section of Urology, Department of Surgery, University of Santo Tomas Hospital*

**Objective:** The study aimed to determine the stone-free rate (SFR) of Extracorporeal Shockwave Lithotripsy (ESWL) on Ureterovesical Junction (UVJ) stones which failed to resolve after Medical Expulsive Therapy (MET.) The SFR of ESWL for UVJ stones is compared to that of Ureteroscopy in order to assess the efficacy of ESWL.

**Methods:** This is a pilot case-series which utilized patient charts from UST Hospital and Manila Lithotriptors, Inc. from January 2010 to August 2015 with UVJ stones that failed to resolve after 2 weeks of MET. These patients subsequently underwent either ESWL or URS for active management of UVJ stones. Stone-free status was determined on 2-week follow-up using repeat imaging. Patient demographics and stone-free rates were subjected to statistical analysis. Patient age and stone size were tested for normal distribution using Shapiro-Wilk test. T-test for two-sample assuming equal variances was used to test for the significance of any noted difference. Data on gender were analyzed using Fisher Exact Probability Test.

**Results:** Nineteen patients fulfilled the inclusion criteria of this study. Seven patients underwent ESWL while 12 patients underwent URS. No statistical significance was observed for patients' age and gender. There was a significant difference in mean stone size between the two groups; 0.5 cm for ESWL and 0.7 cm for URS. Stone-free rates of ESWL and URS were 85.7% and 83.3%, respectively. Fisher Exact Probability test revealed no significant difference in SFR between the 2 groups. In addition, there was poor correlation between stone free rate and the type of procedure done.

**Conclusion:** Extracorporeal shockwave lithotripsy is a viable option in treating UVJ stones after failed MET with a SFR of 85.7%. In comparison to URS, there is no significant difference with ESWL for UVJ stones in terms of stone-free rates.

Key words: extracorporeal shockwave lithotripsy, ureteroscopy, ureterovesical junction stones

### Introduction

At present, numerous treatment modalities are available in treating distal

ureteral stones. In general, ureteral stones measuring less than or equal to 0.5 cm would have a spontaneous passage rate of 77%, while stones greater than 0.5cm would have a

spontaneous passage rate of 46%.<sup>1</sup> In a study done by Morse and Resnick (1991), spontaneous passage rates of proximal and distal ureteral stones were found to be 22% and 71%, respectively. Alpha 1-selective blockers (i.e. Tamsulosin) in conjunction with NSAIDs (i.e. Diclofenac) have been utilized for Medical Expulsive Therapy (MET) of ureteral stones to accelerate stone passage and decrease pain associated with stone passage. Indications for the active management of ureteral stones are stones with low likelihood of spontaneous passage, persistent pain despite medications, persistent obstruction despite MET, and renal failure brought about by ureteral obstruction.<sup>2</sup>

Active management options for distal ureteral stones would include Ureteroscopy (URS), Extracorporeal Shockwave Lithotripsy (ESWL), and Ureterolithotomy (Open or Laparoscopic).<sup>1,2</sup> The decision of which treatment modality would be used would depend on several factors (e.g. stone burden, clinical presentation of the patient, availability of treatment modalities, cost.) Of importance in determining which treatment modality to use is the patient's preference for non-invasive or minimally invasive procedures (e.g. URS.) It is therefore imperative that the patient be informed of the success rates (measured by SFR) of these treatment modalities so they could be aided in deciding which of these would best suit their needs.

Among distal ureteral stones, active management of ureterovesical junction (UVJ) stones poses a clinical dilemma. Ureteroscopy is unacceptable to some patients because of its inherent invasiveness leading them to favor ESWL over URS even though the latter has a higher stone-free rate. However, current literature has not yet stated the specific stone-free rate of ESWL for UVJ stones. Taking into consideration that the UVJ is considered to be one of the anatomical constrictions of the ureter, the efficacy of ESWL in treating UVJ stones has been a topic of debate.

This study aimed to determine the stone-free rate of ESWL for UVJ stones which failed MET. The SFR of ESWL is also compared to that of URS for UVJ stones in order to assess the efficacy of ESWL.

## **Materials and Methods**

This is a pilot case-series which utilized patient charts from UST Hospital and Manila Lithotriptors, Inc. seen during January 2010 to August 2015. This included patients with UVJ stones (defined as stones 1cm or less from the intramural portion of the distal ureter) who failed MET. Medical expulsive therapy is defined as a 2-week course of Tamsulosin 200 mcg/tab 1 tablet taken orally once a day before bedtime and any oral analgesic of choice. Failure of MET is defined as failure of stone passage after 2 weeks of prescribed medications or inability of the patient to tolerate pain despite medication. Stone location and size after MET was confirmed by the use of CT stonogram, KUB ultrasound, or IVP. These patients were subsequently subjected to either ESWL or URS for active stone management. Only one session of ESWL was done using Siemens Variostar Lithotripter under IV sedation. Ureteroscopy (Karl Storz 27400CL) was conducted under spinal anesthesia utilizing intracorporeal pneumatic lithotripsy with stone basket extraction. Double-J stents were inserted after ureteroscopy. Patients who underwent ESWL were given Rowatinex capsule (Natural terpenes) 1 capsule three times a day for 2 weeks as take-home medication while those who underwent URS were given Cefuroxime 500 mg/tab 1 tablet twice a day for 1 week. Follow-up was after 2 weeks post-op wherein KUB ultrasound or KUB x-ray was done to determine UVJ stone free status.

The demographic characteristics (age, gender, stone size) of both groups were noted and relevant data were subjected to statistical analysis. Both age and stone sizes of patients were tested for normal distribution using Shapiro-Wilk test. Once all data sets showed normality of distribution, t-test for two-sample assuming equal variances was used to test for the significance of any noted difference. Data on gender were analyzed using Fisher Exact Probability Test.

## **Results**

On patient chart review, 19 patients met the inclusion criteria of this study. Seven patients

underwent ESWL while 12 opted for URS. Table-1 summarizes the demographic data of the patients. There was no significant difference in the patients' age and gender. However, there was significant difference in the mean stone size of both groups (0.7 cm for the URS group vs. 0.5 cm for the ESWL group.)

**Table 1.** Patient demographics (P<0.05).

	Patient Demographics		
	URS	ESWL	P-value
Age (years)	42 (27-61)	48 (27-60)	0.289565
Gender Male	7	6	0.204
Female	5	1	
Stone Size (cm)	0.7 +/- 0.2 (0.4-1.1)	0.5 +/- 0.1 (0.3-0.7)	0.040788

Presence or absence of UVJ stones of both groups on follow-up was determined and stone-free rate was computed. The ESWL group had an 85.7 % SFR while the URS group had an 83.3 % SFR. No post-procedural complications were noted in both groups. Table-2 compares stone-free rates of both groups using Fisher Exact Probability Test. No statistical significance in SFR was noted between both groups. In addition, there was poor correlation between stone-free rate and the type of procedure done.

## Discussion

The efficacy of ESWL in treating distal ureteral calculi has been proven by a number of studies. Cameron-Strange reported a 69% stone free rate for ESWL of 64 patients with distal

ureteric calculi.<sup>3</sup> A similar study done by Erturk, et al. noted a 3-month 81% stone-free rate for ESWL in treating distal ureteral stones, adding that treatment failure may be attributed to stone impaction and stones larger than 1 cm.<sup>4</sup> Ishii, et al. concluded that ESWL is an acceptable first-line therapy for fragmentation of distal ureteral stones larger than 10 mm with a 3-month stone free rate of 95.1%.<sup>12</sup> One day stone free rates were also determined by Landau et al. and Hochreiter et al. which were 38% and 63%, respectively.<sup>8,10</sup> Stone location and size have also been correlated with stone free rate of ESWL, with distal ureteral stones <10 mm and >10 mm having stone free rates of 86% and 74%, respectively.<sup>2</sup> The results of the aforementioned studies are in congruency with the 85.7% 2-week stone free rate for UVJ stones.

Ureteroscopy has been associated with a higher stone free rate than ESWL. With regard to distal ureteral stones, URS is reported to have a 93% SFR compared to 74% for ESWL regardless of stone size.<sup>2</sup> In the present study, the SFR of URS was 83.3% which was slightly lower than that of ESWL. This could be attributed to the absence of a computed sample size, taking into consideration that this is a pilot study. Additional data collected in the future may help improve the results of future studies in this subject matter.

ESWL has been associated with less need for auxiliary treatments, fewer complications, and shorter hospital stay compared to URS.<sup>6</sup> This is the premise for the use of ESWL in the treatment of distal ureteral stones which, in theory, also includes UVJ stones. In this study, URS had a lower SFR compared to ESWL but the difference was not significant. The range of stone size in the ESWL group was 0.3-0.7cm while that of the URS group was 0.4cm - 1.1cm. The effectivity of a single session of ESWL to UVJ stones may be

**Table 2.** Analysis and comparison of stone free rates.

	Absent	UVJ Stones on 2-week Follow-up		P-value	phi
		Present	Total		
URS	10	2	12	0.477	0.03
ESWL	6	1	7		
Total	16	3	19		

attributed to the small stone size range in the group. This is congruent with the result of Ishii et, al. wherein they stated that a high success rate of 98% was achieved with multisession ESWL (1-12 sessions) for distal ureteral stones more than 10 mm.<sup>12</sup> This has been one of the limitations of this study which could be improved upon by future studies by matching the stone sizes of the subjects and including patients which underwent multiple sessions of ESWL for UVJ stones.

## Conclusion

Extracorporeal shockwave lithotripsy is a viable option in treating UVJ stones after failed MET with a SFR of 85.7%. In comparison to URS, there is no significant difference with ESWL for UVJ stones in terms of stone free rates.

## References

1. Matlaga BR, Lingeman JE. Surgical management of upper urinary tract calculi. In: Wein JA, Kavoussi LR, et al. Campbell-Walsh Urology. 10th Ed. Philadelphia: Elsevier Saunders; 2012; 1375-9.
2. European Association of Urology. Guidelines on Urolithiasis 2013; 19-21, 50-51.
3. Cameron-Strange A. Extracorporeal shockwave lithotripsy for distal ureteric calculi. Aust NZJ Surg 1992; 62(4): 283-6.
4. Erturk E, Herrman E, Cockett AT. Extracorporeal shockwave lithotripsy for distal ureteral stones. J Urol 1993; 149(6): 1425-6.
5. 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(1): 62-5.
6. Aboumarzouk OM, Kata SG, Keeley FX, McClinton S, Nabi G. Extracorporeal shock wave lithotripsy (ESWL) versus ureteroscopic management for ureteric calculi. Cochrane Database Syst Rev 2012; 16:5.
7. Hosking DH, Smith WE, McColm SE. A comparison of extracorporeal shockwave lithotripsy and ureteroscopy under IV sedation for the management of distal ureteric calculi. Can J Urol 2003; 10: 1780-4.
8. Hochreiter WW, Danuaser H, Perrig M, Studer U. Extracorporeal shockwave lithotripsy for distal ureteral calculi: What a powerful machine can achieve. J Urol 2003; 169: 878-80.
9. Hegazy H, Elabbady A. Effectiveness of successive shockwave lithotripsy for renal and ureteral stones after failed initial treatment. Eur Urol Supp 2006; 5(2): 185.
10. Landau EH, Pode D, Lencovsky Z, Katz G, Meretyk S, Shapiro A. Extracorporeal shock-wave lithotripsy (ESWL) monotherapy for stones in lower ureter. Urol 1992; 40(2): 132-6.
11. Ordon M, Schuler TD, Ghiculete D, Pace KT, Honey RJ. Stones lodge at three sites of anatomic narrowing in the ureter: Clinical fact or fiction? J Endourol 2013; 27(3): 270-6.
12. Ishii N, Yoshinaga A, Ohno R, Chiba K, Hayashi T, Kamata S, Watanabe T, Yamada T. Extracorporeal shockwave lithotripsy in the treatment of distal ureteral stones larger than 10mm in diameter. Hinyokika Kiyo 2004; 50(6): 388-8.
13. Zehntner C, Marth D, Zingg EJ. ESWL treatment with ventral shock-wave application: Therapy of iliac and distal ureteral calculi. Urol 1991; 38(1): 51-3.