



## **EMERGENCY “HOT” SHOCK WAVE LITHOTRIPSY: AN EXPERIENCE FROM A TERTIARY REFERRAL CENTRE**

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### **ABSTRACT**

Ureterscopy and extracorporeal shock wave lithotripsy (ESWL) are two widely used methods for the treatment of ureteric and pelviureteric junction (PUJ) stones. ESWL remains the only non-invasive therapy modality for the treatment of urinary stones. Extracorporeal shock wave lithotripsy (ESWL) is a non-invasive, safe and effective treatment for urinary tract lithiasis

#### **Objectives**

To evaluate the effectiveness of emergency “hot” shock wave lithotripsy in treating symptomatic ureteric/PUJ stones.

#### **Materials and Methods**

A retrospective study looking at the emergency referrals for shock wave lithotripsy to the Churchill Hospital between June 2013 to Dec 2017. The Lithotripsy Database and patients’ electronic records were used to complete this project. Emergency referrals triaged by the on-call urology team and go through a renal colic clinic.

#### **Results**

In total, 201 patients underwent emergency shock wave lithotripsy for ureteric/PUJ stones.

The mean stone size was 7.7mm (SD 2.9). 12.4% (25) were PUJ, 45.3% (91) proximal and 42.3% (85) distal ureteric stones. 1% (2) were bilateral ureteric stones. 9% (18) had previous lithotripsy treatment before being referred.

The number of shocks used was 4000 in 52.7%,  $\geq 3000$  in 40.3%,  $\geq 2000$  in 4.5% and  $\geq 1000$  in 2.5%. The median shock frequency was 2 Hz. The median number of treatments for the targeted stone was 2. Stone fragmentation was visible in 27.4% (55), possible in 30.8% (62) and not visible in 41.8% (84).

In terms of follow up, 48.3% (97) were discharged stone-free, while 17.4% (35) were discharged with residual fragments. 21.8% (44) had further clinic follow up while 12.4% (25) had no follow-up information available, possibly because they were referred from different hospitals. 19.9% (40) needed ureteroscopy, while 7% (14) needed further lithotripsy sessions.

#### **Conclusions**

Emergency extracorporeal lithotripsy can be offered as an effective and safe treatment for patients with symptomatic stones.

## INTRODUCTION

Urolithiasis has a prevalence ranging from 5 to 10% and a predictable recurrence rate of approximately 50%, which makes it one of the most common diseases.<sup>1</sup> As a result, stones interventions are expected to increase over time, leading to significantly more pressures on healthcare resources significantly. Geraghty and colleagues found limited evidence to suggest that URS is less expensive than ESWL. Nevertheless, due to the lack of standardization, studies seem to be contradictory, and further randomized studies are needed to address this issue.<sup>2</sup>

Ureteroscopy (URS) and shock wave lithotripsy (SWL) are two widely used methods for the treatment of symptomatic ureteric and pelviureteric junction (PUJ). ESWL remains the only non-invasive procedure for the treatment of urinary stones. Emergency ESWL should be strongly considered if the stones are suitable. In their meta-analysis, Arcaniolo and colleagues found that emergency ureteroscopy is frequently reserved for distally located stones.<sup>3</sup> Their analysis revealed that delayed URS patients presented a significantly larger stone size compared to the emergency URS ones (weighted mean difference WMD: 1.35 mm;  $p = 0.04$ ), whereas there was no difference in terms of stone location, which was mostly distal for both groups (60.6% emergent and 78.5% delayed;  $p = 0.66$ ).<sup>3</sup> The implementation of these therapeutic approaches is likely to be dictated by their availability.<sup>3</sup>

The current, 2016 American Urological Association Guidelines state that URS for proximal ureteral stones has a higher stone-free rate (SFR) in a single procedure compared with ESWL.<sup>4</sup> URS can be recommended as the first treatment option for proximal ureteral stones  $>10$  mm, but for stones  $\leq 10$  mm the EAU Urolithiasis Guidelines panel consensus is that either treatment options are viable as the first choice and should be presented to patients.<sup>5</sup>

Recently, the National Institute for Health and Care Excellence (NICE) adopted a more supportive approach to the use of ESWL in the emergency setting. NICE guidelines recommended offering surgical treatment (including ESWL) to adults with ureteric stones and renal colic within 48 hours of diagnosis

or readmission if the pain is ongoing and not tolerated or the stone is unlikely to pass. The guidelines recommended ESWL for ureteric stones less than 10 mm and URS to ureteric stone 10 to 20 mm but considered ESWL to the latter if local facilities allow stone clearance within four weeks.<sup>6</sup>

## OBJECTIVES

To evaluate the effectiveness of emergency “hot” shock wave lithotripsy in treating symptomatic ureteric/PUJ stones.

## Materials and Methods

We retrospectively reviewed all the emergency referrals for shock wave lithotripsy to a tertiary stone centre from June 2013 to December 2017. All emergency stone referrals are triaged by the on-call urology team and go through a renal colic clinic with subsequent review of treatment progress through the weekly stone multidisciplinary meeting. The Lithotripsy Database, patients’ electronic records, and radiological images were interrogated.

## RESULTS

In this study, we analyzed ESWL in emergency patients with ureteric and PUJ stones. In total, 201 patients underwent emergency shock wave lithotripsy for ureteric/PUJ stones.

The mean stone size was 7.7mm (range 3–20 mm; SD 2.9). 12.4% (25) were PUJ, 45.3% (91) proximal and 42.3% (85) distal ureteric stones. 1% (2) were bilateral ureteric stones. 9% (18) had previous lithotripsy treatment before being referred.

The number of shocks used was 4000 in 52.7%,  $\geq 3000$  in 40.3%,  $\geq 2000$  in 4.5% and  $\geq 1000$  in 2.5%. The median number of treatments to the targeted stone was 2 (range 1–9; SD 1.2). 48.8% (98) needed one session, 35.8 % (72) needed two, 6.5% (13) needed three, 6.5% (13) needed four sessions, 1% (2) needed six, and 0.5% (1) needed five, eight and nine sessions. Stone fragmentation was visible in 27.4% (55), possible in 30.8% (62) and not visible in 41.8% (84).

The stone MDT panel reviewed all cases weekly and recommended individualized treatment plans. In terms of follow up, 48.3% (97) were discharged

stone-free, while 17.4% (35) were discharged with residual fragments. 21.8% (44) had further clinic follow up while 12.4% (25) had no follow-up information available, possibly because they were referred from different hospitals. 19.9% (40) needed ureteroscopy, while 7% (14) needed further lithotripsy sessions after discharge for symptoms related to other kidney stones with subsequent visible fragmentation. URS was booked after a clinic review, following a telephone conversation or after a written correspondence if the patient was appropriately counselled for that before lithotripsy.

The stone size had an impact on lithotripsy outcomes (Figure 1). The percentage of patients discharged stone-free varied according to the stone size as follows: 100.0%(3) in 3 mm stones, 56.3%(9) in 4 mm, 40.0%(10) in 5 mm, 56.8%(21) in 6 mm, 56.7%(17) in 7 mm, 57.1%(16) in 8 mm, 41.2%(7) in 9mm, 46.7%(7) in 10 mm and 25.0%(1) in 14 mm stones. One further patient (100%) with 16 mm stone achieved stone-free discharge. When looking at patients with larger stones, the percentage off patients discharged with residual fragments varied from 20.0%(3) for 10 mm, 33.3%(2) for 11 mm, 50.0%(2) for 13 mm to 50.0%(1) for 20 mm.

### DISCUSSION

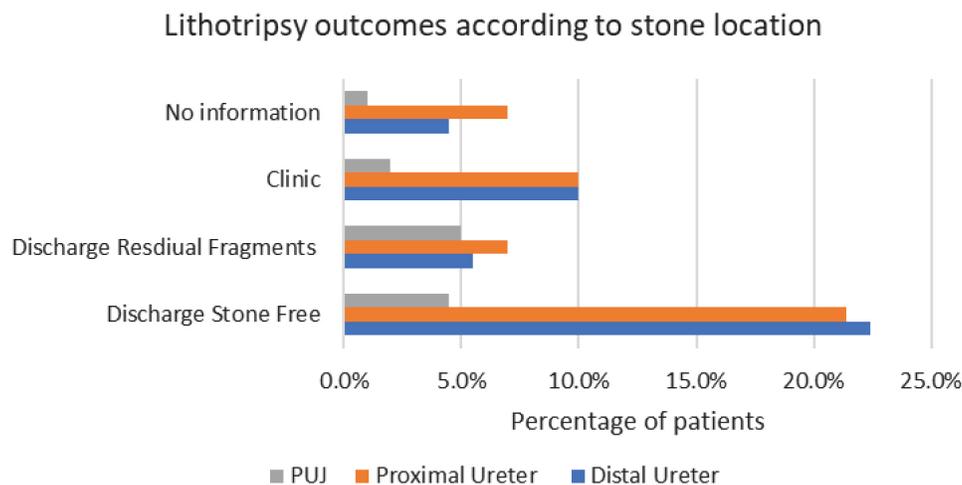
Immediate ESWL has been shown to have better outcomes as Kumar et al. reported a significantly

higher retreatment rate and requirement of auxiliary procedures when treatment is performed beyond 48 hours from pain onset.<sup>7</sup> The rationale for early therapy in patients affected by ureteric colic is a gradual development of ureteric edema after 24–48 hours ultimately impairing the stone clearance.<sup>8,9</sup> In the emergency setting, the use of SWL appears less invasive concerning ureteroscopy, without the need for anesthesia and its associated complications.<sup>10</sup>

Guidance on the emergency ESWL still lacks in the international guidelines with few disperse studies in the literature. In cases where treatment of ureteric stone is necessary, the primary debate currently gravitates between the choice of SWL or URS. In their pooled analysis of six studies (including 570 cases), Picozzi et al. did not register a difference in terms of ESWL stone-free rate between upper ureteral stones (79%) versus mid (78%) or distal (78%) stones.<sup>10</sup> This is comparable to our results. On the other hand, Choo and colleagues reported an overall treatment success rate of 64.4% (509 cases) after ESWL. The rate for upper, middle and lower ureter stones was 59.8%, 65.5%, and 69.6%, respectively.<sup>11</sup> The study had 791 patients with a Mean  $\pm$  SD stone length of 5.9  $\pm$  2.3 mm and mean stone volume was 89.3  $\pm$  140.0 mm<sup>3</sup>.<sup>12</sup>

Health-related quality of life HRQoL is an essential parameter in modern health care. Interestingly, there is no substantial difference in the short-term for proximal ureteral stones < 10 mm as Ceylan and colleagues

**FIG. 1** Lithotripsy outcomes according to stone location.



stated looking at health-related QoL (HRQoL) in 273 patients who were treated successfully with SWL and URS for proximal ureteric stones. However, URS seems to be superior to SWL in short-term follow-up for at least three subscales of HRQoL for the treatment of proximal ureteral stones >10 mm.<sup>11</sup> This could be explained in light of the EAU consensus guidelines which state that compared with ESWL, URS was associated with a significantly higher SFR up to four weeks, but the difference was not significant at three months in the included studies.<sup>5</sup> Also, ureteroscopy was associated with fewer retreatments but with a higher need for adjunctive procedures, greater complication rates, and more extended hospital stay.<sup>5</sup>

### CONCLUSIONS

Emergency extracorporeal lithotripsy can be offered as an effective and safe treatment for patients with symptomatic ureteric or PUJ stones. The implementation of this therapeutic approach is dictated mostly by their availability in the emergency setting.

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