

# Does quality of life in patients undergoing shock wave lithotripsy change with repeat procedures: a prospective pilot study from a teaching hospital

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**Introduction** Shock wave lithotripsy (SWL) is a well-established treatment for kidney stone disease (KSD) and despite its decreased popularity in the past, it has now gained renewed interest due to its minimally invasive nature and good outcomes, especially in the face of COVID-19 pandemic. The aim of our study was to perform a service evaluation to analyse and identify quality of life (QoL) changes [using Urinary Stones and Intervention Quality of Life (USIQoL) questionnaire] after repeat SWL treatments. This would enable a greater understanding of SWL treatment and reduce the current gap of knowledge regarding patient specific outcomes in the field.

**Material and methods** Patients affected by urolithiasis underwent SWL treatment between September 2021 and February 2022 (6 months), were included in the study. A questionnaire was given to the patients in each SWL session and consisted of three main topic areas: a domain on Pain and Physical Health, on Psycho-social Health and on Work (see appendix below). Patients also completed a Visual Analogue Scale (VAS) in relation to the pain related to the treatment. Data from the questionnaires were collected and analysed.

**Results** A total of 31 patients filled in two or more surveys, with a mean age of 55.8 years. On repeat treatments, pain and physical health domain was significantly better ( $p = 0.0046$ ), psycho-social health domain was significantly better ( $p < 0.001$ ), work domain was significantly better ( $p = 0.009$ ) and a correlation [on Visual Analog Scale (VAS)] was observed between pain decreasing in subsequent SWL procedures.

**Conclusions** Our study found that the choice of SWL to treat KSD does improve a patient's QoL. This could be related to improvement of physical health, psychological and social wellbeing, and ability to work. Higher QoL and low pain scores are observed in relation to repeat SWL treatment and are not directly associated to stone-free status.

**Key Words:** kidney calculi ↔ shock wave lithotripsy ↔ quality of life ↔ ureteroscopy ↔ ureteral calculi

## INTRODUCTION

Kidney stones disease (KSD) is a pathological condition that indicates the presence of stones in the urinary tract. The recurrence rate of KSD is currently considered to be 35% at five years [1]. This is often associated with pain and need for repeat treatments

that can lead to a reduced quality of life (QoL) [2, 3, 4]. KSD has previously been shown to affect 10.6% of men and 7.1% of women in the USA [5]. However, lately, women and especially adolescent females have been found to be more likely to develop KSD in their lifetime compared to the previous eras [6]. Global incidence of KSD has been increasing in the last few

decades worldwide [7], as have the rates of treatment of this condition [8]. The worldwide trends in the incidence of urolithiasis seems to be associated with seasonal variation, diet and fluid intake [9].

Several treatments are available for renal and ureteric stones. Rigid and flexible ureteroscopy with lasertripsy (FURSL) is currently one of the first line option for upper urinary stone treatment [10]. Shock wave lithotripsy (SWL) is a well-established treatment for renal stones and despite its decreased popularity in the past, it has now gained renewed interest due to its minimally invasive nature and good outcomes, especially in the face of the COVID-19 pandemic [11]. The European Association of Urology (EAU) guidelines [12] have indeed recognised the role of SWL as the first option in the treatment of upper ureteric stones <1 cm, distal ureteric stones and renal stones up to 2 cm. SWL is associated with shorter recovery periods, reduced need for analgesia, and lower complication rates [13] compared to flexible ureteroscopy. However, the stone-free rates can be compromised in cases of lower pole stones and hard stones with elevated Hounsfield unit (>1000 HU) [14, 15].

Kidney stones can dislodge into the ureter becoming responsible for recurrent renal colic episodes, excruciating pain and the need for surgery. The thought of the acute stone event and colic is typically associated with stress [16], depression [17], lower health related quality of life [18] and seems to cause decreased global quality of life in patients even when asymptomatic [19]. Indeed, an institutional review found that 30.4% of 115 patients with urolithiasis scored in the category of a “significant level of physiological distress”, compared to the general population scoring at 16.5% [17].

In the recent years, we have witnessed a huge shift towards patient reported outcomes, and the development of tools to study QoL has illuminated a lack of validated disease specific questionnaires [20, 21, 22]. As a response to that, the goal of stone treatment should now not only be to achieve an optimal stone-free rate (SFR), but also to improve the patients’ global QoL and wellbeing.

The aim of our study was to perform a service evaluation to analyse and identify QoL changes after repeat SWL treatments. This would enable a greater understanding of SWL treatment and reduce the current gap of knowledge regarding patient specific outcomes in the field.

## MATERIAL AND METHODS

Our sample cohort included kidney stones patients who underwent SWL treatment between September

2021 and February 2022 (6 months), at a high-volume tertiary stone centre in the United Kingdom. The stone parameters and the indications for treatment were discussed between the physician and the patient, and a decision was taken in agreement with the patient’s preferences. Site and location of the upper urinary tract stones were confirmed pre-treatment with a computed tomography kidney ureter bladder (CT KUB) examination and, on the day of the treatment a further plain X-ray was performed for treatment planning. Ethics approval for this evaluation was granted by the University of Southampton ERGO II system (ERGO number 64287) and all patients gave written consent for the study.

Lithotripsy treatment was delivered by a team of two specialist nurses and a radiographer, and was overseen by a Urologist in the department. The patients signed a written consent form to accept being part of the study after reading a patient information sheet. This explained the aim of the study, their participation, and confidentiality and anonymity about them in the study.

The main questionnaire given to participants was the quantitative Urinary Stones and Intervention Quality of Life (USIQoL) questionnaire [23]. This is a QoL survey with disease and symptom specific questions, aimed at quantifying the holistic disease burden. It is further designed to allow changes to the scores to reflect the impact of treatment. The survey consists of three main topic areas: six questions on Pain and Physical Health; seven questions on Psycho-social Health; and two on Work (see appendix below). Patients also completed a Visual Analogue Scale (VAS), circling the pictorial facial expression that best represented their feeling of pain experienced before the procedure.

The institution analgesia protocol included 1 g of oral paracetamol and 100 mg diclofenac suppository given half an hour before commencing the treatment. In case of allergies or intolerance to anti-inflammatories or paracetamol, the patient was offered 30 mg dihydrocodeine tablets. No option of using opiates or intravenous sedatives were given to the patients. During the 30–40-minute lithotripsy sessions, the patients experienced a ramping and gradual increase of stepwise power achieving a maximum of 3000 shocks [24]. Mood lighting and music option of their choice were also offered to enhance relaxation and reduce their anxiety. After the procedure, the patients were given a second visual analogue scale to fill in.

If clinically required, the patients came back for their second and third procedure, following the same protocol. Further questionnaires were filled for each treatment. This study purely examines patients who

completed two or more SWL sessions, and carried out post-procedural questionnaires on both occasions. The consent forms were stored securely, and the data were collected and analysed maintaining anonymity. The raw data was tabulated using Excel and converted to a Logit scale of 0–100, following the USIQoL statistical model. Statistical analysis was done using SPSS and paired and unpaired t-tests was used to correlate scores and identify significant changes in wellbeing before and after the SWL.

## RESULTS

A total of 31 patients filled in two or more surveys, with a mean age of 55.8 years [(standard deviation (SD) = 13.99]; the age range was 27–84 years, with 68.8% experiencing symptoms before the treatment. Only one patient had a JJ ureteric stent in situ with majority of stones in the kidney (Table 1).

### USIQoL questionnaire:

As shown in the appendix below, the questions were scored on a scale of 1–4. Each of the three questioning domains was then converted into a Logit score of between 0 and 100, as according to the USIQoL. The maximum score of 100 indicates a worse QoL.

### Pain and physical health

This segment included 6 questions. The mean score for the first SWL procedure was 59.55 (SD = 8.31), which decreased to 56.29 (SD = 7.77) at the second SWL procedure. On the sample size of 31, a paired t-test found this pattern of decreasing score and increasing QoL was significant ( $p = 0.0046$ ). A lower score was indicative of a greater QoL as shown in Figure 1.

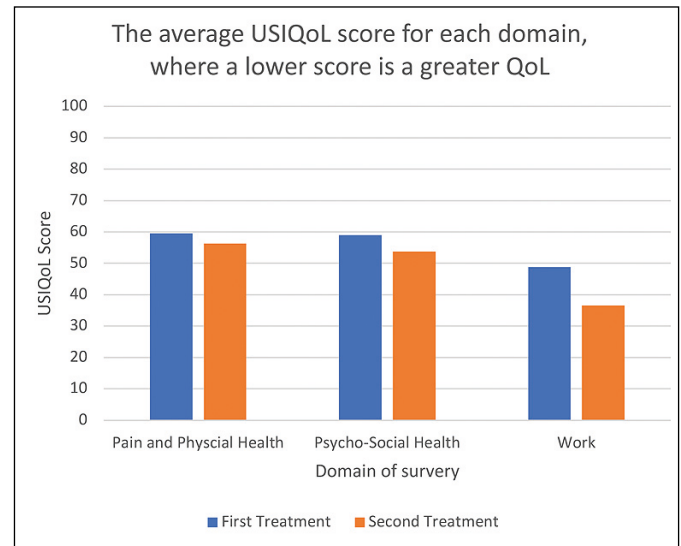
### Psycho-social health

This section consisted of 7 questions. The average USIQoL score at the initial SWL procedure was 56.29 (SD = 8.29), which decreased to 53.80 (SD = 7.90) at the second procedure. This was a sig-

nificant decrease as  $p < 0.001$  using a paired t-test, showing that QoL increases after repeat SWL treatment for kidney stones (Figure 1).

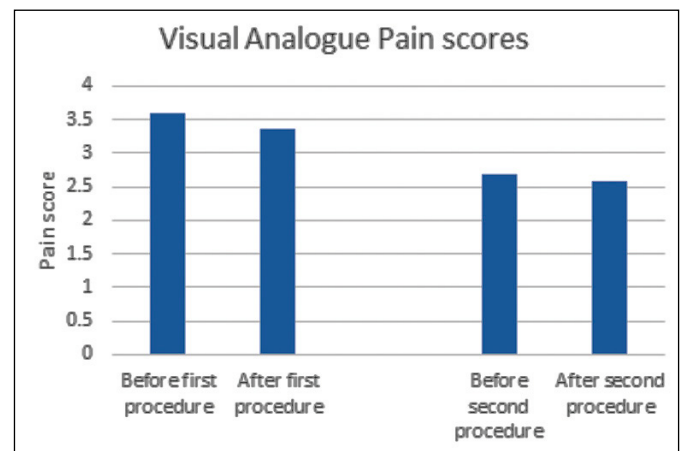
### Work

This section had 2 questions, and we ruled out 13 patients who were not working at the time of survey. The sample size of 18 patients, mean score of 48.72 (SD = 18.23) after the first procedure, which decreased to 36.56 (SD = 15.48). This was further found to be significant ( $p = 0.009$ ) in a paired t-test (Figure 1).



**Figure 1.** A bar chart showing USIQoL Scores for each domain of questions at the first and second shock wave lithotripsy procedures.

USIQoL – Urinary Stones and Intervention Quality of Life; QoL – quality of life



**Figure 2.** A graph depicting the average pain score (1 to 10 considered highest pain level) given by patients at various points throughout their treatment.

**Table 1.** Patient demographics and stone location

Sex	Male	87.1% (27)	Female	12.9% (4)
Symptoms	Yes	71.0% (22)	No	32.3% (10)
Laterality	Left	38.7% (12)	Right	61.3% (19)
Pre-operative stent	Yes	3.2% (1)	No	96.8% (30)
Location	Kidney	77.4% (24)	No	22.6% (7)

## Visual Analogue Scale

VAS was used to capture the perception of pain, scored between 0 and 10, with ten being excruciating pain. For the 19 renal stones patients before and after the first procedure, it decreased from 3.63/10 (SD = 2.34) to 2.63/10 (SD = 2.00). Pain rating after the second procedure was rather constant; from 2.73/10 (SD = 3.17) to 2.89/10 (SD = 2.43) as represented in Figure 2. In the 9 ureteric stone patients, a clear decrease in pain could be seen after the first procedure, 4.67/10 (SD = 2.98) compared to 2.44/10 (SD = 2.59) after the second procedure.

The second SWL was less painful than the first likely related to the fragmentation of the stone followed by potential resolution of the obstruction. Although not statistically significant in an unpaired, two tailed t-test, ( $p = 0.348$  for the before procedure, and  $p = 0.330$  afterwards), a correlation was observed between pain decreasing in subsequent SWL procedures.

## DISCUSSION

We wanted to validate the use of the USIQoL questionnaire for recording changes in QoL among patients undergoing SWL treatment for renal and ureteric stones. We have demonstrated that QoL increased after SWL procedures in both patients with renal and ureteric stones (Figure 2). This outcome, together with the versatility and reduced invasiveness of the procedure, could influence future treatment choice favouring SWL over other techniques. The USIQoL survey was chosen over other stone and urological surveys, such as the Wisconsin questionnaire (WISQOL) [25], because it covers both kidney and ureteric stones, and shows a holistic impact on the affected patients' QoL. Similarly, Mehmi et al. analysed the current endourological tools available for QoL including USIQoL, WISQOL for recurrent stone formers and USSQ for stent symptoms, and concluded that USIQoL was the most universal tool for patient-reported outcome measures (PROMs) in stones patients [26]. USIQoL is also the only core PROM that is validated to evaluate the impact of the disease and interventions in a comparable fashion.

While there was most thrust on clinical success, there has been increasingly more emphasis on QoL in these patients' undergoing intervention for stone disease. A previous study conducted by Walters et al. hypothesized stone scenario to 476 participants, finding that 52.3% of those with scenario of 8 mm stones would choose SWL treatment, over observation or ureteroscopy. However, when the stone scenario involved a 15 mm stone, only 40.8% chose SWL,

while 45.4% chose ureteroscopy. Determining factors in changing these treatment choices included making participants aware of success and complication rates, as well as invasiveness of the procedures [27]. This study concluded that clinicians should start looking at PROMS while assessing the 'success' of a procedure, implying that this piece of information could alter the patient's decision and ultimately the definition of success. A systematic review comparing randomised control trials in nephrolithiasis treatment, found a lack of effective PROMs reporting. This gap should be filled by Health-related Quality of Life (HRQoL) instruments that recognise the importance of patient outcomes [18].

With specific regard to the work section of the USIQoL, the analysis by Joshi et al. revealed that patients had less time off work and felt that their stones interfered with their job to a lesser extent. This had many positive consequences including greater job stability, less financial concerns and thus was likely to positively impact on the work life balance and family wellbeing.

Based on the renewed interest in patient's reported outcomes and QoL, we hypothesise the mechanisms by which the lithotripsy treatments increase their QoL. Patients who have undergone treatment, have the positive expectation that these shockwaves have fragmented their stones, thus psychologically feel more relieved and looked after in addition to a placebo effect of treatment. Looking at surgical intervention outcomes, a review of 313 patients with a WISQoL questionnaire found that stone-free status was not linked with a greater HRQoL [26]. This suggests that there could be a psychological aspect associated with having a treatment. Penniston et al. found the factors that negatively impacted the QoL in patients with KSD including the lack of freedom in attending social events, perhaps due to pain, discomfort, feelings of nausea or anxiety [18]. The social impact of the stone related symptoms is often underestimated by outcome surveys that normally tend to favour stone-free rates or recurrence rates. General emotional stress was not found to have an effect on QoL in patients with stones [16].

The results of previous research in this field overwhelmingly find that reducing pain and symptoms by reducing the burden of stones will improve QoL. Our study has validated SWL as a treatment that improves the general wellbeing of kidney stone patients. In line with our study, Cahait et al. found that residual fragments after SWL procedures correlated with a reduced QoL compared to successful stone-free procedures [19]. Fragments <2 mm affected the patient less, perhaps due to the expectation of easier and pain-free passage of these fragments. Singh et al.



found that the overall satisfaction rate was lower in SWL than after FURSL [27], perhaps due to the higher success rate of the latter (54% vs 84%). It can be noted that this study included patients who did not attain a stone-free status with SWL treatment.

According to our analysis, QoL improves after the first procedure and remains high during the following SWL sessions. This can be related to higher confidence in the team, comfort in the environment and deeper knowledge of the procedure, all factors that reduce the patients' anxiety. This changed attitude is reflected in their VAS showing happier and more relaxed patients. Ragab et al. indeed found that the greatest issues surrounding kidney stones disease were anxiety, pain, limitations to social life and tiredness [3], and thus the importance of these factors not being underestimated in their treatment.

### Limitations of the study and areas of future research

The sample size for our study was low and perhaps a large multicentric study will be needed to confirm our findings. We also did not have a control group and did not compare SWL outcomes to other interventions, therefore we do not know if the QoL

is expected to improve equally after alternative treatment options such as ureteroscopy.

## CONCLUSIONS

Our study found that the choice of SWL to treat KSD does improve a patient's QoL. This could be related to improvement of physical health, psychological and social wellbeing, and ability to work. Higher QoL and low pain scores are observed in relation to repeat SWL treatment and are not directly associated to stone-free rate.

### CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

### AUTHOR CONTRIBUTION

Ella Stephens – contributed to data collection, data analysis, project conceptualization, writing first draft, liaison with ethical committee. Amelia Pietropaolo – contributed to Supervision and review and editing.

Loretta Tear – contributed to data collection and storage.

Tanya Davis – contributed to data collection and storage.

Hrishikesh B. Joshi – contributed to methodology, supervision and review and editing of final draft.

Bhaskar K. Somani – contributed to methodology, supervision and review and editing of final draft.

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