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Extracorporeal shockwave lithotripsy monotherapy for treating patients with bladder stones

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Bladder stone;
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ABBREVIATIONS

AUR, acute urinary retention;
ESWL, extracorporeal shockwave lithotripsy;
KUB, plain abdominal radiograph of the kidneys, ureters and bladder;
US, ultrasonography

Abstract ***Objectives:*** To describe our experience with extracorporeal shockwave lithotripsy (ESWL) for the treatment of bladder stones of < 20 mm.

Patients and methods: This study was prospectively performed in two hospitals (Althawrah Modern General Hospital, and Ibn Sina Specialized Hospital) between November 2012 and November 2015. In all, 44 patients presented with urethral or bladder stones. The location and size of the stones was assessed by abdominal ultrasonography and plain abdominal radiography of the kidneys, ureters and bladder. All patients with radiopaque stones of < 20 mm underwent ESWL monotherapy after fixation of a Foley catheter in a supine position under intravenous analgesia.

Results: The mean size of the stones was 15.8 mm and spontaneous evacuation occurred after removal of the Foley catheter without the need for adjuvant procedures in 40 patients (90.9%). Four patients (9%) developed acute urinary retention due to urethral impaction of large stone fragments. In two of them, the urethral catheter was successfully re-inserted pushing the fragments back to the bladder and a complementary session of ESWL resulted in more fragmentation of the stones, with spontaneous passage after catheter removal. In the other two patients (4.5%), the catheter could not be re-inserted and urgent endoscopic intervention was required.

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Conclusions: ESWL monotherapy is safe and effective method for treatment of bladder stones with no other causes of infra-vesical obstruction. Several indications can be met including patients with high anaesthetic risk, patients fearing anaesthesia or endoscopic procedures, and patients who have difficulty in positioning.

Introduction

The first extracorporeal shockwave lithotripsy (ESWL) was reported in humans in 1980 [1]. Since then, the indications for ESWL have widened to include renal and ureteric stones of variable sizes and locations including staghorn stones [2–4]. However, there are only a few published reports about the use of this technique for treating urinary bladder stones [5–8]. Bladder stones are mobile in the bladder cavity and this in addition to easy endoscopic and suprapubic access to them makes ESWL not an ideal choice for their treatment. Nevertheless, there are still some patients with bladder stones who request and are willing to be treated by ESWL either due to a fear of endoscopic procedures or of anaesthesia and their complications. Also, some patients who are not fit for general or regional anaesthesia, have a high anaesthetic risk, and those who have skeletal comorbidities or deformities that prevent their proper positioning for endoscopic procedures are also candidates for ESWL therapy. Moreover, in some emergency situations, e.g. acute urinary retention (AUR) due to a stone in the posterior urethra or bladder neck, the patient can be managed immediately after relief of the retention by placement of a Foley catheter, thus without the delay of the preparation and induction of anaesthesia, which also increase the cost of the treatment.

In the present study, we describe our experience with ESWL monotherapy for the treatment of bladder stones of $\leqslant$20 mm, and show the different indications for such an approach.

Patients and methods

This study was prospectively planned and performed in two hospitals (Althawrah Modern General Hospital, and Ibn Sina Specialized Hospital) and approved by the scientific committees of these hospitals. Between November 2012 and November 2015, 44 patients who presented with urethral and bladder stones of $\leqslant$20 mm underwent ESWL monotherapy. All patients were male with a mean (SD; range) age of 40 (13.2; 11–64) years. The indications for choosing this approach varied: 16 patients presented with AUR due to bladder neck or posterior urethral stones and the remaining cases were either due to anatomical reasons preventing the lithotomy position, medical reasons making anaesthesia risky for the patients, or due to the patient's preference (Table 1).

The location and size of the stones was assessed by abdominal ultrasonography (US) and plain abdominal radiography of the kidneys, ureters and bladder (KUB; Fig. 1). Patients with a history of urethral strictures, symptomatic BPH, and those with radiolucent stones or stones of $>$20 mm were excluded. Basic investigations; laboratory (complete blood count, coagulation profile, and urine analysis and urine cultures) and radiological (KUB and US) were performed in all patients. Prophylactic antibiotics, in the form of a third generation cephalosporin (ceftriaxone 1 g; i.v.), were started for all patients before insertion of the catheter and continued for 5 days after the procedure with a second generation oral cephalosporin (cefuroxime 250 mg twice daily). After fixation of a 16-F Foley catheter for adults or 10–12 F for children, supine ESWL was performed as an outpatient procedure (Fig. 2).

Two ESWL machines with electromagnetic shockwave generators were used (Simens and Dorneir Compact Delta). ESWL was done under i.v. analgesia (dextrose 5% with 75 mg diclofenac sodium i.v. infusion and 50 mg pethidine i.v.). In three children (aged $<$15 years), the procedure was done under i.v. anaesthesia by an anaesthesiologist (propofol + dextrose 5% i.v. slowly) followed by observation until complete recovery. The catheter was removed after confirmation of stone fragmentation by KUB.

Results

The mean (range) size of the stones was 15.8 (9–20) mm. Fine fragmentation was achieved and uncomplicated spontaneous evacuation occurred without the need for

Table 1 Indications for ESWL monotherapy of bladder stones in the present cohort of 44 male patients.

Indication	Number of patients (%)
AUR	16(36.4)
Difficult lithotomy position	9(20.4)
Wish of patient – fear of endoscopic procedure	8(18.2)
Wish of patient – fear of anaesthesia	6(13.6)
Patients with a high anaesthetic risk	5(11.4)

Figure 1 KUB image.

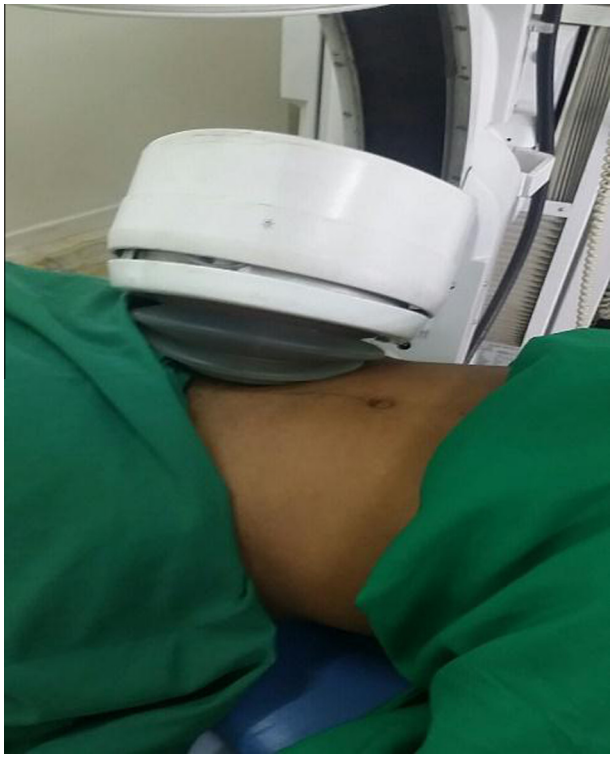

Figure 2 Supine ESWL.

adjuvant procedures in 40 patients (90.9%). Four patients (9%) developed AUR due to urethral impaction of large stone fragments. In two of them, the urethral catheter was successfully re-inserted pushing the fragments back to the bladder and a complementary session of ESWL resulted in more fragmentation of the stones with spontaneous evacuation after catheter removal. In the other two patients (4.5%) the catheter could not be re-inserted and urgent endoscopic intervention was required. The mean (range) number of shocks per stone was 2797 (2000–4000) shocks with a rate of 60–100 shocks/min and a mean (range) voltage of 17.5 (12–18) kV. There were no serious complications during or after the procedure.

Discussion

One of the first questions to arise in the mind of any patient with stone disease, including bladder stones, is whether his stone is feasible for treatment with ESWL, which will avoid the risks of anaesthesia and interventional procedures and allow for a quick return to work and normal life. The use of ESWL for treating renal and ureteric stones is well established [2]. Its success for treatment of bladder stones has been questioned, mainly because of the mobility of the stone in the bladder cavity. The initial reports on the feasibility and safety of ESWL as a treatment option for bladder stones were published in the early 1990s [5], but some of them restricted ESWL to only an adjunctive method for fragmentation of large bladder stones prior to endoscopic treatment [9,10]. Others performed ESWL for bladder stones secondary to BPH before TURP [11]. In 1996, Kostakopoulos et al. [7], reported on the successful ESWL monotherapy of 36 bladder stones as an outpatient procedure with a success rate of 72%, with 28% requiring adjuvant cystoscopic removal. Bhatia and Biyani [12] compared open surgery with transurethral litholapaxy and ESWL for the management of bladder stones. Although open surgery has the highest success rate (100%), it had the longest hospital stay (5.2 days). ESWL showed an advantage of a lesser hospital stay 4 h vs 2.4 days for endoscopic treatment and no complications compared to endoscopic treatment with a complication rate of 25%. The success rate was 95%, as 5% of patients required two sessions of ESWL for complete fragmentation of the stones. Our present study had

similar results with a 95.5% success rate with ESWL monotherapy and only two patients (4.5%) required adjuvant endoscopic intervention.

The inclusion criteria for treatment of bladder stones by ESWL are variable in different studies. Whilst some studies restricted its use to patients with no BOO, others included any bladder stone regardless of the outlet or bladder status [5,11]. Delakas et al. [13] reported on ESWL treatment of bladder stones in 52 patients, of whom ~50% had BOO and ~20% had bladder neuropathy. However, postoperative adjunctive endourological procedures were necessary in ~19% of them. Al-Ansari et al. [8] applied ESWL of bladder stones only in an emergency setting for male or female patients presenting with AUR due to urethral stones. In our present study, we widened the indications for this approach and found situations other than AUR where ESWL monotherapy for bladder stones can be applied but still excluding any case with BOO.

The proper patient positioning for ESWL of bladder stones is also debated. Whilst some suggest a prone position [6] others recommend a supine position [9]. We assume that in the prone position, the sacrum may hinder stone fragmentation to some extent, thus all our present cases were done in a supine position without any observed intestinal complications. With the Foley catheter in place, the stone is stable in the empty bladder and can be fragmented easily.

The optimum size of the bladder stone for ESWL has not yet been defined. There is no consensus about the threshold value of the stone size beyond which ESWL treatment is not effective. Some recommend a stone size between 10 and 20 mm and up to 25 mm for ESWL monotherapy [8,10,13], whilst others report no restriction on the size or number of the stones if ESWL treatment is performed as an adjunctive method prior to endoscopic treatment [9,11]. In our present study, the aim was ESWL monotherapy, so we restricted the size to $\leqslant$20 mm, which is the recommended optimum size for ESWL of renal stones.

The lack of published reports on ESWL monotherapy of bladder stones and the lack of familiarity of most urologists with this approach encouraged us to conduct the present study. Nevertheless, the present study has several limitations, which need to be addressed in further studies. The impact of stone composition, UTI, and stone burden (assessed by more accurate methods such as stone volume) on treatment outcome should be considered.

Conclusions

ESWL monotherapy is a safe and effective method for the treatment of bladder stones of $\leqslant$20 mm in patients with no other causes of infra-vesical obstruction. Several indications can be met including patients with high anaesthetic risk, patients fearing anaesthesia or endoscopic procedures, patients who have difficulty in positioning for endoscopic interventions, and patients who present with AUR due to urethral or bladder stones. The success rate is high and complications are negligible.

Conflicts of interest

None disclosed.

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