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Safety and efficacy of cystoscopically guided percutaneous suprapubic cystolitholapaxy without fluoroscopic guidance

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KEYWORDS

Safety;
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ABBREVIATIONS

KUB, plain abdominal radiograph of the kidneys, ureters and bladder;
PCCL, percutaneous cystolitholapaxy;
QoL, quality of life;
SWL, shockwave lithotripsy;

Abstract ***Objective:*** To evaluate the safety and efficacy of percutaneous cystolitholapaxy (PCCL) under cystoscopic guidance and without fluoroscopy for the management of large or multiple bladder stones.

Patients and methods: Prospectively collected data were reviewed for patients undergoing PCCL with cystoscopic guidance and without fluoroscopy. Patients with a bladder stone burden of $\geqslant 30$ mm were included. Stone fragmentation was achieved using a pneumatic lithotripter through a rigid nephroscope and the fragments were removed with peanut forceps. Patients with concomitant bladder malignancy, previous pelvic radiotherapy, previous pelvic–abdominal surgery, or benign prostate enlargement of >80 mL were excluded from the study.

Results: In all, 40 male patients were included between July 2011 and June 2014 with a mean (SD) age of 36.9 (17.6) years. A single bladder stone was detected in 22 (55%) patients, whilst 18 (45%) had multiple bladder stones, with a mean (range) stone size of 35 (32–45) mm. The stone-free rate was 100% and the procedure was well tolerated by all patients. No intraoperative bladder perforation, bleeding or major perioperative adverse events were recorded. The mean (SD) hospital stay was 2.2 (0.41) days and the catheterisation time was 1.2 (0.6) days. At 4 weeks postoperatively, no significant stone fragments were found in any of the patients.

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TUCL; transurethral cystolitholapaxy; US, ultrasonography

Conclusion: PCCL under cystoscopic control and without fluoroscopy seems to be an effective and safe technique to remove large or multiple bladder calculi. It represents an alternative treatment option, especially in situations where fluoroscopy is not available, and radiation hazards can be avoided.

Introduction

Urinary bladder calculi represent ~5% of urolithiasis [1], most commonly solitary although multiple stones are found in ~25% of cases [2]. The management options for vesical lithiasis have changed dramatically with the development of endourological fibre-optic instruments and extracorporeal shockwave lithotripsy (SWL) [3]. Various techniques have been used for the management of bladder calculi, such as open cystolithotomy, transurethral cystolitholapaxy (TUCL), SWL, and percutaneous cystolitholapaxy (PCCL) [4,5]. However, the ideal treatment option for bladder stones remains controversial [3].

Despite its restriction in children with a narrow urethra, TUCL has gradually gained enough popularity to replace open cystolithotomy [6]. PCCL, which uses the principles of percutaneous nephroscopic stone removal under fluoroscopic guidance, is a well-established technique with high efficacy, particularly when treating large or multiple bladder stones, and has fewer adverse events than TUCL [4,5]. Compared with transurethral surgery PCCL has advantages, as stones are visualised better, it is not limited by prostate enlargement, can deal with large and multiple stones, and fragments are easily removed through the large calibre Amplatz sheath [4].

Although, fluoroscopic guidance in PCCL is recommended, it is not always available in many centres in developing countries. Therefore, we report our experience in the present study in treating men with large or multiple bladder stones by suprapubic PCCL, guided with cystoscopy without fluoroscopy. We believe that this may help to increase the therapeutic effectiveness and decrease the morbidity and complications associated with vesical calculi removal procedures.

Patients and methods

A prospectively maintained database for patients who underwent PCCL was reviewed between July 2011 and June 2014 for patients with bladder stones burdens of $\geqslant 30$ mm.

Patients excluded from the study were those with concomitant bladder pathology such as: malignancies, previous pelvic radiotherapy, previous pelvic-abdominal surgery, or severe LUTS secondary to BPH of >80 mL, in whom open surgery may be required. The IPSS and quality of life (QoL) index were used to assess the bothersomeness of LUTS.

All patients underwent a complete preoperative evaluation including: a full medical history; physical examination; laboratory investigations including urine analysis, urine culture and sensitivity; preoperative laboratory assessment; and imaging studies including abdominopelvic ultrasonography (US) and plain abdominal radiograph of the kidneys, ureters and bladder (KUB). The details of the operative procedure were explained to all patients before obtaining informed consent.

Surgical procedure

A prophylactic preoperative antibiotic injection was administered to patients with sterile urine; those with bacteriuria were treated according to the culture and sensitivity results. The procedures were performed under caudal or spinal anaesthesia with i.v. sedation. In the lithotomy position, urethrocystoscopy was initially performed and the bladder filled with normal saline to make suprapubic access easier. The anterior wall of the bladder was endoscopically observed to provide continuous intravesical guidance for the percutaneous approach. The cystoscope helps to provide continuous intravesical guidance for the puncture and dilatation during the percutaneous approach and avoids injury of the posterior wall of the bladder and the rectum. Also, all steps of the PCCL can be monitored by the assistant surgeon to avoid slippage of the guidewire or loss of the tract and the sheath, and can be used to direct the nephroscope towards missed stones. The cystoscope was not left *in situ* throughout the procedure but only to establish the access for the percutaneous tract and at the end of the procedure, when suction of the stone fragments was needed.

A suprapubic puncture was made with an 18-G needle through a 1–2 cm transverse skin incision above the symphysis pubis. The obturator was then removed and a 0.97 mm (0.038″) floppy-tip guidewire was advanced into the bladder through the needle and coiled inside the bladder. Dilatation of the cystostomy tract over the wire followed, using Alkens' coaxial dilators, to allow insertion of the Amplatz sheath with an inner diameter of 30 F. A 26-F rigid nephroscope was then advanced into the bladder, and the stones were

fragmented using the Swiss Lithoclast. Stones of < 10 mm were actively removed with a grasper through the percutaneous route, whilst smaller fragments were flushed from the sheath by irrigation of saline through the cystoscope. At the end of the procedure, an Ellik evacuator was used to remove small stone fragments followed by whole bladder flushing through the cystoscope or the percutaneous working sheath to produce a unidirectional irrigation jet to eliminate any residual fragments through the percutaneous working or cystoscopy sheath.

After complete stone clearance, the wound was closed with one or two sutures and a silicone urethral catheter was fixed. The urethral catheter was removed after the urine cleared and patients were discharged home if voiding was satisfactory. KUB and/or US of the urinary bladder were performed after removal of the urethral catheter to document complete stone clearance. All patients were followed-up after 2 weeks by urine analysis with culture and sensitivity. The Clavien–Dindo classification system was used to grade postoperative complications.

Statistical analysis

Data were analysed using the commercially available Statistical Package for Social Sciences for windows, version 20 (IBM© SPSS, Armonk, NY, USA). Descriptive data are presented as the mean (SD) for continuous variables and the number and percentage for categorical variables. Postoperative continuous variables were compared with their baseline values using the paired *t*-test; a two-sided $P < 0.05$ was considered to indicate statistical significance.

Results

A total of 40 patients were included with a mean (SD; range) age of 36.9 (17.6; 5–60) years. A single bladder stone was detected in 22 (55%) patients, whilst 18 (45%) had multiple bladder stones (Fig. 1). The mean (range) stone size, measured by the longest axis of the stone, was 35 (32–45) mm, determined by preoperative KUB and pelvic US. A success rate of 100% was achieved, with complete stone clearance in all 40 patients.

BPH was diagnosed in 16 patients who were on α-adrenergic blockers with or without 5α-reductase inhibitors in 11 and 5 patients, respectively. The mean (SD) IPSS score was 15.4 (2.3) and the QoL score was 3.2 (0.9). At 4 weeks postoperatively, the mean (SD) QoL score significantly improved [2.1(1.2) vs 3.2(0.9); $P < 0.001$] with a comparable improvement in the IPSS [14.6 (2.4) vs 15.4 (2.3); $P = 0.13$]. Patients with BPH continued their prostatic medications postoperatively, whilst only five of them underwent late TRUS.

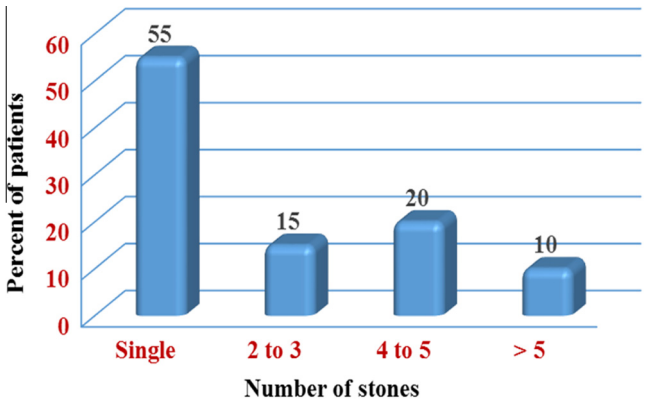

Figure 1 Distribution of the number of vesical stones in the study patients.

In all, 12 patients had neurogenic bladder dysfunction and two patients had neglected ureteric stents, around which large bladder stones had been formed. Both ureteric stents were removed smoothly without difficulty or breakdown.

The mean (SD; range) operative time was 26.5 (3.27; 20–30) min, the mean (SD) duration of urethral catheterisation was 1.2 (0.41) days, and the mean (SD; range) hospital stay was 2.2 (0.41; 1–5) days. There were no major intraoperative complications and postoperatively only two patients developed a fever > 38 °C (Grade II Clavien–Dindo complications), and they were treated conservatively with antibiotics, antipyretics, and i.v. fluids.

Discussion

The optimal management of bladder calculi is still controversial [3]. Currently, various approaches have been used, including TUCL, PCCL, extracorporeal SWL, and open surgery [4,5]. The choice of surgical approach and method of stone disintegration depends on the availability of equipment, surgical experience, underlying comorbidities, and stone characteristics such as stone size, number, and composition [7].

Open suprapubic cystolithotomy has maximised the stone clearance rates in a single session, especially for large calculi, but it has been associated with greater morbidity and a prolonged hospital stay [7]. Although open surgery may be the best available method for very large stones, especially when associated with BPH, minimally invasive procedures are preferred for simpler cases [8].

SWL is a simple and well-tolerated approach, especially in high-risk patients, as it is performed on an outpatient basis without anaesthesia and with a stone-free rate of 72–99% in managing bladder calculi [7,9]. However, > 17% of patients require adjunctive cystoscopy for evacuation of stone fragments [10].

TUCL is the most frequently used approach for bladder stone removal owing to its high efficacy rates [3], despite being associated with an increased average operative time and potential urethral injury, especially in boys secondary to the small urethra [8].

PCCL is a well-established technique with high efficacy, particularly when treating large or multiple bladder stones. In addition, it has fewer complications than TUCL [4,5]. Urethral injuries can be avoided and it can achieve high clearance rates for large or multiple stones [11]. Moreover, it can be safely and effectively performed under local anaesthesia and it might also prove useful when prolonged urethral instrumentation should be avoided, such as in patients with a penile prosthesis or an artificial urinary sphincter and orthotopic neobladder [12]. Nevertheless, the suprapubic approach has been associated with rectal and vascular injury and it is contraindicated in urothelial carcinoma [11]. TUCL and resection of the prostate has been reported to be difficult with a high incidence of morbidity in patients with large, hard or multiple stones and a large prostate, especially the middle lobe [9]. In these cases, PCCL may be a good alternative to manage the stone followed by TURP, as visualisation is excellent during rapid stone fragmentation, and resection of the prostate is faster with continuous suprapubic drainage [8].

We observed that conventional cystolithotomy is widely used as a first line of treatment in most centres in Egypt, especially in rural areas due to the limited availability of endoscopic equipment and fluoroscopy. So, the present study was conducted to evaluate the efficacy and safety of PCCL without fluoroscopy under cystoscopic guidance for management of large or multiple bladder stones. Surprisingly, all included patients were males despite that female sex was not an exclusion criterion for the present study. This could be explained by the fact that males generate bladder stones more frequently than females, especially as they get older.

In the present cohort, PCCL under cystoscopic guidance was used in children, with the use of mini-cystoscopes, regardless of the number of the stones or associated prostatic hyperplasia. The mean operative time was 26.5 min, which is slightly longer than previously reported [13]. This may be due to the smaller number of stones and decreased overall stone size in the latter study. No major intraoperative complications were encountered and only two patients had postoperative fever (>38 °C), and were treated conservatively. Others have reported self-controlled haematuria [14], and rectal and vascular injury [11] with the suprapubic approach. The lower incidence of complications in the present study seems to be due to direct visual control via the cystoscope during the puncture and dilatation of the tract.

Breda et al. [15] reported that endoscopically assisted PCCL is a safe and effective treatment for calculi in reconstructed bladders. The benefits of short convalescence periods and low morbidity make it preferable and support its role as a viable alternative to open cystolithotomy.

Complete stone clearance was achieved in all 40 patients (100%) in our present study. This was probably due to the double visual control, via the cystoscope and nephroscope, to find any missed stone or gravel, and by the continuous flushing of the gravel through the Amplatz sheath.

The cystoscope helps to provide continuous intravesical guidance for the puncture and dilatation during the percutaneous approach and avoids injury of the posterior wall of the bladder and rectum. This is of great importance in the absence of the C-arm. In addition, all steps of the PCCL can be monitored by the assistant to avoid slippage of the guidewire or the sheath and loss of the tract, this helps to shorten the operative time. Furthermore, it helps to flush any stone residual beside it, by directing the Amplatz sheath towards the stones, which helps to minimise intraoperative time and the incidence of missed stones. In addition, cystoscopy is an essential preliminary step in the management of bladder calculi to exclude associated pathology. The small cystoscopes definitely minimise the urethral hazards, in addition to the absence of radiation hazards from fluoroscopy.

The retrospective nature, small sample size, and lack of a control group represent the main limitations of the present study. Another limitation is the lack of pressure-flow studies to differentiate conditions of neurogenic bladder dysfunction and consequently avoid the possibility of fistula formation after removal of the urethral catheter. However, the present procedure seems to be a good alternative option for management of large or multiple bladder stones where fluoroscopy is not available.

Conclusion

PCCL under cystoscopic control and without fluoroscopy seems to be an effective and safe technique to remove large or multiple bladder calculi. It represents an alternative treatment option to open surgery or TUCL, especially in the setting where fluoroscopy is not available, and radiation hazards can be avoided.

Conflicts of interest

None declared.

Source of funding

None.

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