

Transurethral cystolithotripsy with a ureteroscope under local urethral anaesthesia and sedoanalgesia

Hakki Uzun,¹ Yakup Tomak,² Orhan Ünal Zorba,³ Habip Bostan,⁴ Mehmet Kalkan⁵

Abstract

Objective: To investigate if transurethral cystolithotripsy with a ureteroscope is feasible under local urethral anaesthesia, intravenous sedation and analgesia (sedoanalgesia).

Methods: The prospective study was conducted from December 2009 to October 2010 and comprised 18 male patients with bladder calculi over 10mm in widest diameter regardless of etiology. The patients underwent transurethral holmium laser cystolithotripsy with a 9.5f semi-rigid ureteroscope. All patients received 2% idocaine gel local urethral anaesthesia, intravenous 0.03mg/kg midazolam and 7µg/kg alfentanil before the start of lithotripsy. Patients were discharged 1-3 hours after removal of the urethral foley catheter. Patients were asked to scale the discomfort and/or pain level by using visual analogue pain scale. Patients were followed up for at least 6 months.

Results: The overall success rate was 89% (n=16). The mean stone diameter and total number of stones in the 16 patients was 21.48 ±6.7 (12-35) mm and 21 stones, respectively. The average age of the 16 patients was 52.3±17.6 (45-78) years and mean operative time from beginning of intravenous sedoanalgesia until urethral foley catheter insertion was 19.2±18.9 (4-60) minutes. Mean pain score of the 16 patients after ureteroscopic cystolithotripsy was 1.75±0.6cm (1-6). No anaesthesia-related serious complications occurred. After a follow-up of 18 months, recurrent stone formation and urethral stricture was not located in any patient.

Conclusions: Transurethral cystolithotripsy with a ureteroscope under local urethral anaesthesia and sedoanalgesia for stones less than 30mm might offer patients safer anaesthesia and shorter operative time with favourable results.

Keywords: Cystolithotripsy, Anaesthesia, Ureteroscope, pain. (JPMA 63: 961; 2013)

Introduction

Bladder calculi account for a small amount of urinary stones frequently seen in the elderly patients underlying many urological disorders. Shock-wave lithotripsy (SWL), transurethral or percutaneous cystolithotripsy and open surgery are the treatment modalities.¹ Open surgery is restricted to stones inappropriate for endoscopic treatment,¹ and SWL has several limitations, including the size and hardness of the calculi, pain development during the procedure and acquirement of multiple sessions.² Transurethral or percutaneous cystolithotripsy have become the treatment of choice in the management of bladder calculi over a size of 10mm and has been usually performed under spinal or general anaesthesia.^{2,3}

Several trials have been done to assess the feasibility of local urethral anaesthesia and/or sedoanalgesia for ureteroscopic lithotripsy, percutaneous nephrolithotomy and suprapubic cystolithotripsy⁴⁻⁷ but, to our knowledge, transurethral cystolithotripsy has not been investigated.

^{1,3}Department of Urology, ^{2,4}Department of Anaesthesiology, Rize University School of Medicine, Rize, ⁵Department of Urology, Fatih University Sema School of Medicine, Istanbul, Turkey.

Correspondence: Hakki Uzun. Email: hakuzun@yahoo.com

In relation to smaller sizes of ureteroscopes compared to rigid cystoscopes, we hypothesised that the ureteroscopes may allow transurethral cystolithotripsy without spinal or general anaesthesia.

Alfentanil and midazolam sedoanalgesia has been shown to be effective and safe for endourologic interventions⁸ and SWL.⁹ Rigid cystoscopes are not feasible under local anaesthesia for transurethral cystolithotripsy. Thus, the study tried to investigate if transurethral cystolithotripsy could be performed with a ureteroscope at comparable success rates under local urethral anaesthesia and sedoanalgesia to decrease the procedure's morbidity in terms of risk of anaesthesia, post-operative urethral stricture development, analgesic requirement, anaesthesia preparation, recovery and hospitalisation time.

Patients and Methods

The study included all adult men diagnosed with one or several bladder stones regardless of the etiology. The patients were initially assessed at the urology polyclinic and were briefed on the possible benefits of operation under local urethral anaesthesia and sedoanalgesia with a ureteroscope. Visual analogue scale (VAS) was determined as the primary end point. A written consent

form was obtained from each patient and the institutional ethics committee of our university approved the study.

The prospective study was conducted between December 2009 and October 2010. All patients in the study had bladder calculi over 10mm in the widest diameter. Exclusion criterion was based on uncorrected coagulopathy, allergy to opioids, history of drug or alcohol abuse, urethral stricture, and female gender. Additionally, patients with a decision of a simultaneous transurethral prostatectomy were also excluded. All patients were treated on an outpatient basis.

The pre-operative evaluation included medical history, physical examination, blood tests, urine culture, plain kidney, ureter and bladder (KUB) X-ray, and ultrasonography of the urinary tract. The maximum diameter of stones in millimeters and prostate volume were measured on plain KUB X-ray or suprapubic ultrasonography. All patients had sterile urine cultures before the operation.

Cystolithotripsy was performed in the operating theatre. In all patients electrocardiography (ECG), blood pressure, heart rate, and peripheral oxygen saturation (SpO₂) were monitored continuously throughout the procedure. Supplemental oxygen 3 L/min was administered with facemask. The patient was set up for operation in the lithotomy position and 10ml 2% lidocaine gel was instilled into the urethra and retained by a penile clamp for 10 minutes. Then, all patients received 0.03mg/kg midazolam and 7µg/kg alfentanil before the start of lithotripsy. Initially, a 6f small catheter was inserted through the urethra to the bladder for continuous drainage during the procedure. Finally, the operator inserted the 9.5 f semi-rigid ureteroscope (Storz, Germany) beside the 6f catheter and advanced to the bladder. The stones in the bladder were easily visualized. The 365 micrometer end-firing holmium: yttrium-aluminium-garnet (YAG) laser fibre (Stonelight, USA) was inserted through the ureteroscope and the stones were fragmented. The laser energy was set at 1J per 10Hz. During the procedure, as the bladder overdistended, the procedure was not interrupted and the bladder was drained through the ureteroscope. Stones were disintegrated to the smallest fragments possible in order to eliminate the need of basket retrieval of calculi

fragments. The fragments were left for spontaneous passage and urethral foley catheter was inserted and left in place for one hour. Patients were discharged 1-3 hours after removal of the urethral foley catheter. All procedures were performed by a single operator.

Patients were asked to scale the discomfort and/or pain level experienced during the procedure using a 10-point linear VAS before leaving the operating theatre.

All patients underwent post-operative KUB X-ray and ultrasonography after one week. Complete clearance was defined as absence of any fragment. Patients were followed up for at least 6 months. Uroflowmetry and clinical examination was done to exclude urethral stricture.

Results

Of the 18 patients who were initially enrolled, 2 (11.11%) patients with bladder calculi of 4 and 7cm turned into open cystolithotomy due to the prediction of 2-3 hour excessive fragmentation time related to stone composition and required conversion to general anaesthesia. They were regarded as failure and removed from the study. The success rate, as such, was 89% (n=16). Eight of the patients were recurrent stone formers and in 6 patients etiology was unknown. Only 4 patients with bladder stones were considered to be related to benign prostate hyperplasia and were at high risk for spinal or general anaesthesia. The mean stone diameter and total number of stones in the 16 patients was 21.48±6.7 (12-35)mm and 21 stones, respectively. The average age of the 16 patients was 52.3±17.6 (45-78) years and mean operative time from beginning of intravenous sedoanalgesia until urethral foley catheter insertion was 19.2±18.9 (4-60) minutes and mean prostate volume was measured to be 50.7±20.4 (30-80)mL. The procedure was completed within 30 minutes in 14 (87.5%) patients. Two (12.5%) patients with >30 minutes (50 and 60 minutes) had 1 (35mm) and 4 (10-20mm) stones, respectively, and received a second repeat dose of alfentanil and midazolam.

Complete stone fragmentation was achieved and the whole procedure was well tolerated in all patients with low pain scores. Mean pain VAS score of patients was

Table: Visual analogue scale and patient characteristics.

VAS	Number	%	VAS (mean ± sd) (cm)	No of stones / diameter (mean ± sd) (mm)	Operative time (minute)
Mild	14	88	1.28±0.5	16/21.9±4.5	<30
Moderate	2	12	4±0.92	1/35±17.3	50
			6±1.41	4/16.25±13.2	60

1.75±0.6cm (1-6cm). The 14 patients with an operative time less than 30 minutes had a mean VAS score of 1.28±0.5 (1-2) cm. The 2 patients with a VAS score of 4±0.92 and 6±1.41cm had operative times of 50 and 60 minutes, respectively (Table).

Antibiotics were administered only on the operation day. No anaesthesia-related serious complications occurred. Only 2(11.11%) patients that turned into open cystolithotomy required post-operative analgesics. During the cystolithotripsy, no painful jerky movement and mucosal injury of the bladder were noticed. No patient experienced discomfort or pain to force discontinuation of the procedure.

A week after the operation, the patients were evaluated with a KUB X-ray, bladder ultrasonography and urinalysis. Residual fragments were not observed in any patient. After a follow-up of 18 months, recurrent stone formation and urethral stricture had not developed.

Discussion

Endoscopic treatment of distal ureteral stones under local anaesthesia and sedoanalgesia have been attempted^{4,5} but, fear of jerky movement and uncertain compliance of patients have meant that operations still got performed under spinal or general anaesthesia. Fortunately, patients with bladder calculi are out of these disadvantages. Previously, a study used flexible cystoscope to treat the bladder calculi greater than 3cm with holmium laser under local anaesthesia and intra-muscular pethidine analgesia in patients incapable of receiving spinal or general anaesthesia.¹⁰ However, it excluded those with prostate volume larger than 50ml where flexible or rigid cystoscopes might have an increased risk for bleeding from prostatic urethra and could cause poor vision. Prostate volume was not an exclusion criteria in the current study and we did not experience any bleeding that spoiled the vision. Urethral bleeding might also predispose patients to an increased risk for infection. Additionally, cystolithotripsy with cystoscopes might cause a higher risk for pain and discomfort in case of enlarged prostates. Furthermore, flexible cystoscopes made from holmium:YAG laser fibre, result in more costs. Consequently, semi-rigid ureteroscopes were more convenient, feasible and handy compared to the cystoscopes.

Ureteroscopes are designed for ureteral stone management and, to our knowledge, this is the first report of usage in adults for transurethral cystolithotripsy. A study used ureteroscope for transurethral cystolithotripsy in children and found the procedure effective and safe with reduced hospital stay and overall

costs.¹¹ However, it noted that spontaneous passage might fail due to large stone fragments formed by pneumatic lithotripsy. In contrast to pneumatic lithotripter, holmium laser constitutes smaller fragments during disintegration that can be easily passed spontaneously.¹² Additionally, that due to smaller sizes, ureteroscopes might have lower rates of post-operative urethral stricture than cystoscopes. Improvement of technology to decrease the size of the ureteroscope would increase the value of these advantages. However, research and development sections of companies may invest new smaller endoscopes for cystolithotripsy.

Spinal anaesthesia is an invasive procedure in comparison with sedoanalgesia and has several disadvantages and complications. Post-operative backache, post-dural puncture headache, urinary retention, transient neurologic symptoms, high or total spinal anaesthesia, cardiac arrest, systemic toxicity, meningitis, arachnoiditis, and spinal haematoma are the main complications.¹³ Additionally, repetitious injections during spinal anaesthesia might cause severe pain, and post-operative headache might lead to re-hospitalisation in some patients. Furthermore, spinal anaesthesia has longer anaesthesia preparation and recovery time. Sedoanalgesia does not have these restrictions and is favourable. It provides shorter operative and hospitalisation time, no serious infection, less pain, early return to work and daily activities, and minimises patient discomfort. Sedoanalgesia might also reduce the costs per anaesthesia. A study reported that combination of intravenous alfentanil and midazolam was safe and provided adequate analgesia for many endourologic procedures and was considered superior by 18 patients who had previously had spinal anaesthesia.⁸ They found that the alfentanil- midazolam sedoanalgesia provided shorter anaesthesia recovery time with a 46% decrease in costs. These benefits highlight the local ureteroscopic cystolithotripsy being performed as an outpatient procedure.

The concern against performing transurethral cystolithotripsy under local urethral anaesthesia and sedoanalgesia might be the fear about patient discomfort due to possible prolongation of the operation. However, the operation was well tolerated in our patients to 30 minutes. We believe that the smaller caliber of the ureteroscope in comparison with cystoscope is the reason of low pain scores. Our experience suggests that only 2% lidocaine gel local urethral anaesthesia without sedoanalgesia might also be enough. We found the diameter of stones of all 14 patients with a VAS score less than 20mm and an operative time less than 30 minutes to

be below 30mm. In other words, we noticed that the diameter of stones in 2 patients with moderate pain (VAS >30mm) was over 30mm. Bladder calculus in patients with a sum of over 30mm might not be appropriate for local urethral anaesthesia and sedoanalgesia in contradiction to an earlier report.¹⁰ Additionally, the 2 excluded patients with bladder calculi of 4 and 7cm showed that as the stone diameter increased, the operative time prolonged and the treatment became inappropriate with our protocol. The composition of stone is another factor in predicting the outcome of the operation. Nevertheless, there is always a chance to turn the operation into percutaneous cystolithotomy or open surgery. Moreover, patients incapable of receiving spinal or general anaesthesia can be treated with multiple sessions of our protocol. Another concern might be that ureteroscope had narrower view in the bladder compared to the cystoscopes, but we did not encounter any difficulty in terms of vision.

The limitation of our study was lack of a control group treated under spinal or general anaesthesia with rigid cystoscopes. However, the objective of our study was to avoid spinal or general anaesthesia with acceptable VAS score, and the two groups would have been uncomparable.

Conclusion

Local urethral anaesthesia and the analgesic effect of alfentanil and the sedative effect of midazolam seemed to be sufficient for transurethral cystolithotripsy for stones less than 30mm. The protocol might offer patients safer anaesthesia and shorter operative time with favourable results. Further randomised studies should be conducted for bladder calculi less than 30mm under only local

urethral anaesthesia to push cystolithotripsy out of the operating room and towards office settings.

References

1. Bhatia V, Biyani CS. Vesical lithiasis: open surgery versus cystolithotripsy versus extracorporeal shock wave therapy. *J Urol* 1994; 151: 660-2.
2. Papatsoris AG, Varkarakis I, Dellis A, Deliveliotis C. Bladder lithiasis: from open surgery to lithotripsy. *Urol Res* 2006; 34: 163-7.
3. Demirel F, Cakan M, Yalçinkaya F, Demirel AC, Aygün A, Altug UU. Percutaneous suprapubic cystolithotripsy approach: for whom? Why? *J Endourol* 2006; 20: 429-31.
4. Hosking DH, Bard RJ. Ureteroscopy with intravenous sedation for treatment of distal ureteral calculi: a safe and effective alternative to shock wave lithotripsy. *J Urol* 1996; 156: 899-902.
5. Park HK, Paick SH, Oh SJ, Kim HH. Ureteroscopic lithotripsy under local anaesthesia: analysis of the effectiveness and patient tolerability. *Eur Urol* 2004; 45: 670-3.
6. Aravantinos E, Karatzas A, Gravas S, Tzortzis V, Melekos M. Feasibility of percutaneous nephrolithotomy under assisted local anaesthesia: a prospective study on selected patients with upper urinary tract obstruction. *Eur Urol* 2007; 51: 224-8.
7. Tzortzis V, Aravantinos E, Karatzas A, Mitsogiannis IC, Moutzouris G, Melekos MD. Percutaneous suprapubic cystolithotripsy under local anaesthesia. *Urology* 2006; 68: 38-41.
8. Schow DA, Jackson TL, Samson JM, Hightower SA, Johnson DL. Use of intravenous alfentanil-midazolam anesthesia for sedation during brief endourologic procedures. *J Endourol* 1994; 8: 33-6.
9. Monk TG, Bouré B, White PF, Meretyk S, Clayman RV. Comparison of intravenous sedative-analgesic techniques for outpatient immersion lithotripsy. *Anesth Analg* 1991; 72: 616-21.
10. Kara C, Resorlu B, Cicekbilek I, Unsal A. Transurethral cystolithotripsy with holmium laser under local anesthesia in selected patients. *Urology* 2009; 74: 1000-3.
11. Isen K, Em S, Kilic V, Utku V, Bogatekin S, Ergin H. Management of bladder stones with pneumatic lithotripsy using a ureteroscope in children. *J Endourol* 2008; 22: 1037-40.
12. Teichman JM, Rogenes VJ, McIver BJ, Harris JM. Holmium:yttrium-aluminum-garnet laser cystolithotripsy of large bladder calculi. *Urology* 1997; 50: 44-8.
13. Faccenda KA, Finucane BT. Complications of regional anaesthesia. Incidence and prevention. *Drug Saf* 2001; 24: 413-42.