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Outpatient Transurethral Cystolithotripsy of Large Bladder Stones by Holmium Laser

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Abstract

Introduction: To assessment of the efficacy and safety of transurethral cystolithotripsy of large bladder stones by holmium laser in the outpatient setting.

Methods: In a prospective study, 48 consecutive adult patients with large bladder stones, were enrolled for transurethral cystolithotripsy. Patients older than 18 years, with bladder stones larger than 2 cm were enrolled. Urethral stricture, active urinary infection, and any anesthetic contraindications for operation, were the exclusion criteria. Demographic characteristics of patients, outcomes and complications related to operation and post operation period, were recorded.

Results: Patients mean age was 46 ± 7.3 years. Male to female ratio was 45/3. Mean body mass index of patients was 28.5 ± 3.5. Mean stone size was 3.7 ± 1.6 cm. Mean operation time was 43.5 ± 15.5 minutes. Nearly complete stone clearance (98.5%) was achieved in all patients. Mean hospital stay was 6.5 ± 1.3 hours. No major complications were seen. Mean visual analog pain score (VAS) was 4.2 ± 2.1 and 1.4 ± 0.6, during and 1 hour after operation, respectively. During follow up of 22.4 ± 12.5 months, recurrence of bladder stone was not seen. No case of urethral stricture was detected.

Conclusion: Transurethral holmium laser lithotripsy is an effective and safe alternative in selected patients with large bladder stones. This procedure can be easily performed in the outpatient setting.

Keywords: Transurethral; Bladder stone; Holmium laser.

Introduction

Bladder stones constitute 5% of urinary lithiasis in the modern countries.[1] Many treatment modalities have been mentioned for bladder stones. Open surgery has the maximum effectiveness, but more morbidity which has limited the application of this modality.[2,3] Shockwave lithotripsy (SWL) is another modality for treatment of bladder stones. Application of this type of treatments is limited because of the potential for incomplete stone clearance.[3-5] Endourological treatments have provided the opportunity of bladder stone treatment with minimal morbidity and acceptable effectiveness.[3]

Endourological treatments can be classified into two categories: percutaneous and transurethral. Various kinds of mechanical lithotripters and holmium laser are used for stone fragmentation in both approaches. Percutaneous lithotripsy is an effective technique with low rate of complications, especially regarding urethral complications. Bladder carcinoma and history of abdominal surgery are the main limitations for percutaneous lithotripsy.[2,6-8]

Holmium laser lithotripsy has been a great revolution in the treatment of urinary lithiasis.[9-11] Application of holmium laser in the management of stones of urinary tract is well established. There is a great potential of outpatient application of holmium laser lithotripsy.[9] Treatment of larger stones with this modality is challenging, because of concerns on lengthened time of operation and effectiveness. We performed a prospective study to evaluate the successfulness, safety and morbidities of holmium laser lithotripsy for large bladder stones in the outpatient setting. We used Iranian made holmium laser device.

Methods

In this prospective study, we performed transurethral holmium laser lithotripsy for 48 consecutive adult patients with large bladder stones, from January 2011 to January 2015, at Shohada-e-Tajrish hospital of Tehran, Iran.

Patients older than 18 years, with bladder stones larger than 2 cm were enrolled. Urethral stricture, active urinary infection, urinary tracts cancers, and any anesthetic contraindications for operation, were the exclusion criteria. Patients who needed urinary tract operation rather than

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cystolithotripsy, including benign prostatic hyperplasia (BPH) patients were excluded.

We performed lab tests for all patients including cell blood counts (CBC), blood electrolytes and biochemistries (Na, K, Ca, P, BUN, and Cr), coagulation studies (PT, PTT, INR and platelet count), urine analysis and urine culture. Any detected urinary infections were treated before operation.

All medications and drugs, including adrenergic blockers, antihistamines, and anticholinergics, were stopped.

Before beginning the operations, a single dose of 1 g ceftriaxone and 50 mg pethidine were given intravenously, by the anesthesia service under close cardiopulmonary monitoring. After that, 20 cc of 2% lidocaine gel were instilled, and then penile clamps were used for 10 minutes in male patients. All operations were performed in standard lithotomy position. Semi-rigid, 19 Fr cystoscope (Karl Storz, Germany) was used for the procedures. Before lithotripsy, complete cystourethroscopy were done for detection of any urethral and bladder pathology other than lithiasis. Holmium laser apparatus (made in Iranian National Center for Laser Science & Technology, Iran) was set at 0.5 t 1 J and 5 to 15 Hz, and 365-550 micrometers end-fire fibers were used. Stone fragments were evacuated by irrigation, suction and grasper. At the end of the procedure, we performed cystourethroscopy for detection of any stone residues, and finally, 14-16 Fr foley was inserted. All the patients could be discharged from hospital on operation day if there was not any indication to remain at hospital. At the time of discharge from hospital, urethral catheters were removed. Oral antibiotic, ciprofloxacin 500 mg/Bid was continued for 24 hours.

Operation time was measured as the time after completeness of local anesthesia to insertion of foley.

Ten point (0: no pain, 10: worst possible pain) visual analog pain score (VAS) was used to assess pain during operation and one hour after operation.

Demographic characteristics of patients, operation time, stone clearance, catheterization time, intra-operative and post-operative complications, VAS during operation and one hour after, and finally, hospital admission time were recorded.

Patients were followed at 1, 3, 6, 9 and 12 months after operation. In the first visit, we performed pelvic x-ray (ultrasonography for previous non-opaque stones) for detection of stone residues. In every follow up sessions, if there was any suspicion of urethral complications, retrograde urethrography (RUG) was performed.

Informed consent was signed before any intervention, under the supervision of the committee of medical ethics. All the data were described by mean and variance values. SPSS 18 was used for data analysis.

Results

Mean age of patients was 46 ± 7.3 years. Male to female ratio was 45/3. Mean body mass index of patients was 28.5 ± 3.5. Mean diameter of stones was 3.7 ± 1.6 cm.

Mean operation time was 43.5 ± 15.5 minutes. Nearly complete stone clearance (98.5%) was achieved in all patients. Transient hematuria was seen in fourteen patients. Blood transfusion was not needed for any patients. No electrolyte changes were seen. Mean hospital stay was 6.5 ± 1.3 hours. Two patients were admitted for one night because of post-operative fever. Their fever was resolved by intravenous antibiotic therapy. Foley was removed in all patients when they were discharged. Retention happened in three patients after catheter removal. All of them were BPH patients.

No major complications were seen. Bladder wall perforation and extravasation did not happen. Cardiopulmonary and anesthesia problems were not detected during and after procedures. Four patients (8.4%), did not tolerate local anesthesia, therefor intravenous sedation was performed for them. Two of these four patients had operation time near to 50 minutes.

Mean values for VAS were 4.2 ± 2.1 and 1.4 ± 0.6, during and one hour after operation, respectively.

Mean follow up time was 22.4 ± 12.5 months. During follow up, recurrence of bladder stone was not seen. No case of urethral stricture was detected.

Discussion

Bladder stones can be classified as primary and secondary stones. Primary or endemic stones have close relationship to diet and some nutritional deficiencies.[12,13] These kinds of bladder calculi are more prevalent in developing parts of the world. Secondary bladder stones are mainly formed because of urinary stasis and bladder outlet obstruction. These types of bladder stones are more prevalent in developed and western countries. Although bladder stones constitute 5% of urinary stones in developed countries, there is no reliable and documented information about the prevalence of bladder stones in developing countries.[3,14]

There is a broad spectrum of modalities for treatment of bladder stones. Until the past decades, open cystolithotomy had been the standard treatment of bladder stones. Open surgery is an aggressive option, and despite the high rate of success, morbidity rate of the open lithotomy is higher than other therapies.[2-4]

Shockwave lithotripsy (SWL) is another modality for bladder stone lithotripsy. The advantage of SWL is the possibility for outpatient treatment, without need for spinal or general anesthesia. However, complete clearance of large stones is usually not achieved in one session, and multiple operations may be needed.[3-5,15,16]

Endourologic modalities are favorable and applicable options for the treatment of bladder stones.[3,14,17] These treatments are classified as percutaneous and transurethral approaches. Percutaneous cystolithotripsy (PCCL) is effective and feasible, but its application is limited in patients with previous abdominal surgery, also it is contraindicated in the presence of urothelial malignancies.[2,6-8] Transurethral lithotripsy can be performed by Swiss, ultrasonic, pneumatic and other types of lithotripter. Laser fibers are also used for lithotripsy. Holmium laser has

been a great revolution in the management of urinary lithiasis.[3,9-11] The smallest stone fragments are achieved by holmium laser, when compared with other tools of lithotripsy.[11,18] The zone of thermal injury by holmium laser is 0.5 to 1mm.[19] Therefore, holmium laser can be used near to the mucosal surface. Stone composition has minimal effect on the outcome of stone fragmentation.[20]

The method of holmium laser lithotripsy for larger bladder stones has been studied in literature.[3,14] Teichman et al reported successful application of holmium laser lithotripsy for bladder stones larger than 4 cm.[11]

In another promising study, Kara et al treated large bladder stones (>3 cm) with holmium laser under local anesthesia. Lithotripsy was performed using flexible cystoscope. The flexibility of the fibers provided the possibility of flexible cystoscope in transurethral lithotripsy. Mean hospitalization time for patients in that study was 2.3 days.[9] In our study, the mean time of hospital admission of patients was 6.5 ± 1.3 hours, and all of the patients, except two of them, were discharged the day of operation. The use of flexible cystoscope was promising in Kara's study. There are some limitations in using flexible cystoscope in cystolithotripsy. The small caliber of flexible cystoscope does not allow passage of 550 and 365 nm fibers, therefore reduces the efficacy of lithotripsy and increases the time of operation. Because of the "rolling" and the "floating" of the stones in the bladder during the procedure, cystolithotripsy by flexible cystoscope is technically difficult. Economic considerations also limit the extensive usage of this device.

Holmium laser has provided the possibility of simultaneous treatment of BPH and bladder stones. Resection of prostate gland can be performed through enucleation holmium laser enucleation of the prostate (HoLEP) or ablation (HoLAP) by holmium laser. Shah and associates reported successful and effective treatment of simultaneous BPH and bladder stones.[21]

One concern about transurethral lithotripsy is the risk of urethral stricture. In the mean follow up time of 22.4 ± 12.5 months, we did not detect any urethral stricture. This finding is in concordance with similar studies, so it seems that transurethral lithotripsy by holmium laser can be safe regarding urethral stricture, if all cautions are respected during operation.[3,9]

Major complications did not happen during this study. Complications such as transient hematuria were not threatening. Two patients that experienced low grade postoperative fever, were admitted for one night, and both of them were treated by antibiotic therapy. Bladder perforation was not seen, and mucosal injuries were limited and acceptable. According to these findings, transurethral holmium laser lithotripsy was associated with minimal complications and morbidities.[9,11,21]

Analysis of stone composition is very difficult in the holmium laser procedures. Fragment particles produced by holmium laser are similar to the sludge after lithotripsy, and after the irrigation no fragments remain for stone analysis. So, in the majority of patients, stone composition remained unclear.

The large number of patients with bladder stones during such limited time of study was because our study was performed in a large tertiary referral medical center. High referral rate of patients with neurogenic bladder could be a reason.

Our study had some limitations. Despite the prospective design of this study, it was not a comparative study. On the other hand, larger population is needed for definite judgment about safety and efficacy of transurethral holmium laser lithotripsy of large bladder stones. Multicenter randomized comparative studies are needed in this issue.

Conclusion

Transurethral holmium laser lithotripsy is an effective and safe alternative in selected patients with large bladder stones. This procedure can be easily performed in the outpatient setting.

Conflict of Interest

The author has no conflict of interest to declare.

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