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EFFICACY OF THE EGYPTIAN PNEUMATIC LITHOTRIPTOR USING CYSTOSCOPY IN VESICAL CALCULI TREATMENT

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Objective The majority of vesical calculi in adults can now be treated transurethrally with the use of different lithotriptors. The aim of this article was to study the effectiveness of the Egyptian pneumatic lithotriptor through a rigid cystoscope in the treatment of vesical calculi.

Patients and Methods Fourteen adult patients (12 males and 2 females) had single urinary bladder stones. Mean stone diameter was 20 mm. Through a cystoscopic sheath, a modified ureteric catheter was introduced into the bladder. Using the Egyptian pneumatic lithotriptor – KH. YG2, the pneumatic probes (rigid or flexible) were passed through the catheter for stone disintegration.

Results Successful stone disintegration was recorded in 13 patients (92.9%) where the patients were stone-free at the end of the procedure. Failure of stone fragmentation occurred in one case (7.1%). The stone was removed surgically. Its chemical composition was found to be calcium oxalate monohydrate. The average time of cystolithotripsy was 35 minutes. Hospitalization ranged from 12 to 24 hours which was longer (2 to 4 days) for those patients who had undergone other procedures. Minor complications such as mild hematuria (100%) and cystitis (21.4%) were observed. No major complications were noted.

Conclusion The use of the Egyptian lithotriptor during cytoscopy has been found to be an effective, easy, safe and economical method for the treatment of vesical stones.

Key words urinary bladder, stones, pneumatic lithotriptor

INTRODUCTION

Urinary bladder calculi have plagued mankind from time immemorial[1]. Archeologists have discovered a stone in the pelvis of an ancient Egyptian skeleton dating back more than 7000 years[2]. In certain parts of the world, the incidence of vesical calculi is high. In other areas a steady, pronounced decrease in the incidence of vesical stones has been noticed since the19th century which has been attributed to dietary and nutritional progress[3]. Vesical calculi predominantly affect men and account for 5% of all urinary calculi in the western world. Risk factors for bladder calculi include bladder outlet obstruction, neurogenic bladder, chronic bacteriuria (urea-splitting organisms), foreign bodies, bladder diverticula and, rarely, upper tract stones[4]. The majority of bladder calculi are struvite, but calcium oxalate and uric acid stones are also commonly encountered[5].

Several modalities exist for the treatment of bladder calculi, including stone dissolution with Suby G or M solution, cystolitholapaxy, cystolithotripsy with electrohydraulic, ultrasonic, laser or pneumatic lithotripsy, percutaneous cystolithotomy, and open cystolithotomy[4]. Shock wave lithotripsy may be another option[4,6].

The pneumatic lithotrite is used through a nephroscope for bladder stone disintegration[7]. The aim of this work was to evaluate the effectiveness of the Egyptian pneumatic lithotriptor through a rigid cystoscope for fragmentation of vesical calculi.

PATIENTS AND METHODS

This study was performed over a period of two years on 14 patients (12 males and 2 females) with vesical calculi. The patients' age ranged from 19 to 63 years. All patients had

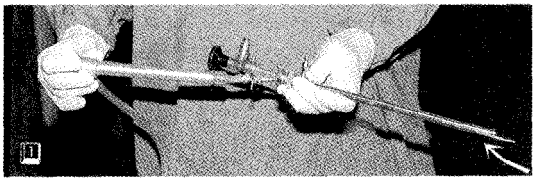

Fig. 1: The rigid probe is passed through the modified ureteric catheter with 2 cm of the proximal end jutting out. The handpiece is slightly above the bridge.

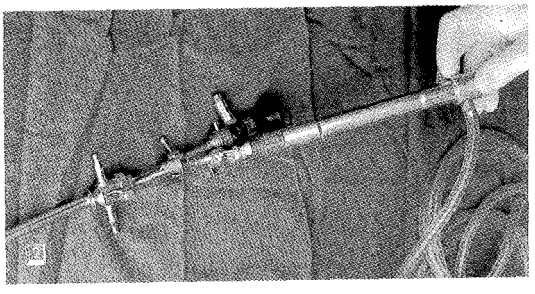

Fig. 2: Lateral view of the ureteric catheter inside the cystoscope with slight elevation of the handpiece of the pneumatic lithotriptor.

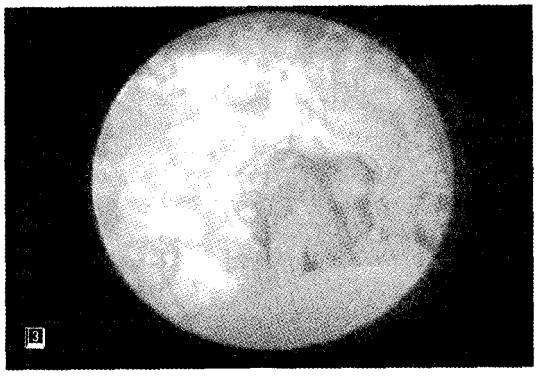

Fig. 3: The probe is in direct contact with the stone during disintegration

single bladder stones. The stone size in its greatest diameter ranged from 15 to 35 mm (mean =20 mm). Preoperative routine clinical examination and investigations including laboratory and imaging studies were done for all patients.

The following instrumentation was used:

1. 23.5F and 25F cystoscopic sheaths with their obturators, bridge and 0° and 30° telescopes (Karl Storz™).

2. Ellik evacuator

3. The Egyptian lithotriptor KH. YG2 with a pneumatic probe used for stone disintegration. Two types of probes were used, the rigid one (bladder probe) with a length of 40 cm and a diameter of 1.6 mm and the malleable one (ureteric probe) with a length of 68 cm and a diameter of 0.8 mm. The pressure of compressed air ranged from 2 to 6 bar. The lithotriptor has two operating modes namely single pulse or multiple pulses (15 pulses/second).

4. A modified ureteric catheter consisting of a ureteric 8F catheter whose upper end was cut to keep its length 33 cm with an open tip, so that only the proximal 2 cm of the rigid probe would be inside the bladder (Fig. 1, 2).

Technique

Under anesthesia, endoscopic inspection of the urethra and urinary bladder was done as a routine step. Through the bridge and cystoscopic sheath (23.5F or 25F) the modified ureteric catheter was moved up to the bladder. After the proper connection of the lithotriptor, the pneumatic probe (rigid or malleable) was connected to the handpiece which contains a small metal projectile. The probe was passed through the catheter to get in direct contact with the stone (Fig. 3). Stone disintegration was started under direct vision with a pressure of 3 bar and a frequency of 15 Hz. The pressure could be changed according to the stone resistance. During disintegration, it was important to keep the handpiece slightly upward above the level of the bridge (Fig. 1, 2). After complete stone disintegration, the stone particles were evacuated by using the Ellick evacuator, and a Foley's catheter was inserted.

One stone that could not be fragmented was extracted by open cystolithotomy. It was dried and its chemical composition was analyzed using infrared spectrometry.

RESULTS

Urinary bladder calculi were treated in 12 (85.7%) males and 2 (14.3%) females. Bladder stones associated with benign prostatic hyperplasia (BPH) were noticed in seven patients (58.3% of the male patients). Transurethral

resection of the prostate (TURP) was done after stone disintegration in two cases only while five patients refused any surgical intervention on the prostate. Distal ureteral stones were recorded in two male patients (14.3%) and were extracted by ureteroscopy before cystolithotripsy. Optical visual urethrotomy was done for one male patient (7.1%) who had a short urethral stricture.

Successful stone disintegration was recorded in thirteen patients (92.9%). Failure of stone fragmentation occurred in one patient (7.1%) with a very hard stone of 2.5 cm in its largest diameter. This stone was removed by immediate open cystolithotomy and analyzed using infrared spectrometry which revealed that its chemical composition was calcium oxalate monohydrate.

The rigid (bladder) probe was used effectively in all cases except the failed one; the malleable probe was tried in two cases, however fragmentation occurred so slowly that disintegration was completed by using the rigid probe.

The overall duration of bladder stone disintegration with associated procedures (TURP, ureteroscopy, open cystolithotomy or visual urethrotomy) ranged from 25 to 120 minutes, while the average time of cystolithotripsy only was 35 minutes. The duration of hospitalization of patients exposed to bladder-stone fragmentation only ranged from 12 to 24 hours, while it ranged from 2 to 4 days for patients who had undergone associated operative procedures.

Regarding postoperative complications, hematuria was observed in all patients and ranged from mild to moderate according to the associated procedures. Acute cystitis was noticed in 3 cases (21.4%). All complications were treated conservatively. No major complications were noticed.

DISCUSSION

Bladder calculi are often found incidentally during evaluation of patients with obstructive or irritative voiding symptoms. Recurrent urinary tract infection is a common and well-known risk factor. Bladder stones may be voided spontaneously, with larger calculi precipitating acute urinary retention[4].

As with any urinary tract stone, the first priority in treatment is to render the patient stone-free. However, relief of bladder outlet obstruction, elimination of urinary infection, and correction of urinary stasis should also be addressed as part of the treatment plan[1,4]. Several procedures are available to remove bladder calculi. The choice of the procedure depends on the age and the physical condition of the patient, the size and hardness of the calculus, and the presence or absence of coexisting pathologic lesions involving the urethra, the bladder neck, or the bladder itself[3].

Electrohydraulic, ultrasonic and pneumatic lithotrites similar to those used through a nephroscope are effective in the management of bladder calculi[7]. In this study, the Egyptian pneumatic lithotriptor was used through the rigid cystoscope sheath to disintegrate bladder stones in adult patients with single stones. Two obstacles may be encountered when using the rigid cystoscope for vesical stone disintegration by the pneumatic probe. The first one is the passage of the probe inside the cystoscope and the second one a possible loss of power jeopardizing effective stone fragmentation. It is known that the probe has to be passed in a more or less straight pathway to obtain effective pulses[8]. In this study we found that mounting the modified ureteric catheter helped to pass the pneumatic probe easily through the bridge and cystoscopic sheath into the bladder, thus overcoming the first obstacle. Bending of the probe inside the cystoscope was decreased by using this modified ureteric catheter with a slight elevation of the handpiece of the probe above the level of the bridge during fragmentation (Fig. 1,2) which solved the second obstacle.

In our study we achieved a success rate of 92.9%. This can be compared to the results of Denstedt et al. who successfully fragmented 94% of the calculi in their series using the Lithoclast with no evidence of intraoperative or long-term complications related to its use[9]. Other authors reported stone fragmentation by a pneumatic lithotriptor in 100% of bladder calculi[10].

Open cystolithotomy may be indicated in cases of large stone burden or hard stones refractory to an endoscopic approach, in cases of abnormal anatomy precluding safe access, or in cases of concomitant open prostatectomy or diverticulectomy[1,4,7]. In this series, open cystolithotomy was done for one patient (7.1%)

who had a very hard calcium oxalate monohydrate stone as proved by infrared spectrometry.

Razvi and coworkers found the Swiss lithoclast to be safe and effective in 20 patients treated, with a short mean operative time (57 minutes), a high success rate (85%) and no complications[11]. During our work, no major complications were noticed. Minor complications such as cystitis and hematuria were encountered and were treated conservatively.

The operation time and hospitalization depend on the performance of associated interventions. A combination of pneumatic lithotripsy and TURP has been found to be safe, effective and economic with an acceptable increase in the overall operative time[12]. This is in accordance with our results.

Certainly, there is a large number of alternative treatment modalities for calculi: Razvi et al. compared calculi treated with manual lithotripsy (53), ultrasonic lithotripsy (17), electrohydraulic lithotripsy (16) and lithoclast devices (20). The success rates were 90%, 88%, 63%, and 85% respectively, the complication rates were 10%, 2.5%, 8% and 10%, respectively[11].

Holmium: YAG laser lithotripsy has also been reported to be effective in the treatment of stones of all compositions with high success rates, especially in large bladder stones[13], and in combination with holmium laser enucleation of the prostate[4,7]. However, laser lithotripsy may not be readily available in all centers.

Percutaneous cystolithotomy has been advocated as an alternative to open cystolithotomy in pediatric patients with narrow urethras and in patients with impassable or surgically ablated urethras and bladder necks, large stone burdens, or multiple stones with anticipated prolonged operative times[14].

In a series on 38 patients with large stone burdens treated with percutaneous ultrasonic or pneumatic lithotripsy, Maheshwari et al. reported a short operative time (40 to 100 minutes), a 100% success rate, no complications and no recurrence at an average of 18 months follow-up[15].

Finally, extracorporeal shock wave lithotripsy (ESWL) is used for the management of bladder calculi in non-obstructed patients but multiple sessions may be required to achieve a stone-free status[4].

The rigid cystoscope may be more readily available than a nephroscope in most hospitals in our environment. Also the cystoscopic sheath is longer (26 cm) than the nephroscopic sheath (21 cm), so it can easily deal with bladder stones in patients with a long urethra or with penile elongation after regional anesthesia.

Our results have shown the use of the pneumatic Egyptian lithotriptor during cystoscopy to be an effective, easy, safe, and economical method for the management of vesical stones. Further studies on a larger number of patients will have to confirm our results.

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RESUME

Efficacité du lithotripteur pneumatique égyptien lors d'une cystoscopie dans le traitement du calcul vésical

Objectifs: La majorité des calculs vésicaux chez les adultes peuvent actuellement être traités par voie trans-uréthrale grâce à des lithotripteurs. Notre but est d'étudier l'efficacité du lithotripteur pneumatique Égyptien lors d'une cystoscopie rigide dans le traitement de calculs vésicaux. **Patients et méthodes:** Quatorze patients adultes (12 hommes et 2 femmes) présentaient des lithiases de la vessie seules. Le diamètre moyen des lithiases était de 20 mm. À travers une gaine cystoscopique, une sonde urétérale modifiée est introduite dans la vessie. On a utilisé le lithotripteur pneumatique Égyptien - KH. YG2, les tiges des lithotripteurs pneumatiques (rigide ou flexible) ont été introduites dans la sonde pour la désintégration des lithiases. **Résultats:** Une désintégration lithiasique complète avec stone-free a été enregistrée chez 13 patients (92.9%). L'échec de fragmentation de lithiase s'est produit dans un cas (7.1%). La lithiase a été enlevée chirurgicalement et sa composition chimique était monohydrate d'oxalate de calcium. Le temps moyen de cystolithotripsie était de 35 minutes. L'hospitalisation a varié de 12 à 24 heures, il était plus long (2 à 4 jours) pour les patients qui avaient subi d'autres procédures. Des complications mineures à type d'hematurie légère (100%) et de cystite (21.4%) ont été observés. Aucune complication majeure n'a été notée. **Conclusion:** L'utilisation du lithotripteur Égyptien pendant la cystoscopie est une méthode efficace, facile, sûre et économique pour le traitement de lithiases vésicales.

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