Mitrofanoff Cystolitholapaxy: An Innovative Method of Stone Clearance in a Hostile Abdomen with an Inaccessible Urethra

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Keywords: urinary calculi; therapy; urinary reservoirs; postoperative complications; urinary diversion; adverse effects.

INTRODUCTION

Patients with urinary tract diversion are at increased risk of cystolithiasis. Management of intravesical calculi poses challenges for the urologist even if non interventional methods of stone clearance are employed. Endourological approaches remain the mainstay of treatment in the management of the patient with an anatomically unique bladder but access can potentially traumatize a reconstructed tract with a conduit mechanism. Therefore achieving complete stone removal while minimizing damage to a reconstructed bladder is difficult in this patient subgroup and the management of neuropathic patients has led to the development of innovative procedures that permit minimally invasive access. Consequently, specific to the neuropathic patient with complex, long term bladder management issues any technique which (a) reduces complications and is (b) reproducible with minimal effects on aberrant anatomy is desirable.

CASE REPORT

A 38 years old, wheelchair dependent, spina bifida female patient presented with multiple bladder stones (**Figure 1**) which had been detected incidentally. Her past history was remarkable for a clam ileocystoplasty, a mitrofanoff catheterizable stoma and a surgically ablated urethra. Prior to definitive urinary diversion surgery she had been managed with a suprapubic catheter. She had referred by the colorectal team having been seen initially with a perineal fistula and pelvic radiology had detected multiple large bladder calculi. In her obstetric history she had an elective caesarian section which had been complicated by a retained suture which encroached upon the mitrofanoff channel. This had been subsequently removed with holmium laser treatment successfully in a different institution. Physical examination of her abdominopelvic region revealed multiple scars, a catheterizable stoma, an ablated urethra and a perineal fistula. On reviewing her case notes it was evident that she had undergone over 30 abdominal procedures in multiple institutions since childhood but the operative details of all her surgeries were not available to us.

TECHNIQUE AND RESULTS

Under general anesthesia and antimicrobial coverage the patient was positioned supine. A standard percutaneous nephrolithotomy (PCNL) drape was used to cover the abdomen and the mitrofanoff stoma was exposed. A Lawrence Add-A-Cath sheath® was back loaded onto a flexible cystoscope in order to achieve a rigid access sheath into the bladder. This permitted repeated passage of the flexible cystoscope into the bladder with concomitant basket retrieval of stone fragments whilst minimizing any damage to the mucosa of the mitrofanoff stoma. The use of a 265 µm laser fiber down the flexible cystoscope permitted fragmentation of large stones which were then removed with the zero tip basket. Additionally, the tip of the sheath was angled towards the stone fragments and using gentle suprapubic pressure whilst withdrawing the cystoscope the stone fragments were expelled with the irrigant fountain using the back loaded Amplatz sheath as a temporary catheter through the mitrofanoff stoma. (**Figures 2 and 3**). This maneuver reduced operative time and the need for repeated stone retrieval. The entire procedure was performed by a single surgeon. On the first attempt the procedure took four hours and rendered the patient completely stone free. She was discharged the next day on 5 days of oral ciprofloxacin therapy and followed up with a repeat flexible cystoscopy after 2 months.

DISCUSSION

Bladder calculi are a common complication of urinary reconstruction with an incidence of between 8 and 50%.[1-3] In patients with myelodysplasia urolithiasis remains a frequent cause of morbidity as the neurogenic bladder prevents complete physiological emptying, thus allowing urinary stasis and concomitant infection.[4]

In the neuropathic enterocystoplasty patient the etiology of stone formation is multifactorial with urinary stasis, mucous production, bacteriuria and foreign bodies being predominant contributing factors.[3,5] Traditionally these stones have been managed using either a transurethral, shockwave lithotripsy[6] or percutaneous approach.[7,8] Neuropathic patients with an impassable or surgically ablated urethra present a unique challenge to the urologist as they do not have

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Received August 2014 & Accepted January 2015

Figure 1. A) Plain X-ray of abdomen demonstrating multiple bladder calculi, distorted pelvic bony anatomy and clips in the right iliac fossa. **B)** Computerized tomography revealing scoliosis and multiple bladder calculi.

dependent bladder drainage.[9] Unfavorable anatomy such as kyphoscoliosis can be detrimental even when non interventional attempts at stone clearance, such as extracorporeal shock wave lithotripsy (SWL), are used in neuropaths.[10]

Open cystolithotomy mandates a prolonged hospital stay and poses surgical difficulties regarding identification of stomas and preservation of previously reconstructed enterocystoplasties. This problem is compounded if repeat procedures are required as recurrent adhesions may complicate attempts at stone removal resulting in damage to a reconstructed tract. Therefore, the presence of an existing suprapubic tract affords the urologist easy accessible to a reconstructed bladder. If no existing tract is present then stone size and burden, patient factors and surgically constructed anatomy must be considered when determining the optimal access approach.

Simple outpatient based procedures, such as flexible cystoscopy have been modified using guide wires to reduce urethral trauma in neuropathic bladder patients.[11] The first suprapubic combined approach to bladder calculi was described by Gopalakrishnan and colleagues in 1988.[12] Since then several modified techniques[13-16] have been described in an effort to achieve stone clearance endoscopically, percutaneously or using a combined approach in neuropathic patients. The potential

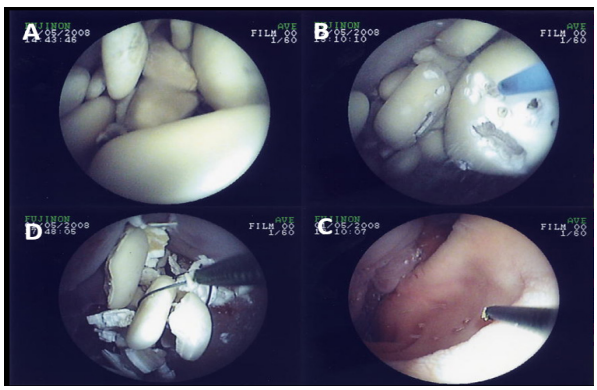

Figure 3. Endoscopic views demonstrating in a clockwise manner. **A)** Multiple bladder calculi in a Mitrofanoff bladder; **B)** Holmium laser fragmentation of bladder calculi with a 265µm fiber through the flexible cystoscope; **C)** Stone free Mitrofanoff bladder; **D)** Stone fragment removal using the zero tip basket.

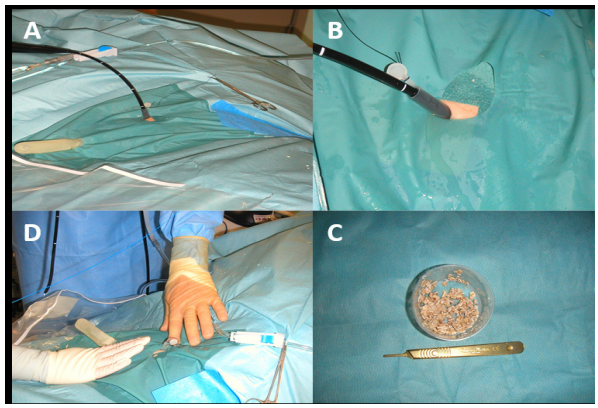

Figure 2. Clinical photographs demonstrating in a clockwise manner: **A)** Standard percutaneous nephrolithotomy drape with Mitrofanoff stoma exposed; **B)** Flexible cystoscope and back loaded Lawrence add-A-Cath sheath through the Mitrofanoff stoma permitting repeated atraumatic access; **C)** Stone burden when removed; **D)** Gentle suprapubic pressure allowing stone fragment expulsion through the access sheath following removal of the flexible cystoscope.

advantages of any modified endoscopic procedure are the avoidance of open surgery in an already scarred abdomen, decreased hospital stay and reduced morbidity.[3]

In spina bifida patients there are reports of urethral closure, formation of a continent vesicostomy via a Benchekroun valve and development of recurrent bladder calculi.[17] Subsequent removal of bladder calculi proved challenging with endoscopic access necessitating a suprapubic cystolithotomy. A repeat attempt at endoscopic access using a ureteroscope to access the Benchekroun stoma was abandoned due to mucosal tears.[17]

Innovative "hybrid" techniques using a combined endoscopic and modified laparoscopic approach have been described.[7] An obvious benefit with this combined approach is that the previous suprapubic cystostomy site is used thus minimizing damage to the vascular supply of the conduit. Separately as all stones are gathered in the entrapment bag "confined lithotripsy" can occur under direct vision.

Elder has described a separate technique in spina bifida patients using an endotracheal tube to dilate a suprapubic tract that did not permit large stone evacuation through the conventional Amplatz sheath.[13] Miller and colleagues have described a separate technique specific to the pediatric augmented bladder with calculi.[15] The use of a combined endoscopic and laparoscopic approach with an entrapment device positioned through a suprapubic laparoscopic port allowed stones to be removed on a day case basis. This technique is notable for avoiding a cystostomy and for reduced operative time but large stones required lithotripsy pre operatively. Additionally this approach does avoid any instrumentation of a continent stoma but is not reproducible in patient with a surgically ablated urethra.[15] In a patient with stones in an Indiana pouch a modified technique using a flexible cystoscope (to allow direct visualization) and a laparoscopic trocar introduced into the pouch, large stones have been entrapped, brought to the pouch entry site and fragmented with electrohydraulic devices.[18]

Use of the Amplatz sheath has been described for dealing with large bladder calculi. Hubscher and colleagues used a 30 French Amplatz sheath inserted through an existing suprapubic tract and then introduced a combination of

either ultrasound or holmium laser to remove the calculi under direct vision with a nephroscope.[5] However in patients with an augment and catheterizable stoma they avoided the constructed conduit and used the native urethra instead.

A combined approach using simultaneous transurethral and suprapubic cystolithotripsy has been described by Sofer and colleagues.[8] Although the procedure was effective in clearing large bladder stones and had a mean operative time of 56 minutes it required two operating surgeons and was not done on a day case basis. Pietro and colleagues have described a technique in a 59 years old spina bifida patient with a mitrofanoff diversion and a renal transplant using a flexible ureteroscope, an Amplatz sheath and combination ballistic and ultrasound lithotripsy. Their approach differs from the one we describe as the patient was catheterized for 7 days post operatively and required a cystogram.[19]

Our technique, with the Add-A-Cath sheath acting as a protective mechanism permits repeated access while preserving mucosal integrity and allows repeated use of a basket for stone retrieval in a patient with a surgically inaccessible urethra. Secondly as no suprapubic puncture is required the potential complication of peritoneal extravasation is avoided. Unlike the procedure described by Miller and colleagues, we were able to perform the procedure with a flexible cystoscope.[15] Our procedure allows for full evacuation of small stone fragments but unlike Van Savage and colleagues, we did use the mitrofanoff conduit for stone evacuation thus avoiding a second suprapubic puncture.[14] Since the establishment of percutaneous access for stone removal, significant work has been devoted to optimize retrieval devices and reduce urothelial trauma.[20]

CONCLUSION

Our approach allows atraumatic access to a reconstructed tract in spina bifida patients with a hostile abdomen or inaccessible urethra and is reproducible on a day case basis allowing bladders such as this to be maintained stone free.

CONFLICT OF INTEREST

None declared.

REFERENCES

1. Palmer LS, Franco I, Kogan SJ, Reda E, Gill B, Levitt SB. Urolithiasis in children following augmentation cystoplasty. J Urol. 1993;150:726-9.
2. Blyth B, Ewalt DH, Duckett JW, Snyder HM 3rd. Lithogenic properties of enterocystoplasty. J Urol. 1992;148:575-7.
3. Kronner KM, Casale AJ, Cain MP, Zerin MJ, Keating MA, Rink RC. Bladder calculi in the pediatric augmented bladder. J Urol. 1998;160:1096-8.
4. Gros DA, Thakkar RN, Lakshmanan Y, Ruffing V, Kinsman SL, Docimo SG. Urolithiasis in spina bifida. Eur J Pediatr Surg. 1998;8 Suppl 1:68-9.
5. Hubsher CP, Costa J. Percutaneous intervention of large bladder calculi in neuropathic voiding dysfunction. Int Braz J Urol. 2011;37:636-41.
6. Kilciler M, Sümer F, Bedir S, Ozgök Y, Erduran D. Extracorporeal shock wave lithotripsy treatment in paraplegic patients with bladder stones. Int J Urol. 2002;9:632-4.
7. Lam PN, Te CC, Wong C, Kropp BP. Percutaneous cystolithotomy of large urinary-diversion calculi using a combination of laparoscopic and endourologic techniques. J Endourol. 2007;21:155-7.
8. Sofer M, Kaver I, Greenstein A, et al. Refinements in treatment of large bladder calculi: simultaneous percutaneous suprapubic and transurethral cystolithotripsy. Urology. 2004;64:651-4.
9. Franzoni DF, Decter RM. Percutaneous vesicolithotomy: an alternative to open bladder surgery in patients with an impassable or surgically ablated urethra. J Urol. 1999;162:777-8.
10. Vaidyanathan S, Johnson H, Singh G, et al. Atrophy of kidney following extra corporeal shock wave lithotripsy of renal calculus in a paraplegic patient with marked spinal curvature. Spinal Cord. 2002;40:609-14.
11. Vaidyanathan S, Soni B, Singh G, Hughes P, Oo T. Use of Flexible Cystoscopy to Insert a Foley Catheter over a Guide Wire in Spinal Cord Injury Patients: Special Precautions to be Observed. Adv Urol. 2011;2011:538750.
12. Gopalakrishnan G, Bhaskar P, Jehangir E. Suprapubic lithotripsy. Br J Urol. 1988;62:389.
13. Elder JS. Percutaneous cystolithotomy with endotracheal tube tract dilation after urinary tract reconstruction. J Urol. 1997;157:2298-300.
14. Van Savage JG, Khoury AE, McLorie GA, Churchill BM. Percutaneous vacuum vesicolithotomy under direct vision: a new technique. J Urol. 1996;156:706-8.
15. Miller DC, Park JM. Percutaneous cystolithotomy using a laparoscopic entrapment sac. Urology. 2003;62:333-6.
16. Kusuma VR, Reddy J, Divella RK. Endoscopic neo cystolithotripsy for multiple calculi in studer ileal neo bladder: a case report. Urol J. 2011;8:159-62.
17. Vaidyanathan S, Soni BM, Singh G, Hughes PL, Mansour P, Oo T. Complications of Benchekroun vesicostomy in a spina bifida patient: severe stenosis requiring permanent suprapubic cystostomy, recurrent vesical calculi and abdominal hernia containing ileocystoplasty - a case report. Cases J. 2009;2:9371.
18. Jarrett TW, Pound CR, Kavoussi LR. Stone entrapment during percutaneous removal of infection stones from a continent diversion. J Urol. 1999;162:775-6.
19. Pietro G, Antonio F, Stefania F, et al. Multiple stones in atypical heterotopic reservoir in a patient with renal transplant: endourologic

resolution. Urologia. 2011;78 Suppl 18:49-53.

20. Hoffman N, Lukasewycz SJ, Canales B, Botnaru A, Slaton JW, Monga M. Percutaneous renal stone extraction: in vitro study of retrieval devices. J Urol. 2004;172:559-61.