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Research Article

Report of Four Cases of Single-Site Percutaneous Vesicoscopy access for Extraction of Bladder Stones after Enterocystoplasty

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Abstract

Introduction: Bladder stones formation is a common problem following augmentation cystoplasty. Standard techniques such as endoscopic lithotripsy and open surgery are questionable because of the number and size of the calculi and their high relapse rate. We describe our experience with a minimally invasive technique using the One Port through a single percutaneous access.

Materials and Methods: Between 2012 and 2014, 4 percutaneous extractions of bladder calculi using the One Port were performed on 4 patients with bladder augmentation. In all cases prior bladder enlargement was performed for neuropathic bladder dysfunction. The procedure consisted of percutaneous placement of the One Port through a 3 cm skin incision, the bladder stones were visualized and collected in an endobag. The One Port's working channels were then removed allowing the stone extraction from the endobag. The operative time, blood loss and chemical composition of calculi were evaluated.

Results: Percutaneous extraction was successful in all cases with a controlled bladder stone-free status and no surgical complication. The extraction of urolithiasis was done without scattering. Our experience shows that this procedure is an interesting technique that needs to be thoroughly evaluated on a larger number of patients.

Conclusion: As recurrent stone formation is expected to occur in children with an augmented bladder, this technique appears to be suitable and reliable for bladder calculi removal during the long term follow up of frequently multi-operated patients.

INTRODUCTION

Enterocystoplasty has become the preferred procedure to manage low compliant and incontinent reservoir in neurogenic or congenitally malformed bladders. Various intestinal segments have been proposed using ileum, colon or stomach. Furthermore, bladder augmentations are often associated with bladder neck resistance enhancement procedures and cutaneous continent diversion.

Equally, bladder neck closure has been suggested to definitively avoid urinary incontinence. As a result, these procedures may have significant complications including recurrent urinary tract infection, spontaneous bladder perforation and reservoir calculus formation. The incidence of calculi after augmentation cystoplasty ranges from 10% to 50% [1,2]. In most circumstances, patients perform bladder emptying by intermittent catheterization per urethra or through a continent conduit represented mainly by the appendix or a Montiplasty [3,4]. As most of the patients have neurogenic conditions with decreased sensitivity or have undergone several bladder reconstruction procedures, they can stay asymptomatic until their stones become numerous and large requiring surgical extraction (Figure 1). Various techniques from open cystolithotomy to endoscopic extraction have been described. Open surgery was traditionally used until recent technological advances in endoscopic instrumentation for percutaneous surgery allowed minimally invasive modalities. These techniques rely on stones fragmentation using electrohydraulic [5,6], ultrasonic or laser lithotripsy with endoscopic or percutaneous stone extraction. The limitation of these techniques resides

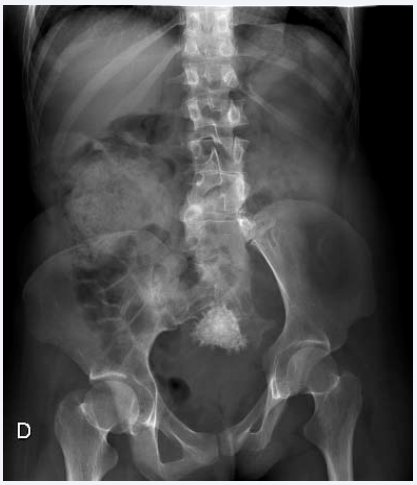

Figure 1 A 4 cm neo-bladder urolithiasisin a spina bifida patient with aMitrofanoff continent diversion and bladder neck closure.

primarily in the difficult extraction process due to previous bladder neck surgery or presence of Mitrofanoff channel. Over the past 6 years, single-port techniques, such as Laparo-Endoscopic Single-site Surgery (LESS), have been applied to perform a wide range of interventions, both in adults and in children, including cancer resections and live donor nephrectomies [7–9].

There are numerous applications of LESS for urological indications involving either reconstructive or ablative procedures [10,11]. Simple prostatectomies as well as diverticulectomies were performed trans-vesically via a single port placed intra-peritoneally through an umbilical incision [10,12]. There are some reports describing the LESS technique performed in a percutaneous way, directly through the bladder wall for foreign body removal, bladder cuff excision or adenomectomy [13–16]; nevertheless, no report on LESS urolithiasis extraction in enterocystoplasty was found.

This report describes our experience with management of stones in augmented bladders using an endoscopic single-site surgery (One Port trocar).

MATERIAL AND METHODS

Percutaneous stone removal was performed in 4 women 23.8 to 34.5 years old (average 26.7 y.) with prior bladder augmentation performed between 2002 and 2011. Indication for enterocystoplasty included neuropathic bladder secondary to spina bifida in 2 cases, post-traumatic paraplegia in 1 case and caudal regression syndrome in 1 case. Bladder enlargement was carried out with ileum and sigmoid respectively in 3 and 1 cases. All patients underwent bladder outlet surgery, by colposuspension in 2 cases, bladder neck closure in 1 case and Kropp procedure in 1 case. The bladder was emptied via a Mitrofanoff channel in 3 cases configured with a Monti neoconduit in all cases. Per uretha intermittent catheterization was performed in one girl. Bladder stones varied in size and number and were too large to transit readily through the urethra or the Mitrofanoff conduit. One patient (Figure 1) underwent previous bladder stones removal on several occasions by open cystolithotomy, whereas the 3 other patients were operated for the first time with the One Port trocar.

Patients were placed in the dorsal position. Before percutaneous access, the cystoplasty or the neo bladder was catheterized via the Mitrofanoff channel or via urethra with a 14-16 F Foley catheter and filled with saline water. A 3-cm skin incision was made in the lower abdominal quadrant. The introducer with the inner ring of a One Port (Port Universel Mono-incision Dalim, distributed by Landanger® Chaumont, France) was inserted directly into the bladder via the skin incision and a small opening of the neo bladder. The rings of the One Port were fixed to the abdominal wall area.

We used a 10-mm rigid 30°C videolaparoscope, which was introduced through the 10-mm channel of the One Port. The three 5-mm working channels were used to manipulate standard laparoscopic surgical grasping forceps and to introduce the endobag (Figure 2). The visibility inside the bladder was satisfactory allowing recognition and control of all anatomical structures. The stone was put in an endocatch bag that was externalized after removal of the One Port (Figure 3). Fragmentation using the Lithoclast was done inside the bag facilitating the extraction of a 4 cm stone in 1 patient (Figure 4); whereas the remaining 3 patients had multiple small calculi (less than 2 cm). After the extraction was done, the rings of the One Port were removed. At the end of the procedure, the bladder was emptied to allow routine closure of the intestinoplasty, abdominal wall muscles and skin. The skin incision required only two stitches.

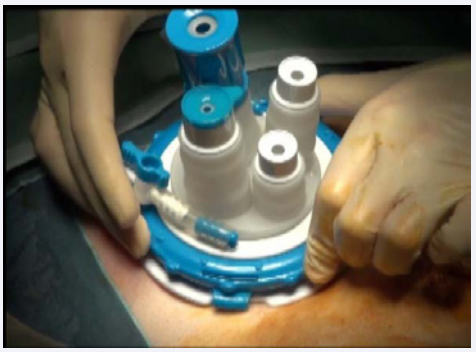

Figure 2 The working channels of the One Port.

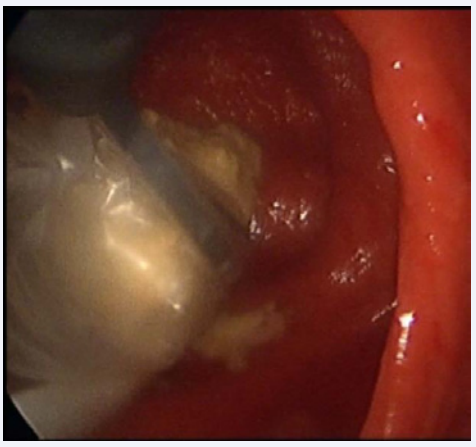

Figure 3 Placing the lithiasis in the endocatch bag.

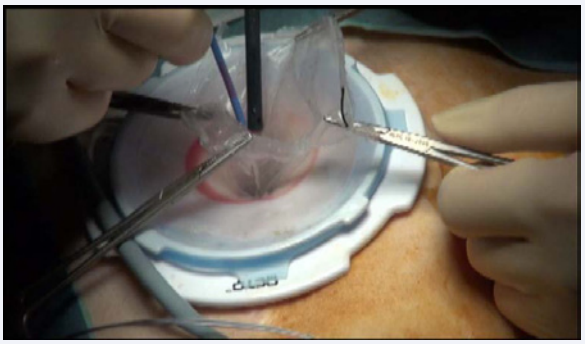

Figure 4 Fragmentation of the lithiasis inside the bag using the Lithoclast.

This technique allowed a complete urolithiasis extraction without scattering. Post-operative continuous urinary drainage through the urethra or the Mitrofanoff conduit was maintained with a silicone Foley catheter for 3 to 5 days. Lavage and aspirations were used to avoid mucus obstruction. Subsequently, intermittent self-catheterization was resumed.

RESULTS

Percutaneous stone extraction was performed on first occurrence of bladder stones in 3 patients and for recurrence in one patient previously treated with open cystolithotomy.

The period between bladder augmentation and first stones extraction ranged from 1.7 to 14.5 years with a median time of 7.6 y. Stone recurred in 1 patient requiring a second percutaneous extraction at 6.3 y of his first intervention.

Percutaneous extraction was successful in all cases without any surgical complication. The mean operative time was 79 min (from 60 to 100 minutes according to the number and size of the stones). Confirmation of the stone-free status by post-operative plain abdominal X-ray was deemed unnecessary in view of excellent endoscopic control of the neobladder post stone removal using the 30°C endoscope. Blood loss was insignificant and no patient encountered electrolyte abnormalities. Chemical composition analysis of stones found struvite and showed bacterial imprints suggestive of a long-term infectious process. All patients were discharged home within 2 to 4 days after the procedure to ascertain post-operative bladder drainage. Patients were asked to stop the once per day saline bladder irrigation previously performed to limit recurrence risk. Mean follow up after the last percutaneous extraction was 7 months (2.3 m – 20.7 m).

Postoperative wound leakage was noted in 2 cases. With local care and frequent self-catheterization the evolution was favorable within 15 days. The wounds healed without complication.

DISCUSSION

Urinary calculus formation is increasingly recognized as a complication of augmentation cystoplasty notably when bladder emptying is obtained via a Mitrofanoff conduit [17]. Managing stones in the reconfigured lower urinary tract is controversial. To date, there is no consensus on what approach is best for urolithiasis extraction in enterocystoplasty. At present, laparoscopy and single-port procedures tend to replace open surgery.

The advent of percutaneous and endoscopic instruments has led to minimally invasive techniques done in conjunction with lithotripsy [5,18]. However, concerns have been raised with regards to fragmentation which as opposed to intact extraction is more likely to leave residual stone fragments within the urinary reservoir; this could subsequently act as a nidus and promote recurrent stone formation.

The advantages of our method are the following:

(i) fragmentation of big stones inside an endocatch without scattering,

(ii) reduction of ports number providing a minimal invasive approach,

(iii) safety to treat recurrent cases,

(iv) effectiveness and reproducibility irrespective of the number and size of stones,

(v) reduced surgery time and hospital stay.

Time to recurrence in patients with bladder or continent reservoir reconstruction according to fragmentation or intact extraction has been discussed by Roberts et al. [19]. Comparison of recurrence times for intact or fragmented extraction failed to demonstrate any significant difference in time to stone recurrence. Their study suggests that the removal method is less important in the development of recurrent urinary stones than the underlying lithogenic factors present in reconstructed urinary systems. Fragmentation techniques may use electrohydraulic, ultrasonic or laser lithotripsy. Hardness of calculi never resisted to electrohydraulic fragmentation. Various methods have been proposed for percutaneous access. Elder recommends progressive dilatation with Amplatz dilator to 34F allowing a 30F working sheath [20]. When the stones are too large to be removed intact, he suggests the use of an endotracheal tube the balloon of which is inflated to the appropriate diameter in the middle of the facial tract. Endoscopic visualization through the continence mechanism has been described with a 16F flexible cystoscope [21]. Limitations of this approach are the small size of the stoma and the risk of compromising the continence valve. The use of laparoscopic entrapment sac has been proposed to facilitate percutaneous intact extraction [22]. This material requires an endoscopic vision through the urethra or continent conduit. Furthermore, lithotripsy was done inside the laparoscopic sac after externalization of the neck of the bag. Suction tubing in a controlled endoscopic manner may be performed with fragmentation technic directly inside the bladder [6]. Vigorous irrigation with warmed saline is a decisive factor to eliminate residual fragments. In order to reduce the risk of hypothermia, the patient should be fully draped with waterproof sheets.

Interestingly, with our technic, we can avoid doing the irrigation procedure since the fragmentation is completely done in the entrapment sac.

The advantage of such multiple minimal invasive procedures is to allow a single tract for endoscopic vision, fragmentation

and extraction, valid in all circumstances encountered in this patients' population.

Moreover, continence mechanism will not be endangered by multiple attempts of stones removal through the urethra or continent conduit. Finally, minimal invasive access contributes to decrease the risk of abdominal wall abscess, urinary fistula and possibly secondary event ration especially in multi-operated abdominal wall such as exstrophy patients. Interestingly, this approach will not be limited by the size and number of stones, which allowed increasing the time between recurrent removals under regular ultrasound supervision although some adjustments may be necessary for the technique to be adapted to particular conditions of the patients.

However, prevention strategies should be promoted. A higher risk of stone formation in ilealcystoplasty compared to sigmoid bladder enlargement has been reported [17]. Although the number of cases in our series is limited, our data is in line with these findings. As medical prevention with routine bladder irrigation failed to eliminate the risk of stone formation after bladder intestinal augmentation, percutaneous access will facilitate long term urological management in this patients' population.

CONCLUSIONS

The One Port extraction is suitable for every case whatever the number and size of the lithiasis especially for relapse cases. As it is difficult to prevent lithiasis formation in cystoplasty and neo bladder, percutaneous and endoscopic technique using the One Port is an efficient and safe way of treatment. Based on our previous experience in the field on laparoscopy and transvesical laparoendoscopy, we find this approach to be a logical, minimally invasive, and simple access for either ablative or reconstructive procedures in the bladder.

Our approach shows that this procedure is an interesting technique that needs to be thoroughly evaluated on a larger number of patients.

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