Novel approach for removal of heavily encrusted ureteral stent

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Objectives and background: *We describe a novel approach for removal of a retained, heavily encrusted ureteral stent via combined laparoscopic cystolithotomy and pyelolithotomy. Due to noncompliance, our patient with a history of nephrolithiasis returned with large proximal and distal stones 2.5 years after placement of a left ureteral stent.*

Methods: *Laparoscopy was performed using three 12 mm ports and two 5 mm ports. The bladder was opened in the midline and the stent divided at the ureteral orifice. The bladder stone (4.7 cm x 4 cm) was placed in a retrieval bag and the cystotomy closed with vicryl suture. The proximal ureter and renal pelvis were dissected free and incised. The stent with 2.3 cm x 1.5 cm stone on the proximal curl was removed. The incision was closed transversely with vicryl suture.*

Results: *The patient's recovery was uneventful, including drain removal prior to discharge on postoperative day 3. The foley was removed after a negative cystogram 7 days later. Analysis revealed calcium phosphate and struvite stones. Left ureteroscopy 2 months later revealed a widely patent proximal ureter. No complications have been identified.*

Conclusions: *Laparoscopic cystolithotomy with stent division combined with pyelolithotomy can be performed safely and successfully as a single procedure to remove the heavily encrusted ureteral stent.*

Key Words: encrusted ureteral stent, laparoscopic, pyelolithotomy

Background and objectives

Placement of ureteral stents for obstruction or nephrolithiasis is a common urologic procedure. When patients are noncompliant or lost to follow up, ureteral stents can act as a nidus for stone formation, particularly in patients with a history of nephrolithiasis. The heavily encrusted ureteral stent can be a difficult clinical scenario, necessitating a decision between open intervention and endoscopic treatment, with the potential for multiple, lengthy procedures. We present a novel technique for removal of the heavily encrusted ureteral stent using a laparoscopic approach.

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Methods and results

Due to noncompliance, our patient, who had previously undergone multiple percutaneous and endoscopic interventions for calcium phosphate stones, returned 2.5 years after placement of a left ureteral stent. Previously, 1 year after initial stent placement, attempts at removal of the calcified stent, Figure 1, using a combination of shock wave lithotripsy and cystolithopaxy had failed, after which the patient was lost to follow up. Upon return, plain x-ray revealed the indwelling stent with very large proximal and distal stones, measuring roughly 4 cm and greater than 5 cm in length respectively, Figure 2. A stone protocol CT scan using bone windows added to surgical planning by delineating the anatomy and more clearly defining the stone burden, Figure 3. The renal pelvis stone measured 2.3 cm by 1.5 cm and the bladder stone 4.7 cm by 4 cm. Since the patient had previously failed endoscopic management, both multistage open and percutaneous approaches were discussed with the patient. He preferred a single stage procedure and requested a minimally invasive approach rather than open surgery. As such, a combined laparoscopic cystolithotomy and pyelolithotomy was planned.

Figure 1. Stent at 1 year.

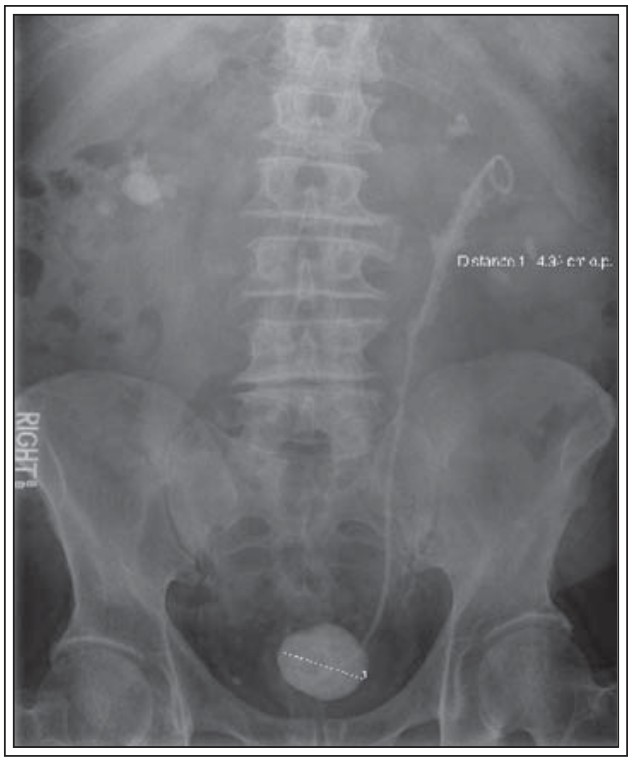

Figure 2. Stent at 2.5 years.

In brief, the procedure was performed as follows. The patient was placed in a supine position and secured with arms at the sides using a beanbag. A foley catheter was placed on the field. In standard fashion, a supraumbilical 12 mm port was placed, followed by a 12 mm port in the left lower quadrant, a 5 mm port midway between the umbilicus and the lateral port,

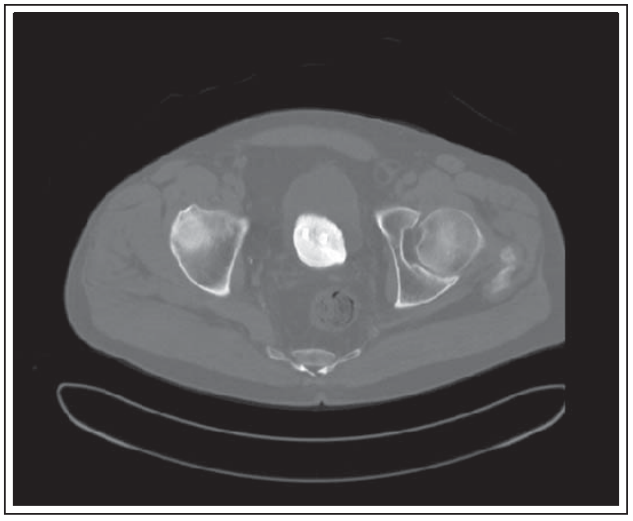

Figure 3. Distal stone as visualized in bone windows.

Figure 4. Stent division at ureteral orifice.

and a 5 mm port in the right lower quadrant. The patient was placed in steep Trendelenburg position and the bladder mobilized as performed in transperitoneal laparoscopic prostatectomy. The bladder was opened in the midline at the dome using the harmonic scalpel and cold scissors. The stone was identified, grasped, and retracted away from the left ureteral orifice allowing visualization and division of a portion of the intraureteral stent, Figure 4, which had significantly less encrustation. After placing the stone in a retrieval bag, Figure 5, the bladder was cleared of remaining stone fragments and a watertight closure performed in two layers using a running vicryl suture. A 20 French foley catheter was then placed.

The table was leveled and rotated left side up. An additional 12 mm port was placed in the left upper quadrant just lateral to midline. Similar to the technique described for laparoscopic pyeloplasty, the lower pole was mobilized aiding identification of the ureter. There was an intense inflammatory reaction around the left kidney, necessitating careful dissection of the proximal ureter and renal pelvis. The ureteropelvic junction (UPJ) and renal pelvis were then incised cephalad to caudad to allow removal of the large stone on the proximal curl with the remaining distal portion of the stent as a single specimen. The specimen was placed into a separate retrieval bag and flexible nephroscopy was performed to allow stone basketing of other identifiable renal stones. A glidewire was then passed antegrade to allow placement of a 6 fr by 26 cm stent, which was confirmed within the bladder by flexible cystoscopy. The renal pelvis/UPJ incision was then closed transversely with vicryl suture. Jackson Pratt (JP) drains were placed adjacent to the kidney and bladder. Port sites were closed in the standard fashion with vicryl suture. The specimen bags were extracted by lengthening the umbilical incision. The specimen is seen in its entirety in Figure 6. There were no immediate complications, nor any postoperative complications. Postoperatively, the patient was started on clear liquids and given scheduled intravenous toradol, as well as oral and intravenous narcotics as needed for pain.

Blood loss was estimated at 150 ml. Operative time was approximately 5 hours. The JP drains were removed prior to discharge based on low output and a fluid creatinine from each drain consistent with serum. The patient was discharged home on postoperative day 3 with his foley catheter in place. A cystogram on postoperative day 10 revealed no leak, after which his foley catheter was removed. The ureteral stent was left in place for 6 weeks and removed at the time of ureteroscopy for a distal ureteral stone. There have

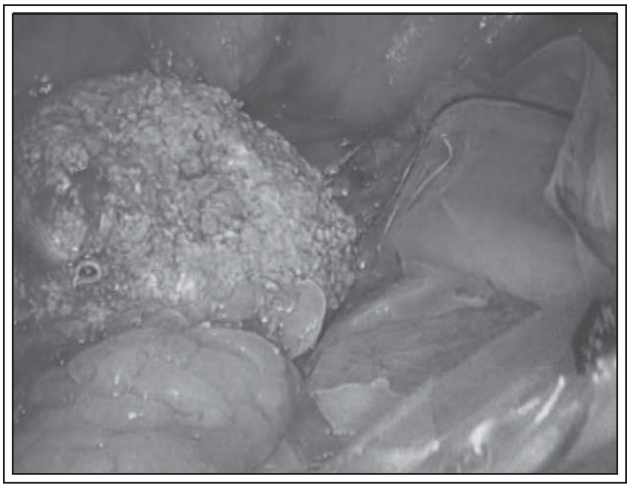

Figure 5. Bladder stone in retrieval bag.

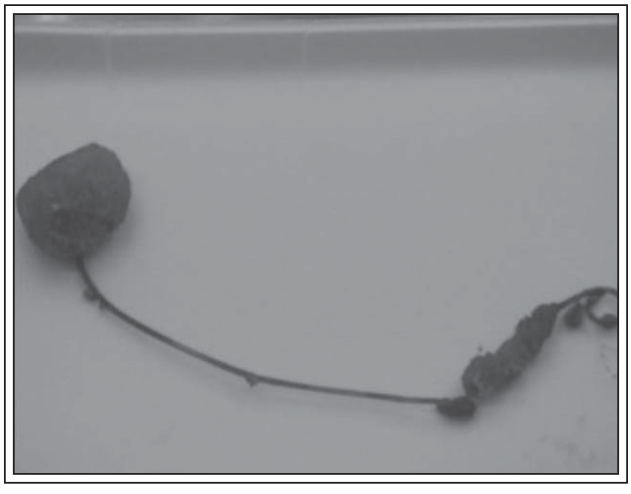

Figure 6. Gross specimen.

been no complications to date. On analysis the UPJ stone was primarily calcium phosphate and weighed 973 mg. The bladder stone was composed of calcium phosphate and magnesium ammonium phosphate, with a total weight of 56.8 grams.

Discussion

Encrustation of ureteral stents is a multifactorial process of varying severity depending on the reason for stent placement, patient medical history, and the length of time a stent is left indwelling.[1] When a ureteral stent is forgotten or a patient is noncompliant with follow up, long term indwelling stents can become severely encrusted, with complications ranging from irritative symptoms to renal failure and death.[2] In an attempt to quantify stone burden in these scenarios, Singh et al proposed multiplying the width of encrustation by the length to determine the burden in millimeters squared. They proposed a grade of mild for < 100 mm^2, moderate for 100 mm^2-400 mm^2, and severe for > 400 mm^2. They also subcategorized the calcification into "linear" and "bulbous" to describe the nature of the stone growth on the stent.[3]

A variety of algorithms have been proposed for treatment of encrusted ureteral stents.[3,4] These algorithms have involved primarily use of endoscopic techniques, including shock wave lithotripsy, ureteroscopy with laser lithotripsy, and percutaneous procedures. Due to the infrequency of forgotten stents and the variability in the degree of encrustation, the literature is primarily composed of retrospective series. Between 1990 and 1994, Monga et al treated 31 patients with an average stent dwell time of 22.7 months, of whom 19% required multiple procedures, one patient required an open cystotomy, and a single patient required simple nephrectomy.[5] Bultitude et al in 2003 published their series of 49 encrusted stents in 41 patients with a mean indwelling time of 5.6 months. Of these patients, treatment consisted of SWL alone in 4, ureteroscopy alone in 28, combination SWL/ureteroscopy in 10, percutaneous nephrostolithotomy (PCNL) in 5, and open removal in 1, with a mean of 1.94 procedures per patient. Also in 2003 Bukkapatnam et al published their series in which they were able to successfully remove severely encrusted stents (mean encrustation of 60 mm^2) with only a single ureteroscopy with laser lithotripsy in 11 out of 12 patients with a mean operating time of 96 minutes by passing a ureteroscope alongside the stent.[6] Open cystolithotomy, a well established practice to aid removal of retained stents, is rarely cited in these studies, with only one or two patients per series requiring open intervention.

In the case of our patient, he was known to be poorly compliant and frequently lost to follow up. When he returned 1 year after stent placement, he underwent treatment which included initial SWL to the encrusted upper portion of the stent without significant fragmentation, Figure 1, followed by cystolithopaxy with successful fragmentation of distal encrustation, and finally repeat SWL. Despite multiple procedures his stent was unable to be removed. After this he was again lost to follow up. When he finally represented 2.5 years after initial stent placement, he had developed a significant increase in his proximal and distal stone burden, including a distal stone measuring roughly 4.3 cm x3.7 cm, Figure 2. A lasix renal scan showed 34% function on the left side with the stent in place, making nephrectomy ill advised in this patient with significant stone disease. Our usual approach in a patient after failed SWL would be to perform PCNL on the proximal stone in conjunction with cystolithopaxy on the distal stone. However, this would likely have required multiple procedures and undoubtedly required an indwelling nephrostomy tube along with a stent. The patient at that time preferred to avoid the time and cost associated with multiple procedures and visits, in part due to a lengthy commute to reach our institution. Furthermore, we had concerns about the possible need for multiple and lengthy endoscopic procedures, his willingness to return should the stent not be removed with a single procedure, his ability to make multiple appointments, and his ability to care for an indwelling nephrostomy tube. Thus it was felt that a single stage method to remove the stent was in the patient's best interest. After discussing percutaneous approaches and open removal as the standard of care for failed endoscopic removal, we discussed the role of laparoscopy. The patient opted for the more minimally invasive laparoscopic approach.

Laparoscopic removal of a ureteral stent has previously been described. Bhansali at al reported a single case of a 14-year-old female with an indwelling stent for 4 years after PCNL who underwent laparoscopic removal. In this case the stone burden on the stent was primarily proximal (total 1280 mm^2: 800 mm^2 renal, 480 mm^2 ureteral), necessitating only a laparoscopic pyelotomy.[7] In our case, on plain x-ray the stone burden for the upper ureter covered an area of 520 mm^2, however the distal burden measured approximately 2200 mm^2 (using the area of an oval with diameters of 43 mm and 37 mm). This large distal stone necessitated intervention at the level of the bladder, while its large size and hard composition would have made endoscopic treatment very time consuming. By positioning the patient as one would

for a laparoscopic prostatectomy, we were able to easily mobilize and open the bladder. Slightly more cephalad port placement in comparison to that of a LRP is preferable to facilitate cystotomy and closure at the dome. We performed the first layer of bladder closure with a running suture tied intracorporeally. The second layer was performed with the Endostitch using a vicryl suture. With the foley having been placed on the field, we were able to demonstrate that our final closure was watertight intraoperatively. We are not aware of any other published reports of laparoscopic cystotomy to remove a ureteral stent.

Repositioning of the operating table as described above allowed for transition to a position similar to that of laparoscopic pyeloplasty. Significant inflammation surrounding the ureter and renal pelvis due to the long term indwelling stent and resultant stone had resulted in a thickened renal pelvis and UPJ. Our pyelotomy began at the UPJ and extended up into the renal pelvis. The distal portion of the stent was easily extracted from the ureter with the bladder stone having been removed, however the proximal curl also had a significant stone associated with it, requiring further incision of the renal pelvis in a cephalad direction. With the thickened tissues, we felt it best to close our pyelotomy transversely so as to not risk decreasing the diameter of the UPJ and thus make further stone passage more difficult. Prior to closure, flexible nephroscopy was performed through a 12 mm port to allow stone basketing. We were not able to make this patient stone free due to a significantly narrowed upper pole infundibulum.

The large stone burden on the proximal stent curl had caused the renal pelvis to dilate over time, which facilitated our pyelolithotomy incision and closure. In the circumstance where the renal pelvis is not dilated and poorly accessible from outside the kidney, this portion of the procedure may be extremely difficult and possibly ill advised, with an increased risk of scarring should the incision need to be carried through the UPJ into the proximal ureter. As such, review of preoperative imaging with close examination to ensure favorable anatomy is critical. An intraperitoneal approach to the bladder was employed in order to reduce need for repositioning and to minimize additional ports for the renal portion of the procedure. An alternative approach would have been to perform extraperitoneal laparoscopic cystolithotomy followed by a retroperitoneal laparoscopic approach to the proximal portion of the stent. Such an approach may allow improved access to the renal pelvis. The effect that the encountered retroperitoneal inflammatory changes would have had on the retroperitoneal approach to the kidney in this patient is unknown.

Clearly the best treatment for retained ureteral stents is prevention. Good communication between surgeon and patient, clear postoperative directions/education, financial counseling assistance for the uninsured, follow up of missed appointments, and maintenance of an up to date stent list are easy methods to decrease the frequency of forgotten stents. Even with these measures, however, there will continue to be noncompliant patients, those prone to swift encrustation in whom normal follow up is not adequate, and those lost to follow up for a variety of other reasons. In these cases, it is necessary for the urologist to have a wide armamentarium of techniques available for use in removing encrusted stents. When endoscopic treatments fail, laparoscopic removal can be a safe and effective minimally invasive technique.

Conclusion

Laparoscopic removal of a retained ureteral stent via cystolithomy and pyelolithotomy is an effective procedure and can be performed safely to aid in removal of the heavily encrusted ureteral stent. This technique is particularly useful when large stone burdens exist in the kidney and bladder. When a surgeon has sufficient laparoscopic skills for this advanced technique, it should be considered for those who fail or refuse endoscopic management. □

References

1. Sofner M, Denstedt J. Encrustation of biomaterials in the urinary tract. *Curr Opin Urol* 2000;10(6):563-569.
2. Singh V, Srinivastava A, Kapoor R, Kumar A. Can complicated forgotten indwelling ureteric stents be lethal? *Int Urol Nephrol* 2005;37(3):541-546.
3. Singh I, Gupta N, Hemal A, Aron M, Seth A, Dogra P. Severely encrusted polyurethane ureteral stents: Management and analysis of potential risk factors. *Urology* 2001;58(4):526-531.
4. Bultitude M, Tiptaft R, Glass J, Dasgupta P. Management of encrusted ureteral stents impacted in upper tract. *Urology* 2003;62(4):622-626.
5. Monga M, Klein E, Castaneda-Zuniga R, Thomas R. The forgotten indwelling ureteral stent: A urological dilemma. *J Urol* 1995;153(6):1817-1819.
6. Bukkapatnam R, Seigne J, Helal M. 1-step removal of encrusted retained ureteral stents. *J Urol* 2003;170(4 Pt 1):1111-1114.
7. Bhansali M, Patankar S, Dobhada S. Laparoscopic management of a retained heavily encrusted ureteral stent. *Int J Urol* 2006;13(8):1141-1143.