Prone split-leg position to manage encrusted ureteral stents in a single-stage procedure in women: Step-by-step surgical technique

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Abstract

The management of encrusted ureteral stents is costly, time consuming and may be risky for the patient and challenging for the urologist. Treatment modalities for encrusted stents include extracorporeal shock wave lithotripsy, cystolithopaxy, rigid or flexible ureteroscopy with intracorporeal lithotripsy, percutaneous nephrolithotomy, open surgery, and a combination of those methods. In this study we describe the management of severe forgotten encrusted ureteral stents in 3 female patients using a prone split-leg position. This position allows us to effectively treat any site and degree of stent encrustation in a single-session approach with the patient in the same position during the whole procedure. All patients were rendered stent and stone free. No complications occurred.

Introduction

Indwelling ureteral stents were introduced in 1967 and were instrumental in the advance of endourology.[1] Ureteral stents are mainly used to manage ureteral obstruction due to intrinsic or extrinsic causes (e.g., urolithiasis, strictures, and malignancy) or after any ureteral surgery.[1-4] Modern ureteral stents are usually designed in a double-pigtail configuration and are composed of polyurethane and/or polyethylene.[5] New biomaterials and ureteral stent coatings, such as heparin and diamond-like carbon compounds, may reduce infection and encrustation rates.[6-8] Nevertheless, underlying stone-forming conditions, pregnancy, and total indwelling-stent time affect the level of encrustation. Stent encrustation rates may increase from 9.2% at <6 weeks to 76.3% at >12 weeks.[9]

The management of encrusted ureteral stents is costly, time consuming and may be risky for the patient and challenging for the urologist.[10] The degree and site of encrustation are important considerations when dealing with forgotten stents. The term ''forgotten, encrusted, calcified (FECal)'' double-J ureteral stent was created to describe stents which cannot be removed cystoscopically without the aid of other auxiliary measures due to encrustation and/or stone formation.[11] The two most severe types of stent encrustation are Grade IV (circular encrustations completely encasing both of the pigtail portions of the stent) and Grade V (diffuse and bulky encrustations completely encasing both of the pigtail and ureteral portions of stent).[11] The ideal method for stent encrustation image evaluation is the non-contrast computed tomography (NCCT), as the standard kidney-ureter-bladder x-ray may miss minor encrustations which can also intricate their removal.

Treatment modalities for encrusted stents include extracorporeal shock wave lithotripsy (SWL), cystolithotopaxy, retrograde rigid or flexible ureteroscopy with intracorporeal lithotripsy (URS), percutaneous nephrolithotomy (PCNL), open surgery, and a combination of those methods.[12-20] Although there are no formal guidelines in the management of encrusted double-J stents,[15] several authors have reported their series and proposed algorithms: some with multiple sequential surgical techniques;[15,19-23] others with a one-step approach.[18,24] Even in this single approach technique, after cystolithopaxy or URS in lithotomy position, the patient must be turned prone for PCNL.

We describe the management of severe forgotten encrusted ureteral stents in prone split-leg position, which allows us to effectively treat any site and degree of stent encrustation in a single-session approach with the patient in the same position during the whole procedure.

Methods

Preoperatively, all patients received prophylactic third-generation cephalosporin during the induction of anesthesia or therapeutic antibiotics, according to the urine culture

Fig. 1. Non-contrast computed tomography accurately evaluate the extent of double J encrustation; A – Axial view depicts significant stone burden associated with the forgotten stent in the kidney and ureteropelvic junction (straight arrow) with less encrustation in the bladder (dashed arrow); B – Coronal view aids evaluation of stent encrustation in the ureter (arrow); C - Volume reconstruction gives a comprehensive understanding of the complete stone burden associated with the stent in all locations of the collecting system.

obtained 7 days before surgery. All patients with complex infection stones began oral antibiotics 7 days before surgery. All procedures were performed under general anesthesia (Table 1). A NCCT was mandatory to accurately evaluate the stone burden associated to the encrusted stent (Fig. 1).

Patients were placed in a prone split-leg position to provide access to the genitalia (Fig. 2). The patient's perineum and flank were prepared and draped in the usual sterile fashion.

A rigid cystoscopy was used for our female patients (in male patients, flexible cystoscopy is used). Cystolithopaxy may be performed with a 600 micron laser fibre or with a pneumatic or ultrasonic lithotriptor depending on stone burden (Fig. 3, part A). In men with significant bladder coil stone burden (>2 cm), ultrasonic cystolithopaxy through a short rigid nephroscope in lithotomy position might be safer for the urethra. Alternatively a suprapubic tract with a 30Fr Amplatz sheath to facilitate extraction of large bladder calculi may be required. In women in the prone split-leg position, both flexible and rigid instruments might be used according to surgeon preference. Prior to fragmenting the bladder stone, the surgeon cannulates the ipsilateral ureteral orifice with a polytetrafluoroethylene-nitinol guidewire with a hydrophilic tip, and the wire is advanced under fluoroscopic guidance to the renal pelvis. In select patients, if URS with the rigid ureteroscope is enough to address all parts of the encrusted stent, a 400 micron laser fibre may be used (Fig. 3, part B). If flexible ureteroscopy is required, it might be done by placing the scope over a wire alongside the stent or by using 10/12 or 11/13Fr ureteral access sheath to facilitate multiple entrances. A 35-cm ureteral sheath is usually used for women or mid-ureteral encrustation and a 45-cm for men or proximal encrustations. We used a 270 micron laser fibre for lithotripsy. The safety wire was kept in place during the whole procedure.

It is important to be prepared to gain percutaneous renal access using ultrasonographic/fluoroscopic techniques in the event that the flexible ureteroscope cannot be passed alongside the stent. For the endoscopic puncture, the flexible ureteroscope is advanced into the renal pelvis and manipulated around intrarenal encrusted portion of the stent until an appropriate calyx for puncture is identified. For a calci-

Fig. 2. The patient is placed in a prone split-leg position to provide access to the genitalia. The patient's (P) perineum and flank are prepared and draped in the usual sterile fashion. The X-ray monitor (XR) is placed in the opposite side of the kidney to be accessed, next to the patient leg (or shoulder). The video (V) is placed by the patient shoulder (or leg) in the same side of the R-ray monitor, and the C-arm (C) is located between them; A – Anesthesiologist; S – Surgeon.

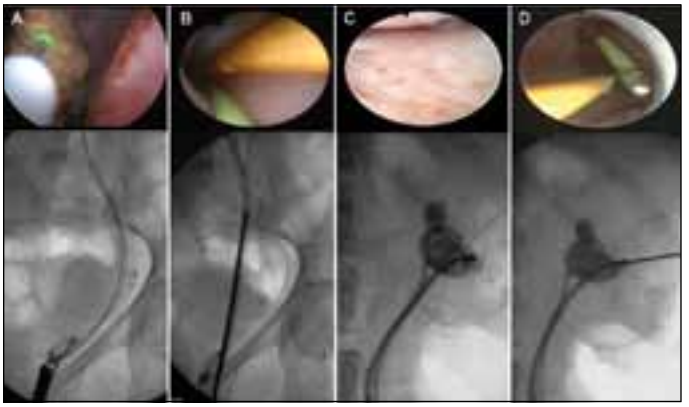

Fig. 3. A - Cystolithopaxy is usually performed with a 600 micron laser fiber within a ureteral catheter for stabilization; B - if URS with the rigid ureteroscope is required, a 400 micron laser fiber may be used; C - if PCNL is planned, the flexible ureteroscope is advanced into the renal pelvis and an appropriate posterior calyx is confirmed by the presence of an air bubble for puncture; D – after the needle is advanced toward the tip of the ureteroscope and is visualized endoscopically entering the collecting system, the guidewire is introduced and grasped by a tipless Nitinol basket.

fied stent, an upper or middle calyx will provide the best access down the proximal ureter to treat the incrustations. A posterior calyx is confirmed by the presence of an air bubble (Fig. 3, part C). The tip of the ureteroscope is advanced directly onto the papilla. The C-arm is rotated until the tip of the ureteroscope is seen "head-on." An 18G Chiba puncture needle is visualized forming a bull's eye image and introduced to target the tip of the ureteroscope. Once the needle is advanced, the C-arm is rotated back to an anteroposterior orientation to monitor the depth of the needle advancement toward the tip of the ureteroscope and the needle is visualized endoscopically entering the collecting system (Fig. 3, part D). A floppy-tip Teflon-coated guidewire is introduced through the needle and grasped by a tipless Nitinol basket as previously described (Fig. 3, part D).[25]

The ureteroscope and guidewire are then withdrawn through the ureteral access sheath, gaining secure through-and-through access. The wire is exchanged for a stiff guide wire using a 5Fr open-ended catheter. The flexible ureteroscope is reinserted to puncture site to monitor dilation of the nephrostomy tract with a balloon or sequential dilator, and to monitor advancement of the Amplatz sheath. Endoscopic monitoring of tract dilation and sheath advancement (Fig. 4, part A) is performed to prevent underdilation into renal parenchyma or overdilation leading to collecting system perforation. For stone fragmentation, the ultrasonic lithotripter or holmium laser is used through the rigid and flexible

Table 1. List of permanent and disposable materials necessary for prone split-leg position in management of encrusted ureteral stents

Procedure	Permanent	Disposable	Alternative
Cystolithopaxy	Flexible cystoscope Rigid cystoscope Holmium laser*	550-600 micron laser fibre*	*Pneumatic lithotripter
URS	Rigid ureteroscope Flexible ureteroscope Holmium laser*	Nitinol/hydrophilic guidewire 400 micron laser fibre* Stiff / rigid guidewire 10/12 // 11/13Fr ureteral access sheath 270 micron laser fibre Double-J stent	*Pneumatic lithotripter
PCNL	Rigid nephroscope Flexible nephroscope Ultrasonic lithotripter Holmium laser 3-prong grasper	18G Chiba puncture needle Floppy-tip Teflon-coated guidewire 120 cm Tipless Nitinol basket<2Fr Stiff / rigid guidewire 5Fr open-ended catheter Balloon dilator* Double-J stent/nephrostomy tube	*Sequential dilators

URS: ureteroscopy; PCNL: percutaneous nephrolithotomy.

Table 2. Patient and stone burden characteristics associated with forgotten encrusted ureteral stents treated in the prone split-leg position

N	Gender, age	Duration of stent (months)	Side	Site	Stone diameter (mm)	Treatment	Operative time (min)	Outcome (POD 1)	Complications	Additional treatment	Final outcome
1	Female, 46	11	Left	Kidney Bladder	25 33	PCNL – ultrasonic Cystolithopaxy – laser	105	Stone free	None	None	Stone free
2	Female, 18	15	Right	Kidney Mid-ureter Bladder	60 10 40	PCNL – ultrasonic Rigid URS – laser Cystolithopaxy - ultrasonic	130	Stone free	None	None	Stone free
3	Female, 35	24	Right	Kidney Upper/ Distal ureter Bladder	35 15/10 25	PCNL – ultrasonic Rigid/Flex URS – laser Cystolithopaxy – laser	240	Residual kidney fragments	None	PCNL + URS	Stone free

URS: ureteroscopy; PCNL: percutaneous nephrolithotomy; POD: postoperative day.

nephroscopes, respectively (Fig. 4, part B). Stone fragments are actively retrieved with a permanent 3-prong grasper or disposable basket. The stent is removed from above (Fig. 4, part C). At the end of the procedure, meticulous examination using flexible nephroscopy plus examination of the kidney with high-magnification fluoroscopy is performed to identify residual fragments. Antegrade flexible ureteroscopy is performed as the ureteral access sheath was withdrawn to confirm clearance of any residual ureteral calculi.

The decision whether to leave a nephrostomy tube in place and the use of a new double J depends on intraoperative findings. A ureteral catheter attached to the Foley catheter is an option if ureteral drainage is not an issue for more than 2 days. Confounding the decision of type of drainage is the concern for patient compliance to return for stent removal.

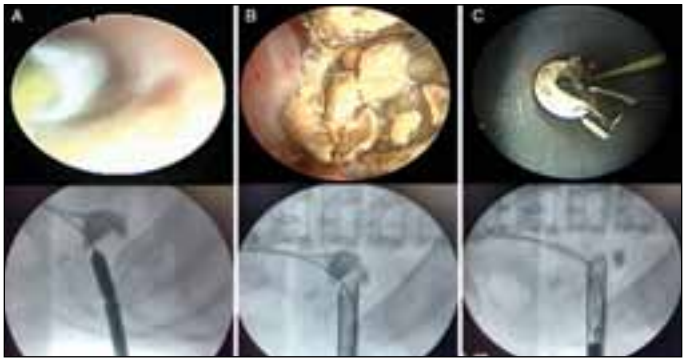

Fig. 4. A – Endoscopic monitoring of tract dilation and sheath advancement is performed to prevent underdilation into renal parenchyma or overdilation leading to collecting system perforation; B - For stone fragmentation, the ultrasonic is used through the rigid nephroscope; C - Stone fragments are actively retrieved with a permanent 3-prong grasper or disposable basket and the stent is removed from above.

Results

Three patients with forgotten encrusted ureteral stents were successfully treated in the prone split-leg position at our Institution (Table 2). All patients were female. Duration of stent ranged from 11 to 24 months and in 2 cases significant incrustations were found in all parts of the stent.

In 2 cases with significant upper and lower coil incrustations, the patients were rendered stone and stent-free after a single session procedure. In the first case, cystolithopaxy and PCNL were performed successfully. In the second patient, rigid URS was also required. Operative times were 105 and 130 minutes, respectively. In one patient with limited mobility of the lower limbs, URS was cumbersome and a second look PCNL combined with flexible URS was required to remove all stone fragments in the kidney. Total operative accounting for both procedures was 240 minutes. The mean length of stay was 3 days. One patient was left with a ureteral stent attached to the Foley catheter, both being withdrawn on postoperative day 2. Two patients had a string attached to the bladder coil and the double J was removed in clinic after 7 days. No complications occurred in any case.

Discussion

Encrusted ureteral stents left in situ unintentionally remain a challenging scenario for urologists worldwide. Although endourology has evolved significantly over the last decades, ureteral stents themselves are 20 years old. Poor patient compliance and inadequate patient counselling may contribute to the increasing rate of forgotten encrusted stents seen in specific locations. Bostanci and colleagues reported a 0.64% rate of forgotten encrusted ureteral stents at their centre.[24]

Management of encrusted stents usually requires a series of combined endoscopic approaches. The stone burden, site of encrustation, and renal function affects the surgical approach. Patients with a non-functioning kidney should undergo nephrectomy of the ipsilateral renal unit with complete removal of all parts of the stent. For functioning kidneys with renal stent encrustation, SWL or PCNL may be used, depending on the grade of encrustation in the proximal part of the catheter. Singh and colleagues proposed treatment of mild to moderate encrustations in any segment of the stent with SWL and traction, while a combination of SWL and URS was proposed for severe encrustations.[1] SWL is ideal for localized, low-volume encrustations in renal units with good function to optimize fragments clearance. If those methods failed or even in cases with severe encrustation of the proximal portion, PCNL might be the best technique to achieve a stone and stent-free status.[15] Based on a literature review, Bostanci and colleagues proposed mild encrustations to be treated with SWL and cystoscopic removal of the stent.[24] For stents with moderate to severe encrustation, cystolithopaxy was advised for lower coil stone formation, while flexible URS with laser lithotripsy and/or PCNL were advocated if ureteral or upper coil encrustation were found on preoperative NCCT.

The need for multiple session endoscopic approaches is not an exception when managing forgotten stents. Borboroglu and colleagues reported an average of 4.2 endourological procedures to render patients with severely encrusted ureteral stents stone and stent-free.[17] A review of the literature suggests that the mean number of endourologic procedures per patient with a significant stone burden related to the forgotten stent ranges from 1.9 to 4.2.[15-17,22,24] In contrast, Bukkapatnam and colleagues reported a case series of 12 forgotten stents in 10 patients successfully treated with a one-stage percutaneous approach with minimal morbidity.[18] Nevertheless, stone burden of those two series were not similar.

In cases of ''forgotten, encrusted, calcified (FECal)" IV or V, SWL is not advised and a combined endoscopic approach is usually required to address all parts of the stent. Cystolithopaxy, URS and PCNL might be performed in conjunction or in a staged fashion. If the distal ureteral part of the stent has the largest stone burden, URS after cystolithopaxy is advised. On the other hand, if the proximal portion has the most pronounced encrustation, retrograde flexible URS with laser lithotripsy or PCNL with antegrade flexible URS might be used. If more calculi are found in the kidney, PCNL has a significant advantage to achieve a stone-free status with complete fragments removal. Most PCNL series to treat forgotten encrusted stents describe the approach in the prone position, which means the patient has to be changed from lithotomy position if cystolithopaxy and/or URS are required prior to the percutaneous approach. This adds time and morbidity to the procedure. Therefore, for patients with significant burden associated with the forgotten stent in which a combined endoscopic approach (cystolithopaxy, URS and PCNL) is planned in advance, we advocate the use of the prone split-leg position. This position allows a one-step approach without patient repositioning during the whole procedure. As with this technique the genitalia is sterile, there is good through-and-through access, retrograde placement of a double J is possible, and a string might be left in place in the distal end of the stent for removal in the office without the need for an additional cystoscopic procedure.

Conclusion

The prone split-leg position allows treatment of forgotten encrusted ureteral stents with severe stone burden in a single-session endoscopic approach without the need for patient repositioning during the whole procedure, especially in women.

Competing interests: The authors declare no competing financial or personal interests.

This paper has been peer-reviewed.

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