Complications of endourological procedures and their treatment

A MISPLACED PCN TUBE IN THE INFERIOR VENA CAVA: A CASE REPORT AND LITERATURE REVIEW

Khaled Refaai, Mohamed Ramadan, Islam O. Koraiem, Mostafa Sakr

Department of Urology, Alexandria University, Egypt

SUMMARY

Percutaneous nephrostomy (PCN) is a great tool for temporary drainage of obstructed kidney especially when severe urinary tract infection and/or systemic symptoms are encountered. PCN insertion is not without complications, even with experienced hands. However, most of these complications are minor. One major complication is misplacement of the PCN in a major vessel. Here, we report a case of right PCN insertion under ultrasound (US) guidance that was found to be misplaced in the inferior vena cava. The case was safely managed but we conclude that PCN insertion should be done under fluoroscopy with or without US guidance by a well-trained urologist or interventional radiologist because US guidance alone may be not enough safe.

KEY WORDS: Percutaneous nephrostomy; Fluoroscopy guidance; Inferior vena cava (IVC).

DISCUSSION

Percutaneous nephrostomy tube insertion is frequently used for management of obstructed kidney specifically in the presence of infected hydronephrosis. Recently, it is reported that PCN tube insertion is the best for temporary urinary diversion whatever the cause even in sterile kidney obstruction (1). Like any other procedure, complications may happen and although most of them are minor, major complications may still occur with serious consequences.

Few cases have been reported for PCN tube misplacement into IVC (Table 1). We previously reported a case of misplaced silicon Foley's catheter during exchange of left PCN tube at our department, which was also managed by exploration with removal of catheter under vision and pyelolithotomy for stone removal. However, as the PCN tube was a silicon Foley's catheter, the inflation of the balloon inside the IVC led to development of deep venous thrombus formation (2). *Dias-Filho et al.* reported a case of Foley's catheter reaching right atrium during exchange of left nephrostomy tube over guidewire blindly (3). This case was managed conservatively by withdrawal of the catheter under monitoring with full preparation for immediate exploration if needed. Another case was reported by *Lee et al.* who misplaced a right PCN tube in the IVC (4). This case was managed non surgically by withdrawal of the PCN catheter and direct right abdomen compression by a 500 mL bottle and tight sponge. Al-Musawi et al reported a case of PCN tube passed through the kidney to the IVC and transfixing it. The case was safely managed by removal of PCN under fluoroscopy till inside the IVC then to the kidney (5). All the previous cases shared the step that the guidewire manipulation and tract dilation were done either blindly or just with US guidance for kidney puncture. In our center the recommended protocol for PCN insertion is to insert it under US guidance using Seldinger technique as a bed side procedure, so resident did not use fluoroscopy in this case as well.

Relatively more cases have been reported of intravenous misplacement of nephrostomy tubes after *percutaneous nephrolithotomy* (PCNL) (Table 2). *Mazzucchi et al.* reported two cases (6) of intravenous insertion at the end of PCNL procedures that were discovered few days later. Catheters were withdrawn in the presence of a surgical team, with no bleeding or further complications encountered. *Chen et al.* (7) as well as *Fu et al.* (8) reported more cases following PCNL, all of them were safely managed either under image guidance (US, fluoroscopy or CT) or through exploration. All the previous reports came to the same conclusion that intravenous misplacement of a nephrostomy tube is an uncommon complication following PCN tube insertion or PCNL procedures, and conservative management with strict bed rest, intravenous antibiotics, and tube withdrawal with appropriate readiness of the *operatory room* (OR) team is safe and feasible.

In our case, passage of the PCN to the inferior vena cava was due to blind guidewire manipulation and blind dilatation of the tract that usually leads to serious complications. Some Authors emphasized the importance of using both US and fluoroscopy during PCN tube insertion to avoid complications (9). We also believe that, unless it is contraindicated, fluoroscopy is mandatory for accurate and safe guidewire passage and track dilatation even for nephrostomy insertion after PCNL where its position should be checked by contrast injection through it before fixation. The synergistic use of both US and fluoroscopy during PCN tube insertion may lead to negligible complication rates. We also should stress that fluoroscopy may be contraindicated in some cases like pregnancy and hypersensitivity to used contrast material. We also stress on the precautions used to minimize radiation exposure to save physician from radiations side effects like skin irritation and cancer.

ACKNOWLEDGMENTS

We thank members of *Endo-urology Unit, Alexandria Faculty of Medicine* (*Professor. Abdelrahman Zahran, Dr. Hussien Abdeldayim, Dr. Tamer Hussien, Dr. Akram Assem, Dr. Omar Elgebaly, Dr. Mostafa Said and Dr. Tarek*

No conflict of interest declared.

Hani) for providing consultation and sharing in decision making. They received no financial compensation.

References

1. Pabon-Ramos WM, et al. Quality Improvement Guidelines for Percutaneous Nephrostomy. J Vasc Interv Radiol. 2016; 27:410-14.

2. Kotb AF, Elabbady A, Mohamed KR, Atta MA. Percutaneous silicon catheter insertion into the inferior vena cava, following percutaneous nephrostomy exchange. Can Urol Assoc JJ Assoc Urol Can. 2013; 7:E505-E07.

3. Dias-Filho AC., Coaracy GAV, Borges W. Right atrial migration of nephrostomy catheter. Int Braz J Urol Off J Braz Soc Urol. 2005; 31:470-71.

4. Lee T-H, Chen H-M, Wu W-J, et al. Successful nonsurgical management of inferior vena cava penetration as a rare complication of percutaneous nephrostomy. Urol Sci. 2014: 25:98-100.

5. Musawi MNA-A, Mahdi M, Mansor A. Inferior vena cava perforation during right percutaneous nephrostomy: a case report with critical review Iraqi Acad Sci J. 2016; 15:124-26.

6. Mazzucchi E, et al. Intravenous misplacement of the nephrostomy catheter following percutaneous nephrostolithotomy: two case reports. Clinics. 2009; 64: 69-70.

7. Chen X-F, et al.. Intravenous misplacement of nephrostomy tube following percutaneous nephrolithotomy: Three new cases and review of seven cases in the literature. Int Braz J Urol Off J Braz Soc Urol. 2014; 40:690-96.

8. Fu W, Yang Z, Xie Z, Yan H. Intravenous misplacement of the nephrostomy catheter following percutaneous nephrostolithotomy: two case reports and literature review. BMC Urol. 2017; 17, 43.

9. Zegel H et al. Percutaneous nephrostomy: comparison of sonographic and fluoroscopic guidance. Am JRoentgenol. 1981; 137: 925-27.

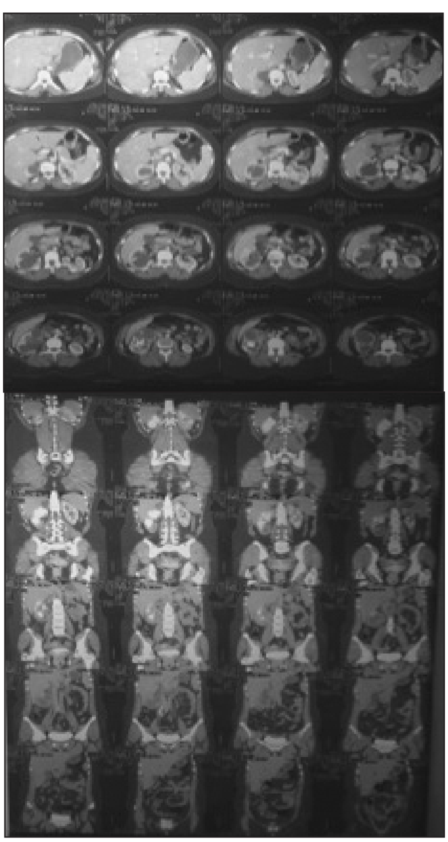

Figure 1.
Axial and coronal cuts of CT scan before PCN insertion.

Table 1.
Reports of intravenous misplacement of a percutaneous nephrostomy tube.

Author	Year	Patient	Side	Place	Catheter	Management
Dias Filho, et al.	2005	63 Y Female	Lt	IVC to Rightt atrium	Foley's cath	Removal under fluoroscopy
Kotb, et al.	2013	50 y male	Lt	IVC	Foley's cath	Exploration with stone removal
Lee, et al.	2014	67 Y Female	Rt	IVC	Foley's cath	Conservative with abdomen compression
						by a 500 mL bottle and tight sponge
AL-Musawi, et al.	2016	42 Y Male	Rt	IVC	Nephrostomy	Removal under fluoroscopy
Refaai, et al.	2019	30 Y Female	Rt	IVC	Nephrostomy	Exploration with stone removal

Table 2.
Reports of intravenous misplacement of a nephrostomy tube after PCNL.

Author	Year	Patient	Side	Place	Catheter	Management
Mazzucchi, et al.	2009	52 Y Male	Lt	Renal vein	Nephrostomy	Under fluoroscopy
Mazzucchi, et al.	2009	35 Y Female	Rt	IVC	Nephrostomy	Under fluoroscopy
Shaw, et al.	2005	54 Y Male	Rt	IVC	Nephrostomy	Exploration
Li, et al.	2013	32 Y Female	Lt	IVC	Nephrostomy	US guided
Chen, et al.	2014	42 Y Male	Lt	IVC	Nephrostomy	CT guided
Chen, et al.	2014	38 Y Female	Lt	IVC	Nephrostomy	Under fluoroscopy
Chen, et al.	2014	48 Y Male	Lt	Renal vein	Nephrostomy	US guided
Fu, et al.	2017	68 Y Male	Rt	Renal vein	Nephrostomy	Exploration
Fu, et al.	2017	28 Y Male	Lt	Renal vein	Nephrostomy	Exploration

Subcapsular hematoma after RIRS. A case report and review of the literature

Eugenio Di Grazia, Davide Di Mauro

Azienda Policlinico Vittorio Emanuele-Ospedale S. Marco, Catania, Italy

Summary

***Introduction:** Among major complications of retrograde intrarenal surgery (RIRS) renal subcapsular hematoma (RSH) is very severe and anecdotal. Large stone size, severe ipsilateral hydronephrosis, long operation duration, higher hydrostatic pressure of the irrigating solution and low ureteral wall compliance are supposed to be risks factors associated with RSH formation. Clinically RSH is characterized by fever, loin pain, white blood cells (WBC) increase and a significant drop in haemoglobin (HB). Diagnosis is based on CT scan. Depending on clinical and hemodynamic conditions RSH management may be conservative or may require renal exploration, super selective renal arterial embolization or simple drainage.*

***Case report:** We report on a case of RSH which occurred on high perfusion pressure a patient after RIRS. Because of clinical symptoms and hemodynamic stability, we drained the RSH under ultrasonic and radiological guidance. Post treatment recovery was uneventful.*

***Conclusions:** Post RIRS RSH is a very rare but severe com-*

plication. Several risk factors together with barotrauma caused by high perfusion pressure during the procedure must be considered to prevent it. Management strategy is tailored to patient's clinical conditions. In hemodynamically stable patients, large hematoma drainage is recommended to prevent further complications and favours early recovery.

KEY WORDS: RIRS; Renal Subcapsular Hematoma; Complications.

DISCUSSION

The rate of RIRS complications is between 0 and 25% and includes fever, low back pain, urinary tract infections, sepsis, haematuria, ureteral and pelvic-mucosal lesion, steinstrasse, urinoma, ureteral avulsion, copious bleeding with the need for transfusion. Post URS/RIRS RSH is considered to be anecdotal (1). According to a review by *Kozminski M et al.*, some preoperative risk factors correlated to RSH are high blood pressure, preoperative stenting deployed for ureteral obstruction or narrowing, and female sex (2).
In these situations, the parenchyma and the pyelocaliceal system are more prone to bleeding even for relatively small insults such as contact with the safety guide wire or a percutaneous puncture (1). Thus, blood and fluids accumulate in the subcapsular space, causing gradual separation of the capsule itself from the renal parenchyma. The physiological intrarenal pressure is around 10 mmHg. During a simple ureterorenoscopy the pressure changes to 35 (+/-10) mmHg, changing to an average of 54 (+/-18) mmHg during the lithotripsy procedure with peaks of 328 mmHg. If the RSH is large, Page's kidney disease may occur.
The underlying pathophysiology of Page's kidney is considered to be that the microvascular ischemia due to renal parenchymal compression activates the renin-angiotensin-aldosterone system, consequently leading to hypertension (3). Usually, the treatment of renal hematoma is conservative in most patients, while renal exploration or super selective renal arterial embolization is accomplished in cases with continuing hemodynamic instability. However, during conservative therapy, the hematoma absorbed slowly so that the symptoms persist in most patients, and the aforementioned complications secondary to hematoma gradually may emerge. In addition, functional deterioration may result from compression especially in solitary kidney patients that can lead to acute renal failure due to SRH.
After RIRS the patient had a persistent fever that began to improve with carbapenems antibiotics, although WBC remained high for several days. That was the reason why we decided during the same session to place a percutaneous nephrostomy and another drain in the RSH.

REFERENCES

1. Yahsi S, Tonyali S, Ceylan C, et al. Intraparenchymal hematoma as a late complication of retrograde intrarenal surgery. International Braz J Urol 2017; 43:367-370.

2. Kozminski MA, Kozminski DJ, Roberts WW, et al. Symptomatic subcapsular and perinephric hematoma following ureteroscopic lithotripsy for renal calculi. Journal of Endourology. 2015; 29:277-282.

3. Bai J, Li C, Wang S, et al. Subcapsular renal haematoma after holmium:yttrium-aluminum-garnet laser ureterolithotripsy. BJU International. 2012; 109:1230-1234.

RETRIEVAL OF BROKEN DJ URETERIC STENT: AA RARE ENDOUROLOGICAL NIGHTMARE

Aldo Franco De Rose, Martina Beverini, Alberto Caviglia, Guglielmo Mantica, Carlo Terrone

Department of Urology, Policlinico San Martino Hospital, University of Genova

SUMMARY

Double-J ureteral stents fracture is a possible but rare complication that is reported in literature in very few cases. We present a rare case of DJ stent fracture discovered one month after the insertion. A broken DJ stent can be safely removed with minimal morbidity and mortality by an experienced endourologist. To minimize further complications, hospitalization and costs it is preferable, when possible, to perform the removal of the broken DJ stent in one time. It is advisable to perform the surgery in two times in case of complications such as fever or extensive stent calcification.

KEY WORDS: Ureteric stent; Urolithiasis; DJ stent; Ureteric stone; Endourology.

DISCUSSION

Ureteral stents are an integral part of urological practice. They have been widely used in daily practice to prevent or relieve the ureteral obstruction, usually for short determining periods. In the literature ureteral stent fragmentation in a rare event accountable for about up to 0.3% of stenting procedures (1-3).
The exact reason for stent fragmentation is unclear (4). Usually, stent fractures spontaneously occur after being in situ for a long time, because of hardening and the loss of tensile strength (2).
However, it is undeniable that such theory cannot be valid for our case and consequently new hypotheses must be considered: it is probable that cellular injury in response to the presence of urinary tract biomaterials may be an important determinant in the promotion and progression of encrustation which might weak the DJ stent (5). Moreover, it has been suggested that fragmentation occurs at a site previously allowed to kink during stent insertion (6). SWL, ureteroscopic laser lithotripsy, PCNL, and open surgery, either alone or in combination, are employed for the management of an encrusted or fragmented Double-J stent, depending on the location and severity of the case.
Urologists well trained and sufficiently advanced in endourology can manage this situation endoscopically, considering open surgery as a last resort when the endoscopic procedures fail (7). The case presented here is an example of fragmentation of DJ stent. Presence of partial encrustation of the broken DJ stent, multiple renal stones, and a functioning new DJ stent beside the broken one may represent technical challenges. Our approach includes a thorough preoperative imaging evaluation to decide the

treatment strategy. Calcifications over the stent can be fragmented with a laser lithotripter while carefully advancing the ureteroscope into the renal pelvis. After all the encrustations and calcification have been fragmented, the ureteral segment of the stent is gently removed with the help of grasping forceps passed through the ureteroscope under fluoroscopic guidance. After that the stent the stent was gently pull out under fluoroscopic guidance. It is important to avoid significant traction on the stent which can lead to ureteral trauma, ureteral avulsion, or further stent fracture and fragmentation (8).

References

1. *Chua ME, Morales ML Jr. Spontaneous fracture of indwelling polyurethane ureteral stents: A case series and review of literature. Can Urol Assoc J. 2012; 6:386-392.*

2. *Ray RP, Mahapatra RS, Mondal PP, Pal DK. Long-term complications of JJ stent and its management: A 5 years review. Urol Ann. 2015; 7:41-45.*

3. *El-Faqih SR, Shamsuddin AB, Chakrabarti A et al. Polyurethane internal ureteral stents in treatment of stone patients: morbidity related to indwelling times. J Urol; 1991; 146:1487-1491.*

4. *Zisman A, Siegel YI, Siegmann A, Lindner A. Spontaneous ureteral stent fragmentation. J Urol. 1995; 153(3 Pt 1):718-721.*

5. *Beiko DT, Knudsen BE, Watterson JD, et al. Urinary tract biomaterials. J Urol. 2004; 171(6 Pt 1):2438-2444.*

6. *Mardis HK, Kroeger RM, Hepperlen TW, et al. Polyethylene double-pigtail ureteral stents. Urol Clin North Am. 1982; 9:95-101.*

7. *Bostanci Y, Ozden E, Atac F, et al. Single session removal of forgotten encrusted ureteral stents: Combined endourological approach. Urol Res 2012; 40:523-529.*

8. *Lam JS, Gupta M. Tips and tricks for the management of retained ureteral stents. J Endourol. 2002; 16:733-741.*

A mini-invasive technique for transurethral replacement of encrusted urinary stents in female patient. Description of the technique and clinical results

Magnano San Lio Vincenzo, Meo Diego, Giordano Giuseppe

Unit of Diagnostic and Interventional Radiology ARNAS "Garibaldi-Nesima", Catania, Italy

Summary

Objective: Usually the replacement of urinary stents with transurethral approach (particularly in women) is performed in angiographic room. However, complete stent obstruction makes it impossible to replace it on a metal guidewire or on hydrophilic guide wire. This transurethral recovery technique that allows, while maintaining access to the ureter, to remove the encrusted stent and replace it with an another stent with the transurethral technique.

Material and Methods: From January 2013 to January 2020 we replaced 402 urinary stents with a transurethral approach (only women) in patients with obstructive urinary disorders (benign and malignant). Out of them 363 were recovered with a standard transurethral approach using a metal guidewire. The remaining 39 stents were obstructed by encrustations, therefore it was impossible to replace them with a standard technique.

Results: In 38 cases it was possible to replace the obstructed stents without complications. All procedures were carried out without any sedation. Patients were discharged after 30 minutes of observation from the end of the procedure.

Conclusions: This technique allows the interventional radiologist to replace obstructed urinary stents avoiding more invasive and traumatic urological procedures with sedation.

Key words: Encrusted urinary stents; Replacement technique; Ureteral catheters; Fluoroscopy.

Material and methods

From January 2013 to January 2020 we replaced 402 urinary stents with a transurethral approach in 325 women with obstructive urinary disorders (benign and malignant). Patients were identified via a *Picture Archive and Communications System* (PACS) and patient demographics and relevant clinical data were obtained from their written medical records.

A total of 363 stents were replaced with a standard transurethral approach using a metal guidewire. The remaining 39 stents were obstructed by encrustations; therefore, it was impossible to replace them with a standard technique.

All procedures were performed in an interventional radiology suite, and written informed consent was obtained from all patients.

The mean age of the cohort was 58 years (range 32-82 years). Most ureteral stent replacements were in patients with urinary tract obstruction secondary to malignancy, other patients were suffering from benign conditions such as endometriosis, fibroids or inflammatory/infectious ureteral stenosis. Before each procedure, microscopic examination of urine, evaluation of renal function, blood count and coagulation were obtained for each patient. The mean time between the procedures of replacement was 7.2 months (SD: 6.5 months).

All procedures are carried out without any sedation.

The patients were discharged after 30 minutes of observation from the end of the procedure.

The fluoroscopic time, technical success (defined as the possibility of replacing the encrusted double J stent with a retrograde approach under fluoroscopic guidance) and the occurrence of complications were recorded.

Discussion

Plastic double J stents are prone to obstruction and encrustation, so it is recommended to replace the ureter stents permanently at intervals of 4-6 months or sooner if they are blocked (1-4).

The chemical components of the urine combine with the stent surface to form a matrix on which further calcification occurs resulting in encrustation. Numerous factors contribute to the speed with which this process occurs, including the material of the stent or catheter, the composition of the urine, and the indwelling time (5).

Formation of encrustations is also dependent bacterial colonization (6). When positioned, the stents are quickly covered by a bacterial biofilm that along time can lead to obstruction of the flow of urine and possibly to sepsis of the urinary tract (7). Some organisms, especially Proteus species, which produce urease, cause hydrolysis of urea with increase of urinary pH which induces the deposition of calcium and ammonium magnesium phosphate crystals along this biofilm (8). Other risk factors for stent encrustation can be pregnancy (9) and history of urolithiasis (10).

Traditionally, ureteral stent replacement has been performed by cystoscopic guidance; the advantage of this approach is direct visualization. This can be done with a flexible or rigid cystoscope. Procedures by rigid cystoscope tend to be painful and can be poorly tolerated without general anesthesia (2).

Transvesical ureteric stent removal and replacement under fluoroscopic guidance was first described by *Yedlicka et al.* (11). It is highly successful and in general well tolerated by patients. Pain is controlled by topical lidocaine gel for the urinary tract and, if necessary, by conscious sedation with midazolam. As confirmed by *Chang et al.* a significant advantage of fluoroscopically guided removal and replacement is the reduction of the general anesthetic costs associated with rigid cystoscopy (4).

Different techniques such as shock wave lithotripsy, ureteroscopy and percutaneous techniques, alone or in combination, are described for the management of encrusted ureteral stents (12, 13).

The present technique, such as that described by *Lopez-Huertas et al.* (14), is very useful for the replacement of stents without coarse calcifications on fluoroscopy where it is not possible to insert a guide inside the stent due to the encrustation of the lumen. If significant calcification is present under fluoroscopy, it is advisable to pursue other methods for removing encrusted stents. In this case, our technique is unlikely to be successful and use of excessive force could result in more serious complications, such as ureteral avulsion or stent fragmentation (14). We have used this technique to successfully treat 28 women. There were no complications, such as ureteral injury, stricture, or stent fragmentation, in any of the cases.

This study is limited by its retrospective nature and by the lack of clear documentation of procedural times. Furthermore, we have limited our study to female patients.

References

1. *Park SW, Cha IH, Hong SJ, et al. Fluoroscopy-guided transurethral removal and exchange of ureteral stents in female patients: technical notes. J Vasc Interv Radiol. 2007; 18:251-256.*

2. *McCarthy E, Kavanagh J, McKernan S, et al. Fluoroscopically guided transurethral removal and/or replacement of ureteric stents in women. Acta Radiol. 2015; 56:635-40.*

3. *Carrafiello G, Coppola A, De Marchi G, et al. Trans-Urethral Ureteral Stent Replacement Technique (TRUST): 10-Year experience in 1168 Patients. Cardiovasc Intervent Radiol. 2018; 41:610-617.*

4. *Chang RS, Liang HL, Huang JS, et al. Fluoroscopic guidance of retrograde exchange of ureteral stents in women. AJR Am J Roentgenol. 2008; 190:1665-70.*

5. *Vanderbrink BA, Rastinehad AR, Ost MC, Smith AD. Encrusted urinary stents: evaluation and endourologic management. J Endourol. 2008; 22:905-12.*

6. *Ramsay JW, Crocker RP, Ball AJ, et al. Urothelial reaction to ureteric intubation. A clinical study. Br J Urol. 1987; 60:504-505.*

7. *Wollin TA, Tieszer C, Riddell JV, et al. Bacterial biofilm formation, encrustation, and antibiotic adsorption to ureteral stents indwelling in humans. J Endourol. 1998; 12:101-111.*

8. *Reid G, Davidson R, Denstedt JD. XPS, SEM and EDX analysis of conditioning film deposition on ureteral stents. Surf Interface Anal. 1994; 21:581-586.*

9. *Gertner JM, Coutan DR, Kliger AS, et al. Pregnancy as state of physiologic absorptive hypercalciuria. Am J Med. 1986; 81:451-456.*

10. *Robert M, Boularan AM, El Sandid M, Grasset D. Double-J ureteric stent encrustations: clinical study on crystal formation on polyurethane stents. Urol Int. 1997; 58:100-104.*

11. *Yedlicka JW Jr, Azipuru R, Hunter DW, et al. Retrograde replacement of internal double-J ureteral stents. Am J Roentgenol. 1991; 156:1007-1009.*

12. *Acosta-Miranda AM, Milner J, Turk TM. The FECal Double-J: a simplified approach in the management of encrusted and retained ureteral stents. J Endourol. 2009; 23:409-415.*

13. *Rana AM, Sabooh A. Management strategies and results for severely encrusted retained ureteral stents. J Endourol. 2007; 21:628-632.*

14. *López-Huertas HL, Polcari AJ, Hugen CM, et al. A novel technique for the removal of minimally encrusted ureteral stents. J Endourol. 2010; 24:9-11.*