Original Research Article

Management of Retained Double - J Ureteral Stents - Our Experience

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International Archives of Integrated Medicine, Vol. 8, Issue 4, April, 2021.
Available online at http://iaimjournal.com/
ISSN: 2394-0026 (P) **ISSN: 2394-0034 (O)**
Received on: 02-03-2021 **Accepted on:** 01-04-2021
Source of support: Nil **Conflict of interest:** None declared.
How to cite this article: Rammohan T, Vijayalaxmi Adepu, N. Surender Reddy. Management of Retained Double - J Ureteral Stents - Our Experience. IAIM, 2021; 8(4): 31-40.

Abstract

Aims and objectives: To present our experience and discuss the various endourological approaches for treating forgotten encrusted (Retained) ureteral stents associated with stone formation.

Materials and Methods: From April 2019 to March 2021, 30 patients (18 men and 12 women) with encrusted ureteral stents were analyzed. The average indwelling time of the stent was 4.9 years (range 1 to 12). X-ray kidney urinary bladder (KUB), Non contrast CT abdomen was used to evaluate encrustation, stone burden, and fragmentation of the stents. Intravenous urogram and a Tc99m diethylene triamine penta acetic-acid renogram was used to assess renal function.

Results: In eight patients, the entire stent was encrusted, in three patients the encrustation was confined to the ureteral and lower coil part of the stent, five patients had encrustation of the lower coil, one patient had upper coil and ureteral encrustation, four patients had only upper coil encrustation, five patients had both upper coil and lower coil encrustation and minimal encrustation was observed in four patients. Percutaneous nephrolithotomy was performed in 2 cases, combined percutaneous nephrolithotomy and retrograde ureteroscopy with intra-corporeal lithotripsy in 1 patient, combined cystolithotripsy and percutaneous nephrolithotomy in 5 patients, combined cystolithotripsy and ureteroscopic lithotripsy in 3 patients and combined cystolithotripsy, ureteroscopic lithotripsy and percutaneous nephrolithotomy in 6 patients. Only cystolithotripsy was used to manage the distal coil of the encrusted stent in 5 patients. Simple cystoscopic removal of the stents with minimal encrustation was carried-out in two cases. Only two patients required open surgical removal of the stent. 27 out of 30 patients were rendered stone and stent free in one session. 2 patients died before any intervention for removal of retained stents due to renal failure. one patient underwent nephrectomy for nonfunctioning kidney.

Conclusion: Endourological management of forgotten encrusted stents is highly successful and often avoids the need for open surgical techniques.

Key words

Stents, Ureteral, Retained, Forgotten, Management, Lithotripsy.

Introduction

Ureteral stents are widely used in urological practice. They are mainly indicated after any ureteral surgery and for managing ureteral obstruction due to intrinsic or extrinsic causes like stones, strictures, uretero-pelvic junction obstruction, retroperitoneal fibrosis, malignancies, and congenital anomalies. They are also placed after iatrogenic injuries to the ureter and before any complex abdominal procedure for identification and protection of the ureters. Because of their wide spread usage, complications due to these stents have also increased like, stent encrustation, stent fragmentation, stone formation and recurrent urinary tract infection [1, 2]. Retention of ureteral stents, often due to poor compliance of the patient is not uncommonly seen [3]. If left untreated, these retained stents result in significant morbidity and mortality. Various methods of treatment combinations of extracorporeal shock wave lithotripsy (SWL), cystolithotripsy (CLT) retrograde ureteroscopy with intracorporeal lithotripsy, percutaneous nephrolithotomy (PCNL) and open surgery have been used for retrieval of these encrusted stents [4-8]. We present our experience with the management of these forgotten stents, associated with significant encrustation and stone burden in 30 patients.

Materials and methods

We had studied 30 patients presented to our out-patient department with retained DJ stent from April 2019 to March 2021. All patients with prior history of DJ stenting and stent indwelling time of more than 1year included in the study. Patients with stent indwelling time of less than 1 year were excluded from the study. All the patients were evaluated for stent encrustation and associated stone burden by plain x-ray KUB, intravenous urogram and NCCT (Non contrast CT). In patients with non-visualized kidneys on intravenous urogram, TC99 diethylene triamine penta acetic acid (DTPA) renogram was done.

Treatment

Treatment decision was made on clinical and radiological findings. Before intervention, all patients had negative urine cultures and antibiotic prophylaxis was given for all patients. Combined endourological procedures such as cystolithotripsy (CLT), ureteroscopic lithotripsy (URSL), percutaneous nephrolithotomy (PCNL) with intracorporeal lithotripsy were performed. In stents with minimal encrustation on plain X-ray KUB, a gentle attempt was made for removal with the help of grasping forceps passed through the cystoscope under local anesthesia and fluoroscopic guidance. Retrograde ureteroscopy was performed using 6/7.5 and 8/9.8 Fr semi-rigid ureteroscope, under fluoroscopic guidance. Intracorporeal lithotripsy was performed with a pneumatic lithotripter. PCNL was carried out using a rigid 24 Fr nephroscope. For patients with encrustation and stone burden involving the lower coil, ureteric body or whole of the stent, initially, CLT, retrograde ureteroscopy and intracorporeal lithotripy was performed in the dorsal lithotomy position. Following this, a gentle attempt was made to retrieve the stent with the help of an ureteroscopic grasper. If the stent failed to uncoil, a ureteric catheter was placed adjacent to the encrusted stent for injection of radio-contrast material to delineate the renal pelvis and calyces. Then the patient was placed in the prone position and PCNL of the upper coil of the encrusted stent along with calculus was done. The approach to the collecting system was through the lower calyx, and middle posterior calyx and no patient required upper pole or supracostal access. A 14 Fr nephrostomy was kept indwelling for 48 hours, in patients who required PCNL. Patients in whom

endourological procedures were unsuitable, open surgery like pyelolithotomy, cystolithotomy was done to clear the stone burden. Re-stenting was done in patients with encrustations in renal and ureteric portions of the stent and in patients requiring pyelolithotomy. Subsequently stent was removed after 2 weeks. A patient with no renal function on DTPA renogram nephrectomy was done. Postoperatively, plain film radiography was done to confirm the stone free status.

Results

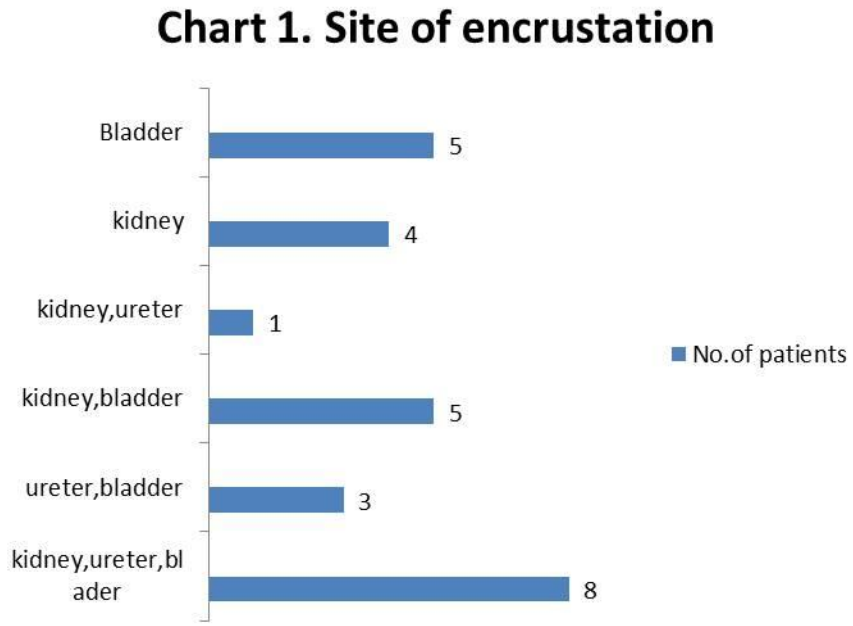
A total of 30 patients presented to our out-patient department with retained DJ stent during the study period. The patient characteristics, indwelling time, site of encrustation, need for renal replacement therapy, type of procedure performed and complications were shown in **Table - 1, 2** and **Chart - 1**.

Table – 1: Patient characteristics, indwelling time, site of encrustatation, renal replacement therapy, procedure done for removal of stent, complications. K=Kidney, U=ureter, B=bladder,M=male,F=female,CLT=cystolithotripsy,URSL=ureteroscopic lithotripsy, PCNL = percutaneous nephrolithotomy

Age/ sex	Indwelling time (years)	Site of encrustation	Need for renal replacement therapy	Procedure done	Complications
25/F	5	K,U,B	No	CLT,URSL,PCNL	No
32/M	2		No	Cystoscopic removal	No
40/F	3	B	No	CLT	No
55/M	4	K	No	PCNL	No
4/M	2	K	No	Pyelolithotomy	No
45/F	5	B	No	CLT	No
42/M	4	K	No	PCNL	No
40/M	3	K,U,B	No	CLT,URSL,PCNL	Sepsis
50/F	7	K,B	No	CLT, PCNL	No
32/M	6	K,B	No	CLT, PCNL	No
55/M	12	K,U,B	No	CLT,URSL,PCNL	No
32/F	1		No	Cystoscopic removal	No
11/M	6	K,B	No	Cystolithotomy, Pyelolithotomy	No
29/M	6	K,U	No	URSL,PCNL	No
44/F	5	K,U,B	No	CLT,URSL,PCNL	No
42/M	5	K,B	No	CLT, PCNL	No
38/F	6	U,B	No	CLT,URSL	No
60/F	4	B	No	CLT	No
23/M	3	B	No	CLT	No
48/F	8	K,U,B	No	CLT,URSL,PCNL	Sepsis
30/M	4	U,B	No	CLT,URSL	No
28/M	6	K,B	No	CLT, PCNL	No
18/M	2		No	Cystoscopic removal	No
55/F	2	B	No	CLT	No
42/M	7	K,U,B	No	CLT,URSL,PCNL	No
33/M	3	U,B	No	CLT,URSL	No
22/F	2		No	Cystoscopic removal	No
29/M	11	K	No	Nephrectomy	No

Table – 2: Procedure done for removal of retained dj stents.

Procedure done	No. of patients
Cystoscopic stent removal under LA	4
CLT	5
CLT, PCNL	4
CLT,URSL	3
URSL, PCNL	1
PCNL	2
CLT,URSL, PCNL	6
Pyelolithotomy	1
Pyelolithotomy, Cystolithotomy	1
Nephrectomy	1



Patients were in the age ranging from 4 years to 60 years. Out of 30 patients 18 were male and 12 were female. Stent indwelling time of study group ranged from 1year to 12 years, the average being 4.9 years. Patients were evaluated for stent encrustation and associated stone burden by x-ray KUB, intravenous urogram and non-contrast CT (NCCT) abdomen. In eight patients, the entire stent was encrusted (**Figure - 1, 2 and 3**), in three patients the encrustation was confined to the ureteral and lower coil part of the stent, five patients had encrustation of the lower coil, one patient had upper coil and ureteral encrustation, four patients had only upper coil encrustation, five patients had both upper coil and lower coil encrustation and minimal encrustation was observed in four patients. Treatment decision was made on clinical and radiological findings. Before intervention, all patients had negative urine cultures and antibiotic prophylaxis was given for all cases. Percutaneous nephrolithotomy was performed in 2 cases, combined percutaneous nephrolithotomy and retrograde ureteroscopy with intra-corporeal lithotripsy in 1patient, combined cystolithotripsy and percutaneous nephrolithotomy in 5 patients, combined cystolithotripsy and ureteroscopic lithotripsy in 3 patients and combined cystolithotripsy, ureteroscopic lithotripsy and percutaneous nephrolithotomy in 6 patients. Only cystolithotripsy was used to manage the distal coil of the encrusted stent in 5 patients. Simple cystoscopic removal of the stents with minimal

encrustation was carried-out in two cases. Only two patients required open surgical removal of the stent. 27 out of 30 patients were rendered stone and stent free in one session. 2 patients required renal replacement therapy in the form of hemodialysis for elevated renal parameters and ultimately these 2 patients died before any intervention for removal of retained stents. One patient underwent nephrectomy for non-functioning kidney. 2 patients had heavy stone burden in kidney. Ureter and bladder developed sepsis in the post-operative period which was managed with appropriate antibiotics and resuscitative measures. All the stents were removed intact except in two patients, who had fragmented stents (**Figure - 4**) at presentation. Stone analysis showed calcium oxalate and phosphate in the majority of cases.

Figure – 1: showing NCCT abdomen film with entire stent encrustation on both sides.

Figure – 2: showing NCCT abdomen film with entire stent encrustation on right side.

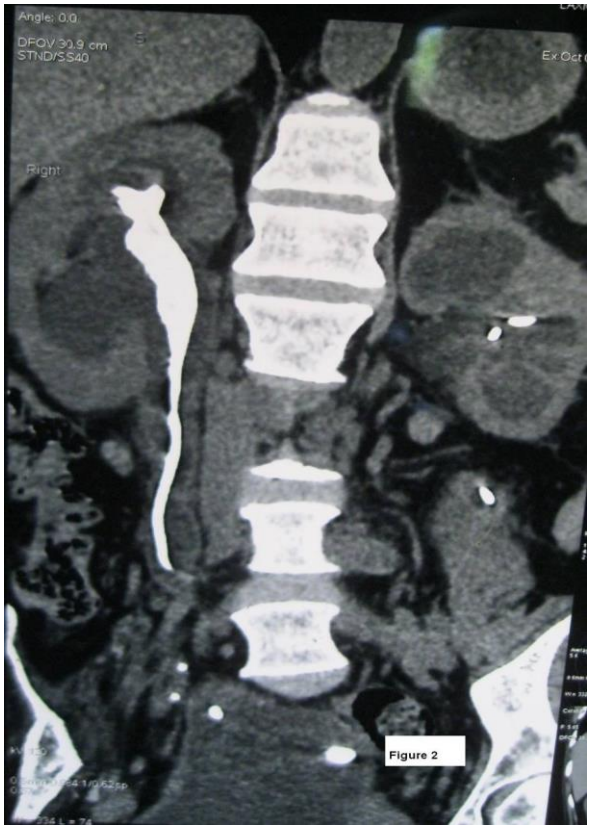
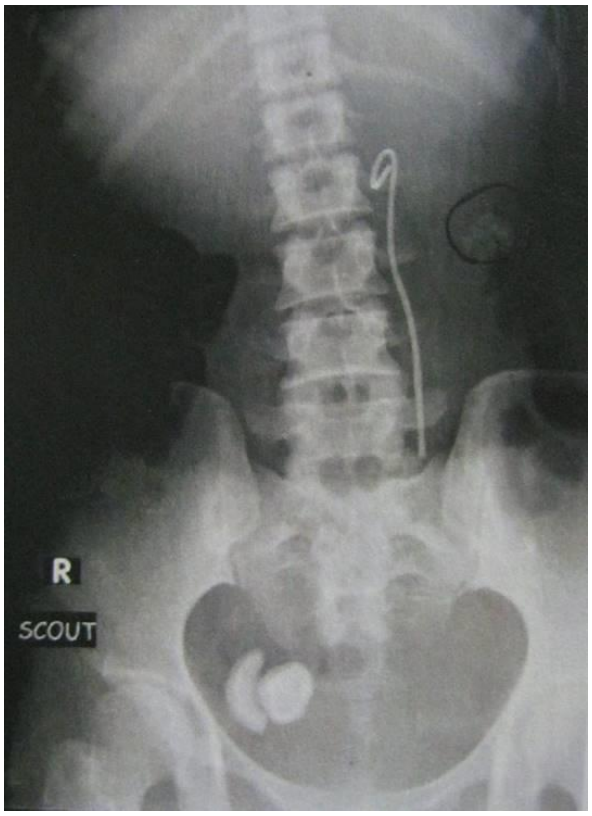


Figure – 3: showing retrived stent showing extensive encrustation and stone formation.

Figure – 4: Plain X ray KUB showing fragmented left dj stent and remaining fragment with calculus in the bladder.



Discussion

Forgotten or retained ureteral stents observed in urologic practice because of poor compliance of the patient or failure of the physician to adequately counsel the patient. These forgotten stents can produce considerable morbidity and mortality, due to extensive encrustation with significant stone burden, knot formation, upward migration and fragmentation [1, 9].

Encrustation of forgotten stents associated with large stone burden is a serious problem, due to complications like recurrent urinary tract infection, hematuria, obstruction and renal failure [10].

The deposition of encrusted material on retained ureteral stents can occur in both infected and sterile urine. The mechanism of encrustation in infected urine is a result of organic components in the urine crystallizing out onto the surface of biomaterial and becoming incorporated into a bacterial biofilm layer, Other factors implicated in the increased incidence of encrustations are chronic recurrent stone formers, metabolic predisposition to stone disease, congenital renal anomalies, malignant urinary obstruction and pregnancy [11].

In a study of Lam JS, et al., the average stent indwelling time was 10.7 months (range 3-28 months) [8]. In another study by Aravantinos, et al., the average stent indwelling time was 24.1 months (range 6-8 5 months) [12].

In present study, the average stent indwelling time was 4.9 years (range 1-2 years). Fragmentation is another important complication of the forgotten stents. It is the result of loss of tensile strength, which is due to hardening and degeneration of the stent polymers [13]. The risk of encrustation and fragmentation is dependent on the type of material of the stent. Silicone was found to be least prone for encrustation, followed by polyurethane, silitek, percuflex and hydrogel coated polyurethane [14].

Fragmentation of polyurethane stents are four times as frequent as the silicone stents [9]. In our series, fragmentation of the lower coil of the stent is seen in four cases at the time of presentation. The indwelling time in all four cases was more than five years. All the retrieved encrusted stents in our series were made of polyurethane.

Retained ureteral stents with encrustation is a challenging problem for urologists. Very often, multiple endourological approaches are needed because of encrustation and the associated stone burden that may involve the bladder, ureter and kidney. This may require single or multiple sessions or rarely open surgical removal of the encrusted stents and associated stone burden. Singh, et al. described multiple accesses and approaches including open surgery to treat the retained Stents [15].

Borboroglu, et al. also reported the endourological treatment of four patients with severely encrusted ureteral stents with a large

stone burden. All patients required two to six endourological approaches (average 4.2) performed at one or multiple sessions, to achieve stone-free and stent-free status. These authors concluded that percutaneous nephrolithotomy and ureteroscopy are often necessary for treating a severely encrusted stent and associated stone burden [7].

One stage removal of 12 encrusted retained ureteral stents has been reported by Bukkapatnam, et al. in ten patients. Of these, 11were managed by ureteroscopy alone and in one patient; the stone was treated through a percutaneous approach. They concluded that, these stents can be removed in one sitting with minimal morbidity and short hospital stay [16].

Using a combination of SWL, PCNL, CLT ureteroscopy with intracorporeal lithotripsy, clearance rates ranging from 75 to 100% have been reported [4, 6, 12]. The site of encrustation, associated stone burden and the function of the affected kidney often dictate the method of access and treatment. Our-approach towards management of these difficult stents is based on the findings on plain-film radiography and NCCT. The proximal, distal coils and body of the stent are examined for encrustation, calcification and fragmentation. Intravenous urogram and DTPA renogram is obtained to determine the function of the kidney. Nephrectomy is done for non-salvageable function of the kidney. Nephrostomy or placement of second sent is done, if the patient presented with pyelonephritis and sepsis. It is possible to put a second stent adjacent to the encrusted stent because the ureter is dilated in majority of these cases.

Extracorporeal shock wave lithotripsy (ESWL) is the initial treatment of stents with minimal encrustation. However, in our series, no patient required SWL because of extensive stone burden in majority of cases.

If there are no encrustations visible on imaging modalities, our approach is cystoscopic removal using a grasping forceps under local anesthesia with flouroscopic guidance. Gentle traction on the stent is applied, if patient complains of pain and if the stent does not uncoil, the procedure is abandoned. An important precaution during the procedure is to avoid excessive force, which can result in breakage of the stent along with ureteral injury or ureteral avulsion. In our series, 4 patients were managed by cystoscopic removal of minimally encrusted stent under local anesthesia.

The next stage is CLT with the help of pneumatic lithotripter on stents with lower coil encrustations. This is followed by gentle pull under fluoroscopic guidance. In our series, 5 patients were managed by CLT alone and 13 patients needed CLT in addition to other procedures for complete stone clearance.

If the cystoscopic approach fails, and in patients with encrustation involving the ureteric portion of the stent, the next approach is under anesthesia, a safety guide wire is passed along the retained stent and ureteroscope is passed retrograde. Calcifications over the stent can be fragmented with a pneumatic lithotripter, while carefully advancing ureteroscope into the renal pelvis. After all the encrustations and calcifications have been fragmented, the stent is gently removed with the help of grasping forceps passed through the ureteroscope. Following removal of the stent, it is mandatory to do a retrograde ureteropyelogram and check ureteroscopy to rule out a ureteric injury. If any signs of ureteric injury or contrast extravasation present, the patient should be re stented. In our series, 10 patients needed URSL for encrustations in body portion of the stent. For stents with large stone burden and those stents which fail to be retrieved by the above mentioned techniques, A 5 Fr ureteric catheter is placed adjacent to stent to enable the injection of radio contrast material into the renal pelvis and calyces as an aid to subsequent percutaneous access and the patient is placed in the prone position. Percutaneous access is established by a lower calyceal or middle calyceal puncture and the proximal coil of the stent along with the stone

is fragmented. The stent is gently removed under fluoscopic guidance through the percutaneous nephrostomytract.

Using the above mentioned approach, it was possible to remove all stents in 25 out of 28 patients, using the endourological approach alone. Open surgery was done in 3 cases. One patient needed pyelolithotomy, one patient needed pyelolithotomy and cystolithotomy and one patient needed nephrectomy for non-functioning kidney. Open surgery for stone clearance was done because of excessive stone burden and patients were of pediatric age group.

Laparoscopic management of a retained heavily encrusted ureteral stent has also been reported [17]. In our series, 2 patients developed sepsis in the immediate post-operative period requiring broad spectrum antibiotics and intensive care management.

In our series, 2 patients required renal replacement therapy in the form of hemodialysis for elevated renal parameters and ultimately these 2 patients died before any intervention for removal of retained stents.

Although, endourological management of these stents achieves success in the majority of these cases with minimal complications, the best treatment that remains is prevention of this complication. The treating physician should be very selective in placing the stents and they must be tracked very closely by documenting the insertion and removal of the stents. All patients should be counseled with respect to the complications of long term use and advised when their stent should be changed. As mentioned earlier, the degree of encrustation is dependent on the indwelling time, so, it is necessary to keep the indwelling time between 2- 4 months is safe [3, 4, 5, 6, 18].

It is also important to maintain a proper record of all stents inserted and keep a track of their due date of removal. Some authors have proposed a computerized tracking program for stent removal [19]. Coatings such as hydrophilic polymers, heparin, pentosanpolysulfate, or oxalate-degrading enzymes have been used in attempt to reduce encrustation [20-23]. The use of bio-degradable compound of poly-L-lactic acid and glycolic acids which are designed to disintegrate can eliminate the problem of retention and encrustation of the stents [24].

Conclusion

Double-J stents are an important tool in an urologist's armamentarium to prevent and relieve obstruction. Routine use is not justified, as they are not free of complications. Their use must be strictly restricted to select cases and one must be familiar with their merits and demerits. The stent should be monitored while in place, promptly removed when no longer needed, and changed periodically if chronically indwelling. Risk factors for complications should be minimized with high fluid intake, prompt evaluation of clinical complaints, and aggressive treatment of documented infection. Encrustation and stone formation in forgotten stents often lead to life threatening complications and pose a challenging management task for the treating surgeon. Stent indwelling time should be minimized to avoid problems. Combined endourologic techniques can achieve safe removal of forgotten stents if treatment is tailored to the volume of encrustation and associated stone. Imaging evaluation and documentation of negative urine culture are imperative prior to any attempt to remove the stent. Satisfactory physician-patient communication is of paramount importance in maintaining compliance with treatment and follow-up, and decreasing the risk of adverse events with potentially litigious ramifications.

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