Forgotten Reminders: an Experience with Managing 28 Forgotten Double-J Stents and Management of Related Complications

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Abstract Combinations of extracorporeal shockwave lithotripsy (ESWL) and endourological and open surgery have been used for management of forgotten double-J (DJ) stents; however, there are only a few case reports or case series in literature. We present our experience of managing 28 cases of forgotten ureteric stents of whom three patients died because of complications after intervention. We retrospectively reviewed the hospital records of 28 cases of forgotten DJ stents from 2000 to 2013. The details reviewed included indications for stent placement, indwelling time, presenting complaints, laboratory, radiographic, nuclear scan findings, management techniques, and complications. Extensive review of literature was done. Mean patient age was 37.7 ± 14 years. Mean indwelling time was 102.9 months. The commonest presenting complaints were irritative voiding symptoms and hematuria. Nineteen (67.8 %) of the stents were complicated. The complicated stents were managed by a combination of endourological techniques and ESWL. Six (21.5 %) patients presented with renal failure. Three patients died of complications. Forgotten DJ stent can be a lethal yet entirely preventable complication. Preoperative imaging with a noncontrast CT is essential especially in long indwelling time, especially to evaluate stone burden at the upper end of the stent. A step-wise approach should be used for management. Where long operative times are expected, the procedure must be staged.

Combined endourological procedures are almost always successful in managing these challenging cases.

Keywords Endourology · Double-J stent · Forgotten stent · Stent · Stone

Introduction

Although double-J (DJ) stents are an indispensable tool in the armamentarium of a urologist to drain and divert the urinary tract, their use is not always justified [1].

A forgotten DJ stent can cause a spectrum of complications ranging from hematuria, stent occlusion, migration, fragmentation, encrustation, and stone formation [2–6] to serious complications like recurrent urinary tract infection (UTI), urinary tract obstruction, and renal failure. Even fistula formation to the iliac arteries is known [7]. Mortality has also been reported [5, 6, 8].

Combinations of extracorporeal shockwave lithotripsy (ESWL) and endourological and open surgery have been used to make the patients stent free [9, 7, 10, 11]. Xu et al. reported the use of holmium laser for management of this condition [12].

The existing review of literature shows numerous case reports or case series on this subject even after advancing technology and recall systems. In this study, we present our experience of managing 28 cases of forgotten ureteric stents of whom 3 patients died because of complications after intervention.

Methods

We retrospectively reviewed the records of 28 cases of forgotten ureteric stents at a tertiary care institute. More than 6000 DJ

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stenting procedures were done in the 13-year study period. Twenty-two of the cases were referred from elsewhere while six cases were stented at our institute. A stent register was maintained in the operation theater as well as in the office. The study was exempt from review by the institutional ethics committee.

The details reviewed included the indications for stent placement, stent material, indwelling time, presenting complaints, laboratory, radiographic and nuclear scan findings, management techniques, and complications of intervention.

For the size of encrustations, a plain X-ray alone was used in 12 cases, most of them in the earlier part of the study, while an additional noncontrast CT scan (NCCT) was used in 16 cases. In the later part of the study, an NCCT was done in all the cases where indwelling time was more than 1 year.

The encrustations were categorized as mild when the encrustation in the upper tracts (in the ureter or along the upper coil of the stent) was less than 5 mm in the maximum diameter on CT, moderate when the diameter was between 5 and 10 mm, and severe when the encrustation was more than 1 cm in diameter. Renal function was assessed with an intravenous urography (IVU) or diethylene triamine pentaacetic acid (DTPA) scan.

An “uncomplicated” stent was defined as an intact DJ stent with mild encrustations, and normal renal function of the ipsilateral renal unit.

A preoperative urine culture was obtained in all of the cases, and when positive, culture-specific antibiotics were given. Intravenous antibiotic cover was given during all the invasive procedures.

An ultrasound was used in the initial workup in 20 patients. If there was evidence of infected hydronephrosis, a percutaneous nephrostomy (PCN) was used to decompress the system.

In the “uncomplicated” stents removed cystoscopically, under local anesthesia, fluoroscopy was used to notice the proximal uncurling of the stent. In case of resistance, and failure of the upper end of the stent to uncoil, the procedure was abandoned in favor of ancillary procedures such as ureteroscopy or percutaneous methods.

For percutaneous procedures, standard technique of percutaneous nephrolithotomy (PCNL) was used using a rigid 24 French nephroscope and an amplatz sheath.

Retrograde ureteroscopy was performed using 8/9.8F and 6/7.5F semi-rigid ureteroscope, under fluoroscopic guidance.

Results

The mean patient age was 37.7 ± 14 years (14–62 years). The male to female ratio was 25:3. The mean indwelling time was 102.9 months (median 23 months). Twenty-one patients had the stent forgotten by the patient, and seven cases had a history of inadequate counseling by the physician about the presence of stent and the need for its removal. Irritative voiding

Table 1 Presentation of forgotten stents

S. no	Presentations	Number of cases
1	Irritative voiding symptoms	13
2	Hematuria	8
3	Recurrent UTI	5
4	Stone formation	7
5	Loin pain	6
6	Renal failure	6
7	Infected hydronephrosis	1
8	Hypertension	1
9	Renal graft dysfunction	1

symptoms were the commonest presentation, present in almost half of the cases (Table 1). Ureteroscopy and PCNL for stone removal were the commonest indications for initial stent insertion (Table 2).

The stents were complicated in 19 patients (67.81 %). Complications included broken stent, migrated stents, and encrusted and calcified stents.

Features suggestive of infected hydronephrosis were present on ultrasound in three patients at presentation. These patients were managed with an initial PCN before definitive management.

An NCCT was done in 16 of the 28 cases. A correlation was made with X-ray, and it was noted that in ten cases (62.5 %), plain X-ray missed encrustations which were subsequently detected on NCCT.

All nine “uncomplicated” stents could be removed successfully by retrograde stent removal. The complicated stents were managed by a combination of endourological techniques and ESWL (Table 3). Cystoscopic retrograde stent removal was possible in seven of the complicated stents, of which two stents got fragmented on pulling, and had to be removed later by percutaneous stent removal. In these two cases, an NCCT was not done in the preoperative period. NCCT done afterwards revealed encrustations >0.5 cm at upper end in both the cases, which was missed preoperatively.

Table 2 Indications of stenting

S. no	Indications	Number of cases
1	URS	9
2	PCNL	9
3	Open pyeloplasty	2
4	Open pyelolithotomy	2
5	Renal transplantation	2
6	Lap pyeloplasty	1
7	RGP and stenting for ESWL of renal stone	1
8	Ureteric reimplantation	1
9	VVF repair	1

Table 3 Management of forgotten complicated DJ stents

S. no	Stents with complications	Treatment modalities	Intraoperative complication	Management of intraoperative complication	Patient outcome
1	Mild encrustations and calcifications along the lower end	Retrograde stent removal	None	—	Alive, no residual fragments
2	Mild encrustations and calcifications at the upper end	Retrograde stent removal	None	—	Alive, no residual fragments
3	Moderate encrustations and calcifications along the lower end	Retrograde stent removal	None	—	Alive, no residual fragments
4	Moderate encrustations and calcifications along whole of the stent	Retrograde stent removal	None	—	Alive, no residual fragments
5	Moderate Encrustations and calcifications along the entire stent with renal failure	Retrograde stent removal	Stent fragmentation	Percutaneous stent removal after NCCT	Alive, no residual fragments
6	Mild encrustations and calcifications both at the upper and lower end of the stent	Retrograde stent removal	Stent fragmentation	Percutaneous stent removal after NCCT which revealed severe encrustations at the upper end	Alive, no residual fragments
7	Large stone at upper end of stent on NCCT	Percutaneous removal of stone and stent	None	—	Alive, no residual fragments
8	Large stone at upper end of stent	Percutaneous removal of stone and stent	None	—	Alive, no residual fragments
9	Large stone at lower end of stent	Mechanical cystolithotripsy and retrograde stent removal	None	—	Alive, no residual fragments
10	Large stone at upper end of stent	Percutaneous Laser lithotripsy and removal of stent	None	—	Alive, no residual fragments
11	Broken upper part of stent (stent removal tried elsewhere) hypertension, non-functioning kidney and renal failure	Simple nephrectomy	None	—	Alive
12	Stone at upper end of the stent	Percutaneous laser lithotripsy	Long operative time, residual fragments. Postoperative fever	Fever managed conservatively. Re-look percutaneous removal after 1 week	Alive, no residual fragments
13	Spontaneously fragmented stent with encrusted lower end of the stent	Laser cystolithotripsy and Retrograde stent removal with cystoscope	None	—	Alive
14	Spontaneously fragmented stent at two places (h/o stenturia of the middle portion) with large stone at upper and lower coil of the stent	Laser cystolithotripsy followed by Percutaneous laser lithotripsy 2 weeks later	Inability to remove whole of stent in one sitting.	Procedure staged. Residual fragments after pcnl. ESWL used	Alive
15	Spontaneously fragmented stent with stone at lower end of the stent with renal failure	Mechanical cystolithotripsy with attempted removal of upper part with a ureteroscope	Intra operative inability to remove whole of the stent. Post operative sepsis and refractory acidosis requiring hemodialysis	Stent fragments left behind	Death

Table 3 (continued)

S.	Stents with no complications	Treatment modalities	Intraoperative complication	Management of intraoperative complication	Patient outcome
16	Upmigrated stent with infected hydronephrosis	Percutaneous nephrostomy followed by antegrade stent removal.	Fragmented stent in upper ureter. Post operative high grade fever and septic shock, DIC	Antegrade removal of fragmented stent in the same sitting	Death
17	Advanced renal failure, COPD, HCV +, with severe calcifications of the entire stent	Ureteroscopic and percutaneous removal of calcified stent in one sitting. Laser used	Intraoperative hypothermia. Post operative sepsis, severe acidosis and DIC	Fragments left behind	Death
18	One year post renal transplant with hematuria and recurrent UTI. Minimal encrustations both at upper and lower end	Retrograde removal of the stent	None	—	Alive
19	Eight years post renal transplant with graft dysfunction with minimal encrustations along the entire stent	Retrograde stent removal	None	—	Alive
20	Ten years forgotten stent with advanced renal failure and hyperkalemia	Refused treatment and died after 2 days at home	Excluded from the study as the patient refused treatment	—	Death

DIC disseminated intravascular coagulation, UTI urinary tract infection

Five cases were managed primarily with percutaneous methods alone, three of which had complete clearance at the time of surgery. Of the two who had residual fragments after PCNL, one achieved complete stone clearance with repeat PCNL. One patient had residual fragments after second PCNL and was subsequently managed with ESWL of the remaining fragments.

The mean number of procedures was 1.25 per patient which included 17 cystoscopic, ten percutaneous, and two ureteroscopic interventions, one session of ESWL, and one simple nephrectomy. Holmium laser was used in five cases. Re-stenting was done in seven patients.

Three patients died in the present study. Another patient presented with a forgotten stent and advanced renal failure, refused treatment and died at home. We excluded this patient from this study. One of the patients, 35-year-old male, had left PCNL for staghorn calculus and presented 1 year later with forgotten stent. His serum creatinine was 1.5 mg%, and the plain X-ray showed an upward migrated stent. A PCN was done which drained 300 ml of pus. The pus culture showed *Escherichia coli* sensitive to amikacin and ciprofloxacin. The patient was treated for 1 week, and the preoperative culture was sterile. The patient was managed by percutaneous removal of stent during which it got broken in upper ureter, but could be retrieved. The patient developed high-grade fever, and hemodynamic instability following the procedure. He subsequently developed septicemic shock, disseminated intravascular coagulopathy (DIC), and multi-organ failure within 12 h and died.

The second death was again due to sepsis following ureteroscopic removal of a forgotten stent in the upper ureter in a 36-year-old male patient. Another mortality was a 62-year-old patient with forgotten stent for 23 years, completely encrusted at the time of presentation (Fig. 1a). The patient was hepatitis C virus (HCV) positive, had chronic obstructive pulmonary disease (COPD) and chronic kidney disease (CKD). He was managed by combined ureteroscopic and percutaneous approach in the same sitting, had intraoperative hypothermia and DIC, so the procedure was abandoned, leaving residual fragments behind. In the immediate postoperative period, the patient had PCN bleed, nasal bleed, and anuria. Appropriate blood products were transfused. Renal replacement therapy could not be planned in view of hypotension. Patient responded well to the above measures and the hemodynamic parameters improved. Unfortunately, the patient had cardiac arrest next day and could not be revived.

Renal failure was present in six patients. Two stents were forgotten in transplant kidneys, one forgotten for 8 years who presented with graft dysfunction and one forgotten for a year, presenting with recurrent UTI. One patient presented with the only complaint being hypertension.

Discussion

A strict definition for “forgotten” does not exist; however, many previous studies consider a variable period of greater

Fig. 1 **a** Plain X-ray showing a stent forgotten for 23 years in a 63-year-old patient, completely calcified. **b** Same patient as in (a), showing 3-D reconstruction of the NCCT showing severe encrustations along the entire length of the stent

than 3 to 6 months to constitute a forgotten stent. Forgotten stent is different from a retained stent, one that is irretrievable cystoscopically requiring further auxiliary intervention [13]. In our study, forgotten DJ stent was defined as a stent which was left in the system for longer than 3 months, unless intended by the physician.

Patient and sometimes physician compliance issues lead to stents being forgotten [14]. Poor compliance of the patients represents the main cause [15], which is reflected in our study as well. Proper information and education of the patient regarding the need for stent removal or change is necessary.

The available literature shows that DJ stent had been missed for a maximum of 17 years [16–18]. We report a forgotten stent for 23 years which is, to our knowledge, the longest duration reported in literature.

The presentation of forgotten stent varies. Damiano et al. [7] observed flank pain in 25.3 %, encrustations in 21.6 %, irritative bladder symptoms in 18.8 %, hematuria in 18.1 %, fever more than 104 °F in 12.3 %, and stent migration in 9.5 % of the patients. In our study, flank pain was relatively less while irritative bladder symptoms and hematuria were the predominant presentations. In a study of 110 stented kidneys, where the stents were kept in situ for different periods, Ringel et al. [10] observed that the total complication rate was up to

32.7 %. In our study, the late complications of ureteric stents were present in almost one third of the patients.

The strategy for management should include a thorough preoperative imaging to decide on the treatment strategy with a special emphasis on stone burden and the site of encrustations. A 3-D reconstructed NCCT is the modality of choice (Fig. 1b). A renal scan may be done to document the function. Murthy et al. found “no additional benefit with the use of NCCT” [15]. In our opinion, NCCT should be done in all the cases where indwelling time is more than 1 year as the stone burden may be radiolucent on plain X-ray.

The treatment is then tailored according to the site and size of stone burden. We used maximum diameter of the encrustation on NCCT, whenever done, to guide treatment decisions. In case of minimal encrustations, cystoscopic DJ stent removal is successful in most of the cases. If difficulty or resistance is felt at any point, the procedure should be abandoned. Singh et al. used primary ESWL followed by traction for all cases of minimal encrustations [6]. They reported broken stent fragments frequently which had to be removed by ureteroscopy later. In our opinion, significant encrustations could have been missed as they used an X-ray to label the encrustations as minimal. In our study, primary ESWL was not used in cases of minimal encrustations. ESWL may be tried for minimal or

Fig. 2 **a** Cystoscopic picture of the lower end of a severely encrusted stent; **b** holmium laser lithotripsy of the severely encrusted lower end of the stent shown in (a)

moderate, localized encrustations in the kidney in a renal unit with good function, or for residual fragments after PCNL. In our series, three cases had residual fragments after PCNL, two of which were subsequently cleared with repeat PCNL. One patient required an additional ESWL.

Severely encrusted stent is a challenge, requiring a multi-modal endourological approach. Common risk factors include long indwelling time, urinary sepsis, history of stone disease, chemotherapy, pregnancy, chronic renal failure, and metabolic or congenital abnormalities [19]. Mean number of procedures reported by Borboroglu et al. was 4.2 [9]. In our study, all cases were managed endoscopically except one who required simple nephrectomy, with the mean number of procedures being 1.2. Figure 2a shows cystoscopic picture of a severely encrusted DJ stent, which was fragmented with holmium laser lithotripsy (Fig. 2b).

Single procedure removal of encrusted stent has also been reported [15, 20], but it should be avoided for severely encrusted stents where long intraoperative times are expected, large stone burden, and for patients with multiple comorbidities. In case of long intraoperative time, over enthusiastic single-stage removal is discouraged, and it is better to stage the procedure.

It has been proposed by Ecke and colleagues that distal part of the stone burden should be removed first. PCNL would then be used for the stone-covered proximal end of the stent. This will facilitate placing a ureteral access catheter [8]. We recommend the same approach with a caveat on operating times. In anticipated long operative times, the procedure must be staged.

Migration and spontaneous fragmentation is an uncommon complication [21, 22]. In our study, 17.8 % of the stents had migration. Migration is related to the length of the stent as well as the material of the stent. An appropriate length of stent should be chosen, especially in children [22]. Silicone stents are more prone to get migrated as compared to polyurethane [19].

Renal failure remains a prominent risk factor for morbidity and mortality especially if associated with prolonged indwelling times, poor compliance, and pyelonephritis with UTI [6]. Aron et al. recommended temporizing PCN and definite operation 2 to 4 weeks later [8]. One of their patients died due to septic complications. We report six cases of forgotten stents presenting with renal failure, two of which died due to septic complications after operative intervention. One patient presented with graft dysfunction after renal transplant and is now waitlisted for a second transplant.

Conclusion

This is one of the largest case series on this subject and underlines that a forgotten stent is a potentially life-threatening

condition. The mortality we report are again a grim reminder that forgotten stent can be a catastrophic yet preventable complication. An entry in a “stent register” should be made in every case of DJ stent insertion, best made at the time of writing operative notes, when the chances of forgetting the stent are minimum. An electronic stent extraction reminder facility recall base has been proposed [23]. A computer-based system that tracks ureteral stents and automatically sends a reminder to both the patient and the urologist’s phones has been described [24]. “Stents on strings” have been proposed where one end of the stent is tied to a string which is externalized for easy removal later [25]. Treatment of all cases with a DJ stent should be considered incomplete unless the stent is removed. An old adage says “prevention is better than cure.” We agree wholeheartedly.

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Conflicts of Interest None.

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