Forgotten DJ Stent a Nagging Problem - Management and Long Term Follow Up

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Abstract
We review our experience and algorithm of tackling such stents safely, with one year follow up of these patients. Between July 2008 until June 2014, 35 forgotten DJ stents were tackled at our unit. Patient with forgotten stent was defined as one who did not follow-up for the stent removal within the stipulated period. Prior to the definitive management, all patients were subjected to biochemistry, radiological investigations and a urine culture sensitivity so as to assess degree of encrustations and active infection and renal function. These patients were followed for one year post management of the forgotten stents. Average age of presentation was 39.8 ± 4.3 years. 85% of the patients were male and average indwelling time was 11 ± 5.5 months. Stents were retrieved endourologically in 33/35 patients. 17 patients required only CPE, seven patients required PCNL (for proximal renal calculus). Ureteroscopy with pneumatic lithotripsy was done for six patients and three patients required cystolitholysis. Two patient required nephrectomy as there renal unit had become non functional. DJ stent should be used judiciously as forgotten stents are a reality even today. Detailed preoperative assessment and prompt management goes a long way in reducing the morbidity of forgotten stent. Moreover, once managed effectively there were no long term adverse effects observed.

Key Words
Forgotten DJ Stent, Encrusted Stent, DJ Stent

Introduction
Since Zimskind et.al (1) first reported an endoscopic placement of silicon ureteral splint in 1967 for the relief of ureteral obstruction, ureteric stents have become fundamental to many endoscopic and open urological procedures. Ureteral stents have come a long way in terms of design and material. This was done to facilitate stent manipulation, prevent spontaneous stent migration, and lower patient discomfort (2). However, despite many innovations and improvements in stent material and design, problem relating to long term indwelling ureteral stents such as stent encrustation, occlusion, migration, spontaneous fragmentation, stone formation, and renal impairment persist. This stent encrustation can be a cause of significant morbidity. Rarely the forceful removal of the encrusted stent can result into stent fragmentation, ureteral tears, and ureteral avulsion (3,4,5). We share our experience of patients with forgotten indwelling stents. The indwelling time, cause behind forgotten stent, morbidity, and management is discussed. Also, these patients were followed up for up to one year to look for any adverse effects or delayed complications following retained stents.

Material and Methods
We removed 35 forgotten DJ stents from patients who presented to us, from July 2008 until June 2014. The patients with forgotten stent included those who did not follow-up for the stent removal within the stipulated period (< 12 weeks). These patients usually presented once they were symptomatic or had urinary sepsis (fever with flank pain with positive urine culture and raised total blood counts). Evaluation and treatment protocol include a detailed history, indication for stenting. Biochemistry (RFT's), haemogram, urine routine and culture sensitivity was done in all the patients. Radiological investigations...
included an ultrasonography, X-ray KUB (to look for encrustations & or stone formation, hydronephrosis). Intravenous urography for functional evaluation was done in all. In case of nonvisualized kidney the patient was subjected to a DTPA renal scan. CECT was reserved for those with renal abscess or perinephric collection on ultrasonography. Depending on the evaluation the treatment algorithm was planned as shown in Fig. 1.

Of all the patients, 30 had a positive urine culture and of these 15 had fever with flank tenderness (urosepsis) and raised total blood counts. All patients were started on sensitive antibiotics at least 48 hrs prior to intervention. Those with urosepsis were treated with culture specific antibiotics until they were afebrile (>24hrs) and had attained baseline total counts before subjecting them to any endourological intervention. All stents removed were subjected to infra red spectroscopy for crystal deposition. Patient follow up protocol involved first follow-up at one month, second at six months and third follow-up at one year. At each follow up the patients were subjected to urine routine, ultrasound of the Kidney ureter and bladder region (KUB). These were done to rule out any long term effects of these forgotten stents.

**Results**

Between July 2008 till June 2013, 35 forgotten stents were retrieved in our endourological unit. Demographic profile, side and avg. duration is provided in table no.1. Indications of stenting were, 21 following open surgery (open pyelolithotomy-13, open ureterolithotomy-7, open pyeloplasty-1), 11 stents were placed after an endourological intervention (Post Ureteroscopy in 8 and post PCNL in 3) and remaining three stents were placed for obstructive uropathy (calculus obstruction -2, CA cervix-1). Of these, 11stents had been placed in our institution and rest at peripheral hospital. Clinical presentation was storage LUTS (lower urinary tract symptoms) in 23 and urinary sepsis in 15 patients. Average indwelling time was 11+ 5.5 months. In two patients, stent had a stent indwelling time of 24 months. All patients were subjected to urine culture and sensitivity prior to stent extraction. Urine culture was positive in 30/35cases (85.7%). Commonest organism was E.coli (24/30) followed by Proteus and Klebeilla in three patients each. Plain KUB revealed calculi either proximal or distal in 11/35 (31.4%) stents (Fig. 2a,b). However minor calcifications were not picked up on KUB (Fig. 3a,b).

All stent could be retrieved endourologically, Table no.2 depicts the various endourological procedures carried out to remove the stents. Two patient who required nephrectomy required percutaneous diversion in view of the pyonephrosis. These patients were subjected to a DTPA renal scan and had GFR of <10ml/min.

Since we strictly followed the principal of non-forceful extraction we did not encounter stent breakage. Any stent extraction which required force was abandoned. Patient was posted again under anaesthesia and stent extraction was facilitated by adding suitable endourological procedure. Stent analysis (infra red spectroscopy) revealed combination of calcium and magnesium phosphate deposits in majority (28/35). Remaining seven had calcium oxalate as the predominant component.

More than 80% (28/35) of forgotten stents were due to the poor compliance. While remaining seven patients gave the history of not being aware of the stent placement i.e communication gap between the operating surgeon and the patient was responsible in 20% of our patients. All the patients were rendered stent free and stone free at the end of the treatment, with two patient requiring nephrectomy. Those patients requiring intervention (PCNL /URS/Cystolitholapaxy) for stent removal were not re-stented, however a retrograde catheter of 6 fr was kept to attain the renal drainage in the post operative period for 48hrs. All procedures were performed safely without intraoperative complications, and there were no postoperative complications reported. These patients were kept on one week of antibiotic in the post op period.

Once discharged these patients were called back first after one month, then six months and final follow-up was at one year. They were advised to follow up early in case of fever or flank pain. On each follow-up they were subjected to urine routine and an ultrasonography of the KUB region. All these patients had normal investigations on follow-up.

**Discussion**

Forgotten DJ stents can be a challenging problem. They are often associated with significant morbidity and rarely mortality if not managed carefully (5,6). One of the most
common complications of forgotten DJ stent is the encrustations which makes the management of these stents difficult (2,5). Rate of encrustation is directly proportional to the indwelling time of the stent as was reported by El-Faqih in their series of 290 patients. They observed 9.2% of the stents of <6 weeks duration were encrusted and the rate rose to 76.5% for stents of >12 weeks duration (7). In a recent observation made by Takashi Kawahara et al the stent encrustation occurred in 26.8% in < 6 weeks, 56.9% at 6 to 12 weeks, and 75.9% at more than 12 week (8). In our series, the indwelling time was 11+ 5.5 months with two patients having an indwelling time of 24 months. Encrustation was evident on all stents removed (minor [24/35] or seen on KUB [11/35]). The exact cause of the encrustation is debatable but in vitro studies have shown that hydrophilic - coated polyurethane stents encrust faster and to a larger extent compared to the silicone or non-hydrophilic counterpart (9). All patients in our series had polyurethane hydrophilic stents. This encrustation is further enhanced in the patients with history of urolithiasis, who have three times increased risk of encrustation compared to non stone formers (10). In our series 45.7% (16/35) stents had encrustations significant enough (either in the form of stone formation, or not amenable to retrieval by CPE) to be tackled endourologically. Of these patients all had DJ stent placed following surgery for urolithiasis. Other risk factors involved in facilitating encrustation include bacterial colonisation, biofilm on the stent, pregnancy (11).

However, why some have only encrustation and others form a stone needs more research. Probably urinary metabolic evaluation in these patients would be of help.

Of the site of encrustation Takashi Kawahara et al observed that the proximal end was involved in 41.8% compared to 22.1% at the distal end. This phenomenon has been reported by others too (4). This was attributed to a more effective peristalsis at the lower part, and because the intraluminal part of the stent is at an angle, thereby decreasing the formation of deposits and also minimizing the encrustation at the lower end (12). In our series also significant encrustation (16/35), requiring PCNL accounted for 43.7% (7/16) of cases while 37.5% (6/16) required Ureteroscopy and 18.7% cystolithotripsy (3/16). Thus, emphasizing on the fact that upper end encrustation is more common than that of lower end.

Forgotten stents may be asymptomatic or may present as irritative lower tract symptoms, flank pain, hematuria, stenturia, urinary incontinence, and urosepsis even death (6,13,14). In our series 23/35 patients presented with irritative LUTS. 15 patients presented with urosepsis. 85.7% (30/35) patients in our series had a positive urine culture. Fifteen patients presented with history of fever, flank pain and had raised total counts along with a positive urine culture. Stone analysis (infra red spectroscopy) of the retrieved stent revealed encrustation of calcium and magnesium phosphate in 28/35 and remaining seven had calcium oxalate crystals. This is attributed to the bacterial biofilm formation on the stent surface. This bacterial biofilm formation is a natural phenomenon, which occurs once the stents are exposed to the urine (15). This bacterial growth leads to urease production, which attacks urea and leads to an increase in the urinary pH. The increased pH attracts calcium and magnesium ions to the biofilm matrix, resulting in crystal formation i.e encrustation (15). This in-turn results in, stent blockade, obstruction to urinary flow and hence, urinary tract infection.

All patients underwent KUB prior to the attempted stent removal to identify stent encrustation. Since the principal chemical composition is, typically calcium and x-ray of the KUB region should facilitate identification.

### Table 1. Depicting, Demographic Profile, side and Average Stent Duration

| Total number | 35 |
| Age in years | 39.8 ± 4.3 |
| Male/female | 30/5 |
| Right /left side | 23/12 |
| Average indwelling time (Months) | 11± 5.5 |

### Table 2. Depicting The Various Procedures Required For Removal of Forgotten Stents.

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Procedure</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cystoscopy</td>
<td>17</td>
</tr>
<tr>
<td>2</td>
<td>Cystolithotripsy (for stone at lower end)</td>
<td>03</td>
</tr>
<tr>
<td>3</td>
<td>Uterorenoscopy with pneumatic lithotripsy</td>
<td>06</td>
</tr>
<tr>
<td>4</td>
<td>Percutaneous nephrolithotripsy</td>
<td>07</td>
</tr>
<tr>
<td>5</td>
<td>Open nephrectomy</td>
<td>02</td>
</tr>
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of the encrustation (11). In our case though we could recognize 11/35 stents with calculus at the proximal or distal end (i.e. either renal or urinary bladder), five patients in whom the KUB was normal did need retrograde ureteroscopy with lithotripsy for the stent removal. Thus, reinforcing the point that x-ray KUB though is a useful tool to recognize the significant encrustation but may mislead if the encrustation is minimal.

Many approaches have been described in the literature with good success for removal of forgotten encrusted stents (3,5,11,16). In certain cases when a retained stent does not accommodate ureteroscope, a new ureteral stent alongside of retained stent is placed with the aim to passively dilate the ureter to facilitate interval ureteroscopy (17). Recently a two-stage bailout technique has been described by K.Mistry et al (18). In their experience, they observed that a placement of a new stent adjacent to the encrusted non yielding stent for 2-4 weeks facilitated the removal of primary stent by simple pull. In our series we always followed the principle of gentle traction under fluoroscopy and if there was any resistance despite a normal KUB the procedure was abandoned this was done avoid any disaster (ureteral avulsion) or stent breakage. These patients were then planned for stent removal under anaesthesia with disintegration of the encrustations using pneumatic lithotripsy. This improved the safety as well as the success of the procedure. We did not use the ‘Bail Out’ technique in any of our patients. Two patients with non functioning renal unit and a retained stent required nephrectomy.

A lot of measures have been discussed in literature to

**Fig. I Showing Study Protocol**

1. History taking
2. Urine culture and sensitivity
3. X-ray KUB
4. USG (KUB region)
5. Sr.Creat

**if abnormal**

1. Functional renal evaluation
2. IVU
3. Renal Scan

**if No encrustation on KUB**

1. CPE# and gentle traction on the stent
2. Under fluoroscopy and Local anesthesia

**In case of encrustations/Definitive stone**

1. Plan accordingly

**Cystolitholapaxy/Ureteroscopy/PCNL**

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prevent or decrease the incidence of forgotten stents. These include patient education, physician education (19), maintaining a web-based registry (20), use of biodegradable stents, use of heparin coating with the aim to reduce encrustation (21,22,23). In our series 24/35 (68.5%) stents had been placed in the peripheral hospitals following various procedures. We strongly believe that in addition to the patient education, physician education in terms of morbidity and mortality associated with retained stents shall go a long way in preventing such situations. Specially, so in our scenario where >50% of the population lives in hilly areas, in areas with difficult terrains and, are often uneducated. They usually depend on the local medics for initial help, and these people can guide them to take timely and appropriate help to avoid unwanted morbidity. In addition, the use of indwelling stents should be rationalized specially so, by the general surgeons who do not have the ways and means to retrieve the stent. We followed all our patients’ upto one year with urine routine and ultrasound KUB region. None of them had any long term sequel.

**Conclusion**

Though DJ stent is a fundamental part of urology, stent use should be judicious as forgotten stents are a reality even today. Also, patients and physicians need to be sensitized towards this menace and there awareness shall go a long way in reducing the morbidity associated with the forgotten stent. Moreover, once managed effectively there were no long term sequel observed.

**References**