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A CLINICAL STUDY OF RETAINED DOUBLE-J URETERAL STENTS

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ABSTRACT

Introduction: The increase in the usage of double J (DJ) ureteral stents in the management of a variety of urinary tract disease processes mandates familiarity with these devices, their consequences and their potential complications, which at times can be devastating. We retrospectively reviewed our series with forgotten/retained DJ ureteric stents.

Aim: To study on retained double-j ureteral stents and stent indwelling time of more than 1 year .

Materials and methods: A clinical study in 30 patients presented to out-patient department with retained DJ stent. All patients with prior history of DJ stenting and stent indwelling time of more than 1 year were included in study. Results: 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 1 year to 12 years, the average being 4.9 years. 2 patients with heavy stone burden in kidney, ureter and bladder developed sepsis in the post-operative period which was managed with appropriate antibiotics and resuscitative measures. 2 patients with elevated renal parameters at the time of admission needed renal replacement therapy and died before surgical intervention.

Conclusion: Forgotten/retained stents in children are a source of severe morbidity, additional/unnecessary hospitalisation and definitely financial strain.

Keywords: Double J stents, postoperative complications, risk management, ureter

INTRODUCTION

Ureteral stents have become a fundamental tool in today's urologic armamentarium and are employed for a number of indications including obstruction relief as a prophylaxis against obstruction or ureteral injury and as use as a ureteral splint.Stents are often inserted to relieve either extrinsic (tumor, retroperitoneal fibrosis) or intrinsic ureteral obstruction (stones, tumors, strictures) as a temporary measure while definitive treatment is instituted or as permanent measure when no corrective treatment is possible. In the context of bilateral obstruction, solitary kidney (anatomic or functional), refractory renal colic or obstruction associated with infection (fever, leukocytosis, pyuria) stent placement to secure drainage is often an emergent absolute indication.

Current percutaneous lithotripsy techniques do not require routine stenting. Exceptions to this practice include extensive perforation of the collecting system, significant stone burden remains with the need for subsequent shock wave lithotripsy (SWL), ureteral obstruction due to edema, concurrent ureteropelvic obstruction, and stone fragment migration into the ureter, supracostal access, and persistent urinary fistula after nephrostomy tube removal.

The use of routine stenting before SWL is not associated with either a decrease of steinstrasse formation or increase in stone-free rates. However, stenting is clearly associated with increased morbidity.[1]

In a study patients with renal stones less than 30 mm. The stone-free rate was not significantly different between groups (stented 31% vs. unstented 30%).Half of the patients in the stented group reported bladder discomfort and symptoms that were relieved on removal of the stent. In another report, stented subjects experienced significantly higher incidence and duration of urinary symptoms (urgency, hematuria, bladder discomfort, and frequency) compared with nonstented subjects . [2]

Indications for pre-SWL stenting are stone burden greater than 2 cm when bilateral SWL is to be undertaken (at least one renal unit), and when treating a solitary kidney.In a cosponsored American Urological Association/ European Association of Urology guideline panel recommended that routine ureteral stent insertion is not necessary after SWL for a ureteral calculus because available evidence shows it does not improve patient outcomes . [3]

Current evidence has also shown that routine stenting after uncomplicated ureteroscopy is unnecessary because unstented patients do not experience an increased risk of complications and have fewer postoperative symptoms.

Stenting in association with ureteroscopy is recommended in patients with an impacted ureteral calculi, incomplete fragmentation, after formal ureteral dilation, and if there are procedural complications such as ureteral perforation.

Urinary calculi during pregnancy, although uncommon, present a unique therapeutic challenge. Drainage, if indicated, can be achieved with an internal stent or a percutaneous nephrostomy tube; however, the indwelling time should be limited and exchange is recommended at a 6-week interval due to the increased risk of rapid encrustation triggered by gestational hyperuricosuria and hypercalciuria.

Another indication for stenting (Double J or 5 open-ended ureteral catheter exteriorized and taped to the urethral catheter) is to serve as a surgical landmark for ureteral identification in order to avoid iatrogenic ureteral injury in abdominal or pelvic surgery.Light-emitting ureteral stents have been developed to serve as an additional optical aid, which may be especially helpful in the context of video-assisted surgery (i.e., laparoscopy), in which the tactile sense is diminished.The use of a stent for ureteral splinting brings us back to the earliest uses of stents. In this setting the stent accomplishes two tasks—one is as a splint or scaffold to promote organized tissue healing and the other equally important role is to allow unhindered urinary flow across the healing segment of the ureter. The main areas where stents are used are following ureteral trauma such as perforation or transection and following ureteral repair (i.e., primary reanastomosis, urinary-intestinal anastomosis, ureterotomy, ureteral reimplantation).

MATERIALS AND METHODS

We have studied 30 patients presented to our out-patient department with retained DJ stent from October 2019to January 2021.

Inclusion criteria: All patients with prior history of DJ stenting and stent indwelling time of more than 1 year .

Exclusion criteria: none.

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, Tc^{99m} diethylene triamine penta acetic acid [DTPA] renogram was done to estimate the renal function.

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, ureteic body or whole of the stent, initially, CLT, retrograde ureteroscopy and intracorporeal lithotripsy 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.

Postoperatively, plain film radiography was done to confirm the stone free status.

RESULTS

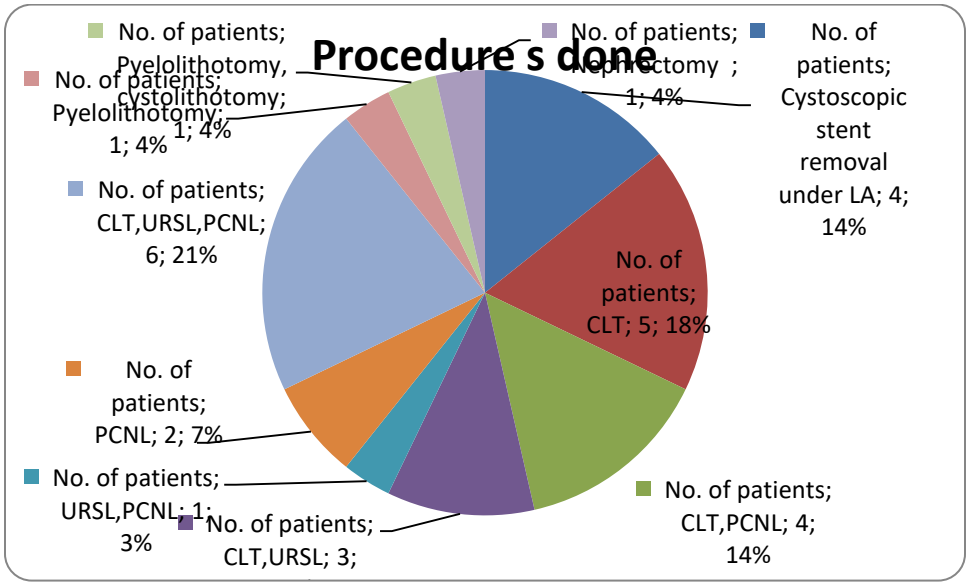
A total of 30 patients presented to our out-patient department with retained DJ stent during the study period.Patients were in the age ranging from 4 years to 60 years.

Table-1: Variables in the study

Gender	**Number of cases**	**Percentages**
Male	18	60
Female	12	40
Site of encrustation		0
Minimal/ no encrustation	4	13.3
Bladder	5	16.7
Kidney	4	13.3
Kidney, ureter	1	3.3
Kidney, bladder	5	16.7
Ureter, bladder	3	10
Kidney, ureter and bladder	8	26.7

Out of 30 patients 18 were male and 12 were female. Stent indwelling time of study group ranged from 1 year to 12 years, the average being 4.9 years.

Figure-1: Treatment Given



Patients were evaluated for stent encrustation and associated stone burden by x-ray KUB, intravenous urogram and non-contrast CT [NCCT] abdomen.

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.

2 patients with heavy stone burden in kidney, ureter and bladder developed sepsis in the post-operative period which was managed with appropriate antibiotics and resuscitative measures.

2 patients with elevated renal parameters at the time of admission needed renal replacement therapy and died before surgical intervention.

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.[4,5] 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. [6]

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 anamolies, malignant urinary obstruction and pregnancy.[7]

In a study by 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 6-85 months).[9] In present study, the average stent indwelling time was 4.9 years (range 1-12 years).

Table-2:Comparision of study Stent indwelling time

Study group	Stent indwelling time
Lam JS et al[8]	10.7 months
Aravantinos et al[9]	24.1 months
Present study	58.8 months

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.[10] The risk of encrustation and fragmentation is dependent on the type of material of the stent. Silicone was found to be least prone to encrustation, followed by polyurethane, silitek, percuflex, and hydrogel coated polyurethane.[13] Fragmentation of polyurethane stents are four times as frequent as the silicone stents.[11]

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.[12]

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.[13]

One stage removal of 12 encrusted retained ureteral stents has been reported by Bukkapatnam et al., in ten patients. Of these, 11 were 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.[14]

Using a combination of SWL, PCNL, CLT, ureteroscopy with intracorporeal lithotripsy, clearance rates ranging from 75 to 100% have been reported.[15] 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 thr kidney. Nephrectomy is done for non salvageable function of the kidney. Nephrostomy or placement of second stent 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 fluoroscopic 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 using 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 the 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 nephrostomy tract.

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.[16]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.[15.]

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.[16]Coatings such as hydrophilic polymers, heparin, pentosanpolysulfate, or oxalate-

degrading enzymes have been used in attempt to reduce encrustation.[17,18,19]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.

CONCLUSIONS

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 evaluationof 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.

When considering ureteral stenting, overall quality of life must be a foremost priority. 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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