Section: Urology

Original Research Article

A CLINICAL STUDY OF RETAINED DOUBLE-J URETERAL STENTS

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Abstract

Background: The aim of this study is to correlate the long term complications of retained 'DJ' ureteral stents. **Materials and Methods:** It is retrospective study conducted in Department of Urology in 20 patients of both genders with prior history of DJ stenting and stent indwelling time of more than 1 year. **Results:** Stent indwelling time of study group ranged from 12 months to 10 years, the average being 35.65 months. The stent indwelling time was less than 3 years in majority of the individuals.[14] The most common complication was encrustation in 18 (90 %) cases. Majority of the patients had encrustation as evident by radiography. 19 (95 %) cases were managed by endoscopic approaches and only 1 (5 %) case required open procedure. Cystoscopic removal of fragmented stent from the bladder was done in 6 patients; URSL was done in 12 patients either alone or in combination with other procedures for ureteric fragments of stent or ureteric migration of stent. CLT was done in 8 patients either alone or combined with other procedures. 2 patients underwent PCNL along with URSL. 1 patient 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. No deaths occurred in the study group. **Conclusion:** 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.

INTRODUCTION

In today's nomenclature, "Stenting" is the use of a hollow device to create a pathway, support a structure, or opening of hollow organs that are partially or completely obstructed due to benign or malignant obstructive diseases1. The word "stent" derives from the name of a British dentist, 'Charles Thomas Stent', lived in the 19th century, who used metallic scaffolds for immobilizing tissues. Scaffolding tubular devices to tutor occluded blood vessels were introduced in the early 1980s and were named "stents" which became an accepted term in the medical vocabulary.[1]

The function of the ureter completely differs from blood vessels. Blood vessels are almost inactive tubes allowing blood to flow forward. In contrast to this, the ureter has variable calibers all along its length and the flow of urine is obtained by its peristaltic function. This makes difficult to stent the ureters the way blood vessels are stented with vascular stents. Additionally, vascular stents are permanently implanted, where in the ureters most stents are for short- or long term use, to be removed after a period of time.[2]

The placement of any type of stent in the ureter is probably one of the most common procedures in everyday urological care. The main indication for stent insertion is to maintain the patency of the upper urinary tract in cases of chronic or acute intrinsic or extrinsic obstruction of the upper urinary tract. Toward this goal, a variety of configurations, designs, and materials have been utilized since the first introduction of a ureteral "stent" in urological practice by Gibbons back in 1976. Still, it was not before the introduction of the silicon stent in a double-J configuration by Finney that the use of ureteral stents was popularized.

What we call today ureteral double-J stents are in reality "intraureteral catheters" made of various polymers. None of the double-Js are scaffolding devices because of their small caliber. They just

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create a pathway but do not create a scaffold in the ureter. For this, they need to be large in caliber and have a large lumen.

The presence of stents in the ureter has been associated with impeded flow of urine, stent encrustation, and infection as well as inability to successfully maintain patency of the upper urinary tract. Certain modifications in stent design and the use of biomaterials have been implemented in an effort to alleviate some of the above mentioned problems as well as the discomfort and reduced quality of life associated with the presence of indwelling plastic ureteral stents and the subsequent need for periodic stent changes. There are clear differences in the occlusion mechanisms between an intrinsic pathology causing a benign obstruction, a primary or infiltrating ureteral malignancy and the compression of an extraureteral tumor. These differences are the cause of differences in success rates when double-J stent is used for benign and also malignant obstructions. The reason for failure of the polyurethane ureteral stents in malignant cases is because their lumen occludes early by debris and the persistent space occludes by the compressing/strangling tumor.[3]

Ureteral stenoses necessitating long-term stenting are caused by intrinsic malignant disease of the ureter, compression, or infiltration of malignancies of the abdominal organs or by iatrogenic reasons such as trauma during ureteroscopy or gynecological accidents. Ureteral anastomoses or ureteral reimplantation to the bladder or bowel made reservoirs or conduits, ureteral ischemia during renal transplantation are additional reasons for the development of ureteral stenoses. Because of a lack of a better alternative and its affordable price, for restoring the obstructed urinary flow, currently small-caliber double-J ureteral stents which were developed more than 30 years ago are used. They have to be changed every 3-6 months. The aim of this study is to correlate the long term complications of retained 'DJ' ureteral stents.

MATERIALS AND METHODS

The present study was conducted in Department of Urology, Government Medical College, Mahabubabad, Telangana. 20 patients were registered within the time period from June 2023 to July 2024.

Inclusion criteria: All male and female patients with prior history of DJ stenting and stent indwelling time of more than 1 year were included in the study.

Exclusion criteria: Patients not willing to be participating in the study.

All the registered patients were examined clinically thoroughly after taking detailed history. Simple investigations like hemoglobin %, bleeding time, clotting time, renal function tests, viral markers, routine urine examination were carried out for fitness of Surgery. All the patients were evaluated for stent encrustation and associated stone burden by plain x-ray KUB, intravenous urogram and NCCT [non contrast CT]. Preoperative urine cultures were sent in all patients and appropriate antibiotic prophylaxis given.

Anesthesia was administered to the patients depending on the general condition at the time of presentation, type of procedure, operating time. Injection ceftriaxone 20mg /Kg/body weight was given before each operation as prophylaxis. Appropriate surgical procedure according to the site of encrustation was performed.

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 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 20 patients presented to our out-patient department with retained DJ stent during the study period from June 2023 to July 2024 were included in this study. Patients were studied in terms of age, sex, stent indwelling time, stent complications, site of encrustation, procedure done and adverse outcomes following the procedure.

Patients were in the age group ranging from 11 years to 60 years. Majority of the patients were in

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the age group of 41 – 50 years. Mean age of patients in the present study was 42.7 years. Majority of the patients were male (60%). Out of 20 patients, 12 were male and 8 were female. 9 patients presented with dysuria and increased urinary frequency. Loin pain was seen in 5 patients, hematuria was seen in 4 patients and recurrent urinary tract infections in 12 patients. [Table 1]

Stent indwelling time of study group ranged from 12 months to 10 years, the average being 35.65 months. The stent indwelling time was less than 3 years in majority of the individuals (14). [Table 2]

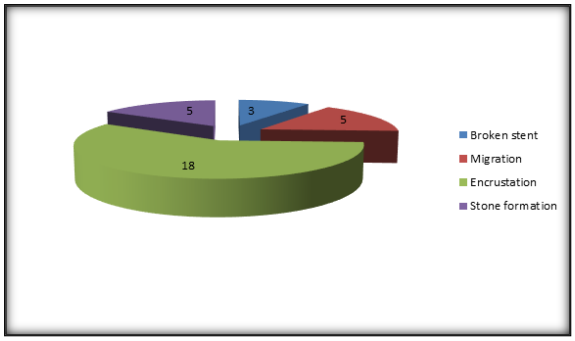
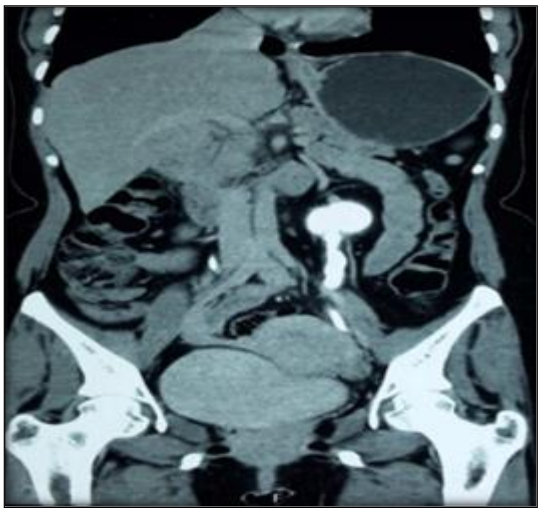


Figure 1: Distribution of stent complications in patients with retained DJ stent

The most common complication was encrustation in 18 (90 %) cases. Other complications were migration in 5 (25 %), broken stent in 3 (15 %) and 5 cases of (25 %) stone formation. Multiple complications were seen in 4 cases. No complications were seen in 2 cases.

Patients were evaluated for stent encrustation and associated stone burden by x-ray KUB, intravenous urogram and non-contrast CT [NCCT] abdomen. Majority of the patients had encrustation as evident by radiography. 2 patients had no or minimal encrustation whereas encrustation was limited to bladder alone in 6 patients, ureter alone in 5 patients. Encrustations involving kidney, ureter and bladder were seen in 2 patients. [Table 3]

X-ray KUB showing broken DJ stent in situ on left side with upper end of DJ stent in situ with encrustations



CT KUB showing broken DJ stent in situ on left side with upper end of DJ stent in situ with encrustations

Figure 2: Images in present study

Abdominal radiograph showing a proximal migration of the right double-J stent

A double J stent with encrustation removed after ureterotomy

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Treatment decision was made on clinical and radiological findings. Before intervention, all patients had negative urine cultures. Antibiotic prophylaxis was given for all cases.

19 (95 %) cases were managed by endoscopic approaches and only 1 (5 %) case required open procedure. In the later case, the forgotten DJ stent fragmented and migrated down with knotting formation causing obstruction of right ureter and had to resort for open ureterotomy as attempt of combined percutaneous and ureteroscopic removal failed. A total of 29 procedures were performed to treat the complications. In 65 % (n = 13) cases single procedure was sufficient to effectively manage the complications, and 35 % (n = 7) cases required multiple procedures.

Cystoscopic removal of fragmented stent from the bladder was done in 6 patients; URSL was done in 12 patients either alone or in combination with other procedures for ureteric fragments of stent or ureteric migration of stent. CLT was done in 8 patients either alone or combined with other procedures. 2 patients underwent PCNL along with URSL.

Due to obstruction of ureter by fragmented and migrated DJ stent with knotting, Ureterotomy was done to remove the stent in one case. [Table 4]

1 patient 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. No deaths occurred in the study group. [Table 5]

Table 1: Demographic details in present study

Age group	Number of patients
11 – 20 years	1
21 – 30 years	2
31 – 40 years	3
41 – 50 years	10
51 – 60 years	4
Gender	
Male	12
Female	8
Clinical presentation	
Dysuria and urinary frequency	9
Loin pain	5
Hematuria	4
Recurrent urinary tract infections	12

Table 2: Stent indwelling time in patients with retained DJ stent

Stent indwelling time	No. of patients
1 year – 5 years	18
6 years – 10 years	2

Table 3: Site of encrustation in patients with retained DJ stent

Site of encrustation	No. of patients
Minimal/ no encrustation	2
Bladder	6
Bladder, Ureter	5
Ureter alone	5
Kidney, Ureter, Bladder	2

Table 4: Procedures done in patients with retained DJ stents

Procedure done	No. of patients
Cystoscopic stent removal	6
URSL alone	5
CLT alone	2
URSL + CLT	5
PCNL + URSL + CLT	1
PCN + URSL + Open ureterotomy	1
Total	20

Table 5: Complications in present study

Complication	No. of patients
Sepsis	1
Death	0

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.[4,5,6] Encrustation of forgotten stents

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associated with large stone burden is a serious problem, due to complications like recurrent urinary tract infection, hematuria, obstruction and renal failure 13. 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.[6]

The mean age in the present study was 42.7 years. In a study done by R Pedamallu, S Subramanian,[7] , the mean age was 41.3 years. The mean patient age was 46.2 ± 18.5 years according to a study by Bostanci Y.[8] Average patient age was 32.5 years (range 25 to 41) in a study by Borboroglu PG.[9] The mean age was 50.2 years in a study by Aravantinos E.[10] No definite conclusion can be made about the relation between mean age and long term complications of retained DJ stent.

Paick et al,[11] point to a nearly 44% risk of catheter colonization, and Kehinde et al,[1] 2 of nearly 42% risk of catheter colonization in patients with retained DJ stents of more than 12 weeks duration. According to a study by Rafal Klis et al,[13] Double–J catheter retention in the urinary tract is associated with an extremely high risk of bacterial colonization, while the associated risk of urine infection is about 8–fold lower. Urine specimens taken from the patients with catheters retained for longer than 90 days were infected in 6 of 12 cases (50%).

In the present study, 12 out of 20 patients presented with recurrent urinary tract infections. The rate of catheter colonization is 60 % in the present study which is comparable to above mentioned studies.

In a study by Lam JS et al,[14] the average stent indwelling time leading to long term complications was 10.7 months (range 3-28 months). In another study by Aravantinos et al,[10] the average stent indwelling time was 24.1 months (range 6-85 months). In a study by Borboroglu PG,[9] the average stent indwelling time was 7 months (range 3 - 12 months). Median indwelling time was 3 years (range 0.25 to 17 y) in a study by Agarwal MM.[15] In the present study, the average stent indwelling time leading to long term complications was 35.7 months (range 12 – 120 months).

In the present study, broken stent was observed in 15 % (3) cases. Breakage occurs in those who had DJ stent for long duration ranging from 15 to 120 months. In contrast, Damiano et al,[4] found a relative lower incidence of fracture stent, only 1.3%. Similar result was (4.79%) also shown by Ikram Ullah et al.[16] Although broken DJ stent is relatively less common in most reported series, we found 15% cases presenting with fragmented stent. It may be due to prolonged indwelling time and also heterogeneity of DJ stent used. Since all the cases were referred to our institution, the make and design of these stents were not known.

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. 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 and fragmentation, followed by polyurethane, silitek, percuflex, and hydrogel coated polyurethane. Fragmentation of polyurethane stents occurs four times more frequent than the silicone stents. Studies has shown a higher rate of fragmented DJ stent in their series. He counted 45% fragmented and another 14% fragmented and calcified. Mean duration of DJ stent was 22.7 months in their series.

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.

In the present study, the rate of encrustation was 90 %. Kawahara et al,[17] reported encrustation rates of 26.8% in < 6 weeks, 56.9% at 6 to 12 weeks and 75.9% > 12 weeks of retained double J stents. They concluded that ureteral stent encrustation was related to the time insitu. 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. All the retrieved encrusted stents in the present study were made of polyurethane.

In the present study, stone formation was seen in 5 patients (25%). Studies concluded that Long-term antibiotic suppression, more frequent follow up with abdominal X-Ray, and shorter periods of internal stenting are suggested for patients with a lithogenic history.

In the present study, stent migration was seen in 5 cases. Stent migrated into bladder in 4 cases and kidney in 1 case. In a study conducted by Breau RH, Norman RW,[18] the stent migration rate was seen in only 2 % of cases. Ikram Ullah et al,[16] also reported low incidence of stent migration rate of 3.5% and 6.84%, respectively. The high incidence in our study population might possibly be due to incorrect positioning and improper size selection. This complication can be avoided by pulling the stent cystoscopically keeping the full loop into the bladder and stent should be in the pelvis not into the calyx.

Migration is an uncommon complication. It can occur proximally toward the kidney or distally toward the bladder. Factors related to distal stent migration include shape and stent material. Stents with a full coil are less prone to migrate than those

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with a J-shape, and stent materials with great memory, such as polyurethane, are less prone to migrate than those with less memory, such as silicone. Conversely, proximal migration occurs when the stent is too short for the ureter; an adequate choice of the stent length is therefore recommended.

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 was obtained to determine the level of obstruction within the urinary tract.

In the present study, a total of 29 procedures were performed. Of the 29 procedures done in this study, 28 were endourological procedures. Open procedure was done in 1 case. Multiple procedures were done in 7 patients and a single procedure done in 13 patients. The average number of endosurgical procedures done in the present study is 1.4. Singh et al,[22] described multiple accesses and approaches including open surgery to treat the retained stents. Borboroglu et al,[9] 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. Aravantinos et al,[10] also reported the endourological treatment of 9 patients with severely encrusted ureteral stents. The mean number number of procedures per patient was 2.1 (range 1 – 4). The mean number of procedures in the management of encrusted ureteral stents was 1.94 in a study done by Bultitude et al.[19]

One stage removal of 12 encrusted retained ureteral stents has been reported by Bukkapatnam et al,[20] in ten patients. Of these, 11 were managed by ureteroscopy alone and in one patient; the stone was treated through a percutaneous approach. The average number of endourological procedures required was 1.1. They concluded that, these stents can be removed in one sitting with minimal morbidity and short hospital stay.

Using a combination of SWL, PCNL, CLT, ureteroscopy with intracorporeal lithotripsy, clearance rates ranging from 75 to 100% have been reported. Extracorporeal shock wave lithotripsy [ESWL] is the initial treatment of stents with minimal encrustation. In the present study, SWL was not used in any of the patients.

In 6 patients, cystoscopic removal using a grasping forceps under local anesthesia with fluoroscopic guidance was done. Gentle traction on the stent was applied and if the stent did not uncoil, the procedure was abandoned. An important precaution during this procedure is to avoid using excessive force, which can result in breakage of the stent along with ureteral injury or ureteral avulsion. In a study by Rajendra Prasad ray et al,[21] out of 19 patients 9 patients were managed by cystoscopic removal of minimally encrusted stent. This is due to encrustation involving larger segments of the stent leading to difficulty while removing them. CLT alone was done in 2 patients where the encrustations were limited to bladder. CLT was combined with URSL in 5 cases where encrustations were extending to body of the stent.

If the cystoscopic approach fails, and in patients with encrustation involving the ureteric portion of the stent, 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. Bukkapatnam et al,[20] reported 1-step removal of encrusted retained ureteral stents in 12 patients. Out of which, eleven (91 %) were managed by ureteroscopy alone and one patient by percutaneous approach. They concluded that, stents can be removed at single step with minimal morbidity and short hospital stay. According to the study by R.Peddamallu, S.Subramanian,[7] encrustations involving upper coil and stent body were removed using percutaneous nephrolithotomy in 9 cases and ureteroscopic lithotripsy in 15 (32 %) cases. In the present study, 12 patients (60 %) needed URSL alone or when combined with other procedures for encrustations in different portions of the stent. URSL is used as a main stay of treatment either alone or combined with other urological procedures when the encrustations are limited to body or upper pole of 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. PCNL was done in 2 cases where the stone was seen in renal pelvis in 1 case and inferior calyx in another case. PCNL was done along with URSL and CLT in one case.

Open procedure was required in one case following failed attempted URS and PCNL, where the forgotten DJ stent fragmented and migrated down

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with knotting formation causing obstruction of right ureter. Rabani,[23] had similar result in his study. Laparoscopic management of a retained heavily encrusted ureteral stent has been reported.

In the present study, 1 patient developed sepsis in the immediate post-operative period requiring broad spectrum antibiotics, intensive care management and renal replacement therapy in the form of hemodialysis for elevated renal parameters.

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, which is safe. Rabani et al,[23] (2012) mentioned endourological management of retained stents lead to success in majority of cases with minimal complications but the best strategy would be prevention of this complication. 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.

Chew et al,[24] even described a novel biodegradable ureteral stent in a porcine model. Coatings such as hydrophilic polymers, heparin, pentosan polysulfate, or oxalate-degrading enzymes have been used in attempt to reduce encrustation. 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.

Table 6: Comparison with other studies

Mean age	Values
R Pedamallu, S Subramanian[7]	41.3 years
Bostanci Y[8]	46.2 years
Borboroglu PG [9]	32.5 years
Aravantinos E[10]	50.2 years
Present study	42.7 Years
Risk of catheter colonization	
Paick et al.[11]	44 %
Kehinde et al.[12]	42 %
Rafal Klis et al.[13]	50 %
Present study	60 %
Stent indwelling time	
Lam JS et al.[14]	10.7 months
Aravantinos et al.[10]	24.1 months
Borboroglu PG[9]	7 months
Agarwal MM[15]	36 months
Present study	35.7 months
Broken stent rate	
Damiano et al·[4]	1.3 %
Ikram Ullah et al.[16]	4.79 %
Present study	15 %
Rate of encrustation if retained for > 12 weeks	
Kawahara et al.[17]	75.9 %
Present study	90 %
Stent migration rate	
Breau RH, Norman RW[18]	2 %
Ikram Ullah et al.[16]	6.84 %
Present study	25 %
Average number of procedures	
Borboroglu et al.[9]	4.2
Aravantinos et al.[10]	2.1
Bultitude et al.[19]	1.94
Bukkapatnam et al.[20]	1.1
Present study	1.4
Number of Cystoscopic removal alone	
Rajendra Prasad ray et al.[21]	9 (47.3 %)
Present study	6 (30 %)
No. of URSL done for stent removal	
Bukkapatnam et al.[20]	91 %
R.Peddamallu, S.Subramanian[7]	32 %
Present study	60 %

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

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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. 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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