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Post operative complications of double-J ureteral stenting: a prospective study

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ABSTRACT

Background: Placement of indwelling ureteral stents has become routine in the management of variety of urinary tract infections. Despite the advances and technology, the ideal stent is not available yet. A double-J stent is never without potential complications which may be minor in form of hematuria, dysuria, frequency, flank and suprapubic pain to major complications such as vesicoureteric reflux, migration, malposition, encrustation, stent fracture etc.

Methods: One hundred urological patients who had undergone double-J ureteral stenting attending surgery department were taken. Patients were subjected to detailed history and clinical examination and other routine investigations and symptoms of any complications were recorded starting at the time of placement of double-J ureteral stent till its removal.

Results: Majority of the patients in our study had only minor complications related to double-J ureteral stenting like flank or suprapubic pain, dysuria, hematuria and urgency which were managed conservatively. Major complication like stent migration was seen only in 1 patient which was managed with removal of stent.

Conclusions: At the end of study, we concluded that double-J stents have become an essential part of many endourological and open urological procedures and their use cannot be completely avoided.

Keywords: Double-J ureteral stent, Post-operative complications, Stent migration, Haematuria

INTRODUCTION

The Double-J (DJ) ureteral stent has become an essential tool in the modern urology practice. The recent increase in the usage of ureteral stents in variety of urological procedures necessitates familiarity with these devices, their consequences and their potential complications.

By definition, the DJ or pigtail stent in a catheter or tube placed within the ureteral lumen in a retrograde or antegrade fashion in order to maintain its patency.1 The pigtail catheter provides a self-retaining capability due to a double coil design at proximal and distal ends that work to securely anchor the stent in the upper urinary tract (renal pelvis and upper calyx) and the bladder. This

prevents stent migration proximally or distally despite urinary flow, patient movement and ureteral peristalsis.

As originally described, the intent of ureteral stent implantation was for treatment of ureteral obstruction or fistula. However, with the advances in endourological procedures the indications for stent placement have expanded. Absolute indications for stent placement are cases of obstructive pyelonephritis and intolerable acute renal colic.² Safety indications include stent placement following endoscopic procedures causing ureteral edema or perforation or steinstrasse, any history of renal failure and solitary or transplant kidney.³ Relative indications are stone burden larger than 2 cm undergoing extracorporeal shockwave lithotripsy, pregnancy, long-standing impacted stone, recent history of urinary tract infection or sepsis, stent to passive dilate the ureter and/or ureteral orifice, prolonged endoscopic operative time (over 45 minutes) and any patients with imminent post-operative plans such as a second-look ureteroscopy.⁴

Design of the implanted device has evolved along with the technique. It should be recognized, however, that no currently available device fulfils all of the criteria for the "ideal" stent.

The "ideal" ureteral stent should be resistant to migration, well tolerated by patient, biocompatible, bio durable, have optimal flow characteristics, resistant to encrustation, easily inserted from any access, non-refluxing, radiopaque or visible at ultrasound, versatile and affordable.

Stent discomfort can vary from one patient to another in a distinctive manner, but is believed to effect over 80% of patients.^{5,6} Conversely, a study by Halo et al reported a low incidence of 19.6% of stent related complicatins.⁷

Several studies have been conducted which describe the symptoms related to ureteral stent and their respective estimated incidence. Minor complications of stent placement are irritative voiding symptoms like frequency (50-60%), urgency (57-60%), dysuria (40%), incomplete emptying (76%), flank (19-32%) and suprapubic pain (30%), incontinence and haematuria (25%).^{2,5,7-11} Major complications associated with DJ stenting include vesicoureteric reflux, migration, malposition, encrustation, stent fracture etc.

Frequency is thought to be caused by a mechanical stimulus by bladder coil of stent. Daytime frequency suggests that mechanical stimulation is related to physical activities and/or awareness of this stimulation during the day. Objective assessment through frequency volume charts collaborates this theory.⁵

Urgency is attributed to direct result from the presence of stent, which may also reveal or worsen pre-existing subclinical detrusor overactivity.⁵

Dysuria which is usually experienced at the end of voiding has been attributed to trigonal irritation by the distal end of the stent when it crosses the midline or forms an incomplete loop. ¹⁰

Flank pain is most likely a result of urine reflux towards the kidney that leads to an excessive rise in intrapelvic pressure that ultimately translates into pain. It is usually mild to moderate and is not influenced by the position of the proximal coil either in upper calyx or in the renal pelvis. Is, 14

Suprapubic pain can result from local bladder irritation by the distal coil or as a secondary sign of associated complications such as encrustation or infection.¹⁵

Haematuria may result from surgical management of existing disease and from the stent placement itself.¹⁴

Incontinence typically occurs in association with episodes of urgency or as a result of stent migration beyond the bladder neck into the proximal urethra bypassing the urethral sphincter mechanism of continence. ¹⁶

It should be noted that all symptoms can also be consequences of associated stent morbidities such as urinary tract infection and encrustation, and the presence of these should be excluded by urinalysis and imaging as necessary.¹⁴

In addition, major complications in the form of urinary tract infection may develop after instrumentation. Therefore, in patients with known urinary tract infection, procedure should be undertaken after treatment with specific antibiotics.

Stents made of stiffer materials may penetrate the ureter or collecting system during placement. An appropriate length of stent is critical for the prevention of irritative voiding symptoms and malpositioning of the stent during insertion.¹⁷

Stent lumen occlusion may occur at any time following insertion to removal leading to incomplete relief of symptoms. Short term luminal obstruction, occurring within hours to days of insertion, may occur from hematuria related to the technique of insertion or from increased urine viscosity and constituent debris associated with insertion into infected urinary system. ¹⁸

No currently available stent is inert within the urinary tract. The presence of stent provides a framework for deposition of urinary constituent's overtime consisting mainly of calcium oxalate, calcium phosphate and ammonium magnesium phosphate.

Stents made of polyethylene fractured after relatively short indwelling times.¹⁹ Stent fracture has also been reported with newer materials.^{20,21} Most stents fracture at fenestration sites likely with encrustation playing a combined role.

The rarest complication of ureteral stent placement is erosion of stent into adjacent structures, especially the arterial system. Intermittent haematuria in a patient with a stent is usual presenting symptom, but massive hematuria to the point of circulatory collapse can also occur and may be provoked by ureteral stent manipulation.²¹

Occasionally stents may be forgotten by the patient which can lead to complications because of longer indwelling time.

Studies regarding complications of DJ ureteral stenting have been conducted worldwide but a detailed study at

our tertiary care centre would allow us to better understand complications of DJ ureteral stenting.

METHODS

This prospective study was conducted in the Department of General Surgery at Sri Guru Ram Das Institute of Medical Sciences and Research, Vallah, Sri Amritsar from November 2017 to September 2019.

This study was conducted after obtaining ethical clearance from the Ethical Committee. In this study 100 urological patients having indwelling DJ ureteral stenting attending Surgery OPD were taken. Patients were questioned about type of surgery; duration of stent implantation and symptoms of any complications like frequency, urgency, dysuria, flank or suprapubic pain, hematuria, incontinence. All the findings were recorded starting at the time of placement of DJ ureteral stent till its removal.

All the patients with complaint of dysuria underwent urine complete examination to rule out urinary tract infection. X-ray kidney, ureter, and bladder (KUB) was done prior to removal of stent to look for any stent malposition or migration, stent fracture or encrustation of stent.

Patients having bleeding disorders, pregnant females and those who refused participation in the study were excluded.

The main aim of the study was to enumerate and study complications of DJ ureteral stenting in urological patients.

The data was analysed using Microsoft excel and presented in number and percentages.

RESULTS

Out of 100 patients, 33 were females and 67 males with mean age of 41.84±14.26 years.

Table 1: Age distribution.

Age group (years)	No. of cases
10-20	3
21-30	23
31-40	26
41-50	16
51-60	19
61-70	11
Total	100

Most common surgical procedure done was percutaneous nephrolithotomy (PCNL) in 50 patients followed by ureteroscopic lithotripsy (URSL) in 39 patients, pyeloplasty in 5 patients. DJ stenting in 3 patients was

done for pyonephrosis while in other 3 it was done as an emergency procedure to relieve ureteral obstruction in view of deranged renal function tests and anuria. Duration of stent implantation was three weeks in 95 patients and six weeks in five patients (Table 2).

Table 2: Types of surgery.

Type of surgery	No. of cases	Percentage
DJ stenting	6	6
PCNL	50	5
Pyeloplasty	5	5
URSL	39	39
Total	100	100

Most common symptom in first week was found to be flank or suprapubic pain in 44 patients, dysuria in 26, hematuria in 19, frequency in eight and urgency in three patients (Table 3).

Table 3: Symptoms in 1st post-operative week.

1 st week	No. of cases	Percentage
Dysuria	26	26
Flank or suprapubic pain	44	44
Frequency	8	8
Hematuria	19	19
Urgency	3	3
Total	100	100

In second week most prevalent symptom was flank or suprapubic pain in 50 patients (one patient was relieved from previous group and seven new patients had flank or suprapubic pain), dysuria in 21 (six patients were relieved from previous group and one new patient has dysuria), haematuria in 19 (all the old patients), frequency in eight (seven old cases, one new case) and urgency in two patients (one patient was relieved) (Table 4).

Table 4: Symptoms in 2nd post-operative week.

2 nd week	No. of cases	Percentage
Dysuria	21	21
Flank or suprapubic pain	50	50
Frequency	8	8
Hematuria	19	19
Urgency	2	2
Total	100	100

Most common symptom in third week was flank or suprapubic pain followed by dysuria, hematuria, frequency and urgency. Most common complication was found to be encrustation in 42 patients which was diagnosed on removal of DJ stent at the end of third week. One patient had stent migration which was

diagnosed on X-ray KUB done at the end of third week (Table 5).

Table 5: Symptoms in 3rd post-operative week.

3 rd week	No. of cases	Percentage
Dysuria	17	17
Flank or suprapubic pain	53	53
Frequency	8	8
Hematuria	19	19
Migration	1	1
Urgency	2	2
Total	100	100

In fourth week, flank or suprapubic pain was found in three patients, dysuria and frequency in one patient each (Table 6).

Table 6: Symptoms in 4th post-operative week.

4 th week	No. of cases	Percentage
Dysuria	1	20
Flank or suprapubic pain	3	60
Frequency	1	20
Total	5	100

During fifth week flank or suprapubic pain was reported in three patients (all old patients), dysuria and frequency in one patient (all old patients) each (Table 7).

Table 7: Symptoms in 5th post-operative week.

5 th week	No. of cases	Percentage
Dysuria	1	20
Flank or suprapubic pain	3	60
Frequency	1	20
Total	5	100

In sixth week, flank or suprapubic pain occurred in three patients and dysuria in two (one new case) patients (Table 8).

Table 8: Symptoms in 6th post-operative week.

6 th week	No. of cases	Percentage
Dysuria	2	40
Flank or suprapubic pain	3	60
Total	5	100

Overall, the most common complication was found to be flank or suprapubic pain followed by dysuria, haematuria, frequency and urgency. Encrustation was noticed in 42 patients out of 100 at the time of stent removal. Migration was found to be a rare complication that occurred in only

one patient (Table 9). Stent migrated to bladder which was diagnosed on X-ray KUB done as part of treatment protocol prior to DJ removal.

Table 9: Post-operative complication.

Total symptoms	No. of cases	Percentage
Dysuria	68	21.59
Flank or suprapubic pain	156	49.52
Frequency	26	8.25
Hematuria	57	18.10
Migration	1	0.32
Urgency	7	2.22
Total	315	100

All the patients who had dysuria underwent urine complete examination to rule out urinary tract infection. Urine complete did not show any pus cells in all the patients with dysuria. Thus, dysuria was attributed to presence of DJ stent.

DISCUSSION

Placement of indwelling ureteral stents has become routine in the management of a variety of urinary tract disease processes. Ureteral stent placement is an important adjunct to many urologic procedures such as URSL, PCNL and pyeloplasty. Ureteral stents may also be useful for managing conditions such as hydronephrosis due to a malignant neoplasm (like carcinoma cervix, carcinoma rectum), pyonephrosis and obstructive uropathy. The indications for stent insertion have increased and the patients presenting with complications of stent have become more frequent.

It is important to keep a record of stents inserted and track them very closely till removal. All patients should be counselled with respect to the complications of long-term use and advised when their stent should be changed for the reason that the degree of encrustation is dependent on the indwelling time.

In present study, the commonest indication for stenting was prophylactic stenting post PCNL or URSL and pyeloplasty for pelviureteric junction obstruction followed by pyonephrosis and obstructive uropathy. This was similar to the study by Nawaz et al who reported prophylactic stenting as the commonest indication followed by obstructive uropathy while this his was in contrast to Saltzman et al, and Memon et al, where the commonest indication was obstructive uropathy followed by prophylactic stenting. ²²⁻²⁴

The age at presentation in our study varied from ten years to 70 years with mean age of 41.84±14.6 years. Most of the patients (26.0%) presented between 31 to 40 years of age. Moreover, in our study 67.0% patients were male and 33.0% were female which is very much comparable

to studies of Memon et al and Ghaffar et al who had also found higher incidence of male than female patients. ^{24,25}

The ideal stent is not yet available. Silicone stent is resistant to biofilm formation and encrustation is less likely. Because of its softness and elasticity, patient feels more comfortable. On the other hand, polyurethane stents are rigid, easily manageable during placement but cause patient discomfort and may cause ureteral erosion.

In our study, 5 Fr 26 cm non coated double coiled silicon stent was inserted in all the patients undergoing DJ stenting.

The majority of patients will experience consequences, and some patients will have complications, which at times can be devastating. These complications may be of minor nature such as flank or suprapubic pain, haematuria, dysuria, frequency, urgency, incontinence or may be more major such as urinary tract infection, malposition, migration, encrustation, stent fracture, ureteral erosion or fistulisation and forgotten stent. The stent should be monitored while in place, promptly removed when no longer needed, and changed periodically if chronically indwelling.

Most common stent related complication is "stent syndrome". 26 It is a constellation of clinical symptoms: flank pain, frequency, urgency, suprapubic discomfort and sometime with haematuria or incontinence. Although selection of the proper stent and the proper size is the prerequisite to reduce the complication, α_1 -blockers for treating these symptoms has been used with good results. 27

In order to avoid such complications, the ideal time for DJ stent removal or replacement is considered between two and four months.

Risk factors for complications should be minimized with high fluid intake, prompt evaluation of clinical complaints, and aggressive treatment of documented infection.

In a study by Damiano et al, flank pain was observed 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.²⁸ They also reported that morbidity and complications were minimal when the stent was left in situ for less than three months, but longer duration of stent retention was associated with increased frequency of encrustations, infections, calculus formation and obstruction of the stented tract.

Study by Pansota et al showed that 13 (32.5%) patients presenting with irritable bladder symptoms was the commonest complications of DJ stenting. Incidence of fever and hematuria in this study was 20% and 27.5% respectively.²⁹

In our study, suprapubic/flank pain was observed in 49.52% patients, dysuria in 21.59%, hematuria in 18.1%, frequency in 8.25%, urgency in 2.22%, and migration in 0.32% patients. One patient required re-admission due to gross hematuria. Patient was managed conservatively and discharged in two days. No patient presented with urinary tract infection or fever.

Stent migration is a recognized complication and may be related to faulty technique of insertion. Double pigtail stents are less likely to migrate as opposed to J loop stent. Migration can occur either way but upward migration is more common.²⁹ However, in our study stent migration was seen in downward direction into the bladder. Causes of migration are renal ureteric dynamics, peristalsis and incorrect size selection.³⁰ Migration was found in one patient in our study which was diagnosed on X-ray KUB at the end of third week just prior to its removal.

Stone encrustation is another problem in long term use. Polyurethane stent are more prone to encrustation. Stents coatings with hydrophilic polymers, heparin, pentosanpolysulfate, or oxalate-degrading enzymes reduce encrustation. 31-34

Encrustation is more common where stent use for stone disease, but it may also occur due to biofilm formation by the bacteria. Risk factors are chronic recurrent stone formers with a lithogenic history, uricosuria, chronic renal failure, congenital anomalies, urinary tract infection, stasis, dehydration and long indwelling times.³⁰ It is seen that silicone stent is more resistant to biofilm formation and so encrustation is less likely. Stent replacement prior to the time of expected encrustation is the only effective method of preventing encrustation.

In our study, encrustation was found in 42 patients out of 100 at the end of 3rd week on cystoscopic removal of stent. Extracorporeal shock wave lithotripsy (ESWL) is the initial treatment of stents with minimal encrustation. In Mathew et al, study 14 (29.1%) patients required ESWL of whom ten (20.8%) also required URSL.³⁵ However, in present series, no patient underwent ESWL or URSL.

Nawaz et al reported stent encrustation and stent migration in 10.5% and 3.5% cases respectively.²² Memon et al and Arshad et al observed stent encrustation in 17.5%, 2.0% and stent migration in 11.7% and 16.3% respectively.^{24,36} While in our study, stent encrustation was seen in 13.3% and stent migration in 0.3% cases which is much lower than previously described studies.

CONCLUSION

From this study we reinforce that DJ stents have become an essential part of many endourological and open urological procedures and their use cannot be completely avoided. However, their use must be strictly restricted to selected cases with proper documentation and close tracking till removal. All the minor complications are generally well tolerated by patients and can be managed conservatively. Major complication if any can be dealt by stent removal/change. DJ stent should be kept for (3-6 weeks) short term period to help in the healing of ureter, drainage of urine and prevent narrowing during healing and should be removed when it is no longer needed. Patients should be counselled regarding the removal in time and to change periodically if required to be chronically indwelling.

Thus, we recommend the continued use of DJ stenting post endourological procedures where they are absolutely indicated. Our study has also revealed that only minor complications occur due to DJ stenting which can be managed conservatively.

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Institutional Ethics Committee

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