Complication and Outcome of Double J Stenting of Ureter in Urological Practice in Alhussain Teaching Hospital

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Abstract:
Background: Urology regularly relies upon Double-J stenting as a key device in a wide variety of urological procedures. However, complications from stent placement continue to create problems for clinicians despite the high frequency of use. The purpose of this study was to analyze a large cohort of patients with ureteric stents, identify the complications associated with ureteric stents and investigate the correlation to the duration of the double-J stents in situ. Furthermore, we sought to determine if a relationship exists between the complication rates and the diameter and makeup of the Double-J stent used. Patients and methods: This study was done in Al-Hussein teaching hospital, Al-Muthanna province from the period of 23 November 2023 to 1 April of 2024. We evaluate 34 case (13 females, 21 male) who undergoing through procedure of JJ stent placement for variable durations, They aged between 4-85 years(those who are younger than 12 year old, their condition was reported by their parents) age distribution shows a mean of (37.26) with a standard deviation of (19.2). Results : The indications of stenting for were noted (kidney stones as the most prevalent 68% (9% of it are post ESWL),ureteric stone at 24%, while bladder stones, congenital ureteric obstruction(UPJ), and ureteric stenosis each comprising 2.6%, and the total number of complications was 30. We encountered 19 cases (53%) of hematuria, we found 24 cases (71%) of Dysuria and frequency in 24 cases (71%). The Flank pain was found in 21 cases (62%) while Fever is present in 18 cases (53%), Urgency is noted as positive in 14 of cases (41%). For UTI, 11 cases (32%) yield positive state. Regarding the collecated data of JJ stent size, duration among symptoms distribution and along with GUE various parameters there was no significant association with any symptom. Conclusion: Double-J stent is an important tool to prevent and relieve obstruction but Irritative urinary symptoms can result from Its presence in more than half of cases despite patient`s gender, age and DJ stent staying duration. The potential correlation between JJ stent diameter and tube length and symptom Incidence, is indicating the importance of considering tube dimensions in the management and treatment of urological conditions.

Keywords: *Double-J ureteral stent, Ureteral stent complications, Lower urinary tract symptoms (LUTS) Urolithiasi. Stent indwelling duration.*

Introduction

A double J (DJ) stent (sometimes called a pigtail stent) is defined as an artificial device that can be added to the ureter either retrogradely or antegradely to keep the ureter open [1]. The primary function of ureteral stenting is to provide temporary drainage of urine from the ureteropelvic junction into the bladder [2].

The pigtail design provides for a double coil (J-shaped) at each end (proximal and distal). This self-retaining design anchors the stent in place within the upper urinary tract and bladder, thus preventing it from moving outside its intended position. This self-retaining design has led many to refer to the DJ stent as a double J stent [1].

The first DJ stents were introduced to the medical community by Zimskind et al. in 1967 [3]. Since then, DJ stents have become essential, reliable instruments used by urologists in a large variety of procedures [3]. In adults, DJ stents generally range from 24-30 cm in length, and common materials used include polyurethane with either bismuth or baryte for radio-opacity and several different diameters to accommodate the varying sizes of ureters [2], [3], [4].

The standard way to insert these stents is via cystoscopy using a cystoscope to visualize the ureteral orifice, followed by passing a flexible guidewire through the cystoscope into the ureter and then finally through the kidney. The stFluoroscopy can be used to accurately position a stent, which is done by real-time X-ray imaging. [2] Most of the time double J stents are placed after kidney stone surgery for the purpose of ensuring that the area heals properly without being restricted, and to eliminate the possibility of a later acute obstruction in the urinary system caused by inflammation from the surgery. However, double J stents also provide a structural support system between two ends of a ureter; therefore, double J stents are frequently used as part of the management of renal & urinary pathology. [5] Also, stents (when placed properly) can be useful for protecting, identifying and assisting with distinguishing the ureters during the course of complex shoulder angio- surgeries if there were incidental or non-intentional/iatrogenic injury to the ureters. [6], [7]

Double J stents may remain in situ (placed and remaining in the body) for anywhere from several days to multiple weeks or months, depending on patient's individual needs. In instances when a stent must be used for long-term use (as may be done in the treatment of renal edema), the stent will likely have to be replaced every 3 months approximately. [8] The procedure to retrieve a cystoscopic stent will typically follow the reverse of the stent insertion procedure; retrieval of a stent will be accomplished by performing cystoscopy with a slim grasping tool on the stented area of the bladder while the patient is awake and under local anesthetic employing the same anesthesia used as the insertion process to insert the stent. [8]

While there is not yet a single ideal stent free of complications that have been developed to date, double J stents are historically associated with a variety of potential complications. Some examples of minor complications associated with a DJ stents are irritative voiding symptoms (e.g. urinary urgency, frequency, dysuria, flank pain, supra pubic pain), hematuria (blood in urine), and incontinence. [2][3][9] More serious complications that can occur as a result of a DJ stent are vesicoureteric reflux, migration, malposition, encrustations, fracture, and infection. [10][11] In extreme cases, these complications can cause systemic inflammatory response syndrome and lead to urosepsis, which endangers the patient. [10],[12], [13] The majority of complications related to DJ stent require removal of the device.

In practice of clinical nursing and medical personnel, the presence of a double J stent will cause a number of patient discomforts (e.g., pain, irritation of the bladder with a persistent urge to void due to the lower curl of the stent), hematuria (blood in urine), fever and urine leaking, especially in the female gender. [13],[14][15] Some other issues that can arise include dislodged or coiling catheters within the ureter, causing abdominal pain while urinating, infection development/exacerbation, and reactions to anesthesia. [9] These symptoms are typically transient and resolve upon stent removal. [14] Drugs prescribed to treat overactive bladder (OAB) type symptoms may be considered in order to reduce the urgency and frequency of urination due to the stent. [8],[14]

DJ stents that are left in place or become forgotten can create a significant risk of morbidity/severity due to encrustation, and the resulting formation of stones on the stent, leading to serious complications requiring prompt removal. [16] Ureteral stents in place beyond 1 year may also require additional procedures to extract, such as shock wave lithotripsy (SWL), ureteroscopy (URS), or percutaneous nephrolithotomy (PCNL). [11],[16] For this reason it is imperative that every patient with a DJ stent is thoroughly counseled about the potential for long-term complications and the need for stent replacement or removal in a timely manner. [11]

Patients with stents normally can resume almost all daily activities while the stent is retained; however, strenuous exercise is discouraged because it may lead to dislodging or displacement of the stent and may trigger hematuria. Patients also should drink enough fluids throughout the day. [5],[8] Routine work, day-to-day activities including sexual activity may also continue normally while the stent remains in place. [1]

Methods

This study was carried out in Al-Hussein teaching hospital, which is the major governmental hospital in the city that receive all the cases directly or referred from peripheries at Al-Muthanna province. During the period of 23 November 2023 to 1 April of 2024.

We evaluate 34 case (13 females, 21 male) who undergoing through procedure of JJ stent placement, they aged between 4-85 years (those who are younger than 12 year old, their condition was reported by their parents) age distribution shows a mean of (37.26) with a standard deviation of (19.2).

In this study, researchers evaluated the information gathered from each of the 34 sample patients' medical records, paying close attention to how long each of the patients had a JJ stent placed in their body (time period), the size of the stent (diameter and length), what symptoms were present when the patient came in for a visit, and what type of surgery had been previously performed prior to the placement of the JJ stent. Furthermore, details surrounding how each stent was removed including the technique used, whether any complications occurred during or after the removal process, were carefully documented by the investigators conducting this research study.

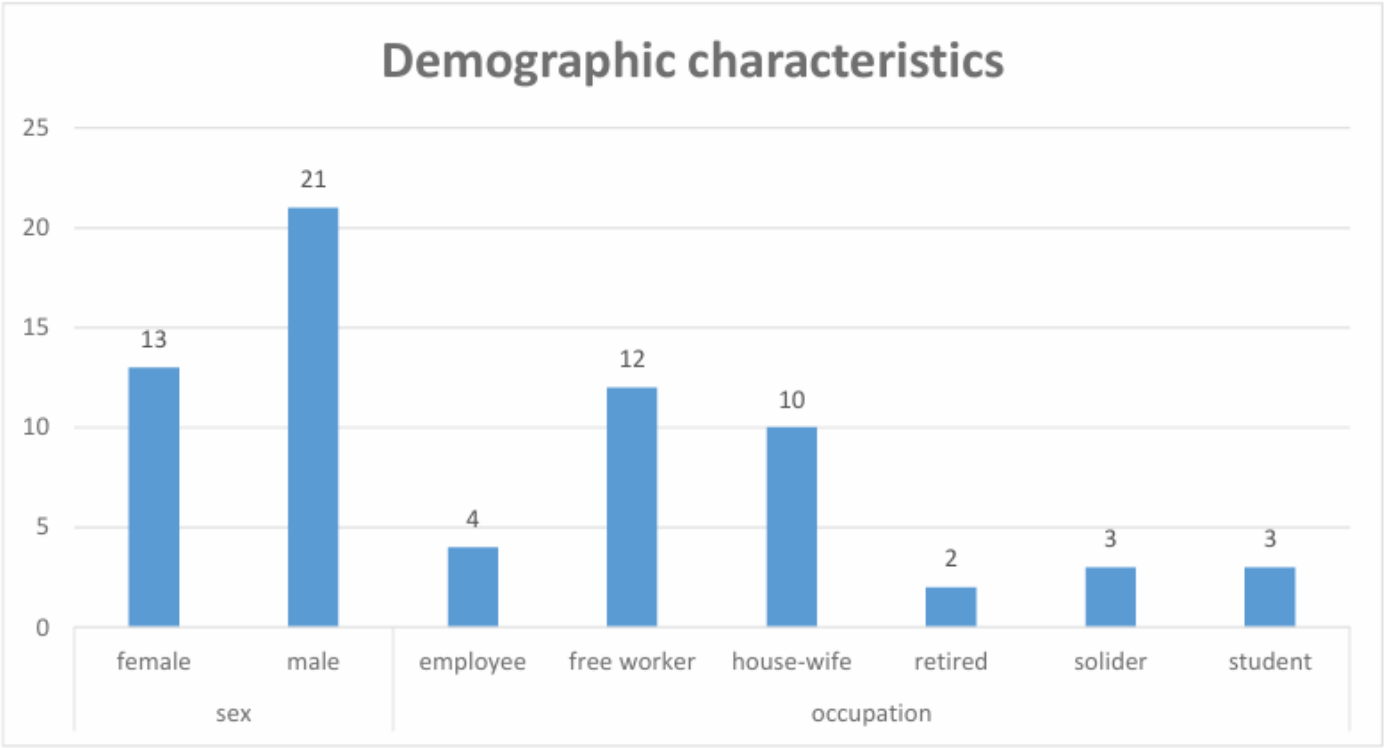

Figure 1. Provides demographic information, presenting counts and percentages across various categories.

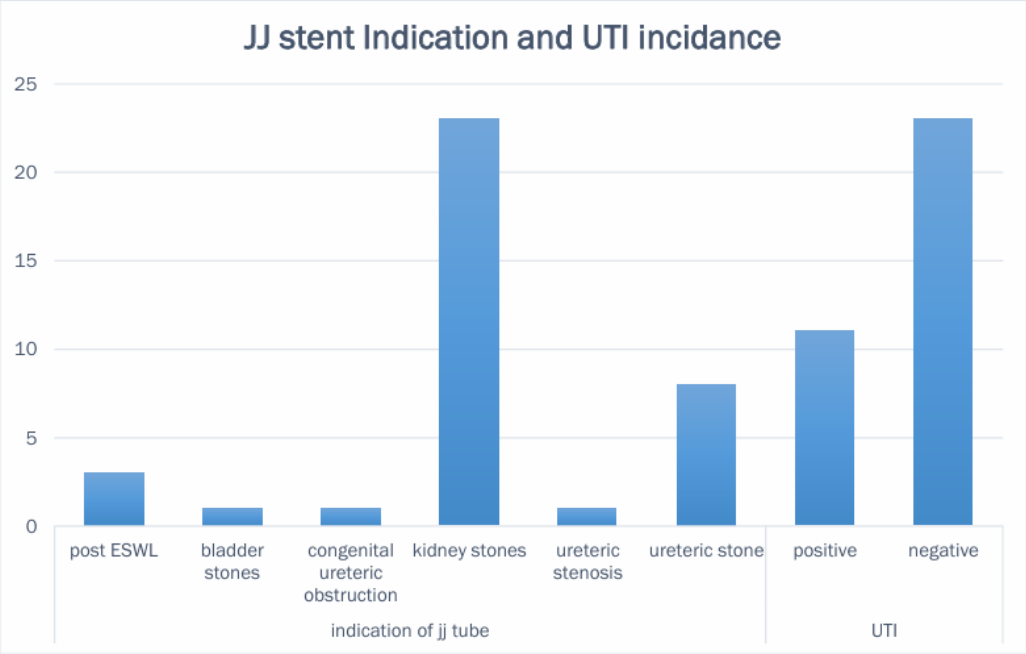

Figure 2. Outlines counts and percentages related to indications, and UTI state.

concerning JJ stent.

Among indications, reveal kidney stones as the most prevalent at 68% (9% of it are post ESWL) followed by ureteric stone at 24%, while bladder stones, congenital ureteric obstruction(UPJ), and ureteric stenosis each comprising 2.6%. For UTI, 32% yield positive state, with 68% stated negative.

Statistic

Almost all the cases admitted and recorded to have JJ stent insertion(as essential part of their condition management) to the hospital during the study period were included.The data were collected from patients themselves and hospital records. The continuous variables were presented as frequency and percent, mean and standard deviation.

Statistical Package for Social Sciences (SPSS) version 20 was used to identify significant variables affecting the development of complications and the outcomes of stenting.

Results

Figure 3 displays counts and percentages concerning symptoms reported by patients. Hematuria is noted in 53% with a rating of "+", in 3% with a rating of "++", and is negative in 44% of cases.

Dysuria is reported as positive in 71% of cases and negative in 29%. Similarly, frequency shows positive results in 71% and negative in 29%.

Flank pain is reported as positive in 62% of cases and negative in 38%. Fever is present in 53% of cases and absent in 47%.

Urgency is noted as positive in 41% of cases and negative in 59%.

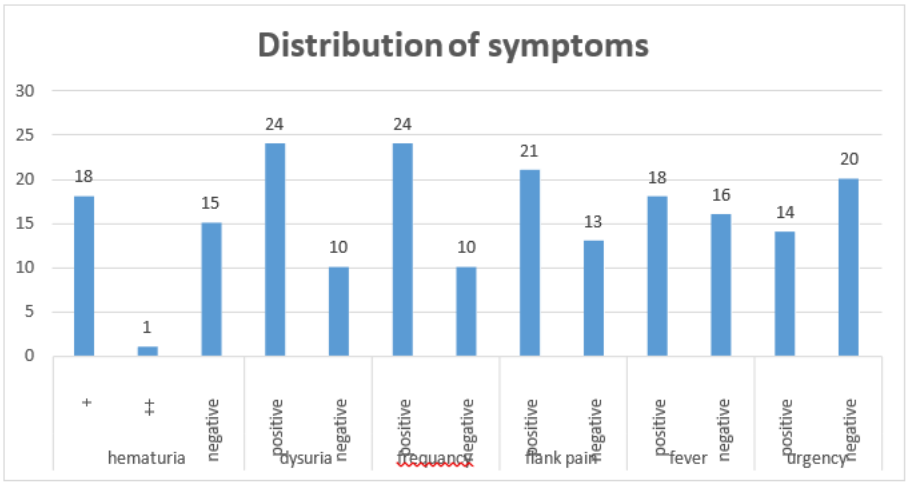

Figure 3. presents findings related to various parameters in the urinary system. GUE (Genito-Urinary Examination) pH levels negative in 41% of cases, pH 5 in 32%, pH 5.5 in 24%, and pH 7.2 in 3%. RBCs are reported as
negative in 50% of cases, with 15% having 4-10 RBCs, 21% having 4 or less,

and 15% having more.

Pus cells show negative results in 47% of cases, 6% have 4 or less, 24% have 4-10 pus cells, and 24% have more. Glucose is reported as "++" in 3% of cases and negative in 97%. Protein is positive in 6% of cases and negative in 94%. Crystals are found to be positive in 12% of cases and negative in 88%.

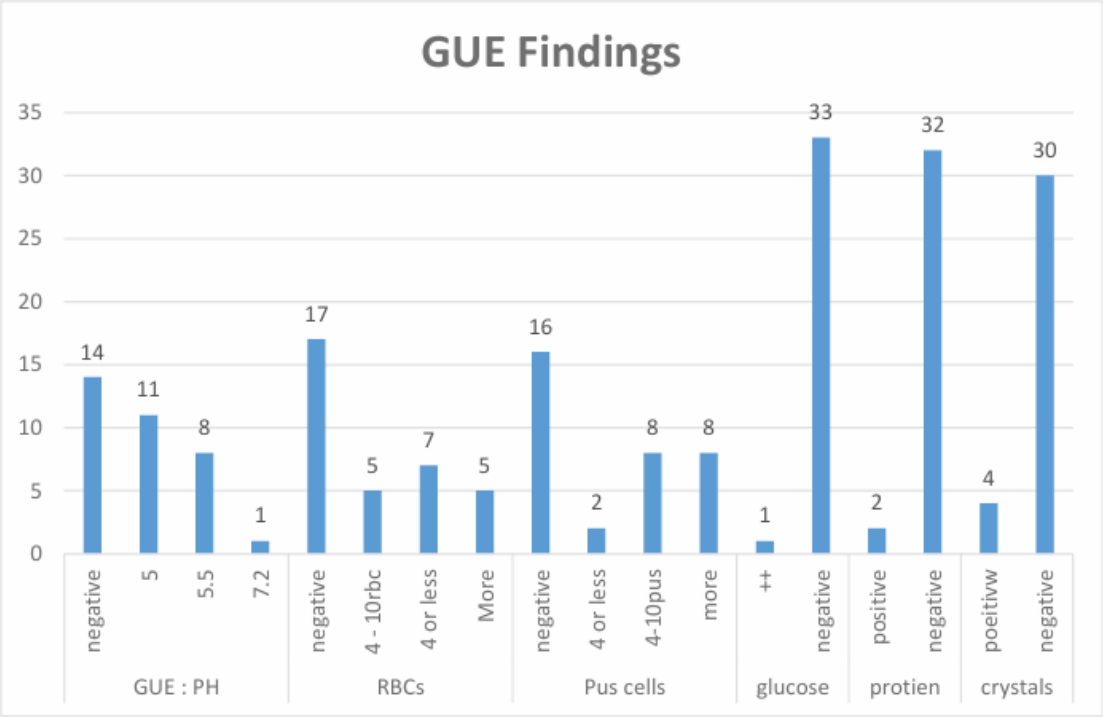

Figure 4. General urine examination findings

Figure 5. Past medical history

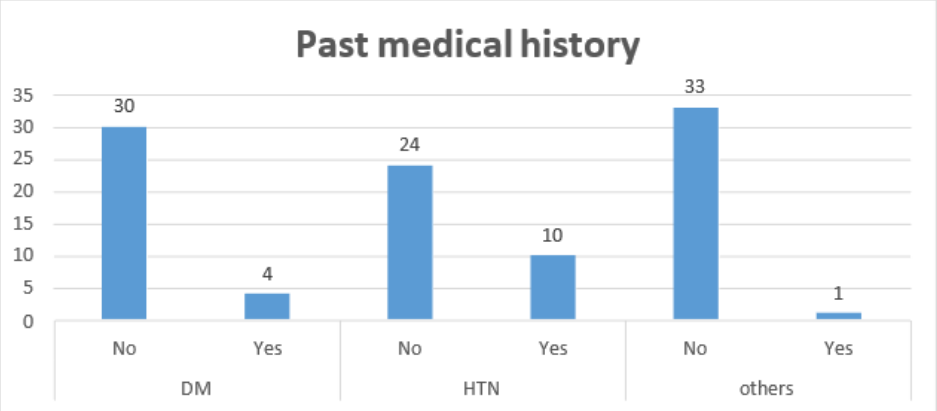

Figure 5 outlines counts and percentages regarding certain medical conditions. In terms of diabetes mellitus (DM), 88% of individuals do not have it, while 12% do. For hypertension (HTN), 71% do not have it, whereas 29% do.

Regarding other medical conditions, 97% of individuals do not have them, while only 3% do.

Table 1. Distribution of symptoms among patients with DJ stent.

Variables		Duration		P value
		2 weeks or less	More	
Haematuria	+	3	15	0.349
	++	0	1	
	-	0	15	
Dysuria	+	3	21	0.242
	-	0	10	
Frequency	+	3	21	0.242
	-	0	10	
Flank pain	+	2	19	0.855
	-	1	12	
Fever	+	2	16	0.618
	-	1	15	
Urgency	+	2	12	0.347
	-	1	19	

Table 1. provides Distribution of duration among symptoms along with associated p-values for various symptoms:

The duration is categorized as "2 weeks or less" and "More." Each symptom, including hematuria, dysuria, frequency, flank pain, fever, and urgency, is evaluated based on its presence or absence, denoted by "+" and "-", respectively.

The table illustrates the frequency of each symptom within the specified duration categories. Additionally, p-values are provided for each symptom, indicating the statistical significance of the association between symptom presence and duration of JJ staying in the body.

Overall, the table provides a comprehensive overview of symptom prevalence and their relationship with DJ duration, aiding in clinical assessment and management decisions.

Table 2. provides the Distribution of duration among General Urine exam results along with associated p-values for various parameters observed in urine analysis, categorized by duration.

Parameters include pH, RBCs, pus cells, glucose, protein, and crystals. Each parameter is assessed based on its count within specified ranges or categories, with "-" indicating absence and various numerical ranges denoting presence.

The table also provides corresponding counts for each category within the specified duration. Additionally, p-values are included to indicate the statistical significance of the observed associations between parameters and duration. This comprehensive overview aids in understanding the urinary characteristics across different durations, facilitating clinical interpretation and decision-making.

Table 2. Distribution of GUE findings among patients with DJ stent.

Variables		Duration		P value
		2 weeks or less	More	
PH	-	1	13	0.282
	5	0	11	
	5.5	2	6	
	7.2	0	1	
RBCs	-	1	16	0.636
	4 – 10 RBCs	1	4	
	4 or less	1	6	
	More	0	5	
Pus cells	-	1	15	0.88
	4 or less	0	2	
	4-10pus	1	7	
	more	1	7	
Glucose	++	0	1	0.752
	-	3	30	
Protein	+	0	2	0.65
	-	3	29	
Crystals	+	0	4	0.508
	-	3	27	

Table 3. provides data on Association between symptoms and diameter of JJ tubes.

the association between various symptoms and tests with different diameters of JJ tubes, where "French"(1 Fr is equivalent to 0.33 mm) is a unit of measure for tube diameter.

The symptoms include hematuria, dysuria, frequency of urination, flank pain, fever, and urgency.

For each symptom, the table shows the number of positive cases represented by "+" and the severity of the symptom denoted by "+", "++", or "-". The diameters of JJ tubes are categorized into 4 French, 5 French, 6 French, and 7 French.

Analysis of the data reveals varying frequencies of positive cases for different symptoms across different JJ tube diameters.

For instance, there's a higher frequency of positive cases for hematuria and dysuria with 6 French tubes compared to other diameters.

Frequency and severity of symptoms like flank pain and fever also exhibit differences across tube diameters.

Overall, the data suggests a potential correlation between JJ tube diameter and symptom presentation, indicating the importance of considering tube size in the management and treatment of urinary conditions.

Table 3. Association between symptoms and diameter of JJ tubes.

Variables		Diameter in French				P value
		4 French	5 French	6 French	7 French	
Haematuria	+	0	0	1	0	0.45
	+	0	0	11	6	
	++	0	0	1	0	
	-	3	2	6	4	
Dysuria	+	3	2	13	6	0.446
	-	0	0	6	4	
Frequency	+	2	2	13	7	0.825
	-	1	0	6	3	
Flank pain	+	2	0	13	6	0.304
	-	1	2	6	4	
Fever	+	2	1	10	5	0.966
	-	1	1	9	5	
Urgency	+	1	1	8	4	0.985
	-	2	1	11	6	

Table 4. provides data on the association between various symptoms with different lengths of JJ tubes, denoted in centimeters (cm).

The symptoms include hematuria, dysuria, frequency of urination, flank pain, fever, and urgency. For each symptom or test, the table indicates the number of positive cases represented by "+", the severity denoted by "+",

"++", or "-", and the lengths of JJ tubes in centimeters ranging from 12 cm to 30 cm.

Analysis of the data reveals varying frequencies of positive cases for different symptoms and tests across different JJ tube lengths.

For example, there's a higher frequency of positive cases for certain symptoms like dysuria, frequency of urination, flank pain, and fever with JJ tube lengths of 22 cm to 28 cm compared to other lengths.

However, the significance of these findings is evaluated through the P-value provided in the table.

Overall, the data suggests a potential correlation between JJ tube length and symptom presentation, indicating the importance of considering tube dimensions in the management and treatment of medical conditions.

Table 4. Association between symptoms and length of JJ tube.

Variables		length in cm								P value
		12 cm	14 cm	16 cm	22 cm	24 cm	26 cm	28 cm	30 cm	
haematuria	+	0	0	0	0	0	1	0	0	0.682
	+	0	0	0	3	8	3	3	0	
	++	0	0	0	0	1	0	0	0	
	-	2	1	2	2	3	1	3	1	
Dysuria	+	2	1	2	3	8	5	3	0	0.32
	-	0	0	0	2	4	0	3	1	
Frequency	+	1	1	2	2	9	5	3	1	0.355
	-	1	0	0	3	3	0	3	0	
Flank pain	+	1	1	0	3	8	5	3	0	0.242
	-	1	0	2	2	4	0	3	1	
Fever	+	1	1	1	2	7	4	2	0	0.672
	-	1	0	1	3	5	1	4	1	
Urgency	+	0	1	1	1	7	2	1	1	0.316
	-	2	0	1	4	5	3	5	0	

Table 5. Distribution of symptoms among UTI state.

Variables		UTI		p value
		positive	negative	
	+	6	12	
	++	1	0	
haematuria	negative	4	11	0.414
	positive	10	14	
dysuria	negative	1	9	0.072
	positive	9	15	
frequency	negative	2	8	0.32
	positive	8	13	
flank pain	negative	3	10	0.363
	positive	10	8	
fever	negative	1	15	0.002
	positive	8	6	
urgency	negative	3	17	0.01

Table 5. displays Distribution of symptoms among UTI state and their respective p-values:

- For hematuria, there were 6 positive cases, 1 case rated as "++", and 4 negative cases. The p-value associated with hematuria is 0.414, indicating no significant association with UTI.
- Dysuria, had 10 positive cases and 1 negative case, yielding a p-value of 0.072, suggesting a marginal association with UTI.
- Frequency, showed 9 positive cases and 2 negative cases, with a p-value of 0.32, indicating no significant association with UTI.
- Flank pain had 8 positive cases and 3 negative cases, resulting in a p-value of 0.363, suggesting no significant association with UTI.

- Fever showed 10 positive cases and 1 negative case, with a p-value of 0.002, indicating a significant association with UTI.
- Urgency exhibited 8 positive cases and 3 negative cases, yielding a p-value of 0.01, indicating a significant association with UTI.

Discussion

Double J ureteral stents are very frequently used by urologists around the world. Depending on the situation, they can be placed temporarily or permanently. When long-term stenting is necessary, replacing them in a timely manner is critical to reduce the risk of complications associated with an extended length of time inside the body. [17]

Urologists continue to use indwelling ureteral stents for urinary diversion, the management of ureteral obstruction, and post-surgical drainage. Nonetheless, since there is no ideal stent, clinicians can expect complications such as urinary tract infections, blockage, hematuria, and the formation of stones, etc. [18] The ideal stent would be easy to insert, provide relief from obstruction, allow adequate urine passage, resist encrustation/infection, have good chemical stability, and have no side effects. [18]

In our study, the predominant reason for stenting was due to obstructive uropathy, with the second most common indication being prophylactic stenting. The main cause of obstructive uropathy seen in this study was stone disease (renal and ureteral stones). This finding agrees with a study performed at the University of Tel Aviv in Israel. [19]

Irritative symptoms, such as little to no urinary control, blood in the urine, frequent visits to the bathroom, bladder pain/nuisance, and renal colic, often diminish one's ability to enjoy their quality of life. [20], [21] Complications experienced during the first two weeks following stent placement were identified in more than 50% of all cases reviewed in our study. In contrast, delayed complications (fever and urinary tract Infection) from stents placed greater than four weeks previously were documented in approximately 35% of stents. Similar to our results, irritative bladder symptoms were identified as the most common stent complication (42.5%) from a single tertiary medical center in South India [23].

Literature has been supportive of the subject matter of our study. For example, Pansota MS and Rasool M in a 2013 study showed that 32.5% of patients with DJ stents placed at Bahawal Victoria Hospital experienced significant irritative bladder symptoms [22].

The most prevalent types of symptoms were as follows:

Flank Pain

The two most common complications in our study cohort were lumbar pain, present in 62% of cases. We think that back-flow and higher pressures within the kidney and pelvis can cause lumbar pain [24], [25]. Those who had DJ stents will commonly experience lumbar symptoms while voiding [26].

Hematuria

Patients can present with hematuria (blood in urine) immediately after placement of their DJ stent or because of treatment of their underlying problems via surgical procedures [27]. In our study, hematuria was seen in 53% of cases, higher than the 13.3% to 27.5% reported in the literature (Pansota MS at Bahawal Victoria Hospital, Mallikarjuna Gurram's tertiary care center in southern India) [22], [23]. Hematuria also occurs frequently after pneumatic ureteroscopy for stone removal.

Dysuria

In the present study, lower urinary complications (dysuria, frequency) were the most common type of complication related to the DJ stent (71% of patients). Similarly, Pansota MS et al. noted: 32.5% of patients reported having irritative bladder complaints (of the 13 patients they studied) [22] [28]. Many studies have demonstrated that nearly all patients (50%) with DJ stents experience pain and irritative urinary symptoms and that these symptoms impact quality of life.

Fever and UTI

Of the 34 patients in our study who were febrile, 18 (53%) developed urinary tract infections (UTI) while they were being evaluated for stent removal. The incidence of infection in this study (53%) was significantly higher than the incidence of fever (15.9%) from Mallikarjuna Gurram and at his tertiary care facility [23]. Mallikarjuna Gurram's data showed that patients with fever represented 26.3% of all patients who required stent removal. Pansota MS et al. found that 37.5% of their patients with fever had received stent removal for UTI. Richter S et al. found that the stent removal rate for fever by the University of Tel Aviv was 55.8% [19]. Unlike these previous studies, none of our patients required stent removal; all patients were treated successfully for UTIs or with intravenous antibiotics and antipyretics.

In our practice, we emphasize extensive counseling of the patient and family and encourage their participation in follow-up care. Each postoperative patient in our practice has been given an X-ray KUB to visualize the location and size of their stent in the urinary tract. All patients are attempted to be contacted after their surgery via either telephone or United States mail; this form of follow-up has allowed the authors to maintain up-to-date information on the progress of each patient after their operation.

Conclusion

In our presented study, we concluded that:

Retrograde stenting (JJ Stent) is an easy and effective procedure for the management of obstructive uropathy, but unfortunately, there is no such thing as a “perfect urinary stent”.

Irritative urinary symptoms can result from a DJ stent in more than half of cases, regardless of the patient's gender, age, or duration of DJ stent stay.

The p-values are provided for each symptom, indicating that there's no significant association between symptom presence and JJ's duration of stay.

The analysis of the data reveals that the significant independent factors affecting the complication rate were the stent length and JJ tube diameter.

For instance, there is a higher frequency of positive hematuria and dysuria cases with 6 French tubes than with other diameters.

The data suggest a potential correlation between JJ tube diameter and tube length and symptom presentation, underscoring the importance of considering tube dimensions in the management of medical conditions.

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