A Prospective Cross-Sectional Study to Assess the Effect of Direct Ureteral Length Measurement to Choose Length of Double J Stent on Stent Related Morbidity

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ABSTRACT

BACKGROUND

A Zimskind et al. in 1967 first described ureteral stenting, and it has become an integral part of the urological procedure since then. There are various problems associated with the procedure of DJ (Double J) stenting. Post stenting complications such as blockage of the stent (25 %), stent migration, haematuria, flank pain, stent irritating trigonal area leading to LUTS (Lower Urinary Tract Symptoms) (78 %), stent pass off, infection, formation of biofilms (11 %), and reflux. The exact mechanism causing stent-related symptoms is not known but the proposed mechanism for it is that firstly intravesical portion of the stent acts as a foreign body which irritates bladder mucosa especially at the trigonal area of the bladder and neck of the bladder. It becomes important to study the methods of measuring required length of stent; there are direct and indirect methods to do so. We wanted to study the direct method of measuring required stent length along with its effect on symptomology.

METHODS

A total of 43 patients who underwent DJ stenting for various reasons were included in the study. The ureteral length was measured using a ruled 5-Fr ureteral catheter under C-arm guidance. With the help of air pyelogram, the exact length of the ureter was noted endoscopically. A stent of the nearest length to the measured ureteric length was inserted. Stent-related morbidity was assessed with the help of post-operative stent related symptomatology. Length of the stent in the bladder is a major determinant of symptoms.

RESULTS

Of the 43 patients, 23 (53.5 %) patients underwent unilateral and 20 (46.5 %) patients underwent bilateral DJ stenting. The commonest indication for surgery was urolithiasis. 4 (9.3 %) patients had postoperative stent-related symptoms.

CONCLUSIONS

Choosing a double J stent by direct measurement of ureteric length can be a very useful, yet simple method to prevent post-stenting morbidity and needs further evaluation.

KEYWORDS

DJ Stent, Ureteric Length, Stent Length, Stent Related Symptoms

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BACKGROUND

Zimskind et al. in 1967 first described ureteral stenting, and it has become an integral part of the urological procedure since then. DJ stent is used in a various urological procedure such as treatment of obstructive uropathy, ureteral stricture, ureteropelvic junction obstruction, post URSL, various open ureteral procedure, and as a preventive tool in a various non-urological procedure such as hysterectomy for malignant as well as non-malignant procedure, retroperitoneal fibrosis.[1]

There are various problems associated with the procedure of DJ stenting as well as post-procedure. During insertion of the procedure, there might be damage to the ureterovesical junction, raising a flap of UVJ (Uretero-Vesical Junction), perforation of the ureter. Post stenting complications such as blockage of the stent (25 %), stent migration, haematuria, flank pain, stent irritating trigonal area leading to LUTS (78 %), stent pass off, infection, the formation of biofilms (11 %), and reflux.[2] In many patients, these side effects persist throughout the period of stent present. Some patients with a short length of DJ stent face the unique issue of stent migration and then not serving the purpose of stent placement and leading to the need for repositioning or replacement of stent.[3] Improper length in term affects the quality of life and social aspect of a person's life because of symptoms such as frequency. Because of all these issues, it becomes of utmost importance to choose the perfect length of the stent.

The exact mechanism causing stent-related symptoms is not known but the proposed mechanism for it is that firstly intravesical portion of the stent act as a foreign body which irritates bladder mucosa especially at the trigonal area of the bladder and neck of the bladder. This irritation stimulates nerve endings which principally comprises of alpha and cholinergic supply which leads to increase bladder contraction and pain perception causing typical stent-related symptoms. Another mechanism of stent-related symptoms is the relaxation of the vesicoureteral junction due to the presence of a foreign body which leads to reflux leading to flank pain and strangury.[4,5] Various studies have shown length of the stent in the bladder is a major determinant of symptoms, distal end crossing midline is major cause irritative symptoms. Excess length in the bladder and stent crossing not only lead to irritative symptoms of the bladder but also lead to body pain, sexual function, and impairment of general health and work performance.[6]

Determining the exact length of the stent is very important, and various methods have been proposed and analysed in various studies.[7,8] But still, there is no single full-proof method or method which is good enough to be considered as a standardised method for length measurement and so every urologist uses a technique that is convenient to him / her. Broadly these methods of measuring the length of stent can be divided into the direct method and indirect method. The indirect method is based on anthropometric measurements of individuals and based on imaging such as CT (Computed Tomography), IVU (Intra-Venous Urogram), and X-Ray. Theory of anthropometric measurement which is based on Vitruvian da Vinci theory.[9] As per this theory, there is proportionality in measurements of various parts of the human body. Based on this principle human figures can be easily be drowned by simple geometric figures. This proportionality is used by anatomists and urologists to calculate the expected length of the ureter and in turn, propose the length of stent required for the patient.[2] Although it has been seen that this proportionality holds true in some aspects, many studies have disproved these measurements and challenged the use of anthropometric measures as the basis of measuring the length of ureter.[2,8,10,11] The direct method of measurement is using guides wire and marked ureteral catheter.[12]

The advantage of the indirect method is that it's easy to use, easy to remember, rapid and reliable plus it avoids the possibility of trauma which is there an indirect method of measurement. The direct method involves repeat cystoscopy, multiple instrumentation, and chances of trauma to the mucosa. The only advantage that the direct method gives is the exact measurement of the length of the ureter and so we can decide the exact length of the DJ stent.[13] So there is no yet agreement on the best method of stent length measurement.

Various methods of DJ stent length measurements such as:

1. Ho et al. in their study compared height and length of the stent and found that for height ranges from 149.5 cm to 178.5 cm, a 22 cm stent is more appropriate[6]
2. Pilcher and Patel studied and gave the formula for range of length and need of stent length for the very fact that stents available in the fixed size and can't be manufactured by individuals need so using height length as range rather absolute value make more sense. Patients with a height of less than 178 cm stent of 22 cm are ideal; for a height of 178 cm - 193 cm stent of 24 cm and a patient more than 193 cm stent length of 26 cm is ideal.[8]
3. Hao et al. used a formula based on the bodyweight of a person, and the distance between the second lumbar vertebrae to the pubic symphysis. " Length = 0.125 × body height + 0.5 cm Vertical distance from the second lumbar vertebra to the pubic symphysis minus 2 cm" [14]
4. Hruby et al. used various anatomical landmarks for measurement of the expected length of stent " X-P (xiphoid process to pubic symphysis distance) S-W (shoulder [acromion process] to the wrist [head of the ulna])"[15]
5. Paick et al. investigated the "actual length of the ureteric trace (ALUT) and linear distance (LD) from ureterorenal junction to the ureterovesical junction by IVU". The used 15 mins view.[16]
6. Kawahara et al." The axial computed tomography distance as calculated by the axial computed tomography."[3]
7. Palmer and Palmer for paediatrics patients, "Age + 10 cm."[13]
8. Lee et al. used height as a parameter to predict the length of DJ stent "According to patient's height.[17]

Height (Feet, Inches)	Stent Length (CM)
< 5 feet 2 inch	22
5 feet 3 inches to 5 feet 7 inch	24
5 feet 8 inches to 5 feet 10 inch	26
5 feet 11 inches to 6 feet 1 inch	28

But not all studies do support this theory of excess length of DJ stent is the cause of LUTS as shown by Calvert et al (2013) and Lingeman et al (2009) shown in their studies that no statistically significant result noted by reducing the amount of intravesical length and thereby refuting the established theory of stent length as the cause of discomfort.[18,19]

Our aim is to see the effects of inserting a stent of actual measured length rather than calculated length to assess the reduction in stent-related morbidity.

METHODS

This prospective cross-sectional study was undertaken between December 2014 and November 2016. The patients who needed ureteric stenting unilaterally or bilaterally for various indications were included in the study. Patients with obvious pathology causing symptoms like stent related morbidity are excluded from our study.

We had made available the DJ (Double J) ureteric stents of different lengths from 12 cm to 26 cms in our operating room, so that the appropriate length stent can be chosen after measuring the actual length of the ureter. In cases of bilateral ureteric stenting, both ureters are measured separately.

All these procedures are done under fluoroscopic guidance. We have used 22F Karl Storz rigid cystoscope, 4F*70 cm ureteric catheter, 0.025" * 150 cm guidewire for insertion of the ureteric catheter. These procedures are done under spinal anaesthesia in the lithotomy position.

Procedure: under spinal anaesthesia, with the patient in the lithotomy position, with strict aseptic precautions, cystoscopy is done with a 22F rigid cystoscope. The ureteric orifice identified and a 0.025"*150 cm Terrumo guidewire was inserted under fluoroscopic guidance. After the guidewire positioning with its coiled tip in the renal pelvis as confirmed by fluoroscopy, a 4F*70 cm ureteric catheter was inserted over the guidewire. After confirming the position of the ureteric catheter in the renal pelvis by fluoroscopy, the guidewire was removed. Now, by injecting about 1 - 2 ml of air into the pelvis via the ureteric catheter, air pyelogram was done and repositioning of the ureteric catheter is done, so that the tip of the ureteric catheter is just proximal to the Pelvic Ureteric Junction (PUJ).

Now, with the cystoscope in the bladder, the marking on the ureteric catheter at the ureteric orifice was noted down. That helps to get the exact length of the ureter as directly measured. Now, a guidewire is reinserted through the ureteric catheter, its position in the renal pelvis confirmed by fluoroscopy, and the ureteric catheter removed. This entire exercise usually takes around 8 - 15 minutes. After noting down the length of the ureter, the nearest size of the DJ stent is selected and inserted over the guidewire, its position confirmed by fluoroscopy, and the procedure completed after inserting a Foley's per-urethral catheter. Post-operatively, the per-urethral catheter is removed on the first post-operative day and symptoms are assessed keeping in mind the possible stent-related symptoms. Even after the discharge, patients were asked to report any symptoms during the follow-up period and they were recorded. Stent removal or stent change was done between 4 and 6 weeks depending on the indications and the progress of each patient.

Study Design

Our study is about method of measurement of length of stent and symptomatology of patient in post op period. For this we collected quantitative data such as length of stent and qualitative data such as presence / absence of symptoms. Since it is a prospective cross-sectional study, we analysed patient's symptoms in post op period.

Statistical Analysis

All data collected during study period was entered in SPSS. Data used for study is categorial variable such as gender and presence or absence of symptoms (yes / no). Percentage of each symptoms is calculated.

RESULTS

Of the 43 patients, 28 (65 %) patients were male and 15 (35 %) were female patients. 23 (53.5 %) patients underwent unilaterally and 20 (46.5 %) patients underwent bilateral DJ stenting. The commonest indication for surgery was urolithiasis. 4 (9.3 %) patients had postoperative stent-related symptoms which included suprapubic pain, frequency, urgency, ipsilateral flank pain, and dysuria. No cases of haematuria were noted.

Stent Size		18	20	22	24	26	Total
No. of Stents		1	4	16	36	6	63
No. of Patients (43)	Unilateral	1	2	6	14	0	23
	Bilateral	0	1	5	11	3	20

Table 2. Different Sized Stents Used in the Study

DISCUSSION

Double J stent is the most important part of an urologist's armamentarium. It is an indispensable part of most of the urological procedures. It helps in effective drainage of the upper tract after many procedures such as ureteroscopic lithotripsy, obstructive uropathy drainage, before ESWL (Extracorporeal Shock Wave Lithotripsy), after some open ureteral procedure such as the procedure for PUJO (Pelvi-Ureteric Junction Obstruction), stricture urethra repair, etc. but just like any good procedure DJ stenting also isn't bereft of complications. Complications such as frequency, haematuria, flank pain, dysuria, and urgency are few of the

most commonly experienced complications, apart from these many patients do experience much debilitating sexual side effects which impairs personal life. Various questionnaire are there to quantitively assess these symptoms and score them such as "The International Prostate Symptom Score (IPSS)", "International Continence Society (ICS) male and quality of life (QOL)", and "Bristol Female Lower Urinary Tract Symptoms (BFLUTS)" questionnaires

In our study we found 4 (9.3 %) patients experiencing such side effects. In a landmark study by Joshi et al in 2003 shown lower urinary tract symptoms after D-J placement include frequency (50 % – 60 %), urgency (57 % – 60 %), dysuria (40 %), incomplete emptying (76 %), and urge incontinence (25 %) after D-J placement. (20) Leibovici et al. in his study showed how stent-related symptoms can affect social life by comparing inability to work, they found 45 % were unable to work for at least 2 days, and total 435 workdays lost in 135 patients[21]

Many studies have shown longer length of the stent causes symptoms by the irritative effect on bladder trigone. As shown by Chen-Hsun Ho et al[6] the use of a longer stent was also significantly associated with higher symptom scores of urinary frequency and urgency. The incidence of urgency was 31.0 %, 53.6 %, and 66.7 % (p 0.02). The incidence of urinary frequency was 24.1 %, 39.3 %, and 56.7 % in the patients with a 22 cm, 24 cm, and 26 cm stents, respectively (p 0.04). The anthropometric variable of height is mainly used for predicting length of the ureter in day to day practice all over the world. For the fact, it's reliable and easy to remember doesn't require complicated mathematics, after many years its reliability and validity are still doubtful as seen by the high rate stent-related symptoms.[3] Many studies have raised serious doubt about this relation and show negative results in comparing anthropometric parameters as a predictor of ureteral length. on contrary, there are proponents of this theory of anthropometric measurements as the correlation of ureteral lengths such as extensive research by Ho et al[6] and Lee et al[22] in Chinese and Korean population showed good relation of both parameters. Some recent studies have proposed that the absolute length of the stent will vary with the position of the patient such as sitting or supine they showed supine position shows the maximum length and shortest when sitting that's why a patient with perfect position on x-ray can have distal end crossing midline and symptoms related to the stent.[18]

The present study has highlighted the need to avoid the surplus length of the stent in preventing bladder symptoms by the longer lower end of the stent. This is a simple and useful method for preventing post-stenting morbidity without additional costs.

The causes of symptoms in 4 patients in this study couldn't be well established and may also be related to primary pathology other than the stent itself. However, those symptoms were relatively mild, and only symptomatic treatment controlled the symptoms without any need for early stent removal.

Limitations of the Study

A smaller study group is an obvious limitation, apart from not being a comparative study and needs further evaluation with larger study groups.

CONCLUSIONS

Choosing a double J stent by direct measurement of ureteric length can be a very useful, yet simple method to prevent post-stenting morbidity and needs further evaluation.

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