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Comparison of Ureteral Stents-Related Symptoms among Patients with Ureteral Stents of 4.7Fr and 6Fr Diameter

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ABSTRACT

Ureteric stents are essential in urology, but factors like diameter, position, and design can significantly impact patients' quality of life. **Objectives:** To compare the mean IPSS scores among patients with ureteral stents of 4.7Fr and 6Fr diameter. **Methods:** The quasi-experimental study was conducted at the Department of Urology and Renal Transplant, Mayo Hospital, Lahore, from March to September 2024. 124 patients were selected for this study who required DJ Stenting after open or endourological surgery. Patients were categorized into two groups. Each group contains 62 patients. All patients underwent open or endourological surgery followed by DJ Stenting as indicated. 4.7 Fr DJ Stents were placed in Group A and 6 Fr DJ Stents in Group B. **Results:** A Total of 124 patients, the mean age of the 4.7 Fr DJ stent group was 47.88 ± 6.56 years, and 49.48 ± 6.57 years in the 6 Fr DJ stent group. The p-value = 0.178, duration of operation 50.85 ± 0.64 minutes in group A and 55.25 ± 0.76 minutes in group B. The p-value = 0.000). There were 43 (55.1%) male and 19 (41.3%) female in group A, and 35 (44.9%) male and 27 (58.7%) female in group B. A (p=0.193) IPSS score was 2.21 ± 0.11 in group A and 6.33 ± 0.19 in group B (p=0.000). **Conclusions:** It was concluded that ureteral stents with larger diameters result in notably more severe urinary symptoms. It is advisable to use ureteral stents with smaller diameters to alleviate symptoms related to stent use.

INTRODUCTION

DJ stenting is a common urological procedure performed under a variety of circumstances. DJ Stents are flexible tubes placed in the ureter with their coiled upper and lower ends placed in the Kidney and Urinary bladder, respectively. They prevent stricture formation after endoscopic or open surgeries by keeping the ureters open during the healing process [1]. They are also used in the identification of ureters during retroperitoneal or pelvic surgeries and to keep ureters patent during conditions like retroperitoneal fibrosis [2]. DJ Stents are associated with significantly lower UT signs, pain, sexual dysfunction, and reduced labor capacity in 80% of patients. These indications are due to bladder mucosa irritation by the distal coil, leading to detrusor contraction [3]. Some research indicates that stents can shift up to 2.5 cm during regular daytime activities. This shifting is believed to increase the pain and lower UTIs due to the direct discomfort of the bladder [4]. Much work has been done in the past studying the etiology of DJ Stent-related LUTS and ways to improve these symptoms, with authors advocating for improvements in stent material, stent placement technique, stent positioning, and pharmacological therapy [5]. The

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mainstays of pharmacologic therapy have been alpha-blockers and anticholinergic agents. However, to date, an optimal strategy to improve stent-related symptoms still doesn't exist [6]. The effect of stent diameter on DJ stent-related LUTS found an insignificant association in pain or irritative symptoms among patients. However, smaller diameter stents had a propensity to migrate downward and become dislodged [7]. Ureteral stents with narrower diameters are suggested for alleviating stent-related symptoms when associated with larger diameter stents, as evaluated using the International Prostate Symptom Score (IPSS) [8]. Patients with larger diameter stents had worse IPSS, intermittency, urgency, voiding symptoms, and storage symptoms sub-scores on IPSS, and total OABSS [9]. The Urinary Symptom Index Score and patients reporting discomfort were notably more favorable for PSS compared to DJ. Urinary stents come with various side effects that impact patients both physically and mentally. The design and models of ideal or nearly ideal stents should focus on minimizing these side effects while maintaining a high level of tolerability, safety, and effectiveness [10]. Urinary stents can lead to a variety of side effects that impact patients both physically and mentally. The optimal or nearly optimal stent designs and models should focus on reducing these side effects, while being as comfortable, safe, and effective as possible.

Stent-related discomfort has been linked to factors such as bladder irritation, stent migration, and design characteristics, yet consensus on an optimal stent diameter to minimize symptoms remains lacking. Existing evidence on the relationship between stent diameter and LUTS is inconsistent, with limited comparative data using standardized symptom scores. This study aims to compare the mean International Prostate Symptom Score (IPSS) among patients with 4.7Fr and 6Fr ureteral stents to evaluate the impact of stent diameter on symptom severity.

METHODS

A quasi-experimental study was conducted in the Department of Urology and Renal Transplant, Mayo Hospital, Lahore, from March 2024 to September 2024 using a non-probability consecutive sampling technique. Patients aged 16-60 years with unilateral DJ Stents without externalized strings, placed after Open or Endo-urological procedures in Urology Unit II, were included. Patients with positive preoperative Urine Culture, diagnosed with bladder outlet obstruction or neurogenic bladder, experiencing treatment with alpha-blockers, anti-cholinergic mediators, or painkillers, performing clean intermittent catheterization, patients with indwelling urethral catheters, suprapubic catheters, or nephrostomy tubes, and pregnant female were not included. This study was approved by the ethical committee of Mayo Hospital, Lahore, with the reference number: CPSP/REU/URO-2021-066-1396. Informed consent about the study was taken from each patient. Demographic data/information (age, gender, and duration of symptoms) were recorded. Investigations including CBC, Urine Culture, Ultrasound of Abdomen and Pelvis, and Kidney-Ureter-Bladder radiography were performed. 124 Patients were classified into 2 categories: group A (n=62) and group B (n=62) according to stent diameters. All patients undergo open or endourological surgery followed by DJ Stenting as indicated. 4.7 Fr DJ Stents and 6Fr DJ Stents were placed in patients. Sample size was calculated by using G-power software, using effect size 9.8%, power 80% and 5% as margin of error [9]. Broad-spectrum antibiotics and non-steroidal analgesics were prescribed to patients postoperatively as indicated. Patients were followed up 7 days after undergoing DJ Stenting and filled validated International Prostate Symptom Score (IPSS) Questionnaire. The IPSS is a standardized tool used to evaluate urinary symptoms, consisting of seven questions, each scored from 0 to 5, with a total score ranging from 0 to 35. The severity of symptoms is classified as mild (0–7), moderate (8–19), and severe (20–35). In this study, the IPSS was used to assess stent-related urinary symptoms, quantifying symptom severity and tracking changes over time. The IPSS scores from both groups were compared to determine whether ureteral stent diameter influenced the frequency and severity of DJ Stent-related lower urinary tract symptoms. Follow-up was limited to seven days due to challenges related to patient availability and significant data loss beyond this period. Moreover, investigations, including Urinalysis and Ultrasound of Abdomen and Pelvis, were performed. Patients who reported severe symptoms or complications during follow-up were evaluated further and provided appropriate management, including medication adjustments, additional diagnostic tests, or early stent removal if necessary. Cases of significant pain, infection, or obstruction were managed following standard urological guidelines, ensuring individualized patient care and intervention as required. Data were arranged and analyzed by SPSS version 22.0. The continuous variables, like age, duration of operation, and IPSS Score, were presented as means. Qualitative variables like gender were presented as frequencies and percentages. T-test was applied for the difference between the two groups of IPSS Score (Group A with 4.7 Fr DJ Stents and Group B with 6 Fr DJ Stents), and chi-square test was used for the comparison of IPSS with age, gender, and duration of symptoms. The level of significance was 5%.

RESULTS

Out of 62 patients, 43 (55.1%) were male and 19 (41.3%) were female in Group A, and 35 (44.9%) were male and 27 (58.7%) were female in Group B. The p-value = 0.178. The mean age

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was 47.88 ± 6.56 years and 49.48+6.57 years, in Groups A and B, respectively (p-value = 0.178), and the mean duration of procedure was 50.85 ± 0.64 and 55.2 ± 50.76, in both Groups, respectively. Regarding to IPSS score, the mean and standard deviation were 2.21 ± 0.11 in Group A and 6.33 ± 0.19 in Group B. Duration of operation and IPSS were significantly associated in both groups, with the p-values of 0.000 (Table 1).

Table 1: Demographic Characteristics of Patients

Variables	Group A (4.7 Fr DJ Stent)	Group B (6 Fr DJ Stent)	p-Value
Age (Years)	47.88 ± 6.56	49.48 ± 6.57	0.178
Male	43 (55.1%)	35 (44.9%)	0.193
Female	19 (41.3%)	27 (58.7%)	
Duration of Operation (Minutes)	50.85 ± 0.64	55.25 ± 0.76	<0.001
IPSS score	2.21 ± 0.11	6.33 ± 0.19	<0.001

Chi-square test was used for the p-values, α<0.05 considered as statistically significant

The mean and standard deviation of patients who were 16-40 years of age in group A, according to IPSS, were 2.24 ± 0.09, and in Group B mean with the age group 41-60 years was 6.38 ± 0.17 (p-value= <0.001. Similarly, the mean ± SD of patients who were 41-60 years of age in group A according to IPSS was 2.21± 0.11, and in Group B mean with age group 41-60 years was 6.33 ± 0.19 (p-value=<0.001). The mean and standard deviation of male in Group A were 2.21 ± 0.10, and in Group B were 6.34 ± 0.21 (p-value=<0.001). The mean ± SD of female in Group A was 2.20 ± 0.12 and in Group B mean was 6.33 ± 0.15 (p-value=<0.001). The mean ± SD of 1-7 days of symptoms in Group A was 2.19 ± 0.12 and in Group B was 6.36 ± 0.11 (p-value=<0.001). The mean ± SD of the above 7 days in Group A was 2.21 ± 0.11 and in Group B was 6.33 ± 0.21 (p-value=<0.001) (Table 2).

Table 2: Comparison of IPSS Score in Both Groups to Age, Gender, and Duration of Symptoms

Parameters	Group A	Group B	p-value
Age (Years)			
16-40	2.24 ± 0.09	6.38 ± 0.17	<0.001
41-60	2.21 ± 0.11	6.33 ± 0.19	<0.001
Gender			
Male	2.21 ± 0.10	6.34 ± 0.21	<0.001
Female	2.20 ± 0.12	6.33 ± 0.15	<0.001
Duration of Symptoms			
1-7 Days	2.19 ± 0.12	6.36 ± 0.11	<0.001
>7 Days	2.21 ± 0.11	6.33 ± 0.21	<0.001

The t-test was used for the p-values, and α<0.05 was considered statistically significant

A comparison of the two groups' IPSS changes from baseline was displayed. Changes between before and after insertion were evident in the values. The IPSS sub-scores of urgencies (p= <0.001) and intermittency (p= <0.001), as well as the overall IPSS (p=<0.001), worsened more in Group 2 patients than in Group 1 (Table 3).

Table 3: Comparison Between Baseline in the IPSS and After Using the DJ Stent in Both Groups

IPSS	Baseline			After Using the DJ Stent		
	Group A	Group B	p-value	Group A	Group B	p-value
Q1: Incomplete Emptying	0.4 ± 1.2	0.3 ± 0.8	0.500	0.68 ± 1.3	1.3 ± 0.4	0.200
Q2: Frequency	1.2 ± 1.0	0.7 ± 1.2	0.700	0.4 ± 0.1	1.0 ± 0.9	0.100
Q3: Intermittency	0.7 ± 1.2	0.5 ± 1.3	0.500	0.3 ± 0.5	0.5 ± 1.2	<0.001
Q4: Urgency	0.8 ± 1.4	0.6 ± 1.2	0.600	0.2 ± 0.7	1.1 ± 0.9	<0.001
Q5: Weak stream	0.6 ± 1.7	0.4 ± 1.5	0.700	0.3 ± 1.1	1.0 ± 1.2	0.200
Q6: Straining	0.6 ± 1.1	0.4 ± 1.0	0.190	0.1 ± 0.9	0.6 ± 0.8	0.020
Q7: Nocturia	0.8 ± 0.7	1.2 ± 0.5	0.180	03 ± 0.8	0.8 ± 0.2	0.020
Voiding Symptoms	2.3 ± 5.2	1.6 ± 4.6	0.300	1.6 ± 2.8	3.4 ± 3.5	0.040
Storage Symptoms	2.8 ± 3.1	2.5 ± 2.9	0.800	0.9 ± 1.6	2.9 ± 2.0	0.010
Total Score	5.1 ± 8.3	4.1 ± 7.5	0.610	2.2 ± 5.4	6.33 ± 5.5	<0.001

Voiding symptom scores were calculated by adding questions 1,3,5, and 6, and Storage symptom scores were calculated by adding questions 2, 4, and 7.

DISCUSSION

Research indicates that 80% patients after the ureteral stenting experience adverse impacts on quality of life (QoL) [11]. Several reasons, including the length, diameter, softness, positioning, and design of the stent, as well as the patient's age and gender, have been examined in the symptoms that affect the ureteral stents [12]. The placement of a DJ stent is a key element linked with symptoms related to the stent; it has been noted that a stent positioned across the bladder's midline correlates with increased urinary issues [13]. The relationship between symptoms associated with the stent and stent diameter remains ambiguous. Harper *et al.* found that while the diameter of the stent was linked to the work competence component, it didn't have a relationship with the Urinary Symptoms component of the USSQ, with stent positioning demonstrating the strongest relationship with most areas of the USSQ [14]. Given these insights, it is essential to account for stent positioning when exploring the relationship between stent diameter and stent-related signs. The current study compared the mean IPSS scores among patients with ureteral stents of 4.7 Fr and 6 Fr diameters. Study found that out of 124 (62 in each group), the mean age of the 4.7 Fr DJ stent group was 47.88 ± 6.56 years, and 49.48 ± 6.57 years in the 6 Fr DJ stent group. (p=0.178), duration of operation 50.85 ± 0.64 minutes in the 4.7 Fr DJ stent group and 55.25 ± 0.76 minutes in the 6 Fr DJ stent group. (p=<0.001) IPSS score was 2.21 ± 0.11 in the 4.7 Fr DJ stent group and 6.33 ± 0.19 in the 6 Fr DJ stent group. (p=<0.001) There were 43 (55.1%) male and 19 (41.3%) female in the 4.7 Fr DJ stent group and 35 (44.9%) male and 27

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(58.7%) female in the 6 Fr DJ stent group. p=0.193. Stents with a reduced diameter exhibited less curvature both proximally and distally, resulting in minimal contact with the bladder mucosa and subsequently leading to a decreased reduction of lower urinary tract symptoms [15]. Additionally, smaller-sized stents demonstrated lower scores on the USSQ concerning the areas of work performance, pain, and sexual function [16].https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9612741/ Although earlier studies conducted before the establishment of the USSQ reported negligible differences in urinary symptoms related to ureteral stent size, more recent studies utilizing the USSQ indicate that ureteral stent size does influence urinary symptoms. A retrospective study found that urinary symptoms were significantly milder with smaller ureteral stents, according to the International Prostate Symptom Score (IPSS) and OABSS outcomes [17]. Nestler et al., noted that there was no notable variation between ureteral stents measuring F4.7 and F6 in diameter. Previous studies have reported similar results, suggesting better outcomes with smaller diameter stents (4.7F), although these findings lacked statistical significance [18]. One study highlighted certain advantages of using smaller diameter stents but didn't distinguish among the various subdomains [18]. The incidence of stent migration was noted to be higher with F4.7 stents, with occurrences at 23.5% and 32%, compared to 10% for F6 stents. In that research, stents of two distinct sizes (4.7 and 7 Fr) were utilized, and comparisons were made regarding irritative voiding symptoms and pain. Various studies have found no significant correlations between the diameter of the stent and stent-related issues [13]. It is believed that physical activity with the stent contributes to stent-related symptoms, and the flexibility of stents can also influence these symptoms. Smaller stents can bend more easily than larger ones, making them softer, and this reduced physical stimulation from smaller stents may lead to weaker symptom manifestation [19]. The diameter and material of stents were analyzed alongside patient symptoms such as hematuria, dysuria, incontinence, discomfort, and frequent urination, which showed an insignificant association within the diameters of the stents [20]. Ehsanullah *et al.* studied whether ureteral stents lead to adverse signs and problems and discovered no link between stent size (6 vs 7 Fr) and the occurrence of symptoms [13]. Allam *et al.* conducted a prospective evaluation of the effect of ureteral stents in the management of renal stones [21]. Although the USSQ is deemed valuable for assessing symptoms related to ureteral stents and quality of life post-stenting, our research utilized the IPSS to evaluate urinary symptoms. The OABSS was developed and validated within Japanese populations in 2006. Earlier research has indicated a fairly strong correlation between the OABSS and patients' perceptions of their bladder health [22].

This study had several limitations, including its retrospective, non-randomized design and short follow-up period of only seven days, which may not capture the full spectrum of stent-related symptoms. Moreover, the single-center setting and use of only the IPSS questionnaire may limit the generalizability of the findings. Future studies should employ prospective, randomized multicenter designs with longer follow-up and multiple validated assessment tools to better evaluate stent-related symptoms and improve generalizability.

CONCLUSIONS

It was concluded that stents that have larger diameters greatly worsen urinary issues, and it is recommended to utilize ureteral stents with smaller diameters to improve symptoms associated with the stents.

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Authors' Contribution

Conceptualization: MZA
Methodology: RNA
Formal analysis: MA, SS
Writing and Drafting: AR, MA, ABZ
Review and Editing: MZA, AR, MA, ABN, RNA, SS

All authors approved the final manuscript and take responsibility for the integrity of the work

Conflicts of Interest

All the authors declare no conflict of interest.

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