Bangladesh Med J. 2024 Sept; 53(3)
DOI: https://doi.org/10.3329/bmj.v53i3.83413

Original Article

Risk and Benefit of Post-operative Double J Stent use after URS and ICPL

*Rahman MH[1], Hossain F[2], Rahman S[3]

Abstract

One of the most important tools in urology for a range of treatments is Double J Stent (DJS). By keeping the ureter open, these stents reduce edema and allow for possible injury. DJS after Ureterorenoscope (URS) with Intracorporeal pneumatic lithotripsy (ICPL) is debatable. However, a number of short- and long-term challenges have been linked to the DJS; for example, hematuria, infection, discomfort, and stent syndrome are all short-term complications. Total 98 individuals with ureteral calculi who visited the Department of Urology during the study period comprised the study population. The Department of Urology at BSMMU, Bangladesh, conducted this prospective comparative study over the period of a year, from November 2022 to November 2023. The purpose of this study was to assess the benefits and drawbacks of post-operative DJS following URS surgery with ICPL. Patients were enrolled in this study after obtaining their written consent. Later, they were split up into two groups. After URS+ICPL, patients in Group A received DJS, but those in Group B did not. Interviews were conducted with each patient to learn more about their clinical and demographic characteristics. Each patient's detailed medical history was documented, including the size and location of the stones, stone free rate, pain and complications as well as the duration of the procedure and hospital stay. DJS following URS+ICPL was evaluated based on stone free rate, ambulatory, pain and complications. Data were analyzed by statistical package for social sciences (SPSS) version 22.0. Mean age of the patients was 39.88 ± 11.44 years in DJS group and 38.10 ± 10.24 years in no DJS group. Males (62%; group-A 32%, group-B 29%) were predominant than females (38%; group-A 17%, group-B 20%) in both the two groups but there was no significant difference between the two groups. In both groups, the percentages of DM (12.2% vs 14.3%) and HTN (22.4% vs 18.4%) were nearly equal. There was no significant difference in BMI, Systolic BP and Diastolic BP between the two groups. In both the DJS and no DJS groups, the left-sided stones outnumbered the right-sided ones. In both the DJS and no DJS groups, the highest percentage of stones were found in the lower calix (40.8% vs. 42.9%), followed by the middle calix (36.7% vs. 38.8%) and the upper calix (22.4% vs. 18.4%). The stone sizes in the DJ and non-DJ stent groups were 22.67 ± 4.16 mm and 20.08 ± 2.57 mm, respectively. Compared to the no DJS group (87.8%), the stone clearance was significantly lower in the DJS group (71.4%). Compared to the no DJS group (59.2%), the ambulatory rate was significantly lower in the DJS group (38.8%). The DJS group spent more times (1.32 ± 0.89 days) in the hospital, compared to less times (1.10 ± 0.30 days) in the non-DJS group (p>0.05). The group with a DJS experienced considerably more complications overall (42.9%) than the non-DJS group (22.4%). Hematuria was less frequent (8.2%) in the non-DJS group and more frequent (18.4) in the DJS group (p>0.05). Both fever (14.3%) and pain (14.3%) experienced in non-DJS groups is equal; where 24.5% fever and 42.9% pain experienced respectively, in the DJS and non-DJS groups (p<0.05). Steinstrasse was 10.2% in DJS group and 6.1% in no non-DJS group (p>0.05). Following URS and ICPL, DJ stenting significantly reduces stone clearance and ambulation rates compared to no stenting, and is associated with increased complications. Omitting DJ stenting after ureteroscopy appears safe.

Keywords: *Double j stent, ureteroscopy, intracorporeal pneumatic lithotripsy.*

1. *Professor Dr. Md. Habibur Rahman, Professor, Department of Urology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka. Email: dulalro@yahoo.com
2. Dr. Faruk Hossain, Associate Professor, Department of Urology, BSMMU, Dhaka
3. Dr. Selina Rahman, Assistant Professor, Dept. of Radiology and Imaging, BSMMU, Dhaka.

* For correspondence

INTRODUCTION

Urolithiasis is the most common urological condition, with a 10-15% prevalence and a 50% recurrence rate.[1] This percentage is far higher in some high-income countries and has risen by more than 37% during the last two decades.[2] Ureteric obstruction, renal colic, infection, and hydronephrosis are the most prevalent complications of ureteral stones. Urinary stones, one of the most common urological disorders, require active treatment due to their high prevalence, recurrence rates, and a variety of implications.[3, 4] There are several therapeutic procedures available for the treatment of ureteral stones, with the goal

of removing the stone completely while minimizing patient morbidity. The most commonly performed techniques include shock wave lithotripsy (SWL), ureteroscopy (URS), percutaneous nephrolithotripsy, laparoscopic ureterolithotomy, and open ureterolithotomy.[5] The therapy of urinary stone disease has changed substantially in the last two decades. Minimally invasive and noninvasive procedures, such as ESWL and URS with ICPL, have largely replaced open surgery.

The management of renal and ureteral stones has changed substantially in recent years. The increased use of ureteroscopy (URS) is owing to technology developments such as endoscope reduction and improved deflection. The European Association of Urology (EAU) now recommends flexible ureteroscopy (fURS) as the first-line treatment for renal stones smaller than 20 mm. It is also effective in treating lower pole renal calculi that are resistant to extracorporeal shockwave lithotripsy (ESWL). For renal stones greater than 20 mm, URS is recommended as a second-line treatment.[6]

Since their introduction in 1967 by Zimskind et al.[7], Double-J (DJ) stents have become one of the most essential and commonly used tools in urology for a variety of therapies. These stents keep the ureter open, minimizing edema and allowing for potential damage. As a result, it is advised as a postoperative treatment technique for patients with ureteric calculi, ureteric stricture, retroperitoneal tumors or fibrosis, ureteropelvic junction obstruction, or any other iatrogenic ureteral injury. The DJ stent is typically the first line of treatment for people with obstructive uropathy caused by urinary calculi.

Urologists continue to question the use of double J stenting (DJS) following URS.[8,9] According to the most recent edition of the urolithiasis EAU recommendation, stenting following URS is optional in uncomplicated URS with full stone removal. DJS is used after URS to prevent occlusion from a residual fragment or postoperative edema. It may also help to avoid ureteral stenosis following surgery. Following ureteroscopy, there is a 1% probability of ureteral stenosis. It is enhanced in cases of prolonged surgical time, ureteroscope diameter more than 9.5F, ureteral perforation, or impacted calculi[10] and may go undetected, resulting in renal function difficulties.[11] These devices are not inconsequential, though, as a patient's quality of life may be impacted by clinical symptoms such as urgency, hematuria, and social and sexual repercussions. In 2003, Joshi et al.[13] discovered that 80% of stent-related discomfort was caused by daily disruption of daily activities, 80% by urinary symptoms, and 32% by sexual dysfunction. Other investigations found that morbidity ranged between 50 and 80%.[12, 13]

Additionally, stent migration, encrustation, pyelonephritis, and forgotten stent might develop following stent insertion.[14] As a result, DJS following URS is still contested among urologists.[8,9]

However, the use of DJ stents has been linked to a variety of complications. Zimskind et al.[7] report that DJ stents have also been connected to complications. The DJ stent has been associated to a variety of short- and long-term complications. Infection, hematuria, pain, and stent syndrome are all short-term complications. Long-term stent retention can cause encrustations, stone formation, stent fractures and blockages, hydronephrosis, and, in certain circumstances, renal function loss. Encrustation on the DJ stent becomes increasingly likely as it is placed in place for an extended length of time.[15] Stent encrustation rates are 9.2%, 47.5%, and 76.3%, respectively, if the stent is left in place for 6 weeks, 6-12 weeks, and more than 12 weeks.[16] The DJ stent should be changed or removed between 6 weeks to 6 months.[17]

Lithotripsy is a procedure for dissolving kidney, bladder, or ureter stones. Lithotripsy destroys hardened masses such as kidney stones, bladder stones, and ureter stones. Intracorporeal Pneumatic Lithotripsy (endoscopic lithotripsy) is an alternative treatment option if Extracorporeal Lithotripsy fails. Pneumatically driven projectiles impact a metallic probe placed endoscopically on a calculus inside the Intracorporeal Pneumatic Lithotripter. The probe is placed on the stone after passing through a rigid endoscopic canal. Ballistic energy fractures the stone (Calculus) into small pieces. Endoscopic basket (Stone Basket) or grasper (Forceps) will be utilized to collect pieces. These devices operate best when utilized through a rigid endoscope, and they may cause stone migration during therapy.

MATERIALS AND METHODS

This prospective comparative study was carried out in the Department of Urology at BSMMU, Bangladesh, between November 2022 and November 2023. The study population consisted of 98 patients with ureteral calculi who visited the Department of Urology during the study period and age more than or equal to 18 years and both sexes. Patients with renal failure, multiple stones without stone analysis report, stones with technically difficult in passing the ureteroscopy, disagreed to participate in this study or

denied to give consent were excluded from this study. This study was carried out to evaluate the benefits and drawbacks of post-operative DJS after URS surgery with ICPL. Patients' signed agreement was obtained before they were enrolled in the trial. They were later divided into two groups. Patients in Group A experienced DJS following URS+ICPL, whereas those in Group B did not. Interviews were conducted with each patient to learn more about their clinical and demographic characteristics. Each patient's detailed medical history was documented, including the size and location of the stones, stone free rate, pain and complications as well as the duration of the procedure and hospital stay. DJS following URS+ICPL was evaluated based on stone free rate, ambulatory, pain and complications. Data were analyzed by statistical package for social sciences (SPSS) version 22.0. Ethical permission was obtained from the institutional review board, in compliance with the Declaration of Helsinki. Patients were enrolled in this study following the acquisition of written consent from each individual. The preoperative evaluation comprised urinalysis, a plain radiograph of the kidneys, ureters, and bladder (KUB), and ultrasonography (USG) of the KUB. An intravenous urogram (IVU) and non-contrast computed tomography (NCCT) of the abdomen were performed on each patient as per our protocol. Urine sterility was verified before to each intervention, and antibiotics were administered when deemed necessary. Patients received general anesthesia and prophylactic antibiotics during the induction of anesthesia. URS was conducted with a 7 Fr Karl Storz semi-rigid uretero-renoscope. A 0.035-inch firm Terumo security wire and a Flexor Ureteral Access Sheath were utilized at the surgeon's choice. The position was regulated utilizing fluoroscopy. An ICPL was employed for stone fragmentation (200 to 550 µm fiber) and a basket was utilized for stone evacuation if required. Each surgery lasted 90 minutes or less to reduce complications. Ultimately, 24 cm and 7 Fr silicone DJS were utilized as per the instructions for patients in Group A. The stent was extracted 1 to 6 weeks post-intervention, either under local anesthetic at a consultation or during the subsequent procedure. Each patient was administered a non-steroidal anti-inflammatory medicine (NSAID) for three days following the intervention. An X-ray was conducted on the first postoperative day and again one-month post- procedure during the stent removal.

Statistical analyses were performed using SPSS 22.0 software (SPSS, Chicago, IL, USA). Numerical data was presented as mean and SD, where categorical data was presented as frequency with percentage. Numerical data was analyzed using unpaired t test and paired t test whereas categorical data was analyzed using Chi-Square test. Statistical significance was considered as $P \leq 0.05$.

RESULTS

Table I displays the distribution of demographic profile, co-morbidity and BMI of the patients; here Mean age of the patients was 39.88±11.44 years in DJS and 38.10 ± 10.24 years in non-DJS group. Males were 61 (62%) and females were 37 (38%) among them 32 (65.3%) male and 17 (34.7%) were in DJS group, where 29 (59.2%) male and 20 (40.8%) female were in non-DJS group. Males were predominant in both the two groups but there was no significant difference between the two groups. DM (12.2% vs 14.3%) and HTN (22.4% vs 18.4%) was almost similar number in both groups; then there was no significant difference in BMI. No significant difference was also found of systolic BP and diastolic BP between the two groups.

Table I: Distribution of demographic profile, co-morbidity and BMI of the patients (N=98)

		DJ stent	No DJ stent	p-value
Age (years)	21 - 30	13 (26.5)	14 (28.6)	
	31 - 40	15 (30.6)	18 (36.7)	
	41 - 50	11 (22.4)	9 (18.4)	[a]0.420
	51 - 60	10 (20.4)	8 (16.3)	
	Mean ± SD	39.88 ± 11.44	38.10 ± 10.24	
Gender	Male	32 (65.3)	29 (59.2)	[b]0.532
	Female	17 (34.7)	20 (40.8)	
Co-morbidity	DM	6 (12.2)	7 (14.3)	[b]0.616
	HTN	11 (22.4)	9 (18.4)	
Systolic BP (mmHg)		124.90 ± 13.83	124.49 ± 10.62	[a]0.870
Diastolic BP (mmHg)		89.49 ± 14.55	88.88 ± 11.65	[a]0.819
BMI (kg/m^2)		28.21 ± 5.54	26.61 ± 4.05	[a]0.106

[a]Unpaired t test and [b]Chi-Square test was done

Table II comprises the distribution of location and size of the stones among the patients; among the patients DJS group 22 (44.9%) and 27 (55.1%) were involved in right and left side respectively; however 24 (49.0%) and 25 (51.0%) in non-DJS group. Thus 11 (22.4%), 18 (36.7%) and 20 (40.8%) stones were located in upper, middle and lower calix in DJS group respectively, where 9 (18.4%), 19 (38.8%) and 21 (42.9%) in non-DJS group. The mean stone size was 22.67 ± 4.16 mm and 20.08 ± 2.57 mm in DJS and non-DJS group respectively (p<0.05).

Table II: Distribution of location and size of the stones among the patients (N=98)

	DJ stent	No DJ stent	p-value
Involved side			
Right	22 (44.9)	24 (49.0)	[b]0.686
Left	27 (55.1)	25 (51.0)	
Location of stone			
Upper calix	11 (22.4)	9 (18.4)	[b]0.882
Middle calix	18 (36.7)	19 (38.8)	
Lower calix	20 (40.8)	21 (42.9)	
Stone Size (mm)	22.67±4.16	20.08±2.57	[a]<0.001

[a]Unpaired t test and [b]Chi-Square test was done

Table III shows the outcome of the after procedure among the patients; here the stone clearance rate was 35 (71.4%) in DJS group, where 87.8% in non-DJs group and this difference was statistically significant. Ambulatory rate was 19 (38.8%) in DJS group, where 29 (59.2%) in non-DJS group and this difference was also statistically significant. The mean duration of hospital stay was 1.32 ± 0.89 days in DJS group and 1.10 ± 0.30 days in non-DJS group (p>0.05).

Table III: Outcome of the after procedure among the patients (N=98)

Stone clearance rate	DJ stent	No DJ stent	p-value
Stone clearance rate	35 (71.4)	43 (87.8)	a0.045
Ambulatory rate	19 (38.8)	29 (59.2)	a0.043
Hospital stay (days)	1.32 ± 0.89	1.10 ± 0.30	b0.101

[a]Unp aired t test and [b]Chi-Square test was done

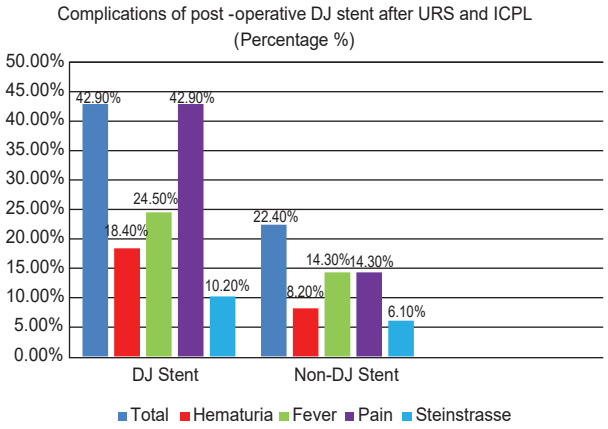

Figure- 1: Complication due to post-operative DJ stent use after URS and ICPL

Figure 1 illustrates the complication due to post-operative DJ stent use after URS and ICPL, here, total complications in DJ stent group was 42.9% and non-DJ stent group 22.4%; this difference was statistically significant. Pain was 42.9% in DJ stent group and 14.3% in non-DJ stent group (p<0.05); this difference was also statistically significant. Hematuria, Fever and Steinstrasse were 18.4%, 24.5% and 10.2% in DJ stent group respectively; where Hematuria, Fever and Steinstrasse were 8.2%, 14.3% and 6.1% in non-DJ stent group respectively. *(Chi-Square test was done)*

DISCUSSION

In this study, the average age of patients in the DJ stent group was 39.88 ± 11.44 years, while it was 38.10 ± 10.24 years in the group without DJ stents. In comparison, Pogula et al.[18] reported mean ages of 43.8 years for the DJ stent group and 46.4 years for the non-stent group. Similarly, Segalen et al.[19] included patients with mean ages of 56.12 years and 54.7 years in the respective groups. Therefore, the participants in our study were relatively younger than those in the previous studies

Although males outnumbered females in both groups, the difference was not statistically significant. Male predominance was also observed in the study of Pogula et al.[18], Khan et al.[20] and Segalen et al.[19].

DM (12.2% vs 14.3%) and HTN (22.4% vs 18.4%) was almost similar number in both groups. There was no significant difference in BMI, Systolic BP and Diastolic BP between the two groups.

The left side stones predominated over right-sided stones in both DJ stent and no DJ stent group in this study. Similar

finding was revealed in the study of Pogula et al.[18]. In contrast, Khan et al.[20] revealed that right side stones were predominant than left side stones. Maximum stones were located in lower calix in both DJ and no DJ stent group (40.8% vs 42.9%) followed by middle calix (36.7% vs 38.8%) and upper calix (22.4% vs 18.4%). Similar stone location was observed in the study of Segalen et al.[19]. The stones included 9 upper (23.7%), 11 mid (28.9%), and 18 lower (47.4%).[21]

Stone size was 22.67 ± 4.16 mm and 20.08 ± 2.57 mm in DJ and no DJ stent group respectively. Stone size was 18.3 ± 14.9 in DJ stent group and 9.4 ± 5.2 in no DJ stent group.[19]

Stone clearance was notably lower in the DJ stent group (71.4%) compared to the non-stented group (87.8%). While stenting following ureteroscopy is often recommended to reduce the risk of ureteral stricture, aid in the passage of stone fragments, and support ureteral healing, several recent prospective randomized trials have found no significant difference in stone-free rates between patients who received stents and those who did not.[12,22] Ambulation rates were also significantly lower in the DJ stent group (38.8%) than in the no stent group (59.2%), a finding consistent with the study by Segalen et al.[19] Additionally, the duration of hospital stay was longer for patients with DJ stents (1.32 ± 0.89 days) compared to those without stents (1.10 ± 0.30 days), although this difference was not statistically significant ($p > 0.05$).

Overall complication was significantly higher in DJ stent group (42.9%) than no DJ stent group (22.4%). Overall complication was 20.6% and 18.0% in DJ stent and no DJ stent group respectively.[18]

In the DJ stent group, hematuria was observed in 18.4% of patients compared to 8.2% in the non-DJ stent group, though the difference was not statistically significant ($p > 0.05$). Similarly, fever occurred in 24.5% of DJ stent patients versus 14.3% in the non-stent group ($p > 0.05$). Although both hematuria and fever were more frequent in the DJ stent group, neither showed a significant difference between the two groups.[20] Pain was reported in 42.9% of DJ stent patients and only 14.3% of non-stent patients, a statistically significant difference ($p < 0.05$), a finding consistent with Khan et al.[20]. Steinstrasse was observed in 10.2% of the DJ stent group and 6.1% of the non-stent group ($p > 0.05$). While hematuria, fever, and steinstrasse were more common in the DJ stent group, none of these differences reached statistical significance.[18]

CONCLUSION

DJ stenting following URS and ICPL resulted in a significantly reduced stone clearance rate and ambulatory rate compared to no DJ stenting. DJ stenting after URS and ICPL resulted in significantly more complications than DJ stenting without URS and ICPL. No stenting after ureteroscopy appears to be safe for patients.

REFERENCES

1. López M, Hoppe B. History, epidemiology and regional diversities of urolithiasis. Pediatric nephrology. 2010;25:49-59.
2. Stamatelou KK, Francis ME, Jones CA, Nyberg Jr LM, Curhan GC. Time trends in reported prevalence of kidney stones in the United States: 1976–1994. Kidney international. 2003;63(5):1817-23.
3. Papadoukakis S, Stolzenburg JU, Truss MC. Treatment strategies of ureteral stones. EAU-EBU update series. 2006;4(5):184-90.
4. Ahn SH, Oh TH, Seo IY. Can a dual-energy computed tomography predict unsuitable stone components for extracorporeal shock wave lithotripsy?. Korean Journal of Urology. 2015;56(9): 644.
5. Rabani SM, Moosavizadeh A. Management of large proximal ureteral stones: a comparative clinical trial between transureteral lithotripsy (TUL) and shock wave lithotripsy (SWL). Nephro-urology monthly. 2012; 4(3):556.
6. Türk C, Skolarikos A, Neisius A. EAU Guidelines on Urolithiasis. 2019. Available at https:// uroweb. org/guideline/urolithiasis.
7. Zimskind PD, Fetter TR, Wilkerson JL. Clinical use of long-term indwelling silicone rubber ureteral splints inserted cystoscopically. The Journal of urology. 1967;97(5):840-4.
8. Foreman D, Plagakis S, Fuller AT. Should we routinely stent after ureteropyeloscopy?. BJU international. 2014;114:6-8.
9. Keeley Jr FX and Timoney AG. Routine stenting after ureteroscopy: think again. European urology. 2007;52(3):642-4.
10. Johnson DB, Pearle MS. Complications of ureteroscopy. Urologic Clinics. 2004;31(1):157-71.

11. Weizer AZ, Auge BK, Silverstein AD, Delvecchio FC, Brizuela RM, Dahm P, Pietrow PK, Lewis BR, Albala DM, Preminger GM. Routine postoperative imaging is important after ureteroscopic stone manipulation. The Journal of urology. 2002;168(1):46-50.

12. Byrne RR, Auge BK, Kourambas J, Munver R, Delvecchio F, Preminger GM. Routine ureteral stenting is not necessary after ureteroscopy and ureteropyeloscopy: a randomized trial. Journal of endourology. 2002;16(1):9-13.

13. Joshi HB, Stainthorpe A, MacDonagh RP, Keeley FX, Timoney AG. Indwelling ureteral stents: evaluation of symptoms, quality of life and utility. The Journal of urology. 2003;169(3):1065-9.

14. Singh I, Gupta NP, Hemal AK, Aron M, Seth A, Dogra PN. Severely encrusted polyurethane ureteral stents: management and analysis of potential risk factors. Urology. 2001;58(4):526-31.

15. El-Faqih SR, Shamsuddin AB, Chakrabarti A, Atassi R, Kardar AH, Osman MK, Husain I. Polyurethane internal ureteral stents in treatment of stone patients: morbidity related to indwelling times. The Journal of urology. 1991;146(6):1487-91.

16. Bultitude MF, Tiptaft RC, Glass JM, Dasgupta P. Management of encrusted ureteral stents impacted in upper tract. Urology. 2003;62(4):622-6.

17. Kawahara T, Ito H, Terao H, Yamagishi T, Ogawa T, Uemura H, Kubota Y, Matsuzaki J. Ureteral stent retrieval using the crochet hook technique in females. PLoS One. 2012;7(1):e29292.

18. Pogula VR, Reddy S, Galeti EH, Rasool M. Stenting versus non-stenting before extracorporeal shock wave lithotripsy for proximal ureteric stones: A prospective interventional study. Asian Journal of Medical Sciences. 2022;13(3):118-24.

19. Segalen T, Lebdai S, Panayotopoulos P, Culty T, Brassart E, Riou J, Azzouzi AR, Bigot P. Double J stenting evaluation after ureteroscopy for urolithiasis. Progrès en Urologie. 2019 ;29(12):589-95.

20. Khan AA, Khan SM, Kanth AN, Khan AM, Wani OA. Comparison of stented versus non-stented patients of ureteric calculi after intracorporeal lithotripsy. International Surgery Journal. 2022 Jan 29;9(2):426-31.

21. Matani YS, Al-Ghazo MA, Al-Azab RS, Bani-Hani O, Rabadi DK. Emergency double-J stent insertion following uncomplicated Ureteroscopy: risk-factor analysis and recommendations. International braz j urol. 2013;39(2):203-8.

22. Srivastava A, Gupta R, Kumar A, Kapoor R, Mandhani A. Routine stenting after ureteroscopy for distal ureteral calculi is unnecessary: results of a randomized controlled trial. J Endourol. 2003; 1710:871-4.