

# An Analytical Study of Stenting versus Non-Stenting for the Treatment of Hydronephrosis due to Ureteric Stones

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## Abstract

**Introduction:** Urinary stones constitute the third most common disease of the urinary tract after urinary tract infections and prostate pathologies. Ureteric stones may cause many complications such as renal/ureteric colic, ureteric/renal obstruction, hydronephrosis and infection like pyelonephritis and pyonephrosis. The treatment of ureteric stones includes ureteroscopic lithotripsy (URSL) semi-rigid or flexible, percutaneous nephrolithotomy, extracorporeal shock wave lithotripsy, medical expulsive therapy (MET), and laparoscopic surgery. Compared to other procedures, URS has a greater stone free rate. The insertion of ureteric stents routinely, reduces the risk of ureteral obstruction, hydronephrosis, renal colic, ease the path for drainage of stone fragments from ureter to the bladder, prevent stricture formation, promotes healing of any mucosal injury caused during surgeries and prevents the ureteric stricture formation. Still, the use of ureteric stents for the treatment of ureteric stones is debatable due to the stent-associated symptoms and complications. Our study aimed to evaluate the role of ureteric stents in resolution of hydronephrosis in ureteric stone patients following URSL.

**Methods:** This was an analytical study with prospective and retrospective approach. Our study involved 390 ureteric stone patients who underwent URSL [295 patients (75.6%) with double J stent placement and 95 patients (24.3%) without double J stent placement]. Data consisting of baseline characteristics, pre-operative status, intraoperative characteristics, and postoperative complications were collected from and presented descriptively. The patients were divided into two groups based on double J stent placement or not. Comparison of hydronephrosis resolution between the groups was analysed with Chi-square test.

**Results:** Impacted ureteric stones were the most common indication of ureteric stent placement following URSL (30.5%). Dysuria was the most frequent symptom that occurred in patients undergoing stent insertion with a total of 41 patients (13.8%) and 18 patients (6.1%) had the major complaint of low back pain. Among the patient in the non-stenting group increased frequency was present in 5 patients (5.2%) and low back pain and haematuria in 3 patients (3.1%) each. After stenting, 270 patients (91.5%) had their hydronephrosis resolved significantly compared with 39 (75%) patients in the non-stent placement group ( $p < 0.05$ ). The analysis results showed that stent placement had a significant effect on the decrement of postoperative hydronephrosis in patients who had preoperative hydronephrosis.

**Conclusion:** Ureteric stenting significantly reduces/resolves pre-operative hydronephrosis after URS lithotripsy in patients with ureteric stone. Ureteral stent placement should be the preferred method for the treatment of pre-operative hydronephrosis due to ureteric stones.

**Keywords:** Ureteric stent; D J stenting; Ureteroscopic lithotripsy; URSL; Ureteric stone.

## INTRODUCTION

Urinary tract stone formation is a common disease in our country. The prevalence rate of stone disease is continuously increasing over the past many years. The prevalence rate can be up to 15%<sup>1</sup> and the 5 year recurrence rate is estimated up to 50%.<sup>2</sup> Changing lifestyle, changing dietary habits and increasing global warming further add to this.<sup>3-5</sup> Various risk factors for stone formation are obesity,<sup>6</sup> diabetes,<sup>7-9</sup> hypertension<sup>4,8,10</sup> and other metabolic syndromes.<sup>11</sup> Urinary stones constitute the third most common disease of the urinary tract after urinary tract infections (UTIs) and prostate pathologies.<sup>12</sup> Ureteric stones may cause many complications such as renal/ureteric colic, ureteric/renal obstruction, hydronephrosis and infection like pyelonephritis and pyonephrosis. The treatment of ureteric stones includes ureteroscopic lithotripsy (URSL) semi-rigid or flexible, percutaneous nephrolithotomy, extracorporeal shock wave lithotripsy (ESWL), medical expulsive therapy (MET) especially for lower ureteric stones, and laparoscopic surgery. Compared to other procedures, URS has a greater stone free rates and is a safer option in patients with co-morbidities like diabetes mellitus, obesity, etc.<sup>13</sup>

URSL and ESWL are the most commonly used techniques to clear stones with high success rates.<sup>13</sup> The insertion of ureteric stents routinely, reduces the risk of ureteral obstruction, hydronephrosis and renal colic.<sup>14</sup> The stents ease the path for drainage of stone fragments from ureter to the bladder, prevent stricture formation and decrease hydronephrosis. In long term, stent promotes healing of any mucosal injury caused during surgeries and prevents the ureteric stricture formation.<sup>15</sup> Still, the use of ureteric stents for the treatment of ureteric stones is debatable due to the stent associated symptoms and complications like irritative symptoms, discomfort, haematuria, stent migration, vesico-ureteral reflux, stent encrustation, etc.<sup>16</sup> These symptoms reduce the quality of life of in selected patients.

Recently, many studies are done regarding the need for ureteric stents in URSL and ESWL. A few studies suggested that ureteric stents were not necessary before or after URSL and ESWL due to complications though stenting improved the stone-free rate.<sup>17</sup> According to the European Association of Urology (EAU) and American Urological Association (AUA) guidelines, the placement of ureter stents is not routinely required in the surgical management of ureteric stones.<sup>18,19,20</sup> Few studies suggested that routine stenting was

good for prophylaxis.<sup>14,16</sup> Due to this controversy, we conducted this analytical study to evaluate the need for ureteral stents for the treatment of ureteric stones.

## METHODS

### *Research design*

We did an analytical study. We took a combined retrospective and prospective approach and used secondary data taken from the medical records of SMBT IMS & RC, Dhamangaon, Nashik, Maharashtra, India, from August 2016 to July 2021.

### *Study subjects*

We did total sampling in our study the sample size represents the whole population of all eligible patients admitted to the hospital. A total of 390 patients with ureteric stones were included in our study and underwent URS lithotripsy. The inclusion criteria were all male and female patients, aged 18 years or above, with ureteric stones who underwent URS lithotripsy. The exclusion criteria of this study were patients with history of malignancy, abnormal laboratory values, and patients with incomplete medical records.

### *Patient assessment*

All patients who were admitted to SMBT IMS & RC, Nandi Hills, Dhamangaon, Nashik, Maharashtra, India were assessed preoperatively by history and physical examination. Blood investigations included complete blood counts, kidney function tests including serum creatinine, urea, sodium, and potassium, urine routine microscopy and urine cultures. Stone size and location were assessed preoperatively by plain radiograph of the kidney, ureter, and bladder (KUB) and by non-enhanced computed tomography (CT) of the KUB region. Stones were classified as per radiological classification Upper ureteric stones were located above the superior border of the sacroiliac joint, mid-ureteric stones were those located between the superior and inferior borders of the sacroiliac joint, and distal ureteric stones were those located below the inferior border of the sacroiliac joint.

### *Stent*

We used 5 Fr and 6 Fr double J polyurethane stents in our patients as per the availability and the surgeon's choice.

**Statistical analysis**

All values were presented statistically as frequency and percentage. Comparison of variables between two groups – group 1 in which stent was placed after URSL and group 2 where stent was not placed after URSL, was analysed using the Chi-square test. A p value of <0.05 was considered statistically significant. Statistical analysis was done using SPSS version 21 software.

**Ethical committee Permission**

This study was approved by the Ethical Committee of SMBT IMS & RC, Dhamangaon. All subjects participating in the study were informed about the study and informed and written consent were taken after admission in the hospital.

**RESULTS**

A total of 390 patients with ureteric stones were included in our study, who underwent URS lithotripsy. Demographic data of the patients as well as their pre-operative status and stone characteristics are shown in the Table 1. More

**Table 1:** Demographic data with stone characteristics and pre-operative status

Characteristics		Stent (n,%)	Non-stent (n,%)	p value
Age (years)	< 45	129 (43.7)	38 (40)	>0.05
	≥ 45	166 (56.2)	57 (60)	-
Gender	Male	222 (75.2)	72 (75.7)	>0.05
	Female	73 (24.7)	23 (24.2)	-
BMI	<25	73 (24.7)	67 (70.5)	<0.05
	≥25	222 (75.2)	28 (29.4)	-
Stone size	<1cm	225 (76.2)	70 (73.6)	<0.05
	>1cm	70 (23.7)	25 (26.3)	-
Location of stone	Upper ureter	118 (40)	38 (40)	-
	Middle ureter	59 (20)	19 (20)	-
	Middle ureter	59 (20)	19 (20)	-
Preoperative hydronephrosis	No	95 (32.2)	71 (74.7)	<0.05
	Yes	200 (67.8)	24 (25.2)	-

than 50% of the patients who used stents after ureteroscopy (URS) were above 45 years old with a mean age of 48.2 years. Male patients predominated the study (75.2%). In the patient group with a body mass index (BMI) <25 kg/m<sup>2</sup> there were 73 patients (24.7%) who had stent inserted and 67 patients (70.0%) in whom stent was not kept. There was a

significant difference in patient’s BMI among the stent users (p value <0.05). A total of 118 patients (40%) had stones in the proximal ureter, 59 patients (20%) had stones in the mid ureter and 59 patients (20%) had stones in the distal ureter. These patients underwent stent insertion post-URS. Among the non-stented group, 38 patients (40%) had stones in the proximal ureter, 19 patients (20%) had stones in the mid and lower ureter each. Stone location did not have a significant correlation with stent placement post URS (p value >0.05). There were 225 patients (76.2%) with ureteric stones less than 1 cm in diameter, 70 patients (23.7%) with ureteric stones of ≥1cm in diameter. The analysis results showed that the size of the stone had a significant effect on stent placement after URS (p value <0.05). Preoperative hydronephrosis was present in 200 patients (67.8%) among the stenting group and 24 patients (25.2%) among the non-stenting group.

The intraoperative characteristics of the patients are shown in Table 2. Among the stented group, there were 32 patients (10.8%) who experienced minor intraoperative complications. Only 2 patients (2.1%) among the non-stented group experienced minor complications. There was a significant difference in complications in the stent group and the non-stent group during surgery (p value <0.05). Patients who underwent stent insertion had longer duration of surgery as compared to the non-stent group. There was a statistically significant difference when compared with the group without stents (p value < 0.05). There were 18 patients with residual stones and 19 patients with retropulsion of stones during the URS procedure and all of these patients had stent insertion. The stone free rate in the stent and non-stent groups was 87.4% and 100%, respectively. There was a significant difference between the two groups (p< 0.05) (Table 2).

**Table 2:** Intra-operative characteristics

Characteristics		Stent (n %)	Non-stent (n %)	p-value
Intra-operative complication	No	263 (89.1)	93 (97.9)	<0.05
	Yes	32 (10.8)	2 (2.1)	
Duration of procedure (minutes)	<60	59 (20)	13 (13.6)	<0.05
	≥60	236 (80)	82 (86.3)	
Stone free rate	Completely free	258 (87.4)	95 (100)	<0.05
	Residual	18 (6.1)	0 (0)	
	Retropulsion	19 (6.4)	0 (0)	

Most of the indications for stent placement in our study were the presence of impacted stones (30.5%), followed by stone in the ureter with ureteric wall

oedema in 20 patients (20.2%). There were also 18 patients (6.1%) with residual stones, 19 patients (6.4%) with a duration of surgery of more than 90 minutes, and 36 patients (12.2%) in whom stent placement was the surgeon's preference.

On post-operative course analysis, dysuria was the most frequent symptom that occurred in patients undergoing stent insertion with a total of 41 patients (13.8%) and 18 patients (6.1%) had the major complaint of low back pain. Among the patient in the non-stenting group increased frequency was present in 5 patients (5.2%) and low back pain and haematuria in 3 patients (3.1%) each. There was a significant difference in postoperative complications between the stent and non-stent groups ( $p < 0.05$ ). The majority of patients did not require further treatment and follow-up after the planned URS, but eight patients were planned for percutaneous nephrolithotomy (PCNL) and seven patients underwent ESWL later on. All patients requiring ESWL and PCNL after URS had stent placement. In our study, we used a 5/26 and 6/26 French (Fr) double J (DJ) stent. 62.7% patients were stented with 5/26 Fr and 37.2% patients with 6/26 Fr DJ stents. A total of 265 patients (89.8%) had a stent indwelling time of less than 30 days, whereas in 30 patients (10.1%) the stent indwelling time was more than 30 days, as shown in Table 3.

**Table 3:** Post-operative characteristics

Characteristics		Stent (n %)	Non-stent (n %)	p-value
Post-operative complication	None	206 (69.8)	81 (85.2)	<0.05
	Hematuria	15 (5.0)	3 (3.1)	
	Dysuria	41 (13.8)	2 (2.1)	
	Retention	2 (0.67)	1 (1.0)	
	Low backpain	18 (6.1)	3 (3.1)	
	Increased frequency of urine	13 (4.4)	5 (5.2)	
Accessory procedure	None	280 (94.9)	95 (100)	
	ESWL	8 (2.7)	0 (0)	
	PCNL	7 (2.3)	0 (0)	
Stent size	5Fr	185 (62.7)	None	
	6Fr	110 (37.2)	None	
Stent indwelling time (days)	<30	265 (89.8)	NA	<0.05
	≥30	30 (10.1)	NA	
Hydronephrosis resolution		n = 295	n = 52	<0.05
	Yes	270 (91.5)	39 (75)	
	No	25 (8.4)	13 (25)	

After stenting, 270 patients (91.5%) had their

hydronephrosis resolved significantly compared with 39 (75%) patients in the non-stent placement group ( $p < 0.05$ ). The analysis results showed that stent placement had a significant effect on the decrement of postoperative hydronephrosis in patients who had preoperative hydronephrosis.

## DISCUSSION

Because of advances in various methods of lithotripsy ESWL and URSL have become the first-line treatment for ureteric stones.<sup>13</sup> Decades ago, it was a routine practice to keep ureteric stent before and after ESWL and URSL.<sup>21,22</sup> Current guidelines suggest that, a double J stent reduces the risk of renal colic and obstruction, but it does not reduce the steinstrasse formation or the risk of infective complications. Stents are recommended to the patients who are at increased risk of complications such as ureteric trauma, residual fragments, perforation, bleeding, urinary tract infection, or pregnancy. Finally in all doubtful cases it is used to avoid stressful emergencies.<sup>13</sup> A meta-analysis done in 2011 suggested that D J stents were not necessary after uncomplicated URSL as they cause LUTS and pain without improvement in stone-free rate or emergency visits.<sup>23,24</sup> Still the choice of DJstents after the treatment of ureteric stones depends on the preference and experience of the surgeon because of lack of any standards or fixed guidelines. A survey done in 2015 showed that 63% of the surgeons routinely keep stent following URSL.<sup>25</sup>

In our study, there were 390 patients with ureteric stones who underwent URS procedure at SMBT IMS & RC, Nashik, Maharashtra, India, from August 2016 to July 2021. The patients comprised 295 (75.6%) with stents (group I) and 95 (24.3%) without stents (group II). Most patients in both the groups were over 45 years old (56.2% and 60% in group I & II respectively) with a mean age of 48.2 years. There were no significant differences in age group and gender regarding the use of stents after URS. Meta-analysis done by Hai Wang et al.<sup>26</sup> also showed the same.

There are many factors that influence the need of stent placement or not after URSL.<sup>27,28</sup> These include gender, age, BMI, stone location, number of stones, and presence/absence of hydronephrosis before surgery, history of congenital disorders, solitary kidney, previous stone surgery, use of anticoagulants. In our study, the most frequent indication for stent placement was larger stones, longer duration of surgery and associated

complications. Widyokirono DR et al had ureteral lesions as the most common indication for stent placement.<sup>29</sup>

Symptoms that occur after stent placement include dysuria, haematuria, retention of urinary, low back pain, suprapubic discomfort, increased frequency of urine, UTI etc.<sup>30</sup> In our study dysuria (13.8%) followed by low back pain, haematuria and increased frequency of urine were the main stent related symptoms. In the non-stent group, increased frequency of urine (5.2%), followed by haematuria, low back pain and dysuria were the main stent related symptoms. Widyokirono DR et al also had dysuria as the main stent related symptom in their study but low back pain was the main symptom among the non-stent group.<sup>29</sup> Abdelaziz et al. in their study reported that all patients who had stent insertion experience dysuria, haematuria and recurrent fever.<sup>31</sup> But there was no significant difference in the complication rates between the stent and non-stent groups after URSL. There are many randomized trials that reported that among the stent and non-stent groups, there was no significant difference in complications and postoperative pain.<sup>32-34</sup>

In our study, the stent indwelling time was less than 30 days in 89.8% patients while only 10.1% patients had stent indwelling time of more than 30 days. Chandhoke PS et al.<sup>16</sup> and Aghamir SM et al.<sup>14</sup> kept stent for 4 weeks in their patients after URSL. Widyokirono DR et al had stent indwelling of more than 90 days in 8.1% of the patients.<sup>29</sup> There was also a significant difference in the incidence of resolution of hydronephrosis among the stent and non-stent groups. In the stenting group 91.5% patients had preoperative hydronephrosis resolution, while 75% patients had their hydronephrosis resolved among the non-stent placement group, and the difference was statistically significant. Widyokirono DR et al also had similar results in their study.<sup>29</sup> There are many studies that talk about various benefits of stent placement like reducing the risk of ureteral stricture, ureteral oedema, mucosal inflammation at the site of the stone formation and easy passage of residual stone.<sup>35,36</sup>

The limitation of our study is the use of secondary data with a limited information on stone density, the use of pneumatic lithoclast, the power of lithotripsy not mentioned and the duration of follow-up. Our study supports the fact that ureteric stents are helpful in preventing and resolving hydronephrosis. Future studies, randomised controlled or an experimental design, are needed to evaluate the indications of the stent placement and

to prove where there is no need of keeping the DJ stent.

## CONCLUSIONS

In our study, ureteric stents significantly reduced/resolved pre-operative hydronephrosis after URSL in patients with ureteric stones. The procedure is necessary and safe, especially in patients with pre-operative hydronephrosis, as it shows significant resolution and has only mild treatable associated stent symptoms.

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