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Original Research Article

COMPARE THE OUTCOME OF STENTING VERSUS NON-STENTING IN PATIENTS UNDERGOING LASER LITHOTRIPSY FOR URETERIC CALCULI

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Abstract: *Acute renal colic caused by ureteral calculi is one of the most common abdominal emergencies, accounting for 1% of emergency department visits. Ureteroscopic lithotripsy (URL) and extracorporeal shock wave lithotripsy (ESWL) are two widely used methods for the treatment of ureteral stones.* ***Objective:*** *To compare the outcome (mean pain score, hospital stay, and frequency of UTI of stenting versus non-stenting in patients undergoing laser lithotripsy for ureteric calculi.* ***Methods:*** *This randomised controlled trial was conducted at the Department of Urology, Shaikh Zayed Hospital, Lahore, over six months from 07-10-2020 to 07-04-2021. After approval from the hospital's ethical committee and informed consent, 248 (124 in each group) patients fulfilling the inclusion criteria were admitted to the Department of Urology, Shaikh Zayed Hospital, Lahore. Patients were inquired about their demographical information. A lower abdominal ultrasound determined the position of the stone in the kidney. Patients were randomised into two groups. Group A was placed with a stent while group B was taken as control means without a stent. Both groups compared the outcome on the 3rd post-operative day as a per-operational definition. All the data was collected through well-defined proforma. (Annexed). Pain score, hospital stay, and UTI were recorded (as per operational definition).* ***Results:*** *Out of 248 cases (124 in each group), mean age was calculated as 46.11 ± 7.96 years in Group-A and 46.90± 7.59 years in Group-B, 33.1 % (n=82) in Group-A and 26.2 % (n=65) in Group-B were male whereas 16.9 % (n=42) in Group-A and 23.8 % (n=59) in Group-B were females. Urinary tract infection was also studied; urinary tract infection was present in 10.9 % (n=27) in Group A and 2.4 % (n=6) in Group B. The data was stratified by age, gender, size, location of the stone, and the duration of the patient's disease.* ***Conclusion:*** *We concluded that the implantation of ureteral stents might influence the stone-free rate. However, stent-related complications are the most significant drawbacks of ureteral stenting in most patients.*

Keywords: Ureteric calculi, stenting, Urinary tract infection

Introduction

Epidemiological surveys have been previously reviewed, showing that the prevalence rate ranged between 4% and 20% in economically developed countries. (1) Objective
To compare the outcome (mean pain score, hospital stay, and frequency of UTI of stenting versus nonstenting in patients undergoing laser lithotripsy for ureteric calculi. Even in the latter part of the 20th century, the prevalence and incidence of upper urinary tract stones were on the rise in Western countries; again, this can be attributed to the advancement in clinical diagnostic tools and changes in nutrition and environment. Infantile bladder stones with features similar to those reported in Europe in the nineteenth century were not uncommon in large areas of Turkey, Iran, India, China, Indochina, and Indonesia. They were composed of ammonium urate and calcium oxalate due to malnutrition during the first years of life and weaning on cereal diets. (3) At present, the lifetime risk of forming nephrolithiasis in the United States is estimated to be According to the estimates, about 30 million people are affected by hepatitis C in the United States. An estimated 2 million patients come with

The diagnosis of stone disease on an outpatient basis annually in the United States, which is an increase from 40% in 1994. Caucasian US male's chance of being affected by stone disease by age 70 years is 8%. Upper urinary calculus is more prevalent in the United States than in all other countries combined. (3) Abdominal or costovertebral angle or lower abdominal pain can be seen on physical examination. Assessment through urine tests should be conducted on every client. The fact that passed microscopic haematuria synchronized with the characteristic of renal colic strongly correlates with the diagnosis of urolithiasis. Nevertheless, the latter may be observed without haematuria. Abnormal results in nitrites or bacteria with leucocytes on the urine dipstick may suggest urinary tract infection; hence, urine should be cultured. Last but not least, a microscopy examination of urine might reveal crystals, as in the case of cystinuria, where one is likely to observe hexagonal-shaped crystals. In the acute setting, laboratory evaluation includes complete blood count, serum

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electrolytes, and measurement of renal function. (4) It has been reported that renal colic will affect about 10% of the population at some point in their lifetime. Any patient with such features undergoes treatment as an emergency right away. Nevertheless, those patients who present with un-complicated renal colic are best dealt with in primary care, with an urgent referral for imaging to confirm the diagnosis, preferably on the same day. Paracetamol and NSAIDs are recommended more than morphine for managing pain in patients with renal colic. Phosphor crystals will naturally pass through the urinary system in most cases, but recent studies suggest using alpha-blockers to help facilitate its passage. (5) Several factors that may influence the favorable outcome of ESWL have been assessed. They include the size of the stone, its size and concentration, the degree of Impaction, and ureterohydronephrosis. Research on the double J stent's impact on the ESWL's success has yielded inconclusive results. Moreover, even though lumbar ureteral stones present a therapeutic dilemma, the influence of the double J stent presence has not yet been the subject of any reported study. (6) In one study, it was observed that 12 (5%) patients without the stent and 42 (17%) patients with the stent on the day of double J stent removal yielded positive urine cultures. (7) Interestingly.

Methodology

This randomized controlled trial was conducted at the Department of Urology, Shaikh Zayed Hospital, Lahore, over a six-month period from October 7, 2020, to April 7, 2021. A non-probability consecutive sampling technique was employed to ensure that all eligible patients who met the inclusion criteria during the study period were included until the desired sample size was achieved. The inclusion criteria comprised patients aged between 20 and 60 years, of both genders, diagnosed with ureteric stones, and advised for ureteroscopy. Patients were excluded if they had undergone extracorporeal shock wave lithotripsy (ESWL) within the last six months, had a history of renal procedures, had diabetes mellitus with HbA1c levels greater than 7.4%, were on steroid treatment for any comorbidity within the last six months, had a solitary functioning kidney, had a transplanted kidney, or had chronic kidney disease with a glomerular filtration rate (GFR) less than 30 ml/min.

After obtaining ethical approval from the hospital's ethical committee and informed consent from participants, a total of 248 patients were enrolled in the study. These patients were randomly divided into two groups, with 124 patients in each group. Group A received a stent, while Group B was the control group without one. Demographic information, including name, age, gender, address, and contact number, was collected through interviews. Patients were screened for diabetes mellitus and hypertension to ensure they met the inclusion criteria. The ureteric stone position was confirmed using a lower abdominal ultrasound, and once confirmed, the patients were scheduled for ureteroscopy.

The outcomes were compared between the two groups on the third postoperative day, as defined by the study's operational definitions. The outcomes measured included pain score, duration of hospital stay, and the occurrence of urinary tract infection (UTI). Data was collected using a well-defined proforma, and statistical analysis was performed using SPSS version 20. Quantitative variables such as age, mean pain score, mean hospital stay and disease duration were analyzed using mean and standard deviation. Qualitative variables, including gender and the occurrence of UTI, were assessed through frequency and percentage. Stratification was used to control for effect modifiers such as age, gender, stone size and location, and disease duration. Following stratification, a chi-square test was applied for qualitative variables, with a p-value of ≤ 0.05 considered statistically significant. A t-test was used to determine the significance of quantitative variables.

Results

Table 1 outlines the distribution of age, gender, and the occurrence of urinary tract infections (UTIs) between the two groups. Most patients (76.6%) were in the 41-60 age group, with 35.9% in Group A and 40.7% in Group B. The mean age in Group A was 46.11 ± 7.96 years, while in Group B, it was slightly higher at 46.90 ± 7.59 years. Regarding gender, males comprised 59.3% of the total population, with 33.1% in Group A and 26.2% in Group B. Females accounted for 40.7%, with 16.9% in Group A and 23.8% in Group B. Regarding UTI, 13.3% of patients experienced an infection, with a higher incidence in Group A (10.9%) compared to Group B (2.4%).

Table 1: Distribution of Age, Gender, and Urinary Tract Infection (N = 248)

Variable	Stenting Group (Group A)	Non-Stenting Group (Group B)	Total
Age Group			
20-40 years	35 (14.1%)	23 (9.3%)	58 (23.4%)
41-60 years	89 (35.9%)	101 (40.7%)	190 (76.6%)
Total Age Group	124 (50.0%)	124 (50.0%)	248 (100.0%)
Mean±SD (Years)	46.11 ± 7.96	46.90 ± 7.59	
Gender			
Male	82 (33.1%)	65 (26.2%)	147 (59.3%)
Female	42 (16.9%)	59 (23.8%)	101 (40.7%)
Total Gender	124 (50.0%)	124 (50.0%)	248 (100.0%)
Urinary Tract Infection			
Yes	27 (10.9%)	6 (2.4%)	33 (13.3%)
No	97 (39.1%)	118 (47.6%)	215 (86.7%)
Total Urinary Tract Infection	124 (50.0%)	124 (50.0%)	248 (100.0%)

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Table 2 presents the distribution of mean pain scores, mean hospital stay, and disease duration. The mean pain score was similar between the groups, with Group A reporting 3.48 ± 1.55 and Group B reporting 3.37 ± 1.46. A notable difference was observed in hospital stay duration, where Group A had a longer mean stay of 4.22 ± 0.95 days compared to 1.48 ± 0.77 days for Group B. The disease duration was comparable between the groups, with Group A at 4.79 ± 1.55 years and Group B at 4.69 ± 1.68 years.

Table 2: Distribution of Mean Pain Score, Mean Hospital Stay, and Duration of Disease (N = 248):

Variable	Stenting Group (Group A) Mean ± SD	Non-Stenting Group (Group B) Mean ± SD
Mean Pain Score	3.48 ± 1.55	3.37 ± 1.46
Mean Hospital Stay	4.22 ± 0.95 days	1.48 ± 0.77 days
Duration of Disease	4.79 ± 1.55 years	4.69 ± 1.68 years

Table 3 provides a stratification of the mean pain score based on various factors, including age, gender, stone size, location, and disease duration. No statistically significant differences were found in the mean pain score between the groups for any of the stratified variables, with p-values greater than 0.05 across all categories. For example, in the 20-40 age group, the mean pain score was 3.97 ± 1.48 for Group A and 4.52 ± 1.38 for Group B (p = 0.16), and for males, it was 3.45 ± 1.60 in Group A and 3.40 ± 1.25 in Group B (p = 0.83).

Table 4 shows the stratification of UTI occurrences using the chi-square test, considering the same variables as Table 3. A statistically significant difference in UTI incidence was observed between the groups in several categories. For instance, in the 41-60 age group, 11.6% of Group A patients developed a UTI compared to 3.2% in Group B (p = 0.00). A similar trend was seen among females, where 6.9% of Group A experienced a UTI, while only 1.0% of Group B did (p = 0.006). The size and location of the stone also showed significant differences in UTI incidence between the groups, with p-values of 0.02 and 0.00, respectively.

Table 3: Stratification for Mean Pain Score with Respect to Age, Gender, Size of Stone, Location of Stone, and Duration of Disease Using Independent Sample t-test (N = 248)

Variable	Groups	N	Mean	Std. Deviation	Std. Error Mean	p-value
Age Group (20-40 years)	Stenting Group	35	3.97	1.485	0.251	0.16
	Non-Stenting Group	23	4.52	1.377	0.287	
Age Group (41-60 years)	Stenting Group	89	3.28	1.537	0.163	0.41
	Non-Stenting Group	101	3.11	1.348	0.134	
Gender (Male)	Stenting Group	82	3.45	1.596	0.176	0.83
	Non-Stenting Group	65	3.40	1.247	0.155	
Gender (Female)	Stenting Group	42	3.52	1.469	0.227	0.56
	Non-Stenting Group	59	3.34	1.667	0.217	
Size of Stone (0.1-0.5 cm)	Stenting Group	20	3.20	0.894	0.200	0.82
	Non-Stenting Group	31	3.29	1.637	0.294	
Size of Stone (>0.5 cm)	Stenting Group	86	3.57	1.732	0.187	0.31
	Non-Stenting Group	78	3.33	1.438	0.163	
Location of Stone (Mid)	Stenting Group	51	3.24	1.305	0.183	0.79
	Non-Stenting Group	60	3.17	1.416	0.183	
Location of Stone (Shaft)	Stenting Group	73	3.64	1.686	0.197	0.76
	Non-Stenting Group	64	3.56	1.479	0.185	
Duration of Disease (1-5 years)	Stenting Group	79	3.35	1.519	0.171	0.91
	Non-Stenting Group	85	3.33	1.459	0.158	
Duration of Disease (>5 years)	Stenting Group	45	3.69	1.593	0.237	0.50
	Non-Stenting Group	39	3.46	1.466	0.235	

Table 4: Stratification for Urinary Tract Infection with Respect to Age, Gender, Size of Stone, Location of Stone, and Duration of Disease Using Chi-Square Test (N = 248)

Variable	Groups	Yes (n, %)	No (n, %)	Total (n, %)	p-value
Age Group (20-40 years)	Stenting Group	5 (8.6%)	30 (51.7%)	35 (60.3%)	0.58
	Non-Stenting Group	0 (0.0%)	23 (39.7%)	23 (39.7%)	
	Total	5 (8.6%)	53 (91.4%)	58 (100.0%)	

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Age Group (41-60 years)	Stenting Group	22 (11.6%)	67 (35.3%)	89 (46.8%)	0.00
	Non-Stenting Group	6 (3.2%)	95 (50.0%)	101 (53.2%)	
	Total	28 (14.7%)	162 (85.3%)	190 (100.0%)	
Gender (Male)	Stenting Group	20 (13.6%)	62 (42.2%)	82 (55.8%)	0.07
	Non-Stenting Group	5 (3.4%)	60 (40.8%)	65 (44.2%)	
	Total	25 (17.0%)	122 (83.0%)	147 (100.0%)	
Gender (Female)	Stenting Group	7 (6.9%)	35 (34.7%)	42 (41.6%)	0.006
	Non-Stenting Group	1 (1.0%)	58 (57.4%)	59 (58.4%)	
	Total	8 (7.9%)	93 (92.1%)	101 (100.0%)	
Size of Stone (0.1-0.5 cm)	Stenting Group	6 (11.8%)	14 (27.5%)	20 (39.2%)	0.02
	Non-Stenting Group	2 (3.9%)	29 (56.9%)	31 (60.8%)	
	Total	8 (15.7%)	43 (84.3%)	51 (100.0%)	
Size of Stone (>0.5 cm)	Stenting Group	17 (10.4%)	69 (42.1%)	86 (52.4%)	0.05
	Non-Stenting Group	4 (2.4%)	74 (45.1%)	78 (47.6%)	
	Total	21 (12.8%)	143 (87.2%)	164 (100.0%)	
Location of Stone (Mid)	Stenting Group	13 (11.7%)	38 (34.2%)	51 (45.9%)	0.00
	Non-Stenting Group	1 (0.9%)	59 (53.2%)	60 (54.1%)	
	Total	14 (12.6%)	97 (87.4%)	111 (100.0%)	
Location of Stone (Shaft)	Stenting Group	14 (10.2%)	59 (43.1%)	73 (53.3%)	0.00
	Non-Stenting Group	5 (3.6%)	59 (43.1%)	64 (46.7%)	
	Total	19 (13.9%)	118 (86.1%)	137 (100.0%)	
Duration of Disease (1-5 years)	Stenting Group	18 (11.0%)	61 (37.2%)	79 (48.2%)	0.02
	Non-Stenting Group	5 (3.0%)	80 (48.8%)	85 (51.8%)	
	Total	23 (14.0%)	141 (86.0%)	164 (100.0%)	
Duration of Disease (>5 years)	Stenting Group	9 (10.7%)	36 (42.9%)	45 (53.6%)	0.01
	Non-Stenting Group	1 (1.2%)	38 (45.2%)	39 (46.4%)	
	Total	10 (11.9%)	74 (88.1%)	84 (100.0%)	

Discussion

Ureteric calculi, or stones located within the ureter from the ureteropelvic junction (UPJ) to the vesicoureteral junction (VUJ), are a leading cause of renal colic, a type of severe abdominal pain. These stones are a subtype of urolithiasis, a condition affecting between 5-12% of the population at some point in their lives, with recurrence rates nearing 50%. The incidence and prevalence of stone disease are on the rise, likely driven by changes in nutritional and environmental factors. Recent advancements in the surgical management of ureteric stones have significantly transformed treatment approaches. Developing smaller caliber semi-rigid and flexible ureteroscopy and using laser energy for intracorporeal lithotripsy have made ureteroscopy a less traumatic, safer, and more effective outpatient procedure for stones located anywhere in the ureter. The use of ureteral stents dates back over a century, with significant improvements in design over time to prevent migration and improve efficacy. The Double-J stent, introduced in the 1970s, remains widely used today, particularly in complicated cases of ureteroscopy lithotripsy (URSL) where bleeding, ureteric trauma, or a sizeable residual stone burden is present. Ureteric stent insertion is also the standard of care for patients who are pregnant or have a solitary kidney, transplanted kidney, or renal impairment. In our study, involving 248 patients (124 in each group), the mean age was 46.11 ± 7.96 years in Group A (stenting) and 46.90 ± 7.59 years in Group B (non-stenting). The gender distribution showed that 33.1% (n=82) of Group A and 26.2% (n=65) of Group B were male, while 16.9% (n=42) of Group A and 23.8% (n=59) of Group B were female. One key outcome studied was urinary tract infection (UTI) incidence. Our results indicated that UTI was significantly more common in the stenting group, with 10.9% (n=27) of patients affected, compared to only 2.4% (n=6) in the non-stenting group. These findings align with previous research, which also found a higher incidence of urinary infections (OR: 2.01; 95% CI: 1.16 to 3.47; $p = 0.01$) and hematuria (OR: 3.68; 95% CI: 1.86 to 7.29; $p < 0.001$) in patients with stents. Additionally, flank pain or voiding pain was more frequent in the stented group (OR: 2.45; 95% CI: 1.45 to 4.15; $p < 0.001$). However, no significant differences were observed between the two groups in terms of fever rate (OR: 0.78; 95% CI: 0.52 to 1.18; $p = 0.25$) and ureteral stricture rate (OR: 0.52; 95% CI: 0.20 to 1.13; $p = 0.17$).

Conclusion

We concluded that the stone-free rate might be influenced by the implantation of ureteral stents. However, long-indwelling stents cause ureteral wall edema, epithelial hyperplasia, destruction, and inflammatory cell reactions, suggesting their use only over the short term. Stent-related complications are the

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most significant drawbacks of ureteral stenting in most patients.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate
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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

ABDUL HASSAN (Medical Officer Department)
Coordination of collaborative efforts.
Study Design, Review of Literature.
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Conception of Study, Development of Research Methodology Design, Study Design, manuscript Review, ***M.***
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Data entry and data analysis, as well as drafting the article.
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Data acquisition and analysis.
Coordination of collaborative efforts.

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