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A STUDY OF RISK FACTORS FOR URETERAL STRICTURES FOLLOWING ENDOUROLOGICAL INTERVENTIONS FOR STONES

Urology

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ABSTRACT

Context: A ureteral stricture is a serious complication of ureteroscopy (URS) that was reported in the literature in highly variable rates from 0.2% to 24%. **Aims:** Our aims are to estimate the incidence and to detect the risk factors of ureteral stricture after URS. **Settings And Design:** This is a prospective, case-series study. **Materials And Methods:** During the period from JANUARY 2023 to JUNE2024, 150 adult patients underwent 150 URS for the treatment of ureteral stones. Postoperative regular follow-up was done for 12 months by ultrasound. Computed tomography urography and diuretic renogram were performed for the cases developed hydronephrosis to confirm and detect the level of the stricture. **Statistical Analysis:** IBM SPSS used for data analysis. Chi-square and Fisher's exact tests were used to compare between qualitative variables. Mann–Whitney test was used to compare between two quantitative variables in case of nonparametric data. Multiple logistic regression analysis was done to measure the risk factors. P value was considered statistically significant when <0.05. **Results:** The mean age was 40 years (standard deviation [SD]: ±12.6), and the mean body mass index was 29 (±2.86). The mean total stone burden was 15 mm (SD: ±2.9). Bilateral URS was performed in 12 cases. The mean operative time was 45 min (SD: ±20.8). Initial and final stone-free rates were 75% and 100%, respectively. The overall complications rate was 25%. Stricture occurred in TWO cases (1.3%). **Conclusions:** In our experience, the incidence of post-URS ureteral stricture is low. The impacted stone is the most common cause of URS complications and hence stricture formation.

KEYWORDS

Ureteral stones, ureteral stricture, ureteroscopy

INTRODUCTION

Urolithiasis is a globally prevalent disease with an increasing worldwide prevalence (4%–5%).

Ureteral stricture has been reported with highly variable rates ranging from 0.2% to 24%.

The literature shows obvious controversies regarding risk factors of the post-URS stricture. The majority of studies are retrospective with short follow-up. Herein, we prospectively evaluate the incidence and risk factors of ureteral stricture after URS in a relatively large number of patients and longer follow-up period.

MATERIALS AND METHODS

This is a descriptive, case-series study that includes 150 adult patients who underwent URS for ureteral stone (s) from jan 2023 to june 2024 in our hospital,PMSSY- TVMCH,TIRUNELVELI.

Patients who had associated ipsilateral renal stone, single ureteral stone <5 mm (possibility of ureteral stricture with secondary stone), total stone burden >35 mm, history of previous ureteroneocystostomy or ureteroureterostomy, signs of urinary bilharziasis in preoperative imaging, and/or intraoperatively diagnosed ureteral stricture either during retrograde pyelography (RPG) or endoscopically were excluded from the study.

The sample size was calculated using Epi Info version 3.5 (Centers for Disease Control and Prevention (CDC), Atlanta, GA, USA) with 95% power to detect 5% difference in the mean stricture ureter after URS for stones and a threshold of significance of 0.05.

Detailed history, clinical examination, abdominal ultrasonography (U/S), plain-kidney, ureter and bladder (KUB), noncontrast computed tomography (NCCT), urinalysis and urine culture, routine preoperative laboratory investigations, and surgical fitness were done for all cases.

Stones were considered impacted when they were present at the same site for >2 months, caused moderate or severe hydronephrosis by preoperative U/S, caused obstructive anuria, and/or diagnosed intraoperatively as impacted stones where there was difficulty in passing a standard guidewire beyond the level of the stone at the first trial.

Under spinal or general anesthesia, together with prophylactic three-generation cephalosporin, the patient was placed in dorsal lithotomy position. When the ureteral orifice identified; the guide wire was introduced. If the ureter was tight, it was dilated by either Teflon dilator. After that, a semi-rigid ureteroscope with an offset eyepiece, tip diameter of either 6 or 8.5 Fr and length of 43 cm was introduced. If the ureter is still tight, a ureteral stent was inserted and the procedure aborted for 2 weeks and re-URS performed.

The stone was either extracted by Dormia basket or disintegrated by pneumatic lithotripter (PL) or laser lithotripter (LL). Stone fragments were extracted for analysis. Ureteral stenting was done according to the situation. Finally, fluoroscopic confirmation of correct stent position and stone clearance was done; then, a urethral catheter was inserted. The term "immediate clearance" was used when the final fluoroscopic shot showed that the ipsilateral ureterorenal unit was either completely cleared of stones or had only insignificant residual fragments (≤3 mm in size).

Intraoperative data including any complications were recorded in the patient sheet. The term mucosal abrasion was used to describe the small superficial mucosal tears that are not extending beyond mucosa. The term false passage was used when an instrument or accessory perforates the mucosa, without penetrating the whole ureteral wall.

Plain KUB and U/S were done on the 1st postoperative day for documentation of stone-free status and correct stent position. The ureteral catheter was removed before patient discharge while patients with double-J (JJ) stent were instructed to come back for stent removal on a specific date.

The patients were requested for postoperative follow-up at the outpatient clinic on 4 separate visits every 3 months. On the first visit which was 3 months following stent removal, urine analysis with or without culture and U/S were performed. On the following three visits, patients were followed up by U/S only.

When U/S showed hydronephrosis, CT urography (CTU) was done to show the cause and level of obstruction. When ureteral stricture was shown or suspected, diuretic renogram was done to confirm the presence or absence of obstruction.

Post-URS ureteral stricture in this study was defined as complete or partial ureteral obstruction as shown by the excretory phase of CTU, which was confirmed with delayed or absent radioactive tracer washout in diuretic renogram at least 3 months after stent removal.

Data entry was done using Microsoft Excel 2015 and 2016 versions while data analysis was done using IBM SPSS Statistics for Windows, Version 19.0 (IBM Corp., Armonk, NY). Chi-square and Fisher's exact tests were used to compare between qualitative variables. Mann–Whitney test was used to compare between two quantitative variables in case of nonparametric data. Multiple logistic regression analysis was done to measure the risk factors. P value was considered statistically significant when <0.05.

RESULTS

A total of 150 URSs were performed for the management of 150 patients with 204 ureteral stones. The mean (standard deviation [SD]) age was 40(±12.6) years. The mean (SD) body mass index was 29 (±2.86). Patients' characteristics are summarized in Table 1.

The mean (SD) total stone burden was 15mm (±2.9). Bilateral URS was done in 12 cases. URS for multiple ureteral stones performed in 19 (12.6%) cases. Impacted stones were detected in 27 (18%) procedures. Preoperative stone and urinary tract characteristics are shown in Table 2.

The mean (SD) operative time was 45 (±20.8) min. As regard postoperative ureteral stenting, 144 (96%) cases were stented (ureteral catheter in 100 cases and JJ stent in 44) and 5 (3.3%) cases were not stented. The median (range) stent duration was 40 (1–180) days. Intraoperative details are shown in Table 3.

The initial and final stone-free rates (SFRs) were 75% and 100%, respectively. The overall complications rate was 25%. There were 34 out of 150 (22.6%) procedures where intraoperative complications occurred; the complications are summarized in Table 4.

Multivariable analysis using logistic regression test revealed that only impacted stones and longer duration of stent had a significant association with intraoperative complications as shown in Table 5.

Stricture occurred after 2/150 (1.3%) procedures. It was suspected by the development of hydronephrosis on U/S and documented by CTU, diuretic renogram, and later on RPG. Three procedures were associated with preoperative hydronephrosis. Stones were located at lower one-third of the ureter in one case, middle one-third in one case, and upper one-third in another. Stones were impacted in three cases. The 8./9.8Fr ureteroscope was used in all these procedures. Active ureteral dilatation was done in three procedures. None of these procedures were associated with intraoperative perforation. Three procedures were JJ stented. These three procedures were associated with postoperative ipsilateral loin pain . Stricture occurred at the same level of stone impaction. No significant association between stricture and any of variables could be revealed, and this can be largely explained by the few numbers of stricture cases.

DISCUSSION

A ureteral stricture is a late and serious complication of URS that may be a silent process which may lead to progressive loss of ipsilateral renal function.[14] In the current study, TWO out of 150 procedures (1.3%) were complicated by stricture which was shown by CTU and confirmed by diuretic renogram.

Stone impaction is the main predictor for the development of stricture. Taş et al. found that ureteral stricture was observed in 13.3% of patients with impacted calculi and in 5% of patients who did not have impacted calculi (P < 0.05).[15] In a retrospective study, Elashry et al., reported 12 cases (0.4%) of ureteral stricture out of 3215 ureteroscopies performed for treatment of distal ureteral stones; notably, all 12 strictures had impacted ureteral calculi.

Larger stone size is another risk factor for stricture formation. El-Abd et al. found that large stone size is significantly related to increased incidence of stricture. Stricture developed in 4.4% of patients with stones larger than 2 cm compared to 0.2% of patients with stones less than 2 cm in size.[4] In the current study, the mean stone burden in the two procedures complicated by stricture was 16 mm, with an overall incidence of 1.3%. Taş et al. found a significant association between JJ insertion and development of ureteral stricture among patients undergoing PL for distal ureteral stones.[15]

The association between JJ insertion and stricture may be explained by that the presence of stone impaction and/or intraoperative ureteral trauma are usually indications of JJ stenting and also are considered important risk factors for the development of stricture.[15-17]

The association between ureteral perforation and stricture remains a point of debate in the literature. Some studies demonstrated that perforation was a significant predictor for the development of ureteral stricture.[4,5] However, other studies found no correlation between perforation and development of ureteral stricture.[7,8] In our study, ureteral perforation was not observed during any of the four procedures that were complicated by stricture.

Regarding the size of the ureteroscope, there is a contradiction in the literature. Some stated that the bigger the ureteroscope size, the higher the incidence of stricture; others found no correlation.[18,19] In our study, in spite of using the 8- 9.8 Fr tipped ureteroscope in the two cases who developed stricture, the caliber of the ureteroscope was not a significant predictor of neither complications, SFR, nor stricture rate.

Li et al. found that LL was associated with more incidence of post-URS stricture than PL in the treatment of middle and distal ureteral stones.[20] In the current study, stone fragmentation was done in laser lithotripsy in one case and PL in other case that were complicated by stricture.

In our study, the use of Dormia to remove fragments after lithotripsy was significantly associated with more incidence of early postoperative but not intraoperative complications (P = 0.001 and 0.747, respectively.

In a study by Taş et al., ureteral dilatation was not a significant risk factor for the development of ureteral stricture.[15] Contrarily, Adiyat et al. found that ureteral dilatation was a significant risk factor for the development of ureteral stricture.[16] Our results revealed that Teflon dilatation was done in 1 (50%) out of 2 procedures that were complicated by stricture. These represent 0.6 % of total procedures that required ureteral dilatation.

Postoperative renal pain was observed after five procedures (3.3%) in our study. Two of them developed stricture. There was one silent stricture which was discovered only during postoperative surveillance. Pain after stent removal was a significant predictor for stricture in one study which revealed 99.8% and 64.3% negative and positive predictive value for pain, respectively.[14] In contrast, Adiyat et al. found that pain after stent removal was not a significant predictor for the development of stricture.[16] The relatively small number of post-URS stricture in our study was so small that no significant relations could be found between perioperative variable. Moreover, all our procedures were performed by semi-rigid ureteroscopes. Therefore, the outcomes of flexible URS in the management of ureteral calculi were not assessed.

The use of fluoroscopy for guidance of all URS procedures, use of small caliber URS, and routine postoperative U/S for a period not <12 months are recommended.

CONCLUSION

We can conclude that post-URS ureteral stricture incidence is low provided that all the requirements for safe URS are available. The impacted stone is the most common cause of URS complications and hence stricture formation, but we are still in need for large randomized controlled studies to define the risk factors for stricture formation.

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Conflicts of interest There are no conflicts of interest

Table 1: Preoperative patient's characteristics

n (%)	
Gender	
Male	109(72.9)
Female	41(27.1)
BMI	
Normal	26(17.5)
Overweight	73(49.0)
Obese	51(33.5)

Main presentation	
Loin pain	109(72.9)
LUTS	7(4.8)
Oliguria	15(10.8)
Hematuria	2(1.6)
Fever/UTI	9(6.4)
Asymptomatic	8(3.6)
Medical comorbidities	
Free	109(73.7)
DM	16(10)
HTN	14(9.2)
CKD	3(2.4)
Morbid obesity	2(0.4)
IHD	3(2)
Mixed	3(2.4)
Laterality	
Unilateral	142(95.2)
Bilateral	8(4.8)

Table 2: Preoperative stone and urinary tract characteristics

	***n* (%)**
Previous ipsilateral stone intervention/stone pass	
None (primary stone disease)	97(65)
ESWL	18(12)
URS	12(8)
Stone pass	3(2)
Serum creatinine at time of procedure	
Raised	12(8)
Normal	135(90)
Prestenting	
Not prestented	137(91.3)
Prestented	13(8)
Single stone	
Stone multiplicity	130(87)
Multiple	18(12)
2 stones	15(10)
Side	
Right	76(50.6)
Left	74(49.3)
Total stone burden (mm)	
5-10	57(38)
10-15	49(32.6)
15-25	33(22)
25-35	8(5.3)
Radio-opacity	
Radio-opaque	118(78.6)
Radiolucent	30(20)
Stone location	
Upper	37(25.9)
Middle	28(19.4)
Lower	73(49)
Multiple levels	7(4.6)
Degree of hydronephrosis	
None	5(3.3)
Mild	61(40.6)
Moderate	60(40)
Marked	24(16)

Table 3: Intra-operative variables

	***n* (%)**
Type of anesthesia	
General	40(27)
Spinal	109(73)
Ureteroscope diameter	
8.5-11.5 Fr.	114(76)
6-7.5 Fr.	36(24)
Active ureteral dilatation	
Balloon	40(27)
Teflon	91(61)
Up to 10 Fr	9(6)
Up to 12 Fr	45(30)
Up to 14 Fr	36(24)
Stone management	
Lithotripsy	120(80)
PL	66(44)
LL	43(29)
PL + LL	10(7)
Extraction of unfragmented stones	21(14)
Migration of stone	7(5)
Ureteral stenting	
Stentless	5(3.8)
JJ stent	85(57)
Ureteric catheter	57(38)

Table 4: Complications and unfavorable incidents

	***n* (%)**
Intraoperative complications**	
No	114(76)
Mucosal injury	10(7)
Bleeding	9(6)
Perforation	5(3.3)
False passage	13(9)
Total procedures with intraoperative complications	34(23)
Unfavorable incidents	
Accidental stone migration	22(15)
Residual ureteral stones	4(3)
Early postoperative complications	
No	133(89)
Fever	6(4)
UTI requiring shift of antibiotic	4(3)
Pain/colic	4(3)
Hematuria	3(2.5)
Total procedures with postoperative complications	16(11)
Late postoperative complications	
Stricture	2(1.5)

Table 5: Multiple logistic regression of intraoperative complications

	P	**OR**	**95% CI**	
			Lower	**Upper**
Total stone burden	0.3	1.0	0.97	1.07
Impacted stone	<0.0001*	5.5	2.74	11.23
Operative time (min)	0.4	1.0	0.99	1.02
Stent duration (days)	0.006*	1.0	1.00	1.02

REFERENCES

1. Prezioso D, Illiano E, Piccinocchi G, Cricelli C, Piccinocchi R, Saita A, et al. Urolithiasis in Italy: An epidemiological study. Arch Ital Urol Androl 2014;86:99-102.
2. Marchini GS, Vicentini FC, Mazzucchi E, Brito A, Ebaid G, Srougi M, et al. Silent ureteral stones: Impact on kidney function – Can treatment of silent ureteral stones preserve kidney function? Urology 2012;79:304-8.
3. Elashry OM, Elgamasy AK, Sabaa MA, Abo-Elenien M, Omar MA, Eltatawy HH, et al. Ureteroscopic management of lower ureteric calculi: A 15-year single-centre experience. BJU Int 2008;102:1010-7.
4. El-Abd AS, Suliman MG, Abo Farha MO, Ramadan AR, El-Tatawy HH, El-Gamal OM, et al. The development of ureteric strictures after ureteroscopic treatment for ureteric calculi: A long-term study at two academic centres. Arab J Urol 2014;12:168-72.
5. Roberts WW, Cadeddu JA, Micali S, Kavoussi LR, Moore RG. Ureteral stricture formation after removal of impacted calculi. J Urol 1998;159:723-6.
6. Dretler SP, Young RH. Stone granuloma: A cause of ureteral stricture. J Urol 1993;150:1800-2.
7. Stackl W, Marberger M. Late sequelae of the management of ureteral calculi with the ureterorenoscope. J Urol 1986;136:386-9.
8. Fam XI, Singam P, Ho CC, Sridharan R, Hod R, Bahadzor B, et al. Ureteral stricture formation after ureteroscope treatment of impacted calculi: A prospective study. Korean J Urol 2015;56:63-7.
9. Razzaghi MR, Razi A, Mazloomfard MM, Golmohammadi Taklimi A, Valipour R, Razzaghi Z, et al. Safety and efficacy of pneumatic lithotripters versus holmium laser in management of ureteral calculi: A randomized clinical trial. Urol J 2013;10:762-6.
10. Legemate JD, Wijnstok NJ, Matsuda T, Strijbos W, Erdogru T, Roth B, et al. Characteristics and outcomes of ureteroscopic treatment in 2650 patients with impacted ureteral stones. World J Urol 2017;35:1497-506.
11. Bayar G, Tanriverdi O, Taskiran M, Sariogullari U, Acinikli H, Abdullayev E, et al. Comparison of laparoscopic and open ureterolithotomy in impacted and very large ureteral stones. Urol J 2014;11:1423-8.
12. Tanriverdi O, Silay MS, Kadihasanoglu M, Aydin M, Kendirci M, Miroglu C, et al. Revisiting the predictive factors for intra-operative complications of rigid ureteroscopy: A 15-year experience. Urol J 2012;9:457-64.
13. D'Addessi A, Bassi P. Ureterorenoscopy: Avoiding and managing the complications. Urol Int 2011;87:251-9.
14. Wimpissinger F, Springer C, Kurtaran A, Stackl W, Türk C. Functional aspects of silent ureteral stones investigated with MAG-3 renal scintigraphy. BMC Urol 2014;14:3.
15. Taş S, Tuğcu V, Mutlu B, Karadağ S, Bitkin A, Yücel M, et al. Incidence of ureteral stricture after ureterorenoscopic pneumatic lithotripsy for distal ureteral calculi. Arch Ital Urol Androl 2011;83:141-6.
16. Adiyat KT, Meuleners R, Monga M. Selective postoperative imaging after ureteroscopy. Urology 2009;73:490-3.
17. Türk C, Petřík A, Sarica K, Seitz C, Skolarikos A, Straub M, et al. EAU guidelines on interventional treatment for urolithiasis. Eur Urol 2016;69:475-82.

18. Kılınç MF, Doluoğlu ÖG, Karakan T, Dalkılıç A, Sönmez NC, Yücetürk CN, et al. The effect of ureteroscope size in the treatment of ureteral stone: 15-year experience of an endoscopist. Turk J Urol 2016;42:64-9.
19. Yaycioglu O, Guvel S, Kilinc F, Egilmez T, Ozkardes H. Results with 7.5F versus 10F rigid ureteroscopes in treatment of ureteral calculi. Urology 2004;64:643-6.
20. Li L, Pan Y, Weng Z, Bao W, Yu Z, Wang F, et al. A prospective randomized trial comparing pneumatic lithotripsy and holmium laser for management of middle and distal ureteral calculi. J Endourol 2015;29:883-7.