Clinical Study

Ureteral duplication and upper urinary tract stones – there are differences in outcome?

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Abstract

Introduction and Objectives. Collecting system duplication is one of the most common congenital anomalies of the urinary tract. Complete or incomplete duplication could be associated with ureteral or renal stones. Our objective was to compare urolithiasis treatment outcomes in patients with and without ureteral duplication.

Material and methods. A total of 68 patients with ureteral duplication who underwent ureteroscopy (URS) for ureteral and renal stones were retrospectively evaluated from 1995 to 2019. We compared the outcome after ureteroscopy for 3 groups: Group 1 (47 patients with incomplete duplication), Group 2 (21 patients with complete duplication) and Group 3 (control group - 68 patients without ureteral anomalies). Pre- and postoperative data were analyzed. Stone location and size were perfect matched. Clinical data and outcomes were compared between the 3 groups.

Results. For ureteral location (stones between 7-19 mm. diameters) there are differences concerning operative time (slightly longer for duplication cases): group 1 (19/47) average 36 min. (range 22 to 67 min.), group 2 (11/21) average 33 min. (range 19 to 71 min.) and group 3 (32/68) average 28 min. (range 20 to 48 min.). For renal location (stones between 9-28 mm. diameters) we found the same differences: group 1 (28/47) average 56 min. (range 27 to 81 min.), group 2 (10/21) average 49 min. (range 29 to 67 min.) and group 3 (36/68) average 39 min. (range 27 to 70 min.). Ureteral duplication had no effect on stone-free rates or need for additional procedures for ureteral stone location. For renal location we found a difference between Group 1 and 3 (68% stone-free for Group 1 vs. 79% for Group 3). Complication rate (Clavien1-3) was similar in all groups.We didn't describe any cases with Clavien 4 and 5. Also, the location of ureteral duplication did not affect operative time or stone-free rates.

Conclusions. Ureteral duplication seems to have no significant effect on ureteroscopy safety and efficacy for upper urinary stones. We described a slightly longer operative time for duplication cases. The stone-free rate is significantly lower especially in incomplete duplication cases.

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Introduction

Ureteral duplication can be described as two pyelocaliceal systems draining a single kidney, occurring in approximately 0,8% of the population1and have highest prevalence in Caucasian females.[1]

Duplex kidney is the most common birth defect related to the urinary tract and it is believed to be autosomal dominant in inheritance with incomplete penetrance.[2]

Presentation of duplication is variable and highly dependent on age. Approximately half of patients with duplication identified prenatally will endure repeated urinary tract infections and about 10% of children with such infections have this condition. Vesicoureteral reflux can alleviate with age.[3]

Most of the adult patients are asymptomatic and diagnosed incidentally with acute or recurrent urinary tract infections, hydroureteronephrosis (Fig.1) which may present as flank pain, incontinence, hematuria, stone formation.

Our objective was to compare urolithiasis treatment outcomes in patients with and without ureteral duplication.

Material and methods

A total of 68 patients with ureteral duplication who underwent ureteroscopy (URS) for urolithiasis were retrospectively evaluated from 1995 to 2019. There were 47 patients with incomplete duplication (Group 1), 21 patients with complete duplication (Group 2). A control cohort of 68 patients without ureteral duplication undergoing URS was also identified (group 3). Preoperative, intraoperative, and postoperative data were collected retrospectively.Preoperative evaluation included abdominal X-ray or non-contrast CT of the abdomen and pelvis. Stone location and size were perfect matched:for ureteral location we found stones between 7-19 mm. diameters and for renal location we found stones between 9-28 mm. diameters. Clinical data was collected: age, sex, BMI, past stone history, pre-stented. In Group 2 we found 2 patients with ureterocele and 1 patient with UPJ obstruction.

Surgery was performed accordingly to procedures of the time, but most of them by flexible ureteroscopy.

The particularities of the upper urinary tract anatomy have a significant impact over the flexible ureteroscopic approach. Undergoing ureteroscopy the patient is placed in lithotomy position, with local anesthesia, sedation or spinal anesthesia. The procedure starts with a rigid cystoscopy, after this a guidewire is placed into the renal cavities. A semi-rigid or flexible ureteroscope is easily steered up to the stone, and holmium laser lithotripsy is done (Fig 4,5,6).

We compared the outcome after ureteroscopy for 3 groups: Group 1 (47 patients with incomplete duplication), Group 2 (21 patients with complete duplication) and Group 3 (control group - 68 patients without ureteral anomalies). Succes rate was defined as residual fragments under 3 mm.

Results

For ureteral location there were 19 patients with incomplete duplication (Group 1) and 11 with complete duplication (Group 2). Operative times were slightly longer for duplication cases: group 1 (19/47) average 36 min. (range 22 to 67 min.), group 2 (11/21) average 33 min. (range 19 to 71 min.) and group 3 (32/68) average 28 min. (range 20 to 48 min.).

For patients with renal stones we found the same differences: group 1 (28/47) average 56 min. (range 27 to 81 min.), group 2 (10/21) average 49 min. (range 29 to 67 min.) and group 3 (36/68) average 39 min. (range 27 to 70 min.).

Group 1 underwent semirigid ureteroscopy in 17 cases, Group 2 in 10 cases and Group 3 in 32 cases of ureteral stones. Flexible ureteroscopy was done in very few cases in ureteral stone location: 2 cases in Group 1 and 1 case in Group 2, while for renal location there were 28 cases in Group 1, 10 cases in Group 2 and 36 cases in Group 3.

Ureteral duplication had no effect on stone-free rates or need for additional procedures for ureteral stone location. For renal location we found a difference between Group 1 and 3 (68% stone-free for Group 1 vs. 79% for Group 3).

There were also situations when it was difficult to get ureteral access because of the small caliber and pre-stenting was necessary: 16 patients with ureteral duplication required pre-stenting (6 in Group 1/10 in Group 2) and 12 in Group 3.

A double J stent catheter was inserted at the end of each procedure(Fig.2). After achieving stone free status, the catheter was removed after 1 to 3 weeks withoutany complication (Fig.3).

Complication rate (Clavien1-3) was similar in all groups. We didn't describe any cases with Clavien 4 and 5. Also, the location of ureteral duplication did not affect operative time or stone-free rates.

	Ureteral Duplication		
	No	Yes	
N	68	Complete	Incomplete
		21	47
Females/Males	36/32	12/9	32/15
Median Age	55	55	56
Stone location			
Ureteral	32	11	19
Renal	36	10	28
Stone size			
Ureteral location	8-20 mm	7-19 mm	
Renal location	15-20 mm	9-28 mm	



Fig 1.
Complete bilateral ureteral duplicity



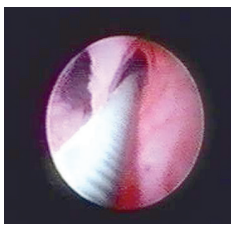
Fig 2.
Left JJ stent in the inferior pyelo-caliceal system and residual stone fragments

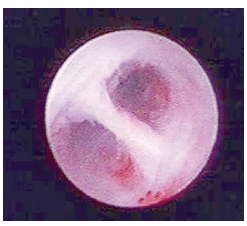
Operative characteristics			
Operative time	No duplication	Duplication	
		Complete	Incomplete
Ureteral location	28 min (20-48min)	33 min (19-71min)	36 min (22-67 min)
Renal location	39 min (27-70min)	49 min (29-67 min)	56 min (27-81min)
Pre-stented	12	10	6
Semi-rigid ureteroscopy			
Ureteral location	32	10	17
Renal location	0	0	0
Flexible ureteroscopy			
Ureteral location	0	1	2
Renal location	36	10	28

Post -Operative characteristics			
Succes Rate	No duplication	Duplication	
		Complete	Incomplete
Ureteral location	91%	90%	91%
Renal location	75%	73%	70%
Clavien Grade 1-3	18%	14%	
Clavien Grade 4-5	0	0	



Fig 3.
Left incomplete duplicity after ureteroscopy





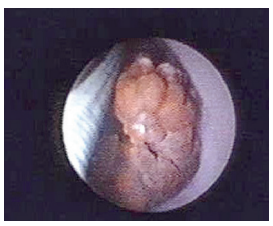


Fig 4, 5, 6. Endoscopic view of double barreled Y junction with wire –guide and stone extraction

Discussions

Throughout the embryonic development, 2 ureteral buds rarely develop separately from a single mesonephric duct, giving rise to a duplex kidney with ureteral duplication.[4]

In patients with ureteral duplication a possible comorbidity which can be observed is urinary stone formation, often due to relative stasis of urine. Evaluation and management of this pathology include intravenous urography, computed tomography urography, and magnetic resonance imaging.

Complete duplication without obstruction may evade ultrasound detection.3 Voiding cystourethrography may identify lower pole reflux, an abnormal axis or 'drooping lilly sign', or decreased number of lower pole calices.[3] With the exception of ureteropelvic junction obstruction, all complications are more common in females and must be identified.[3]

Privett et al. described renal hypoplasia or dysplasia and pyelonephritic scarring of 29% of duplex units. Urinary tract infections are also present in 35%ofcases.[5]

Stasis in one limb is frequently found.Ureteral Y junction is sometimes associated with urine passage down to the junction and then, in a retrograde fashion, up the other side of the Y (this ureteral reflux can involve stasis and ureteral dilation). Geavlete et all describe an endoscopic classification of the Y zone: double-barrelled, lateral insertion, punctiform insertion and valvular insertion that could provide new criteria and an optimum protocol in the choice of treatment for these particular ureteral anomalies.[5]

Most of the articles we found were case presentations.William D. Aiken et al. reported on a patient having bilateral complete ureteral duplication with calculi obstructing both limbs of the left double ureter.6 Because of the small caliber of the ureters, it was difficult to get ureteral access, and those authors recommended passive ureteral dilation by pre-stenting as an adjunct to enhance ureteral compliance prior to ureteroscopy, and to allow easy, uncomplicated retrograde passage of the ureteroscope.

Ahmed Jalal Alsayyadet al. presented a patient with bilateral complete duplicated ureteral systems, a calculus simultaneously obstructing each of the four ureteral limbs, and multiple bilateral renal calculi. The ureteral stones ranged from 7 to 23 mm in length, and 5–11 mm in width. The four ureteral lumens were wide enough to easily accommodate the small caliber semi-rigid ureteroscope, and to allow for laser lithotripsy without the need for ureteral dilatation or pre-stenting. All ureteral stones were removed completely and successfully from the four ureters in a sequential fashion, in a single setting.[7]

To the best of our knowledge there is one single report in the medical literature regarding ureteroscopy outcomes in patients with ureteral duplication. Nathan Chertack et al. found that preoperative knowledge of ureteral duplication appears to have no significant effect on URS's safety or efficacy, when comparing a 1:1 control cohort of patients.[8]

Our study compared the outcomes after ureteroscopy and found that operative times were slightly longer for duplication cases. There was no difference in stone free rates between control versus study populations for ureteral stone location. For renal location we found a difference between the group with incomplete duplicity and control group.

This ureteral anomaly is very rare and from this point of view our study sample was small. Another limitation of the study was that patients were collected over a long period of time, during which some practice patterns may have evolved. Nowadays, areas of the pyelocaliceal system accessible otherwise only by percutaneous or open surgery, can be approached in a retrograde fashion, using the anatomical pathways[9]. Despite this limitation, most of our population of ureteral duplication patients underwent flexible ureteroscopy. The strengths of our study include a heterogenous cohort with regard to stone size and location.

Conclusions

In our study patients with ureteral duplication undergoing ureteroscopy have similar stone free and complication rates compared to patients without duplication and no need for additional procedures. Location of ureteral duplication and preoperative knowledge of ureteral duplication did not affect operative time. We described a slightly longer operative time for duplication cases. The stone-free rate is significantly lower especially in incomplete duplication cases.

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