Original Article

Indian Journal of Anatomy
Volume 3 Number 2, April - June 2014

A Study of Congenital Anomalies of Ureter

Suma Dnyanesh*, Daksha Dixit, Dnyanesh D.K.***, Amit Magadum******

Abstract

Background: The ureters are a pair of thick walled cylindrical tubes which convey urine from the corresponding kidney to the urinary bladder. They descend along the posterior abdominal wall to enter the bladder on its poster inferior surface. Premature division of urethral bud results in double ureter. Duplication of ureter can be incomplete or complete. The term 'bifid' ureter is used when it is incomplete. **Aims and Objectives:** To study the anomalous pattern of ureters and its clinical implications. **Materials and Methods:** We studied 150 cadavers over a period of 2 years for the presence of anomalies of ureters. **Results:** We found 2 cases of bifid ureter: in the first case, we found unilateral incomplete double ureter. The duplicated ureters joined with each other in lower part and finally opened in the urinary bladder by a common orifice. In the second case, we got bilateral double ureters. Both the ureters on both the sides opened independently in urinary bladder with 4 separate openings. **Conclusion:** Double ureter can go unnoticed many times and can give rise to a number of clinical manifestations. Variations are thus important for urological conditions, radiological interpretations and also for surgeries involving renal transplants.

Keywords: Double ureter; Urethral bud; Urinary bladder.

Introduction

The ureters are a pair of thick walled cylindrical tubes which convey urine from the corresponding kidney to the urinary bladder. They descend along the posterior abdominal wall to enter the bladder on its postero inferior surface. Premature division of ureteric bud results in double ureter. Duplication of ureter can be incomplete or complete. The term bifid ureter is used when it is incomplete. Incidence of bifid ureters is 0.8%, ranging from 0.5 to 3%.[2] Familial incidence of double ureters is reported, but is a rare incidence. Bifid uretes are seen twice more commonly in females and on right side compared to males.[3]

Double ureter can go unnoticed many times and can give rise to a number of clinical manifestations. It can lead to the formation of calculi, urinary tract infections, etc. A thorough knowledge of these clinical conditions and their correlation with the developmental basis will be of great help in their diagnosis and management.

Embryological Aspects[3]

Ureteric bud grows from the postero-medialside of the caudal part of the mesonephric duct. Its distal end dilates and invades the lower part of nephrogenic cord and divides into cranial and caudal parts, forming the future major calyces. These major calyces divide repeatedly to about 13 or more generations of tubules. The branches of 2nd, 3rdand 4th orders are absorbed to form the minor calyces. The stalk of the ureteric bud persists as the ureter and its dilated end forms

Author's Affiliation: *Assistant Professor, ** Professor & Head, ****Assistant Professor, Department of Anatomy, ***Associate Professor, Department of Pediatrics, KLE University's J. N. Medical College, Belgaum, Karnataka - 590010, India.

Reprint's Request: Dr. Suma Dnyanesh, Assistant Professor, Department of Anatomy, KLE University's J. N. Medical College, Nehru Nagar, Belgaum Karnataka, India Pin code: 590010.

E-mail: drdnyaneshk@gmail.com, drsuma410@gmail.com

the pelvis of the ureter.

Premature division of ureteric bud results in double ureter. The 2 ureters thus formed are connected to a single kidney and open in the bladder either by a common orifice or by 2 separate orifices, upper and lower. When 2 such separate orifices are present, the upper ureter drains urine from the upper part of kidney and the lower ureter drains from its lower part. In this condition, the mesonephric duct gives rise to two ureteric buds, cranial and caudal, which invade the metanephricblastema independently and induce the development of upper and lower poles of the kidney respectively. As the mesonephric duct undergoes loop formation in the posterior wall of the bladder, the lower ureter opens in the bladder in normal position, whereas the upper ureter migrates more caudally along with the caudal shift of the terminal part of mesonephric duct and opens in ectopic position. That is how the normal and ectopic ureters cross each other.

Materials and Methods

We studied 150 cadavers over a period of 4 years for the presence of anomalies of ureters. Of these, only 2 cadavers showed the presence of bifid uereters: 1 was unilateral and the other was bilateral. We then studied the course and termination of these ureters. The presence of these bifid ureters in adults and their effects were then correlated.

Figure 1: Showing Course of Bifid Ureter

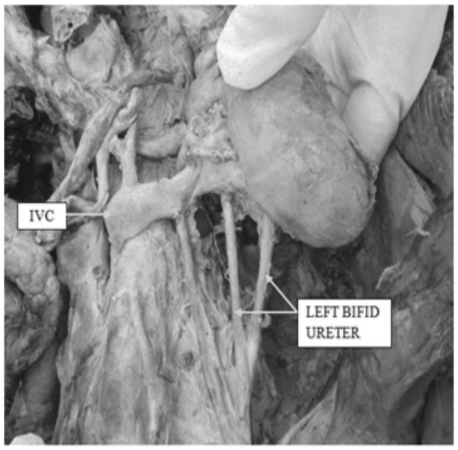
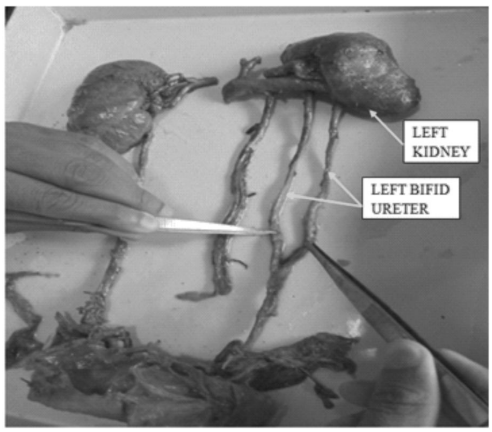


Figure 2: Showing the Bifid Ureter on Left Side



Case I

During dissection of a 60 year old male cadaver, a unique anatomical variation involving left ureter was found. Two ureters were found connected to the left kidney. They descended from separate renal pelvis from the upper and lower poles of the left kidney. The upper ureter was arising from the hilum of the kidney maintaining its normal position. The lower ureter was arising from the lower pole (Figure 1). The duplicated ureters joined with each other about 2.5cm proximal to vescicoureteraljunction and finally opened into the urinary bladder by a common orifice (Figure 2). Apart from this variation, the shape, size and position of both kidneys were normal. The right ureter was also normal

Fig 3: Showing the Course of Bilateral Bifid Ureters

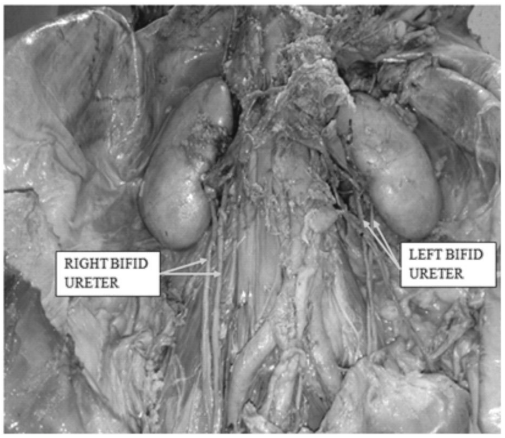
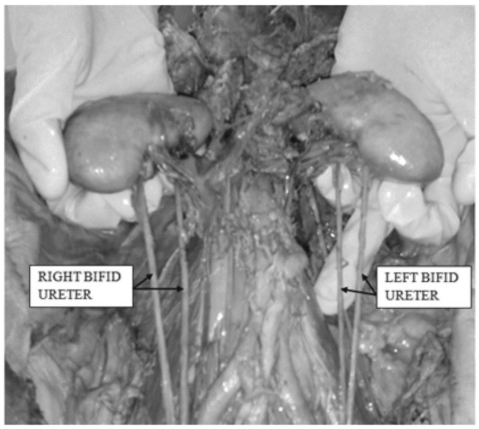


Fig 4: Showing Bilateral Bifid Ureters



(Figure 3).

Case II

We dissected a 55 year old male cadaver, in which we found that double ureters were connected to kidneys of both the sides and with further dissection the following was observed.

At their proximal ends, on both sides (right and left), the 2 ureters had separate renal pelves. The ureter which was laterally placed arose from lower pelvis and emerged from lower part of the hilum, the second ureter which was placed medially arose from upper pelvis and emerged from the upper part of the hilum.

On Right Side: Both ureterscame down parallel to each other up to the pelvic brim.

On Left Side: Both ureters descended down parallel to each other upto a level just above the bifurcation of aorta.

Then themedial ureters (right and left)which werearising from upper pelvis, crossed the lateral ureters superficially from medial to lateral side and remained lateral till they opened into the urinary bladder with separate openings placed at a lower level. The lateral ureters (right and left) which were arising from the lower pelvis opened into the bladder with separate openings at the normal position. Thus both the ureters on both the sides opened independently into the urinary bladder with 4 separate openings.

Discussion

The duplication of upper urinary tract is one of the commonest anomalies and occurs in 1 in 160 individuals.[5] In our study we got 2 cases out of 150 cadavers. Cases of familial bifid or double ureter which is an autosomal dominant condition have been reported. But such occurrence is rare.[6]

The incidence of duplex renal collecting system and ureter ranges from 0.5-3%. Unilateral ureteral duplication is more commonly seen than the bilateral duplication.[7,8] In the present study, out of 150 cadavers, we have got 1 case of unilateral bifid ureter and 1 case of bilateral complete ureteral duplication.

Duplex collecting system is seen in approximately 1.3% patients[9] and 0.7% of these have associated urinary tract anomalies.[10]

The incidence of bifid pelvis and bifid ureter is 4% in the population of North America.[11]

Table I: Morphology of Bifid Ureters

	Side	Feature of Ureter	Beginning	Termination	Openings in the bladder
Case – I	Right	Normal	Normal	Normal	2
	Left	Bifid	Separate pelvis	The duplicated ureters joined and opened into the bladder by a common orifice	
Case-II	Right	Bifid	Separate pelvis	Independent opening into the bladder	4
	Left	Bifid	Separate pelvis	Independent opening into the bladder	

A duplicated ureteral system is dangerous as it can give rise to an array of clinical manifestations. It can lead to the formation of urinary stones, vesicoureteral reflex, ureterocele, obstructive uropathy, etc.

Conclusion

Variations are important for urological conditions, radiological interpretations and also for surgeries involving renal transplants. Surgeons must be careful about the urinary tract anomalies before the surgical management of urinary stones or renal transplants, since co-existing ureteral duplication may increase the morbidity and mortality of the affected individual. The various manifestations and complications along with their developmental basis need to be kept in mind by clinicians and surgeons in order to bring about their early diagnosis and treatment.

References

1. Sadler TW. Urogenital system, Langman's medical embryology, 9th edition. LippincottWilliums and Wilkins; 2004: 321-6.
2. Setsuko Tohno, Cho A, Yoshiyki TJ. *NARA Med Assoc*. 2008; 59(1): 183-87.
3. Rege VM, Deshmukh SS, Borwankar SS, Gandhi RK. *Journal of Postgraduate Medicine*. 1986; 32: 233-35.
4. Dutta AK. Essentials of Human embryology 4th ed. Kolkatta: Current Books International; 2007, 215-22.
5. Campbell MF, Harrison JH. Urology, 3rd edition, vol. 2. Philadelphia: WB Saunders; 1970, 1488.
6. Atwell JD, Cook PL, Howell CJ, Hyde I, Parker BC. Familial incidence of bifid and double ureters. *Archives of Diseases in Childhood.* 1974; 49: 390.
7. Kawahara T, Ito H, Terao H. Ureteroscopy assisted retrograde nephrectomy (UARN) for an incomplete double ureter. *Urol Res*. 2012; 40: 781-2.
8. Inamoto K, Tanaka S, Takemura K. Duplication of renal pelvis and ureter: associated anomalies and pathological conditions. *Radiat Med*. 1983; 1: 55-64.
9. Stec AA, Baradaran N, Gearhart JP. *Urology*. 2012; 79(1): 207-209.
10. Amis ES, Cronan JJ, Pfister RC. *Urology*. 1985; 26: 82-88.
11. Adel K Afifi. Illustrated encyclopedia of human anatomic variation; organ systems: Urinary systems Kidney, ureters, bladder and urethra.