



INCIDENCE OF UNILATERAL BIFID HUMAN FOETAL URETER WITH ITS EMBRYOLOGICAL AND CLINICAL SIGNIFICANCE

Anatomy

Dr. Roli Joshi	MD Anatomy, Assistant Professor, Department of Anatomy Saraswati Medical College
Dr. Deepa Deopa*	MD Anatomy, Associate Professor, Department of Anatomy Government Medical College Haldwani *Corresponding Author
Dr. A K Singh	MS Anatomy Professor and Head, Department of Anatomy Government Medical College Haldwani
Dr. Vinod Kumar	MS Anatomy Professor and Head of Department Department of Anatomy Saraswati Medical College

ABSTRACT

Most common type of congenital anomalies of urinary system is the abnormality of renal collecting system. One such variation is duplication of ureter. It may be complete or incomplete and often accompanied by various complications and with other congenital anomalies. In study of 98 normal foetuses incidentally we found 5 foetuses having unilateral bifid ureter, Male (2): Female ratio (3) and Right (3): Left (2). Anomalous sides have double while normal side having single limb. Both limbs joined at certain distance before entry to urinary bladder wall. In histological slides double lumen on anomalous side and single lumen on another side is seen. The study of bifid ureter is useful for Nephrologists and gynecologists for abdominal and pelvic surgeries.

KEYWORDS

Bifid ureter, Pelvic surgeries, congenital anomalies

INTRODUCTION

Human kidneys have single ureter, having thick-walled muscular cylindrical tube of 25-30cm length in adults. It continuous superiorly with funnel shaped structure called renal pelvis, inferiorly it opens into the lateral angle of the base of the urinary bladder for conveying of urine. Nearly 10% of all human beings are born with a congenital abnormality of the urogenital system. This anomaly takes special importance because they remain asymptomatic or clinically present as pyelonephritis or urinary lithiasis. Even information of this kind of variation is very useful for radiological diagnosis Ureter develop from ureteric bud which penetrates the metanephric tissue [1]. Ureteric duplication may be partial or complete. Complete duplications are less common where both ureter drain one kidney and have separate orifices into the urinary bladder known as complete duplications. Incomplete duplication is known as bifid ureter. Incomplete ureter is three times more common than complete ureter and also known as bifid ureter **Lowsly et al (2)**.

The presence of ipsilateral duplicated ureter is believed to be the result of premature branching of the ureteric bud during prenatal development. However, sometimes the ureteric bud may divide before penetrating the meta-nephric tissue, thus giving rise to a double ureter having a single opening into the bladder known as incomplete duplication of ureter **Sadler (3)**.

MATERIAL AND METHOD

We have collected 98 aborted human foetuses (45 female, 53 male) of gestational age 10 weeks to 40 weeks from obstetrics and gynecology department of **DR SUSHILA TIWARI MEMORIAL HOSPITAL associated with GOVERNMENT MEDICAL COLLEGE HALDWANI** with due regards on ethical ground. Embalming (10% Formalin) was done soon after procurement. Gestational age was taken from hospital records by patient's USG and it is correlated with Crown rump length taken manually. During Dissection incidentally we found 5 foetuses having unilateral bifid ureter. We have recorded the length of ureter of both side anomalous and normal by using digital vernier caliper and have taken the tissue for histological examination.

RESULT

Firstly the gestational age was which was taken by hospital record was correlated with crown rump length taken manually in **FIGURE 1**.



FIGURE 1- MEASUREMENT OF THE CROWN RUMP LENGTH IN FOETUS.

After dissecting the urinary tract, both kidney with their ureter and path up to bladder are taken out from foetus for clear vision and measurement, in **FIGURE 2** we can easily see how the normal fetal urinary tract looks like.



FIGURE 2- SHOWING NORMAL URETER OF BOTH SIDE AND MEASUREMENT WITH VERNIER CALIPER OF 32 WEEK FOETUS.

Both limb of ureter emerging out from the pelvis of kidney as a separate entity. The upper limb was emerging from upper end of hilum and lower limb taking origin from lower limit of hilum. Both limb runs parallel to each other in lower abdomen and joins to form single common ureter in pelvic cavity before entry to urinary bladder. The hilum of anomalous side was relatively longer and dilated than the hilum of normal side. This anomaly is found in both female and male foetus of different gestational ages as seen in **FIGURE 3 AND FIGURE 4**. The ureter of the other side had single normal ureter with normal hilum. Kidneys of both sides were found to be normal in place with normal shape and size.

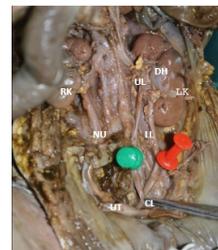


FIGURE 3- LEFT SIDED BIFID URETER SHOWING UTERUS (UT), UPPER LIMB (UL), LOWER LIMB (LL) COMMON LIMB (CL) AND DILATED HILUM (DH) WITH NORMAL RIGHT KIDNEY (RK) AND RIGHT URETER (RU) IN 31 WEEK OF FEMALE FOETUS.

Among 98 fetuses of both sexes we have found total 5 fetuses having anomaly of unilateral bifid ureter. Which is more commonly seen in females on left side. We have taken the parameter of both upper limb and lower limb and the point of joining to form common limb till entry to urinary bladder we have also taken the length of normal sided ureter as shown in **TABLE 1 AND FIGURE 4.**

We did not found any other associated congenital anomaly in any of our cases.

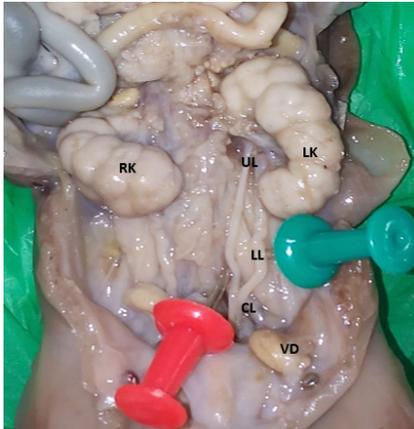


FIGURE 4- LEFT SIDE BIFID URETER SHOWING VAS DEFERENS (VD), UPPER LIMB (UL), LOWER LIMB (LL) AND COMMON LIMB (CL) IN 24 WEEK OF MALE FOETUS

TABLE 1- SHOWING MORPHOMETRY OF BIFID URETER AND ITS RELATION WITH NORMAL URETER

CASE	GA (Wks)	GENDER	DUPLICATION SIDE	LENGTH OF UPPER LIMB (cm)	LENGTH OF LOWER LIMB (cm)	LENGTH OF URETR AFTER UNITING OF BOTH COMMON LIMBS (cm)	LENGTH OF NORMAL URETER (cm)
1	16	FEMALE	LEFT	2.3	2	0.6	3.1
2	18	FEMALE	RIGHT	2.6	2.3	0.8	3.5
3	24	MALE	LEFT	3.4	3.2	0.9	4
4	31	FEMALE	LEFT	4.8	4.5	1.2	5.7
5	34	MALE	RIGHT	5.2	5	1.3	6.2

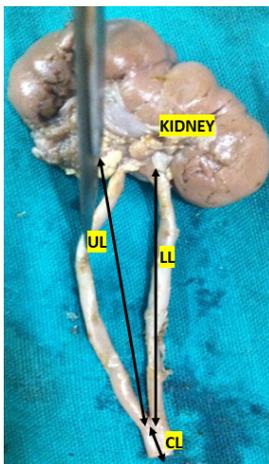


FIGURE 4- MEASUREMENT OF LIMBS

HISTOLOGICAL FEATURES

We have taken Cut section of kidney at the region of pelvic region containing bifid ureter and normal ureter of normal side. Tissues were stained with **HEMATOXYLIN AND EOSIN** stain and histological

features were seen under binocular microscope. Histological slide of normal ureter in **FIGURE-5** shows irregular star shaped lumen having arborvitae pattern with extensive transitional epithelium, underdeveloped lamina propria, developing musculature with inner longitudinal and outer circular coat with underdeveloped connective tissue surrounding it. This shows the normal pattern of developing fetal ureter.

While the histological slide of bifid ureter in **FIGURE 6** is quite different. The slide

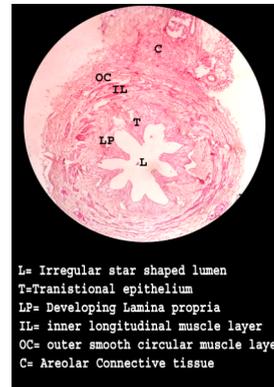


FIGURE 5- SHOWING THE URETER OF NORMAL SIDE

Shows first ureter (U1) having lumen somehow enlarged irregular shaped, having its own 5-6 layers of transitional epithelium, with less developed lamina propria. Lumen of Second ureter (U2) has triangular shape and again its own 7-8 layers of transitional epithelium, with less developed lamina propria. But both the lumen is

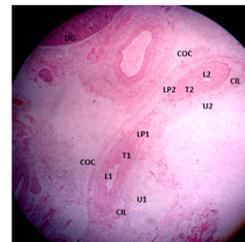


FIGURE 6- BIFID URETER SLIDE OF PELVIC REGION WITH FIRST URETER (U1) HAVING LUMEN (L1), TRANSITIONAL EPITHELIUM (T1), LAMINA PROPRIA (LP1) AND SECOND URETER (U2) HAVING LUMEN (L2), TRANSITIONAL EPITHELIUM (T2), LAMINA PROPRIA (LP2) WITH COMMON INNER LONGITUDINAL MUSCULAR COAT (CIL), COMMON OUTER SMOOTH MUSCLE COAT (COC) AND DEVELOPING GLOMERULI (DG)

enclosed with common inner longitudinal and outer smooth muscle coat. Second ureter is showing less developed as comparatively then first and both ureter showing less developing signs then normal sided ureter. As the section is taken from pelvic region some developing glomeruli of kidney can be seen in slide.

For the conformation of its character we have also taken longitudinal section in **FIGURE 7** of ureter. Two lumens which were lined by transitional epithelium separately and layered by common muscular tissue were seen. Both lumens running parallel to each other .which denotes two muscular lumen of bifid ureter.

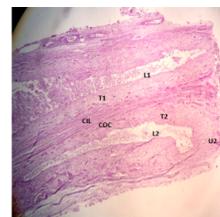


FIGURE 7- LONGITUDINAL SECTION OF BIFID URETER SLIDE WITH FIRST URETER (U1) HAVING LUMEN (L1), TRANSITIONAL EPITHELIUM (T1), AND SECOND

URETER (U2) HAVING LUMEN (L2), TRANSITIONAL EPITHELIUM (T2), WITH COMMON INNER LONGITUDINAL MUSCULAR COAT (CIL), COMMON OUTER SMOOTH CIRCULAR MUSCLE COAT (COC)

DISCUSSION

The reported incidence of bifid ureter in general is 0.5% to 3.0% **Tohno S et al 2008**, 1% by **kulkarni 2012**. **Russel et al (2000)** found, 3% excretory urograms showing ureteral duplication on routine examination. during our study we found it 5.01%. The incidence of bifid ureter is more common in females in our study and twice by **Rege VM et al 1986**. It is three times more common than complete duplication **Das et al 2001**. Duplication of ureter is more common on right side **Rege VM et al 1986** and **Khin PP 2010**, opposite to our study.

In comparison by our foetal study to cadaver, Y-shaped incomplete ureter on left side which was opening through a single opening on the posterior surface of the urinary bladder by **Prakash et al 2011**, **kulkarni et al 2014** and **Reddy 2014**. **Prakash et al 2011**, **Ansari et al, 2013**, **Reddy et al, 2014** saw left sided bifid ureter of male cadaver, without any gross and congenital abnormalities. Bifid ureter had been detected in the past in association with various congenital anomalies and defects. Sometimes, there are features of reflux and as a result, urinary calculi (**Giannokopoulos et al, 1994**), pyelonephritis and uretero-hydronephrosis (**Chalouhy et al, 1992**) develops. These complications manifest with symptoms and immediate life saving surgical interventions are needed. The risk of infection in children with bifid ureter increases twenty fold, it is prone to urinary tract infection either from obstruction of ectopic ureter, calculi or vesicoureteric reflux **Das et al 2001**. **Gomula A 1983**, **Petersen R o 2008**, told that bifid ureter is having same histological features as normal ureter.

CONCLUSION

In our study the incidence of bifid ureter is 5.10% (5 cases in 98 foetuses), more common in females and on left side. Importance of this study is for radiological investigations and surgical interventions for nephrologists. Though duplication of ureter may remain asymptomatic but it has a wide clinical significance especially in presence of, urogenital or gynecological surgeries or laparoscopic procedures where it may get injured if not diagnosed earlier. It might be detected during routine investigations or incidental findings at autopsy. Bifid ureter may remain asymptomatic in life and create academic interest.

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