

Complete Unilateral Ureteral Duplication Encountered during Cadaveric Dissection and its Embryological Basis - A Case Report

Raviprasanna KH^{1*} and Vinay G²

¹Associate Professor, Department of Anatomy, Mamata Medical College, Rotary Nagar, Khammam, Telangana, India

²Professor and HOD, Department of Anatomy, Mamata Medical College, Rotary Nagar, Khammam, Telangana, India

***Corresponding Author:** Raviprasanna KH, Associate Professor, Department of Anatomy, Mamata Medical College, Rotary Nagar, Khammam, Telangana, India.

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Abstract

Duplication of renal collecting system is one of the common anomalies of urinary tract. The ureteric bud is an outgrowth from the caudal part of the mesonephric duct. The ureteric bud gives rise to the ureter, renal pelvis, major and minor calyces and collecting tubules. Ureteral duplication can be classified as complete or incomplete. Complete double ureters which open into the urinary bladder separately are rare. Two ureteral buds from mesonephric duct may be the reason for complete duplication. We report a case of unilateral complete ureteral duplication in a female cadaver on the right side. During routine dissection of abdomen for demonstration, we observed double ureters arising from two poles in the hilum of the right kidney. The ureters were traced into the urinary bladder to observe that both ureters opened separately. Patients with double ureters are more prone for urinary infection and calculi. This case report is an addition to the literature and will be helpful for the surgeons. The probable embryological reasons for the formation of a double ureters will be discussed.

Keywords: Double Ureter; Ureteric Bud; Premature Splitting; Infection; Calculi; Duplication; Ureter; Urinary Bladder

Introduction

The most common renal congenital anomalies include duplication of ureters with an incidence of 0.7 - 4% according to Kawahara, *et al.* [1] and 1 in 160 individuals according to Campbell MF and Harrison JH [2]. Caudal part of mesonephric duct gives rise to an outgrowth called ureteric bud. The ureter, the renal pelvis, the major and minor calyces, and collecting tubules are the derivatives of the ureteric bud. The ureter begins as a downward continuation of renal pelvis and lies on psoas major and enters pelvic cavity by crossing in front of bifurcation of common iliac artery. In the pelvic cavity opposite to ischial spine, the ureter turns forward and medially to reach the base of the urinary bladder and opens in the cavity of the bladder at the lateral angle of its trigone as ureteric orifice. Ureteral duplication can be grouped as complete or incomplete duplication (Bifid ureter). Premature division of ureteric bud during development of renal system can give rise to duplication of ureter [3]. Two patients with bilateral ureteral duplicated systems - one with complete and the other with incomplete duplication - and a solitary calculus obstructing one limb of the duplicated systems in each patient was reported by Migliari and Usai [4]. People with duplication of ureter will be usually asymptomatic or they may present with clinical manifestations such as urinary stones, ureterocele, vesicoureteral reflux, urinary tract infection and obstructive uropathy [5]. Presence of ureteral duplication can act as a severe risk factor and might get injured while conducting any open or laparoscopic surgical procedures in the abdomen and pelvis [6].

Materials and Methods

The present variant related to complete double ureter was observed in a female cadaver which was used to educate undergraduate MBBS students in the Department of Anatomy, Mamata Medical College, Khammam. The above cadaver was fixed in 10% neutral buffered formalin. The gross dissection of abdomen was done to expose retroperitoneal organs after reflecting the intestines and peritoneal folds in the abdomen by avoiding damage to underlying structures. Both ureters were exposed and traced from renal pelvis to the opening into the urinary bladder. The anomalous division of ureter into two complete ureters were observed.

Results

A unilateral complete double ureter was encountered on the right side as seen in the figure 1, during routine dissection of abdomen region in a female cadaver in the Department of Anatomy, Mamata Medical College, Khammam which was used to educate medical undergraduate students. apart from the double ureter, the shape and size of both kidneys were normal. The ureter draining the upper part of kidney appeared longer and slender which was arising from upper part of hilum of the right kidney and lower part of hilum gave rise to second ureter as seen in the figure 2. Duplicated ureters on right side passed parallel to each other in front of right common iliac vessels and crossed the lower border of broad ligament of uterus to enter the musculature of urinary bladder separately. Two separate orifices of the duplicated ureters on the right side and single orifice on the left side along the lateral margin of the internal trigone can be observed in figure 3.

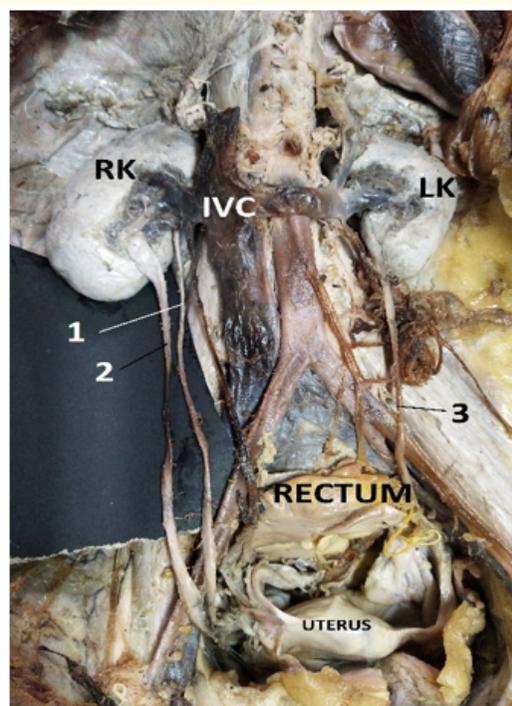


Figure 1: Dissection of the abdomen and pelvis to expose kidneys, ureters and structures in pelvis. On right side, double ureters are observed. [RK- Right kidney, LK- Left kidney, IVC- Inferior vena cava, 1- Ureter arising from upper part of right kidney, 2- Ureter arising from lower part of right kidney, 3- Ureter arising from left kidney].

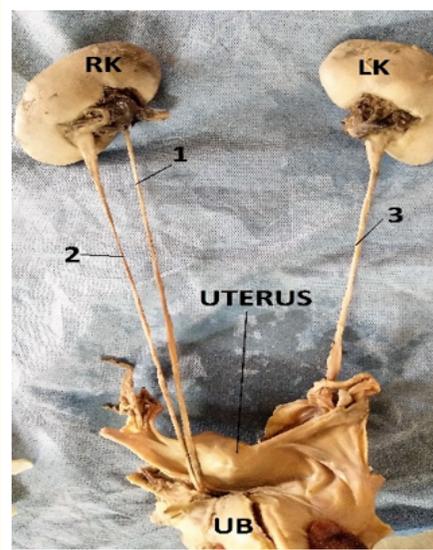


Figure 2: Showing double ureters from right kidney, single ureter on left side. [RK- Right kidney, LK-Left kidney, IVC- Inferior vena cava, 1- Ureter arising from upper part of right kidney, 2- Ureter arising from lower part of right kidney, 3- Ureter arising from left kidney, UB- Urinary bladder].

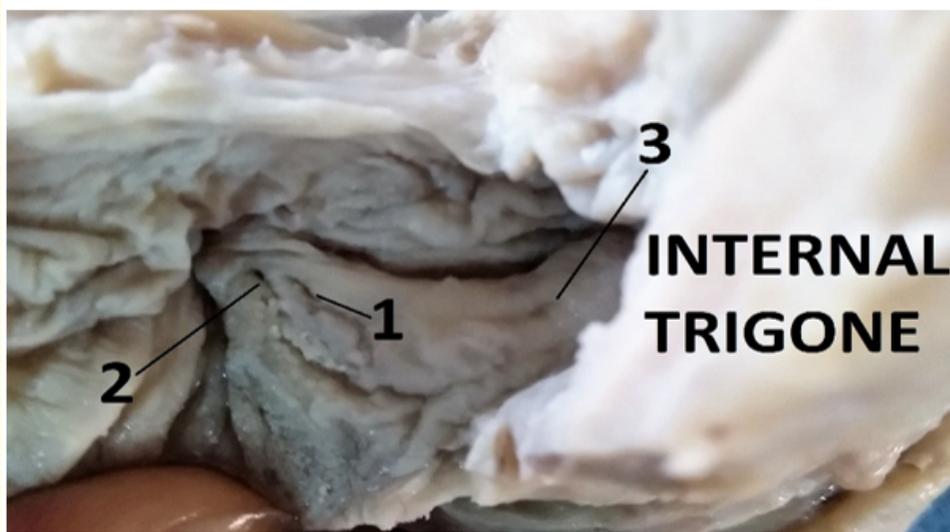


Figure 3: Dissection of the urinary bladder to expose ureteral orifice opening into the bladder. [1- Ureteral orifice of accessory ureter arising from upper part of right kidney, 2- Ureteral orifice of ureter arising from lower part of right kidney, 3- Ureteral orifice of the ureter arising from left kidney].

Discussion

Double ureters arising from a single kidney is one of the congenital anatomical variation of urinary system where the ureters may join before entering urinary bladder to form partially duplicated ureter or remain fully separated till, they open into urinary bladder as ureteral orifice and create a complete duplication, as in the present case. In a study of 5196 excretory urograms performed on both children and adults, duplex systems were present in 95 (1.8%) patients, bilateral in 16 (0.3%) patients and complete duplication was demonstrated in < 1/3 of the duplicated systems [7]. Unilateral duplication of ureter was observed in up to 0.8% in autopsy studies, while bilateral duplication was found in 0.16 - 0.32% according to Peppas DS., *et al* [8]. 2:1 female predominance was reported by William A., *et al.* for all variants of renal duplications [9]. Giannokopoulus X., *et al.* reported that presence of double ureters may remain asymptomatic for the whole life of a person or this condition is often complicated by recurrent urinary tract infection and calculi [10]. Whitaker and Danks reported that the disturbances during early development can cause bifid or double ureter which may be the result of an autosomal dominant gene which is of low penetrance i.e. it fails to manifest in some patients [11]. Duplication of ureter can be graded as two types a) Complete - when two ureters drain their specific areas and open individually into the urinary bladder as seen in the present case, b) Incomplete - wherein the two ureters join together and become one before opening into the urinary bladder. There may be unilateral or bilateral duplication. The complete duplication may be due to early splitting of the ureteric bud near to the mesonephric duct where the double ureters enter the internal trigone of the urinary bladder as separate openings. The incomplete or bifid ureter is due to the premature splitting of the ureteric bud before it reaches the nephrogenic cord [12]. This explanation gives an insight towards the anomaly related to the present case where the ureteric bud is split near to its origin from Wolffian duct to give rise to complete duplication of the ureter on the right side or there may be origin of two ureteric buds from single mesonephric duct which can also give rise to double complete ureters as in present case. Fufezan O., *et al.* reported that partial duplication is observed in metanephric tissue that has not separated fully, but complete duplication may be due to result of two distinct ureteric buds. Complete duplication is observed in approximately one third as common as partial duplication. Weigert Mayer law is observed in complete ureteral duplication cases [13]. Alexandra V., *et al.* presented case of accidental detection of complete unilateral duplication of the left ureter derived from single renal parenchyma while operating a 51-year-old Caucasian female for an intersphincteric resection for low rectal cancer [14]. Selahattin Çalışkan., *et al.* reported a case of unilateral complete ureteral duplication with ureterocele formation in a 41-year old woman presented with abdominal pain. The ureterocele sometimes prolapsed into the urethra and resulted in bladder outlet obstruction with acute retention of urine [15]. Ahmed Jalal Alsayyad reported a case of an adult male patient with bilateral complete duplication of the ureters, with a single stone simultaneously obstructing each of the four ureteral limbs [16]. These types of congenital abnormalities constitute a major risk-factor of accidental ureteral injury during any operations in the abdomen and pelvic region and these anomalies should be given at most importance by surgeons to avoid any untoward complications.

Conclusion

Complete duplication of ureter can be understood by knowing the changes taking place during embryological development. Identification of any abnormalities during cadaveric dissection indicates that the effect of abnormality is minimal in leading a normal life or may not be detected. Vesicoureteral reflux and recurrent urinary tract infections will be common symptoms in adults with duplication of ureters.

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Conflict of Interest

Nil.

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