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UNILATERAL BIFID URETER ACCOMPANIED BY ABNORMAL RENAL VESSELS: A CASE STUDY

Anatomy

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ABSTRACT

Background: Ureteral duplication is the most prevalent form of congenital abnormality within the urinary system. Congenital anomalies account for approximately 40% of urinary system disorders. Ureter duplication may manifest as either a complete or an incomplete form. Complete ureteral duplication, a less common condition, affects approximately 1 in every 160 people and entails each ureter independently draining urine to the bladder. In contrast, incomplete duplication, referred to as a bifid ureter, was observed during routine abdominal dissection in the Department of Anatomy during the first year of MBBS studies. A case involving a 55-year-old male revealed a unilateral left-sided bifid ureter accompanied by two accessory renal arteries alongside the primary left renal artery. The dissected specimen was documented through photographs. In this instance, the left bifid ureter merged with the right ureter before entering the urinary bladder normally. The accessory renal vessels originated from: a) the abdominal aorta beneath the left inferior phrenic artery; b) another arose at the point where the inferior mesenteric artery (L3) branches off from the abdominal aorta. The bifid ureter may result from delayed fusion of the ureteric bud during fetal development, while accessory renal arteries could arise due to an earlier than usual emergence of renal vessels. Both renal veins appeared normal bilaterally, and there were no abnormalities detected in the urinary bladder. These variations typically do not present any symptoms throughout life and are usually identified solely during standard cadaver dissections. Therefore, understanding accessory renal arteries and bifid ureters is crucial for surgeons and nephrologists before performing any surgical interventions.

KEYWORDS

Unilateral Bifid Ureter, Aberrant Renal Artery, Absence of Renal Pelvis.

INTRODUCTION

Congenital anomalies of the urinary system represent approximately 40% of the conditions or disorders affecting the urinary system. The ureter can be duplicated either fully or partially. A bifid ureter refers to an incomplete duplication of the ureter. Total duplication of the ureter is rarer, with each ureter opening separately into the urinary bladder, occurring in 1 in 160 people. [1] In this case, bifid ureters are linked to accessory renal arteries on the left side. [2] Accessory renal vessels were found in 30% of the subjects. A bifid ureter is frequently linked to congenital hydronephrosis, contralateral orthotopic quadrifid ureter [3,4], urinary tract infections, hydronephrosis, and the development of kidney stones. The current case report discusses a unilateral bifid ureter accompanied by an additional renal artery.

MATERIALS & METHOD

During standard abdominal dissection for first-year MBBS students in the Anatomy Department at JN Medical College, Belagavi, we encountered a unilateral left-sided bifid ureter accompanied by left accessory renal arteries in a 55-year-old male cadaver. The specimen was subsequently dissected and photographed for further analysis.

RESULTS

The case presented a unilateral left-sided bifid ureter in the 55-year-old male cadaver, which was linked to the absence of the renal pelvis on the left side and the presence of accessory renal arteries. Specifically:

a) One artery originates at the same level as the inferior phrenic artery from the abdominal aorta and enters the kidney's substance through its upper pole.
b) An additional accessory renal artery arises from the site corresponding to the inferior mesenteric artery and reaches the hilum to supply blood to both the middle and lower anterior sections of the kidney.

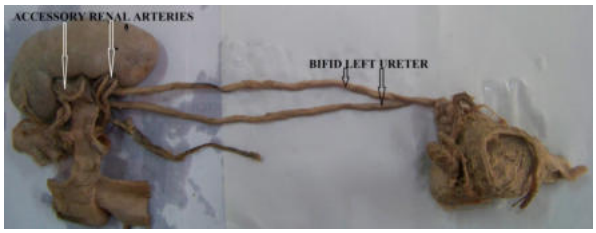

Fig 1: Left-sided accessory renal arteries with bifid ureter

The upper segments of both limbs of the ureter emerge separately from the renal pelvis and descend along the posterior abdominal wall adjacent to the inferior vena cava. The bifid ureter consisted of two limbs, each measuring 15 cm, which converged approximately 5 cm before reaching the urinary bladder, where they opened into a common orifice within it.

DISCUSSION

Accessory renal arteries are prevalent, occurring in approximately 30% of the population. [5] These vessels can originate from the abdominal aorta either above or below the renal hilum or emerge directly through kidney tissue, typically near the upper or lower pole. Accessory renal vessels supplying the lower pole may obstruct the ureter by passing anteriorly and could result in hydronephrosis. These arteries function as end arteries; therefore, if they are ligated or sustain damage, it can cause ischemia in the corresponding kidney segment.

The incidence of bifid ureters ranges from 0.5% to 3%, with a higher prevalence observed in females, 2 to 5 times more common than in males. [6,7] Incomplete duplication occurs three times more frequently than complete duplication, and right-sided ureteral duplication is more common than on the left. [8, 9] A study involving 4,215 autopsies identified 18 cases of incomplete ureteral duplication: two were bilateral incomplete duplicates, seven were unilateral incomplete duplicates, and eight were unilateral complete duplicates. [10]

The inheritance pattern for bifid ureters follows an autosomal dominant trait. The current case describes a unilateral bifid ureter on the left side found in a 55-year-old male cadaver who was asymptomatic throughout his life. About 3% of routine excretory urograms reveal urethral duplication. [11]

Bifid ureters are linked with several conditions, including Goltz syndrome, high cephalic kidney anomalies, pelvic duplication, and unilateral pulmonary hypoplasia. [12, 13, 14] They may also co-occur with complete duplication of the contralateral ureter. Complications that can arise from bifid ureters include urinary tract infections, renal calculi, uretero-ureteric reflux, ureteric stenosis, urinary lithiasis, pyelonephritis, non-functioning renal units, and bronchio-oto-ureteral (BOU) syndrome. [15, 16, 17, 18]

DEVELOPMENTAL BASIS

Accessory renal arteries result from either the persistence of embryonic lateral splanchnic arteries or an early emergence of a segmental artery from the aorta. Bifid ureters develop due to errors during intrauterine formation processes. The ureteric bud originates from the mesonephric duct around the fifth week of gestation, when it

incorporates into the posterior wall of the urogenital sinus along with parts of the Wolffian duct and metanephric diverticulum around week seven. The bud opens laterally above the Wolffian duct and grows into metanephric tissue to form the renal pelvis; this structure subsequently divides into major and minor calyces, completing what comprises the collecting system, including these elements.

If division occurs within somites before they penetrate metanephric tissue, this results in a bifid ureter that may eventually merge into a single structure again. [19] Bone morphogenic factor 4 plays an essential role in organogenesis within the urinary tract, while glial cell-derived neurotrophic factor contributes to growth and elongation of urinary buds; both factors are involved in failed attempts at duplicating urination structures. C-ret acts as a receptor for GDNF and is vital for branching growth within developing ureters; deficiencies here can lead to bifid ureters or renal agenesis. [20]

Additionally, PAX2-a gene crucial for kidney and ureter development-is implicated in causing bifid systems as well as familial vesicoureteric reflux when mutated. [21]

CONCLUSION:

This report presents findings on a unilateral bifid ureter located on the left side, accompanied by an accessory renal artery. It underscores various congenital anomalies associated with urogenital anatomy. Understanding such cases is invaluable for interventional radiologists, transplant surgeons and nephrologists aiming to minimise complications arising during surgical procedures related to the kidneys and urinary tracts.

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