Unilateral Complete Agenesis of Mesonephric Duct Derivatives in an 82-year-Old Male Cadaver: Embryology, Anatomy and Clinical Considerations

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Abstract

Development of urogenital anatomy in the human fetus is the result of a complex interplay between multiple different tissues. The time course of development is well documented and the morphologic outcomes of insults at various time points during development are predictable. We present a cadaveric case of unilateral agenesis of the left kidney, ureter, seminal vesicle, hemitrigone, vas deferens, and epididymis. Failure of development of the mesonephric duct early during embryogenesis, likely between the third and fifth week, caused ipsilateral urogenital organ agenesis.

Introduction

Development of urogenital anatomy in the human fetus is the result of a complex interplay between multiple different tissues. The time course of development is well studied and the morphologic outcomes of insults at various time points during development are predictable. We present a cadaveric case of unilateral agenesis of the left kidney, ureter, seminal vesicle, hemitrigone, vas deferens and epididymis. Failure of these organs to develop likely resulted from an event that occurred between the third and fifth weeks in development.

Case presentation

During dissection of an 82-year-old male cadaver, correlated urogenital anomalies were discovered. The left kidney, ureter, and related vasculature were absent. The left inferior suprarenal artery, usually derived from the left renal artery, arose directly from the aorta, and the left suprarenal and testicular veins emptied into a truncated left “renal” vein (Fig. 1). The right kidney, with three arteries and two veins, was large, with an elongated renal pelvis that drained into an unremarkable ureter.

The gross morphology of the bladder was notable for absence of the left hemitrigone and left ureteric opening (Fig. 2A). Bladder diverticula were present, one on each posterolateral corner, the left being larger (Fig. 2B). The left seminal vesicle, vas deferens, and epididymis were absent. The right seminal vesicle and epididymis were grossly normal, and the right vas deferens patent. Both testes were present, equal in size, and fully descended.

Discussion

A review of the English literature revealed an abundance of reports of renal and genital duct anomalies. Barakat & Drougas1 (13,775 autopsies) and Weiske et al2 (4500 men) reported anomaly frequency in their total samples, but not the existence and type of multiple anomalies in each individual.

Congenital absence of kidney

Unilateral renal agenesis (URA) is most often asymptomatic and usually identified incidental to procedures for other conditions, at autopsy, or cadaveric dissection. URA is reported in 0.06–0.18% of the general population, occurs more often in males (1.4–2.3:1), and is more frequent on the left side (56–78%). The ipsilateral ureter and hemitrigone are usually absent, but as many as 25% of patients with URA have a blind-ending ureter of varying length. Ipsilateral anomalies of genital duct structures are common and affect both
males and females. In males, agenesis or cysts of the seminal vesicle are the most frequently reported condition, followed by anomalies of the vas deferens and epididymis. Many people with URA also have anomalies of the contralateral kidney (30%) and/or ureter (31.8–32%).

The common etiology for URA is failure of one or more components of the embryonic mesonephros to develop properly, due to genetic mutations or unknown etiologies. A rare cause of apparent URA is multicystic renal dysplasia, with regression of the kidney during development, yet scant renal tissue may remain. Most cases have a blind-ending ureter or ectopic insertion with normal vesicoureteral relations. Individuals with URA may have recurrent urinary tract infections, hypertension and renal insufficiency.

**Congenital absence of the vas deferens**

Congenital unilateral absence of the vas deferens (CUAVD) is frequently diagnosed during infertility evaluation or vasectomy procedures. Congenital bilateral absence of the vas deferens (CBAVD) is present in 1–2% of infertile men and 80–90% of men with cystic fibrosis gene mutations (CFTR). The cause of CFTR-related vasal agenesis is failure of canalization of the mesonephric duct (Wolfian duct) followed by regression of the non-cannulated region. Only 10–12% of individuals with CFTR-related agenesis of the vas deferens also have renal agenesis. URA and CUAVD denote a defect of mesonephric duct development before the formation of the ureteral bud at five weeks gestation. Isolated, unilateral absence (CUAVD) occurs in less than 1% of men and is not related to CFTR mutations. CUAVD occurs more frequently on the left (66–73%) and is strongly correlated (76%) with contralateral duct anomalies, including dilated or cystic seminal vesicle, ejaculatory duct obstruction, and epididymis anomalies.

**Embryology**

The embryonic mesonephric duct gives rise to key components of the urinary system in both males and females, as well as internal structures of the reproductive system of the male. Agenesis or dysplasia of one or more components of the mesonephric duct is relatively common and may or may not have clinical consequences. Defects in either the urinary system or the internal reproductive system occur more frequently than unilateral complete agenesis of all mesonephric duct structures.

Congenital absence of the kidney and renal collecting system is most often due to failure in the reciprocal interaction between the ureteric bud, an outgrowth of the distal mesonephric duct, and the metanephric mass before week 5 in utero (Fig. 3A). The ureteric bud typically branches during the 4th week and makes contact a few days later with the neighboring metanephric mass.

Congenital absence of the male genital duct system is frequently due to defects in development of the mesonephric duct proper, which appears early in the 4th week, growing caudally as a solid rod of tissue along the mesonephric ridge (Fig. 3A). It fuses with the urogenital sinus in the developing pelvis and then begins the process of cavitation from caudal to cranial to form a functional tube. In males, the mesonephric duct gives rise to the ejaculatory duct,
seminal vesicle, vas deferens, and the tail and body of the epididymis (Fig. 3B). The head of the epididymis forms separately from mesonephric tubules that must communicate with the adjacent mesonephric duct to form a complete epididymis. Anomalies of development after the 7th week may involve either discrete sections of the mesonephric duct leading to agenesis of individual derivative organs, or the entire duct system with complete unilateral genital duct absence.

**Conclusion**

This cadaver had complete unilateral agenesis of all mesonephric derivatives, without contralateral anomaly aside from a bladder diverticulum near the right hemitrigone. The multiple ageneses in the present case likely stemmed from an early embryologic insult to the left mesonephric duct, prior to week five of development. Ultimately, findings of agenesis in these systems underscore the importance of knowledge of the interplay between tissues during embryogenesis and the possible resulting anatomic anomalies.

**Conflict of interest**

The authors of this manuscript confirm that there is no conflict of interest in submitting this report.

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**Figure 3.** (A) – The ureteric bud, an outgrowth of the distal mesonephric duct, branches before the 5th week of development to contact the metanephric mass. (B) – The mesonephric duct gives rise to the ejaculatory duct, seminal vesicle, vas deferens, and the tail and body of the epididymis, while the head of the epididymis forms separately from mesonephric tubules. (C) – The ultimate configuration of the mesonephric duct derivatives and related organs.

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**Suggested reading**

6. Larsen’s Human Embryology, 5th ed. [Chapter 15] Development of the Urinary System.