Renal and Ureteral Fusion in a Calf with Atresia Ani

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ABSTRACT. A 10-day old male calf exhibited multiple congenital anomalies of the urinary and gastrointestinal tracts, including renal fusion (horseshoe kidney), ureteral fusion, rectovesicular fistula, and atresia ani. In horseshoe kidney, the organs were fused together at the caudal poles. The left kidney and cranial half of right kidney were shrunken, while the remaining lobules were hypertrophic. Ureters were fused cranially and bifurcated caudally. The terminal rectum was narrowed and connected with the bladder. The anus was imperforate. The cause of these anomalies could not be determined.

KEY WORDS: horseshoe kidney, rectovesicular fistula, ureteral fusion.

NOTE  Pathology

Urogenital anomalies are most commonly induced as a consequence of cloacal membrane defects during embryogenesis, and frequently associated with anomalies such as renal fusion, renal dysplasia or agenesis [10]. Renal fusion (horseshoe kidney) is a developmental anomaly of the upper urinary tract in which the caudal poles of the kidneys are linked by an isthmus of parenchyma. In humans, this is the most common urogenital developmental defect, with an incidence ranging from 1 in 350 cases to 1 in 1,800 cases [2]; however, it has been rarely reported in cattle.

A 10-day old male calf was referred to the College of Veterinary Medicine, Kyungpook National University for evaluation of atresia ani. Except for the imperforate anus, there were no remarkable findings during physical examination. Surgical correction of this defect was unsuccessful; the calf was euthanized and necropsied.

At necropsy, the calf had multiple identifiable congenital defects including horseshoe kidney, ureteral fusion, and communication between the bladder and rectum. The horseshoe kidney was located at the sublumbar area. The kidneys were fused together at the caudal poles and had a typical horseshoe shape (Fig. 1). The kidneys were asymmetric in size, with the long axis of the right kidney measuring 11 cm and 7 cm on the left. The left kidney and cranial half of right kidney were small and had roughened, undulating surfaces and a firmly adherent capsule. Mild hydronephrosis was seen at the cranial part of the right kidney. The remaining three lobules of the right kidney were hypertrophic. At the isthmus, there were two lobules; one was hypertrophic and another was hypoplastic. The hilus opened medially on both sides, and the ureters were located posterior to the isthmus. Both sides of the ureter were fused cranially and bifurcated caudally (Fig. 2). The bladder and urethra were within normal limits; however, the terminal rectum was narrowed and communicated with the bladder (Fig. 3).

Microscopically, interstitial nephritis was observed within hypoplastic lobules. Inflammatory cells infiltrated the interstitium within the cortex and underneath the capsule. Several necrotic foci were also observed. Tubules were dilated and filled with inflammatory cells and bacteria. The architecture of the three hypertrophic lobules of the right kidney was considered within normal limits. The isthmus consisted of renal parenchyma, and at this location, adjacent hypertrophic and hypoplastic lobules were separated by thin fibrous tissue (Fig. 4).

Simultaneous congenital defects of the urogenital and gastrointestinal system have been reported in sheep, cattle and goats [1, 5, 7, 9]. While renal fusion is considered the most common developmental anomaly of the urogenital tract [2, 6, 8], its combination with ureteral fusion has not been previously reported. Horseshoe kidneys usually function adequately, although an increased incidence of hydronephrosis, as seen in this case, may be observed [3, 4].

During normal development of the kidney, the metanephros develops within the pelvic region and migrates cephalad to its definitive position, rotating so that the ureter attains its normal orientation. The developing kidneys rotate so that the ureters leave each kidney from its medial aspect and the axes of the kidneys diverge. If the right and left kidneys make contact during the rotation, fusion may occur, generally at the caudal poles. While ureteral fusion, as seen in this case, is previously unreported, we speculate that the ureteral fusion was also brought about as an associated event during formation of the horseshoe kidney.

During embryogenesis, the cloaca begins to be divided into two parts, a dorsal part developing to the rectum and a ventral part to the urogenital sinus. In our case, we suspect that failure of cloaca differentiation may have resulted in the
other identified anomalies (atresia ani and rectovesicular fistula).

REFERENCES