NOTE Anatomy

Morphological Observations of Uterine and Vaginal Duplexes with a Developmental Anomaly at the Vaginovestibular Junction in a Japanese Brown Calf

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ABSTRACT. Since a rare anomaly of the female genital tract was defined as uterine and vaginal duplexes with a developmental anomaly at the vaginovestibular junction, it was morphologically examined in detail in a Japanese Brown calf. The genital tract was completely duplicated from the uterus to the vagina just cranial to the vestibule. At the vaginovestibular junction, a hymenal constriction and an aberrant location of the outer urethral orifice were also observed. These anomalies suggest that an error in the complete fusion of the Müllerian ducts and a failure in the correlated development between the Müllerian ducts and the urogenital sinus occurred in the embryonic stage.

KEY WORDS: Müllerian duct, uterine and vaginal duplexes, vaginovestibular junction.

In mammals, there are large variations in the morphology of the uterus, from a duplex to a simplex uterus, due to the degree of fusion and canalization of the paramesonephric (Müllerian) ducts [10]. In cattle, the type of uteri is classified as uterus bicornis [10]; however, it is often referred to as a bipartite uterus because of the separation by a thin midline septum at the cranial part in the apparent common tract between the horn and cervix of the uterus. Various types of developing disorders of the Müllerian ducts have been reported in cattle [1, 5–7, 9, 11, 12]. Although the white heifer disease is accompanied with abnormal development of the Müllerian ducts, such as segmental aplasia, and is a hereditary condition [6, 8, 12], the incidence of other anomalies is sporadic, and the relationship to infertility has been pointed out [9, 12]. The author encountered a rare anomaly of the female genital tract, namely, uterine and vaginal duplexes with a developmental anomaly at the vaginovestibular junction, and it has not been reported in cattle as far as is known. In this paper, therefore the morphological changes of the malformed female genitalia were examined, and their pathogenesis was discussed from an embryological point of view.

The anomalous Japanese Brown calf was an eleven-month-old female who weighed 200 kg at the time of the postmortem examination. At the time of the physical examination prior to sacrifice under xylazine sedation, urolithiasis was suspected because of dysuria and the attachment of calculus to the pubic hairs. No change was observed on the exterior of the outer genitalia. Data regarding the dam, including health conditions and medical treatment during pregnancy, were insufficient.

At the postmortem examination, the uterus appeared to be completely duplicated at the level of the round ligament, and the intercornual ligament was not detected; on the other hand, purulent nephritis and calculosis were observed at the urine pathway including the renal pelvis, ureter, urinary bladder, and urethra. A congenital anomaly of the female genital tract, such as uterus didelphys, was suspected, and the range and degree of the duplication and associated defects were examined in detail after removal of the broad ligaments, the superfluous serosal coats, and the intervening connective tissues between the duplicated regions. The malformed genital tract is shown in Fig. 1. The complete duplications of the uterus and the vagina and the anomalous changes are shown at the vaginovestibular junction including the hymenal constriction (arrows) and aberrant location of the external urethral orifice (arrow head). Ub: urinary bladder; Ut: uterus; Vg: vagina; Vt: vestibule

Fig. 1. Appearance of the malformed genital tract. The complete duplications of the uterus and the vagina and the anomalous changes are shown at the vaginovestibular junction including the hymenal constriction (arrows) and aberrant location of the external urethral orifice (arrow head). Ub: urinary bladder; Ut: uterus; Vg: vagina; Vt: vestibule
duplication of the uterus and the vagina reaching just cranial to the vestibule was observed. The duplicated genital tracts were similar with each other in structure. The boundaries between the horn and cervix of the uterus and between the cervix and the vagina were clearly identified. The internal surface and the wall of the genital tract seemed to be normal in appearance from the uterus to the vestibule. At the level of the vaginovestibular junction, the hymenal ring was extremely constricted, and the external urethral orifice was opened immediately caudal to the divergent portion of the vagina rather than in the dorsal wall of the suburethral diverticulum. The vestibule seemed to be relatively long. No morphological abnormalities were observed at the ovary and the oviduct.

In the present case, there is no doubt that the complete failure of the fusion of the arrested Müllerian ducts in the embryonic period resulted in the complete duplication of the uterus and the vagina. This condition is similar to the original pattern of female genital organs in primitive mammals, such as monotremes and marsupials [10], and is consistent with uterus didelphys with vaginal duplication. Thus, it can be classified as uterine and vaginal duplexes. The constriction of the hymenal ring and the aberrant location of the external urethral orifice were characteristic. The boundary between the vagina and the vestibule observed in these anomalies corresponds to the level at which the Müllerian ducts joined the urogenital sinus in the embryo. Judging from the normal outer genital organ, the primary developmental disturbance does not seem to be derived from the urogenital sinus. Therefore, it is assumed that the arrested state of the Müllerian ducts influences the correlated development of the urogenital sinus, and would have resulted in the malformations at the transition between the vagina and the vestibule.

The Müllerian ducts unite to form a single lumen in the uterine and vaginal region in a 51 mm bovine fetus [2]. This fetal length is compatible with approximately the 180th day of development [4]. It is possible that a disturbance of morphogenesis in the female genital tract occurs due to a dysgenetic agent at the terminal phase [3] in the middle fetal period. The etiology for this anomaly was not identified in this study.

In conclusion, the present rare anomaly in the female genital tract is classified as uterine and vaginal duplexes with a developmental anomaly at the vaginovestibular junction due to an error in the complete fusion of the Müllerian ducts and a failure in the correlated development between the Müllerian ducts and the urogenital sinus.

REFERENCES