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Imaging Characteristics of *Perosomus elumbis* in a Puppy

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ABSTRACT

A 4-day-old, male Poodle dog was presented with dull, depressed and exhausted activity after the birth. On physical examination, the puppy showed arthrogryposis, muscular atrophy and no movement of hindlimbs. Palpation on dorsum revealed an absence of lumbar and sacral vertebrae. On prenatal and postnatal radiography, lumbar vertebrae, sacrum and coccygeal vertebrae were not visualized. On ultrasonography, bilateral kidney and urinary bladder were observed. On computed tomography, there were no apparent abnormalities in the forelimbs, cervical vertebrae or head, while lumbar vertebrae, sacrum and coccygeal vertebrae were not observed. At necropsy examination, the liver, stomach, intestine, kidney and urinary bladder were normal. This congenital anomaly was consistent with *Perosomus elumbis*. *Perosomus elumbis* in dogs is a rare condition of unknown etiology. In this report, *Perosomus elumbis* was evaluated with radiography, ultrasound and computed tomography.

(Key words: congenital anomaly, *Perosomus elumbis*, dog, radiography, CT)

INTRODUCTION

Perosomus elumbis is a lethal congenital anomaly characterized by agenesis of lumbar, sacral and coccygeal vertebrae. Concurrent hindlimb arthrogryposis and muscular atrophy are common in affected animals due to lack of innervation (Jones, 1999; Amaral *et al.*, 2012). Other abnormalities may also be observed, such as atresia ani, urogenital tract defects, shortening of intestine, cerebral aplasia, asymmetric ribs, and anomalies of thoracic vertebrae (Agerholm *et al.*, 2014; Amaral *et al.*, 2012; Gerhauser *et al.*, 2012; Son *et al.*, 2008). *Perosomus elumbis* has been reported in swine, sheep, goats and dogs and more commonly in cattle. Investigations of *Perosomus elumbis* during recent years suggest possibilities of genetic etiology or fetal viral infection (Agerholm *et al.*, 2014; Karakaya *et al.*, 2013), though, the accurate etiology of *Perosomus elumbis* has not been understood (Agerholm *et al.*, 2014; Amaral *et al.*, 2012; Gerhauser *et al.*, 2012; Jones, 1999; Karakaya *et al.*, 2013; Lee *et al.*, 2006; Son *et al.*, 2008). The present report describes a case of newborn dog showing congenital defect of *Perosomus elumbis*.

CLINICAL CASE

A 4-day-old, male Poodle dog was presented with dull, depressed and exhausted activity after the birth. It was one of a litter of three puppies and the other puppies were normal. On physical examination, the puppy showed arthrogryposis, muscular atrophy and no movement of hindlimbs. Palpation on dorsum revealed an absence of lumbar and sacral vertebrae (Fig. 1). It could be fed orally and the defecation and urination were normal.

The radiographic images of maternal radiograph before the birth and post-natal radiograph were evaluated (Fig. 2). On the maternal radiograph before the birth, three fetuses were identified and the lumbar vertebrae were not observed in one of the fetuses. On the postnatal radiographs of the puppy, the absence of lumbar vertebrae, sacrum and coccygeal vertebrae was identified. The cervical and thoracic vertebrae and pelvis were normally observed.

The liver, gall bladder and urinary tract were evaluated with ultrasound (Fig. 3). The liver was observed with homogeneous echogenicity and anechoic gall bladder was identified. Bilateral kidneys were found with hypoechoic medullary tissue and echoic cortical tissue. Anechoic urinary bladder was seen normally at the ventral side to the kidney.

The patient was dead at 5 days after the birth and the computed tomography (CT) scanning of whole body underwent

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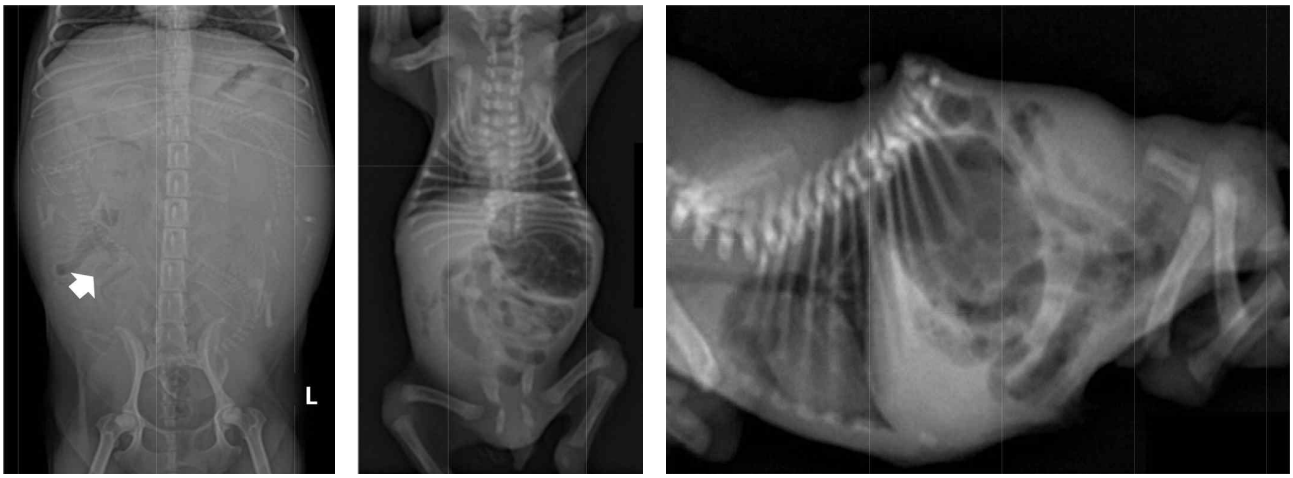
(A) (B)

Fig. 1. Gross images of lateral (A) and dorsal (B) aspect of whole body. Note the end of thoracic vertebra (arrowhead) and arthrogryposis of hindlimbs (arrow).



(A) (B) (C)

Fig. 2. Ventrodorsal view of maternal radiograph before the birth (A). Three fetuses were identified, and the lumbar vertebrae were not observed in one of the fetuses (arrow). Dorsoventral (B) and lateral (C) view of postnatal radiographs. The absence of lumbar vertebrae, sacrum and coccygeal ver- tebrae was identified. The cervical and thoracic vertebrae and pelvis were observed.

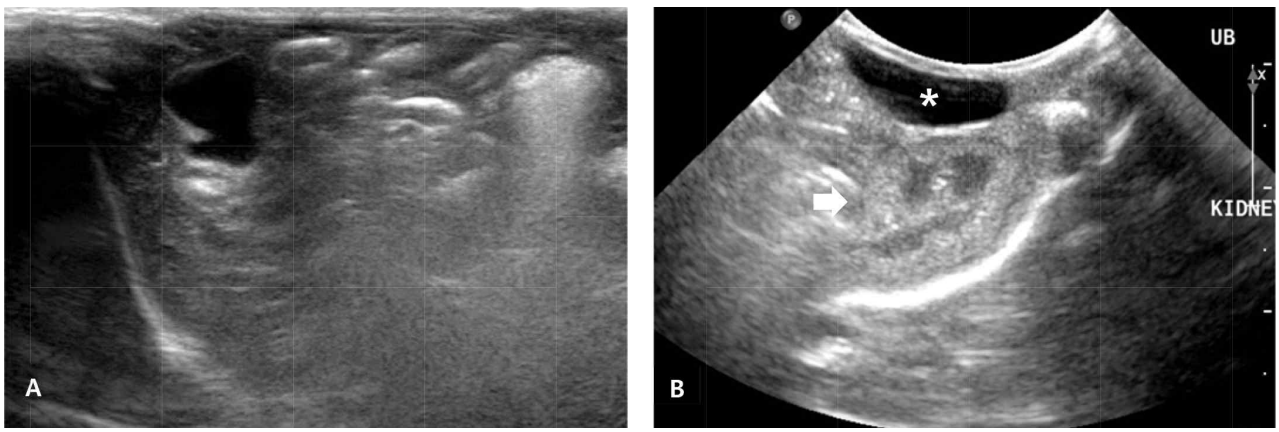


Fig. 3. Liver and gallbladder (A). Hypoechoic medullary tissue and echoic cortical tissue of a sagittal view of the kidney (arrow). Anechoic urinary bladder was seen (asterisck) (B).

right after the death. On the bone window, sagittal CT images of whole body and 3-dementional reconstruction CT images of skeletal system (Fig. 4) revealed no lumbar vertebrae, sacrum and coccygeal vertebrae. No apparent abnormalities were observed in the forelimbs, cervical vertebrae or head. Small amount of intestinal gas were seen, while visceral organs were not identified clearly because of lack of abdominal fat.

The necropsy was performed. The stomach, liver and kidney were normal. Any defects were not observed in digestive system including anus, while the genital organs were not identified clearly.

DISCUSSION

Perosomus elumbis is fairly common in the calf compared to other animals, and is important in cattle because it is closely relative to dystocia that need caesarean operation (Son *et al.*, 2008; Tiwari *et al.*, 2012). In dogs, only few cases have been reported (Amaral *et al.*, 2012). As described in piglet (Jones, 1999) and in dogs (Amaral *et al.*, 2012), only one litter can be affected while the other littermates were normal. In this report, one of three fetuses was affected and the other two puppies were normal.

Concurrent anomalies are common. Atresia ani or unilateral renal agenesis are the most common malformations of soft tissue (Jones, 1999). Visceral defects may occur due to disturbed development of the embryonic back (Agerhoim *et al.*, 2014). In a study, they mentioned that *Perosomus elumbis* in dogs is more similar with that in sheep than cattle, because of more frequent occurrences of visceral abnormalities and urogenital agenesis (Amaral*et al.*, 2012). In this case, there were no gastrointestinal abnormalities such as shortening of intestine or atresia ani. Bilateral kidneys and urinary bladder were seen normally while genital organs were not seen clearly.

Affected animals with *Perosomus elumbis* usually were the state of stillborn before the birth, and even though they had been born they were euthanized because of poor prognosis (Amaral *et al.*, 2012; Gerhauser *et al.*, 2012; Karakaya *et al.*, 2013; Lee *et al.*, 2006; Son *et al.*, 2008). The most severe form of *Perosomus elumbis* is associated with spina bifida or cerebral aplasia (Gerhauser *et al.*, 2012). In this case, the puppy was dead naturally at five days after the birth, however, unfortunately the reason of death was not clearly identified.

Although there was no clear etiology of *Perosomus elumbis*, some possibilities were suggested in recent studies. It might be related to malformation or improper migration of the neural tube during the tail budding stage, accompanied by partial agenesis of caudal spinal cord (Jones, 1999; Son *et al.*, 2008). In a study, they suggested that a viral infection of bovine viral diarrhea virus might contribute to development of *Perosomus elumbis* triggering chromosomal mutations and control of gene expression (Karakaya *et al.*, 2013). In a previous study, they attempted to investigate pedigree examination to know if *Perosomus elumbis* is inherited in Holstein calf and suggested more

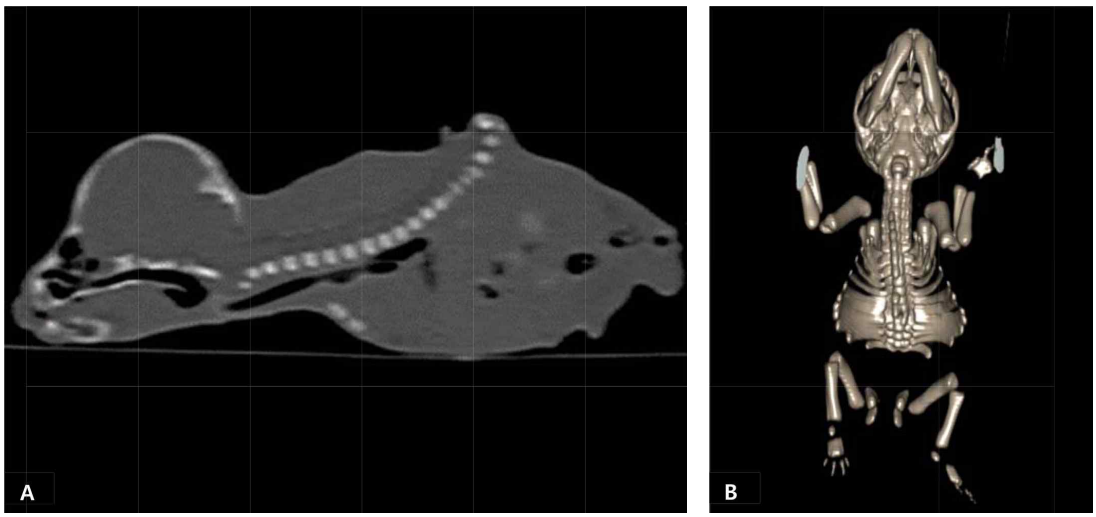


Fig. 4. Bone window, sagittal CT image of whole body (A) and 3-dementional reconstruction CT image of skeletal system (B). There were no lumbar vertebrae, sacrum and coccy- geal vertebrae. There were no apparent abnormalities in the forelimbs, cervical vertebrae or head.

than one mutant allele were involved (Gerhauser *et al.*, 2012). A previous report described the *Perosomus elumbis* focused on pathologic information in a poodle dog (Amaral *et al.*, 2012), which is the same breed in this case report. Even though, it is difficult to evaluate of the breed predisposition in dogs.

In conclusion, a puppy was presented with congenital deformity consistent with *Perosomus elumbis*. This is the first report describing imaging characteristics of *Perosomus elumbis* in a dog.

REFERENCES

Agerholm JS, Holm W, Schmidt M, Hyttel P, Fredholm M and McEvoy FJ. 2014. *Perosomus elumbis* in Danish Holstein cattle. BMC Vet. Res. 10:227.

Amaral CB, Romao MAP and Ferreira AMR, 2012. *Perosomus elumbis* in a puppy. J. Comp. Path. 147:495-498.

Jones CJ, 1999. *Perosomus elumbis* (vertebral agenesis and arthrogryposis) in a stillborn Holstein calf. Vet. Pathol. 36: 64-70.

Gerhauser I, Geburek F and Wohlsein P. 2012. *Perosomus elumbis*, cerebral aplasia, and spina bifida in an aborted Thoroughbred foal. Res. Vet. Sci. 92:266-268.

Karakaya E, Alpay G, Yilmazba-Mecitoglu G, Alasonyalilar-Demirer A, Akgul B, Inan-Ozturkoglu S, Ozyigit MO, Seyrek-Intas D, Seyrek-Intas K, Yesilbag K, Gumen A and Keskin A. 2013. *Perosomus elumbis* in a Holstein calf infected with bovine viral diarrhea virus. Tierarztl. Prax. Ausg. G. Grosstiere. Nutztiere. 41:387-391.

Lee Y, Choi H, Chang D, Eom K, Yoon J, Choi M, Lee K, Yeon S, Lee H, Won C and Lee H, 2007. Imaging diagnosis - *Perosomus elumbis* in a Korean calf. Vet. Radiol. Ultrasoud. 48:30-31.

Pandey AK, Singh G, Bugalia NS, Kumar S and Syamsunder. 2012. Dystocia due to *Perosomus elumbis* with *Schistosomus reflexus* in a buffalo. I.J.A.R. 33(1):88-89.

Son JM, Yong HY, Lee DS, Choi HJ, Jeong SM, Lee YW, Cho SW, Shin ST and Cho JK, 2008. A Case of *Perosomus elumbis* in a Holstein Calf. J. Vet. Med. Sci. 70(5):521-523.

Tiwari SK, Kashyap DK, Giri DK and Dewangan G. 2011. Vet. World. 4(11):515-516.

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