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of Tracheal Collapse in A Calf**

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Clinical, radiographic and bronchoscopic findings of tracheal collapse in a calf

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ABSTRACT: A six-day-old calf was presented to the Firat University Veterinary Teaching Hospital with a history of wheezing (noisy respiration) and dyspnea that worsens over exercise and drinking. The calf shown upper respiratory distress symptoms including extended head and neck, dilated nostrils, severe inspiratory stridor with characteristic goose-honk cough, and exophthalmos. Upon these findings, upper airway obstruction was suspected and cervical-thoracic radiographs and bronchoscopy were decided to be performed focusing to obtain detailed visualization of the upper respiratory tract. Thoracic radiograph, a significant tracheal lumen narrowing was visible at the area of the thoracic inlet, beginning from the caudal cervical region (C5) and extending to the cranial thorax (T1). Also, severe dorsoventral narrowing was detected, approximately 15 cm after entering the tracheal lumen by the bronchoscope. A diagnosis of tracheal collapse was established based on clinical, radiographic, and bronchoscopic findings. It is important to remember that tracheal collapse should be considered in the differential diagnosis of calves that show symptoms from the upper respiratory tract such as extended head and neck, dilated nostrils, severe inspiratory stridor with characteristic goose-honk cough.

Keywords: Calf; inspiratory dyspnea; honking sound cough; tracheal collapse

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CASE HISTORY

Tracheal collapse occurs due to tracheal lumen narrowing most often at a dorsoventral direction or sporadically to lateral-to-lateral direction and is characterized by symptoms compatible to upper respiratory tract disease (Woolums, 2015). Tracheal collapse is an uncommon disease of cattle, and affected animals usually show clinical signs within the first weeks of age (Jelinski and Vanderkop, 1990; Ashworth et al. 1992). Although the etiology is not known precisely, it may be related to cranial thoracic trauma, tracheostomies, roping, dystocia, and congenital defects (Woolums, 2015). This paper aims to present clinical, radiographic, and bronchoscopic findings of tracheal collapse in a calf.

A six-day-old male, Holstein calf, was admitted to the Firat University Veterinary Teaching Hospital with a history of wheezing (noisy respiration), dyspnea that worsens over exercise and drinking and goose-honk cough. The owner reported that the calf was born with dystocia, and it has been started to show respiratory signs after birth that gradually exacerbated. Prior to admission to the Firat University Veterinary Teaching Hospital treatment was initiated by another veterinarian containing of an antibiotic for three days. At presentation the calf showed upper respiratory tract symptoms including extended head and neck, dilated nostrils, severe inspiratory stridor with characteristic goose-honk cough, and exophthalmos. Heart rate was 144 beats/minute (reference interval: 100-140 beats/minute) respiratory rate was 88 breaths/minute (reference interval: 30-60 breaths/minute), and body temperature was 40 °C (reference interval: 38.5-39.5 °C). Hematocrit was 30% (reference interval: 22-33%) and total white blood cell count was $10.3 \times 10^3/\mu\text{L}$ (reference interval: $4.9-12 \times 10^3/\mu\text{L}$). While plasma total protein concentration was decreased (5 g/dL, reference interval: 6.74-7.46 g/dL), plasma fibrinogen concentration (10 g/L, reference interval: 2-7 g/L) was increased. Upon these findings, upper airway obstruction was suspected. To obtain detailed visualization of the upper respiratory tract, radiography and bronchoscopy were scheduled.

Right and left lateral recumbent radiographs of the cervical and thoracal region were performed with digital radiography (CPI CMP 200 DR, Communications & Power Industries LLC., Palo Alto, CA; RAD-14, Varian Medical Systems, Salt Lake City, UT; Canon CXDI-50G, Canon Inc., Tokyo, Japan) selecting appropriate exposure setting (10mA and 70 kV). On the

thoracic radiograph, significant tracheal collapse was visible at the area of the thoracic inlet, beginning at the caudal cervical region (C5) and extending until the cranial thorax (T1) (Figure 1). No rib fractures or an extra-tracheal mass compressing the tracheal lumen were detected. After radiography, bronchoscopic examination was performed to confirm the diagnosis and to evaluate the degree of the tracheal collapse along with other possible intraluminal pathology. For this purpose, the calf was premedicated with an intramuscular injection of xylazine at a dose of 0.05 mg/kg and was restrained in sternal recumbency. A flexible fiberoptic bronchoscope (Karl Storz, Tuttlingen, Germany) was inserted through the right nostril, nasal cavity, pharynx, larynx, and trachea. There was no visible lesion in the nasal cavity, pharynx, and larynx (Figure 2a). However, severe dorsoventral narrowing of the tracheal lumen starting approximately 15 cm after entering the trachea was displayed (Figure 2b). The tracheal collapse extended until the tracheal bifurcation. No additional lesions of the tracheal lumen were detected before tracheal bifurcation.

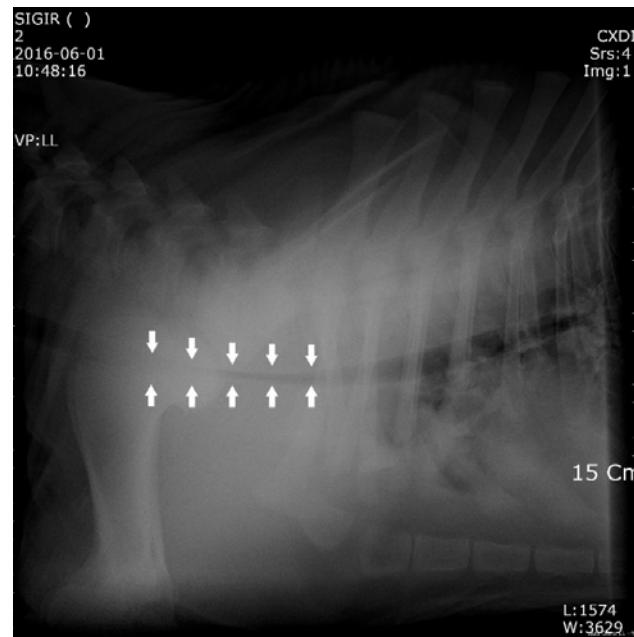


Figure 1. Right lateral thoracal radiography of calf. The severe tracheal collapse was evident between C5-T1 (arrows).

Although there is no grading system for tracheal collapse in calves, a classification system reported for dogs based on the loss of tracheal luminal diameter has long been established (Tappin, 2016). According to this grading system, the tracheal collapse was graded from 1 to 4 point: 25% loss of the tracheal lumen diameter was described as grade 1, 50% loss of the lu-

men was described as grade 2, 75% loss of the lumen was described as grade 3, complete loss of the lumen was described as grade 4. In the present case, the loss of tracheal intraluminal diameter was approximately 75% and was classified as grade 3 tracheal collapse.

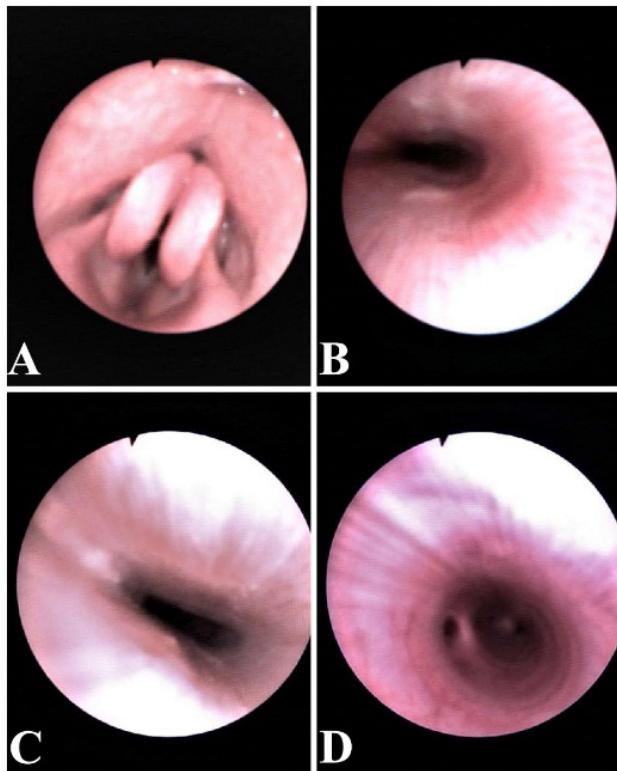


Figure 2. Normal appearance of the larynx (A). The starting point of the tracheal collapse (B) and the most severe collapsed segment of the trachea (C). Normal appearance of the tracheal lumen just before the bifurcation point (D).

DISCUSSION

Tracheal collapse is mostly diagnosed in dogs and can also encounter in cats, goats, and horses (Bell et al., 2003; Aleman et al., 2008; Mims et al., 2008; Johnson and Pollard, 2010). Also several cases have been reported in calves of different age (Fingland et al., 1990; Jelinski and Vanderkop, 1990; Ashworth et al., 1992; Faillace et al., 2018; Verdemal et al. 2019). The etiology is not yet completely understood, but it is speculated that thoracic trauma, dystocia, rib fracture, and congenital defects may cause tracheal collapse

(Woolums, 2015). Also, Ashworth et al. (1992) stated that heritable chondrodysplasia must be considered as a cause of the tracheal collapse. In previous reports, the calves suffered from tracheal collapse were of various age ranging from 15 days to 4 months old, and a rib fracture that was evidenced of cranial thoracic trauma during delivery was most commonly diagnosed in those cases (Fingland et al., 1990; Jelinski and Vanderkop, 1990; Ashworth et al., 1992; Faillace et al., 2018; Verdemal et al. 2019). The time of onset of clinical signs was also considerably variable. Jelinski and Vanderkop (1990) reported that their case started to show clinical signs associated with tracheal collapse 7 days after birth. Another publication reported that the mean age of ten calves with tracheal collapse at the onset of clinical signs was 2.7 weeks and 9.4 weeks upon presentation (Fingland et al., 1990). In the present report, the age of the calf that was presented for examination was in accordance with previous reports.

Additionally, the clinical signs associated with the tracheal collapse in the present case started soon after birth, unlike previous reported cases. There may be two possible explanations for the earlier onset of the clinical findings in the present case compared to previous ones. The first explanation is that it may be associated with the dorsoventral compression of the cranial thorax during delivery. Secondly, it may have been caused by a congenital anomaly like a heritable chondrodysplasia, as mentioned by Ashworth et al. (1992). The latter was thought to be the reason in this case report.

In conclusion, the diagnosis of tracheal collapse can be easily made using radiographic and bronchoscopic imaging. Tracheal collapse should be considered in the differential diagnosis in calves showing symptoms compatible with upper respiratory tract disease such as extended head and neck, dilated nostrils, severe inspiratory stridor with characteristic goose-honk cough.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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