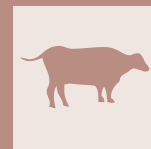


Hoflund's syndrome in a Simmental calf associated with respiratory syndrome in the feedlot



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SUMMARY

This report describes a case of Hoflund's syndrome in a calf associated with Bovine Respiratory Disease (BRD) on a farm that was diagnosed in May 2023. This case involves a chronically bloated male Simmental calf with clinical findings that included abnormal body symmetry, reduced rumen motility, apathy, a negative foreign body test, maldigested faeces, and normal body temperature and continued bloating. Abdominal distension clearly affected the entire left side of the abdomen and the relaxed right ventral quadrant of the abdomen. Based on the clinical picture and non-response to the applied therapy for chronic bloating, this case was indicative of Hoflund's syndrome type I as the cause of chronic bloating. After rumenotomy and examination of the available parts of the rumen and reticulum, no changes were found that could be related to the cause of the bloating. The appearance of flatulence was related to an episode of BRD in the feedlot, where in this case, the appearance of flatulence began in the recovery phase and during treatment of the presented case. After euthanasia, a significant damaged lung parenchyma was noted in the form of emphysematous and atelectasis changes with small deposits of fibrin on the lung lobes. One notable finding of this study was the demonstration of a causal relationship between BRD and the occurrence of Hoflund's syndrome in the calf. Our case represents a significant finding towards improving our understanding of this disease and in providing effective prevention of the occurrence of respiratory diseases in feedlots.

KEY WORDS

Calf, Hoflund's syndrome, BRD, feedlot.

INTRODUCTION

Hoflund's syndrome (vagal indigestion) is a condition that can occur in ruminants, associated with inflammatory processes on the *nervus vagus*, which violate the motor functions of the forestomach. The *N. vagus* is a motor parasympathetic sensitive sensory nerve; ventral branches of the left and right *n. vagus* follow the oesophagus, pass through the thoracic cavity and the diaphragm and, innervate of the stomach compartments of ruminants [1]. Many factors can cause damage, such as inflammatory processes due to traumatic reticulo-pericarditis, pneumonia, abomasal displacement, thoracic trauma, and compression can damage branches of the *n. vagus* [2,3]. Based on clinical manifestation and location of damage to the *n. vagus*, Hoflund's syndrome is categorized into: Type I vagal indigestion, characterized by a failure of eructation; Type II vagal indigestion, associated with failure of rumen outflow (this is the most common type of vagal indigestion and is often associated with traumatic reticuloperitonitis); Type III vagal indigestion, resulting from abomasal outflow failure with reflux of abo-

masal contents into the forestomaches; Type IV vagal indigestion, which is less well defined and is thought to be associated with disruptions in pyloric outflow or generalized ileus [4]. Bovine respiratory syndrome (BRD) is the largest problem in feedlots in Serbia [5]. Bovine respiratory disease has been described as one of the potential causes of Hoflund's syndrome. Due to the topographic position of the *n. vagus* and its course through the thorax, inflammatory changes can affect all structures inside the thorax [2]. The presence of inflammatory changes associated with the occurrence of pleuritis and pneumonia is associated with the development of inflammatory changes in the thoracic part of the *n. vagus*, as a result of which ruminal motility disorders and the appearance of bloating occur. Various pathological lesions in the thorax can exert pressure on the branches of the *n. vagus* [3].

The case report described here can provide valuable information for the diagnosis and outcome of Hoflund's syndrome and consequently respiratory syndrome in feedlots.

History and clinical findings

This report describes a case of Hoflund's syndrome in a calf associated with BRD on farm that was diagnosed during May 2023 in the municipality of Vladimirci, Ma vanski district, Serbia. The disease was found on a beef fattening farm with 22 Sim-

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mental calves aged from 4 to 6 months. All calves were kept in a tie-stall farm. All calves had respiratory disease, with treatment lasting between 5-8 days. Broad-spectrum antibiotics, non-steroidal anti-inflammatory drugs, supportive therapy, electrolyte solutions, and vitamins were used in the treatment of the sick calves [6]. The calves were not vaccinated against respiratory pathogens of BRD. The causal agent of pneumonia was confirmed to be the bovine respiratory syncytial virus through the analysis of nasal swabs by real-time PCR. Bacteriological analysis of the lungs of dead calves was carried out, but due to antibiotic therapy, findings were negative. Due to the development of BRD with severe clinical signs, 4/22 calves died (18.18%). In a calf, disturbance of ruminal function was recorded 7 days after the onset of pneumonia, during the recovery phase, with the major clinical sign being accumulation of gas in the rumen-reticulum. Abdominal distension affected the entire left side of the abdomen and the relaxed right ventral quadrant of the abdomen (Figure 1).

Clinical examination of the calf showed abdominal distension, tympani, hypomotility of the rumen, anorexia, dehydration, scanty faeces, depression, muscular weakness, apathy and indifference to normal stimuli. Over 7 days, treatment was attempted to eliminate the primary tympani, but without success, whereby the calf remained bloated: even after stomach tubing and elimination of gases from the rumen. In addition to the elimination of gases, non-ionic surfactants to reduce surface tension, agents to promote the development of bacterial flora in the rumen and to assist in regulating the pH levels were administered. After 4 days of initial therapy, rumen transfaunation was performed using contents from a healthy cow, amounting equivalent to 3.5% of the calf body weight, and this was repeated after 24 h. Rectal temperature was within the physiological range, bradycardia was not present, and the heart rate was about 60 beats/min with minimal variation. The passage of ingesta was slowed down but remained dark green. Bio-



Figure 1 - Abdominal distension affected the entire left side of the abdomen and the relaxed right ventral quadrant of the abdomen.

chemical and haematological findings were nonspecific, except for higher serum levels for total bilirubin, ALT, CK and AST. A provisional diagnosis of traumatic reticulo peritonitis (TRP) was made based on clinical findings that included abnormal body symmetry, reduced rumen motility, apathy, negative foreign body test, maldigested faeces, and rectal temperature within physiological limits. The presence of metal foreign bodies was ruled out using a metal detector. During the treatment, transfaunation of the rumen contents of healthy animals was performed continuously for 2 days, but it did not produce the expected therapeutic effect.

Rumenotomy was performed to determine the presence/absence of foreign bodies, phytobezoars, and potential causative agents of tympany in the calf. After opening the rumen and examining the available parts of the rumen and reticulum, no changes were noted that could be related to the cause of the tympany. During the rumenotomy, a portion of the digest was removed. A light green liquid mass with a certain amount of foaming content was present in the rumen.

After 15 days of treatment, at the request of the owner, the animal was euthanized for welfare reason and to avoid further treatment costs. At the necropsy, the calf was noted to have an enlarged, distended rumen and omasum, with dark green rumen contents, though without other visible pathological changes in the digestive tract organs. The most significant pathomorphological changes, due to respiratory problems, were noted in the lungs. The main lesions observed at necropsy were found in the lungs with the presence of emphysematous bullous changes on the lung tissue due to the action of bovine respiratory syncytial virus. The characteristic lesions caused by bovine respiratory syncytial virus, emphysematous lesions and the presence of atelectatic areas, are shown in Figure 2.

The treatment was done in compliance with Serbian Law on Animal Welfare (Official Gazette of the Republic of Serbia No 41/09) and Ordinance on the conditions for registration for experimental animals and the keeping of such a register, training programmes on welfare on experimental animals, request forms for approval of conducting experiments on animals, standing, treatment and killing experimental animals and reproduction, circulation, or implementation experiments on animals (Official Gazette of the Republic of Serbia No 39/10).



Figure 2 - Emphysematous lesions and the presence of atelectatic areas characteristic of the BRD.

DISCUSSION

Inflammatory changes in the *n. vagus* arise from disturbances in the motility of the forestomach and stomach in ruminants. Many factors may cause damage to its branches and can lead to clinical manifestations, depending on the severity and location of the affected *n. vagus* branches [3]. Based on the topographical relationship between the lung tissue and the branches of the *n. vagus*, we hypothesize that the cause of the dysfunction of the *n. vagus* was due to the presence of emphysematous and atelectatic changes on the lungs that put pressure on the nevous branches of the *n. vagus*. As a result of inflammatory changes in the lung parenchyma, caused by the virus, lung structure was damaged, affecting surrounding structures connected to the lung parenchyma. Based on the location of the functional disorder in the gastric compartments, we conclude a Type I case for this calf involving failure of eructation, which occurred as a result of damage to the *n. vagus* with the presence of abdominal distension caused by the accumulation of free gas in the rumen. Failure of eructation with abdominal dilation occurs due to the impossibility of eliminating gases from the rumen [3, 7]. In addition, a characteristic finding was minimal passage of contents through the digestive tract with the presence of mucus in the faeces, which corroborates Soares et al. [8].

Biochemical analysis showed higher than usual serum levels for enzymes ALT, CK and AST and total bilirubin, indicating liver function damage. Hussain et al. [2] reported that similar findings of non-specific alterations occurring due to liver function impairment were most likely due to long-term pressure on the liver.

During the necropsy, changes were noted on the lungs indicating acute fibrinous pneumonia, with emphysematous changes on the dorsal lobes of the lungs, with the presence of an interstitial pattern with the presence of well-demarcated solid and swollen of lobes [9].

One of the main limitations of this case was that we could not perform a pathohistological diagnosis to define the histological changes on the *n. vagus*. Clinical findings are also valuable in making an adequate diagnosis, which is a prerequisite for the proper management of any herd health issue and prevention of the occurrence of future cases.

CONCLUSION

Based on the findings observed in the present case, we conclude that the occurrence of Hoflund's syndrome can be attributed to BRD. Considering the findings in this case, we suggest adequate management, nutrition, preventive measures, and vaccination of calves after arrival at the feedlot. These are key elements to prevent the necessity of culling calves.

Conflict interest

The authors declare no conflict.

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