



Clinical Reports

Abomasal bloat in Holstein calf

Timpanismo abomasal em bezerra da raça Holandesa

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ABSTRACT

This paper reports a case of abomasal bloat in a Holstein heifer, after an episode of the complete fracture of the left thoracic limb, which occurred on the farm. The animal, with 15 days of age, was donated to Veterinary Teaching Hospital (Hovet) of Faculty of Veterinary Medicine and Animal Science of University of Sao Paulo (FMVZ/USP) where it was operated, resulting in a complete fracture consolidation and no post-surgical complications. At 52 days of age, the heifer manifested acute apathy, anorexia, abdominal discomfort, and diarrhea. After physical and complementary (i.e., blood count and abdominal ultrasound) examinations and the assessment of nutritional management, the calf was diagnosed with abomasal bloat. Therefore, the following treatment was performed: correction of dehydration, antibiotic therapy, administration of a non-steroidal anti-inflammatory drug, and attempt of gas release through the esophageal tube. Moreover, dietary adjustments were made and consisted in interrupting the supply of concentrate, decreasing the volume of milk replacer, as well as supplying ruminal liquid, water, and green grass. Despite the acute and fatal characteristics seen in abomasal tympanism, the rapid identification of the initial clinical manifestations presented by the heifer allowed immediate therapeutic intervention, culminating in the survival of the animal and complete recovery at the end of the treatment.

RESUMO

Este trabalho relata um caso de timpanismo abomasal em uma bezerra da raça Holandesa, após um episódio de fratura completa do membro torácico esquerdo, ocorrida na fazenda. O animal, com 15 dias de idade, foi doado ao Hospital Veterinário Universitário (Hovet) da Faculdade de Medicina Veterinária e Zootecnia da Universidade de São Paulo (FMVZ/USP) onde foi operado, resultando em consolidação total da fratura e sem complicações pós-cirúrgicas. Aos 52 dias de idade, a bezerra manifestou apatia aguda, anorexia, desconforto abdominal e diarreia. Após exames físicos e complementares (hemograma e ultrassonografia abdominal) e avaliação do manejo nutricional, a bezerra foi diagnosticada com timpanismo abomasal. Desta forma, foi realizado o seguinte tratamento: correção da desidratação, antibioticoterapia, administração de anti-inflamatório não esteroide e tentativa de liberação de gás por sonda esofágica. Além disso, ajustes dietéticos foram feitos e consistiram em interromper o fornecimento de concentrado, diminuição do volume de sucedâneo do leite, bem como o fornecimento de líquido ruminal, água e capim. Apesar das características agudas e fatais do timpanismo abomasal, a rápida identificação das manifestações clínicas iniciais apresentadas pela bezerra permitiu a intervenção terapêutica imediata, culminando com a sobrevivência do animal e recuperação completa ao final do tratamento.

Palavras-chave:

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INTRODUCTION

Raising calves is one of the costliest phases in the dairy production system, since the money spent on the liquid diet represents 37.3% of the total production cost. Whole milk would be the ideal food at this stage, but its use is economically unfeasible because it reduces the quantity available for sale. Therefore, it is substituted with milk replacers and transition milk (COELHO, 2019).

The artificial milk feeding system aims to mimic the natural system and provide a greater volume of milk or milk replacer, while ensuring better animal performance, lower mortality rates, and greater weight gain, as well as anticipating age at first calving and promoting better performance at first lactation (SILPER et al., 2014). However, this method must be used carefully because the volume and frequency of feedings and the nutritional composition of the solutions provided can lead to a decrease in the rate of abomasal emptying and the development of diseases such as tympanism (BURGSTALLER; WITTEK; SMITH, 2017).

Abomasal bloat is an acute syndrome that mainly affects dairy calves that are less than two months old and is characterized by anorexia and abdominal distension, which can lead to death within 6 to 48 hours. Although the etiology of this syndrome has not been fully elucidated yet, it is believed that the excess of fermentable carbohydrates in the abomasum, associated with the presence of fermenting bacteria, such as *Clostridium perfringens* and *Sarcina spp.*, are determinant for the occurrence of this disease (PANCIERA; BOILEAU; STEP, 2007). Abomasal bloat has already been identified in farms that use both whole milk and milk replacers, indicating that the diet is not the only factor involved in its etiopathogenesis (BURGSTALLER; WITTEK; SMITH, 2017).

Few reports of abomasal bloat are available in the literature (PANCIERA; BOILEAU; STEP, 2007; EDWARDS et al., 2008) and, considering the severity of this disease, this is the first national report of a case of successful cure after treatment. The objective of this study was to describe a case of abomasal bloat in a Holstein calf, emphasizing clinical symptoms, predisposing factors, and therapeutic success.

CASE REPORT

On 09/29/2017, a 15-day-old Holstein calf was donated to FMVZ/USP because an accident occurred on the farm, resulting in a complete transverse fracture in the distal region of the left radius and ulna of the calf. After treatment, the animal was referred for surgery (osteosynthesis), resulting in good recovery and fracture healing after 30 days. During the 30-day recovery period the animal remained hospitalized and, on 11/06/2017, at 52 days of age, manifested an acute condition of apathy, anorexia, abdominal discomfort, and diarrhea.

Upon arrival at the hospital, the calf started receiving a milk replacer (Replacer 1) from a bottle, in addition to concentrate and water at will. The initial volume of milk replacer was 4 L, corresponding to approximately 10% of the calf's live weight (35 kg) at 15 days of age, divided into two feedings per day. The volume was increased gradually, until reaching a total of 12 L/day of milk replacer (calf weight = 65 kg; age = 52 days), split into three feedings. The day before the onset of symptoms, as all of the supply of Replacer 1 had been consumed, another milk replacer was used (Replacer 2), nutritionally different from the first one (Table 1).

On the physical examination performed on the first day of the clinical condition (i.e., day 1 - D1), the calf was found in sternal recumbency (Figure 1A), tachycardic (140 bpm), and tachypneic (60 movements per minute). Moreover, it suffered from fever (40.5°C), moderate dehydration (i.e., skin turgor = 3 seconds, and enophthalmia), and abdominal distention (Figure 1B). The calf also presented redness of the conjunctival mucosa and dark-colored stools with a pasty consistency and the presence of blood (Figure 1C), as well as a foul odor. Palpation and percussion of the right abdominal wall revealed a tense-elastic consistency and produced a tympanic sound, respectively. Therefore, the following complementary examinations were performed: (1) abdominal ultrasound, which identified gas distension of the intestinal loops; (2) hemogram, which revealed a leukocytosis with neutrophilia (total leukocytes = 16,720 cells/ μ L; segmented neutrophils = 11,220 cells/ μ L); and (3) venous blood gas analysis, which indicated values within the limits considered normal for the bovine species.

Based on the findings of the clinical examination and the history of milk feeding, abomasal bloat was suspected and treatment was carried out accordingly: (1) attempt to release the gas accumulated in the abomasum via the esophageal tube; (2) antibiotic therapy with parenteral procaine penicillin (daily 22,000 IU/kg intramuscular injection, for 10 days), associated with oral procaine penicillin (two daily applications of 22,000 IU/kg diluted in 200 mL of mineral oil); (3) injection of anti-inflammatory flunixin meglumine (2.2 mg/kg intravenously, three times a day for three days); (4) oral administration of ranitidine (2 mg/kg twice daily, for 10 days); (5) injection of hyoscine (25 mg/kg intramuscularly, in the first five days of treatment when there was abdominal pain); (6) fluid therapy with lactated Ringer's solution, calculated for a degree of dehydration of 8% (5.2 L administered at a speed of 20 mL/[kg/hour]), followed by maintenance fluid therapy (100 mL/kg throughout 24 hours); (7) withdrawal of the concentrate; (8) decrease in the volume of milk replacer supplied (maximum 2 L/day), and (9) ruminal transfusion (200 mL/day). Throughout the treatment, the calf consumed water and green grass at will.

Table 1. Nutritional composition and dilutions recommended by the manufacturer of the milk replacers used for milk feeding of the heifer with abomasal bloat.

Composition	Replacer 1	Replacer 2
Dilution (per liter of water)	115–130 grams	200 grams
Crude protein	20.0 %	22.0%
Ether extract	16.5 %	19.0%
Mineral matter	8.5 %	not mentioned
Crude fiber	0.6 %	0.1 %
Lactose	40 %	44 %

Figure 1. Clinical manifestations presented by the heifer with abomasal bloat. (A) Sternal recumbency at the beginning of the clinical condition. (B) Abdominal distension. (C) Pasty, darkened, bloody stools.



During the entire treatment period (D1 to D10), the calf was evaluated clinically. Symptoms were more intense between D1 and D7, with changes in heart and respiratory rates (mean values of 139 bpm from D1 to D4 and of 49 respiratory movements per minute from D1 to D3, respectively), fever (41.0°C on D2), pain, abdominal distention, and diarrhea (D1 to D8). Hemograms were also performed (on D1 - D4, D8, and D12), with the reversal of leukocytosis on D2 (10,510 cells/ μ L) but the persistence of neutrophilia on D2 and D3 (7,380 cells/ μ L and 6,130 cells/ μ L, respectively), monocytosis on D3 and D4 (1,800 and 1,820 cells/ μ L, respectively), and monocytopenia on D8 (380 cells/ μ L). At the end of the treatment and clinical recovery, the heifer was weaned.

DISCUSSION

This study reports a case of abomasal tympanism in a 52-day-old calf. The acute condition characterized by apathy, anorexia, abdominal discomfort, and diarrhea is in accordance with the signs described in the literature (MARSHALL, 2009). The distention of the abomasum and intestinal loops due to the presence of liquid and gas, identified by physical examination (i.e., tense-elastic consistency of the right abdominal wall, verified by palpation, tympanic sound identified by auscultatory percussion) and ultrasound, were similar to the necropsy findings in animals diagnosed with this disease (PANCIERA; BOILEAU; STEP, 2007; MARSHALL, 2009; SIMPSON; CALLAN; VAN METER, 2018).

Another important element to support the diagnostic suspicion was the leukocytosis caused by neutrophilia without deviation to the left, which is frequent in diseases induced by *C. perfringens*, one of the probable causative agents of abomasal tympanism (SIMPSON; CALLAN; VAN METER, 2018). The persistence of neutrophilia on D2 and D3 reflected the continuity of inflammation even after the start of the treatment,

emphasizing the severity of abomasal tympanism, which culminates in death in most cases.

The etiology of abomasal tympanism is multifactorial and poorly understood. It is believed to be due to the excess of fermentable carbohydrates and the presence of fermenting bacteria, such as *Clostridium spp.* (mainly *C. perfringens* type A and type C, which produces β toxin) and *Sarcina spp.* (EDWARDS et al., 2008; MARSHALL, 2009). The excessive ingestion of fermentable carbohydrates favors the growth and multiplication of these bacteria, generating gas and dilation of the abomasum (PANCIERA; BOILEAU; STEP, 2007).

Abdominal distension can promote breathing difficulty and hemodynamic changes that can lead the animal to shock because of the pressure of the abomasum on the diaphragm and large vessels (SIMPSON; CALLAN; VAN METER, 2018). As for the calf described in this report, breathing difficulties were observed during the most critical period of the clinical condition (D1–D7), with the intensity of dyspnea varying according to the degree of abdominal distension. In addition, the respiratory pattern was of the costal type, owing to the pain and compression of the diaphragm resulting from abdominal distension (SIMPSON; CALLAN; VAN METER, 2018). Notably, the production of β toxin by *C. perfringens* also promotes damage to the microvilli of the intestinal mucosa and consequent necrosis, hence favoring the translocation of bacteria from the intestine to the circulation, and causing septicemia and death (SONGER; MISKIMINS, 2005).

Factors that lead to a decrease in the rate of emptying of the abomasum, such as the volume and frequency of feeding (whole milk or milk replacer), osmolality, and the quantity of proteins and fats, may also predispose calves to the occurrence of tympanism, since the food stays longer inside this organ, intensifying the

fermentation process (BURGSTALLER; WITTEK; SMITH, 2017).

Ellingsen et al. (2016) found that bottle-feeding of up to 6.8 L of whole milk per feed did not result in digestive changes. The heifer reported in the present study received 12 L of milk replacer divided into three feedings per day (4 L/feed). However, as the components of the substitute may differ from milk and between milk replacers, such factors may have interfered with the abomasum emptying rate. The substitution of the milk replacer for another one containing higher levels of protein and fat may have compromised digestion, even though the acceptable volume of 4 L/feed. Although the osmolality of the two milk replacers has not been quantified, caloric solutions containing 20% of both protein and fat can promote a significant reduction in abomasal emptying (MARSHALL, 2009).

The initial therapeutic approach was to release the gas trapped in the abomasum through the esophageal tube, which resulted in an unsuccessful attempt. According to Marshall (2009), the use of a catheter (18G) introduced with the calf in the supine position can be effective. In addition, ultrasound-guided abomasocentesis could have been performed to promote the drainage of the accumulated gas and provide support for diagnosis. However, such procedures were not performed considering the risk of rupture of the abomasum, which was related to the greater fragility of the abomasum due to tympanism-associated abomasitis (SIMPSON; CALLAN; VAN METER, 2018).

Procaine penicillin is the antibiotic of choice for *Clostridium spp.* and is administered by parenteral or oral route. However, the oral route seems to be more effective than the parenteral one since the multiplication of the bacteria occurs in the intestinal lumen. Therefore, the antibiotic must quickly reach the lumen of the abomasum and small intestine to interrupt the production and release of bacterial exotoxins. In addition, penicillin administered parenterally is excreted by the renal system, with little excretion or secretion in the gastrointestinal tract (SIMPSON; CALLAN; VAN METER, 2018). Therefore, the objective of the antibiotic therapy using the two routes was to reach the bacteria as quickly as possible via the oral route in association with the delayed and prolonged effects of the parenteral route, both of which were important to improve the health state of the heifer. The systemic antibiotic therapy for a period of ten days was implemented as the heifer still had episodes of abdominal distension and diarrhea on the seventh day of treatment. The anti-inflammatory agent flunixin meglumine should be used because of the release of beta toxin by *C. perfringens* (MARSHALL, 2009), and the dose of 2.2 mg/kg was chosen because it is more effective to control the endotoxemia of calves with diarrhea compared to the 0.25 mg/kg dose (BENESI et al., 2002).

Enteritis caused by *C. perfringens* in cases of abomasal bloat can lead to dehydration and metabolic acidosis due

to diarrhea (BURGSTALLER; WITTEK; SMITH, 2017). However, the heifer reported in the present study did not present metabolic acidosis, probably because the degree of dehydration was moderate (i.e., 8%). Furthermore, the fluid of choice was Ringer's lactate solution, owing to its alkalizing and prophylactic properties against acidosis.

In the present report, the findings from the physical examination, ultrasound, hemogram, and evaluation of the methods of supplying the milk replacer allowed to the diagnosis of abomasal bloat. Although the bacteriological culture of the abomasal content can be an aid in establishing the diagnosis, this examination was not carried out as the team decided not to perform abomasocentesis, because of the risks mentioned earlier. Additionally, the identification by culture of fermenting bacteria that cause tympanism must be associated with nutritional history, physical examination, and necropsy (DEPREZ, 2015), since these bacteria can compose the intestinal microbiota of healthy calves (SIMPSON; CALLAN; VAN METER, 2018).

The decrease in the volume of milk replacer and the suspension of the ration were applied to reduce the amount of fermentable carbohydrates in the abomasum (SIMPSON; CALLAN; VAN METER, 2018), in addition to decreasing abdominal distention. Transfaunation was carried out to initiate the development of the ruminal microbiota and accelerate weaning. According to the literature, the volume of rumen fluid to be supplied can vary from 1 L for calves to 18 L for adult animals (DEPETERS; GEORGE, 2014). In the case of the heifer, a volume below the indicated dose (i.e., 200 mL/day) was chosen to avoid abomasal overload, which could have worsened the abdominal distension and dyspnea. The rumen fluid used for transfaunation was collected, as described by Depeters and George (2014), from donor animals (from veterinary hospital) with a ruminal fistula. At the end of the treatment, the heifer was already ruminating and consuming green grass, showing that transfaunation was important in the recovery and acceleration of the weaning process.

Notably, there was a good evolution of leukocyte numbers with the antibiotic therapy. Monocytosis at the beginning of the clinical condition (D3 and D4) may have been a reflection of necrosis, hemolysis, and inflammation of the wall of the abomasum and intestine caused by *C. perfringens*, or a response to stress (JONES; ALLISON, 2007). As for monocytopenia (observed on D8), it may have been related to endotoxemia or the sequestration of blood to tissues (SIMPSON; CALLAN; VAN METER, 2018). Regarding the clinical condition, the first seven days were the most critical. After this period, the stabilization of parameters and symptoms enabled the beginning of weaning after the treatment.

CONCLUSIONS

Abomasal tympanism is an acute and fatal disease in most cases, but the heifer described in this report

showed complete recovery after the treatment. Overall, the rapid identification of clinical manifestations in the hospital environment allowed for immediate therapeutic intervention and appropriate dietary adaptations.

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