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Abomasal tympanism due to sand impaction in neonate calf – case report

Timpanismo abomasal por sablose em bezerro neonato – relato de caso

Tímpano abomasal por sablose en becerro recién nacido – reporte de caso

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Ângela Imperiano da Conceição
ORCID: https://orcid.org/0000-0002-0422-4912
Federal Rural University of Pernambuco, Brazil
E-mail: angelaimperiano@hotmail.com
Jobson Filipe de Paula Cajueiro
ORCID: https://orcid.org/0000-0003-3228-2383
Federal Rural University of Pernambuco, Brazil
E-mail: jobson.filipe@gmail.com
Carla Lopes de Mendonça
ORCID: https://orcid.org/0000-0002-4985-4985
Federal Rural University of Pernambuco, Brazil
E-mail: carlalopes.mendonca@gmail.com
Luiz Teles Coutinho
ORCID: https://orcid.org/0000-0003-4350-2273
Federal Rural University of Pernambuco, Brazil
E-mail: coutinholtc@gmail.com
Rodolfo José Cavalcanti Souto
ORCID: https://orcid.org/0000-0003-3380-5596
Federal Rural University of Pernambuco, Brazil
E-mail: rodolfo.souto@hotmail.com
José Ricardo Barboza Silva
ORCID: https://orcid.org/0000-0002-5027-2384
São Paulo State University, Brazil
E-mail: jose.ricardo_mrdvrt@hotmail.com
José Augusto Bastos Afonso
ORCID: https://orcid.org/0000-0002-6558-644X
Federal Rural University of Pernambuco, Brazil
E-mail: afonsojab@gmail.com

Abstract
Abomasal diseases in newborn calves are infrequent, but when they occur they are associated with severe clinical manifestations, a poor prognosis, high cost of treatments, developmental delay and death. Among these diseases, abomasal tympanism stands out for its frequency and clinical severity. Aimed report a case of abomasal tympanism due to sand impaction in a 12-day-old heifer. The animal had a clinical history of frequent episodes of colic, loss of appetite, tachycardia, tachypnea, and abdominal distension with the presence of subtympanic resonance on percussion of the right paralumbar fossa; complementary exams were performed, such as blood count, which evidenced neutrophilic leukocytosis and hyperfibrinogenemia, analysis of the ruminal content, which revealed increase in the chloride content was found, and ultrasonography, whose images suggested marked abomasal distension in the right antimere; the animal was submitted to exploratory laparotomy, and abomasal tympanism secondary to sand impaction was diagnosed, which was corrected through abomasotomy and subsequent emptying of the organ. The clinical evolution of the animal was satisfactory, with return of the physiological clinical parameters, followed by hospital discharge on the third day of hospitalization. The unique aspects of this case are highlighted, whereby the calf was not fed artificially and the presence of about 1kg of sand in the abomasum from ingestion in an animal only 12 days old. Therefore, it is suggested that sand impaction be included among the differential diagnoses of abomasopathies in newborn calves, particularly if predisposing factors for excessive intake of sand are observed.
Keywords: Abomasopathies; Colic; Chloride content; Sand.

Resumo
As enfermidades abomasais em bezerros neonatos são pouco frequentes, mas quando ocorrem estão associadas a manifestações clínicas severas, com prognóstico reservado, custo elevado com tratamentos, atraso no desenvolvimento e óbito. Dentre essas enfermidades, destaca-se por sua frequência e severidade clínica o timpanismo abomasal. Objetivou-se relatar um caso de timpanismo abomasal em decorrência de sablose em uma bezerra de 12 dias de idade. O animal tinha histórico clínico de episódios de cólica, inapetência, taquicardia, taquipneia e distensão abdominal com presença de ressonância subtimpânica à percussão da fossa paralombar direita; foram realizados

exames complementares como hemograma, que evidenciou leucocitose por neutrofilia e hiperfibrinogenemia, análise do conteúdo ruminal, que revelou elevação do teor de cloretos, e a ultrassonografia, cujas imagens sugeriram acentuada distensão abomasal no antímero direito; o animal foi submetido a laparotomia exploratória, sendo diagnosticado o timpanismo abomasal secundário a sablose, que foram corrigidos através da abomasotomia e posterior esvaziamento do órgão. A evolução clínica do animal foi satisfatória, retornando os parâmetros clínicos fisiológicos, seguida de alta hospitalar no terceiro dia de hospitalização. Ressalta-se os aspectos singulares deste caso, onde o bezerro não recebia aleitamento artificial e a presença de aproximadamente 1kg de areia no abomaso oriunda de ingestão em um animal de apenas 12 dias de idade. Portanto, sugere-se incluir dentre os diagnósticos diferencias das abomasopatias em bezerros neonatos, a sablose, particularmente, se for observado fatores predisponentes para ingestão excessiva de areia.
Palavras-chave: Abomasopatias; Areia; Cólica; Teor de cloretos.

Resumen
Las enfermedades de abomaso en terneros recién nacidos son poco frecuentes, pero cuando ocurren se asocian a manifestaciones clínicas severas, con mal pronóstico, alto costo de los tratamientos, retraso en el desarrollo y muerte. Entre estas enfermedades, la hinchazón del abomaso destaca por su frecuencia y gravedad clínica. El objetivo de este estudio fue reportar un caso de timpanismo abomasal por sablose en una novilla de 12 días. El animal presentaba antecedentes clínicos de episodios de cólicos, inapetencia, taquicardia, taquipnea y distensión abdominal con presencia de resonancia subtimpánica a la percusión de la fosa paralumbar derecha; se realizaron exámenes complementarios, como hemograma, que mostró leucocitosis por neutrofilia e hiperfibrinogenemia, análisis del contenido ruminal, que reveló la aumento en el contenido de cloruros, y ecografía, cuyas imágenes sugirieron marcada distensión abomasal en el antímero derecho; el animal fue sometido a laparotomía exploradora, y se diagnosticó timpanismo abomasal secundario a sablose, que se corrigió mediante abomasotomía y posterior vaciado del órgano. La evolución clínica del animal fue satisfactoria, con retorno de los parámetros clínicos fisiológicos, seguido del alta hospitalaria al tercer día de hospitalización. Se destacan los aspectos singulares de este caso, donde el ternero no recibió alimentación artificial y la presencia de aproximadamente 1 kg de arena en el abomaso por ingestión en un animal de tan solo 12 días de edad. Por tanto, se sugiere incluir entre los diagnósticos diferenciales de abomasopatías en terneros recién nacidos, sablose, particularmente si se observan factores predisponentes para la ingesta excesiva de arena.
Palabras clave: Abomasopatías; Arena; Cólicos; Contenido de cloruros.

1. Introduction

In calves, although intestinal disorders are more frequently reported, abomasopathies such as dilatation/tympanism, displacement, volvulus, and ulcers, like in adult animals, cause serious inconvenience and reduced productivity for the sector (Steiner & Baumgartner, 2010; Souza *et al*., 2016; Alcantara *et al*., 2020; Pinheiro *et al*., 2020). The etiopathogenesis of these diseases is multifactorial and is generally associated with inadequate diet, management errors, stress, and/or delay in abomasal emptying (Borges & Bastos, 2007; Burgstaller et al., 2017).

The passage of food through the abomasum is directly influenced by the volume, composition, viscosity, and osmolality of the intake, content pH, organ motility, intra-abomasal pressure, and contractions of the abomasal wall. Alterations in these factors provide a delay in abomasal emptying, and consequently, tympanism in this organ (Burgstaller *et al*., 2017).

Some animals may have an eating behavior disorder, and ingest foreign bodies that do not have a nutritional function, such as gravel, metallic objects, and sand (sand impaction), which can accumulate in the segments of the gastrointestinal tract, leading to alterations in the emptying rate and/or compaction (Erickson & Hendrick, 2011; Melendez *et al*., 2007; Pessoa *et al*., 2017). Thus, the aim of this study was to describe a clinical case of a calf affected by abomasal tympanism secondary to sand impaction treated in a hospital routine.

2. Case Report

A 12-day-old Holstein heifer, weighing 51 kg, not vaccinated or dewormed, was treated at the Clínica de Bovinos de Garanhuns, Campus of the Federal Rural University of Pernambuco (CBG/UFRPE), with a history of abdominal pain. The

calf's diet consisted exclusively of milk. The animal was clinically examined according to Dirksen (1993), after which blood samples were collected in tubes with anticoagulant (EDTA and Fluoride) for blood count, plasma determination of total protein and fibrinogen, and plasma concentration of enzymatic lactate (Kaneko, Harvey & Bruss, 2008; Harvey, 2012), in addition to a ruminal fluid sample for characteristic analysis and measurement of chloride content (Dirksen, 1993).

During the physical examination, it was observed that the calf was restless, with inappetence, lying down and contracting frequently, dehydrated (5%), tachypneic, and tachycardic. The abdomen was bilaterally bulged, with constant borborygmi and a sound of splashing liquid during auscultation of the left paralumbar fossa, in addition to dilated viscera with subtympanic resonance on percussion in the right paralumbar fossa (Figure 1). The intestines presented hypomotility and the stools had a physiological aspect.

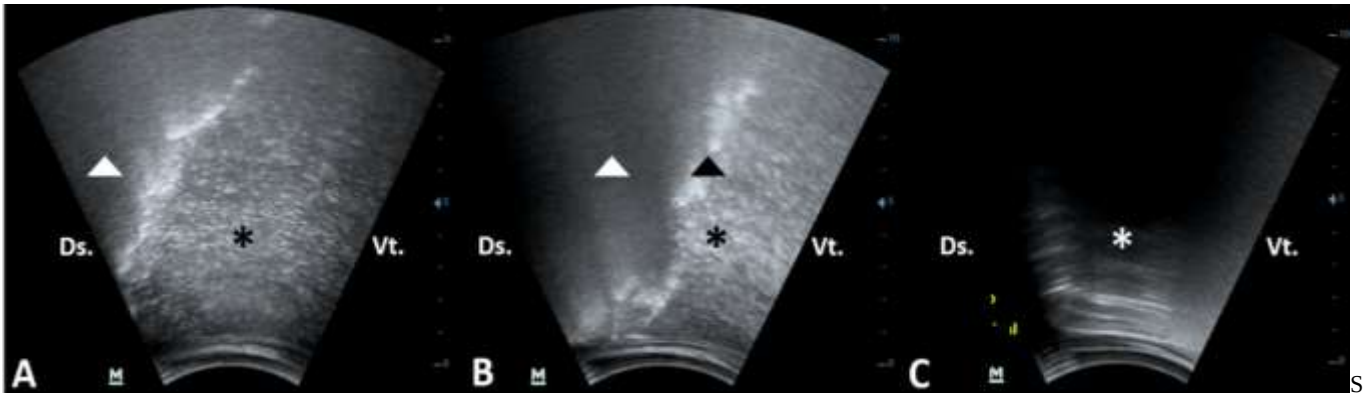
Figure 1. Dorsal view of a 12-day-old heifer affected by abomasal bloat caused by sablose. (A): abdominal distension in the right paralumbar fossa; (B): Absence of abdominal distention after surgical correction of abomasal dilatation.

Source: Garanhuns Bovine Clinic, Federal Rural University of Pernambuco - Authors (2021).

The hematological examination revealed leukocytosis (13,400/µl) due to neutrophilia (6,432/µl) with a regenerative left shift (1,742/µl). Clinical biochemistry showed hyperlactatemia (3.16 mmol/L). In the analysis of rumen content, an increase in the chloride content was evidenced (88.11mEq/L).

Ultrasound examinations were also performed, in a quadrupedal position, without sedation, using Mindray brand Z6Vet equipment with a convex probe, multifrequency model 3C5P, working at a frequency of 5.0 MHz, in which the presence of dilated viscera in the right paralumbar fossa was evidenced, possibly an abomasum (Figure 2A, B and C). Due to the association of clinical findings and complementary exams, it was decided to perform an exploratory laparotomy on the right, according to Fubini and Ducharme (2017).

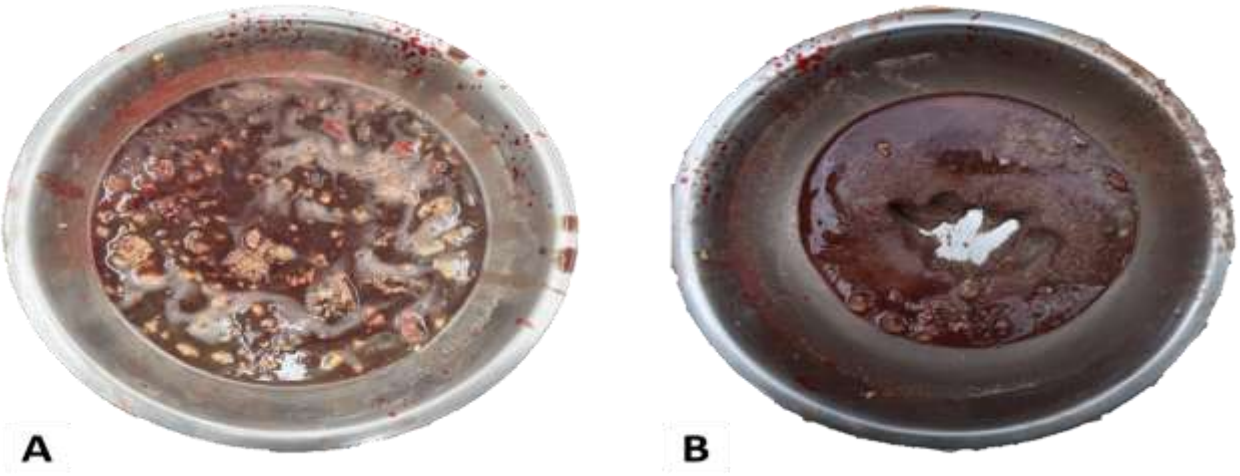
Figure 2. Transabdominal ultrasound of a heifer, in the cranial region of the intestinal recess at the level of the 12th intercostal space of the right antimere. (A and B): Dilated abomasum containing fluid ventrally with multiple hyperechoic dots (black asterisk), suggestive of geosediments and milk clots, dispersed in the more hypoechoic abomasal fluid (white arrowhead), with a transition area between (arrowhead black); (C): Dilated abomasum containing hypoechoic fluid and gas accumulation (reverberations/bloat – white asterisk) consequent to sablose; Ds.: dorsal, Vt.: ventral.



Source: Garanhuns Bovine Clinic, Federal Rural University of Pernambuco - Authors (2021).

In the exploration of the cavity, the abomasum was dilated, in its anatomical position, without displacement, and was punctured to remove the free gas from its interior, which allowed the realization of partial exteriorization and subsequent abomasotomy, with a large volume of dark brown liquid content and foul odor (coagulated milk) (Figure 3A), in addition to a certain amount of geosediment (approximately 1Kg) (Figure 3B), which were removed. The postoperative therapeutic approach consisted of anti-inflammatories (Maxican 2%, dose mg/Kg, IV, five applications with a 24-hour interval), antibiotics (Ceftiofur 1 mg/Kg, IM, seven applications with a 24-hour interval), fluid therapy, gastric secretion inhibitor/proton pump (Omeprazole, 4mg/Kg, VO, three applications with a 24-hour interval), prokinetics (Metoclopramide, 0.3 mg/Kg, SC, three applications with a 24-hour interval), calcium borogluconate (1g/Kg, SC, three applications with a 24-hour interval), and daily wound dressings. The animal presented satisfactory clinical evolution from the instituted therapy, with all physical parameters returning to normal within the first 24 hours after the surgical procedure.

Figure 3. Content extracted from the interior of the abomasum of a heifer affected with abomasal tympanism caused by sablose. (A): Dark brown liquid content with presence of curdled milk; (B): geosediment (approximately 1Kg) of the abomasum content.



Source: Garanhuns Bovine Clinic, Federal Rural University of Pernambuco - Authors (2021).

Three days after the surgery, hematological and biochemical evaluations were performed again, which found, in the blood count, plasma fibrinogen in the upper limit (800mg/dL), and also leukocytosis (14,950/µl) due to neutrophilia (10.166/µl) with a slight regenerative left shift (448/µl). The plasma concentration value of the enzymatic lactate showed a significant reduction (1.33 mmol/L), and in view of these complementary findings and good clinical condition, with physical parameters within physiological limits, the animal was discharged from the hospital.

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3. Discussion

The manifestation of colic in cattle is related to intestinal disorders, such as intussusception and torsion, but less frequently it has also been observed in cases of displacement of the right abomasum, bloat and abomasum ulcer, as in the present report (Van Metre *et al*., 2005; Naylor & Bailey, 1987; Pinheiro *et al*., 2020). The colic observed in the current report can be explained by the distension of the abomasum, with stimulation of pain receptors, promoting the clinical signs.

The diagnosis of abomasal dilatation was based on the presence of colic, abdominal distension, metallic resonance on abdominal auscultatory percussion in the right paralumbar fossa, with the sound of fluid during ballooning, associated with ultrasound images and increased rumen chloride content (Navarre, Belknap & Rowe, 2000).

Hematological alterations, such as neutrophilic leukocytosis with a regenerative left shift, are due to damage to the abomasal mucosa, caused by the abrasive action of large amounts of sand, similar to horses affected by sand impaction (Granot *et al*., 2008); this change was not described in adult cattle, possibly due to the absence of a hemogram (Mendelez *et al.*, 2007; Erickson *et al.*, 2011). Hyperlactatemia due to hypovolemia associated with severe dehydration was found in the clinical examination, which leads to cellular hypoxia with consequent anaerobic cell metabolism (Lausch *et al*., 2019).

The analysis of the ruminal content should be interpreted according to the digestive physiology of a 12-day-old calf, where there is no established ruminant microbiota (Baldwin & Connor, 2017; Nagy, 2017). Regarding the chloride content, the established reference value is 45 mEq/L, and in the present report, the value was 88.11 mEq/L, which indicates elevation and the presence of abomasal-ruminal reflux (Dirksen, 1993). In this case, there was failure in abomasal-enteral emptying, caused by the weight of the sand, preventing adequate abomasal contraction, associated with organ distension, through gas and fermented content, which when they exceed the baroreceptor threshold, cause motility inhibition and, consequently, content reflow (Melendez *et al*., 2007; Trent, 2017).

On ultrasonographic examination, the observation of a viscera, with gas-liquid interface, and marked distension throughout the right paralumbar fossa and from the 10th right intercostal space (RICD), is suggestive of distension and/or displacement of the abomasum, with the need for differentiation of cecal dilation, since the latter, when dilated in a calf, would occupy almost the entire length of the abdominal cavity. It is noteworthy that at this stage of development, the abomasum is the largest intra-abdominal cavity organ, which also explains why this distended organ occupies the entire paralumbar fossa, unlike that observed in adult bovines (Braun, Krüger & Hässig, 2013; Silva *et al*., 2014).

It is important to emphasize the importance of the abomasotomy, allowing the emptying of the altered content, and favoring the reestablishment of the physiology of the viscera. In this case, after reducing the abomasal tympanism, caused mainly by excessive ingestion of sand, leading to colonization of milk with putrefactive microorganisms, the emptying of the organ was performed through abomasotomy (Burgstaller *et al.*, 2016; Trent, 2017).

The clinical evolution of the calf was satisfactory throughout the treatment and the laboratory indicators on the 3rd postoperative day can be justified by the surgical trauma. A reduction in plasma lactate and physiological parameters to normal levels was noted. The outcome of this report was also positive, unlike Mendelez (2007), where of all adult cattle operated on due to abomasal compaction by sand impaction, none were discharged from hospital.

A factor to be considered in this work is the large intake of sand in a calf, raised with the cow, with deliberate suckling, and no dietary changes that constitute risk factors for geophagy, however, we cannot rule out exposure to stress conditions that may have contributed to this medical condition. Other hypotheses of factors associated with this eating disorder are diseases that cause metabolic acidosis, in which the animal seeks buffering due to the alkalinity of the sand (Mendelez *et al.*, 2007), or that the food, such as silage, contains a high amount of sand (Erickson & Hendrick, 2011) similar to that suggested in horses (Granot *et al.*, 2008). However, in this case, there was no previous clinical condition that progressed with metabolic acidosis and the animal was an infant.

4. Conclusion

This work portrays the occurrence of sand impaction in a lactating calf is confirmed, which should be included as a differential diagnosis in abomasopathies in these animals. The rapid multidisciplinary clinical intervention to obtain the diagnosis and start the therapeutic approach were undoubtedly decisive regarding the prognosis and outcome of the animal. It is also important to highlight the importance of reducing factors associated with sand impaction in calves on farms, thus preventing the onset of the disease and consequent losses to the sector.

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