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Vagal indigestion in mini-cattle[1]

Lucas V.O. Ferreira[2], Maria L.G. Lourenço[2], Regina K. Takahira[2], Juliana M. Alonso[2], José P. Oliveira-Filho[2], Alexandre S. Borges[2], Simone B. Chiacchio[2] and Rogério M. Amorim[2*]

ABSTRACT.- Ferreira L.V.O., Lourenço M.L.G., Takahira R.K., Alonso J.M., Oliveira-Filho J.P., Borges A.S., Chiacchio S.B. & Amorim R.M. 2023. **Vagal indigestion in mini-cattle**. *Pesquisa Veterinária Brasileira 43:e07240, 2023*. Departamento de Clínica Veterinária, Faculdade de Medicina e Zootecnia, Universidade Estadual Paulista "Júlio de Mesquita Filho", Rua Prof. Doutor Walter Mauricio Correa s/n, Cx. Postal 560, Botucatu, SP 18618-681, Brazil. E-mail: rogerio.amorim@unesp.br

Vagal indigestion (VI) is a digestive disorder characterized by the dysfunction of the vagus nerve. This disorder leads to changes in forestomach motility. The causes of VI are varied. Failure to transport digestive contents may occur due to mechanical obstruction or a neurogenic origin. There are few reports in the literature regarding this disease in mini-cattle. These cattle seem to be predisposed to the development of VI. The aim of the present study was to analyze the epidemiological, clinical, laboratory, and electrocardiographic aspects of mini-cattle diagnosed with VI. The medical records of nine mini-cattle diagnosed with VI were retrospectively reviewed. Mini-cattle were referred to the Large Animal Hospital in Botucatu, Brazil, from 2002 to 2021. It was observed that VI affected young mini-cattle. The predominant clinical manifestations were intermittent gas ruminoreticular tympanism with increased volume in the left paralumbar fossa and increased volume in the right ventral region (apple/pear aspect), hypomotility in ruminal auscultation and the presence of pasty stools. The mean heart rate of the animals was 75 beats per minute. In one case, bradycardia was observed by electrocardiogram and Holter monitor system. In this case, the predominance of parasympathetic activity of the autonomic nervous system was observed. The main hematological findings were leukocytosis and lymphocytosis. The therapeutic approach included ruminal fistulation and the implantation of a permanent rumen cannula. All animals undergoing the procedure were discharged with daily care instructions.

INDEX TERMS: Abdominal distension, mini-cattle, tympany, vagal indigestion, vagus nerve.

RESUMO.- [**Indigestão vagal em mini-bovinos.**] A indigestão vagal (IV) é um distúrbio digestivo caracterizado pela disfunção do nervo vago. Esse distúrbio leva a alterações na motilidade dos pré-estômagos. As causas da IV são variadas. A falha no transporte do conteúdo digestivo pode ocorrer por obstrução mecânica ou pode ser de origem neurogênica. Há poucos relatos na literatura a respeito dessa enfermidade em mini-bovinos. Esses bovinos parecem estar predispostos ao desenvolvimento de IV. O objetivo do presente estudo foi analisar os aspectos epidemiológicos, clínicos, laboratoriais e eletrocardiográficos de mini-bovinos diagnosticados com IV. Os prontuários de nove mini-bovinos diagnosticados com IV foram revisados retrospectivamente. Os mini-bovinos foram encaminhados ao Hospital de Grandes Animais de Botucatu, Brasil, de 2002 a 2021. Observou-se que a IV acometeu mini-bovinos jovens. As manifestações clínicas predominantes foram timpanismo ruminoreticular gasoso intermitente com aumento de volume na fossa paralombar esquerda e aumento de volume na região ventral direita (aspecto maçã/pêra), hipomotilidade na ausculta ruminal e presença de fezes pastosas. A frequência cardíaca média dos animais foi de 75 batimentos por minuto. Em um caso, foi observada bradicardia por meio do eletrocardiograma e do sistema Holter. Neste caso observou-se a predominância da atividade parassimpática do sistema nervoso autônomo. Os principais achados hematológicos foram leucocitose e linfocitose. A abordagem terapêutica incluiu fistulação ruminal

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[2] Departamento de Clínica Veterinária (DCV), Faculdade de Medicina e Zootecnia (FMVZ), Universidade Estadual Paulista "Júlio de Mesquita Filho" (Unesp), Rua Prof. Doutor Walter Mauricio Corrêa s/n, Cx. Postal 560, Botucatu, SP 18618-681, Brazil. *Corresponding author: rogerio.amorim@unesp.br

e implante de cânula ruminal permanente. Todos os animais submetidos ao procedimento receberam alta hospitalar com orientações de cuidados diários.

TERMOS DE INDEXAÇÃO: Distensão abdominal, mini-bovinos, timpanismo, indigestão vagal, nervo vago.

INTRODUCTION

Vagal indigestion (VI) or Hoflund syndrome comprises motor disorders that hinder the passage of ingested material from the ruminoreticular cavity and/or abomasum (Simões et al. 2014). This term was first introduced by Hoflund in 1940. In his experimental study, the author reproduced such disorders after selective vagotomy (Hussain et al. 2014a).

The total or partial damage, compression or inflammation of the tenth pair of cranial nerves is one of the main determining factors for indigestion. It is responsible for the motility of the forestomach in ruminants (Fidelis Júnior et al. 2011). The VI may be divided into various types of functional disorders depending on the site of the ingesta obstruction. It is classified as anterior functional stenosis when there is a failure in the passage of the ingesta through the reticulo-omasal orifice or posterior when there is a failure in pyloric emptying (Garry & McConnel 2015).

According to Foster (2017), VI comprises four types. Type 1 is related to failure to eructation, while type 2 involves the failure of rumen outflow. Type 3 is characterized by the failure of abomasal outflow, and type 4 is associated with partial failure of pyloric outflow/proximal intestinal obstruction.

The causes of the development of this syndrome are varied. Failure to transport digestive contents may occur due to mechanical obstruction or a neurogenic origin (Hussain et al. 2017). Among the causes are traumatic reticuloperitonitis, reticular and hepatic abscesses, reticular adhesions, neoplasms such as lymphoma (Miesner & Reppert 2017, Attia et al. 2021, Soares et al. 2021), fibropapilloma (Gordon 1997), fibromyxoma (Movassaghi et al. 2013), right displacement of the abomasum (Sattler et al. 2000), and advanced pregnancy (Gul & Issi 2009, Hussain et al. 2014b).

The clinical signs of VI include progressive inappetence, decreased production and appetite with gradual weight loss, alteration in the consistency and volume of feces, recurrent tympanism, and abdominal distension, which assumes a typical apple/pear shape. Some animals may present with bradycardia of vagal origin or vagal-mediated bradycardia (Braun et al. 2009, Fidelis Júnior et al. 2011, Reis et al. 2016).

In recent years, there has been an increase in mini-cattle creation. These animals can be raised as pets, show cattle and for production, being more suitable for small properties as they are considered more docile and easier to handle, and their rearing costs are lower compared to larger cattle (Boden 2008). There are few reports in the literature regarding VI in mini-cattle (Fidelis Júnior et al. 2011, Rizzo et al. 2015). These animals are believed to have a genetic predisposition to develop VI due to their chondrodystrophic conformation (Rizzo et al. 2015).

This retrospective study was performed due to the lack of existing literature on this topic. Thus, the present study aimed to describe the epidemiological, clinical, laboratory, and electrocardiographic aspects of mini-cattle diagnosed with VI.

MATERIALS AND METHODS

Study local and contextualization. The clinical records of nine mini-cattle diagnosed with vagal indigestion were retrospectively reviewed. The mini-cattle were referred to the Large Animal Hospital in Botucatu (22°53’09” S, 48°26’42” W), Brazil, from 2002 to 2021.

Epidemiological, clinical and laboratory data. The epidemiological aspects included sex and age. The clinical (timing of disease development, physical examination results, and treatment) and laboratory data were based on the findings presented by veterinarians in the medical records. Complete blood count and ruminal fluid analyses were performed in the clinical pathology laboratory of the veterinary hospital.

Collection of biological material. Blood was collected for hematological analysis by puncturing the jugular vein. It was stored in a vacuum tube containing EDTA, an anticoagulant agent. According to the manufacturer’s instructions, blood count analysis was performed using a pocH-100iV DiffTM-Sysmex. The ruminal fluid was collected using an esophageal tube and was subsequently analyzed according to Dirksen (1993). The chloride content was determined by the colorimetric method of mercury thiocyanate, according to the manufacturer’s instructions (Dialab Diagnostics Kits).

Electrocardiographic evaluation. Records of conventional electrocardiographic assessments were obtained using a Televet 100 system (version 4.2.3; Kruuse, Marslev, Denmark) for five minutes. According to the manufacturer, the filter used to obtain the RR intervals with the Televet was 50 Hz. For the correction of artifacts, the correction tool of the software itself was used, and the Smooyhn priors filter was used for further analysis. The ambulatory electrocardiographic monitoring (Holter system) data were recorded with a Cardiolight three-channel digital device (Cardios, SP, Brazil) for 14 hours. The analysis was performed using Kubios software (Biomedical Signal Analysis Group, Applied Physics Department, University of Kuopio, Finland). The main focus of the examination was to evaluate heart rate variability (HRV). In the frequency domain, spectral analysis was conducted using the fast Fourier transform (FFT) algorithm. The evaluations were performed by the Veterinary Cardiology Service of the FMVZ-Unesp.

RESULTS

Animals and epidemiological data

In this retrospective study, 7/9 of the animals were male, and 2/9 were female, aged between 6 and 19 months (mean = 13.5 months). The timing of disease development in the property where the animals were kept until they arrived for assistance at the veterinary hospital was six–180 days (mean = 52 days) (Table 1).

Clinical signs

The clinical signs of the animals in this study are represented in Table 1. At the initial physical examination, the mean heart rate, respiratory rate, and rectal temperature values were 75bpm (beats per minute), 24mpm (movements per minute), and 38.7°C, respectively.

Evaluation of the digestive system revealed intermittent gas ruminoreticular tympany in all animals. Increased volume was observed in the left paralumbar fossa and the right ventral region (apple/pear aspect) (Fig.1 and 2).

Laboratory findings

The blood profile analysis revealed that leukocytosis and lymphocytosis were the main alterations observed in this study (Table 2).

The ruminal fluid analysis was performed in seven samples, and it was observed that the pH varied from 6.9 to 8.5 (mean = 7.7), with fluid consistency in 57% (4/7), a slightly viscous consistency in 29% (2/7), and a viscous consistency in 14% (1/7) of the samples. In addition, the methylene blue reduction time (MBRT) showed that in 50% (3/6) of the analyzed ruminal fluids, the reduction occurred within three minutes, and in 50% (3/6), the reduction occurred after five minutes. The chloride concentration was analyzed in five samples and increased by 60% (3/5) of the ruminal fluids (Table 3).

Electrocardiographic evaluation

Conventional electrocardiographic. Electrocardiographic evaluation was performed in 22% (2/9) of the animals (cases 8 and 9). The heart rates below the reference parameters for cattle (Constable et al. 2017) were observed in case 8, with a mean of 57 bpm. In both cases, sinus arrhythmia with sinus bradycardia, the electrical axis of the QRS complex, the amplitude of the P wave, PR interval and QT interval remained within the normal values for cows (QRS complex (50-130ms), P wave (60-120ms), PR interval (160-260ms) and QT interval (280-440ms) (Bonelli et al. 2019).

Ambulatory electrocardiographic monitoring (Holter system). The animal that presented with bradycardia in the electrocardiographic evaluation (case 8) was fitted with an ambulatory electrocardiographic monitor (Holter) (Fig.3).

Table 1. General information and clinical signs of the affected mini-cattle by vagal indigestion (n=9). Botucatu/SP, 2022

Mini-cattle	Sex	Age (months)	BW[a] (kg)	Timing of disease development (days)	Clinical signs	Outcome
1	M[b]	8	203	58	5% dehydration, intermittent gas rumenoreticular tympanism with abdominal distension on the right and left flanks (apple/pear aspect), ruminal hypomotility and pasty stools.	Discharged
2	M	18	150	40	5% dehydration, intermittent gas rumenoreticular tympanism with abdominal distension on the right and left flanks (apple/pear aspect), ruminal hypomotility and pasty stools.	Discharged
3	M	10	110	60	5% dehydration, lethargy, intermittent gas rumenoreticular tympanism with abdominal distension on the right and left flanks (apple/pear aspect), ruminal hypomotility and pasty stools.	Discharged
4	F[c]	12	137	14	Mucous membranes congested, intermittent gas rumenoreticular tympanism with abdominal distension on the right and left flanks (apple/pear aspect), ruminal atony and pasty stools.	Discharged
5	M	19	NR[d]	30	Lethargy, intermittent gas rumenoreticular tympanism with abdominal distension on the right and left flanks (apple/pear aspect) and ruminal atony.	Discharged
6	M	17	148	60	Intermittent gas rumenoreticular tympanism with abdominal distension on the right and left flanks (apple/pear aspect), ruminal hypomotility and pasty stools.	Died
7	M	13	NR	180	Lethargy, intermittent gas rumenoreticular tympanism with abdominal distension on the right and left flanks (apple/pear aspect), ruminal hypomotility and pasty stools.	Died
8	F	18	89	6	Intermittent gas rumenoreticular tympanism with abdominal distension on the right and left flanks (apple/pear aspect), ruminal hypomotility and dry stools.	Discharged
9	M	6	135	21	Intermittent gas rumenoreticular tympanism with abdominal distension on the right and left flanks (apple/pear aspect), ruminal atony and dry stools.	Discharged

[a] Body weight, [b] male, [c] female, [d] not recorded.

Table 2. Hematological values in mini-cattle diagnosed with vagal indigestion (n=8). Botucatu/SP, 2022

Parameters	Cases								Reference[b]
	1	2	3	4	5	6	8	9	
Haematocrit (%)	39	29	29	40	31	22	35	34	24-46
Red blood cells ($10^6/\mu L$)	7.87	6.51	8.89	9.93	6.75	5.58	7.60	NP[a]	5-10
Haemoglobin (g/dL)	14.3	9.4	9.3	12.6	11	7.2	10.5	NP	8-15
Total protein (g/dL)	7.0	7.2	7.8	7.6	7.2	7	7.2	7.2	7-8.5
Fibrinogen (mg/dL)	200	400	600	600	400	400	600	600	300-700
White blood cells (/µL)	22200	13100	12540	22785	13755	9800	13800	12400	4000-12000
Neutrophils (/µL)	11100	524	3636	5012	3851	4000	4100	3500	600-4000
Lymphocytes (/µL)	10212	12445	8903	16860	8115	4200	9500	7600	2500-7500
Monocytes (/µL)	222	-	-	227	1375	1500	100	1000	25-840
Eosinophils (/µL)	666	131	-	455	137	100	-	400	0-2400
Basophils (/µL)	-	-	-	227	275	-	-	-	0-200

[a] Not performed, [b] Kramer (2000).

The indices analyzed in the time domain were the mean of all normal RR intervals, standard deviation of RR intervals (SDNN), minimum, mean and maximum heart rate, square root of the mean of successive differences between adjacent RR intervals (RMSSD), and the proportion of differences between successive RR intervals exceeding 50ms (pNN50%). In addition to the indices in the frequency domain, this included both low frequency (LF) and high frequency (HF), in normalized units (Table 4).

Treatment

In all cases presenting with ruminal bloat, an esophageal tube was introduced through the oropharynx to remove gas. There were no signs of esophageal obstruction. An exploratory laparoruminotomy was performed in 78% (7/9) of the mini-cattle, and none of the animals showed any abnormality. Subsequently, a two-stage ruminal fistulation proceeded and, in most of the cases, a permanent ruminal cannula (Kehl®, Campinas, Brazil) was placed (Fig.4). After the procedure,

Fig.1-4. Mini-cattle with vagal indigestion. (**1** and **2**) Mini-cattle showing increased volume in the left paralumbar fossa and in the right ventral region ("apple/pear" aspect). (**3**) Ambulatory electrocardiographic monitoring system (Holter) on a Mini-cattle with vagal indigestion. (**4**) Mini-cattle with vagal indigestion after placement of a permanent ruminal cannula. Botucatu/SP, 2022.

the mini-cattle were followed until they were discharged from the veterinary hospital. Due to the general condition of the animals when they arrived at the service, 22% (2/9) died before the procedure. In one of the cases, death was attributed to gaseous tympanism due to VI and, in the other, to secondary pulmonary infection. Regarding the digestive system of these animals, the *post mortem* examination revealed dilation of the rumen, ruminits and abomasitis in both cases.

DISCUSSION

Digestive tract diseases in ruminants are of great clinical relevance, one of these conditions being VI (Hussain et al. 2017). Despite its importance, the literature on mini-cattle regarding VI is scarce, making a greater approach to this syndrome necessary.

The age of the animals in this study varied from six to 19 months. Our data were similar to those identified by Fidelis Júnior et al. (2011) and Rizzo et al. (2015). These authors reported ages ranging from nine months to one year. Our findings suggest that VI predominantly affected young mini-cattle, probably due to their chondrodystrophic conformation (Rizzo et al. 2015).

The presence of abdominal distension on the right and left flanks was observed in all studied animals and other reports of VI in mini-cattle (Fidelis Júnior et al. 2011, Rizzo et al. 2015). This data corroborates with studies in cattle (Reis et al. 2016, Attia et al. 2021). The main cause of abdominal distension is an increase of gas and liquid in the ruminoreticular cavity (Hussain et al. 2017, Attia et al. 2021). The increase in rumen volume occurs due to the interruption of the flow of ruminoreticular contents to the omasum and abomasum (Reis et al. 2016).

Ruminal motility may be normal, decreased, or increased in patients with VI (Braun et al. 2009, Reis et al. 2016). The majority of the present animals showed hypomotility during the auscultation of ruminal movements, similar to previous reports in cattle (Romão et al. 2012). In contrast, in cattle, incomplete rumen contractions with normal and increased frequency were observed by Reis et al. (2016). The non-transmission of motor impulses by the vagus nerve leads to a deficiency in the aboral flow of the ingested material. Motility may be normal or increased in the early stages of VI due to the activation of low-threshold tension receptors (LTHTR) that are present mainly in the medial wall of the reticulum and in the dorsal ruminal sac (Constable et al. 2017, Hussain et al. 2017). These receptors are activated by mild to moderate abdominal distention and induce ruminoreticular motility (Attia et al. 2021). However, high-threshold tension receptors (HTHTR) are inhibitory to ruminoreticular motility, and as ruminoreticular distension increases, motility decreases due to continuous stimulation of these receptors (Attia et al. 2021). Movements cease in cases of severe distention, possibly as a result of the greater degree of activation of the HTHTR receptors by hyperdistension of the rumen wall (Constable et al. 2017).

Regarding evaluating the consistency of feces, 67% (6/9) of the animals presented with pasty stools. Similar data have been reported for cattle (Romão et al. 2012). However, Reis et al. (2016) found a firm consistency in two cattle. Decreased

Table 3. Analysis of ruminal fluid of mini-cattle diagnosed with vagal indigestion (n=7). Botucatu/SP, 2022

Cases	Color	Odor	Consistency	pH (5.5-7)[c]	Live protozoa (%)			MBRT[a] (minutes) (<5 minutes)[c]	Chloride content (mEq/L) (<30mEq/L)[c]
					Small	Medium	Large		
1	Olive green	Aromatic	Fluid	7.8	90	60	100	3	11.7
2	Green	Aromatic	Fluid	7.7	80	10	10	2	NP[b]
3	Brownish green	Aromatic	Fluid	6.9	70	Absent	Absent	13	NP
5	Green	Aromatic	Fluid	8	90	85	100	3	33.5
6	Olive green	Aromatic	Slightly viscous	7	30	30	0	NP	24
8	Olive green	Aromatic	Slightly viscous	8	Absent	0	0	>15	47
9	Olive green	Aromatic	Viscous	8.5	90	10	0	>15	46

[a] Methylene blue reduction time, [b] not performed, [c] Foster (2017).

Table 4. Heart rate variability indexes in a mini-cattle diagnosed with vagal indigestion. Botucatu/SP, 2022

Parameters	Case 8	Reference in cows
Mean RR[a] (ms[f])	1086.49	744 – 1014[k]
SDNN[b] (ms)	131.47	20.4 – 53.8[k]
Mean HR[c] (beats/minute)	55	71.7[k]
Minimum HR (beats/minute)	46	59.3[k]
Maximum HR (beats/minute)	75	80.9[k]
RMSSD[d] (ms)	84.39	4.9 – 25.7[k]
pNN50[e] (%)	44.94	-
LF[g] (n.u.[j])	46.65	92.1±2.7[l]
HF[h] (n.u.)	45.93	9.3±2.9[l]
LH/HF[i]	1.01	13.8±6.4[l]

[a] Mean of all normal RR intervals, [b] standard deviation of RR intervals, [c] heart rate, [d] square root of the mean of successive differences between adjacent RR intervals, [e] proportion of differences between successive RR intervals exceeding 50ms, [f] milliseconds, [g] low frequency, [h] high frequency, [i] ratio of low-frequency to high-frequency, [j] normalized units, [k] Erdmann et al. (2018), [l] Quevedo et al. (2019).

flow from the forestomach allows for longer ingesta retention (Garry & McConnel 2015); this explains the pasty state of the feces.

Despite the description that cattle (Braun et al. 2009, Reis et al. 2016) and mini-cattle (Rizzo et al. 2015) diagnosed with VI commonly present with a decreased heart rate, the average obtained heart rate of the mini-cattle (cardiac auscultation) was within the reference interval (75 beats per minute), excepting for one animal that presented bradycardia observed by electrocardiographic analysis and a Holter monitor system. According to most of our findings, Reis et al. (2016) did not find bradycardia in cattle. The presence of bradycardia in VI is not well understood. However, it is suspected to be linked to probable vagotonia secondary to injury (Garry & McConnel 2015). Nonetheless, only one animal with bradycardia was observed in the present study. This indicates that VI should not be ruled out due to the absence of bradycardia.

We observed a predominance of parasympathetic activity in the autonomic nervous system during the Holter examination. No studies were found on using HRV in the domain of time and frequency for evaluating mini-cattle with VI. Therefore, the pathophysiology of VI in cattle remains unclear. Further studies on the activity of the autonomic nervous system are required to understand better the involvement of the central or peripheral parasympathetic nervous system in this condition.

Hematological findings are variable, depending on the chronicity and the primary cause of the damage to the vagus nerve. Analysis of the blood profile revealed that leukocytosis and lymphocytosis were the main changes observed in this study, results that differ from studies that did not describe changes in the hematological profile for mini-cattle (Rizzo et al. 2015) and cattle (Reis et al. 2016). Other studies report leukocytosis and neutrophilia in mini-cattle attributed to a possible infectious process (Fidelis Júnior et al. 2011) and inversion of neutrophils, lymphocytes, and hyperfibrinogenemia in cattle, suggesting an acute inflammatory process (Romão et al. 2012).

The results of the ruminal liquid pH in the present study differed from the findings of Rizzo et al. (2015), which found normal characteristics and pH. The present variation in consistency, pH, and the decreased activity of rumen microbiota and protozoa, can be explained by ruminal stasis (Câmara et al. 2009, Foster 2017).

The analysis of the chloride content of the rumen liquid is important and can demonstrate the presence of abomasal reflux (Romão et al. 2012). The chloride concentration increased in 60% (3/5) of the analyzed ruminal fluids in this study. This high value (above 30mEq/L) may occur due to the compromised flow of the ingesta (Foster 2017).

An exploratory laparoruminotomy was performed in 78% (7/9) of the animals in this study. No abnormalities were identified in the reticulum-omasal or pylorus. Due to the absence of abnormalities, we believe that mini-cattle presented a genetic predisposition for the development of VI due to their chondrodystrophic conformation, as previously reported by Rizzo et al. (2015). Fidelis Júnior et al. (2011) verified the tone of the reticulum-omasal orifice after exploratory laparoruminotomy in two mini-bovines, one tone was present, and one was absent.

The surgery of ruminal fistulation was performed in two steps. The first was realized to fix and promote adhesion of the rumen to the abdominal wall, and the second was to create the orifice. Using a permanent ruminal cannula allowed the removal of accumulated gas during ruminal tympanism. These animals were followed daily to clean and open the ruminal cannula when gas tympanism occurred.

The animals were discharged with daily care recommendations. Therapeutic approaches are palliative for managing free gas bloats (Rizzo et al. 2015). Despite this, the placement of the permanent ruminal cannula provides greater survival for the animal (Fidelis Júnior et al. 2011). However, the prognosis is considered reserved due to digestive disorders that can impair the development of the animals.

Two animals died before the placement of the permanent ruminal cannula. In one of the cases, the cause of death of the animal was attributed to respiratory failure due to compression of the diaphragm caused by gas tympanism, as previously reported in bovines (Hussain et al. 2014b). In the other case, the mini-cattle developed a pulmonary infection that can be explained by the pressure exerted on the thoracic cavity due to abdominal distention. This pressure reduces the capacity for correct expansion and contraction of the lungs, compromising lung ventilation. Consequently, there is a decrease in phagocytic activity and an increase in the retention or multiplication of infectious agents (Tharwat & Oikawa 2011). In addition, the animal's general condition, stress and the hospital environment may have contributed to the suppression of the animal's immunity, making it more susceptible to secondary infections.

The anatomopathological findings of the digestive system observed in both cases can be attributed to the impairment of ingesta flow with consequent retention of content in cases of VI (Garry & McConnel 2015).

CONCLUSIONS

The affected animals in this study were young and showed clinical signs compatible with VI.

The most common laboratory findings were leukocytosis and lymphocytosis.

Bradycardia was observed in only one animal through electrocardiographic analysis and a Holter monitor system, reinforcing that VI should not be ruled out due to the absence of this clinical sign.

The therapeutic approach with the implantation of a definitive ruminal cannula, although palliative, allows greater life expectancy for mini-cattle.

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