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Metal detector as alternative tool for Traumatic Reticuloperitonitis diagnosis in cattle along seasons. Detector de metais como alternativa para o diagnóstico de Reticuloperitonite Traumática bovina ao longo das estações do ano.

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Abstract

This study aimed to evaluate the occurrence and location of sharp metallic bodies ingestion in cattle during rainy (winter) and dry (summer) seasons, evaluating an alternative tool for metal body detection. Thus, two studies were carried out, *in vivo*, with 28 cattle suspected of ingestion of hardware bodies; and a *post-mortem* study with a total of 1000 cattle stomachs from the slaughterhouse. Both studies showed the significant higher frequency of metal bodies in summer than in winter. The use of detector associated with ultrasonographic examination aided to notice the effects of these materials on animal organism. Preventive actions to control animal feeding is needed to enhance health, well-being and productivity.
Keywords: Bovine. Stomach. Hardware disease. Winter. Summer.

Resumo

Este estudo teve como objetivo avaliar a ocorrência e localização de ingestão de corpos metálicos agudos em bovinos durante as estações chuvosa (inverno) e seca (verão), avaliando uma ferramenta alternativa para detecção de corpos metálicos. Assim, dois estudos foram realizados, *in vivo*, com 28 bovinos com suspeita de ingestão de corpos metálicos; e um estudo *post-mortem* com um total de 1000 estômagos bovinos de matadouro. Ambos os estudos mostraram a frequência significativamente maior de corpos metálicos no verão que no inverno. O uso de detector associado ao exame ultrassonográfico ajudou a perceber os efeitos desses materiais no organismo animal. Ações preventivas para controlar a alimentação dos animais são necessárias para melhorar a saúde, o bem-estar e a produtividade.
Palavras-chave: Bovino. Estômago. Doença de hardware. Inverno. Verão.

Introduction

Finding of foreign bodies in the cattle digestive tract is a common diagnosis in the clinical routine. Some factors directly influence this high frequency: inefficient sanitary management, mechanization and intensification of systems (MENDES et al., 2009), and the lack of sense of taste in cattle leading to poorly selective eating habits (DYCE; SACK; WENSING, 2010).

The presence of sharp foreign bodies in the stomach of cattle can cause a condition known as "hardware disease" or foreign body syndrome (FBS), by the lesion of the gastric wall compartments. Depending on the worsening of this condition, there may be reticuloperitonitis, pericarditis, hepatic and diaphragmatic abscesses, and a lot of other pathologic conditions (DYCE; SACK; WENSING, 2010; ASHFAQ et al., 2015, UMPHREY; STAPLES, 1992).

The economic losses resulting from the presence of metallic foreign bodies in the digestive tract of ruminants are considerable (SILVA, 2011; SOARES, 2012). They range from a large reduction in milk and meat production, treatment costs, embryo losses in pregnant animals and deaths (NUGUSU et al, 2013). The results of a study carried out in Ethiopia showed a 13.22% incidence of the presence of foreign body in the stomach of slaughtered cattle, with a sample of 484 animals (464 males and 20 females), 80% in females and 72.72% in animals with low body score (TESFAYE; CHANIE, 2012). Therefore, we aimed to test the effectiveness of a commercial metal detector as a tool on diagnosis of this clinic condition and compare the frequency of detection of metal foreign bodies in the stomach of male and female bovines during the dry season (summer) and rainy (winter) seasons.

Material and methods

All methodology adopted for the development of the present research was submitted and approved by the Ethics Committee on the Use of Animals (CEUA) of the Federal Rural University of Pernambuco (UFRPE), Recife-PE.

Animals

In Vivo study: 28 cattle suspected to ingest metallic foreign bodies were evaluated during the period of a year at the Cattle Clinic of Garanhuns, UFRPE, state of Pernambuco, Brazil.

Post Mortem study: A total of 1000 stomachs of male and female adult bovine animals from the Municipal Slaughterhouse were evaluated according to the reliable sample estimate used by Tesfaye and Chanie (2012). The animals were slaughtered and their stomachs were evaluated during the months of August (rainy season in Garanhuns region, state of Pernambuco, Brazil) and February (dry season in the region). Five hundred samples were collected at each season studied.

Evaluation Methods

In Vivo study: The animals were evaluated with a commercial metal detector (Garrett VLF, 6.5 KHz, ACE 250 – Garland, USA, all metal mode, sensitivity 8/8) and a ultrasound machine (Mindray – São Paulo, Brazil) using 3.5 MHz in a convex transducer. All the examinations were

performed by a single operator. The abdominal region of the standing animal were scanned by the metal detector, approaching it, in cranio-caudal and ventro-dorsal sense, from the xiphoid region to the pubic region, and in both antimers, from the hypochondriac region to the flank region in zigzag movements, comprising a lateral area from the alba line at the height of the vertebrae transverse processes. The Coin depth indicator of the metal detector indicated the possibly depth of the object, those data were saved (separated in "+", "++", and "+++" ranges) and compared with the presence or not of metallic objects. Ultrasonographic examinations followed the techniques cited by BRAUN et al. (2018a), by applying to the ventral surface of the thorax (xiphoid region) on both sides of the sternum and to both sides of the lateral thorax up to the level of the elbow. Findings were listed and compared with data collected from the metal detector evaluation. In addition, animal data, such as sex and body score were recorded.

Post Mortem study: After the slaughter, as soon as the stomach was separated from the other viscera, the metal detector (Garrett VLF, 6.5 KHz, ACE 250 – Garland, USA, all metal mode, sensitivity 8/8) was approached to the rumen, reticulum, omasum and abomasum, in cranio-caudal and ventro-dorsal sense, searching any sign of metal presence. Then the compartments were opened and the contents confronted with the results of the metal detector and ultrasound. When present, these were photodocumented and described in terms of shape, weight and trauma potential, considering metal materials having edges, sharp tips, or piercing-sharp surfaces. The frequency of finding metallic bodies in the evaluated stomachs was discussed and compared for rainy (winter) and dry (summer) seasons.

Statistical Analysis

Descriptive statistics were performed using the absolute and relative frequencies of each variable. Pearson's Chi-square qualitative test was used to analyze the association between variables (SAMPAIO, 1998). EpiInfo® 7 was used to perform the statistical calculations and the level of significance was 5.0%.

Results

From July to September, in the rainy season, five cattle were examined, having as clinical suspicion the presence of metallic bodies in the stomach. From October to May, dry season, 23 cases were attended. The body score ranged from 2-3/5, 14 animals presented a score of 3/5. All of the 28 suspected animals were adults, only one male. The pathologic findings on the examined and necropsied animals are listed on table 1.

In the *in vivo* study, from 18 animals with positive detection, 11 had no metallic bodies found in necroscopic investigation. Five animals were detected by the device with metallic object in superficial depth (+) (Table 1). Although that, at necropsy, metallic bodies were not found in three animals, but in other two animals they were found. The moderate depth (++) occurred in four animals. Two animals did not showed metallic bodies at necropsy. Nine animals the presented high depth (+++) of metallic bodies, however, six of them did not presented any metallic body at necropsy.

Table 1 - Ultrasonographic findings, aided examination with metal detector and metal bodies in cattle attended at the Beef Clinic of Garanhuns-PE, from July to May.

Animal	Sex	Ultrasound findings	Detector signal	Metallic body
1	F	Reticulum adherence	+++	1wire/1 screw
2	F	Adherence and abscess	+	Not found
3	F	Pericarditis	++	1 wire
4	F	Pericarditis	+++	2 wires
5	F	Pulmonar lesion	++	Not found
6	F	Pericarditis	+++	Not found
7	F	Pericarditis	Negative	Not found
8	F	Reticulitis with adherence	+++	Not found
9	F	Pneumonia/reticulum adherence	Negative	Not found
10	F	Pericarditis	+	3 wires
11	M	Inconclusive	Negative	Not found
12	F	Pericarditis/pleuritis	++	1 wire
13	F	Inconclusive	Negative	Not found
14	F	Pericarditis	+++	Not found
15	F	Traumatic splenitis	Negative	1 wire
16	F	Displacement of abomasum to the left	+	Not found
17	F	Tuberculosis	Negative	Not found
18	F	Abscess	Negative	Not found
19	F	Cranial peritonitis	Negative	Not found
20	F	Tuberculosis	Negative	Not found
21	F	Pericarditis and right pleuritis	+	Not found
22	F	Pericarditis	+++	Not found
23	F	Inconclusive	+++	Not found
24	F	Abscess and reticulum adherence	++	1 wire
25	F	Inconclusive	+	1 wire
26	F	Pericarditis	Negative	Not found
27	F	Hydrothorax	+++	1 nut
28	F	Traumatic reticulopericarditis with abscess	+++	Not found

M = male; F = female; + = weak; ++ = moderate; +++ = strong

In the *post-mortem* study, on the rainy season, 500 cattle were analyzed, the metal detector was effective in all cases, confirmed by the opening of the positive signal stomachs and investigation of the presence or not of metallic bodies (figure 1). Among them, metallic bodies were found in 31 animals (22 females and 09 males). The prevalence of perforating and non-perforating metallic objects in the animals is described on Table 2. Perforating bodies were found in 14 animals, thirteen cases in the reticulum (10 females and 3 males) and one case in the spleen (female). On the other cases, metallic objects were found loose in the ruminal contents, without perforation signal.

Figure 1 - Samples of metal bodies found in stomachs of cattle from the Municipal Slaughterhouse of Garanhuns, PE, during the winter period. Nails, wires, fence clips, screw part, and even a cannula, among other objects were located with the detector and subsequently photographed

During the dry season, stomachs of 500 more cattle were analyzed, totalizing 1000 animals. Metallic bodies were found in 103 animals, sex and perforating or not discrimination can be seen on Table 2. Among the samples collected in the summer, 30 animals presented perforating metallic objects, 29 cases in the reticulum (11 females and 18 males).

Table 2 - Distribution of the presence or absence of perforating and nonperforating metallic bodies in bovine stomachs at the Garanhuns Municipal Slaughterhouse, according to sex, during the rainy (winter) and dry (summer) season along one year. N = 1000.

Sex	**Dry Season**				**Rainy Season**			
	Present		**Absent**	**Total**	**Present**		**Absent**	**Total**
	Perforating	**Non Perforating**			**Perforating**	**Non Perforating**		
Female	12	30	168	**210**	11	11	221	**243**
Male	18	43	229	**290**	3	6	248	**257**
Total	**30**	**73**	**397**	**500**	**14**	**17**	**469**	**500**

Regarding the location of the metallic foreign bodies, in the group of the 134 evaluated stomachs, 91 animals were located in the rumen (50 males and 41 females), as it was located in the reticulum in 43 animals (21 males and 22 females).

On rainy season, small elements such as a metal sphere and a screw, of 1 cm in diameter and length, respectively, were found up to a wire 13 cm in length. Other metallic foreign bodies observed were nails, fence clamps, cannula and unidentified corroded parts of metal objects (figure 2).

Figure 2 - Samples of metallic bodies found in bovine stomachs of the Municipal Slaughterhouse of Garanhuns, PE, during summer period

Discussion

FBS is one of the most common diseases of the digestive tract of cattle and buffalo (ASHFAQ et al., 2015). Significantly more objects were found in the rumen than in the reticulum in the present study. Similarly, a study carried out in Curitiba investigated the location of the confirmed foreign body in bovines, and in 44% (33/75) of the affected animals, the object was present in the reticulum (between the fifth and seventh intercostal space) and in 56% (42/75) was located in the rumen (OLLHOFF; BIRGEL-JUNIOR, 2012).

Among the animals analyzed, there was a significant difference regarding the higher incidence of foreign bodies in the dry season (summer) in relation to the rainy season (winter). As described by Hailat et al. (1998), there may be differences in food supply according to the season. In Southern Center of Pernambuco State, the climate also influences the quality of food, with winter being a rainy season with a greater supply of pastures and summer, a dry season with a need for supplementation. Martins et al. (2004) warn that the presence of foreign bodies in the digestive apparatus of animals is a consequence of some aspects related to accidental situations, such as dietary deficiencies that condition appetite aberrations due to the organic need of these animals to seek the nutrients which they lack in anomalous sources.

Anteneh and Ramswamy (2015) explain that the addition of grains into the diet of the herd, a direct consequence of the food shortage caused by the decrease in pasture feeding, can be an

important predisposing factor to the development of FBS, since, accidentally, some metal parts may blend together with food. In this way, sharp and perforating objects are commonly found in forage processed foods, which would hardly be found in the pasture. Kahn (2005) points out that dairy cattle are commonly more affected than beef cattle because those ones are more commonly fed with chopped foods such as silage or hay.

In the *in vivo* study of 28 suspected animals, all were adults and only one was male. Braun et al. (2018a, b) mention that among 503 cattle treated with a presumptive diagnosis for RTP at the University Veterinary Hospital of the University of Zurich from January 1, 2001 to December 31, 2014, 496 were females and only 7 were males. In addition, the age of these animals ranged from 1 to 14.9 years (median of 4.1 years) with 97% of animals aged over two years. The clinical manifestation period lasted from 1 to 90 days, with a median of 4 days. Most of the cows (33%) had calved from 0 to 8 weeks before presenting the condition.

Ultrasonography (*in vivo* study) and metal detector (*in vivo* and *post-mortem* study) were used for the investigation of metallic bodies in bovines.

In the *in vivo* study, when evaluated in isolation, the use of the metal detector was not effective in analyzing the presence of metallic bodies in the attended cattle, although on ultrasonography and necropsy the compatible lesions were present in positive animals. Steinemann (1996) reports a metal in a living being is prone to corrosion. The interaction of the foreign body with tissue involves the redox reaction at the interface, the hydrolysis (proton exchange) of oxide-hydrates as corrosion products and the formation of metal-organic complexes in the electrolyte. The denatured tissue in contact with the foreign body is the consequence. Therefore, the longer the metal stays in the animal's body, the greater the possibility of this interaction.

The *post mortem* study, the metal detector was effective in all investigations, confirmed after the opening of the stomachs and the manipulation of the organ and the contents. Human medical clinic has also reported the efficacy of the detector regarding the presence and location of the metallic foreign body (TIDEY et al., 1996; MUENSTERER; JOPPICH, 2004).

Imaging methods such as ultrasonography and radiography have been used for the detection of metallic bodies and their complications in cattle (BRAUN; FLUCKIGER; GOTZ, 1994). Silva (2011) reports that ultrasound findings are determinant for the confirmation of diagnosis and the determination of prognosis of the cattle affected by traumatic reticulopericarditis. The use of a metal detector as an aid during the physical examination allows early diagnosis, reducing expenses and increasing the chance of success in treating the consequences of the ingestion of sharp metallic bodies (MENDES et al., 2009).

Elhanafy and French (2012) report that image diagnosis, such as chest x-ray and cardiac ultrasonography, are difficult to apply in most animals, for a variety of reasons, mainly: lack of equipment, time and/or money. Such factors end up limiting the professional's diagnostic capacity. This may lead to an incorrect diagnosis of the patient, unnecessary treatments and a negative impact on the veterinary-client relationship, causing unnecessary suffering to the animal.

If there is no detailed medical history and when the patient is evaluated many days after ingesting a metal object, the diagnosis becomes more difficult (RAMIN, 2011). Chanie and Tesfaye (2012) recommend other diagnostic methods such as rumenotomy and laparotomy.

In acute cases of Traumatic Reticuloperitonitis (TRP), affected animals usually show clinical signs within 24 hours after the foreign body has penetrated the reticulum wall. The animals present a state of hyporexia to anorexia, marked decrease in milk production, low fever, ruminal atony and recurrent tympanism, anxiety, reluctance to move, arched back, abduction of the thoracic limbs,

progressive weakness, depression of the general state and in some cases, death. Chronic cases of the disease result in less apparent clinical signs (WARD; DUCHARME, 1994; ABU-SEIDA; AL-ABBADI, 2016; BRAUN, 2018b).

Bovine animals may present a decrease in feed intake, milk production and fecal passage for a prolonged period. Less severe cases may resolve within 3 to 5 days after the onset of acute signs. Resolution of the condition is marked by a considerable increase in appetite and normogalactia (MIESNER; REPPERT, 2017, BRAUN, 2018b).

The economic losses resulting from the presence of perforating metallic foreign bodies, ie by FBS, in the digestive tract of ruminants is considerable (SILVA, 2011; SOARES, 2012). The economic importance of this large occurrence in adult females is raised in the results observed by Abu-Seida and Al-Abbadi (2015) on the loss of milk production in buffaloes after the Sharp Foreign Body Syndrome. Before the syndrome, the buffaloes presented average daily production of 5.5 ± 0.4 L and after reducing to 1.58 ± 0.2 L of milk. The authors also observed a high incidence in females in relation to buffalo males (99.1%). According to Nugusu et al. (2013), in addition to the reduction in milk production, reduction in meat production, treatment costs and losses of embryos and pregnant animals are important factors that directly influence the economic issue of production. Radostits et al. (2007), and Anteneh and Ramswamy (2015), further emphasize that those animals seen clinically as being sick, where still about 25% develop serious complications, leading to poor prognoses, and high mortality rates. Therefore, prevention becomes imperative (TESFAYE; CHANIE, 2012).

Conclusion

The Foreign Body Syndrome is a pathological condition of relevance, especially in regions with marked rainfall in dry and rainy seasons. This relevance is sustained not only by pathological implications of the condition, but also by the high incidence of cases and the consequences of it. The use of the metal detector as an alternative tool for the diagnosis of this condition, especially the *in vivo* study, was ineffective by its use as a single examination method, however, when associated with ultrassonography examination, can be used satisfactorily as an alternative tool for diagnosis on clinical routine.

References

ABU-SEIDA, A.M.; AL-ABBADI, O.S. Recent advances in the management of Foreign Body Syndrome in cattle and buffaloes: A Review. **Pakistan Veterinary Journal**, v. 36, n. 4, p. 385-393, 2016.

ABU-SEIDA, A.M.; AL-ABBADI, O.S. Studies on sharp foreign body syndrome in Iraqi buffaloes and its impact on milk production. **Asian Journal of Animal Sciences**, v. 9, n. 3, p. 128-133, 2015.

ANTENEH, M.; RAMSWAMY, V. Hardware disease in bovine (review article). **Academic Journal of Animal Diseases**, v. 4, n. 3, p. 146-159, 2015.

ASHFAQ, M. et al. Factors affecting the economic losses due to livestock diseases: a case study of district Faisalabad. **Pakistan Journal of Agricultural Sciences**, v. 52, p. 515-520, 2015.

BRAUN, U. et al. Clinical and laboratory findings in 503 cattle with Traumatic Reticuloperitonitis. **BMC Veterinary Research**, v. 14, p. 66, 2018b.

BRAUN, U. et al. Ultrasonographic and radiographic findings in 503 cattle with Traumatic Reticuloperitonitis. **Research in Veterinary Science**, v. 119, p. 154-161, 2018a.

BRAUN, U.; FLUCKIGER, M.; GOTZ, M. Comparison of ultrasonographic and radiographic findings in cows with Traumatic Reticuloperitonitis. **Veterinary Record**, v. 135, p. 470-478, 1994.

CHANIE, M.; TESFAYE, D. Clinico-pathological findings of metallic and non-metallic foreign bodies in dairy cattle: a review. **Academic Journal of Animal Disease**, v. 1, n. 3, p. 13-20, 2012.

DYCE, K.M.; SACK, W.O.; WENSING, C.J.G. **Tratado de Anatomia Veterinária**. 4ª ed. Rio de Janeiro: Elsevier, 2010, 687p.

ELHANAFY, M.M.; FRENCH, D.D. Atypical presentation of constrictive pericarditis in a Holstein heifer. **Case Reports in Veterinary Medicine**, v. 2012, p. 1-5, 2012.

HAILAT, N. et al. Pathology of the rumenin goats caused by plastic foreign bodies with reference to its prevalence in Jordan. **Small Ruminant Research**, v. 30, p. 77-83, 1998.

KAHN, C. M. 2005. **The Merck Veterinary Manual**. Whitehouse Station: Merck and Co., 9th ed. 2712p.

MARTINS, A.M.C.R.P.F. et al. Presença de corpos estranhos no habituais no aparelho digestório dos bovinos. **Arquivos do Instituto Biológico**, v. 71, n. 1, p. 83-87, 2004.

MENDES, L.C.N. et al. Use of metal detector to determine the prevalence of metallic foreign bodies in dairy cows in Araçatuba region, Brazil. **Ars Veterinaria**, v. 25, n. 2, p. 54-57, 2009.

MIESNER, M.D.; REPPERT, E.J. Diagnosis and Treatment of Hardware Disease. **Veterinary Clinics of North America: Food Animal Practice**. v. 33, n. 3, p. 513-523, 2017.

MUENSTERER, O.J.; JOPPICH, I. Identification and topographic localization of metallic foreign bodies by metal detector. **Journal of Pediatric Surgery**, v. 39, n. 8, p. 1245-1248, 2004.

NUGUSU, S. et al. Studies on foreign body ingestion and their related complications in ruminants associated with inappropriate solid waste disposal in Gondar Town, North West Ethiopia. **International Journal of Animal and Veterinary Advances**, v.5, p. 67-74, 2013.

OLLHOFF, R.D.; BIRGEL-JUNIOR, E.H. Detecção de corpos estranhos metálicos por meio de ferroscopia em rebanho bovino de leite de alta produção. **Arquivos do Instituto Biológico**, v. 79, n. 3, p. 415-417, 2012.

RADOSTITS, O.M. et al. **Veterinary Medicine: a textbook of diseases of cattle, horses, sheep, pigs, and goats**. 10th ed. Philadelphia: Saunders Elsevier, 2007, 2156p.

RAMIN, A.G. et al. Predication of traumatic pericarditis in cows using some serum biochemical and enzyme parameters. **Acta Veterinaria Belgrade**, v. 61, p. 383-390, 2011.

SAMPAIO, I.B.M. **Estatística aplicada à experimentação animal**. Belo Horizonte: Fundação de Ensino e Pesquisa em Medicina Veterinária e Zootecnia, 1998, 221p.

SILVA, N.A.A. **Achados epidemiológicos, clínicos e ultrassonografia em bovinos acometidos com Reticulopericardite Traumática**. 60f. Garanhuns, PE. Dissertação (Mestrado em Sanidade e Reprodução de Ruminantes), Universidade Federal Rural de Pernambuco, 2011.

SOARES, G.S.L. **Reticuloperitonite Traumática: uma realidade nos rebanhos leiteiros do Agreste Meridional de Pernambuco**. 49f. Garanhuns, PE. Monografia (Graduação em Medicina Veterinária), Universidade Federal Rural de Pernambuco, 2012.

STEINEMANN, S.G. Metal implants and surface reactions. **Injury**, v. 27, suppl. 3, S/C16-S/C22, 1996.

TESFAYE, D.; CHANIE, M. Study on rumen and reticulum foreign bodies in cattle slaughtered at Jimma municipal abattoir, south west Ethiopia. **American-Eurasian Journal of Science Research**, v. 7, n. 4, p.160-167, 2012.

TIDEY, B. et al. The use of metal detector to locate ingested metallic foreign bodies in children. **Journal of Accident and Emergency Medicine**, v. 13, p. 341-342, 1996.

UMPHREY, J.E.; STAPLES, C. **General anatomy of the ruminant digestive system**. University of Florida Cooperative Extension Service, Institute of Food and Agriculture Sciences, EDIS. 1992. Available at <http://ufdcimages.uflib.ufl.edu/IR/00/00/47/05/00001/DS06100.PDF>. Accessed in May 2019.

WARD J.L.; DUCHARME N. G. Traumatic Reticuloperitonitis in dairy cows. **Journal of the American Veterinary Medical Association**, v. 20, p. 874-877, 1994.

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