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Urolithiasis with uroperitoneum and hydronephrosis in grazing cattle in Southern Brazil

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ABSTRACT: *The purpose of this paper was to describe obstructive urolithiasis with uroperitoneum and hydronephrosis in range cattle in southern Rio Grande do Sul. The disease was observed in castrated male cattle, aged between 18 months and 3 years in a herd of 200 steers that were in a ryegrass pasture during the winter and a native pasture during the summer. Different mineral salts were used as a supplement for the animals during the two seasons of the year. Cattle presented a progressive abdominal distention, depression and dehydration ranging from 10 days to one month in duration. One animal was necropsied, and approximately 50 liters of urine (uroperitoneum) in the abdominal cavity were observed. The bladder had a small rupture and was adhered to the pelvic cavity. The right kidney was enlarged with hydronephrosis. Uroliths of more than 1cm in diameter were housed in the penile urethra. In this study, the disease occurred probably because of mineral salt supplementation, resulting in an imbalance of calcium and phosphorus intake.*

Key words: ruminants, uroliths, hydronephrosis.

Urolitíase com uroperitônio e hidronefrose em bovinos a campo no Sul do Rio Grande do Sul

RESUMO: *O objetivo deste trabalho foi descrever urolitíase obstrutiva associada a hidroperitônio e hidronefrose em bovinos no sul do Rio Grande do Sul. A doença foi observada em um rebanho de 200 bovinos machos castrados, com idade entre 18 meses e três anos, mantidos a campo, que permaneciam no inverno em pastagem de azevém e no verão em campo nativo e eram suplementados com diferentes sais minerais nas duas épocas do ano. Os bovinos afetados apresentavam aumento de volume abdominal progressivo, depressão e desidratação, com evolução de 10 dias a um mês. Um bovino foi necropsiado e havia na cavidade abdominal aproximadamente 50 litros de urina (uroperitônio). A bexiga apresentava pequena ruptura e aderência à cavidade pélvica. O rim direito estava aumentado de tamanho e apresentava hidronefrose. Havia urólitos de mais ou menos 1cm de diâmetro alojados na uretra peniana. Neste caso é provável que a doença tenha ocorrido em consequência da suplementação com sal mineral contendo quantidades inadequadas de cálcio e fósforo levando a um desequilíbrio entre estes minerais.*

Palavras-chaves: ruminantes, urólitos, hidronefrose.

Urolithiasis is a metabolic and multifactorial disorder characterized by the formation of uroliths because of the precipitation of minerals or organic substances within the urinary tract of ruminants consuming diets rich in grains or pastures with a high content of silica and/or oxalates. This disease is also associated with a low consumption of water and an increase in the pH of the urine (RIET-CORREA et al., 2008; MORAIS et al., 2016). Ruminants fed with grains or their by-products are more predisposed to urolithiasis. Sheep are more frequently affected than cattle, and the disease has been reported mainly in the Northeast region of Brazil in non-castrated males of variable ages fed with concentrated grains, such as maize or by-

products of soybean or wheat bran (RIET-CORREA et al., 2008). Outbreaks of urolithiasis in castrated range cattle have been described in Mato Grosso do Sul and Minas Gerais without a determination of causes (LEMOS et al., 1998; RIET-CORREA et al., 2008). Urolithiasis has also been described in range ruminants in Australia (MCINTOSH et al., 1974).

In Rio Grande do Sul, an outbreak of urolithiasis was diagnosed in feedlot cattle. Five animals were affected, and four out of 1100 cattle died. Animals received feed rich in grains (wheat, corn, barley, rice bran and soybean), and their associated mineral supplementation contained a high phosphorus content, low fiber and little availability of water (LORETTI et al., 2003). The purpose of this

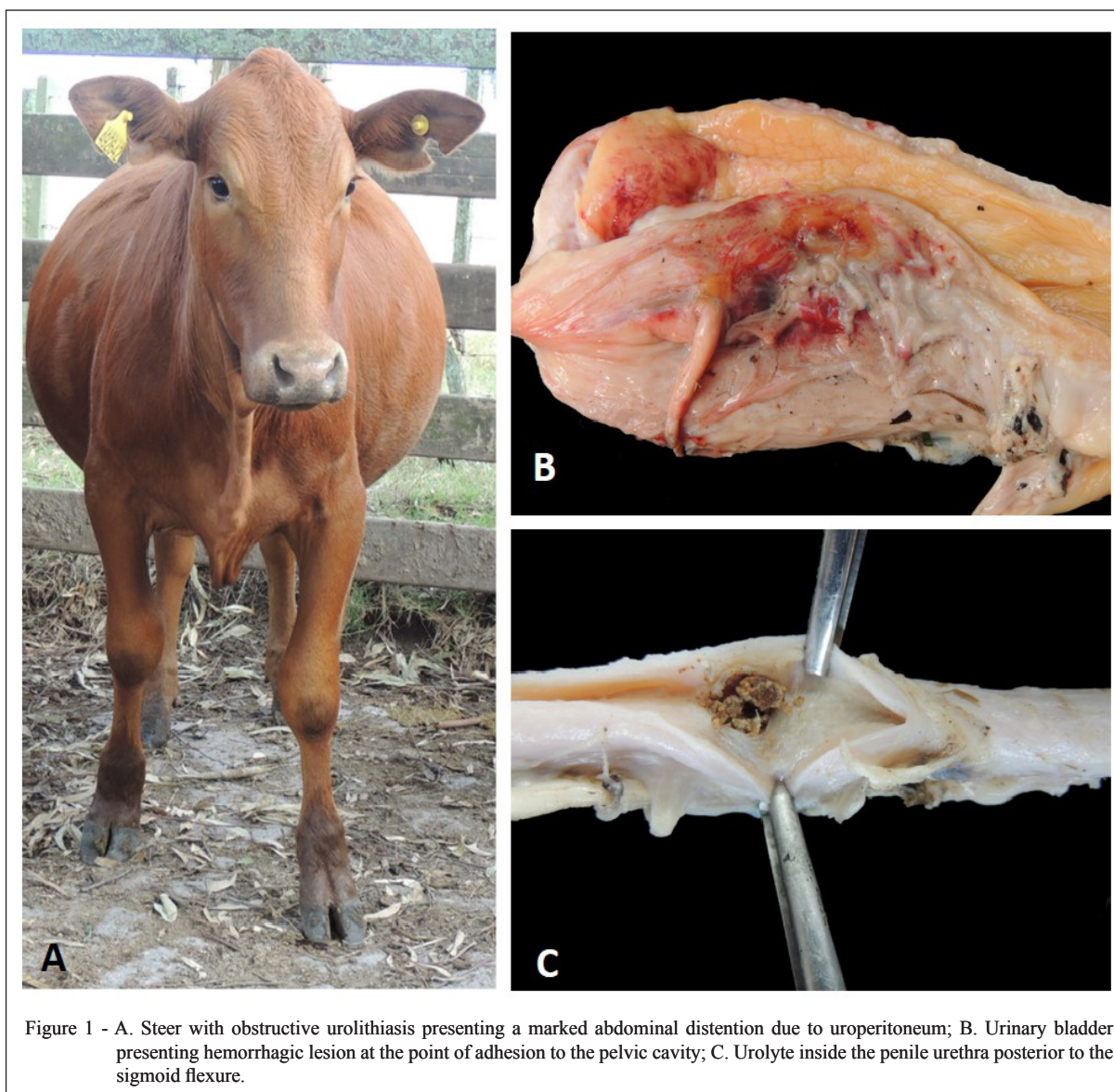
paper was to describe urolithiasis with uroperitoneum and hydronephrosis, which was diagnosed in range cattle in Southern Rio Grande do Sul.

In a farm located in the municipality of Pedro Osório, Rio Grande do Sul, cattle were dying with a history of a progressive abdominal distension, depression and weight loss. Deaths occurred in ten steers between June 2013 and December 2015. A group of 200 crossbred castrated steers, between 18 and 36 months old, was kept grazing in a *Lolium multiflorum* (ryegrass) pasture during the winter and a native field infested with *Eragrostis plana* (Anoni grass) during the summer. Animals received two types of mineral salt *ad libitum* during the whole year. Cattle had free access to water, and according to the owner of the farm, the disease appeared after the beginning of the mineral salt administration. The Ca:P ratio in both salts administered was approximately 1:1. The affected cattle presented a progressive weight loss, dehydration and apathy ranging from 10 days to one month in duration. There was a progressive bilateral abdominal distension, which worsened before death, giving a dull appearance to the abdomen (Figure 1A). A physio-chemical analysis of the water supplied to the animals revealed to be non-potable with a hardness of $35.0\text{mg l}^{-1} \text{CaCO}_3$. A necropsied steer showed subcutaneous edema around the penis and edema in the serosa of the bladder near the middle ligament. The abdominal cavity was filled with 40-50 liters of ammoniacal yellow citric liquid, which was characterized as urine. A part of the ventral wall of the bladder presented a rupture of 1cm and contained a hemorrhagic area on the serosa, which was attached to the pelvic cavity (Figure 1B). The mucosa was thick. Ureters were dilated, and the right kidney was enlarged with hydronephrosis present at the cut surface. Uroliths were observed in the penile urethra near the sigmoid flexure (Figure 1C). The analysis, performed by the Department of Veterinary Clinical Pathology of the Universidade Federal do Rio Grande do Sul, revealed the presence of calcium carbonate and phosphate magnesium ammonia (struvite).

The diagnosis of urolithiasis was made based on the clinical signs, macroscopic lesions and presence of uroliths in the penile urethra. The fact that the animals were ranging in a ryegrass pasture or native field and not supplemented with concentrated feed suggested that the administration of mineral salt *ad libitum* probably led to the formation of uroliths. Cattle have good tolerance to calcium and phosphorus, and its requirements may vary depending on the stage of production; generally, a ratio between 0.6:1 and 6:1 is acceptable if both

minerals are in suitable amounts within the mixture (TOKARNIA et al., 2010). The salt administered to the animals in the present report had a ratio of 1:1. The amount of calcium and phosphorus was 92g kg^{-1} and 70g kg^{-1} , respectively, in the feed administered during the winter. In a study on urolithiasis in Guzera cattle, the authors mentioned the occurrence of the disease in animals eating mineral salt with 88g kg^{-1} of phosphorus. Additionally, the salt of the control group without the disease had only 40g kg^{-1} of the mineral (SACCO & LOPES, 2011). The increase in phosphorus intake causes hyperphosphatemia and a consequent increase in urinary phosphorus content, which, together with hypermagnesemia, contributed to the genesis of uroliths (SACCO & LOPES, 2011). In the present case, the pasture where the cattle remained during the winter was ryegrass, which contains an average of 0.47% of calcium and 0.26% of phosphorus based on dry matter (NATIONAL RESEARCH COUNCIL, 2001). The quantities of these minerals required for cattle are extremely variable, making it difficult to estimate. Quantities required depend on the category of the animal, the amount of these elements in the pasture, the soil in different seasons of the year, and the amount absorbed by the cattle (TOKARNIA et al., 2010). In the native pasture where the cattle stayed during the summer, FREITAS et al. (1994) reported percentages of 0.21% and 0.12% of calcium and phosphorus based on dry matter, indicating that a supplementation with these minerals was necessary. The fact that the disease was observed after the introduction of the mineral salt to the animals reinforces its possible involvement in the etiology of the disease. Morbidity of 5% observed in this study is high if we assume that all bovines with clinical signs were affected by the disease. If the diagnosis of urolithiasis was considered only for the steer that was necropsied, the morbidity rate was 0.5%, and the lethality of 100%. In an outbreak of urolithiasis in feedlot cattle, the morbidity rate was 0.45% (LORETTI et al., 2003). It is possible that other factors contributed to the formation of uroliths. In the outbreak reported by LORETTI et al. (2003), the disease occurred in a period of 30 days, and it stopped when they corrected the causes contributing to the formation of uroliths. In contrast, in the present report, deaths occurred over a long period, and other factors that may have contributed to the occurrence of the disease were not observed, such as a lack of dietary fiber or poor availability of water.

The presence of a small rupture in the bladder with adhesions in the pelvic cavity and a hemorrhagic area explains the presence of uroperitoneum. Rupture of



the bladder secondary to total urethral obstruction by the presence of uroliths leads to the gradual accumulation of intraperitoneal fluid, resulting in an abdominal distention (LORETTI et al., 2003). Most likely, in the present case, the urine was gradually deposited in the abdominal cavity over the course of one to two weeks. The edema in the prepuce apparently occurred due to extravasation of urine through the urethra without rupture of the urethra. Extravasation has been observed in other reports of the disease (RIET-CORREIA et al., 2008).

The possibility of the disease to be associated with water supplied to the cattle was discarded since the total hardness of water was in the concentration of 35.0mg of $\text{CaCO}_3 \text{ l}^{-1}$, considered adequate. Water

hardness was related to the occurrence of urolithiasis in Turkey where the mean hardness of water sampled was 285ppm (285mg l^{-1}) and was greater than the acceptable limits for water hardness (SAHINDURAN et al., 2007). In Australia, a study on urolithiasis was carried out in range ruminants, and the authors associated the cases with exuberant native vegetation after rainfall in semi-arid regions (MCINTOSH et al., 1974).

This paper demonstrated that obstructive urolithiasis can occur in range cattle, causing important economic losses, and demonstrated that the disease is not always associated with feeding with grains. Although, the cause of the disease has not been proven, it is likely that it was related to the

mineral salt administration since the disease occurred on the property after starting the administration of the salt, and no other factors were observed that could lead to the formation of the uroliths.

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