http://dx.doi.org/10.1590/1678-4162-11152

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***Arq. Bras. Med. Vet. Zootec.*, v.71, n.6, p.2041-2048, 2019**

Cervical vertebral osteomyelitis secondary to Streptococcus equi infection in an adult horse - case report

[*Osteomielite vertebral cervical secundária à infecção por* Streptococcus equi *em um cavalo adulto - relato de caso*]

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ABSTRACT

A 15-year-old, mixed breed, male horse was attended with a history of multiple abscesses in the cervical region with a three-year evolution. Upon admission, three fistulous tracts with drainage of purulent secretions in the cervical region, low body score, restriction of cervical movements, and painful sensitivity to palpation were observed. The horse was diagnosed with osteomyelitis secondary to *Streptococcus equi* infection. The initial treatment was antibiotic therapy and local curative. Owing to the lack of response, surgical debridement was performed. An initial favorable response was observed; however, after 4 months, drainage recurred, and the animal was euthanized. A post-mortem computed tomography scan was performed to obtain details of the injury. Cervical osteomyelitis is rare, and its occurrence through hematogenous spread in adult horses and the tomographic findings had not been reported previously. The long period of evolution, difficulty in performing an aggressive debridement, and the presence of multi-drug resistant bacteria contributed to the negative outcome.

Keywords: tomography, bone infection, surgical debridement

RESUMO

Um equino macho, sem raça definida, de 15 anos de idade, foi atendido com histórico de múltiplos abscessos cervicais com evolução de três anos. Na admissão, foram observados: três trajetos fistulosos com drenagem de material purulento na região cervical; baixo escore corporal; restrição de movimentos cervicais; e sensibilidade dolorosa à palpação da região. Foi diagnosticada osteomielite vertebral cervical secundária à infecção por Streptococcus equi. *O tratamento inicial consistiu na administração de antibióticos e curativo local. Na ausência de resposta à terapia, realizou-se o debridamento cirúrgico. Inicialmente, obteve-se uma resposta favorável, entretanto, após quatro meses, houve recidiva da lesão e o animal foi submetido à eutanásia. Realizou-se tomografia computadorizada no* post mortem *para detalhamento da lesão. A osteomielite vertebral cervical é rara, e sua ocorrência por meio de disseminação hematógena em animais adultos não foi previamente reportada. O longo período de evolução, aliado à dificuldade de realização de um debridamento agressivo, e a característica multirresistente do agente etiológico contribuíram para o desfecho negativo do caso.*

Palavras-chave: tomografia, infecção óssea, debridamento cirúrgico

INTRODUCTION

Cervical vertebral osteomyelitis in foals usually occurs secondary to a systemic disease, such as *Rhodococcus equi* or *Streptococcus equi* infection, tuberculosis, or brucellosis, as an extension of soft tissue infection or through hematogenous spread (Dyson, 2011). Vertebral osteomyelitis is rare but is a life-threatening condition in horses (Finley, 1975). Vertebral

Recebido em 20 de novembro de 2018
Aceito em 15 de abril de 2019
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osteomyelitis is often associated with septic arthritis. It occurs in most of the tissues in the body of a foal due to hematogenous dissemination of bacteria with its localization near the physeal growth plate in the metaphyseal or epiphyseal regions of the bone (Crabtree and Jorgensen, 2012). Multiple cases of vertebral osteomyelitis in foals have been reported; however, few reports are described in adult horses. To the best of our knowledge, cervical osteomyelitis secondary to *Streptococcus equi* infection has not previously been reported in mature horses.

CASE STUDIES

A 15-year-old, mixed breed, male horse was attended with a history of abscessing injury in the cervical region with a three-year evolution. Systemic treatment with benzathine penicillin and local outer curative with water, neutral soap, and repellent were carried out at the property. The owner was not able to report the origin of the abscess but denied any on-site medication or trauma in the area. Upon hospital admission, three fistulous tracts with drainage of purulent secretion were observed: one in the middle third of the left cervical region and two in the region of the withers, bilaterally (Figure 1). A low body score (3/9) (Henneke *et al.*, 1983), restriction of cervical movements (flexion, extension, and lateral rotation), and pain sensitivity to palpation of the cervical region were also observed. In all the fistulas, abundant drainage of purulent contents was observed along with the presence of floating areas interspersed with areas of firm consistency in the adjacency of the fistulous tracts.

Figure 1. Aspect of injuries in the horses with cervical vertebral osteomyelitis (horse lateral view). A. Right lateral view: presence of fistula in the region of the withers; B. Left lateral view: presence of fistula in the middle cervical region and fistula at the withers.

Purulent material was collected from the fistulas and sent for microbiological testing. A hemogram, biochemistry profile, serology tests for brucellosis and tuberculosis, and cervical radiographic examination were carried out (Figure 2). The hemogram revealed normocytic and normochromic anemia (globular volume: 21%, erythrocytes: 4.8 x 10^6/µL and hemoglobin: 7.4g/dL), plasma protein 10.2g/dL, fibrinogen 800mg/dL, 14.700 leukocytes/µL, with neutrophils (10.600/µL) and other leukocytes within normal values. Urea, creatinine, aspartate aminotransferase, alkaline phosphatase, and gamma glutamyl transferase levels were within normal limits. The total protein (9.7g/dL) and globulins (8.2g/dL) were increased, while the albumin level was low (1.5g/dL). The test for brucellosis and tuberculosis were negative.

Radiographic examination revealed intense lysis and proliferation in the region of the C2–C5 spinous processes, the presence of calcifications interspersed in the cervical musculature, and areas of gas accumulation in the musculature. Via fistula exploration, it was possible to observe the presence of communication between all the fistulous tracts.

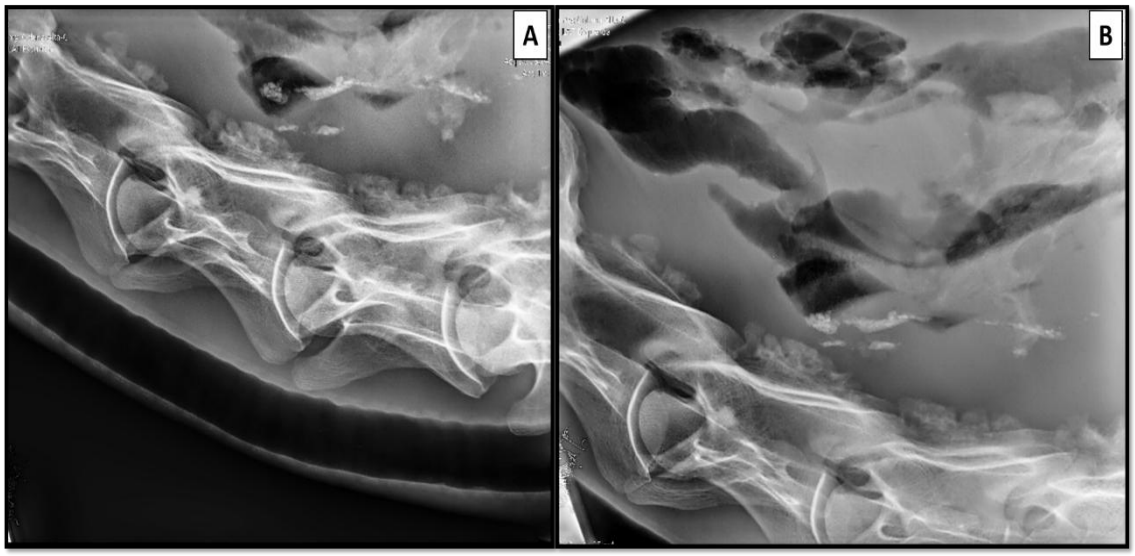

Figure 2. Radiographic images of the cervical region of the horse. A. Presence of intense reactivity of vertebral spinous processes, with areas of lysis and bone proliferation, presence of areas of calcification interspersed in the musculature; B. Point A, in evidence presence of gas in the musculature.

Initial therapy was performed four times a day via diary systemic ceftiofur administration (5mg/kg IV 10 days), local hydrogen peroxide, and 2% iodine solution. No clinical improvement was observed. Bacteriological aerobic culture revealed the growth of *Streptococcus equi* (subspecies zooepidemicus) resistant to various antibiotics, including penicillin and ceftiofur. As an alternative, florfenicol administration was prescribed (20mg/kg IM) for every 48 hours for 10 days; however, after the second administration, there was an episode of diarrhea, and the drug was discontinued.

Ultrasonographic evaluation was performed to identify regions of secretion accumulation and to evaluate the presence of foreign bodies. Multiple abscesses with the presence of heterogeneous content, hyperechoic points in fluctuation, and many vessels adjacent to the lesion were observed (Figure 3).

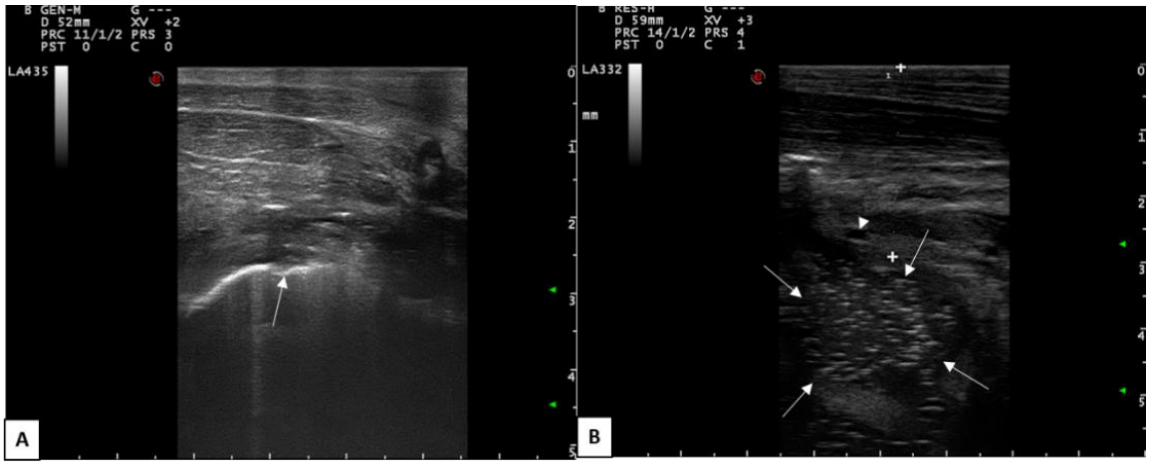

Figure 3. Ultrasonographic image of the cervical region of the horse. A. C4 bone irregularity (arrow); B. Debris accumulation with heterogeneous characteristics and hyperechoic points in floatation (arrow), presence of vessel adjacent to the lesion area (arrowhead).

Drainage of the exudate and fistula exploration and debridement were performed in the standing position with continuous infusion of detomidine (bolus of 5µg/kg followed by continuous infusion of 20µg/kg/h) for sedation. The cervical region was bilaterally clipped, subjected to antisepsis and local anesthetic block.

Two incisions (one incision in each cervical antimer) were made in the region of the middle third of the bilateral neck at the sites identified by ultrasonography as the points of greatest accumulation of secretion. Immediately after the incisions, a large amount of the purulent contents was drained; via the use of long curettes, curettage of the accumulation regions was performed together with the fistulous trajectories of the middle third and the region of the withers bilaterally. Through curettage, fibrous tissue was removed, as well as calcified tissue interspersed with purulent material and large quantities of bone scrapings.

During curettage of the right middle third region, there was significant bleeding and the need for ligation of a large caliber vessel, a factor that impaired the quality of the curettage in this region. In the postoperative period, the horse was administered flunixin meglumine (1.1mg/kg IV SID) for 3 days, a single dose of anti-tetanic serum (10.000IU), and doxycycline (10mg/kg VO BID) for 30 days. A local curative with water, hydrogen peroxide and 2% iodine tincture was used twice a day.

There was a significant improvement in the drainage of fistulas and drainage permanence only by the incision of the right third of the neck. Continuous changes were made in the local curative to promote resolution of the clinical condition; however, drainage was maintained through the right middle cervical region. Local daily treatment was carried out without improvement for 4 months, with continuous emaciation and recurrence of other fistulas; therefore, the patient was euthanized.

After euthanasia, the head was removed together with the cervical vertebrae and a computed tomographic (CT) evaluation of the cervical spine was performed post mortem, using helical cuts of 3mm thickness. The CT image was suggestive of dystrophic mineralization and chronic lytic degenerative processes in cervical vertebrae, identified by areas of vertebral hypoattenuation around the meningeal space; bone lysis in spinous process from C2 to C5; heterogeneous volume increase in the cervical region with areas of hyperintensity of 217-815HU as more evident in C3–C4; hyperintensity of the vertebral body of the caudal dorsal arch at C4; multiple soft tissue dystrophic mining areas extending from C4 to C5, most evident in the dorsal region of 150-900 HU; hypodensity of the dorsal margin of the caudal joint process of C5 (Figure 4). After CT, necropsy was performed. Multiple abscesses were observed in the cervical region, dorsally to the vertebrae, extending to the thoracic region, measuring between 3 and 10 cm at its greatest dimension, with fistulous tracts in musculature (Figure 5).

The cervical muscles showed diffuse necrosis, moderate congestion with moderate mononuclear inflammatory infiltrate, neutrophilic contents, and structures consistent with bacterial colonies. Moreover, in fragments of bone tissue, moderate congestion and hemorrhage were observed, in addition to infiltration of fibrous connective tissue and moderate inflammatory mononuclear infiltrate. Myositis and pyogranulomatous osteomyelitis caused by *Streptococcus equi* was also observed. No other relevant alterations were identified at necropsy.

DISCUSSION AND CONCLUSIONS

Cervical osteomyelitis is characterized by the presence of fever, pain sensitivity on palpation, cervical positional abnormality, anorexia, and weight loss (Dyson, 2011; Coleman *et al.*, 2012). These symptoms were partially observed in the present case, where a constant position of cervical extension, difficulty in positioning in the trough for feeding, and apprehension for food was observed. No hyperthermia was observed, possibly due to the constant drainage of the secretion.

The low body score was attributed to the difficulty in cervical movement for feeding in association with the chronic inflammatory disease due to the prolonged infectious process, a factor that, possibly in association with the nutritional supply, contributed to observed anemia (Weiss and Goodnough, 2005). The presence of leukocytosis with neutrophilia and

hyperfibrinogenemia is consistent with aggressiveness of the lesion and is in agreement with previous reports of the disease (Dyson, 2011), although it is suggested that approximately 80% of the adult animals affected by vertebral osteomyelitis do not present changes in leukocyte counts (Coleman *et al*., 2012). The chronicity of the disease results in hypoalbuminemia and the presence of infectious agents promotes intense hyperglobulinemia (Crisman *et al.*, 2008).

Radiographic examination was carried out to evaluate the severity, extent, and chronicity of the disease. This examination confirmed that the spread of the infection was restricted to the vertebral spinous processes, without the involvement of the vertebral body and medullary channels. The presence of calcification areas demonstrated the chronicity of the process, consistent with the reported evolution of 3 years. Contrary to our observations, other studies have suggested a higher prevalence of injuries in the vertebral body (Coleman *et al*., 2012). Infections associated with *Brucella* and *Mycobacterium tuberculosis* are relatively rare (Kelly *et al.*, 1972); however, due to the zoonotic nature of these diseases, serology tests were performed to exclude Brucellosis and tuberculin.

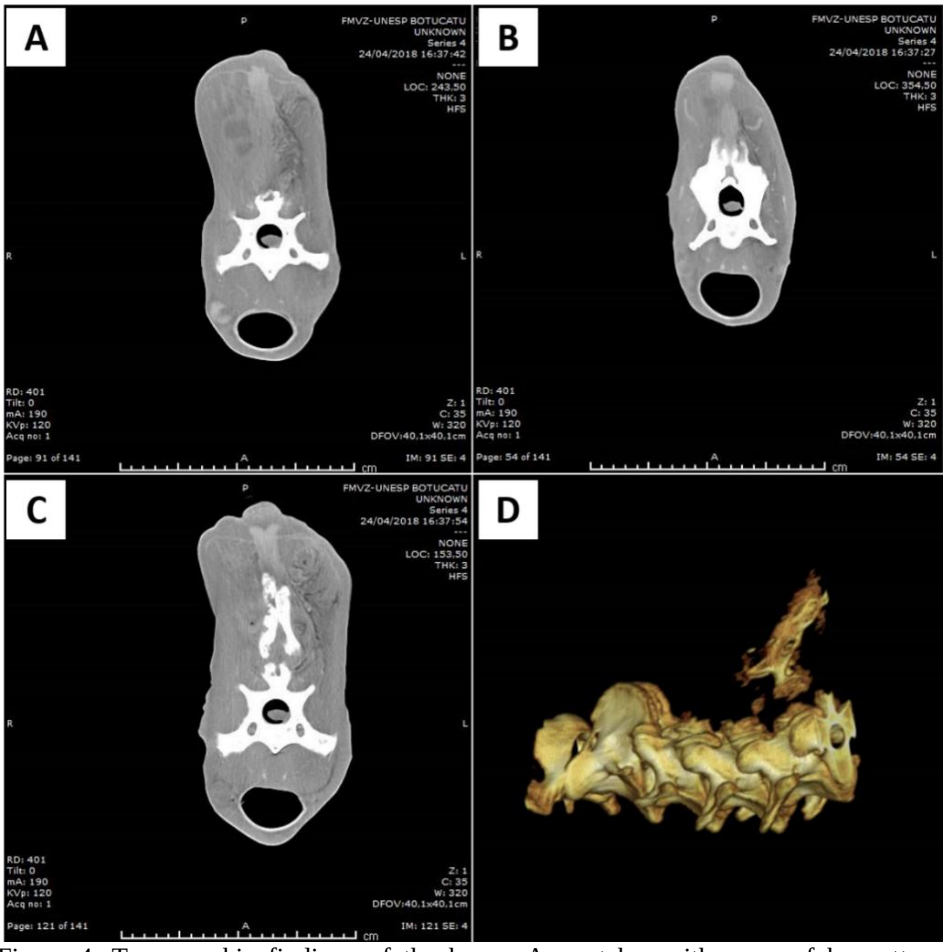

Figure 4. Tomographic findings of the horse. A. vertebra with areas of hypoattenuation around the meningeal space (post mortem), bone lysis observed in a spinous process; heterogeneous volume increase in the cervical region with areas of more evident hyperintensity at C3–C4, B. bone lysis in spinous process from C2 to C5; heterogeneous volume increase in the cervical region with areas of hyperintensity more evident in C3–C4; C. multiple soft tissue dystrophic mining areas extending from C4 to C5, most evident in the dorsal region; hypodensity of the dorsal margin of the caudal joint process of C5; D. 3D reconstruction of the cervical region evidencing the fistula.

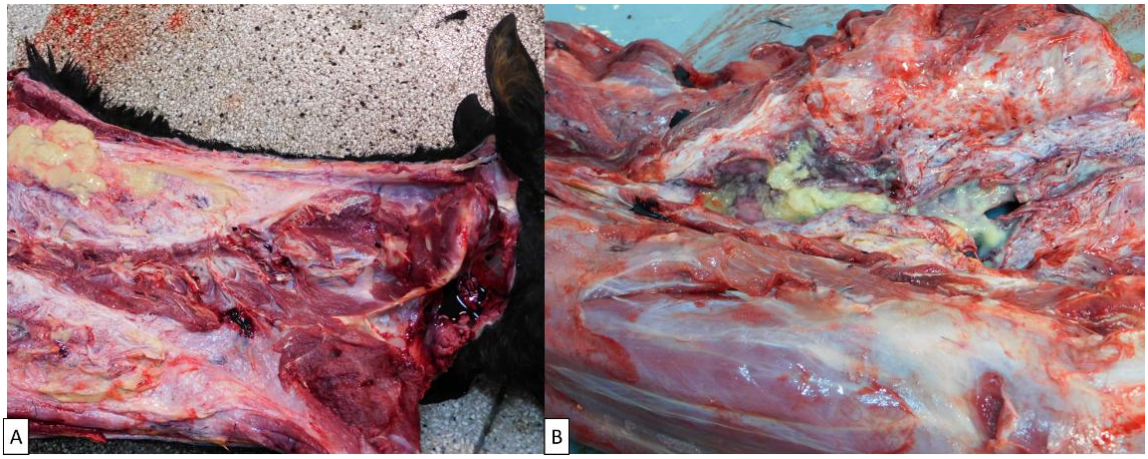

Figure 5. Axial view of the cervical region of the horse. A. Fistulous paths in musculature; B. Approximate view.

In general, the sources of infection for osteomyelitis are divided into three categories: hematogenous, traumatic, and iatrogenic. Hematogenous infections occur due to sepsis and are almost exclusively observed in foals; traumatic infections are usually secondary to lacerations and perforating lesions; and iatrogenic infections are most often associated with orthopedic surgical procedures. In these cases, the main destinations of the infectious agents are the joints and the physeal growth plate in the metaphyseal or epiphyseal regions (Goodrich, 2006). Although infection with a hematogenous origin is rare in adult animals, it is hypothesized as the etiology in the present case, given the absence of local traumatic lesions, intramuscular administration of drugs, and/or surgical procedures.

Infections caused by *Streptococcus equi* in horses are associated with equine adenitis, a disease that can occur in horses of any age but is most frequently observed in young horses (Sweeney *et al*., 2005). Although *Streptococcus equi* is described as the causative agent of vertebral osteomyelitis (Dyson, 2011) and the involvement of *Streptococcus* spp. as an etiological agent of vertebral infections in horses has been described (Giguere and Lavoie, 1994), there are no specific reports of cervical vertebral infection with *Streptococcus equi* (subspecies zooepidemicus) in adult horses or foals . The occurrence of bacteremia in Streptococcal infections has a tendency to cause metastatic infections in humans, including vertebral osteomyelitis (Nickerson and Sinha, 2016). These pathways might be similar in horses due to the frequent hematogenous spread of the infectious agents to the lymph nodes, thorax and abdomen (Sweeney *et al*., 2005), thus triggering cervical osteomyelitis in this case.

Ultrasound examination effectively delimited the regions of accumulation of secretion, and facilitated the identification of a large number of blood vessels as well as surgical exploration. Surgical debridement with posterior fixation of the vertebral body has been previously described as an effective method for controlling cervical infection (Hu *et al*., 2009). In the present case, as the spread of the infection was restricted to the vertebral transverse processes, there was no need for curettage of vertebral bodies or the use of implants for cervical stabilization.

Surgical debridement resulted in improvement of local infectious condition, with restriction of the infection to a right lateral fistula. Despite previous ultrasonographic identification of the local vasculature, the accidental removal of a section of a large vessel during curettage of the right lateral region prevented better surgical exploration and debridement of the fistula, which then persisted with drainage; this was a possible limitation of the applied technique.

The treatment of bone infections requires surgical curettage along with prolonged antibiotic therapy (Roblot *et al.*, 2007; Hu *et al.*, 2009; Crabtree and Jorgensen, 2012). Thus, the administration of doxycycline therapy, an antibiotic with an affinity for bone tissue

(Schnabel *et al*., 2010) was performed to increase the drug concentration in the bone tissue over a long period of time. It is important to note that the infectious agent presented a multiresistant characteristic, being sensitive only to florfenicol and doxycycline among the nine antibiotics tested. Florfenicol has a low molecular weight, which allows good tissue penetration (Papich, 2016). However, the occurrence of adverse effects, such as depression and diarrhea, prevents its use for prolonged periods, as observed in this animal.

The initial favorable result obtained after surgical curettage may have been due to debridement, the use of doxycycline, or the combination of both. However, it is emphasized that curettage plays a fundamental role in the therapeutic strategy and should be aggressive (Hu *et al.*, 2009). While an unfavorable accidental result was obtained for mild curettage and debridement of the fistula, favorable results were also observed in other fistulae where a considerable amount of fibrosis, debris, and bone scabs were removed. We opted for standing exploration, considering the horse's debilitated condition, which precluded the use of general anesthesia, and the need for bilateral access. However, it is believed that general anesthesia would favor an aggressive debridement and hemorrhage prevention.

Cervical vertebral osteomyelitis presents a reserved prognosis (Dyson, 2011; Coleman *et al*., 2012; Crabtree and Jorgensen, 2012), being even more aggressive in the presence of associated infection in the vertebral body, medullary canal, and intervertebral joints (Crabtree and Jorgensen, 2012). The absence of therapeutic response, associated with the general state of the patient and low quality of life, were decisive in the choice of euthanasia.

Radiographical examination was a sensitive tool for the identification of the vertebral infectious process and to demonstrate its chronicity. The tomography was performed after the death of the animal, considering the cost of examination and to restrict expenses, as requested by the owners. However, its accomplishment at an earlier point could have contributed to detailed localization of the infection, as new reactive areas in vertebral bodies were observed in tomographic scans that were not visualized on radiographical examination.

Tomographic examination as well as necropsy findings demonstrated the aggressiveness of the disease, justified the refractoriness of the therapeutic strategies adopted, and justified the indication for euthanasia. It is suggested that the main factors that contributed to the aggressiveness of infection were the time of evolution under inadequate therapy, involvement of multidrug resistant bacteria, absence of physiological condition for patients' response, and difficulty in performing an aggressive debridement.

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