

## Osteomyelitis of Cervical Vertebrae in Foal: Clinical Aspects, Radiographic Images and Computed Tomography

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### Abstract

Osteomyelitis of the vertebral body is a rare condition, and its prognostic is reserved in several species, causing spinal cord involvement, and neurological manifestations. In foals, the disease can be resulted from an infection caused by several bacteria, in which *R. equi* has a higher incidence among the responsible agents. The objective of this report is to describe the osteomyelitis occurrence on the structures that constitute the atlantoaxial joint in a 115 day-old foal. At the cervical spine radiographic exam suspected a fracture in the odontoid process. After the radiograph results, associated to the clinical manifestations, and the owner's interest, it was decided to euthanize the animal. In order to find a more accurate diagnosis, a myelography and a myelotomography were performed. The radiograph was not enough to identify precisely the vertebral disorders, whilst the computerized tomography detected the lesions related to the condition was confirmed later with necropsy and histopathological evaluation.

**KEYWORDS:** Cervical spine, computerized tomography, equine, myelotomography, osteomyelitis

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Received: 2019-05-13

Accepted: 2019-06-22

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### How to Cite This Article

Curvelo de Barros, A. d. M., Cicolo, S., & Lucas, F. C. B. F., Wilson Roberto, et. al., (2019). Osteomyelitis of cervical vertebrae in foal: clinical aspects, radiographic images and computed tomography. Iranian Journal of Veterinary Medicine, 13(3), 326-330.

## Case history

An equine, female, American Trotter, 115 days old, was referred to the veterinary hospital presenting incoordination since the day before, that started with the forelimbs and extended to the hindlimbs. The owner denies previous infection by Herpesvirus or Leptospirosis in the property. The filly was treated previously with three liters of Ringer-lactate solution, corticosteroids, flunixin meglumine, trimethoprim-sulfamethoxazole, and 100mL of dimethyl sulfoxide (DMSO). Additional information regarding doses and treatment duration were not obtained. After therapy, the filly showed improvement on the incoordination of the forelimbs. However, still had trouble getting up and nursing.

## Clinical presentations

Physical exam showed a heart rate of 60 beats per minute (bpm), respiratory rate of 30 breaths per minute (bpm), congested mucous membranes, capillary refill time of two seconds. There were no adventitious lung

sounds. At palpation, the cervical region had an increase in volume with fluctuant consistency on the atlantoaxial joint. The animal could not maintain itself stable when up, nor lifting its head. The hooves had elevated temperature and distal a strong pulse was felt on the palmar and plantar arteries, being more intensive on the right forelimb.

## Diagnostic testing

In the simple radiographic examination of the vertebral column (Fig. 1), the initial suspicion was a fracture of the odontoid process causing compression of the spine. After examining the alterations in the radiographs associated with clinical manifestations of the foal and the owner's interests, euthanize was chosen.

In order to get a more precise diagnosis, by educational and scientific interests, a myelography and myelotomography post-mortem was made. The first showed dorsal displacement of the spine on the atlantoaxial joint and in the dorsoventral projection a thinning of



**Figure 1. Cervical spine simple radiographic exam:** Simple radiographic exam in laterolateral projection of the cranial cervical spine. The atlantoaxial relation is preserved, with an increase of volume in an area that has soft tissue radiopacity curved dorsal and ventrally (arrows), and a discrete diffuse heterogeneous radiopacity at the extension of the odontoid process ossification nucleus and of the axis cranial epiphysis extremity (\*).

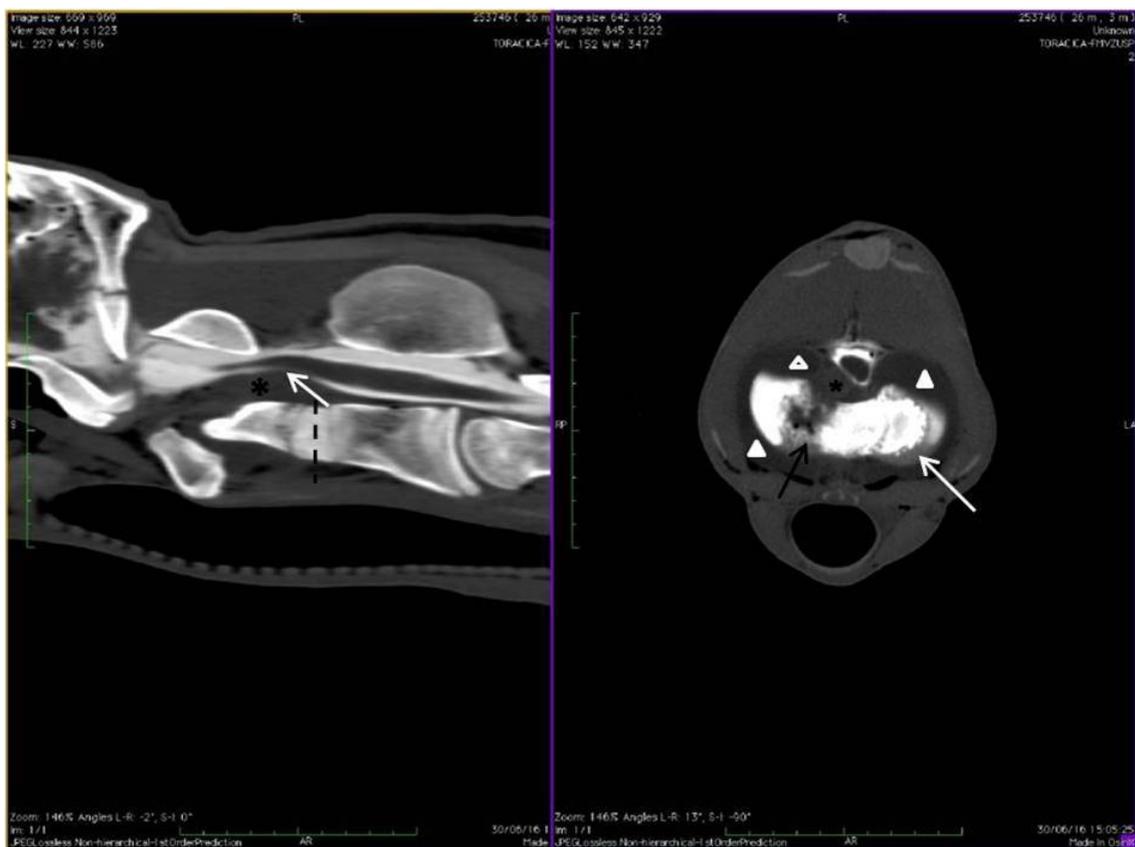
contrast columns and right lateral displacement, compatible with extradural compression. Figure 2 shows which changes were detected in myelography, suggesting infection.

The skull and the spine were sent to pathology for a more definitive diagnosis. After cutting the atlantoaxial joint, a high amount of purulent fluid was drained and a nodular formation of approximately two centimeters in diameter was observed in the joint, reaching the vertebral canal, with irregular and yellow surfaces, friable to the cut. No macroscopic changes were observed on the spine and the encephalon.

Marked Wallerian degeneration was ob-

served at the histopathology exam, especially on the ventral area, with moderate axonal swollen focuses. The neural bodies presented strongly eosinophilic, reduced in size, and with pyknotic nucleus (neuronal necrosis). Both dorsal and ventral roots showed marked Wallerian degeneration. The brain showed moderate multifocal neuronal necrosis, neurophagia focuses, and marked gliosis.

Cytologic exam revealed a high amount of integrated and degenerated neutrophils associated to a high number of coccoid bacteria, and eventually, of intra and extracellular bacillus, suggesting a septic acute inflammatory process.



**Figure 2. Cervical spine myelotomography:** (A) Reformatting of the cervical spine in sagittal plane shows thinning and dorsal displacement of the ventral contrast column (white arrow) and presence of hypodense material in ventral vertebral canal in atlantoaxial transition (\*). The dashed black line indicates the location of the transversal cut showed on the right. (B) Myelotomography in transversal plane, soft tissue window, shows a marked osteolysis on the right side of the axis' cranial epiphysis (white arrow) and bone irregularity (black arrow). Hypodense homogeneous material in ventral vertebral canal on the right (\*) compresses and displaces dorsolateral the spine to the left (extradural compression). A hypodense halo in soft tissues surrounds all the extension of this region (edema/inflammation) (white triangles).

A culture of the material collected from the atlantoaxial region was made and no bacterial growth was observed. Therefore, it was not possible to conclude with agent was the one responsible for the osteomyelitis occurrence. The liquor was also evaluated, and no significant alterations were found.

### **Assessments**

Supporting the two foals' reports that showed vertebral osteomyelitis and septic arthritis caused by *R. equi* infection (Guiguère & Lavoie, 1994), the equine from this report probably had a hematogenous microorganism spread, since the patient history did not show any information regarding trauma or medications administered by contaminated needles or tools that might have caused a local infection. However, the filly did not show signs of pulmonary or gastrointestinal disorders related to a possible *R. equi* or another pathogen infection.

Although the hematogenous spread through suppurative lesions originated by lungs seems common, most agents are successfully eliminated from the blood by the endoplasmic reticulum system, constituted by reticular and endothelial cells which have a phagocytosis function, performing the defense against pathogens (Prescott, 1994; Cabtree & Jorgensen, 2012).

The low potential to eliminate the microorganisms by alveolar macrophages, when compared to macrophages of other parts of the organism, suggests that *R. equi* causes vertebral infection through alveolar macrophage migration. In this context, some studies report that the disease may occur spontaneously when there is no pulmonary injury or another kind of infection (Prescott, 1994), as happened to the filly in this report.

For diagnosis purposes, radiographic eval-

uation is very important in the vertebral osteomyelitis cases, but the classic radiographic lesions of osteolysis and bone proliferation may not be evident two to eight weeks after clinical signs appears, and bone lysis is not radiographic recognized until 30-50% of bone mineralization is lost. In a study made, four to six foals presenting vertebral osteomyelitis did not showed radiographic changes, despite the extensive osteolysis observed at macroscopic and histologic post-mortem evaluation (Stewart et al., 2007).

In conjunction with this information, in a published article regarding a 3-month-old colt that showed acute neurologic signs and was diagnosed with osteomyelitis of the occipital bone, the cervical radiographs and the ones made on the cranium basis were inconclusive with no evidence of osteolysis or changes in the soft tissue radiopacity (Morresey et al., 2007). Along with the study mentioned, this report was also not able to detect typical changes that mark the vertebral osteomyelitis after the acute onset of clinical signs, only being able to find heterogeneous and diffuse radiopacity at the axis odontoid process and a likely loss of bone continuity, which led to a mistaken fracture suspicion.

Another study about the computerized tomography use in cases of cervical osteomyelitis reports a 3-month-old foal with head tilt history after *R. equi* treatment that was sent to a CT exam that revealed a left parietal bone and occipital bone osteolysis, resulting in a caudal displacement of the latter. As a consequence of the infection that reached bone structures, a soft tissue mass was formed associated to the osteolytic lesions, compressing the cerebellum and rostrally displacing the occipital lobe of the brain. The mass expanded medially, taking up part of the magnum foramen without invading the atlantooccipital

joint apparently (Janiceck et al., 2006).

The filly in this report also showed a mass but it was a nodular formation and it was also caused by an infection and it was responsible for compressing the spine. Besides this, the vertebral osteomyelitis diagnosis was efficiently made by computerized myelotomography that was able to identify osteolysis at the axis cranial epiphysis and an increase in the volume of the soft tissue between C1 and C2 corresponding to the nodular formation that was later detected on necropsy.

The bacterial culture of the atlantoaxial joint matter was negative, although the cytological evaluation detected coccoid and bacillus bacteria. Though the fact that *R. equi* is very resilient to temperature changes, depending on how the samples are stored, the culture sensibility for this microorganism may reduce. This can explain the negative culture result in some situations (Huber et al., 2018). Therefore, not identifying bacteria in the filly's joint of this report does not rule out a *R. equi* infection possibility.

In conclusion, the cervical vertebrae osteomyelitis is a grave affection that requires agility and precision in its diagnosis, so an adequate treatment can be started soon enough. In this report, the myelotomography showed more detailed images, contributing to a more effective and precise diagnosis. It is possible then, to highlight the highly importance of different images to assist the diagnosis and avoid mistakes when making diagnostic suppositions.

### **Conflicts of Interest**

The author declared no conflict of interest.

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