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What Is Your Diagnosis?

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Abnormal behavior, and whole-body tremors in a two-year-old Tennessee Fainting Goat cross wether

History

A 2-year-old 25.6-kg Tennessee Fainting Goat cross wether was admitted for evaluation of hyporexia, reduced water intake, abnormal behavior, and whole-body tremors. The goat had been evaluated 2 days prior to hospitalization due to lethargy and hyporexia, and at that time meloxicam (1 mg/kg, PO, q 24 h) was prescribed.

On physical examination, the goat was tachycardic (120 beats/min; reference range, 70 to 90 beats/min) with no evidence of murmurs or dysrhythmias upon auscultation. Respiratory rate (24 breaths/min; reference range, 12 to 24 breaths/min) and thoracic auscultation were unremarkable. Ruminal atony was noted, and ruminal fill appeared decreased on the basis of transabdominal palpation.

On neurologic examination, the goat showed signs of altered mental status, characterized by an apparently normal behavior when manually stimulated that alternated to a dull state when the animal was left undisturbed. The patient consistently demonstrated a stance with an arched back. Menace response and pupillary light reflex were present bilaterally and deemed normal. Palpebral reflex was present but delayed for the left eye. A left ear droop was present. Additionally, the goat displayed head deviation toward the left side. When standing, the patient showed whole-body tremors, which would cease when walking. At walk, no evidence of ataxia was recorded. There was a mild paraparesis affecting both hind legs equally when the goat walked with caudal traction applied (ie, tail pull).

Alessandro Migliorisi, DVM, MS, DACVIM[1]*; Elizabeth V. Acutt, BVSc, MS, DACVR[2]; Catherine Krus, DVM[3]; Katharine M. Simpson, DVM, MS, DACVIM[3]

[1]College of Veterinary Medicine and Biomedical Sciences, Colorado State University, Fort Collins, CO
[2]Department of Environmental and Radiological Health Sciences, College of Veterinary Medicine and Biomedical Sciences, Colorado State University, Fort Collins, CO
[3]Livestock Medicine and Surgery, Department of Clinical Sciences, College of Veterinary Medicine and Biological Sciences, Colorado State University, Fort Collins, CO

*Corresponding author: Dr. Migliorisi (acm8@colostate.edu)

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On the basis of physical and neurologic examination findings, a mostly left-lateralized CNS disorder was highly suspected, with putative lesion (or lesions) neurolocalization at the level of the forebrain, cerebellum, or brainstem, alone or in combination. Involvement of cranial nerves V (trigeminal nerve) and VII (facial nerve) was also suspected.

Clinically important findings on CBC included a moderately high Hct (46%; reference range, 22% to 33%) and mild neutropenia (1.4 X 10^3 cells/µL; reference range, 2 X 10^3 to 6 X 10^3 cells/µL). On plasma biochemical analyses, there was mildly high creatine kinase activity (954 U/L; reference range, 100 to 315 U/L). Results for blood markers of inflammation (fibrinogen, albumin, and globulin) were within reference intervals.

An otoscopic examination was conducted to investigate the presence of ear ticks or other foreign material or debris. Both ear canals were clean and free of visible parasites, exudate, or blood.

At admission, the patient was started on IV isotonic balanced crystalloid fluids (Veterinary pHyLyte Injection pH 7.4) with 20 meq/L KCl added and administered at 3 mL/kg/h, florfenicol (40 mg/kg, SC, q 96 h), flunixin meglumine (1 mg/kg, IV, q 12 h), and thiamine (20 mg/kg, SC, q 12 h). Extralabel drug use was performed with owner consent and complied with provisions of AMDUCA and 21 CFR §530.

The goat was then anesthetized with a combination of midazolam, butorphanol, and ketamine for CSF sampling from the lumbosacral space. The CSF sample appeared clear and colorless. Fluid analysis revealed 0 cells/µL and a total protein concentration of 43 mg/dL (reference range, < 12 mg/dL).[1] These findings were indicative of proteinorrachia and albuminocytological dissociation.

The day following hospital admission, the patient's neurologic signs were unchanged. An intracranial space-occupying lesion was still highly suspected, so advanced diagnostic imaging was recommended and performed. The patient was sedated with a combination of midazolam and butorphanol, placed in sternal recumbency, and underwent CT of its head. Detail transverse slices were obtained in a bone algorithm (window width, 4,000 HU; window level, 700 HU) and in a soft tissue algorithm (window

width, 350 HU; window level, 50 HU) with 1-mm slice thickness before and 5 minutes after administration of iohexol (350 mg/mL; 2 mL/kg [700 mg/kg], IV). Images were reformatted in dorsal and sagittal planes **(Figure 1)**.

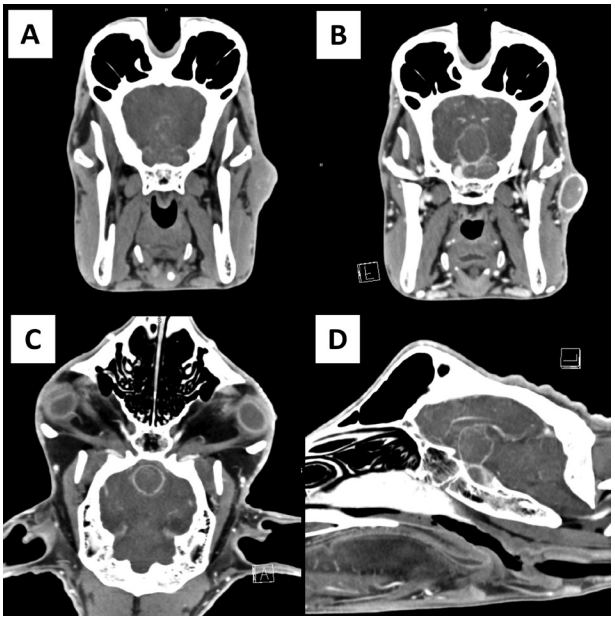

Figure 1—Precontrast transverse (A) and postcontrast transverse (B), dorsal (C), and sagittal (D) plane CT images of the head of a 2-year-old 25.6-kg Tennessee Fainting Goat crossbred wether evaluated because of body tremors and signs of abnormal mental status. The images were obtained at the level of the rostral aspect of the diencephalon and are presented in a soft tissue algorithm (window width, 350 HU; window level, 50 HU) with a 1-mm slice thickness. The goat's right side (A, B, and C) and rostral aspect of its head (D) are toward the left in the images.

Formulate differential diagnoses, then continue reading.

Diagnostic Imaging Findings and Interpretation

Computed tomography revealed a large, lobular, space-occupying, heterogeneously soft tissue–attenuating, rim contrast-enhancing mass along the floor of the calvarium **(Figure 2)**. The mass expanded within the sella turcica and extended dorsally into the diencephalon with mild extracalvarial extension ventrally through the left oval foramen. The mass caused compression of the dorsally adjacent brain parenchyma. A second subcutaneous ovoid soft tissue–attenuating, rim contrast-enhancing mass was present lateral to the left mandible and cranial to the left parotid salivary gland with extension toward the left horizontal ear canal. The soft tissues surrounding this mass were moderately thickened and mildly contrast enhancing. There was a smoothly marginated, strongly contrast-enhancing structure extending through the trigeminal canal, which was thought to most likely represent the inflamed maxillary branch of the trigeminal nerve. The diagnosis, based on the findings of CT, was lobular cerebral abscess with extension through the left oval foramen and associated right trigeminal neuritis (maxillary branch) and additional subcutaneous abscess formation lateral to the left mandible.

Figure 2—Same images as in Figure 1. A large, lobular, space-occupying, soft tissue–attenuating mass (thick white arrows) is in the ventral calvarium and has rim contrast enhancement on postcontrast images. There is enlargement and marked contrast enhancement in the region of the right maxillary branch of the trigeminal nerve (black arrow). Lateral to the left mandible is a subcutaneous ovoid soft tissue–attenuating, rim contrast-enhancing mass (thin white arrow), consistent with an abscess.

Treatment and Outcome

Following CT findings, and due to poor to grave prognosis for life, humane euthanasia was discussed and performed by IV injection of pentobarbital sodium (87 mg/kg).

Postmortem examination confirmed the nature of the space-occupying lesions as abscesses, likely originating from the pituitary gland. Culture of the lesions yielded growth of *Corynebacterium pseudotuberculosis*.

Comments

Computed tomography has become more readily available and cost accessible for many livestock species including small ruminants. Furthermore, it is a quick procedure that can often be performed under sedation or injectable anesthesia. Computed tomography imaging in goats has been successfully used to diagnose a variety of disorders[2–4] and plan further therapeutic steps accordingly. The CNS is an immune-privileged site, and in the case described in this report the presence of neuroparenchymal abscesses was not associated with laboratory evidence

of systemic inflammation. Although CSF analysis remains a fundamental step in the assessment of many neurologic disorders, the present case report highlights its limitations when a well-encapsulated lesion is present in the CNS. Albuminocytological dissociation is defined as the presence of increased CSF-TP concentration with a lack of pleocytosis, a condition appreciated secondary to a variety of disease processes affecting the central or peripheral nervous system. Examples of underlying disorders that may lead to albuminocytological dissociation include increased intrathecal synthesis or release of proteins, blood-brain barrier dysfunction due to meningeal inflammation, and reduced CSF flow. The importance to include a postcontrast examination is also highlighted in this case report. Ring-enhancing lesions only become defined following contrast administration, when they appear to be characterized by a hyperattenuating rim that surrounds a hypoattenuating core. Although the presence of a ring-enhancing lesion is not pathognomonic for a specific disorder, it generally associates with a local disruption of the blood-brain barrier, a local increase of blood flow or both. Known causes of ring-enhancing lesions include cerebral metastases, neoplasia, abscesses, and infarcts. The positive-contrast CT examination allowed us to identify the underlying lesions and interpret the imaging findings in conjunction with the observed clinical signs. The cerebral lesions explained the abnormal mental status. Extension of the space-occupying mass into the diencephalon could explain the body tremors, likely due to disruption of the cerebellothalamic system. Left facial nerve paralysis could be explained by the presence of abscess formation in close proximity to the exit site of cranial nerve VII from the calvarium. Postmortem examination confirmed the nature of the lesions as well-encapsulated abscesses, and bacterial culture yielded growth of *C pseudotuberculosis* as the causative agent for the observed lesions. Although caseous lymphadenitis is usually associated with infection of superficial lymph nodes in goats, involvement of deeper lymph nodes or visceral organs can occur and carries a poorer prognosis. Suppurative brain inflammation in goats has been previously linked to *C pseudotuberculosis* as well as to other bacterial agents,[5] with invasion of the CNS likely originating from septic embolization of the pituitary rete mirabilis. The diagnostic information collected antemortem allowed us to engage in an informative discussion with the client and recommend euthanasia on the basis of the grave prognosis.

This case highlights the feasibility of advanced diagnostic imaging in identifying CNS lesions in companion small ruminants when other, first-line diagnostics fail to provide informative results.

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