What Is Your Diagnosis?

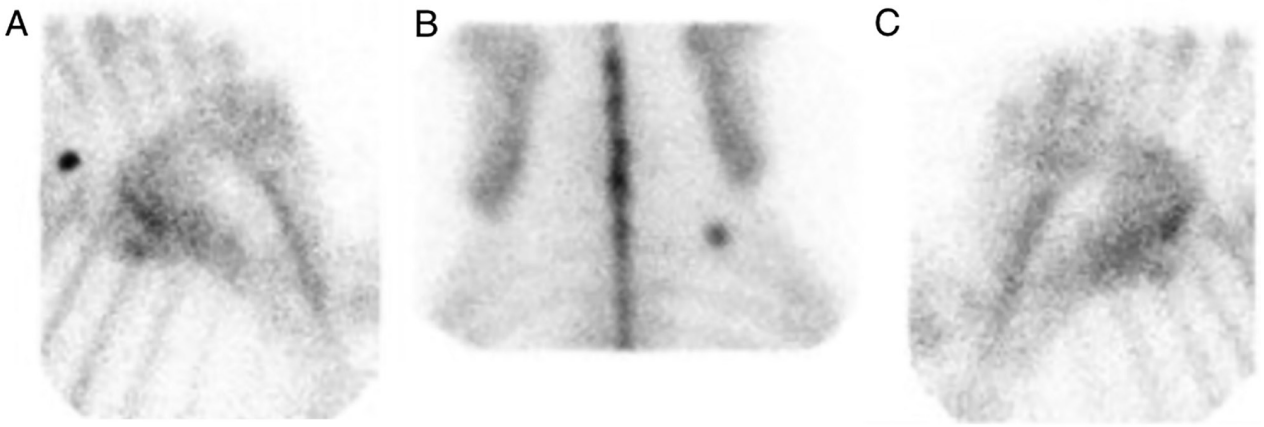

Figure 1—Right lateral (A), dorsal (B), and left lateral (C) nuclear scintigraphic images of the cervical and thoracic regions of the vertebral column of a 9-year-old 500-kg (1,100-lb) American Quarter Horse referred for evaluation of lameness in the right forelimb and restricted range of motion in the neck that had progressed to an inability to eat off the ground. For images A, B, and C, the horse's head is toward the right, top, and left of the images, respectively.

History

A 9-year-old 500-kg (1,100-lb) American Quarter Horse gelding used for barrel racing was referred for evaluation of right forelimb lameness of several weeks' duration that had not resolved with rest. When examined by the referring veterinarian on the farm approximately 5 days before the referral examination, the horse had a grade 3/5 lameness in the right forelimb and substantially limited range of motion in its neck, particularly toward the left. Severity of the lameness increased when flexion tests were performed on the carpal, elbow, and shoulder joints of the affected limb, and lameness was not abolished by regional anesthesia (ie, palmar digital, basal sesamoid, low 4-point [low palmar], or high 4-point [high palmar] regional nerve blocks). On the basis of suspicion of cervical arthritis or some other axial skeletal abnormality, the horse was referred for nuclear scintigraphy and further treatment. A few days later but before diagnostic imaging, the owner reported that the horse had become unable to eat hay off the ground and had developed a low-grade fever.

On referral examination, the horse was quiet, alert, responsive, and febrile (40°C [104°F]; reference range, 37.2°C to 38.6°C [99°F to 101.5°F]). Other findings on physical examination were unchanged from those reported by the referring veterinarian, and no additional localizing clinical signs were evident.

Results of a CBC and serum biochemical analyses indicated hypoalbuminemia (2.2 g/dL; reference range, 2.6 to 4.2 g/dL), hyperglobulinemia (6.9 g/dL; reference range, 1.8 to 4.3 g/dL), anemia (Hct 28%; reference range, 32% to 52%), neutrophilia (12,750 neutrophils/μL; reference range, 2,260 to 8,580 neutrophils/μL) without evidence of a left shift, and hyperfibrinogenemia (900 mg/dL; reference range, 100 to 400 mg/dL). Cytologic examination of a CSF sample collected by lumbosacral centesis with the horse in a standing position revealed no abnormalities. An intravenous jugular catheter was placed, technetium Tc-99m methyl diphosphonate[a] (0.4 mCi/kg [0.18 mCi/lb], IV) was administered, and 2 hours later, nuclear scintigraphy of the cervical and thoracic regions of the vertebral column was performed **(Figure 1)**.

Formulate differential diagnoses and treatment strategies from the history, clinical findings, and Figure 1—then turn the page →

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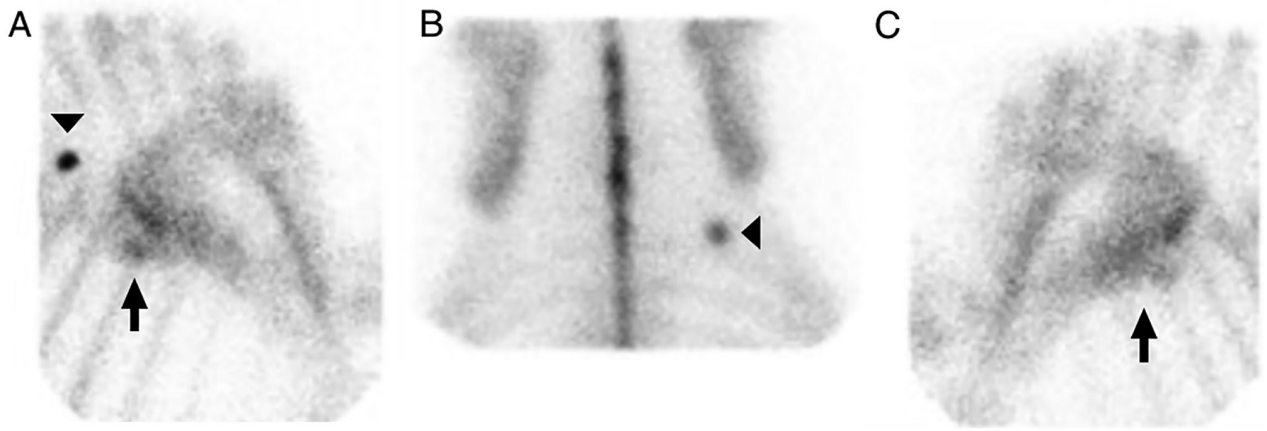

Figure 2—Same images as in Figure 1. Increased radiopharmaceutical uptake is evident in the ventral aspect of the cranial thoracic region of the vertebral column (arrows; A and C) at the level of the caudal border of the scapula and in the area of the right epaxial musculature (arrowheads; A and B).

Diagnostic Imaging Findings and Interpretation

Nuclear scintigraphy revealed increased radiopharmaceutical uptake (IRU) in the ventral portion of the cranial thoracic vertebrae at the level of the caudal border of the scapula in both lateral view images **(Figure 2)**. This was not readily confirmed in the dorsal view image; however, distinction between spinous processes in the region was difficult. Another small focal area of severe IRU located abaxially in the epaxial musculature caudal to the right scapula was evident in the dorsal and right lateral view images but not the left lateral view image.

The IRU associated with the thoracic vertebrae was nonspecific, and the differential diagnosis ranged from benign spondylosis to more aggressive abnormalities, such as abscess formation, neoplasia, diskospondylitis, or vertebral trauma. Our primary differential diagnosis for the IRU in the epaxial musculature was abscess formation or dystrophic mineralization secondary to focal muscle necrosis or chronic granuloma.

Radiography of the cervical and thoracic regions of the vertebral column revealed no abnormalities (not shown). Ultrasonography was used to localize the focal area of intense IRU in the epaxial musculature caudal to the right scapula (not shown) and to guide fine-needle aspirate sampling of the area. Results of cytologic examination of samples collected indicated dystrophic calcification, the cause of which was unknown but presumed not clinically relevant to the other abnormal clinical signs observed.

Treatment and Outcome

Because of the horse's hyperglobulinemia (consisting of a polyclonal gammopathy) and hyperfibrinogenemia, the underlying cause was presumed to have been an infectious process. Findings on gastroduodenoscopy and abdominal and thoracic ultrasonography were unremarkable, and bacterial culture performed on samples of blood and CSF yielded no growth. Further imaging was not possible because of anatomic limitations, given the depth of the lesion and the horse's large size. With no way to safely sample the affected area of the vertebral column and no causative organism identified from bacterial cultures performed on samples of blood and CSF, broad-spectrum antimicrobial treatment was administered.

Despite multiple rounds of antimicrobial treatment (trimethoprim-sulfadiazine, 30 mg/kg [13.6 mg/lb], PO, q 12 h for 8 days; oxytetracycline, 6.6 mg/kg [3 mg/lb], IV, q 24 h for 7 days; minocycline, 4 mg/kg [1.8 mg/lb], PO, q 12 h for 10 days; chloramphenicol, 55 mg/kg [25 mg/lb], PO, q 6 h for 12 days; and ceftiofur sodium, 4.4 mg/kg [2 mg/lb], IV, q 12 h for 7 days), the horse's condition continued to worsen. The horse became cachectic, developed neurologic deficits in its hind limbs, and showed signs of persistent discomfort with abnormal posturing of the head, neck, and forelimbs. Given a lack of response to treatment and severely progressive neurologic deficits, the owners elected euthanasia for the horse (approx 6 weeks after the referral examination and nuclear scintigraphy).

On necropsy, an abscess (approx 1.5-cm diameter) was identified in a transverse process of T7, with discoloration and congestion of the adjacent spinal cord and meninges. The laterality of the abscess was not reported; nonetheless, this finding supported the nuclear scintigraphic and clinical findings. Multifocal thoracic lymph node abscesses were also present, and one of the abscesses had eroded through the intimal layer of the aorta, creating an area of endarteritis with inflammation and fibrosis substantial enough to prevent overt hemorrhage. Microbial culture performed on a sample obtained from the abscesses yielded *Aspergillus fumigatus*.

Comments

Nuclear scintigraphy is highly sensitive at detecting bone turnover, especially in instances of fracture or soft tissue injury involving periosteal attachments, and can be useful in aiding the localization of bony lesions in horses with ambiguous clinical signs of pain.

However, nuclear scintigraphy has lower specificity[1] and provides less anatomic detail than do other imaging modalities, such as radiography and CT, in part because of the lower number of photons emitted during the acquisition of scintigraphic images.[2]

As demonstrated by the inability to definitively see evidence of the vertebral abscess on the dorsal scintigraphic image of the horse in the present report, interpretation of nuclear scintigraphic findings can be complicated by multiple factors, such as tissue attenuation and the determination of clinical relevance of mild to moderate IRU in areas,[3] and the use of other imaging modalities following localization with scintigraphy is often needed. Radiography, as subsequently performed on this horse, is frequently used because of its inherently superior spatial resolution and anatomic detail; however, radiography often cannot identify early bony changes, particularly in the thoracolumbar region in adult horses,[4] and radiography revealed no abnormalities in the horse of the present report. Bony lysis may not be radiographically evident until 30% to 50% of bone mineral has been lost.[5,6] This may explain why results of radiography were unremarkable for the horse of the present report, given that radiography was performed relatively early in the disease course and that only a small-diameter vertebral abscess was identified postmortem 6 weeks later. We suspected that radiographic evidence of the bony changes in the affected vertebra of this horse would have been apparent later in the disease process.

Tissue attenuation could explain why there were no abnormalities detected in the dorsal view scintigraphic image, despite the fact that IRU was evident in both lateral views. Because of the anatomic location of the lesion, not only was the lesion distance from the camera greater for the dorsal view versus the lateral views, but additional attenuation was likely when obtaining the dorsal view image because of thicker overlying musculature from the dorsal perspective versus the lateral perspective.[7,8] This is secondary to the fact that for technetium Tc-99m, there is 50% attenuation of γ rays for every 5-cm thickness of muscle tissue traversed.[2] We suspected that if nuclear scintigraphy had been repeated later in the course of disease in the horse of the present report, the vertebral area of IRU would have been more dramatic and more lateralized to the affected transverse process of T7, likely because of a combination of disease progression and continued cachexia involving the overlying soft tissues.

When we considered the finding of hyperglobulinemia combined with the abnormal findings from nuclear scintigraphy in the horse of the present report, we suspected that an infectious process was most likely. Diskospondylitis was deemed less likely than a solitary abscess because of the apparent monostotic nature of the lesion.[9] In addition, multiple myeloma was excluded as a differential diagnosis through both the identification of a polyclonal gammopathy and the fact that myeloma lesions typically have low bony radiopharmaceutical uptake as a result of bone resorption secondary to greater osteoclastic and less osteoblastic activity.[10] This is in contrast to the IRU seen in the horse of the present report.

Vertebral body abscess formation generally carries a poor to guarded prognosis, especially when advanced, and identification of the condition early in the disease process can be challenging. Microbial culture performed on samples from the vertebral abscesses identified on necropsy grew *A fumigatus*, for which successful treatment would have been unlikely.[11] Infectious processes involving the vertebral bodies are uncommon in adult horses[b] and usually associated with prior episodes of pneumonia or hematogenous seeding of an infectious organism secondary to trauma; however, an inciting event was never identified in the horse of the present report.

Our findings in this horse supported potential advantages of nuclear scintigraphy as either a solitary or adjunct imaging modality in instances of vertebral abscess formation or when an infectious focus occurs in an area of the body that cannot otherwise be meaningfully or reliably imaged. We believe that nuclear scintigraphy may be a useful tool for identifying similar abscesses, with the caveat that timing of the procedure relative to the course of the disease may affect the usefulness of the imaging findings, thereby possibly increasing the utility of performing or repeating the procedure later in the disease course.

Acknowledgments

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Footnotes

a. Cardinal Health, Stamford, Conn.
b. Coleman MC, Chaffin MK, Griffin J, et al. Vertebral osteomyelitis and diskospondylitis in adult horses (abstr). *J Vet Intern Med* 2012;26:747.

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