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AUTHORS: Crawford, A H; Hedley, J E; Lam, R W; Drozdzynska, M J; De Decker, S

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Surgical treatment of a paraspinal abscess with osteomyelitis and spinal cord compression in a rabbit

Abbe H. Crawford BVM&S, PhD

Joanna E. Hedley BVM&S

Richard Lam BVSc

Maja J. Drożdżyńska DVM

Steven De Decker DVM, PhD

From the Department of Clinical Science and Services, Queen Mother Hospital for Animals, Royal Veterinary College, University of London, North Mymms, Hatfield, Hertfordshire AL9 7TA, England. Dr. Lam's present address is Small Animal Specialist Hospital, Level 1, 1 Richardson Pl, North Ryde, NSW 2113, Australia.

Address correspondence to Dr. Crawford (ahcrawford@rvc.ac.uk)

CASE DESCRIPTION

A 16-month-old neutered male Continental Giant rabbit (*Lepus curpaeums*) was referred for evaluation of a 7-day history of acute-onset, progressive, symmetric paraparesis.

CLINICAL FINDINGS

On initial examination, the rabbit was nonambulatory, and results of neurologic examination were consistent with a lesion affecting the T3-L3 spinal cord segments. Thoracic radiography showed irregular widening of the left T11-12 articular process joint. Marked dorsolateral and lateral extradural spinal cord compression with contrast enhancement of the adjacent epaxial muscles was evident on MRI images of the spine.

TREATMENT AND OUTCOME

A left-sided T11-T12 hemilaminectomy was performed, which revealed an abnormal and hypertrophic T11-12 articular process joint and an osteolytic lesion communicating with the vertebral canal. Copious purulent material causing marked spinal cord compression was evident, and the surgical site was lavaged extensively with sterile (0.9% NaCl) saline solution. Results of aerobic, anaerobic, and enriched bacteriologic cultures of swab specimens obtained from the surgical site were negative. Histologic analysis of biopsy samples revealed chronic purulent osteomyelitis, myositis, and fasciitis with necrosis, fibrosis, and dystrophic mineralization. The rabbit was discharged 48 hours after surgery. Ten weeks after surgery, the rabbit was ambulatory with mild paraparesis. On telephone follow-up 21 months after surgery, the owners indicated that the rabbit was healthy and expressed satisfaction with the treatment and outcome.

CLINICAL RELEVANCE

Paraspinal abscess with vertebral canal involvement should be considered as a differential diagnosis for rabbits with clinical signs of progressive T3-L3 myelopathy. Outcome for the patient of the present report suggested that surgical treatment including decompression and debridement can result in a favorable long-term outcome. (*J Am Vet Med Assoc* 2017;251:340–344)

A 16-month-old 5.4-kg (11.9-lb) neutered male Continental Giant rabbit (*Lepus curpaeums*) was referred to the Queen Mother Hospital for Animals at the Royal Veterinary College for evaluation of a 7-day history of acute-onset, progressive, symmetric paraparesis with no history of trauma. Radiography of the vertebral column performed by the referring veterinarian revealed irregular widening and slightly increased radiopacity of the left T11-12 articular process joint **(Figure 1)**. Results of initial physical examination were unremarkable; however, a complete neurologic examination identified nonambulatory paraparesis with proprioception absent in both pelvic limbs. Additionally, the patellar reflexes were increased bilaterally, but there was no evidence of spinal hyperesthesia. On the basis of these findings, the provisional diagnosis was a lesion affecting the T3-L3 spinal cord segments. Results of a CBC, serum biochemical analyses, and venous blood gas analyses were within reference limits.

The rabbit was premedicated with midazolam (0.5 mg/kg, [0.23 mg/lb]), ketamine (5 mg/kg [2.3 mg/lb]), and butorphanol (0.2 mg/kg [0.09 mg/lb]) administered IM in preparation for MRI[a] of the spine. At the time of premedication, ranitidine (3 mg/kg [1.4 mg/lb], SC) and metoclopramide (0.3 mg/kg [0.14 mg/lb], SC) were also administered prophylactically in an effort to decrease the likelihood of postoperative ileus. A 22-gauge, 2.5-cm IV catheter was placed in the right marginal auricular vein, general anesthesia was induced with alfaxalone (3 mg/kg) administered IV, and the trachea was intubated with a 3-mm uncuffed endotracheal tube. Anesthesia was maintained with sevoflurane in oxygen (end-tidal sevoflurane concentration, 1.9% to 2.6%) and mechanical ventilation. Hartmann solution was infused at a rate of 5 mL/kg/h IV throughout.

Magnetic resonance imaging of the thoracolumbar vertebral column was performed, including T2-weighted sagittal and transverse images and T2-weighted short-tau inversion recovery sagittal images. T1-weighted sagittal and transverse images were acquired before and after IV injection of gadolinium contrast material. Slice thickness was 1.75 mm in the sagittal plane and

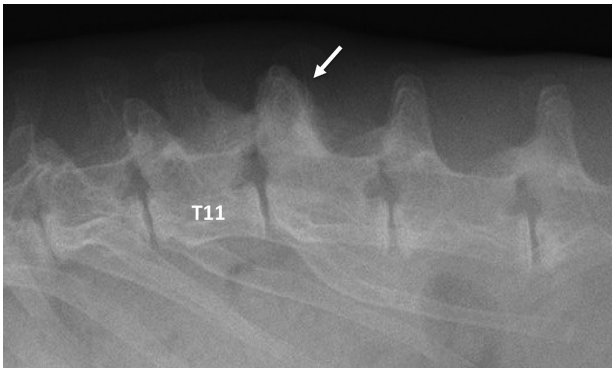

Figure 1—Lateral radiographic view of the thoracolumbar vertebral column of a 16-month-old neutered male Continental Giant rabbit (*Lepus curpaeums*) that was referred for evaluation of a 7-day history of acute-onset, progressive, symmetric paraparesis. Notice the irregular widening of the T11-12 articular process joint (arrow).

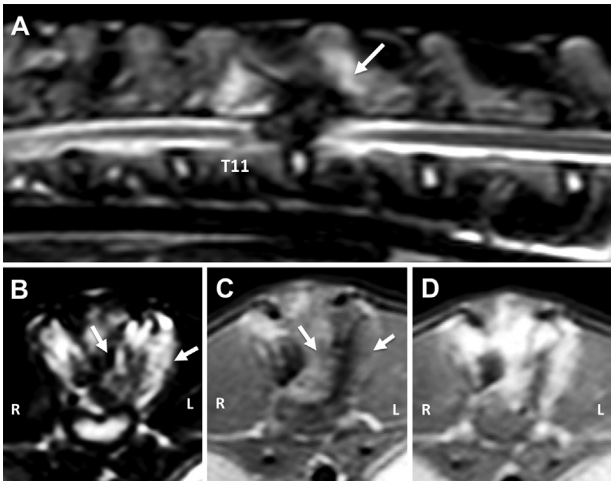

Figure 2—Magnetic resonance images of the thoracolumbar vertebral column of the rabbit in Figure 1. T2-weighted sagittal (A) and transverse (B) images indicate irregular widening of the T11-12 articular process joint. Moderate to severe dorsolateral and lateral extradural spinal cord compression is evident on the T1-weighted transverse image (C; arrows), with marked contrast enhancement of the articular process, articular facet, pedicle, lamina, and associated epaxial muscles apparent on the T1-weighted postcontrast transverse image (D).

2 mm in the transverse plane, with an interslice gap of 0.9 mm in all planes. Magnetic resonance imaging identified irregular widening of the T11-12 articular process joint and moderate to severe dorsolateral and lateral extradural spinal cord compression. Spinal cord compression was most evident on T2-weighted and T2-weighted short-tau inversion recovery images as hyperintense material that extended beyond the vertebral canal and involved the articular process joint and the adjacent epaxial muscles. There was moderate to marked contrast enhancement of this abnormal tissue. Irregular enlargement of the pedicle and spinous process of T12 with irregular osseous margins were also evident **(Figure 2)**.

To further evaluate the extent and nature of the lesions, CT[b] was performed immediately after MRI during the same anesthetic episode. Results of CT confirmed the abnormalities evident with MRI and additionally identified a smooth periosteal reaction surrounding the articular processes of T11 and T12 and the vertebral arch and spinous process of T12. Focal osteolytic lesions of the cranial articular process of T12 and between the articular process and spinous process of T12 were also identified **(Figure 3)**. Contrast material was not administered because contrast enhancement had been documented with MRI. Differential diagnoses at this time included spinal cord compression caused by an inflammatory or neoplastic disease process. Further diagnostic interventions were discussed with the owners, including collection of tissue specimens for cytologic or histologic analysis by means of fine-needle aspiration or percutaneous needle biopsy. However, in view of the severity of the neurologic deficits and the marked spinal cord compression detected with MRI, it was elected to proceed immediately with biopsy and surgical treatment.

A standard left-sided T11-T12 hemilaminectomy was performed **(Figure 4)**. Dissection of the epaxial musculature from the spinous and articular processes revealed an abnormal and hypertrophic T11-12 articular process joint

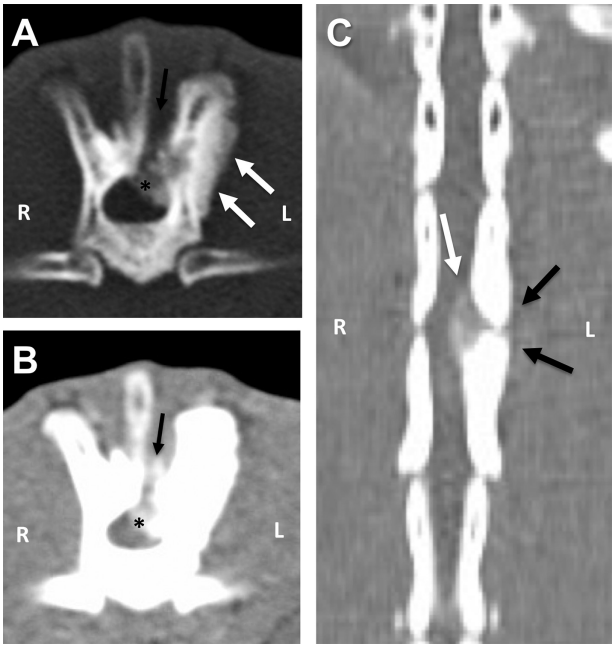

Figure 3—Computed tomographic images of the thoracic vertebral column of the patient in Figure 1, acquired at the level of the T11-12 articular process joint. Notice the smooth periosteal reaction delineating the left articular processes in the transverse plane image (A; white arrows). An osteolytic lesion is evident between the spinous process and lamina (B; black arrow). Dorsolateral spinal cord compression caused by an extradural lesion with soft tissue–attenuating characteristics is also present (asterisk). A dorsal reconstruction (C) demonstrates left-sided spinal cord compression (white arrow) and remodeling of the left caudal articular process of T11 and left cranial articular process of T12 (black arrows).

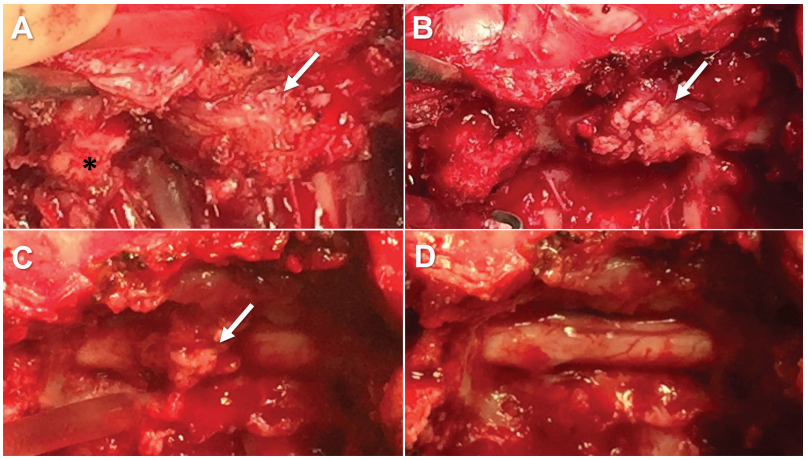

Figure 4—Intraoperative photographs of the rabbit in Figure 1 during hemilaminectomy for treatment of a paraspinal abscess with osteomyelitis and spinal cord compression. Notice the irregular T11-12 articular process joint that is covered by a fibrous capsule (A; arrow), compared with the unaffected T10-11 articular process joint (asterisk). Partial sharp debridement of the affected articular process joint revealed caseous purulent material (B; arrow). Spinal cord compression caused by thick purulent material is evident (C; arrow). Spinal cord decompression was achieved after debridement of all purulent material and copious lavage (D).

covered by a thick fibrous capsule and an osteolytic lesion communicating with the vertebral canal at the junction of the pedicle and lamina of T12. Partial excision of the left articular processes revealed purulent discharge and osteolytic changes affecting the articular facets, articular processes, and pedicles of T11 and T12. When the vertebral canal was entered, copious purulent material with a thin fibrous capsule that was causing marked spinal cord compression was identified. A sample of an affected articular process and epaxial musculature was collected and submitted for histologic examination, and swab specimens were obtained from the vertebral canal and surrounding osteolytic bone lesions and submitted for microbial culture and susceptibility testing. All purulent material was then removed, and the surgical site was copiously lavaged with sterile saline (0.9% NaCl) solution. The wound was then closed routinely in 3 layers. The patient recovered without apparent complications.

Intraoperative analgesia was provided with fentanyl (0.1 to 0.4 µg/kg/min [0.045 to 0.18 µg/lb/min], IV) and ketamine (10 µg/kg/min [4.54 µg/lb/min], IV), adjusted as indicated. To facilitate intraoperative collection of samples for microbial culture and susceptibility testing, the patient did not receive preoperative antimicrobials. After surgery, the rabbit received buprenorphine (0.03 mg/kg, IV, q 8 h for 2 days), meloxicam (0.5 mg/kg [0.23 mg/lb], IV, once, followed by the same dose PO, q 24 h for 10 days), metoclopramide (0.5 mg/kg, SC, q 8 h for 2 days), and ranitidine (4 mg/kg [1.8 mg/lb], PO, q 12 h for 5 days). Penicillin G procaine–benzathine was administered SC (60,000 U/kg [27,000 U/lb]) every 48 hours, with administration continued for a total of 8 weeks after surgery. Syringe feeding[c] was provided every 4 hours for the first 12 hours until recovery of sufficient voluntary food intake. The rabbit maintained a good appetite, with voluntary control of urination and defecation. It remained nonambulatory and paraparetic and was discharged 48 hours after surgery with instructions to the client for strict cage rest, continued nursing care, and home rehabilitation (massage and passive range-of-motion exercises twice daily for 10 minutes) .

Results of microbial (aerobic, anaerobic, and enriched bacteriologic) cultures of surgical specimens were negative. Histologic analysis of the surgical specimens identified abundant viable and degenerate neutrophils with chronic purulent osteomyelitis, myositis, and fasciitis in conjunction with necrosis, fibrosis, and dystrophic mineralization. Microorganisms were not observed. The histologic diagnosis was paraspinal abscess with vertebral osteomyelitis as the cause of spinal cord compression.

A follow-up examination 4 weeks after surgery revealed marked improvement; the rabbit was ambulatory with mild to moderate paresis and proprioceptive ataxia of the pelvic limbs. Hopping and paw placement responses were present, although decreased, in both pelvic limbs. Further improvement was seen at the 10-week follow-up examination, although mild paraparesis was still evident. A telephone interview 7 months after surgery indicated that the rabbit had improved further and, according to the owners, was clinically normal. Twenty-one months after surgery, the owners reported that the rabbit was healthy and that they were satisfied with the treatment and outcome.

Discussion

Whereas a variety of conditions including vertebral fracture or luxation, intervertebral disk disease, infection, congenital malformations, metabolic bone disease, and neoplasia have been reported[1–4] as causes of spinal cord disease in rabbits, we are unaware of previous reports describing the diagnosis and successful surgical treatment of a paraspinal abscess causing vertebral osteomyelitis and spinal cord compression in this species. Rabbit neutrophils (or heterophils) contain a lower concentration of myeloperoxidase digestive enzymes, compared with concentrations in neutrophils of other mammals, resulting in the formation of thick purulent material, and abscesses are relatively common in this species[5,6] Consistent with the intraoperative findings for the rabbit of the present report, chronic abscesses are characterized by resorption of water from the purulent exudate, producing thick, caseous material that becomes separated from the surrounding tissues by a fibrous capsule. A thin fibrous capsule was evident in the patient described in the present report, and the thick purulent material had coalesced to form a dense aggregate causing focal

compression of the spinal cord, rather than dispersing along the vertebral canal. As such, a diagnosis of paraspinal abscess, rather than epidural empyema, was made. Antimicrobial penetration of an abscess cavity is often inadequate because of poor vascularity, and surgical intervention with debridement and lavage to remove all purulent exudate is typically necessary. We suggest that it is therefore unlikely that the rabbit of the present report would have improved without surgical intervention.

As for the patient described in the present report, abscesses in rabbits may not appear painful, nor are they generally associated with clinical signs such as pyrexia and inappetence. In the rabbit of this report, the underlying cause of the abscess was not apparent from the medical history or the physical examination. Possible causes included direct inoculation following a bite injury, penetrating trauma, or migrating foreign body. Alternatively, a primary infectious focus may have occurred distant to the spinal cord (eg, dental infection), with secondary hematogenous or lymphatic spread. However, results of microbial culture of swab specimens obtained intraoperatively from the surgical site were negative, consistent with results of previous studies[7–9] in which culture of specimens obtained from abscess contents infrequently identified pathogenic bacteria. In published reports,[3,7] the bacteria most frequently isolated included *Pasteurella multocida*, *Staphylococcus aureus*, *Pseudomonas* spp, and *Fusiform* spp. Penicillin G procaine–benzathine was chosen to treat the rabbit of this report on the basis of our anecdotal clinical experience when treating rabbits with abscesses. We speculate that it may achieve effective drug concentrations in abscesses, with efficacy against commonly isolated bacteria.[8] It also seems to be well tolerated in rabbits when administered parenterally.[8] Because of the high clinical suspicion of a bacterial infection on the basis of the purulent exudate evident intraoperatively, the previously reported[7–9] low likelihood of identifying the causative organism, and the potentially catastrophic clinical consequences of failure to resolve the infection, we elected to continue antimicrobial treatment for 8 weeks for the rabbit of this report.

Ranitidine and metoclopramide were administered SC immediately prior to surgery, as it was thought that the rabbit was at high risk of developing ileus as a result of the combined effects of the anesthetic drugs, stress, and the potential pain involved. Although in vivo studies have not been performed to demonstrate a clinical benefit in rabbits undergoing surgical procedures, in vitro studies have suggested that both ranitidine and metoclopramide have a gastrointestinal prokinetic effect.[10–12] Reported effective doses vary (metoclopramide, 0.2 to 1 mg/kg [0.09 to 0.45 mg/lb], PO or SC, q 6 to 12 h; ranitidine, 2 to 6 mg/kg, [0.9 to 2.7 mg/lb]; PO, SC, or IV; q 8 to 24 h).[13–15] Cisapride is an additional prokinetic medication that may be considered.[16,17]

In the rabbit described in the present report, MRI and CT were used as complementary diagnostic techniques to reach a presumptive diagnosis of a paraspinal abscess with vertebral osteomyelitis and spinal cord compression. Although not yet reported for rabbits, the diagnostic imaging appearance of inflammatory disorders of the vertebral column, including vertebral osteomyelitis and epidural empyema, has been reported for dogs and cats.[18–21] The diagnostic features previously reported share similarities with the imaging abnormalities identified in our patient. The use of CT myelography would have been an alternative to the use of MRI to reach a diagnosis and confirm the site and lateralization of the spinal cord compression in the rabbit of this report.[2] This technique may be associated with decreased cost and shorter anesthetic time, compared with MRI; however, CT myelography can be technically challenging in rabbits because of their small size. Although it can provide excellent bone detail, it also provides comparatively less detail regarding soft tissue changes.

Currently there is little published information regarding the surgical decompression of spinal cord lesions in rabbits. One prior case report[2] described successful treatment of vertebral synovial cysts causing spinal cord compressions by means of a Funkquist type A dorsal laminectomy.[2] Although hemilaminectomy is an accepted treatment for dogs and cats, several species-specific differences should be considered when performing this surgical technique in rabbits. Rabbits typically have 12 thoracic vertebrae, although they may occasionally have 13. The first 3 lumbar vertebrae have a ventral crest, and all lumbar vertebrae have a prominent mammillary process of the cranial articular process, where the powerful lumbar musculature attaches to the vertebral column. The dorsal aspect of this prominent mammillary process is level with, or slightly ventral to, the spinous process.[22]

The small size and relatively brittle nature of rabbit bones combined with the muscular strength of the pelvic limbs have led to suggestions that the prognosis for successful surgical treatment of vertebral fractures and luxations is poor.[3,4] As such, we emphasize that the rabbit of the present report was a 5.4-kg Continental Giant. The reported case demonstrates that paraspinal abscess formation should be considered as a differential diagnosis in rabbits examined for progressive paraparesis and that surgical management of this condition can achieve a successful outcome. However, further studies are indicated to evaluate whether decompressive spinal surgery can be successfully performed in rabbits of various sizes.

Footnotes

a. Intera 1.5T, Philips Medical Systems, Best, The Netherlands.
b. Mx8000 IDT, Philips Medical Systems, Best, The Netherlands.
c. Critical Care for Herbivores, Oxbow Animal Health, Murdock, Neb.

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