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Case Report

Thoracic spinal epidural empyema in a cat

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Abstract

A 2-month-old male domestic shorthair cat was referred to a private veterinary clinic with a history of dyspnea and inappetence. At the clinical examination, the cat was in poor body condition, with hyperthermia and abdominal distension. No major abnormalities were observed in the thoracic radiographs or abdominal ultrasound. A complete blood count revealed leukocytosis with neutrophilia. Although no clinical diagnosis was made, the cat received support therapy, but went into cardiac arrest and died. The cat was submitted for necropsy and the main gross finding was two white nodules on the ventral surface of the thoracic vertebrae (from T1 to T4). At the cut surface, the nodules were friable and filled with yellow exudate. The epidural space of the thoracic region was filled with yellowish viscous material. Histologically, the vertebrae were partially replaced by abscess formation characterized by a necrotic center with degenerate neutrophils, surrounded by fibrous connective tissue. The epidural space was filled with degenerate neutrophils, necrotic debris, fibrin, and intralesional colonies of gram-negative short rod-shaped to coccobacillary bacteria. Bacteriologic culture yielded *Pasteurella multocida*. This paper describes the gross, histological, and bacteriological features of a rare case of spinal epidural empyema caused by *Pasteurella multocida* in a cat.

Key words: bacterial infection, feline, *Pasteurella multocida*, abscess, diagnosis.

Introduction

Spinal epidural empyema (SEE), also called spinal epidural abscess, is characterized by the accumulation of purulent material in the epidural space of the vertebral canal (3, 5). Several reports of this condition have been described in humans and dogs; while it is uncommon in cats (5, 7, 12, 13). The causes of SEE vary among species and include foreign bodies (e.g., migrating grass awns), bite wounds, extension of osteomyelitis, hematogenous and/or lymphatic spread of bacteria, or unknown origin (5, 7, 12). Delay in the diagnosis allows for the progression of clinical signs and consequent worse outcomes, despite therapy (3, 5). Herein, we describe the clinical, pathological, and microbiological features of a case of spinal epidural empyema associated with discospondylitis caused by *Pasteurella multocida* in a cat.

Case description

A 2-month-old male domestic shorthair cat was referred to a private veterinary clinic with a history of dyspnea and inappetence. The owner reported it was smaller than the rest of its litter. At clinical examination, the cat was in poor body condition at the clinical examination, with hyperthermia (39.6 °C) and abdominal distension. Thoracic radiographs had no evident abnormalities. Abdominal ultrasonography examination revealed only mild splenomegaly. The complete blood count (CBC) had a leukogram with leukocytosis (total leukocyte count: 31.6 × 103/µL; reference range: 5.5 - 19.5 × 103/µL), with neutrophilia (neutrophils: 21.8 × 103/µL; reference range: 2.5 - 12.5 × 103/µL) and left shift (band neutrophils: 1.2 × 103/µL; reference range: 0 - 0.3 × 103/µL). The reference range was based on Weiss and Wardrop (20). The neutrophils had toxic changes, including nuclei

fragmentation, basophilia, and cytoplasmic vacuolization. The clinical treatment of the cat was attempted with dipyrone (25mg/kg, intramuscular), simethicone (40mg, oral), ampicillin (30mg/kg, intravenous), and fluid therapy with ringer lactate (40ml/kg, intravenous). However, even with palliative treatment the cat went into cardiac arrest and died shortly after the initial examination.

At post-mortem examination, the cat was in poor body condition and had pale pink mucous membranes. No cutaneous abnormalities were detected during external physical examination. We also evaluated the nasal cavity, sinuses, ear (middle and inner), and eyes, and no alterations were observed. Between the first and the fourth thoracic vertebrae (T1-T4), on the ventral surface, there were two soft, white nodules surrounding the vertebrae (Fig. 1). One of the nodules measured 1.2 x 0.8 x 0.3 cm, and the other 1.0 x 0.8 x 0.2 cm. At the cut surface, both nodules were filled with a yellow viscous material. Similar material was observed filling the epidural space between T1 and T4 (Fig.2). No other gross abnormalities were detected in other organs. Tissues of several organs were collected, fixed in 10% buffered formalin, processed routinely for histology, and stained with hemotoxin and eosin (HE). Selected sections of the vertebrae were also submitted to a modified Brown Hopps stain.

Microscopically, the nodules on the ventral surface of vertebrae were characterized by marked necrotic cell debris, degenerate neutrophil infiltration, and fibrin exudation, surrounded by moderate fibrovascular tissue proliferation (pyogenic spondylitis) (Fig.3). The epidural

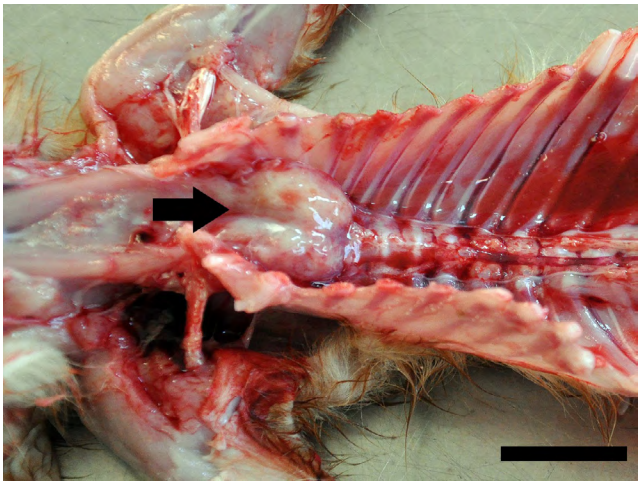

Figure 1. Gross findings in a cat with spinal epidural empyema. On the ventral surface of the vertebrae (T1-T4) there are two white, soft nodules (arrow). Bar = 1.5 cm.

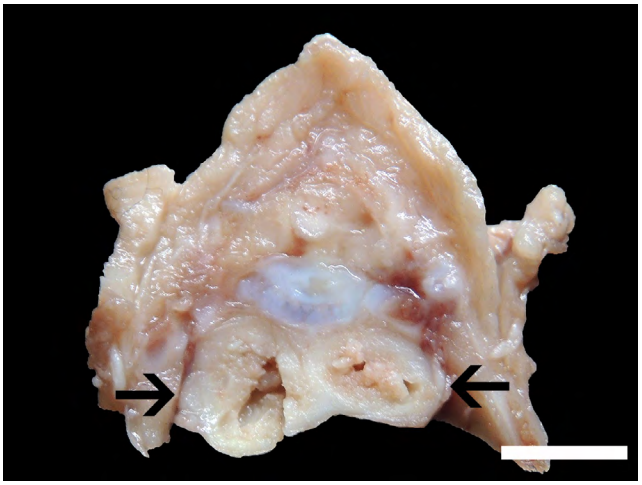

Figure 2. Gross findings in a cat with spinal epidural empyema. At the cut surface, both nodules (arrows) are filled with yellow viscous material. The epidural space is filled with similar yellow material. Bar = 1.5 cm.

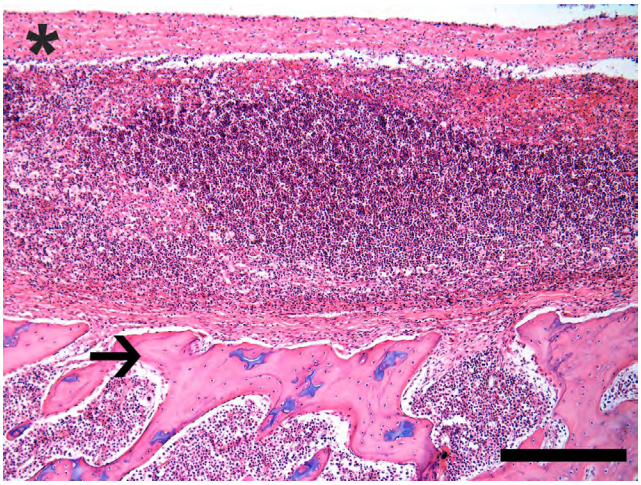

Figure 3. Histopathological findings in a cat with spinal epidural empyema. Microscopically, the epidural space located between the dura mater (asterisk) and the vertebrae (arrow), was filled with necrotic cell debris, degenerate neutrophils, and fibrin exudation. Hematoxylin and eosin bar = 50µm

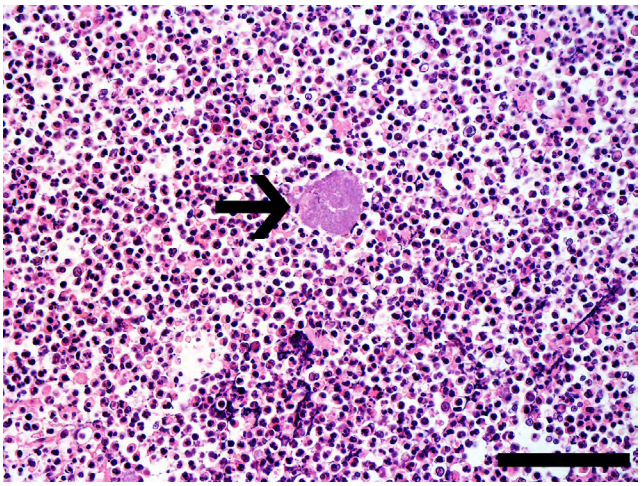

Figure 4. Histopathological findings in a cat with spinal epidural empyema. Gram-negative short rod-shaped to coccobacillary bacteria were visualized within the degenerate neutrophils (arrow). Hematoxylin and eosin bar = 200µm.

space was filled with fibrin, degenerate neutrophils, necrotic debris, and occasional intralesional colonies of gram-negative short rod-shaped to coccobacillary bacteria (Fig.4). In the thoracic spinal cord, in the empyema region, the white matter had multifocal mild axonal spheroids. In the lung, there were moderate, multifocal areas of inflammatory infiltrate of neutrophils, macrophages, and lymphocytes admixed with fibrin exudation in the alveolar lumen. In the lumen of the occasional bronchiole, a moderate number of neutrophils and fibrin were also observed. Also, there was a moderate infiltrate of lymphocytes and macrophages in the alveolar septa.

A swab sample of the nodules was submitted for aerobic bacteriologic culture. The smear was inoculated in 5% sheep blood agar and MacConkey agar and incubated for 72h at 37°C. The isolated bacterial colonies were identified by their cultural, morphologic, and biochemical characteristics (14). Some of these characteristics included round, grey, and viscous colonies, catalase and oxidase-positive, with no hemolysis on blood agar. Bacteriologic culture yielded heavy pure growth of *Pasteurella multocida*.

Discussion

Herein, we have described the gross, histologic, and microbiological findings associated with *Pasteurella multocida* infection leading to subdural spinal empyema in a young cat. Spinal epidural empyema (SEE), also referred to as spinal epidural abscess, represents a severe pyogenic infection of the epidural space of the vertebral canal. Infection results from either the hematogenous spread of bacteria or by direct local extension (3, 12). In our case, no direct relation was observed between pyogenic spondylitis and epidural empyema. This feature suggests that the bacterial infection of the epidural space may have resulted from hematogenous dissemination. This hypothesis was also considered since the cat presented fever and had leukocytosis. These two findings are common in cases of bacteremia caused *P. multocida* (19).

SEE is a progressive myelopathy uncommonly reported in cats (7, 9, 13), that can progress to severe spinal dysfunction (9). In a private veterinary clinic study, the prevalence of spinal epidural empyema is 0.02% of all feline patients and 0.7% of neurologically affected cats (9). As observed in our case and in previous studies, young cats (ranging from 3 months to 3 years old) appear to be more susceptible to SEE (7, 9, 13). The active nature of young cats can be considered a predisposing factor since fight wounds are a common cause of SEE (9). Although no external wounds were observed in our case, the possibility of a fight wound could not be completely excluded.

The rarity of spinal epidural empyema, combined with the relatively nonspecific clinical signs, often results in a delay in diagnosis (5). Nonspecific clinical manifestations of SEE can include fever, localized spinal pain, and progressive neurological deficits (3, 12). In a cat diagnosed with SEE through computed tomography, tetraplegia with the rigidity of the forelimbs, absence of neck muscle tone, and mild neck pain have been observed (7). As shown in our case, spinal epidural abscesses can cause compression of the cord, leading to axonal degeneration, characterized by the presence of axonal spheroids (1). As reported by the clinician, the cat went into cardiac arrest shortly after the initial examination; therefore, a complete neurological exam was not performed, and the neurological status of this cat was unknown.

Although no neurological signs were observed in our case, the cat had dyspnea. We believe that the dyspnea could be a direct result of the insult caused to the neurons in the medullary respiratory center, which descend in the cervical and thoracic spinal cord to project on motoneurones forming the phrenic nerves and the nerves controlling the intercostal muscles (11). We also believe that the pulmonary lesion observed microscopically could have contributed to the dyspnea; however, it was not possible to determine the origin of pneumonia. Immunosuppression related to stressors and viruses is known as predisposing factors to opportunistic bacterial infection in young cats, including changes in the environment/diet, felid herpesvirus, feline calicivirus, and feline immunodeficiency virus (2). In our case, the cat was not tested for viral agents such as herpesvirus and calicivirus, but we hypothesized that the young age of the cat, environmental changes, and close contact with other cats may have predisposed to immunosuppression.

The CBC results of this case report demonstrated leukocytosis with neutrophilia, left shift, and toxic neutrophils, which has been previously reported in dogs with SEE (12, 15). This finding can be associated with abscess formation, as observed in our case, septicemia, and hematogenous spread of bacteria (20). As isolated in our case, the infection with *Pasteurella multocida* is probably the leading cause of these changes in the leukogram. Common bacterial etiologies for epidural abscess or empyema in dogs and cats include *Streptococcus* spp., *Staphylococcus* spp., *Brucella* spp., *Pasteurella* sp., and *Fusobacterium* spp. (1).

Pasteurella multocida is a highly versatile gram-negative rod or coccobacillus frequently associated with the normal oropharyngeal microbiota of animals (21). This bacterium is an important pathogen associated with atrophic rhinitis in pigs, snuffles in rabbits, and fowl cholera in poultry (6). *P. multocida* is a major pathogen associated with wound infections in humans due to animal bites (19). In cats, *P. multocida* has been associated with one case of SEE (7) and meningoencephalomyelitis (2). This pathogen was described as the causative agent of subdural empyema in humans with close contact with cats (17).

As discussed previously, although a skin wound is a plausible portal of entry for *P. multocida* in our case, upper respiratory tract disease (sinusitis) and otitis media

have also been associated with bacterial infection of the central nervous system in cats (2). In addition, primary osteomyelitis in cats is commonly caused by a bacterial infection (8). The bacteria gain access to the marrow cavity by direct trauma, surgical intervention, extension of soft tissue infection (e.g. abscess), or hematogenous spread (10). Although uncommon, another possibility in our case would be primary osteomyelitis of the vertebral bone forming a spinal empyema. Unfortunately, no differentiation could be made between primary and secondary osteomyelitis during our pathological evaluation.

Conventional radiography (CT), as performed in our case, is not reliable in the diagnosis of SEE, since osteolysis of vertebral body endplates may take several weeks to appear (4, 16). Non-enhanced CT, magnetic resonance imaging (MRI), and CT myelography are usually used to diagnose SEE (7, 15, 16); however, these options of diagnostic tools are not always available. As SEE is commonly confined to the epidural space, the cerebrospinal fluid analysis may be within the reference range (11). Furthermore, careful consideration as to whether spinal fluid should be collected must be taken, since puncture of the subarachnoid space may lead to leptomeningitis because of communication with the epidural space (11).

Differential diagnosis in cases of SEE must include inflammatory and neoplastic diseases (e.g., feline infectious peritonitis [FIP], lymphoma of the vertebral column, or extradural nonvertebral column neoplasia) (7). In younger cats, as described in this report, FIP and neoplasms are uncommon; therefore, hematogenous spread of bacteria from the genitourinary system, oral cavity, heart valves, or skin must be also included in the differential of spinal lesions (18). Surgery therapy using laminectomy is the treatment of choice for SEE, which allows decompression of the spine, drainage of the purulent material from epidural space, and collecting samples for histopathological and microbiological examination (7). Antibiotic therapy, based on the results of culture and sensitivity tests, can improve the results of surgery (7, 13). Although in our case the SEE was fatal, this condition in cats frequently has favorable outcomes, once the correct diagnosis is made (9).

In conclusion, this report provides a clinical, pathological, and microbiological description of spinal epidural empyema caused by *Pasteurella multocida* in a young cat, a rare condition that should be considered as a differential diagnosis of feline neurological diseases.

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