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Abstract

Steroid-responsive meningoencephalomyelitis (SRMA) is a severely painful form of autoimmune meningoencephalomyelitis most commonly diagnosed in young, large-breed dogs. The age most commonly affected is reported to be between 6 and 18 months. This case report describes the presenting complaint, examination findings, diagnostics, and treatment of a 6-year-old boxer ultimately diagnosed with SRMA after a full neurologic workup. Key points include a review of the neurologic history, exam, and advanced diagnostics used to aid with the final diagnosis, as well as a treatment plan.



NEUROLOGY

A Case of Steroid-Responsive Meningitis-Arteritis in a 6-Year-Old Boxer

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Steroid-responsive meningitis-arteritis (SRMA) is an immune-mediated systemic disease that primarily causes inflammation of the meninges and associated arteries.^{1,2} The disease is reported to affect young dogs 6 to 18 months of age, and a breed predisposition has been reported in beagles, Bernese mountain dogs, border collies, boxers, English springer spaniels, Jack Russell terriers, Nova Scotia duck tolling retrievers, Weimaraners, whippets, and, most recently, golden retrievers and wirehaired pointing griffons.¹ SRMA is characterized by cervical hyperesthesia, depression, and pyrexia and occasionally occurs concurrently with immune-mediated polyarthritis.^{3,4}

SIGNALMENT, HISTORY, AND PRESENTATION

London, a 30-kg (66-lb), 6-year-old, neutered male boxer was transferred to the neurology department from the emergency service for severe cervical pain. At presentation, London had a 48-hour history of walking with short steps and a hunched back. The signs progressed to an unwillingness to walk, hyporexia, and decreased water intake. London was presented to the referring veterinarian the day before; at that visit, pyrexia (39.4 °C [103 °F]) and generalized pain were noted. He had a history of bilateral cranial cruciate ligament tears but was otherwise healthy.

Take-Home Points

- Veterinary professionals cannot exclude certain diagnoses based merely on the typical signalment and history. A thorough workup that includes a detailed history with timeline and careful physical and specialized examinations (in this case, a neurologic examination) is essential for an accurate diagnosis.
- Steroid-responsive meningitis-arteritis can be misdiagnosed without advanced diagnostics. Cerebrospinal fluid analysis is a very sensitive tool used to evaluate the health of the central nervous system.
- Veterinary nurses have a responsibility to recognize and advocate for patients' comfort. Invisible pain (such as that caused by meningitis) can be hard to detect and evaluate, but recognition of pain and advocacy for adequate analgesia are some of the ways veterinary nurses can work alongside veterinarians to manage patients.



INITIAL ASSESSMENT

On presentation, London was found to be tachycardic with a heart rate of 168 beats per minute and normothermic at 39 °C (102.3 °F). His physical examination was otherwise unremarkable. On neurologic examination, his cranial nerves were normal, no ataxia or paresis was noted, and proprioceptive testing and spinal reflexes were all normal. He maintained a low head carriage and was hesitant to move. Moderate pain was elicited on paraspinal palpation. Using the Colorado State University Canine Acute Pain Scale (go.navc.com/3SLCDMd), he was rated at a 3 out of 4. London's neuroanatomic localization included cervical hyperesthesia, indicating a possible cervical myelopathy.

A serum biochemical profile and complete blood count performed at London's primary veterinarian the day before presentation were unremarkable. Three-view

thoracic radiographs were obtained to assess for evidence of cardiopulmonary disease, which would need to be considered in developing an anesthetic protocol. The radiographs did not reveal any abnormalities or concerns.

ADVANCED DIAGNOSTICS

An 18-g IV catheter was placed in the left cephalic vein, and 1 mg/kg maropitant and 0.3 mg/kg methadone were administered intravenously in preparation for magnetic resonance imaging (MRI) under general anesthesia. Flow-by oxygen was delivered via face mask during the preanesthetic period. London

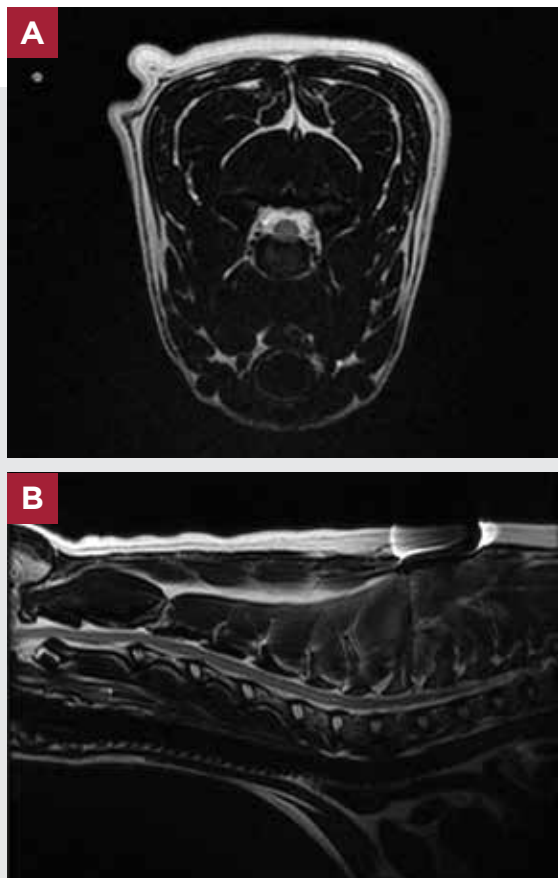


FIGURE 1. London's magnetic resonance imaging results showed very mild chronic disk protrusion at C2-C3 with no compression of the cord and no evidence of contrast enhancement within the imaged central nervous system. **(A)** Transverse T2-weighted view. **(B)** Sagittal T2-weighted view.

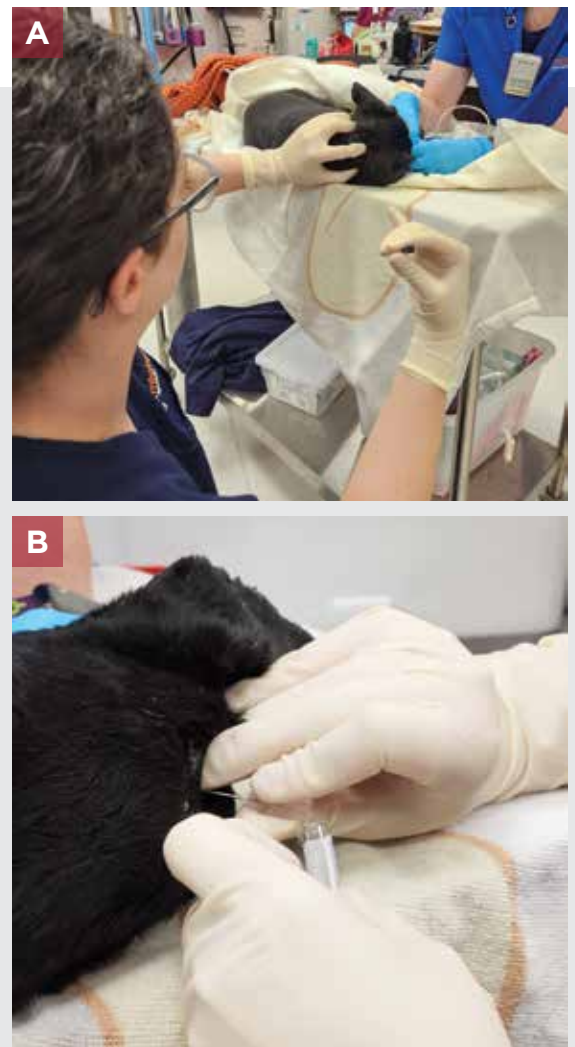


FIGURE 2. A clinician performing a cisternal medullary cerebral spinal fluid tap on a dog. **(A)** The clinician palpates the occipital bone protrusion along with the wings of the atlas (C1), **(B)** then uses a 22-g, 1.5-in spinal needle to obtain approximately 0.25 mL of cerebrospinal fluid from the cisternal medullary space.



BOX 1

London's Cerebrospinal Fluid (CSF) Analysis With Cytology

Cytology source: CSF**Volume:** 0.25 mL**Appearance:** Colorless/hazy**Protein (CSF):** 140.3 mg/dL (reference range, 0–35 mg/dL)**Red blood cell count:** 53 cells/ μ L (reference range, 0–30 cells/ μ L)**Nucleated cell count:** 2215 cells/ μ L (reference range, 0–4 cells/ μ L)**Pathologist's report****Interpretation:** Mixed-cell pleocytosis

Cytopathologic description: The preparation is highly cellular, well preserved, and minimally hemodilute on a colorless background. Neutrophils are the most frequently encountered cells within the sample. Some of the neutrophils appear pyknotic. Mixed lymphocytes are present in moderate number. Most of the lymphocytes are small, but there are some intermediate to large lymphocytes and plasma cells. The large mononuclear cells are typically nonvacuolated. Rare eosinophils are present. No infectious agents or overtly neoplastic cells are identified.

was induced with 0.25 mg/kg midazolam IV followed by 2 mg/kg ketamine and 2 mg/kg propofol. He was intubated with a 10.5-mm Murphy eye endotracheal tube. He was placed on 1% isoflurane in 100% oxygen at 1 L/min. All initial vitals under anesthesia were within normal limits at time of induction. He was then transferred to the MRI machine and placed on the spine coil in dorsal recumbency. Once London was positioned with his neck extended, his heart rate and blood pressure increased, indicating pain. An additional 2 mg/kg IV of ketamine was administered, and the remainder of the anesthetic event was uneventful.

MRI of the cervical and thoracolumbar vertebral column was included in the study (**FIGURE 1**). Two-plane T2-weighted and T1-weighted images with gadolinium contrast were conducted to evaluate the spinal cord, meninges, vertebrae, associated

intervertebral disks, and paraspinal soft tissues. The MRI was unremarkable aside from a very mild chronic disk protrusion at C2–C3 with no compression of the cord. There was no evidence of contrast enhancement within the imaged central nervous system.

After completion of the imaging, London was positioned and prepped for a cisternal medullary cerebral spinal fluid (CSF) tap (**FIGURE 2**). London was placed in right lateral recumbency, and the occipital bone protrusion was palpated along with the wings of the atlas (C1). An approximately 4 × 4-cm area on the midline was aseptically prepped between the 2 landmarks. A 22-g, 1.5-in spinal needle was used by the clinician to obtain approximately 0.25 mL of CSF, collected into an EDTA tube, and sent out for analysis.

The CSF analysis revealed a mixed-cell pleocytosis with a cell differential of 58% neutrophils, 20% lymphocytes, 20% macrophages, and 2% eosinophils (**BOX 1 AND FIGURE 3**). The total cell count included 2215 nucleated cells/ μ L (reference range, 0 to 4 cells/ μ L), 53 red blood cells/ μ L (reference range, 0 to 30 cells/ μ L), and a protein concentration of 140.3 mg/dL (reference range, 0 to 35 mg/dL). These findings are most consistent with meningomyelitis of either infectious or immune-mediated origin.

Serum samples were sent to the Texas A&M Veterinary Medical Diagnostic Laboratory for antibody testing of common protozoal infections, including *Toxoplasma gondii* and *Neospora caninum*. A second sample was sent out for a tick and flea serology to the NC State College of Veterinary Medicine Vector Borne Disease

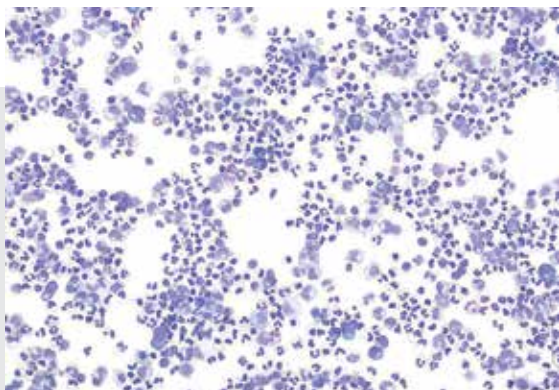


FIGURE 3. The cerebrospinal fluid analysis revealed a mixed-cell pleocytosis.



Diagnostic Laboratory. All protozoal and tick/flea infectious disease testing returned negative.

After common infectious components were ruled out, the primary differential diagnosis included immune-mediated meningomyelitis. Although there are several recognized autoimmune meningitis causes, SRMA was ultimately diagnosed after consideration for patient signalment, the neurologic examination, and all advanced diagnostics.

TREATMENT

At the time of London's discharge, the infectious disease testing was still pending. Results often take 7 to 10 days to return, and therefore general treatment is commenced for the most likely causes until results are received. This not only can facilitate clinical improvements but also helps prevent an infection, if present, from spreading or progressing. In London's case, clindamycin, a lincosamide antibiotic, was prescribed to treat a potential protozoal infection. Additionally, pregabalin, a gabapentinoid that works on the presynaptic neurons in the dorsal horn of the spinal cord, was prescribed for analgesia. A single dose of dexamethasone sodium phosphate was given at 0.2 mg/kg. Lastly, London was prescribed prednisone, a corticosteroid, at an anti-inflammatory dose to begin to treat presumed immune-mediated meningomyelitis.

A couple of days later, the owners were contacted to follow up on London's progress. He was reported to be doing very well and almost back to normal. He began to eat again and did not show any signs of pain that the owners were able to perceive. The infectious disease testing results were reported to the owners along with the results of the CSF analysis. The probable diagnosis of SRMA was reviewed with the owners along with the treatment plan.

London's treatment plan included discontinuing clindamycin and continuing the pregabalin as needed for pain or discomfort; a very slow weaning schedule of the prednisone was prescribed. Three weeks after starting the prednisone, London's dose was reduced by 25%, then 50% at 6 weeks, and 75% at 9 weeks and was discontinued at 12 weeks. During this tapering dose, the owners were instructed to monitor for any signs of relapse, such as neck pain, lethargy, or inappetence. Aside from a bout of pyoderma, London did well and did not show signs of relapse during weaning.

DISCUSSION

The 2 recognized forms of SRMA are acute, or "classic," form and chronic form.³ The acute form is typically characterized by cervical hyperesthesia and cervical rigidity with guarding of the head and neck, along with a stiff gait and pyrexia.³ The chronic form is observed following relapses of the acute disease, which is relatively common, with 32.4% of dogs reported to relapse in 1 study.^{3,2}

Diagnosis of SRMA is based on clinical examination, findings on CSF analysis, and exclusion of other diseases.² An MRI study may reveal meningeal enhancement along the spine and occasionally the brain, but scans can often be normal, showing no contrast enhancement.³ A CSF analysis may reveal a mononuclear pleocytosis, elevated protein, the presence of red blood cells in the acute form, and a mononuclear or mixed-cell pleocytosis and normal or mildly elevated protein concentration in the chronic form.³ Both forms of SRMA may show neutrophilia with a left shift and elevated inflammatory markers in systemic blood work.^{2,3} All infectious disease testing should be negative to rule out infectious meningitis.

Unfortunately, because SRMA is often unaccompanied by neurologic deficits, it is often overlooked in the differential diagnosis. Pain is often difficult to localize and can be attributed to myriad issues, some neurologic in origin and some not. Often, intervertebral disk disease and herniation are top differential diagnoses for spinal pain but are usually associated with neurologic deficits and do not cause pyrexia. Typically, the first line of treatment with a patient suspected to have a disk herniation, particularly with no neurologic deficits, is medical management with analgesics, anti-inflammatory drugs, and occasionally muscle relaxants. However, the duration of treatment required is potentially short-term, and signs can quickly return as SRMA requires longer therapy. This ends up delaying diagnosis and treatment. Timely investigation and initiation of treatment are imperative to relieve this painful condition.

Treatment for SRMA in the acute form consists of anti-inflammatory or immunosuppressive doses of corticosteroids with or without additional immunosuppressive drugs.⁵ Prognosis is reported to be fair to good, particularly in the acute form of the disease.³ With more than one-quarter of dogs relapsing between discontinuation of monotherapy and 1.5 years, often an additional immunomodulatory drug, such as

azathioprine, mycophenolate, or cytarabine, must be added to the treatment protocol.^{2,5}

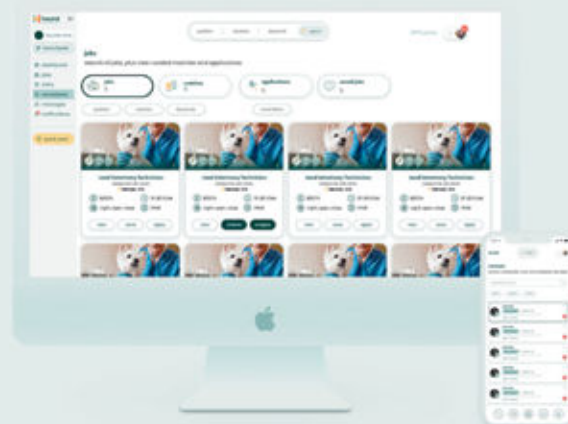
As of 7 months after his initial presentation to the clinic, London was reported to be doing well. He had discontinued therapy and was released from the care of the neurology department. The owners are aware a relapse in disease is possible and were educated on signs that London should be evaluated to indicate a reemergence of SRMA. **TVN**

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Jackie is the lead neurology and neurosurgery veterinary nurse at MissionVet Specialty & Emergency in San Antonio, Texas. She is a licensed veterinary technician and a veterinary technician specialist in neurology. Jackie worked in human medicine before moving into the veterinary industry in 2008. She worked as a veterinary assistant until she graduated from the Palo Alto veterinary technician program in 2011, then worked in general practice until moving to MissionVet in 2013. She quickly fell in love with the diverse and challenging specialty of neurology, which encouraged her to pursue a specialization. She completed her VTS credential in 2018, expanding her knowledge and technical abilities. Jackie has a special interest in client education and neurosurgery anesthesia.



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