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A case of suspected bacterial meningoencephalitis in a Miniature Pinscher dog

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Abstract : A 4-year-old male Miniature Pinscher was referred because of head tilt, nystagmus, and ataxia. The hemogram revealed a moderate neutrophilic leukocytosis. On magnetic resonance imaging, cerebellar inflammation was detected. And cerebrospinal fluid analysis indicated marked neutrophilic pleocytosis. Based on these results, bacterial meningoencephalitis was suspected. The clinical signs were well controlled by a combination antibiotics therapy of the third generation cephalosporins (cefotaxime and cefixime) and metronidazole. We tentatively diagnosed this case as a bacterial meningoencephalitis because clinical signs were improved after only antibiotics therapy and relapsed when stopped antibiotics administrations, even though the result of bacterial culture on communication of cerebrospinal fluid (CSF) was negative.

Key words : bacterial meningoencephalitis, dog, magnetic resonance imaging (MRI)

Introduction

Bacterial infection of the central nervous system (CNS) as a cause of meningitis and meningoencephalitis in dogs has been infrequently reported [1, 4-7, 9].

In general, brain tissue is relatively resistant to infection, and it is difficult for organisms to gain access to the CNS in the presence of an intact blood-brain barrier (BBB) or dura mater. The most common routes of bacterial infection into the CNS are hematogenous resulting from mucous membrane colonization or a distant pyogenic focus, direct invasion (such as after a dog bite or traumatic injury), by contiguous effect (otitis interna, nasal sinus infection, etc), and via communication of cerebrospinal fluid (CSF) with body surfaces [6, 9].

This report describes the clinical findings, laboratory findings, imaging characteristics, CSF characteristics, and response to antibiotics of suspected bacterial meningoencephalitis.

Case report

A 4-year-old male Miniature Pinscher with body weight of 5.4 kg was presented due to head tilt, nystagmus, and ataxia. Intermittent nystagmus and ataxia were observed at the initial stage, and clinical signs were worsened rapidly. Results of neurological examination revealed head tilt to right side and postural reaction deficits especially on the right side (Fig. 3A), horizontal and positional nystagmus, and ventrolateral strabismus. Based on the neurological examination, clinical signs were likely due to intracranial lesion. Results of complete blood count (CBC) profiles showed a marked leukocytosis ($35.24 \times 10^3/\mu l$; reference range, $6\text{-}17\times 10^3/\mu l$) due to a hypersegmented neutrophilia. No abnormalities were evident on the serum chemistry profiles, otoscopic examination and radiographic findings.

Thus, we performed a brain magnetic resonance (MR) scan (E-scan; ESAOTE, Italy) using 0.2 T unit. T1- and T2-weighted images and post contrast T1-weighted images were obtained. On T2-weighted images, focal hypersignal intensed lesion was found at flocculonodular lobe of cerebellum (Fig. 1). This lesion was enhanced after intravenous administration of gadolinium-diethylenetriamine pentaacetic acid (Omni-scan; Nycomed, USA) (0.1 mmol/kg, intravenously [IV]).

Before CSF collection, we used 15 % mannitol

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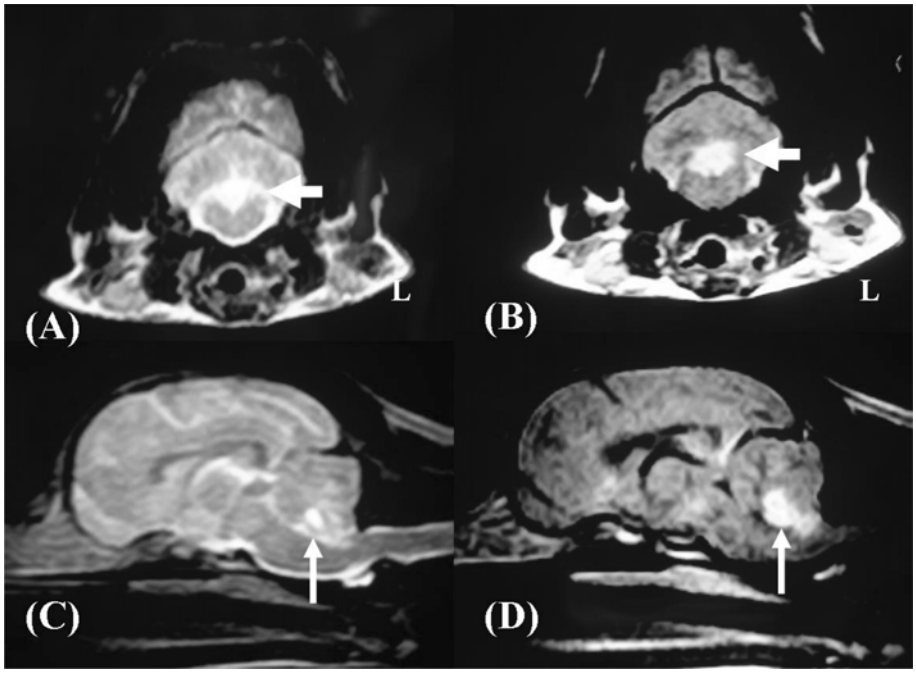

Fig. 1. MR images of the present case (A: Transverse T2-weighted image, B: Enhanced transverse T1-weighted image, C: Sagittal T2-weighted image, D: Enhanced sagittal T1-weighted image.). Hypersignal intensed lesion was found at flocculonodular lobe of cerebellum on T2- and enhanced T1-weighted images (arrows).

(Daehan Pharm, Korea; 1 g/kg CRI for 30 min) to decrease intracranial pressure and collected CSF from the cerebellomedullary cistern. The results of CSF analysis were abnormal. Cytological evaluation of the CSF showed a marked neutrophilic pleocytosis (Fig. 2). The CSF was characterized by increased protein (200 mg/d*l*; reference range, 0-35 mg/d*l*), hypoglycorrhachia (trace on urine dipstick). To rule out canine distemper virus (CDV) infection and toxoplasmosis, CDV antigen (RT-PCR) and toxoplasma IgG/IgM (Neodin Vetlab, Korea) were tested, and all results were negative in CSF. In addition, bacterial (aerobic and anaerobic) and fungal cultures were performed on the CSF, and the results were all negative.

Based on these results, we suspected steroid responsive meningoencephalitis (SRME) or bacterial meningoencephalitis. Initially we administrated prednisolone (Prednisolone; Korea Pharma, Korea; 1 mg/kg PO q 12 h) for 2 days to rule out SRME. However, clinical signs were much worse and CBC profiles revealed a more severe neutrophilic leukocytosis than previous (48.56 $\times 10^3/\mu l$; reference range, 6-17 $\times 10^3/\mu l$). Thus, we discontinued prednisolone therapy and began a combination antibiotics therapy of cefotaxime (Sudo Pharm, Korea; 50 mg/kg IV q 12 h) and metronidazole (Cellart Pharm, Korea; 15 mg/kg PO q 12 h). Two days after antibiotics administration, nystagmus, head tilt, and ataxia were improved gradually. Seven days after therapy, all neurological signs were disappeared (Fig. 3B). Then,

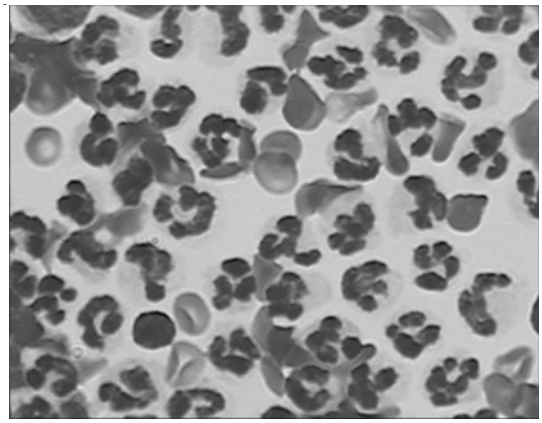

Fig. 2. Cerebrospinal fluid cytology of the present case. Marked neutrophilic pleocytosis was identified (Diff-Quik stain, ×1000).

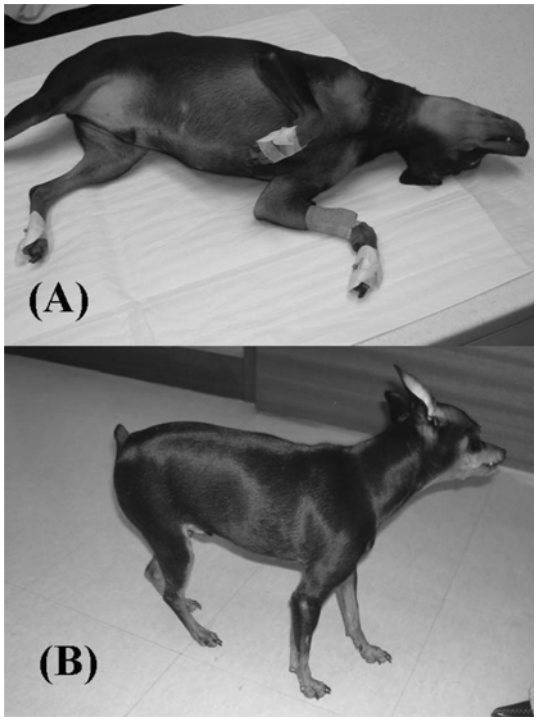

Fig. 3. Clinical findings of this case. A: Severe head tilt and ataxia were demonstrated before therapy. B: Clinical signs were improved after antibiotics therapy.

the patient was discharged from hospital with oral antibiotics prescription. Because cefotaxime is an injectable antibiotic agent, we prescribed other oral antibiotics as cefixime (Myungmoon Pharm, Korea; 10 mg/kg PO q 12 h) and metronidazole (15 mg/kg PO q 12 h).

Eight weeks after discharge, we stopped antibiotics and clinical signs relapsed. Thus, antibiotics were administered again and clinical signs were improved.

The patient's symptoms were well controlled for 6 months by only antibiotics therapy. Ultimately, the patient had sudden death 6 months after initial diagnosis. Necropsy was not performed due to refusal of the client.

Discussion

In general, bacterial infections of the nervous system are uncommon. However, it is unclear whether these infections are truly rare or rarely reported due to high early mortality [2].

Bacteria can gain access to the brain via the hematogenous route or by extension of infection from a neighboring focus (e.g., extension of otitis interna into the brainstem) [1, 2, 6, 8, 9]. In the case described here, the route of infection was unknown, however moderate neutrophilic leukocytosis would suggest that hematogenous infections might have been the original source, even though we could not performed blood culture. Although the mechanisms underlying bacterial transversal of the intact blood brain barrier are largely unknown, recent reports suggest that endothelial cells within these structures may possess specific receptors for adherence of bacteria, which may facilitate entrance to the subarachnoid space [11].

Fever (40%) and cervical hyperesthesia (20%) were common clinical findings in bacterial meningoencephalitis cases [2], however these signs were not found in this case.

A tentative diagnosis of bacterial meningoencephalitis is based upon historical and clinical data, as well as results of laboratory tests. A positive response to antibiotic drugs also supports the diagnosis. CT or MRI may be helpful in diagnosing CNS inflammatory lesions. However, image findings could not differentiated bacterial meningoencephalitis from other CNS inflammatory diseases. The present case showed marked enhanced lesion on MR images as if brain tumor.

The most valuable information is obtained from CSF analysis, which is abnormal in most of cases. The result of the CSF analysis, namely a marked neutrophilic pleocytosis is typical CSF pattern of bacterial meningoencephalitis [3]. However, steroid-responsive meningoencephalitis, viral encephalitis, fungal infections, meningiomas could demonstrated a neutrophilic pleocytosis on CSF analysis [2]. Thus, other tests for differential diagnosis should be carried out. We performed CDV RT-PCR, fungal culture, toxoplasma IgG/IgM tests and results were all negative.

The presence of intracellular bacteria in the CSF sample confirms the diagnosis. Positive CSF culture result also supports the diagnosis of bacterial meningoencephalitis. However, bacteria are rarely observed in CSF preparations and are often difficult to culture. In one previous report [9], the result of culture of CSF in bacterial meningoencephalitis dogs was positive in only 13%. The cause of this result is unknown, however it may be related to the small volume of CSF typically available from dogs for culture. In the present case, a marked neutrophilic pleocytosis was observed on CSF cytology. However, bacterial organisms were not observed and the result of culture of CSF was

negative.

Bacterial infection of the CNS is a life-threatening condition and should be treated rapidly and aggressively. Corticosteroids have been used for the treatment of bacterial meningoencephalitis in dogs [7], however their benefits have not been clearly demonstrated in veterinary medicine, and their use in CNS infections remains controversial. We used prednisolone for initial therapy and clinical signs were much worse. Appropriate antibiotic therapy for CNS infections is based on identification of the causative organism and the choice of an effective antimicrobial agent. As this is not often obtainable, aggressive antibiotic treatment should be initiated [1, 2, 6, 9]. The choice of antibacterial agent for the treatment of bacterial meningoencephalitis depends on a drug's ability to penetrate the CSF [1, 2, 6]. Therefore, we chose the third generation cephalosporins (cefotaxime or cefixime) and metronidazole, and good response was observed after therapy.

The prognosis for patients with bacterial infections of the CNS is guarded [1, 2, 6, 9]. Relapses occur frequently and death is common, even when appropriate antibiotic therapy is administered [1]. In one retrospective study of 15 dogs with known bacterial encephalitis, 2 recovered after treatment with antibiotics, 6 were euthanized and 7 died [10]. The present case was fully improved after antibiotics therapy, however clinical signs were relapsed when therapy stopped. Finally, the patient died suddenly, despite antibiotics were administrated.

Histopathological examination was not performed because the client declined necropsy.

Conclusion

We tentatively diagnosed this case as a bacterial meningoencephalitis because clinical signs improved after only antibiotics therapy and relapsed when stopped antibiotics administrations.

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