Pakistan Veterinary Journal

ISSN: 0253-8318 (PRINT), 2074-7764 (ONLINE)
Accessible at: www.pvj.com.pk

CASE REPORT

Long-Term Management of Seizure Disorders Associated with Porencephalic Cysts in Two Cats

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ARTICLE HISTORY (13-081)

Received: February 27, 2013
Revised: May 29, 2013
Accepted: July 31, 2013

Key words:
Cat
Feline immunodeficiency virus
Magnetic resonance imaging
Porencephalic cyst

ABSTRACT

Porencephalic cysts are an unusual neurological disease characterized by congenital or acquired cavities within the cerebral hemisphere. Two domesticated, short-haired cats - an 11-month-old, castrated male and a 10-month-old, spayed female - presented with chronic seizure activity after adoption from the street. The seizure episodes were observed upon adoption and became progressively worse. PCR testing for infectious diseases yielded negative results in both cats. The female cat, however, was positive for the feline immunodeficiency virus antibody. In addition, magnetic resonance imaging of the brain demonstrated cystic cavitation within the right hemispheres in both cats. Long-term medical management with anticonvulsant medications was successful and resulted in no recorded complications.

To Cite This Article: Kang MH, YK Ho and HM Park, 2014. Long-term management of seizure disorders associated with porencephalic cysts in two cats. Pak Vet J, 34(2): 276-278.

INTRODUCTION

Congenital malformations of the central nervous system (CNS) can occur during development of the neural plate (MacKillop, 2011). Any developmental defects caused by genetic or environmental factors may induce congenital malformation of the brain (Sharp *et al*., 1999). Among these congenital malformations, cystic lesions are common and well documented (Lee *et al*., 2009; MacKillop, 2011). A cyst can arise from any area of the brain that is affected by hemorrhage, trauma, infection, and/or hypoxia (Sharp *et al*., 1999). Magnetic resonance imaging (MRI) and computed tomography (CT) are common imaging modalities used for diagnosis of intracranial cysts in both animals and humans (Osborn and Preece, 2006; Schmidt *et al*., 2012).

This report describes the clinical signs, MRI features, and medical treatment outcomes of seizure disorders associated with porencephalic cysts in 2 cats.

CASE PRESENTATION

History and clinical examination: Two domesticated, short-haired cats - an 11-month-old castrated male (case number 1/ cat-1) and a 10-month-old spayed female (case number 2/ cat-2) were presented with a history of seizures. Both cats were adopted from the street 6 and 2 months, respectively and the owners subsequently witnessed the seizure episodes. In case number 1, tonic-clonic seizures were observed at a frequency of 8 times per month over a 6-month period. In case number 2, tonic-clonic seizures with facial twitching were observed thrice per week after adoption (over a 2-month period). The physical and neurologic examinations results were normal in case number 1. In case number 2, the cat had seizure episode prior to presentation and examinations demonstrated mental dullness. Delayed pupillary light response with slightly constricted pupil was also detected. The cat was treated with mannitol (1g/kg IV over 15 minutes, MANNITOL CHOONGWAE INJ; JW life science, Korea) and started oxygen therapy (flow-by oxygen flow rate started 2-3L/min then maintained 0.2-0.5L/min). The cat was fully recovered 1 hour later. In case 1, complete blood count (CBC) and serum chemistry profiles were insignificant, while, in case 2, CBC revealed leukocytosis (23.81×10^3/µl; reference range $5.5\text{-}19.5 \times 10^3$/µl) with neutrophilia, and the serum chemistry profile revealed elevated creatine kinase (6060 U/L; reference range 73–260 U/L) and aspartate aminotransferase (AST, 63 U/L; reference range 12-46 U/L). Serum thyroxine level was normal. Survey radiograph of thorax and abdomen were insignificant in both cases. PCR analyses were negative for FIP, FIV, FLeV and toxoplasmosis in both cases. The case-2 was sero-positive (Western blot, Antech Diagnostic, USA) for (FIV).

Diagnosis and treatments: On the basis of the history, clinical signs, and neurologic examinations, both the patients were suspected for intracranial lesions. Thus, brain MRI scans using a 0.2 T scanner (E-scan®;

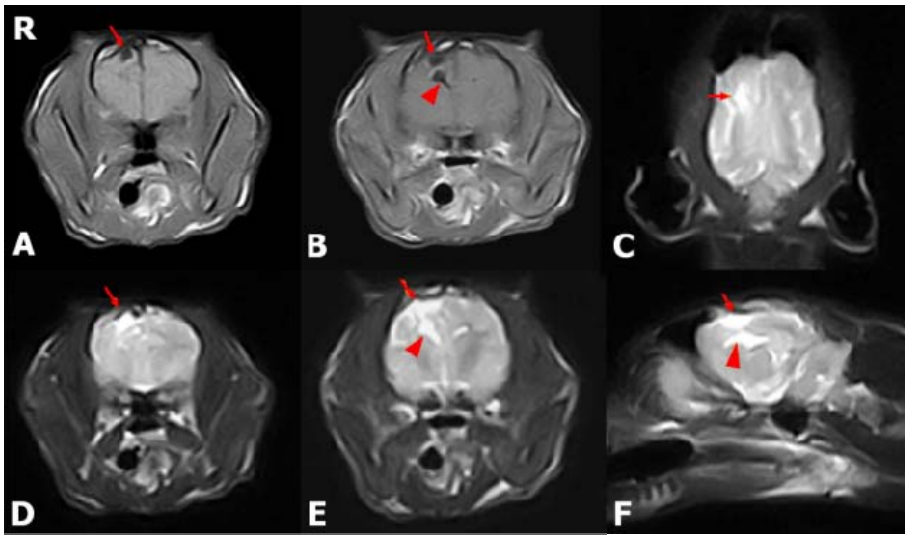

Fig. 1: Transverse T1-weighed (A and B) and T2-weighed (D and E), dorsal T2-weighed (C) and sagittal T2-weighed (F) MR images of case 1. A small cyst-like lesion at the right parietal lobe (arrow) and ipsilateral ventricular enlargement (arrowhead) were noted on both T1- and T2-weighed images at the level of the thalamus (B and E). The wedge-shaped cyst communicated with the lateral ventricle.

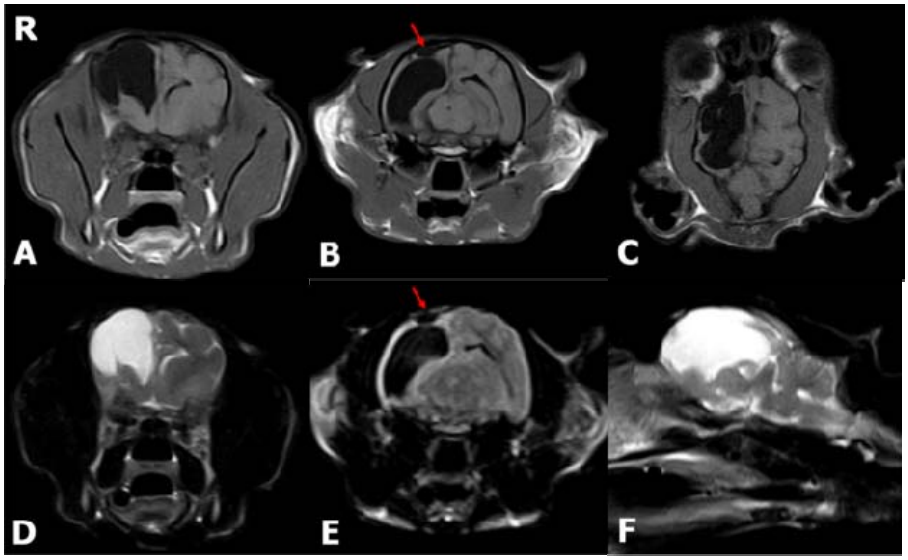

Fig. 2: Transverse T1-weighed (A and B) and T2-weighed (D), dorsal T1-weighed (C) and sagittal T2-weighed (F) MR images of case 2. A large cyst-like lesion in the right parieto-occipital lobes was observed on both T1-weighed images (WI) and T2-WI. The pons was intact and the wedge-shaped cyst communicating with the lateral ventricle (arrow) was noted on T1-weighted (B) and FLAIR (E) images.

ESAOTE, Genova, Italy) with sequence T1, T2, FLAIR and T1 post contrast, were performed in both cats. In cat-1 (case number 1), a small wedge-shaped cavitation within the right parietal lobe with communication to the lateral ventricle was revealed (Fig 1A-F). A thin rim of cerebral cortex was found to overlie the cavity and ventricular size was noted to be asymmetrical (Fig 1B and E). In cat-2, extensive cystic lesions of the right forebrain with communication to the lateral ventricle were noted and these lesions were surrounded by residual brain tissue (Fig 2A-F). There was also a small wedge-shaped cavity with extension to the surface of the hemisphere (Fig 2 B and E). Fluid filled, cyst-like lesions in both cats were hypointense on T1- and hyperintense on T2- weighted images. These lesions did not enhance on T1- weighted images after intravenous administration of gadolinium (0.1 mmol/kg iv, Omniscan®; Amersham Health, USA) and complete fluid signal suppression on FLAIR images. Findings on MRI images revealed cerebral spinal fluid (CSF) like cystic spaces within brain parenchyma. The results of CSF analysis were normal.

Based on imaging findings, a diagnosis of seizure disorder associated with porencephalic cysts was reached for both cats. Treatment was initiated with a phenobarbital (2.5 mg/kg PO twice daily, Tab. Phenobarbital, Hana Pharm, Korea) in case-1. A combination of furosemide (0.7 mg/kg p.o daily, Laxis®; Handok, Korea, for 7 days) and phenobarbital (2.5 mg/kg p.o. twice daily, PHENOBARBITAL TAB; Hana Pharm, Korea) was prescribed to cat-2. For the first week after the medication, no seizure episode was noted and phenobarbital was maintained in both cats. Post-treatment, clinical signs gradually improved in each case. In case 2, seizure activity ceased completely. However, in case 1,

the seizure episodes still remained for a month or two. Four months later, cat-1 was moved into a new house and the seizure returned with increased frequency. The serum phenobarbital concentration was within the therapeutic range, thus levetiracetam (20 mg/kg p.o. 3 times a day, Keppra®; UCB S. A., Belgium) was added as part of the treatment regimen. After the medication was changed, seizure activity decreased and eventually ceased completely in case number 1 as well. During 3 years (case 1) and 21 months (case 2) of follow-up, the cats were found to be clinically healthy and showed no further complications.

DISCUSSION

Porencephalic cysts are an unusual neurological disease characterized by congenital or acquired cavities within the cerebral hemisphere that usually communicate with the ventricles or arachnoid space (Wyss-Fluehmann *et al*., 2008; Schmidt *et al*., 2012). The size and number of the porencephalic cysts and the findings showing communication with the ventricles are variable (Osborn and Preece, 2006). Seizures are the most frequent manifestation of these porencephalic cysts in humans. However, the size of the cavities is not predictive of the severity or frequency of the induced seizures (Ho *et al*., 1998). In cats, there are few reports of congenital malformations, such as hydranencephaly, associated with viral infection and porencephaly (MacKillop, 2011; Schmidt *et al*., 2012).

In the 2 feline cases presented, seizures were seen at a relatively young age and MRI imaging revealed CSF-filled cysts that communicated with the lateral ventricles. Other possibilities considered in the differential diagnosis included arachnoid cysts, ependymal cysts, and hydranencephaly. Arachnoid cysts occur in the subarachnoid spaces and are usually located in the caudal cranial fossa (Osborn and Preece, 2006). Ependymal cysts typically occur within the parenchyma in the paraventricular region (Wyss-Fluehmann *et al*., 2008). In contrast, hydranencephaly has no residual neural parenchyma (MacKillop, 2011). The definitive diagnosis of intracranial cysts is usually based on histopathological examinations. Recently, however, imaging modalities using CT and/or MRI technology are widely being used as a diagnostic technique in the identification of intracranial cysts in human medicine (Osborn and Preece, 2006). Differentiation of the various types of cysts, on the basis of the imaging findings alone, can be difficult. However, the various types of intracranial cysts have unique anatomic locations and imaging findings that can help narrow the differential diagnosis. On the basis of both the characteristic history of the presenting disease and the specific anatomic locations of the cysts in these 2 feline cases, porencephalic cysts were highly suspected.

The exact etiology of the porencephalic cysts in these 2 feline cases could not be determined. Due to a lack of previous history, it is unknown which prenatal or perinatal factors could have been the etiological cause. Numerous viruses could have induced CNS malformation (Sharp *et al*., 1999); however, the lesions could be different depending on the time of infection (Schmidt *et al*., 2012). FIV causes neurological impairment, which predominantly targets the microglia and brain macrophages (Ho *et al*., 1998). Various neurological signs caused by the diffuse encephalitis may occur. However, there is no previous report that describes an FIV infection creating prominent, neuropathological defects. In case number 2, the cat had FIV antibodies and neurologic signs. However, the exact time of the viral invasion is unknown (which made it difficult to correlate the formation of the porencephalic cysts with the FIV infection and clinical diagnosis). Therefore, although acquired forms of porencephalic cyst secondary to hemorrhage, trauma, infection, and hypoxia cannot be definitively excluded, the age of the cats makes a congenital abnormality highly likely.

Treatment options for porencephalic cysts include alleviating clinical signs by using antiepileptic medications and/or reducing excessive CSF (Douzenis *et al*., 2010). With the exception of one previous report (Schmidt *et al*., 2012), there is very little information on the treatment options and long-term prognosis in the field of veterinary medicine. This limitation exists due to the fact that most of the previous cases were euthanized in the early disease process or the brain lesions were found during autopsy. In these 2 feline cases, medical treatments with anticonvulsants were used for controlling the seizures. Both cats responded favorably and maintained a good prognosis after the prescribed medical management.

In conclusion, these 2 case reports demonstrate long-term treatment outcomes of seizure disorders concurrent with porencephalic cyst in felines. In addition, location-based approach to intracranial cysts using MRI is helpful in establishing an appropriate differential diagnosis in congenital malformations.

Acknowledgement: This paper was supported by Konkuk University in 2013.

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