Clinical communication — Kliniese meededeling

Magnetic resonance imaging of a cerebral cavernous haemangioma in a dog

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INTRODUCTION

Brain tumours are reported to occur more frequently in dogs than in any other domestic species and occur most commonly in older animals. The most common primary intracranial tumours in dogs are meningiomas. Although vascular tumours are common in the dog, a retrospective study of 211 canine haemangiomas and haemangiosarcomas found the spleen, skin and subcutaneous tissues to be the most common sites, with only 1 tumour in this series affecting the central nervous system (CNS). Further reports have referred to vascular tumours affecting the CNS of dogs, although the unequivocal distinction between neoplastic and hamartomatous vascular lesions of the CNS has not always been possible. This paper describes a case of cerebral cavernous haemangioma in a Golden retriever and is the 1st in which the magnetic resonance imaging (MRI) findings are described.

CASE HISTORY

A 13-month-old, neutered, male Golden retriever was presented to the Queen’s Veterinary School Hospital, University of Cambridge, with a history of seizures and progressive depression. The neurological condition progressively deteriorated and magnetic resonance imaging (MRI) revealed the presence of a large, contrast-enhancing, space-occupying mass in the right cerebral hemisphere. Therapy with corticosteroids, mannitol and furosemide ameliorated the signs of depression and ataxia, but the owner elected euthanasia after 1 week. Post mortem examination of the brain confirmed the presence of a large haemorrhagic lesion in the right olfactory lobe, the histopathological appearance of which was consistent with cerebral cavernous haemangioma. This is the 1st case describing the MRI appearance of a cavernous haemangioma of the cerebrum in the veterinary literature.

Key words: canine, cavernous haemangioma, magnetic resonance imaging, seizures.

ataxia in all 4 limbs.

Haematological parameters were within normal limits. Significant findings on serum biochemistry included markedly elevated gamma glutamine transferase (GGT) activity, markedly elevated cholesterol and triglyceride levels, moderately elevated fasting bile acid concentrations and mildly elevated serum glucose concentrations. A bile acid stimulation test revealed no abnormal stimulation. Total serum thyroxine and endogenous thyroid stimulating hormone (TSH) concentrations were within normal range. No serological evidence of *Toxoplasma* infection was found. Immunofluorescent antibody test was positive to a dilution of 1/50 to *Neospora caninum*. This was not considered significant, given the signalment and clinical signs of the dog. The serum phenobarbitone concentration was below the therapeutic range and was considered unlikely to have contributed to the depression.

Over the next 24 hours the patient showed a deterioration in neurological status and started to circle continuously to the right. The patient became progressively more stuporous and appeared unresponsive to his environment. Ophthalmoscopic examination revealed bilateral papilloedema (Fig. 1). The neurological examination further demonstrated decreased nasal sensory awareness on the left. The neurological findings were consistent with a right cerebral hemisphere lesion, with concomitant elevation of intracranial pressure and a magnetic resonance examination was performed.

**Magnetic resonance imaging findings**

Magnetic resonance imaging (0.5 Tesla, SMIS, Guilford, Surrey) was performed. Contrast enhancement was demonstrated by the administration of gadolinamide (Omniscan, Nycomed, UK) 287 mg/m	extsuperscript{2} at a dose of 0.1 mmol/kg intravenously.

On T	extsubscript{1}-weighted images an ill-defined soft tissue mass of 22 mm in diameter was seen in the cortex of the rostral frontal lobe. The mass was isointense with surrounding brain matter and extended caudally to the thalamic adhesion. An associated moderate mass effect, as evidenced by a midline shift to the left, moderate reduction of the right ventricular volume and occlusion of the rostral aspects of both lateral ventricles, was seen. A thin, 1 mm hypointense rim surrounded most of the mass. Another poorly defined, up to 5 mm, hypointense zone surrounded the mass laterally and extended dorsally into the parietal and temporal white matter. The latter was interpreted to be peritumoral oedema. The left lateral ventricle was moderately enlarged.

On T	extsubscript{2}-weighted images the mass was of mixed signal intensity, with an apparently multi-lobulated hypointense centre and a heterogenous hyperintense periphery, giving it a ‘popcorn-like’ appearance. The previously described hypointense rim on T	extsubscript{1}-weighted images was hyperintense on T	extsubscript{2}-weighted images and was in turn surrounded by another very thin hypointense rim.

Post-contrast T	extsubscript{1}-weighted images showed a homogenous uptake in the central portion of the mass. Mild heterogenous contrast uptake was noted peripherally. Based on the above findings, a diagnosis of a space-occupying lesion (most likely tumour) with associated unilateral (left) obstructive hydrocephalus, was made (Fig. 2).

In light of the MR findings and the presence of elevated intracranial pressure,
CSF collection at the cisterna magna was considered too risky and therefore not performed. CSF collection in the lumbar region was not attempted.

Treatment consisted of initial intravenous corticosteroids in combination with intravenous osmotic and loop diuretics. Phenobarbitone (Epiphen, Vetoquinol UK) was administered orally at a dose of 3 mg/kg twice daily in an attempt to control the seizures. The loop diuretic treatment was tapered over a few days. The dog improved gradually over the next 4 days and was discharged with a view to commencing radiotherapy the following week. During the ensuing week the dog deteriorated and became more depressed. The owner decided against further treatment and requested to have the animal euthanased.

The head was submitted for pathological examination.

Pathology

On macroscopic examination of the head, muscular and skeletal structures were essentially normal. The meninges were congested. In the brain, the right olfactory bulb, medial and lateral olfactory tracts, the rhinal sulcus and the ventral part of the frontal lobe were effaced by an extensive subdural red-black rubbery blood clot (approximately 40 × 20 × 15 mm) which extended rostrally to the cribiform plate (Fig. 3). The cut surfaces of the brain showed this to extend caudally to approximately the level of the genu of the corpus callosum, dissecting rostrally between the right and left cerebral hemispheres. The left cerebral hemisphere was slightly displaced to the left (Fig. 4). The cerebellum was flattened and slightly caudally displaced.

On microscopic examination, poorly defined haemorrhage blended with areas of crisply defined blood-filled vascular channels of variable size. Each was lined by orderly, well-differentiated factor VIII-positive endothelial cells upon a delicate basement membrane, and supported by an arborescent trabecular glial fibrillary acid protein (GFAP)-negative collagenous stroma without neural parenchymal tissue. At the margins with adjacent neural tissue, vascular channels impinged irregularly without encapsulation. A diagnosis of cavernous haemangioma was made.

DISCUSSION

In the central and peripheral nervous systems of humans, tumours of vascular origin are considered to comprise true neoplastic proliferations (capillary haemangioblastomas and angiosarcomas) and a range of vascular hamartomas. The latter include capillary telangiectases, cavernous angiomas, arteriovenous malformations and venous malformations. The incidence of such cerebrovascular malformations in human autopsy material ranges from 0.1% to 4% in different studies, and are most commonly observed in the 3rd to 5th decades of life. Multiple cavernous haemangiomas (cavernomas) are common in humans. Although cavernomas can cause seizures and rarely, clinically manifested brain haemorrhage, many are discovered incidentally. They

Fig. 3: Ventral aspect of the brain showing the large blood clot affecting the right olfactory bulb, medial and lateral olfactory tracts, rhinal sulcus and ventral portion of the frontal lobe.

Fig. 4: Transverse section through the rostral aspect of the cerebral hemispheres demonstrating compression of the right cerebral hemisphere by the blood clot, with a shift of the mid-line to the left.
may be associated with venous malformations especially if located in the brainstem. Vascular malformations of the nervous system are uncommon in domestic animals and few cases have been described. Furthermore, criteria for discriminating between hamartomatic and neoplastic lesions have only recently been suggested, and are not established in the veterinary literature. Thus, a limited range of variously classified angiomatous proliferations are cataloged, affecting dogs, cats, horses and calves.

The macroscopic and histopathological appearances of the tumour in this case were consistent with cavernous haemangioma. Cells lining vascular sinuses labelled positively with antibodies against factor VIII, whilst the intervening trabeculae failed to label with antibodies against GFAP. This is a pattern considered characteristic of haemangioma, rather than hamartoma, in a recent description of 5 cases of cerebral hamartomas of dogs. Whether this entity is truly a vascular neoplasm or a hamartomatous vascular malformation remains debatable but the age of the animal may favour the latter. The lesion may have been latent since birth, with subsequent catastrophic haemorrhage explaining the acute onset of clinical signs. One other similar case has been described in the dog, notably also in the forebrain of a young Golden retriever. Two cases of compression of the spinal cord by these tumours have also been described in dogs.

MR has proved to be a very sensitive and highly specific means of differentiating vascular malformations in humans and therefore MRI may have the same specificity for detecting these lesions in dogs. However, more cases need to be studied to confirm this hypothesis.

Prior to the widespread use of CT and MR, the diagnosis of cavernous haemangioma in humans was usually made on post mortem examination. A recent study of hereditary, cerebral cavernous angiomas in 57 French families, showed seizures to be the most common symptom, followed by brain haemorrhage and focal neurological deficits. They classified the cavernomas into 4 types, depending on the MR findings. The MR findings in our patient seem to be consistent with the Type II cavernomas described in humans (hypointense signal on T1-weighted image and hyperintense signal on T2-weighted image).

Surgical treatment had a favourable outcome in a human study. However, in this case the lesion was considered too extensive and deep to contemplate surgery. The fact that the 2 documented cases of this rare tumour, in a similar location, are both in Golden retrievers, may well be coincidental, but could indicate a breed association. MRI of the siblings and parents of future affected dogs may thus be of benefit.

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