Vasculitis in a Dog Resembling Isolated Angiitis of the Central Nervous System in Humans

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Abstract. An 11-year-old dog succumbed to a seizure disorder of 18 days duration. At necropsy, an area of hemorrhage and discolored parenchyma was identified in the left pyriform lobe of the brain. Microscopic examination revealed a localized, necrotizing vasculitis with associated cerebral necrosis. Vasculitis was not present in other organs. This presentation is consistent with isolated central nervous system (CNS) angiitis, a rare form of vasculitis in humans.

Key words: Angiitis; central nervous system; dogs; vasculitis.

In humans, the vasculitides are a large group of disorders which may be classified as primary or secondary forms of blood vessel inflammation.^{4,5} Primary vasculitides are idiopathic and include polyarteritis nodosa, temporal arteritis, and isolated angiitis of the central nervous system (CNS). Secondary vasculitides are associated with a variety of infectious agents, toxins, collagen disorders, and other diseases. Whereas many vasculitides are systemic, isolated angiitis of the CNS is unique in its restriction to vessels of the nervous system.¹

An 11-year-old spayed female mixed breed dog seizured over an 18-day period. Although initially treated at home, she was returned to the clinic in seizures, was hospitalized and died overnight. Necropsy the next day revealed a focal 5 mm area of hemorrhage on the surface of the left pyriform lobe of the brain. On transverse section, hemorrhage extended into the underlying cerebral cortex and the tissue had a dark gray discoloration. There was an impression of mild atrophy of the affected pyriform cortex when compared with the opposite hemisphere, which may have been the result of necrosis. The brain and selected organs were fixed in 10% buffered formalin, routinely processed into paraffin blocks, sectioned at 4 µm, and stained with hematoxylin and eosin (HE). The spinal cord was not examined. Grocott-Gomon methenamine-silver, periodic acid-Schiff (PAS), modified Steiner, and Congo red stains were applied to selected brain sections. For glial fibrillary acidic protein (GFAP) staining, we used strepavidin-biotin immunocytochemistry (DAKO, 1:3,000 without pretreatment). Microscopic examination of the left pyriform lobe revealed a severe vasculitis, which in some vessels was necrotizing with fibrinoid necrosis (Fig. 1). Lymphocytes, plasma cells (some with Russell bodies), macrophages and fewer neutrophils encircled and infiltrated the walls of larger vessels, often obscuring the margin of the vessel and filling the perivascular space. Sometimes these inflammatory cells extended into the brain parenchyma (Fig. 2). Smaller, capillary-sized vessels had a more acute vasculitis in which neutrophils predominated and PAS-positive fibrin-like deposits were found (Fig. 3). Occasional multinucleated giant cells were present within both large and small vessel vasculitic lesions (Figs. 4, 5). In areas of less dense inflammation, the intervening neuropil was degenerate and pale staining with HE, showed patchy mild to moderate hemorrhage, and contained reactive, swollen astrocytes and increased numbers of rod cells (microglia). In the most severe area of the brain lesion, ischemic neurons, focal necrosis, and mineralization were found. Vasculitis, sometimes with conspicuous giant cells, was also present in the leptomeninges adjacent to the pyriform lobe (Fig. 6).

Lesions of the left pyriform lobe showed very minimal extension into the hypothalamus and spared the adjacent optic tracts. At the lateral margins of the affected lobe, dense inflammation could be found on one side of the sulcus with minimal change on the other side. Lesions were not found elsewhere in the brain with the exception of mild inflammation of the choroid plexuses of the lateral and third ventricles, with vasculitis of one vessel and a couple of small lymphocytic perivascular cuffs in the right pyriform lobe. The presence of this localized dense necrotizing brain lesion raised the possibility of an embolic infection but special stains for infectious agents were negative. The GFAP stain clarified the extent of reactive gliosis which involved the pyriform lobe and adjacent brain parenchyma, with the latter probably reflecting the development of cerebral edema. No evidence of vasculitis or other lesions was found in the heart, lungs, liver, spleen, or kidney.

This mature dog had a sudden onset of a seizure disorder resulting from a focal, angiocentric, inflammatory lesion. The differential diagnosis of cerebral vasculitis in the dog is limited. Systemic necrotizing vasculitis occurs in Beagle dogs⁷ and other dog breeds and involves the cardiac, mediastinal, thymic, and other vessels including those of the CNS. However, CNS involvement is more common in the spinal cord than the brain and is usually limited to the leptomeninges. Furthermore in this dog, vascular lesions were not found in nonneural tissues. Vasculitis can occur in the rickettsioses,² but there was neither clinical nor pathologic evidence of systemic disease. Microscopically the lesions may suggest granulomatous meningoencephalomyelitis (GME), but GME lacks both fibrinoid vascular necrosis and giant cells and predominates in white matter.

Primary angiitis of the CNS is an idiopathic disorder in humans, in which the clinical manifestations are largely non-specific (persistent headache, vomiting, and malaise) and which in children is often fatal.³ Focal and generalized seizures may occur.⁶ Computerized tomography and magnetic resonance imaging of the brain show ischemic changes and sometimes tumor-like foci.³ Angiography and brain biopsy are often employed in an attempt to establish the diagnosis. Reports of the histopathologic findings describe small- and

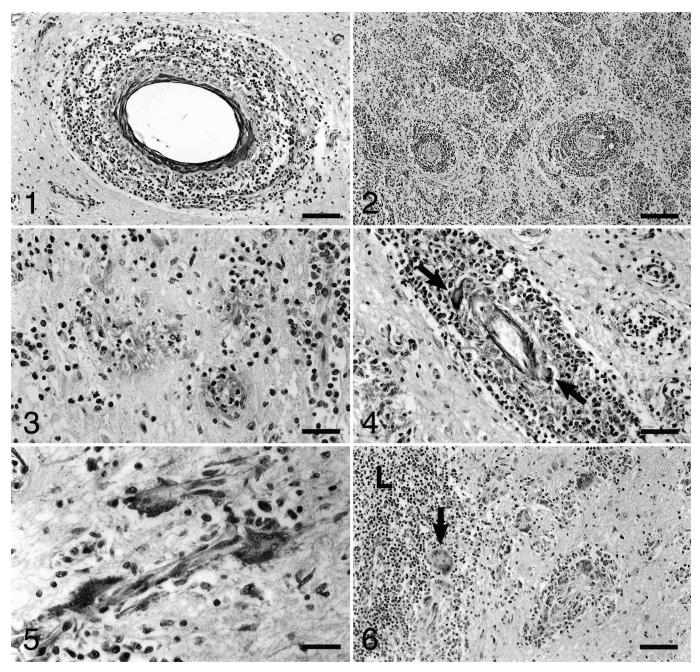


Fig. 1. Pyriform lobe; dog. Vasculitis with fibrinoid necrosis of the tunica intima. PAS stain. Bar = 107 μ m. Fig. 2. Pyriform lobe; dog. Widespread vasculitis with leukocytic infiltrates extending into the neuropil. HE stain. Bar = 184 μ m.

Fig. 3. Pyriform lobe; dog. Area of capillary vasculitis with neutrophilic infiltrates and fibrin deposition. HE stain. Bar = $50 \mu m$.

Fig. 4. Pyriform lobe; dog. Vasculitis with multinucleated giant cells (arrows). HE stain. Bar = $64 \mu m$.

Fig. 5. Pyriform lobe; dog. Three multinucleated giant cells abut this small vessel. HE stain. Bar = $34 \mu m$.

Fig. 6. Pyriform lobe; dog. Leptomeningitis (L) and vasculitis with giant cells, some in proximity to blood vessels (arrow). HE stain. Bar = $104 \mu m$.

medium-sized meningocerebral arteries and veins infiltrated predominantly by lymphocytes with the variable presence of neutrophils, epithelioid macrophages and multinucleated giant cells, eosinophils, and sometimes fibrinoid necrosis.^{3,5,6}

Concurrent amyloid angiopathy has been noted in the human disorder,⁶ but in this canine case the Congo red stain was negative.

In conclusion, this case report describes a dog with an

abrupt onset of seizures resulting from an idiopathic, focal, giant cell vasculitis of the brain, a clinical and neuropathologic presentation closely resembling isolated angiitis of the CNS in humans.

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