

# ENCEPHALITIS (INFLAMMATION OF THE BRAIN)

## BASICS

### OVERVIEW

- “Encephalitis” is the medical term for inflammation of the brain
- May be accompanied by inflammation of the spinal cord (known as “myelitis”) and/or meninges (the membranes covering the brain and spinal cord; inflammation of the meninges known as “meningitis”)

### SIGNALMENT/DESCRIPTION of ANIMAL

#### Species

- Dogs and cats

#### Breed Predispositions

- Inflammation of the brain and the membranes covering the brain (meninges) characterized by nodular, inflammatory lesions (known as “granulomatous meningoencephalitis”)—mostly small-breed dogs, especially terriers and miniature poodles; large-breed dogs also affected
- Inflammation of the brain (known as “pug encephalitis”)—pugs
- Inflammation of the brain, spinal cord, and membranes covering them with mononuclear cells and neutrophils (pus) present in the tissues (known as “pyogranulomatous meningoencephalitis”)—German shorthaired pointers
- Inflammation of the brain (known as “Maltese encephalitis”)—Maltese
- Inflammation of the brain characterized by the destruction and death of nervous tissue (known as “Yorkshire terrier necrotizing encephalitis”)—Yorkshire terriers

### SIGNS/OBSERVED CHANGES in the ANIMAL

- Usually a very sudden (peracute) to sudden (acute) onset of clinical signs that rapidly progress
- Inflammation of the brain and the membranes covering the brain (meninges) characterized by nodular, inflammatory lesions (granulomatous meningoencephalitis) and fungal or protozoal caused inflammation of the brain (encephalitis)—sometimes signs progress over a more long-term (chronic) course
- Fever, lung disease, and/or gastrointestinal disturbances—usually precede inflammation of the brain (encephalitis)
- With mycotic, rickettsial, viral, and protothecal organisms—lesions in the retina (back part of the eye) are frequent
- Signs are determined by the portion of the brain most affected; front part of the brain—seizures; circling; pacing; personality change; decreasing level of responsiveness; back part of the brain—abnormalities related to the brainstem (drowsiness or sleepiness [known as “somnia”]), head tilt, weakness or partial paralysis to paralysis of the facial muscles, incoordination)
- Progression (such as unequal size of the pupils [known as “anisocoria”], pinpoint pupils, decreasing level of consciousness, short, rapid movements of the eyeball [known as “nyctagmus”])—suggests the brain has pushed downward in the skull and has herniated through the opening that leads to the neck (known as “tentorial herniation”)

### CAUSES

#### Dogs

- Unknown cause (so called “idiopathic” disease) or immune-mediated disease—inflammation of the brain and the membranes covering the brain (meninges) characterized by nodular, inflammatory lesions (granulomatous meningoencephalitis); pug encephalitis; Maltese encephalitis; Yorkshire terrier necrotizing encephalitis; inflammation of the brain and membranes covering the brain (meninges), characterized by the presence of a type of white-blood cell, the eosinophil (condition known as “eosinophilic meningoencephalitis”)
- Viral infections—canine distemper virus; rabies virus; herpes virus; parvovirus; adenovirus; pseudorabies; Eastern and Venezuelan equine encephalomyelitis virus
- Inflammation of the brain and spinal cord following vaccination (known as “postvaccinal encephalomyelitis”)—canine distemper virus; rabies virus; canine coronavirus-parvovirus
- Rickettsial disease—Rocky Mountain spotted fever; ehrlichiosis
- Fungal or mycotic disease—cryptococcosis; blastomycosis; histoplasmosis; coccidioidomycosis; aspergillosis; phaeohyphomycosis
- Bacterial infections
- Protozoal disease—toxoplasmosis; neosporosis; encephalitozoonosis
- Spirochetes—borreliosis (Lyme disease)
- Parasite migration—heartworms (*Dirofilaria immitis*); roundworms (*Toxocara canis*); hookworms (*Ancylostoma caninum*); *Cuterebra*; cysticercosis (where a tapeworm larva has embedded itself in nervous tissue)
- Migrating foreign body—plant awn; others
- Protothecosis (infection with a type of algae, *Prototheca*)

#### Cats

- Unknown cause (so called “idiopathic” disease) or immune-mediated disease—inflammation of the brain and the membranes covering the brain (meninges) characterized by nodular, inflammatory lesions (granulomatous

meningoencephalitis); inflammation of the brain and membranes covering the brain (meninges), characterized by the presence of a type of white-blood cell, the eosinophil (eosinophilic meningoencephalitis)

- Inflammation of the gray matter of the brain and spinal cord for unknown cause (condition known as “idiopathic polyoencephalomyelitis”)
- Viral disease—feline infectious peritonitis (FIP); rabies; feline immunodeficiency virus (FIV); pseudorabies; panleukopenia; rhinotracheitis
- Fungal or mycotic disease—cryptococcosis; blastomycosis; phaeohyphomycoses
- Bacterial infections
- Protozoal disease—toxoplasmosis
- Parasite migration—heartworms (*Dirofilaria immitis*); *Cuterebra*

#### RISK FACTORS

- Medications that decrease the immune response (known as “immunosuppressive drugs”) and feline immunodeficiency virus (FIV) or feline leukemia virus (FeLV) infection—infectious causes of inflammation of the brain (encephalitis)
- Tick-infected areas—rickettsial and *Borrelia* infections
- Travel history—fungal or mycotic infections

## TREATMENT

#### HEALTH CARE

- Inpatient—diagnosis and initial therapy
- Symptomatic treatment—control fluid build-up in the brain (known as “brain edema”) and seizure activity, as necessary
- Fluid build-up in the brain (brain edema)—20% mannitol; may repeat within 1 to 2 hours to achieve maximum response; limit fluids to prevent rebound fluid build-up; with mannitol, short-term steroid treatment (dexamethasone) may be indicated for further control
- Seizures—treat with medications to control seizures (known as “antiepileptic drugs”); control may be erratic until the inflammation of the brain (encephalitis) is treated

#### ACTIVITY

- As tolerated

#### DIET

- With severe depression or vomiting—nothing by mouth until condition improves, to prevent aspiration

#### SURGERY

- Brain biopsy—may be needed for specific diagnosis

## MEDICATIONS

Medications presented in this section are intended to provide general information about possible treatment. The treatment for a particular condition may evolve as medical advances are made; therefore, the medications should not be considered as all inclusive.

- Apply specific therapy once diagnosis is reached or highly suspected
- Unknown cause (so called “idiopathic” disease) or immune-mediated disease—steroids (prednisone), as directed by your pet’s veterinarian
- Rickettsial disease and borreliosis (Lyme disease)—doxycycline
- Protozoal disease—clindamycin
- Fungal or mycotic—requires treatment for 1 to 2 years; use itraconazole or fluconazole; steroids often are needed during the first 4 to 6 weeks to control fluid build-up in the brain (brain edema)
- Viral and postvaccinal inflammation of the brain (encephalitis)—no definitive treatment; treat symptomatically
- Bacterial disease—broad-spectrum antibiotics that penetrate the blood–brain barrier; if bacteria is not identified as to actual type, a combination of enrofloxacin and ticarcillin-clavulanate or amoxicillin-clavulanate may be tried
- CCNU (lomustine)—treat dogs for one year; may be effective in causing remission in dogs with immune-mediated inflammation of the brain (encephalitis) that does not respond to prednisone; adverse effects include bone-marrow suppression, leading to low red-blood cell and low white-blood cell counts; gastrointestinal effects; and liver toxicity
- Cyclosporine modified—can be used with prednisone, CCNU and cytarabine for 1.5 years to achieve maximum decrease in the immune response (immune suppression) in dogs with immune-mediated inflammation of the brain (encephalitis)
- Cytarabine—after CCNU in dogs with immune-mediated inflammation of the brain (encephalitis) to achieve further decrease in the immune response (immune suppression); adverse effects are similar to those of CCNU, but much milder than side effects seen with CCNU

## FOLLOW-UP CARE

### PATIENT MONITORING

- Frequent nervous system evaluations in the first 48 to 72 hours to monitor progress
- Relapse as medication is withdrawn—repeat cerebrospinal fluid (CSF) analysis
- Measure serum titer of *Cryptococcus* capsular antigen every 3 months until negative, if cryptococcosis is diagnosed
- If treated with CCNU (lomustine), a complete blood count (CBC) should be done at 1 and 3 weeks following treatment; serum chemistry profile and serum bile acids should be done at 3 weeks and then every 2 months
- If treated with cytarabine, a complete blood count (CBC) should be done 2 weeks following treatment

### PREVENTIONS AND AVOIDANCE

- A method of effective tick control should be used on animals that live in an area where ticks are common
- Avoid vaccination of dogs that have had inflammation of the brain and the membranes covering the brain (meninges) characterized by nodular, inflammatory lesions (granulomatous meningoencephalitis)

### POSSIBLE COMPLICATIONS

- Long-term steroid therapy—signs of excessive levels of steroids in the blood following treatment (known as “iatrogenic hyperadrenocorticism” or “iatrogenic Cushing’s disease”)
- Cerebrospinal fluid (CSF) collection or natural course of the disease—brain may push downward in the skull and herniate through the opening that leads to the neck (tentorial herniation)
- Death

### EXPECTED COURSE AND PROGNOSIS

- Inflammation of the brain (encephalitis) is life-threatening, if left untreated
- Resolution of signs—generally gradual (2 to 8 weeks)
- Protothecal (algae) inflammation of the brain (encephalitis)—almost always progresses to death
- Immune-mediated disease—fair to good prognosis for complete remission with aggressive treatment to decrease the immune response (immunosuppression)
- Rickettsial, fungal or mycotic, bacterial, protozoal, and spirochete infections—fair chance of survival
- Parasite migration, migrating foreign bodies, pyogranulomatous meningoencephalitis, Yorkshire terrier necrotizing encephalitis, and polioencephalomyelitis—usually fatal
- Pug and Maltese encephalitis—may be fatal; course varies greatly; some patients respond to steroid treatment for long periods
- Inflammation of the brain and spinal cord following vaccination (postvaccinal encephalomyelitis)—may resolve on its own; often permanent damage and death

### KEY POINTS

- Inflammation of the brain (encephalitis) is life-threatening, if left untreated
- Relapse is possible with idiopathic (of unknown cause) or immune-mediated inflammation of the brain (encephalitis) when therapy is discontinued

