

# 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 PET

##### Species

- Dogs
- Cats

##### Breed Predilections

- 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 PET

- Sudden (acute) onset of clinical signs that rapidly progress
- With mycotic (fungal), rickettsial, viral, and protothecal organisms—lesions in the retina (back part of the eye) are frequent
- Signs vary with 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 “somnolence”], 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 “nystagmus”])—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; West Nile virus; Eastern and Venezuelan equine encephalomyelitis virus
- Inflammation of the brain and spinal cord following vaccination (known as “post-vaccinal 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*)
- PME

## 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 polyencephalomyelitis”)
- Viral disease—feline infectious peritonitis (FIP); rabies; feline immunodeficiency virus (FIV); pseudorabies; panleukopenia; rhinotracheitis
- Fungal or mycotic disease—cryptococcosis; blastomycosis; phaeohyphomycosis
- 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 buildup in the brain (known as “brain edema”) and seizure activity, as necessary
- Fluid buildup in the brain (brain edema)—20% mannitol; may be repeated within 1–2 hours to achieve maximum response; your veterinarian will limit fluids to prevent rebound fluid buildup; short-term steroid treatment (dexamethasone) can be added for further control
- Seizures—treat with medications to control seizures (known as “antiepileptic drugs”)

## ACTIVITY

- As tolerated

## DIET

- If severe depression or vomiting—nothing by mouth until condition improves, to prevent aspiration (material going down the windpipe instead of the esophagus)

## 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 where possible
- 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 1–2 years; medications include itraconazole and fluconazole; steroids often are needed during the first 4–6 weeks to control fluid buildup in the brain (brain edema)
- Viral and post-vaccinal 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
- Alternative Drugs: Leflunomide—often effective for immune-mediated inflammation of the brain (encephalitis) that is unresponsive to other treatment; side effects include low white blood cell (WBC) counts (known as “leucopenia”), low platelet or thrombocyte counts (known as “thrombocytopenia”), and bloody inflammation of the large intestine (known as “hemorrhagic colitis”)
- Mycophenolate can be added to leflunomide and prednisone in dogs with immune-mediated inflammation of the brain (encephalitis) to achieve further decrease in the immune response (immune suppression)

## Follow-Up Care

### PATIENT MONITORING

- Frequent nervous system evaluations in the first 48–72 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 leflunomide, a complete blood count (CBC) should be done monthly. If treated with mycophenolate, a CBC should be done 2 weeks following treatment and then monthly

### PREVENTIONS AND AVOIDANCE

- A method of effective tick control should be used on pets 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 “iatrogenic hyperadrenocorticism” (or “iatrogenic Cushing’s syndrome”)
- Cerebrospinal fluid 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 (2–8 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 pets respond to steroid treatment for long periods
- Inflammation of the brain and spinal cord following vaccination (post-vaccinal 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