

Congenital Hydrocephalus

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▲ **FIGURE 1** Chihuahua with a dome-shaped head caused by congenital hydrocephalus

Hydrocephalus is enlargement of the ventricular system resulting from increased CSF production, inadequate CSF drainage, obstruction of CSF outflow, or reduced brain parenchyma volume (eg, age-related brain atrophy, infarction).^{1,2}

Although hydrocephalus can also occur as an acquired disorder, this discussion highlights the congenital form. Congenital hydrocephalus is most often obstructive (ie, noncommunicating). Most cases result from fusion of the rostral colliculi in the midbrain causing obstruction of the mesencephalic aqueduct, with sec-

ondary enlargement of the ventricular system rostral to the midbrain.³ Congenital hydrocephalus in cats can be caused by prenatal treatment with griseofulvin⁴ in queens or intrauterine exposure to feline panleukopenia virus.⁵

Signalment

Congenital hydrocephalus is most commonly identified in young (2-3 months of age) toy-breed dogs (see *Dog Breeds Commonly Affected with Congenital Hydrocephalus*).^{2,6} The condition is much less common in cats.

Clinical Signs

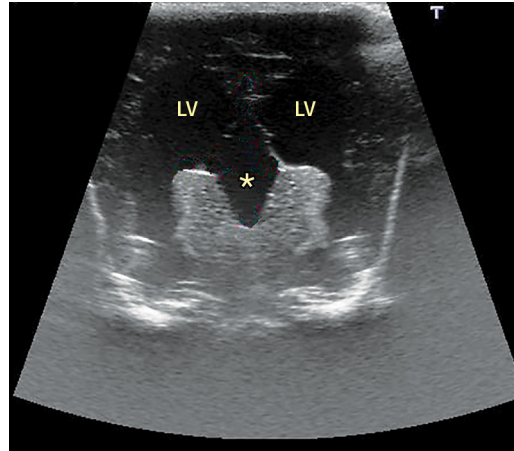
Common clinical signs include a dome-shaped head (*Figure 1*) with a persistent fontanelle, behavior problems (particularly difficult house-training), blindness, and seizures.^{1,2} Bilateral ventrolateral

DOG BREEDS COMMONLY AFFECTED WITH CONGENITAL HYDROCEPHALUS⁹

- ▶ Boston Terrier
- ▶ Cairn Terrier
- ▶ Chihuahua
- ▶ English Bulldog
- ▶ Lhasa Apso
- ▶ Maltese
- ▶ Pekingese
- ▶ Pomeranian
- ▶ Pug
- ▶ Toy Poodle
- ▶ Yorkshire Terrier



▲ **FIGURE 2** Pug with divergent strabismus caused by congenital hydrocephalus



▲ **FIGURE 3** Transverse ultrasound of the brain obtained through a persistent fontanelle demonstrating enlargement of the lateral ventricles (LV) and a supracollicular collection of CSF (asterisk)

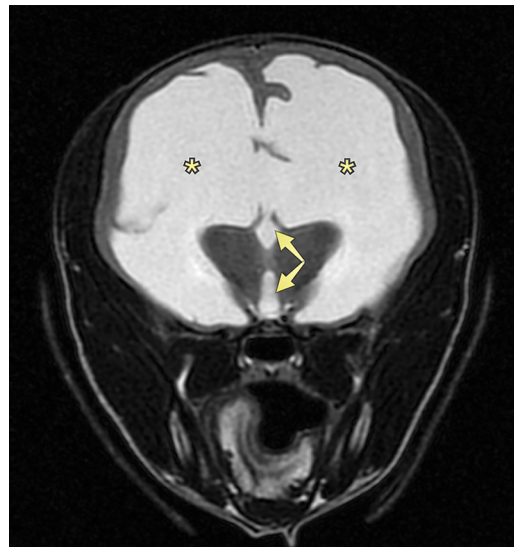
strabismus (ie, a type of divergent strabismus, *Figure 2*; characterized by the “setting sun” sign) may be seen if both eyes are affected.² Patients may appear mentally dull to stuporous. Gait abnormalities (eg, head pressing, dysmetria, ataxia, pacing, circling) are also common.^{1,2}

Diagnosis

Ultrasonography of the fontanelle, temporal bone, or foramen magnum can be used for diagnosis in patients with a persistent fontanelle (*Figure 3*).⁷ Advanced imaging, with MRI preferable to CT (*Figure 4*), is required to fully characterize the condition and rule out concurrent disorders.

Treatment

Medical management—which is not curative—is typically started first to alleviate acute clinical signs or deterioration. It may be the only treatment pursued when surgery is not an option. The duration of improvement may be relatively short (weeks to months) in moderately-to-severely affected patients; however, some patients with mild-to-moderate



▲ **FIGURE 4** Transverse MRI at the level of the thalamus demonstrating severe enlargement of the lateral ventricles (asterisks) and third ventricle (arrows)

clinical signs can be managed long-term. The primary goal of medical management is to reduce CSF production and treat secondary clinical signs (eg, seizures). Options for reducing CSF production include 1 or more of the following: omeprazole (0.5-1.0 mg/kg PO

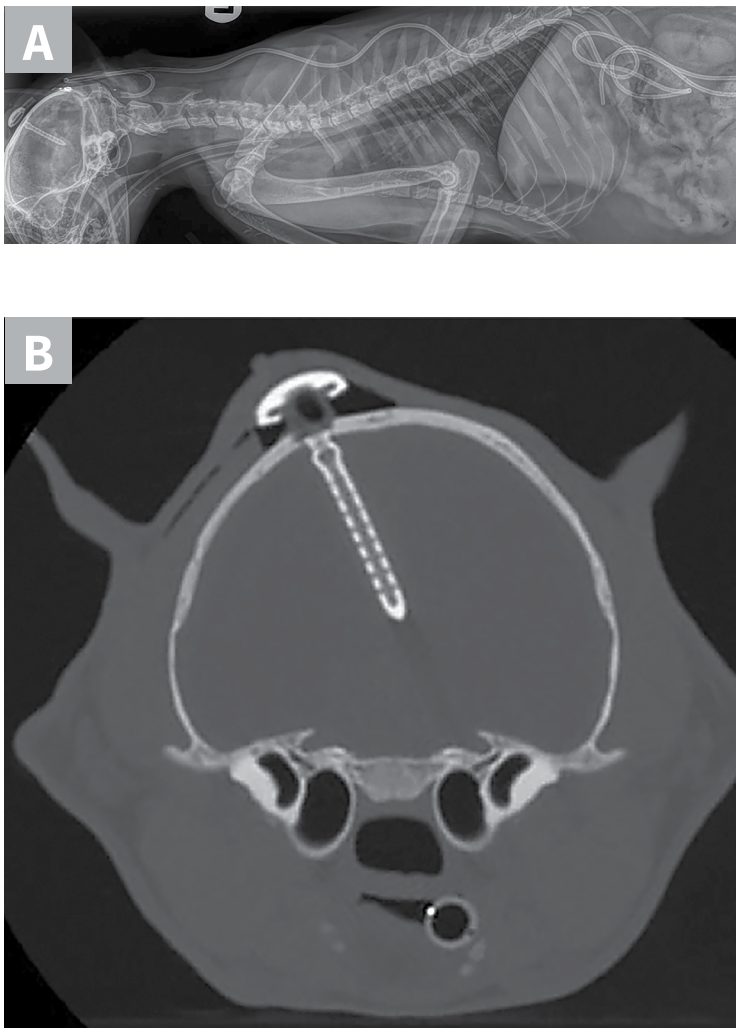
once a day), furosemide (0.5-2.0 mg/kg PO once or twice a day), prednisone (0.25-0.5 mg/kg PO twice a day), and acetazolamide (10 mg/kg PO 3 times a day).^{1,2,8-10} Mannitol (0.5-1.0 g/kg IV over 15-20 minutes) may be needed for emergent patients. Omeprazole or furosemide may be used in mildly affected patients, with other medications added as needed. The author typically starts with prednisone. The goal of treatment is complete res-

olution of clinical signs, but often only partial remission is achieved. Once clinical signs are controlled or stabilized, the prednisone dose can be reduced every 1 to 2 weeks to the lowest effective dose, typically administered every other day, to maintain an acceptable quality of life.

Surgical placement of a shunt is preferred, especially when medical management fails.^{1,2,11,12} Because return to normal condition is uncommon following surgery, the goal of shunt placement is improvement in clinical signs. Most commonly used is a ventriculoperitoneal shunt (**Figure 5**), which diverts CSF from the ventricular system through a tube tunneled through the subcutaneous tissues to the abdomen, where CSF is then reabsorbed.^{1,2} Patients with mild-to-moderate hydrocephalus often do well postoperatively; patients with severe hydrocephalus and only a thin rim of brain parenchyma are at higher risk for postoperative complications.^{1,2,9} If too much CSF is removed (ie, overshunting), the brain parenchyma may collapse, resulting in tearing of meningeal vessels and hemorrhage.^{1,2} Other postoperative complications can include undershunting; shunt infection or obstruction, which may necessitate replacement; and/or seizures.^{1,2}

Prognosis

The prognosis for congenital hydrocephalus is variable and depends on the degree of ventriculomegaly and presence of concurrent disease(s). No peer-reviewed scientific reports in the veterinary literature describe long-term prognosis for dogs treated medically, and few studies exist describing postoperative outcomes in small patient populations. In general, approximately 75% of dogs and cats have a successful outcome postoperatively.^{11,12} ■



▲ **FIGURE 5** (A) Postoperative lateral radiograph and (B) transverse CT image showing a ventriculoperitoneal shunt placed in a cat. Although the well was not flush with the skull, the shunt appeared stable after the sutures were tightened. The cat did well after surgery. *Images courtesy of Dr. Eric Glass, Red Bank Veterinary Hospital/Compassion First Pet Hospitals*

See page 30 for references.

**Veraflox (pradofloxacin) Oral Suspension for Cats
25 mg/mL**

For the treatment of skin infections (wounds and abscesses) in cats.
Do not use in dogs.

BRIEF SUMMARY:

Before using Veraflox Oral Suspension for Cats, please consult the product insert, a summary of which follows:

CAUTION:

Federal law restricts this drug to use by or on the order of a licensed veterinarian. Federal law prohibits the extra-label use of this drug in food-producing animals.

PRODUCT DESCRIPTION:

Pradofloxacin is a fluoroquinolone antibiotic and belongs to the class of quinolone carboxylic acid derivatives. Each mL of Veraflox Oral Suspension provides 25 mg of pradofloxacin.

INDICATIONS:

Veraflox is indicated for the treatment of skin infections (wound and abscesses) in cats caused by susceptible strains of *Pasteurella multocida*, *Streptococcus canis*, *Staphylococcus aureus*, *Staphylococcus felis*, and *Staphylococcus pseudintermedius*.

CONTRAINDICATIONS:

DO NOT USE IN DOGS. Pradofloxacin has been shown to cause bone marrow suppression in dogs. Dogs may be particularly sensitive to this effect, potentially resulting in severe thrombocytopenia and neutropenia. Quinolone-class drugs have been shown to cause arthropathy in immature animals of most species tested, the dog being particularly sensitive to this side effect. Pradofloxacin is contraindicated in cats with a known hypersensitivity to quinolones.

HUMAN WARNINGS:

Not for human use. Keep out of reach of children. Individuals with a history of quinolone hypersensitivity should avoid this product. Avoid contact with eyes and skin. In case of ocular contact, immediately flush eyes with copious amounts of water. In case of dermal contact, wash skin with soap and water for at least 20 seconds. Consult a physician if irritation persists following ocular or dermal exposure or in case of accidental ingestion. In humans, there is a risk of photosensitization within a few hours after exposure to quinolones. If excessive accidental exposure occurs, avoid direct sunlight. Do not eat, drink or smoke while handling this product. For customer service or to obtain product information, including a Material Safety Data Sheet, call 1-800-633-3796. For medical emergencies or to report adverse reactions, call 1-800-422-9874.

ANIMAL WARNINGS:

For use in cats only. The administration of pradofloxacin for longer than 7 days induced reversible leukocyte, neutrophil, and lymphocyte decreases in healthy, 12-week-old kittens.

PRECAUTIONS:

The use of fluoroquinolones in cats has been associated with the development of retinopathy and/or blindness. Such products should be used with caution in cats. Quinolones have been shown to produce erosions of cartilage of weight-bearing joints and other signs of arthropathy in immature animals of various species. The safety of pradofloxacin in cats younger than 12 weeks of age has not been evaluated. The safety of pradofloxacin in immune-compromised cats (i.e., cats infected with feline leukemia virus and/or feline immune-deficiency virus) has not been evaluated. Quinolones should be used with caution in animals with known or suspected central nervous system (CNS) disorders. In such animals, quinolones have, in rare instances, been associated with CNS stimulation that may lead to convulsive seizures. The safety of pradofloxacin in cats that are used for breeding or that are pregnant and/or lactating has not been evaluated.

ADVERSE REACTIONS:

In a multi-site field study, the most common adverse reactions seen in cats treated with Veraflox were diarrhea/loose stools, leukocytosis with neutrophilia, elevated CPK levels, and sneezing.

ANIMAL SAFETY:

In a target animal safety study in 32, 12-week-old kittens dosed at 0, 1, 3, and 5 times the recommended dose for 21 consecutive days. One 3X cat and three 5X cats had absolute neutrophil counts below the reference range. The most frequent abnormal clinical finding was soft feces. While this was seen in both treatment and control groups, it was observed more frequently in the 3X and 5X kittens.

HOW SUPPLIED: 15mL and 30mL

U.S. Patent No. 6,323,213
NADA141-344, Approved by FDA
Made in Germany
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Bayer

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