

# Hydrocephalus

A. Courtenay Freeman, DVM  
Marc Kent, DVM, DACVIM (Small Animal and Neurology)  
Scott J. Schatzberg, DVM, PhD, DACVIM (Neurology)

## BASIC INFORMATION

### Description

Hydrocephalus occurs when there is an increased amount of cerebrospinal fluid (CSF) present within the brain. CSF is produced within specialized spaces or compartments of the brain called *ventricles*. This fluid flows through the ventricular system, around the brain, and eventually down the spinal cord. When the volume of CSF increases, the ventricles enlarge, and the fluid puts pressure on the surrounding brain tissue, which causes various neurologic problems.

### Causes

The volume of CSF usually increases because of a blockage in the ventricular system (obstructive hydrocephalus), although the exact location of the obstruction is not often identified. Only rarely is an excessive amount of CSF produced. There are several potential causes of obstruction of CSF flow:

- Birth defects within the ventricular system can result in enlarged ventricles filled with CSF. This congenital form of hydrocephalus is most frequently seen in young, small-breed dogs such as the Chihuahua, Yorkshire terrier, Boston terrier, and Pekingese.
- Brain masses (usually tumors) can block the flow of CSF.
- Inflammation or infections in the brain may also prevent the flow of CSF.

### Clinical Signs

Clinical signs are variable. Some animals have no clinical signs and lead normal, healthy lives, even with severe hydrocephalus. Mild clinical signs that can be seen with hydrocephalus include lethargy, depression, and behavioral changes. Some animals with hydrocephalus have difficulty with house training or learning commands. More severe clinical signs include seizures, blindness, and an uncoordinated gait.

With congenital hydrocephalus, the skull may be rounded or dome-shaped. A small opening in the top of the skull, called a *fontanelle*, may be felt under the skin in some animals.

### Diagnostic Tests

Although the clinical signs and physical findings described are suggestive of hydrocephalus, special imaging the brain is required to confirm the diagnosis. Magnetic resonance imaging (MRI) allows detailed evaluation of brain tissue, ventricles, and CSF, and may also detect the underlying cause of hydrocephalus. Computed tomography (CT scan) also may be used to diagnose hydrocephalus. In young animals with a fontanelle, an ultrasound scan can be performed through the fontanelle to show the presence of dilated

ventricles. CSF may be collected via a spinal tap to identify potential underlying causes of hydrocephalus, such as inflammation.

## TREATMENT AND FOLLOW-UP

### Treatment Options

Medical and surgical therapies exist for animals with clinical signs associated with hydrocephalus. In most cases, medical therapy is pursued initially, and surgery is reserved for cases that do not respond to medical treatment.

The goals of medical therapy are to treat the underlying cause (if possible) and to alleviate the clinical signs associated with hydrocephalus. Drugs such as steroids, acetazolamide, certain antacids called *proton pump inhibitors* (such as *Prilosec*), and diuretics can be used to decrease CSF production. Anticonvulsants may be used to control seizures. (See handout on **Seizures: Treatment**.)

Surgery involves the placement of a shunt (tube) that allows CSF to drain from the brain into the abdominal cavity. One end of the shunt is placed in the ventricular system of the brain and the other in the abdominal cavity. The tube is tunneled under the skin along the neck and back and is not visible. Not many veterinarians perform this surgery, so your pet may be referred to a specialist for an evaluation to determine whether it is a candidate for this surgery and for the actual surgery to be performed. Potential surgical complications include obstruction and infection of the shunt, which can result in return of the clinical signs.

### Follow-up Care

In cases treated medically, animals are re-examined periodically to evaluate the effectiveness of therapy. Blood tests may be used to monitor animals treated with acetazolamide or diuretic therapy. After surgery, animals require frequent evaluations to ensure the success of the procedure. If no complications occur after the initial postoperative period, recheck visits may be decreased to every 6 months.

### Prognosis

Prognosis depends on the severity of the clinical signs. Some animals live normal, healthy lives with this condition and do not require any treatment. Medical therapy often helps animals with mild signs. Surgery can improve clinical signs in some dogs; however, loss of brain tissue from fluid pressure may result in irreversible changes. In severely affected animals, clinical signs may not improve with treatment. Prognosis is guarded for patients with tumors blocking CSF flow. In animals with infection or inflammation, hydrocephalus may improve with proper treatment of the underlying condition.