



# Chihuahua

## Update

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## Understanding Portosystemic Shunts in Chihuahuas

**A** healthy liver is critical to proper metabolism and filtering of toxins. Unfortunately, some breeds of dogs — including Chihuahuas — are more likely to have a vascular defect, called a portosystemic shunt, that diverts blood from flowing correctly through the liver. Consequently, unfiltered blood from the gastrointestinal system bypasses the liver and circulates throughout the body, resulting in a buildup of toxins, especially after a high-protein meal.

The accumulation of toxic material, particularly ammonia, a byproduct of protein digestion, can trigger a host of neurological signs and unusual behavior in as little as 15 to 45 minutes after a dog has eaten. Signs may include stupor, lethargy, circling, confusion, blind staggers, head pressing, staring, or seizures. Less common signs include excessive drinking, urinating, diarrhea or vomiting, even blindness. General ill health, as evidenced by stunted growth and a poor coat, also can be an indicator of a liver shunt, as well as urinary crystals, specifically ammonium biurate crystals.

"The classic presentation we see is a dullness or mental depression that occurs after eating," says Tony Mann, D.V.M., DACVS, associate professor and director of small animal emergency and critical care at the University of Missouri. "That's because the blood bypasses the liver so it doesn't have the opportunity to filter out toxins it normally does. Some of the toxic chemicals that remain circulating in the bloodstream are depressants. They make the animal appear depressed, drunk or even sleepy."

Neurological signs seen with shunts also can be mimicked by other medical conditions, some common in Chihuahuas. For example, hydrocephalus, an abnormal accumulation of cerebrospinal fluid in the brain, can manifest as a dulled mental state and can cause seizures. Chihuahuas presenting with signs of a liver shunt could actually have hydrocephalus, Mann says.

Other medical conditions that produce neurological signs similar to

those caused by a portosystemic shunt include hypoglycemia, or low blood sugar, epilepsy, upper neck problems, and hepatic microvascular dysplasia, where microscopic blood vessels in the liver do not develop properly.

### Study Reports on Risk

Liver shunts can be congenital, meaning they are inherited and are present at birth, or they can be acquired, meaning they develop later in life as a result of another illness such as

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hepatitis or cirrhosis. The shunts are intrahepatic, located inside the liver, or extrahepatic, located outside the liver. Large dogs tend to have intrahepatic shunts, which involve small, multiple veins and are more difficult to treat. Small dogs, including Chihuahuas, are more likely to have extrahepatic shunts involving one of two large vessels. This type is usually easier to correct surgically.

Karen Tobias, D.V.M., professor of small animal surgery at the University of Tennessee, examined records of 2,400 canine cases of PSS at 27 institutions across the United States over a 22-year period. The study noted that 33 breeds are at increased risk of having portosystemic shunts (PSS). Havanese, Yorkshire Terrier, Maltese,

Dandie Dinmont Terrier, Pug, and Miniature Schnauzer top the list, while Chihuahua ranks 22.

Tobias found that PSS occurred in 0.18 percent of all dogs. "The annual proportion of dogs diagnosed with PSS increased tenfold from 0.05 percent (five out of 10,000 dogs) in 1980 to 0.5 percent (five out of 1,000 dogs) in 2001," she says. "Better recognition of signs — by veterinarians and breeders alike — is thought to be a factor in the upswing of liver shunt diagnoses."

Shunts are seen in 0.25 percent, or one in every 400, of Chihuahuas presented to referral hospitals. "The odds of a Chihuahua having a shunt is 4.9 times greater than that for a mixed-breed dog, where the incident rate is one in every 2,000 dogs," Tobias says. "Thus, it is highly likely that the condition is hereditary in Chihuahuas."

### Identifying a Liver Shunt

Clinical signs of a liver shunt are often seen at a young age, usually before an animal is 1 year old, and sometimes as early as 3 months of age. Some dogs show no clinical signs until they are older, when they develop bladder and kidney problems, such as infections and stones.

Some dogs are diagnosed after a prolonged recovery from anesthesia. "Historically, we'll see these animals after they've been spayed or neutered," Mann says. "One of the complaints we hear is that it took the dog forever to wake up from anesthesia. That's because they don't metabolize the drugs very well."

Diagnosis of a suspected portosystemic shunt includes blood tests. "Dogs with congenital liver shunts usually have low blood urea nitrogen (BUN) and albumin concentration levels," Tobias says. "They may be slightly anemic or have red blood cells that are smaller than normal. They also may have increased liver enzymes (AST and ALT)."

When these abnormalities are

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## Portosystemic Shunts

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present, bile acid or ammonia concentrations should be measured to evaluate liver function. Bile acid should be measured after eating and after a 12-hour fast. "Dogs with shunts will almost always have high bile acids two hours after eating, and usually at least 95 percent of dogs will have high bile acids after a 12-hour fast," Tobias says. "However, some breeds and individual dogs may have increased bile acids without a liver shunt."

A definite determination of a shunt can only be made using radiography to locate and determine the extent of the shunt. Testing includes scintigraphy, portography, ultrasound, CT scan or MRI, or even exploratory surgery.

Scintigraphy measures and compares blood flow between the liver and heart through the rectal insertion of radioactive material that is followed

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with a special camera connected to a computer. Though scintigraphy tells whether shunting is present, in most cases the veterinarian cannot tell whether the shunt is inside or outside of the liver, whether there is more than one shunt, or whether the shunt is congenital or acquired. A new method of scintigraphy, where the radioactive material is injected directly into the spleen, is proving more useful for differentiating the number and type of shunts, Tobias says.

Portography uses a contrast dye to produce a radiograph of the blood vessels. While ultrasound is one of the least invasive ways to confirm the presence of a shunt, it is also one of the most difficult. Shunts can be easily missed, especially if the dog is small or wiggly, Tobias notes, adding that the experience level of the ultrasonographer often has the greatest impact on the success of the diagnostic test. CT scans are being used more frequently to diagnose portosystemic shunts, but they also require expensive equipment and special expertise.

### Managing a Shunt

Medical and dietary management are used to help a dog with a portosystemic shunt. "Most animals improve immediately with proper diet and medicine, and about one-third of dogs

treated medically will live a relatively long life," Tobias says. "Dogs that tend to do well with long-term medical management are usually older at the time of diagnosis, have more normal blood work and less severe clinical signs."

Medical management aims to reduce the amount of ammonia circulating in the body. Lactulose, a type of carbohydrate utilized by certain intestinal bacteria that changes the pH in the large intestine, can be helpful. The change in pH decreases absorption of ammonia and other toxins, Tobias says. Antibiotics may also be prescribed to decrease the toxin-producing bacteria in the intestines. Dietary management often involves feeding a lower protein food that is easily digested, rich in antioxidants and vitamins, and low in copper and iron. The "right" level of protein is based on an individual case. The clinician must try to balance meeting the dog's protein needs while minimizing the risk of worsening the blood ammonia levels.

Surgery provides the best chance for long life in most dogs with a portosystemic shunt, Tobias says. Surgeries that are successful are more common in dogs with extrahepatic shunts, those located outside of the liver, which are the type most common in Chihuahuas. Surgery involves finding the abnormal blood vessel and closing it off by rerouting the blood through the liver.

Two devices used to close off the abnormal blood vessel are cellophane bands or ameroid constrictor rings. When cellophane bands are used, thin strips about 5 millimeters wide are placed around the shunt and secured with surgical strips. Scar tissue forms gradually over the band, which completely closes the shunt.

The ameroid constrictor is a metal band with an inner ring of casein, a protein found in milk. Once in place, the casein absorbs naturally occurring liquid from the abdomen and expands. As the casein swells, it presses on the abnormal vessels, causing scar tissue reaction that seals the shunt in a few weeks. Compared to other techniques, complications are fewer when shunts are gradually occluded, or closed, Tobias says.

The most serious surgical complication is portal hypertension, which, if acute, can be fatal. Death from hypertensive shock typically occurs within 12 to 24 hours after surgery. Portal hypertension rarely occurs in dogs that undergo gradual occlusion. Another uncommon but serious complication is postoperative seizures. These seizures can be difficult to control and fatal. Milder but more common complications include low blood sugar, pain, low body temperature, and bloating.

Most of these conditions occur within the first 24 hours after surgery and can be medically managed. Dogs with low blood protein concentrations, high white blood cell counts, or severe neurological signs are more likely to have problems following surgery.

Not all dogs are good surgical candidates. The liver metabolizes some anesthetics, and surgery can put undue stress on an already frail animal. In addition, intrahepatic shunts, those within the liver tissue, can be difficult to find and repair. These dogs are more likely to suffer post-surgical complications and require additional care.

Post-operative care often includes a lower protein diet for at least eight to 12 weeks. Lactulose can be continued as well, or gradually decreased. Most dogs do not require antibiotics unless they have infections. "The survival rate depends partly on the health of the dog," Tobias says. "Because Chihuahuas — particularly those with shunts — are so small, it is important to have the surgery performed by a board-certified veterinary

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PROFESSOR OF SMALL ANIMAL SURGERY  
AT THE UNIVERSITY OF TENNESSEE*

surgeon who has experience with toy dogs and who can perform the surgery quickly."

Generally, "the long-term prognosis following surgery is good if the animal gets through the short-term consequence," Mann says.

Unfortunately, in some cases, euthanasia is the only option. Uncontrollable neurological signs, such as seizures, behavior changes or progressive liver damage are examples of when euthanasia may be best for a dog with a shunt.

### Breeding a Dog with PSS

In Chihuahuas, it is not known definitely whether portosystemic shunts are hereditary, but it is possible because of the increased incidence, Tobias says. In some breeds, such as Irish Wolfhounds, Cocker Spaniels, Maltese and Yorkshire Terriers, shunts are considered hereditary.

Since it is not definite that shunts are hereditary and since the mode of inheritance is not known, it is best to avoid breeding dogs that produce offspring with shunts, Tobias says. All affected animals should be neutered or spayed.

By not breeding dogs likely to pass the condition on to their offspring, breeders are helping to end the proliferation of shunts in Chihuahuas. Meanwhile, with proper medical and dietary management, and possibly surgery, owners often can help those dogs diagnosed with portosystemic shunts live a long, healthy life. ■