

# Portosystemic Shunts

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Portosystemic shunts are caused by abnormalities of the veins in the abdomen. In normal animals, blood from the stomach, intestines, spleen, and pancreas drains into the liver through a large vein called the “portal” vein. Blood is detoxified in the liver from the portal vein before it passes into the general circulation. In animals with portosystemic shunts, some of the blood draining from the portal system bypasses (“shunts” past) the liver and directly enters the general circulation.

There are a number of types of portosystemic shunts. Most are “congenital,” which means that the abnormality was present at birth. Congenital liver shunts are likely an inherited problem so dogs and cats that have them should not be bred. Portosystemic shunts are rather rare in cats, but quite frequently encountered in dogs (especially small breeds).

The most common types of shunts are the following:

1. **Single extrahepatic shunt:** a single shunting vessel that is located outside the liver. This is the most common type and is usually congenital.
2. **Single intrahepatic shunt:** a single shunting vessel within the liver. These are most commonly seen in large-breed dogs and are usually congenital.
3. **Multiple extrahepatic shunts:** multiple shunting vessels not located within the liver. These are caused by underlying liver disease and are usually not present at birth (they are usually not congenital).
4. **Microvascular dysplasia (portal vein hypoplasia with sinusoidal shunting):** this is a situation where there are numerous capillary shunts within the liver. This is not correctable by surgery, however many of these patients seem to do clinically well for many years. This is a congenital defect mostly seen in small breeds of dogs.

## Diagnosis

Diagnosis is generally fairly straight forward. Serum bile acids test is often done to determine liver function (working capacity of the liver). This test indirectly evaluates portal blood flow. Most dogs or cats with liver shunts have a tremendous elevation in the test values. A second test, Protein C assay, may be recommended to differentiate a shunt from microvascular dysplasia. If the protein C assay suggests the presence of a shunt, then surgery will likely be recommended. If the Protein C assay is normal in a patient with markedly elevated bile acids, then microvascular dysplasia is most likely present and surgery will likely not be recommended.

Abdominal ultrasound will often be advised, if for no other reason than to evaluate the urinary bladder for the presence of stones. Dogs and cats with shunts may develop stones that are not readily observed on routine radiographs. If stones are present and surgery for the shunt is indicated, the bladder stones will be removed at the time of surgery to correct the shunt.

## Symptoms

Portosystemic shunts can cause a variety of symptoms. The most common include the following:

- ✦ **Nonspecific signs**, including lethargy, failure to grow, and weight loss
- ✦ **Gastrointestinal signs**, including poor appetite, vomiting, diarrhea, and excessive salivation
- ✦ **Urinary tract signs**, including excessive drinking and urinating, difficulty passing urine, and urine that may appear bloody
- ✦ **Neurologic signs**, including lack of coordination, head pressing, aimless walking and seizures. These signs can be more common after eating.

**Poor recovery** from anesthesia (e.g., after spay or neuter surgery)

# Portosystemic Shunts Continued...

## Treatment

There are both medical and surgical options when treating patients with liver shunts. Many people believe that surgery is the preferred method of treating dogs and cats with congenital portosystemic shunts. The aim of surgery is to close down the shunting vessel as far as possible and stop the flow of blood around the liver.

Medical therapy is used to stabilize pets prior to surgery and for long-term management in which either surgery is not performed or surgery cannot completely close down the shunting vessel. Many patients can be managed for many years on appropriate medical therapy with a good quality of life. Medical therapy is tailored based on the individual patient's condition and the response to treatment. Therapy can include the following:

- ✦ Low animal-based protein diet to reduce the nitrogen content of the diet (nitrogen is one of the toxins that a liver normally breaks down).
- ✦ Antibiotic therapy to reduce the number of certain bacteria in the gut and treat any bacteria that are absorbed into the blood stream.

Lactulose to reduce the absorption of compounds rich in nitrogen and cause them to be lost in the stool. The dose is adjusted to produce soft but formed stools.

Debilitated dogs or cats may also require fluid therapy, enemas, and other treatments prior to more definitive treatment. Appropriate treatment, either medial or surgical, is determined on a case by case basis.

At surgery, the abdomen is explored to locate the portosystemic shunt(s). The surgical procedure performed depends on the type of abnormal vessel(s). Single extrahepatic shunts are treated by either tying a piece of silk suture material around the vessel (suture ligation) or placement of a device or piece of sterile cellophane that slowly closes the vessel off. Suture ligation is the traditional method and is still done by many surgeons today. A suture is placed around the shunting vessel and temporarily tightened to look for signs of portal hypertension. Portal hypertension is caused by an unacceptable increase in the pressure in the veins draining the portal system and is a severe and often fatal complication after surgery. If no signs of portal hypertension are present, the shunt can be completely ligated. If signs of portal hypertension are observed, the shunt is partially ligated so that the flow of blood through the shunt is reduced but some flow remains to prevent portal hypertension.

More recently, portosystemic shunts have been treated by placing a device (ameroid ring) or piece of sterile cellophane around the shunting vessel that slowly constricts the vessel and attenuates blood flow. These are designed to reduce the chances of severe portal hypertension as the liver can slowly accommodate to the increased blood flow. These gradual occlusion devices attenuate blood flow through the shunt over a number of weeks. In rare cases no portal vein (portal atresia) exists; no surgical treatment has been established for this condition.

Surgery for some **single intrahepatic shunts** is similar to a single extrahepatic shunt. Because the abnormal vein is inside the liver, it is more difficult to visualize and therefore the surgery is more difficult. There are newer methods that are being developed for some of these shunts that involve the placement of many small metal coils within the shunt vessels to try to close off the flow of blood through them. These are performed with the aid of real-time radiographs (fluoroscopy) and catheters that are advanced into the abnormal vessel. Current treatment options for liver shunts are continuing to evolve and there are many different factors that help determine what treatment is best for each individual patient.

No surgical treatment exists for **multiple extrahepatic shunts**. A liver biopsy should be obtained to try and diagnose the underlying liver disease. Results may help determine the appropriate medical treatment and long-term prognosis.



# Portosystemic Shunts Continued...

## Prognosis

The long-term outlook for many dogs and cats with portosystemic shunts that are treated either medically or surgically can be favorable with a good quality of life for many years. For those dogs that are deemed to be good candidates for surgery, the long-term prognosis for single extrahepatic portosystemic shunts can be favorable. For pets in which the shunt was able to be completely closed successfully, the long-term prognosis is excellent. The prognosis for dogs with intrahepatic shunts and in cats is more guarded; although many can still do very well. The outlook for pets in which the shunt was partially closed down is more variable and depends on the amount of blood still bypassing the liver via the shunt.

Complications of surgery are uncommon but can be severe. Specific complications of portosystemic shunt surgery include the following:

- ✦ Portal hypertension. Severe portal hypertension causes rapid, progressive fluid accumulation within the abdomen, shock and bloody diarrhea within a few hours of closure of a shunt. The only treatment is surgical removal of the ligature and prognosis is extremely guarded. Moderate portal hypertension can occur with gradual occlusion devices resulting in distension of the abdomen with fluid within days to weeks after surgery. Fluid distension generally resolves within a few weeks.
- ✦ Seizures. These are often severe and can be continuous. They generally develop within 3 days after surgery. Pets that do not have seizures before surgery can develop seizures immediately after surgery. These seizures can be difficult to control. When dogs or cats develop seizures after surgery the prognosis can be guarded.
- ✦ Generalized bleeding or systemic infection (sepsis).

Medical therapy may be needed in some dogs and cats with continued shunting after surgery that experience clinical signs. Some partially closed shunt vessels go onto completely close over the weeks to months following surgery and some patients benefit from a second surgery to completely close off the shunt vessel after the liver has had time to accommodate to the added blood flow.

Some dogs with congenital liver shunts also have another underlying liver disease that makes them unable to handle the added blood flow through the liver that closing the shunt vessel provides. Testing prior to surgery (blood tests, ultrasound, possible liver biopsy, etc) is recommended to try to determine those patients that are good candidates for surgery and those that may be better managed medically.



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