PORTOSYSTEMIC SHUNT SURGERY AND PO CARE IN CATS AND DOGS

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consider, in the second of their two-part article, the differing approaches to dealing with extrahepatic and intrahepatic variants

FOLLOWING diagnosis and appropriate stabilisation of dogs and cats with portosystemic shunts (PSS), as detailed in part one of this article (VT40.45), the authors generally recommend surgery. The aim of surgical treatment is to occlude the shunting vessel (preferably completely at surgery or gradually over time) so that blood flow is diverted entirely through the liver and the animal can be slowly weaned off medical management. Certain situations may be influenced by both patient and owner factors, where surgery is not recommended and the patient continues on long-term medical management, as discussed in the previous article.

Finding the shunt (extrahepatic)

Before surgery, the nature of the shunt (extrahepatic or intrahepatic) should be confirmed wherever possible using ultrasound, mesenteric portovenography, computed tomography or magnetic resonance imaging.

The shunting vessel is approached via a ventral midline laparotomy, taking particular care when entering the abdomen because, rarely, shunts can be located in the falciform ligament (Brockman, 1998). In the first instance, exploration of the caudal vena cava (CVC) is advisable and this can be achieved by performing the duodenal manoeuvre, followed by the colonic manoeuvre. In a normal dog, no vessels should enter the CVC between the right renal/ phrenicoabdominal and hepatic veins, so any large vessels identified in this region may be a shunt (Figure 1).

Shunts can be very large (15mm or larger) and the blood flow within the shunt and the CVC in this region will be turbulent. Occasionally, CVC dilation can also be seen at the level of shunt.

If a vessel is not visualised using this technique, exploration of the epiploic foramen may be rewarding. This can be performed by opening the two leaves of the omentum and following them dorsally. The boundaries of the epiploic foramen include the CVC (dorsally), the hepatic artery and portal vein (ventrally), and the celiac artery (caudally).

A porto-azygous vessel is usually identified at surgery as a vessel that heads in a craniodorsal direction arising from a contributory of the hepatic portal vein. Exploration of the diaphragmatic crura and oesophageal hiatus should also be performed, by retracting the liver and stomach to the right to aid visualisation. Very rarely, more than one shunt may be present. Shunts have been described associated with the phrenic vein, left colic vein or umbilical vein remnant. A full abdominal exploration is, therefore, strongly advised in every case. If no shunt can be found, intravenous mesenteric continued overleaf
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portovenography is recommended, as is a liver biopsy to rule out microvascular dysplasia (hypoplasia of the portal vein).

Finding the shunt (intrahepatic)
Intrahepatic shunts are very challenging to locate because they are usually completely surrounded by hepatic parenchyma. In a similar fashion to extraha-
epatic PSS, the hepatic and portal vein branches associated with the shunt may be identifiable as dilated vessels containing turbu-
ent blood flow.

To minimise extensive parenchymal dissection (which may cause profuse haemorrhage, particularly in patients that may have coagulation problems), surgeons have attempted to identify the shunts by palpating the aneurysms associated with them through the liver lobes (Breznock, 1983), per-
forming intraoperative ultra-
sonography (Wigley, 1983) or catherising the shunt via the portal vein (Tobias, 1996). Shunt location can be confirmed by digital occlusion of the vessel and observation of changes in portal pressure or visceral appearance.

Shunt occlusion (extrahepatic)
Once the shunt has been located, the authors place a Rummel tourniquet (Figure 2) to achieve complete occlusion of the shunt: central venous pressure should be limited to around 7mmHg, arterial blood pressure should be limited to changes of 5mmHg or less and the heart rate should not dra-
namically change. Changes in excess of this mean that complete ligation is not possible at this stage because the risk of portal hyperten-
sion is too great. Some sur-
geons also measure portal pressure via a jejunal venous catheter to assess for hyperten-
sion. Normal portal pressure is 6mmHg to 10mmHg and animals with PSS have pressure of 0mmHg to 8mmHg. Post-ligation pressure should be limited to between 12mmHg and 17mmHg, with a maximum change of 6mmHg to 7mmHg (Martin, 1987; Swalec, 1991; Tobias, 2003).

If gross clinical changes and pressure measurements are acceptable, the Rummel tour-

niquet can be removed and a figure placed (the authors use polypropylene) to achieve complete ligation of the shunt, but only 40 per cent to 68 per cent of dogs and cats can tolerate this (Swalec, 1991; Tobias, 2003).

Partial ligation is possible and this may be performed with suture, followed by complete occlusion at a subsequent laparot-
omy. In the authors’ experience, owners are often reluctant to proceed with a second proce-
dure and, for this reason, we recommend the use of ameroid constrictors or cellophane band-
ing where complete ligation is not possible. These techniques cause gradual occlusion and fewer post-
operative complications (Tobias, 2003), and reduce the need for sec-
ond surgery. A meroid con-
strictors are cased rings encased in stain-
less steel (Figure 4). The casing absorbs fluid from the body and swells inwards, compressing the shunt placed within the lumen over four to five weeks, although this can be highly variable (Vogt, 1996; Monnet, 2005). Rings are avail-
able in a variety of sizes and should be selected so that the ring fits snugly around the shunt, causing minimal occlusion when first placed. Ideally, dissection around the shunt should be kept to a minimum to reduce move-
ment of the heavy ring, which otherwise may cause kinking and, therefore, premature occlu-
sion of the shunt. For this reason, placement as close as possible to the vena cava is also advised.

Folded strips of cellophane bands are easy to place and gradual occlusion of the shunt over eight weeks by incl-
ing a fibrous reaction (Youmans, 1998). In the same manner as the ameroid constrictors, they should not cause any occlusion when first placed, and security of the band is achieved using vascular clips (Figures 5 and 6). Particularly large shunts may not occlude completely after cello-
phane banding.

Following shunt attenuation, a liver biopsy should be obtained to assess for other hepatic disease, such as copper storage disease.

Shunt occlusion (intrahepatic)
Complete ligation of intrahepatic shunts is only possible in 27 per cent of cases, but the shunts may also be occluded with cel-
lophane or ameroid constrictors. Because the shunts are often dif-
icult to locate and dissect, treat-
ment often consists of ligation of the portal vein or hepatic vein associated with the shunt. For intrahepatic shunts, the authors prefer to use transvenous coil embolisation, which has also been described for extraha-
epatic PSS (Leveille, 2003; Schneider, 2005; Bussadori, 2008).

For this technique, a guide wire, under fluoroscopic guid-
ance, is passed from the jugular vein, via the cranial vena cava and right atrium, into the caudal vena cava. A catheter is advanced over the guide wire (Figure 7) and contrast angiography is per-
formed to confirm the location of the shunt, using fluoroscopy...
and digital subtraction (Figure 8).

The diameter of the caudal vena cava is measured and an appropriately sized, encephalized, self-expanding nitinol stent (Figure 9) is advanced over the guidewire and deployed under fluoroscopic guidance so that it covers the entry point into the CVC - the left hepatic vein in this case (Figure 10).

Accurate placement is confirmed by repeat angiography, which is especially important because dilation of the CVC in the region of the shunt is not uncommon and may lead to incorrect stent positioning.

A cobra-tipped catheter is passed down the guidewire, through the interstices of the stent into the shunt, and is used to pass thrombogenic coils into it (Figure 11).

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The stent prevents migration of the coils into the CVC and the catheter tip also allows measurement of portal pressures. Coils are added until the portal pressures increase by 7mmHg to 14mmHg and, in the authors’ experience, three to five coils are required to achieve this.

Postoperative care

Following surgery, animals should be constantly monitored in the intensive care unit for at least 24 hours, recording demeanour, heart rate, pulse quality, respiratory rate, blood pressure and urinary output.

Postoperative complications include hypoglycaemia, prolonged anaesthetic recovery, haemorrhage (surgical or gastrointestinal haemorrhage), sepsis or portal hypertension, all of which are reported to be common in up to 75 per cent of cats (Kyles, 2002).

Signs of portal hypertension include gastrointestinal haemorrhage, abdominal pain and ascites, but this is uncommonly seen with techniques that cause glacial occlusion.

Other parameters measured at the authors’ institution include blood gas analysis, electrolytes and glucose, and appropriate treatment, such as potassium or glucose-splashed fluids, is provided as required and assessed frequently in the immediate postoperative period.

It is particularly important to assess pain levels closely because increased pain may be an indication of portal hypertension or pancreatitis. Patients recovering from PSS surgery are particularly challenging in this respect because they respond unpredictably to analgesics as a result of their slowed liver metabolism.

For this reason, full opioid analgesia - administered as required - may be more advisable than a static standard protocol of one dose every four hours. The development of hepatic encephalopathy may also be misinterpreted as dysphoria or pain, so careful monitoring by experienced personnel is essential.

Ideally, PSS patients should require no long-term medical management following successful surgical attenuation of the shunt. If animals are otherwise clinically well, they should be reviewed after one month to allow measurement of serum biochemical parameters (particularly bile acids) parameters. At this stage, antibiotics may be stopped if results are normal. After two months of satisfactory progression, lactulose may be titrated down and stopped.

After three to four months, the gradual introduction of a normal diet may be considered. It is important to perform dynamic bile acid assessment at this stage.

Mortality rates for patients treated surgically are illustrated in Table 1. Good-to-excellent outcomes can be expected in up to 94 per cent of dogs undergoing surgery for extrahepatic PSS, regardless of the method used. Where the shunt is intrahepatic, the same results may be expected for 70 to 89 per cent of dogs receiving amiodar constrictors, 76 to 100 per cent undergoing complete occlusion and 55 per cent undergoing cellophane band placement (Berent, 2009).

In cats, an excellent long-term outcome is less guaranteed, being seen in up to 75 per cent of cats undergoing ligation or amiodar constrictor placement, and 80 per cent receiving cellophane bands.

Acknowledgements

Ed Friend acknowledges the collaboration with Jackie Demetriou for the interventional radiology technique described here, and the mentorship of Allyson Berent, Chick Weisse and Jeff Solomon.

References and further reading


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**BEATING DEMONS, SAVING LIVES: PLEDGE DONATIONS TO THE VBF**

Rory O’Connor

Rory O’Connor has been the national coordinator of VSHSP for over two years. Rory has many years of experience as a mental health nurse, which offered him specialist training in treating addictions. He also has an MSc in addictions treatment and an MSc in veterinary science.

The VSHSP service users could be anyone, from young vets to long-established vets. Rory has helped with many vets resort to chemicals to cope with mental health problems. The service works to rebuild their confidence.

Rory has worked with many vets, who were often idealists, yet sometimes they became disheartened.

Rory encouraged vets to talk with peers and do a lot of research before offering help.

Rory is a long-distance runner and he plans to run next year’s London Marathon to raise money for VBF.

**What happens after treatment is complete?**

I maintain regular contact and, where necessary, we have some practices provide us with training experience to those who need to rebuild their confidence.

In the case of those with mental health difficulties, I work to ensure they are adequately supported and in touch with their local NHS mental health team.

“Everyone around the afflicted person is usually very supportive, but I also work with the practice if any feelings of hostility, anger or other strong emotions are present. In a small business, the practical fall-out needs careful management.”

Sometimes this is a by-product of the obsessive-compulsive traits engendered by the education and training process of medicine. Often there’s no malice.

We have to deliver that help to them – sometimes we have to keep pushing before they accept help.

Rory O’Connor

**JOEL DUDLEY**

Veterinary Times reporter

Joel Dudley talks to the national coordinator of the Veterinary Surgeons’ Health Support Programme about the life-changing effects its assistance can have on people. Joel Dudley is a long-distance runner and he plans to run next year’s London Marathon to raise money for VBF.

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Kelly graduated from the RVC in 1996 and worked in a mixed practice in Buckinghamshire for a year, before undertaking training positions at the RVC, University of Liverpool and University of Cambridge. He became a diplomate of the ECVS and a European specialist in small animal surgery in 2003. He joined the University of Bristol surgery department as a soft tissue surgeon in 2009 and enjoys ear, nose and throat surgery, thoracic surgery, trauma cases and wound management.

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