PANDORA’S BOX: POST-OPERATIVE ASSESSMENT FOR EHPSS
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Key Points:
• Postoperative assessment for patients treated for extrahepatic portosystemic shunts (EHPSS) has historically drawn from techniques used for primary diagnosis of EHPSS.
• The sensitivity and specificity of these assessment techniques are often imperfect, with surgical success (shunt closure) and clinical success (asymptomatic patients) not always overlapping.
• The appropriate treatment for patients with persistent shunting after EHPSS attenuation or closure is uncertain: monitoring/medical management vs. repeat surgery?

The diagnosis of EHPSS involves a series of diagnostic steps. Suspected cases of EHPSS are identified based on clinical signs, signalment, or abnormalities found (often incidentally) on laboratory work, stone analysis, or radiographs. The level of suspicion is raised when paired serum bile acid (pSBA), or fasting ammonia (AM) values are elevated in the absence of other evidence of hepatic disease or confounding variables. Macroscopic EHPSS is differentiated from microvascular dysplasia based on imaging (transcolonic or transsplenic scintigraphy, ultrasound, portal venography, MRI, or CT angiography), with or without additional laboratory testing (protein C activity). The presence of an EHPSS may then be confirmed at surgery, which remains the most commonly recommended treatment for dogs with uncomplicated EHPSS. The diagnostic value of each of these tests is documented, with the specific approach employed by each veterinarian and referral center based on test availability and personal preference.

A variety of surgical treatments have been employed for EHPSS, including complete and partial ligation, ameroid constrictor or cellophane band placement, and interventional techniques. The success of these treatments has been evaluated through various lenses, including resolution of clinical signs, survival, resolution of biochemical abnormalities, normalization of pSBA or AM levels, and normalization of diagnostic imaging (scintigraphy, portography, and ultrasound). Possible outcomes of patients that survive the perioperative period can include clinical and physical resolution of portosystemic shunting with a presumably normal life thereafter, clinical improvement without physical resolution of portosystemic shunting, or failure to achieve durable clinical improvement due to significant persistent shunting or development of multiple acquired shunts. The questions raised by this presentation are:

• What is the diagnostic value of commonly employed diagnostic tests in the postoperative assessment of EHPSS?
• What outcome measures are relevant to the well-being of the patient?
• What approach is most appropriate for the asymptomatic patient with persistent shunting?

Resolution of clinical signs is a commonly described means of evaluating response to surgery. When the wide spectrum of complaints that lead to the initial presentation of EHPSS patients is considered, it is not surprising that clinical signs alone are a relatively poor predictor of biochemical or physical resolution of portosystemic shunting. Worley et al. described that SBA evaluation was abnormal in 3 of 8 and AM values were abnormal in 2 of 5 asymptomatic dogs after PSS surgery. Another study found that 10 of 45 dos had clinical problems associated
with persistent shunting after PSS ligation, but other dogs with documented elevations in postoperative SBA or ammonia tolerance testing (ATT) remained asymptomatic. A third study found that ATT or SBA evaluation was abnormal in 14 of 88 animals treated with cellophane banding, but clinical signs resolved or improved in all cases. Our experience reflects these results. Conversely, 5/11 dogs with clinical signs suggestive of continued shunting did not have concurrent elevations in ammonia or abnormal transcolonic scintigraphy results.

Resolution of pSBA or ammonia abnormalities provides a more precise means of determining shunt closure. Though described as being nearly 100% sensitive for the preoperative diagnosis of EHPSS, elevated pSBA levels postoperatively do not necessarily reflect failure of the EHPSS to close. Landon et al. found that three of 10 dogs with normal transcolonic portal scintigraphy shunt indices had elevated postprandial serum bile acids. Another study found that none of the EHPSS cases treated showed complete normalization of SBA results postoperatively (though some were quite low). A variety of reasons for persistent elevations in ammonia or SBA exist, including persistent blood flow through the original shunt, development of multiple acquired shunts, concurrent microvascular dysplasia, or development of a second shunt vessel. The development of a second shunt vessel is poorly described, and is more likely to be related to failure to ligate or attenuate the original shunt vessel in a location that incorporates all of its portal tributaries. (unpublished data) SBA evaluation not only can’t distinguish between these outcomes, normal pSBA values can be measured despite evidence of persistent shunting based on CT angiography. (unpublished data)

Short of repeat laparotomy, advanced diagnostic imaging provides the most effective means of confirming physical closure of EHPSS. Abdominal ultrasound has user-dependent, variable sensitivity for the identification of EPHSS preoperatively, and its sensitivity for postoperative evaluation has not been fully evaluated. It is likely that it is easier to identify the site of vessel attenuation if a cellophane band or ameroid constrictor has been used than if suture ligation is performed, and that the hyperechoic appearance of the metallic components of the hemoclips generally used with cellophane bands and ameroid constrictors may make identification of the attenuated vessel easier than in its native form.

Splenoportography and mesenteric portography have been used extensively in EHPSS diagnosis and characterization. Due to the invasive nature of mesenteric portography and the diagnostic limitations of splenic portography, these diagnostics are being gradually replaced by less invasive scintigraphic procedures and three-dimensional imaging.

Transsplenic scintigraphy has been validated in the preoperative diagnosis of EHPSS, but has not been described as a postoperative outcome assessment tool. Transcolonic scintigraphy has been used as an assessment of postoperative outcome, but was not measured concurrently with SBA or ammonia, nor did it allow the identification of the source of continued shunting. Transsplenic and transcolonic scintigraphy have the advantages of being minimally invasive and very sensitive in the detection of portosystemic shunting. Transsplenic scintigraphy has the advantages of a more rapid scan, smaller radioisotope requirements, and the provision of potentially more morphologic information (though it is best used as a rule in/out diagnostic). Disadvantages of transsplenic scintigraphy are the injection of the radionuclide into the splenic/left gastric vein side of the portal vein tributaries. Different shunt morphologies or changes in shunt flow following attenuation of a splenic/left gastric shunt may result in unexpected underestimation of shunt fraction. The advantages of transsplenic scintigraphy vs. SBA evaluation in the postoperative monitoring of patients with EHPSS remain to be established.
Three-dimensional imaging such as MRI or CT angiography offers tremendous advantages in the pre and post-operative evaluation of patients with EHPSS. These imaging modalities provide excellent morphologic detail of portosystemic shunts, facilitating the appropriate placement of ligatures or attenuating devices. At our hospital, CT angiography has become a recommended preoperative diagnostic for this reason, particularly as the evaluation of postoperative CT angiograms has resulted in the identification of multiple cases in which vessel attenuation occurred, but portosystemic shunting continued through left gastric vein branches or other shunt tributaries that were not identified intraoperatively. Misplacement of the attenuating band was the principal cause of persistent shunting in twice as many cases as those for which the cellophane band failed to completely attenuate the vessel. (unpublished data) Three-dimensional imaging also allows assessment of portal development and hepatic enlargement in dogs after shunt attenuation. Liver size increases in dogs following EHPSS even if persistent shunting is present.9

A case may be made for follow-up following surgery for EHPSS to initially involve monitoring of pSBA or AM (or ATT) values, with more advanced diagnostics employed in cases with persistent clinical signs and elevated pSBA or AM values or (arguably) elevated pSBA or AM alone. As a secondary diagnostic, CT angiography is preferred at our hospital as it provides the clinician with rapid, minimally invasive, high-detail information about the nature of the persistent shunting. If the patient’s remaining symptoms or biochemical dysfunction is deemed severe and the cause of persistent shunting is incomplete closure or poor placement of the original shunt attenuation procedure, additional surgery may be pursued.

When contemplating follow-up assessment in dogs with EPHSS, the clinician is presented with the following questions: “How will the results of each test change my decision-making, if at all?” and “What constitutes an acceptable outcome?” Our experiences have highlighted themes that have long been present in the literature regarding EHPSS: that excellent clinical outcomes and biochemical or physical resolution of portosystemic shunting don’t always align. Increased use of more sophisticated follow-up diagnostics will continue to expose patients with persistent shunting that would not be suspected based on their clinical outcomes. When the cause of persistent shunting is surgically correctable in an improved, asymptomatic patient, should it be reoperated or monitored and managed medically? Further study of medical management and long-term effects of subclinical portosystemic shunting are needed to definitively answer this question.

References: