

Microvascular Dysplasia vs. Portosystemic Shunts

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Overview:

One of the more 'silent' issues in terriers is HMD (Hepatic Microvascular Dysplasia), also known as Microvascular Dysplasia (MVD). The more easily seen liver issue is Liver Shunt, or Portosystemic Shunt, sometimes seen in newborns who fail to thrive. This article provides background about why it is important to test, and exactly how to do it to obtain accurate results.

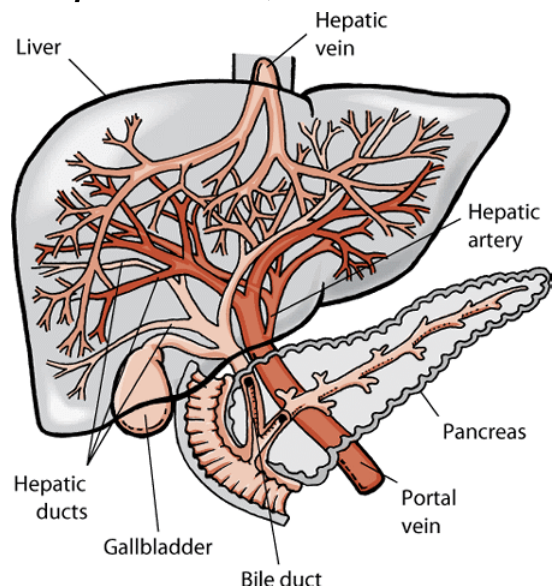
Nan Anderson (RIP) from Tenterra Cairns and Norfolk Terriers was the Norfolk Terrier Club's real expert in these syndromes. She was our mentor in teaching us the importance of knowing the quality of the livers in our breeding stock as well as in puppies sold as pets. She made sure that the leading US expert in the field, Dr. Sharon Center, came and spoke to the club at the Montgomery County National specialty years ago, and taught everyone she could about testing for this congenital issue. The information below is a simplified version of what she taught.

The liver performs an incredible number of functions to maintain health of animals, including filtering out toxins, storing sugar, and making proteins. According to the ACVS (American College of Veterinary Surgeons),

*"Most of the blood that is carried to the liver for these processes arrives via the portal vein, which drains the intestines, stomach, pancreas, and spleen. Within the liver, the portal vein branches into smaller and smaller vessels so that the blood can percolate throughout the tissues to each liver cell. When these microscopic vessels are abnormal on liver biopsy, the condition is called "hepatic microvascular dysplasia (HMD or MVD)" or "portal atresia". When the **microscopic vessels within the liver are underdeveloped or absent**, the liver becomes small ("atrophied") and the animal can no longer process toxins or make proteins necessary for growth and normal function."*

Microvascular Dysplasia can only be diagnosed with liver biopsy. However, Bile Acid testing gives a strong indication of the health of the liver, allowing us to rule in or out MVD.

Portosystemic Shunt (PSS), is an abnormal connection between the filtering system of the liver and the main circulatory system of the body. The shunt can be inside the liver or outside the liver. Most liver shunts are congenital in nature, though there are instances of acquired shunt if there is another problem with the liver. When a shunt is



present, the toxins and nutrients are dumped directly into the circulatory system, causing central nervous system issues (Hepatic Encephalopathy) as well as growth being stunted. Other clinical signs of PSS can be gastrointestinal issues, intolerance to drugs that require liver filtration, dementia (such as head pressing, abnormal vocalization, acting wobbly, as if drunk), aggression, lethargy, seizures, comas and small litter size. These signs of PSS often are seen to be most severe after ingestion of a high-protein meal.

Since around 20% of affected dogs show no clinical signs, (the rest show signs early in life, though they can also begin to show signs later in life as the liver weakens with age), it is recommended that we test all of our breeding stock prior to breeding, and all puppies before they leave for their new home. This give a baseline for the veterinarians who will be caring for our puppies in their new homes. Bile Acid testing is relatively inexpensive and only needs to be done once.

Microvascular Dysplasia

Most dogs with MVD are subclinical. Cases are often discovered upon routine screening for elective surgery with mild increase in hepatic enzyme concentrations. The majority of dogs do not need medical therapy and have a normal life expectancy. Testing on a cohort of Norfolk Terriers done in the 1990s found many to have MVD and were clinically normal. Therefore Bile Acid and Protein C testing need to be accurate to differentiate between PSS and MVD.

The testing needs to be very precise. Dr. Sharon Center has graciously allowed us to reprint her recommendations for this testing, which is below:

PSS should be expected with very elevated bile acids generally > 200 post prandially

MVD may have mild to moderate elevations of post prandial bile acids 35-60

Protein C is an anticoagulant protein that is synthesized in the liver. Protein C is significantly lower in dogs with congenital or acquired PSS and is normal in dogs with MVD. Therefore this test may help determine if further testing is needed to look for PSS. PSS is confirmed by Ultrasonography or CT. PSS is a condition which can be treated with surgical and medical therapy. MVD is subclinical and rarely needs treatment.

Bile Acid Testing: Optimal Conditions

1. For best test utility you need paired samples around a meal.
 - a. collect a sample of blood before the meal
 - b. collect a sample of blood 2-hrs after the meal
2. **It is NOT necessary to Fast a Dog 12-hours** before collecting pre-meal samples.
 - a. it is essential to collect **PAIRED** samples: one before and one 2hr after meal consumption
3. Blood collected into **lithium heparin vacutainers (green top) or Whole blood tubes (red top)**. It is important to treat blood gently as hemolysis (rupture of red blood cells releasing hemoglobin that colors plasma red) complicates test results. Red color competes with blue color in the assay that measures the concentration of bile acids. Lipemic blood (fatty blood) after the meal increases red blood cell fragility- and must be centrifuged out of the sample.
 - a. for tiny dogs: we collect blood into a syringe with a butterfly needle set up- or directly from jugular vein
 - b. remove the needle from the syringe and remove the top of your vacutainer tube
 - c. **gently** put the blood (roll down the side of the glass) into the vacutainer
 - d. replace the stopper on the vacutainer making sure it seals tightly
 - e. centrifuge the sample to separate plasma from red blood cells.
 - f. put plasma in a separate tube **BEFORE** mailing.
 - g. **DO NOT USE** separator tubes as these are inconsistent in their ability to keep red blood cells and plasma separate [which can cause] hemolysis which complicates assay result.
 - h. bile acids cannot be measured in EDTA blood, so **DO NOT** collect into purple top tubes
 - i. Volume of blood necessary for bile acid determination: at least %ml (0.5 ml) **of PLASMA**, that means 1 to 1.5 ml of blood.
4. Use the quantitative method of bile acid determination, rather than tests that signify values are "high" or above the normal range- ask your veterinarian what type of test they are using and specify you want quantification of the Bile acids uM/L.
5. **Disregard the normal fasting ranges provided by laboratories:** this value is NOT USEFUL and will only confuse you. Approximately 15% to 20% of dogs have fasting > post-prandial (after meal) bile acid values due to individual differences in the rate of stomach emptying and intestinal motility and food consumption.
DO NOT DO THIS TEST AFTER a couple of tablespoons of food- you need to stimulate stomach contraction and a meal is more reliable.
6. Based on extensive work in our laboratory with bile acids: dogs with plasma or serum bile acid concentrations > 25 uMol/L are ABNORMAL. It does not matter if this is FASTING or POSTPRANDIAL (2-hrs after a meal).
Some labs have determined what they believe are normal ranges, the > 25 umol/L value was determined using data derived from a spectrum of dogs with LIVER BIOPSIES which confirms presence or absence of liver disease (so we know who is abnormal and who is normal) rather than just a range of bile acid values from many animals where the status of the liver remains unknown.