Circulatory disturbances in the liver of dogs and cats

Definition: Circulatory disturbances in the liver are characterized by congenital or acquired alterations of blood flow or blood pressure. They result in a marked dysfunction of the liver causing vomitus and central nervous symptoms.

Types of circulatory disturbances in the canine liver are:
1. Congenital portosystemic shunt
   - intrahepatic shunt
   - extrahepatic shunt
2. Acquired portosystemic shunt
3. Hepatic microvascular dysplasia
4. Primary hypoplasia of the portal vein
5. Cardiac congestion of the liver

1) Congenital portosystemic shunt of the dog: The portosystemic shunt (PSS) connects the portal vein system directly with systemic venous circulation. PSS is designed as congenital if a single large vein is seen without portal hypertension. Intrahepatic and extrahepatic shunts can be divided.

   - Congenital intrahepatic portosystemic shunts are mainly shunts of the porto-caval system. Congenital PSS connects the left or the right branch of the V. portae directly or secondary by a liver vein with the V. cava caudalis. This type of PSS is predominantly seen in large breeds as St. Bernards or Retrievers.

   - Congenital extrahepatic porto-systemic shunts begin in the vein of the spleen (spleno-caval shunt) or in the right vein of the stomach (gastro-caval shunt) or from both vessels. They end at the abdominal or thoracic part of the V. cava caudalis. Extrahepatic PSS are most common in small breeds as Maltese, Schnauzer and Terrier.

2) Acquired portosystemic shunts develop within the liver due to marked remodeling processes as liver cirrhosis. However, in most cases extrahepatic shunts are caused by portal hypertension. Prehepatic portal hypertension can be induced by compression (neoplasm, cysts) or obstruction (thrombus, neoplasm) of the portal vein.

Pathogenesis of portosystemic shunts
Portosystemic shunts have the same or larger diameter as the caudal part of the portal vein behind the shunt. Due to this, the blood pressure is similar or lower and the blood is taking the direct way to the V. cava without circulating through hepatic sinusoids. This is resulting in malperfusion of the liver and causes underdevelopment and insufficiency of the liver.

Clinical symptoms in portosystemic shunts may be: retarded growth, vomitus, skin lesions, ataxia, convulsions, and coma.

Diagnosis of portosystemic shunt
Decreased detoxification activity of the liver results in chronic hyperammonaemia and decreased urea values in blood. Furthermore postprandial investigation of bile acids in blood plasma may help to diagnose PSS clinically. Atypical vessels can be demonstrated clearly by ultrasonography or angiography. Histopathological investigation of liver biopsies is useful for diagnosis as well as for detection of degree and chronicity of the alterations. Therapeutic success can be documented by comparative examination of biopsies pra- and post operationem.
Histopathological diagnosis of shunts is independent from the biopsy site within the liver.
Histopathological findings in portosystemic shunts are small portal tracts with hypoplastic or missing portal veins, arteriolar proliferation (A), lymphangiectasia and bile duct proliferation. Hepatocytes may be irregularly shaped or atrophic.

3) Hepatic microvascular dysplasia is a disease commonly seen in Cairn terriers. It is defined as a special type of congenital portosystemic shunt where the shunt vessel is not identified grossly.

4) Primary hypoplasia of the portal vein may affect the intrahepatic as well as the extrahepatic part of the portal vein. It is well described in dogs but is rare in cats. The diagnosis requires negative results of ultrasonography but typical histological findings.

5) Cardially induced congestion may be induced by left side heart failure (chronic mitral valve degeneration). Blood pressure is elevated in the central vein (CV) and typical centrolobular fibrosis and atrophy of hepatocytes develops. Clinically cardiac symptoms are dominant. However, liver biopsies may give information about cardially induced remodelling processes in the liver.

Types of circulatory disturbances in the feline liver are:
1. Congenital portosystemic shunt  
   - extrahepatic shunt  
   - intrahepatic shunt  
2. Acquired portosystemic shunt  
3. Peliosis hepatis

1) Congenital portosystemic shunts in cats are rare and show a high anatomical variety, which is not seen in dog. Intrahepatic porto-caval shunts in cats are very rare. The shunt vessel is often very thin because it is not always the continuation of the left or right branch of the V. portae. Anatomy of extrahepatic spleno-caval and spleno-azygos shunts in cats is similar to the findings in dogs: one single extrahepatic vein is building the shunt.

2) Acquired portosystemic shunts resulting from extrahepatic factors are caused by the same diseases as in dogs. Intrahepatic shunt in cats may develop during portal hypertension caused by liver fibrosis or liver cysts (idiopathic, PCKD).

3) Peliosis hepatis: Peliosis hepatis is characterized by small cystic blood-filled caverns. They are caused by local obstruction of small branches of the portal vein with subsequent atrophy of hepatocytes and dilation of sinusoids (syn. teleangiectasia). From the functional and clinical point of view this disease is not relevant.

Relevance of liver biopsies in the diagnosis of circulatory disturbances: The liver biopsy conduces to the diagnosis of circulatory disturbances in liver and their differentiation from other metabolic, inflammatory and neoplastic hepatopathies.