Assessment of Portal Venous System using Ultrasound
**Caption:** Portal vein, coloured ultrasound scan. The portal vein (red) transports nutrient-rich blood from the digestive organs to the liver. This scan shows the point at which the portal vein enters the liver and splits into two main branches. The cells of the liver remove digested fats, carbohydrates, vitamins and iron from the blood, for storage or distribution to the body's tissues. Ultrasound is a diagnostic technique that sends high-frequency sound waves into the body via a transducer. The returning echoes are recorded and used to build an image of an internal structure. Sonography of the portal vein may diagnose conditions such as thrombosis (blood clot).
The portal vein should have constant forward flow into the liver (hepatopetal).
If there is flow reversal, this is hepatofugal (tip: Fugitive = run away) and represents portal hypertension.

Because the hepatic veins drain into the IVC immediately prior to the right atrium, they have phasic flow reflective of cardiac motion.
Portal Flow Showing Continuous Flow

Hepatic Vein Showing Phasic Flow
PORTAL HYPERTENSION

- Is the increase in blood pressure in the Portal vein.
- The portal vein is formed from the junction of the Splenic vein and the Superior mesenteric vein and takes blood into the liver.
- Portal hypertension is usually secondary to chronic liver disease, often **alcoholic cirrhosis**.

Terms:
- **Hepatopetal** = into the liver.
- **Hepatofugal** = away from the liver.

*Remember:*
Fugal-Fugative = run away
Normal *Hepatopetal* flow.
PV=Portal Vein
SMV= Superior Vesenteric Vein
Spl V= Splenic Vein

*Hepatofugal.*
Reversed flow in the portal venous system.
The back pressure can result in splenomegally and abdominal varices.
The most common varices are:
Gastric/oesophageal
Recanalisation of the ligamentum teres and Umbilical vein.
Abdominal wall varices
Portal vein diameter:

Portal hypertension may only produce reversed flow during acute episodes. Therefore, the diameter of the portal vein should be measured. For consistency, measure at porta hepatis when the IVC is directly beneath. 13mm is the accepted upper limit of normal. An accurate measurement of greater than this warrants careful searching for:

- Varices
- Subtle re-canalization of the ligamentum teres
- Splenomegally
NORMAL
Going towards the liver

ABNORMAL
Going away from the liver
There is significant retrograde flow in the splenic vein.

The Superior mesenteric vein also shows a component of retrograde flow but less than the Splenic vein.
Recanalisation of the Ligamentum Teres:

Recanalisation, and dilatation of the Ligamentum Teres.
CT of Recanalized Umbilical Vein
Subsequent recanalisation and dilatation of the Umbilical vein may occur.

Lower Abdo wall varices from re-canalized umbilical vein.
CT of varices
Figure 3. Cirrhotic patient with peri-splenic and retroperitoneal collateral circulation (A), and umbilical vein recanalization (B). The spectral curve of the splenic artery (C) shows a low resistance pattern, with $RI = 0.53$ and $PI = 0.74$. 
Splenomegaly:

Resultant splenomegaly can be diagnosed if the spleen is greater than 14cm in length or has rounded, lobulated margins and is greater than 13cm.
CT of splenomegaly
Portal Vein Thrombus
CT of Portal Vein Thrombus
Partial Portal Vein Thrombus
CT of Portal Vein Thrombus and Tail Mass
Cavernous transformation of thrombosed portal vein
MICRONODULAR CIRRHOSIS:
Cirrhosis is the result of chronic liver disease. There is the development of fibrosis within the regenerating liver. On the surface this manifests as a nodular appearance. It also accounts for the heterogenous coarse parenchymal echogenicity. Micronodular is often referred to as 'Laenec's cirrhosis' after the person who coined the term 'cirrhosis'. Laenec's cirrhosis is often used to describe alcoholic cirrhosis. Importantly, micronodular cirrhosis DOES NOT have to be alcohol related.

MACRONODULAR CIRRHOSIS:
Is defined as surface nodules greater than 3mm in size. It is thought to generally be the progression from micronodular cirrhosis. All cirrhosis patients should have regular thorough investigations due to the increase risk of developing hepatocellular carcinoma.
CT of Hepatocellular carcinoma
Ultrasound of Hepatocellular Carcinoma
Ultrasound of Hepatocellular Carcinoma