Portal Vein Embolization in Patients with Resectable Hepatocellular Carcinoma

Essay

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at Radio Diagnosis

By

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Introduction

Hepatocellular carcinoma or hepatoma is the commonest primary malignant neoplasm of the liver. There are many predisposing factors, including direct carcinogens such chronic hepatitis and cirrhosis, post-necrotic cirrhosis and that associated with haemochromatosis, Aflatoxin. There is wide geographical variation in incidence, which largely parallels the prevalence of local predisposing conditions, in particular chronic hepatitis B and C. In western countries the incidence is relatively low but currently increasing as a result of chronic hepatitis C infections ***(Madoff et al., 2005).***

In patients with hepatocellular carcinoma under going surgical resection by lobectomy the remaining lobe usually is not sufficient to maintain the physiological requirements of the patients under going the surgery.

As the liver has the ability to regenerate, this phenomenon was first described in 1920 by Rous and Larimore after they ligated portal vein branches in rabbits and noted that the ligated (ipsilateral) lobe became atrophic and the non ligated (contralateral) lobe became hypertrophic. And so on portal vein embolization was developed.

Portal vein embolization (PVE) is gaining acceptance in the preoperative management of patients selected for major hepatic resection. PVE redirects portal blood flow to the intended liver remnant to induce hypertrophy of the non diseased portion of the liver and thereby reduce complications and shortens hospital stays after resection ***(Madoff et al., 2005).***

Aim of the Work

To high light importance and evaluate effect of preoperative portal vein embolizaion upon results of surgical resection in patients with resectable hepatocellular carcinoma.

Chapter (1)

Anatomy of Portal Vein

The portal venous system comprises all of the veins draining the abdominal part of digestive tract including the lower esophagus and from the spleen, pancreas, and gall bladder, but excluding the lower GIT anal canal ***(Gray H., 2004).***

Fig. (1): CT coronal reconstruction showing the main portal vein *(Gray, 2004).*

From these viscera the blood conveyed to the liver by the portal vein. in the liver this veins ramifies like an artery and ends in capillary – like vessels termed sinusoids, from which the blood conveyed to the inferior vena cava by the hepatic veins ***(Gray H., 2004).***

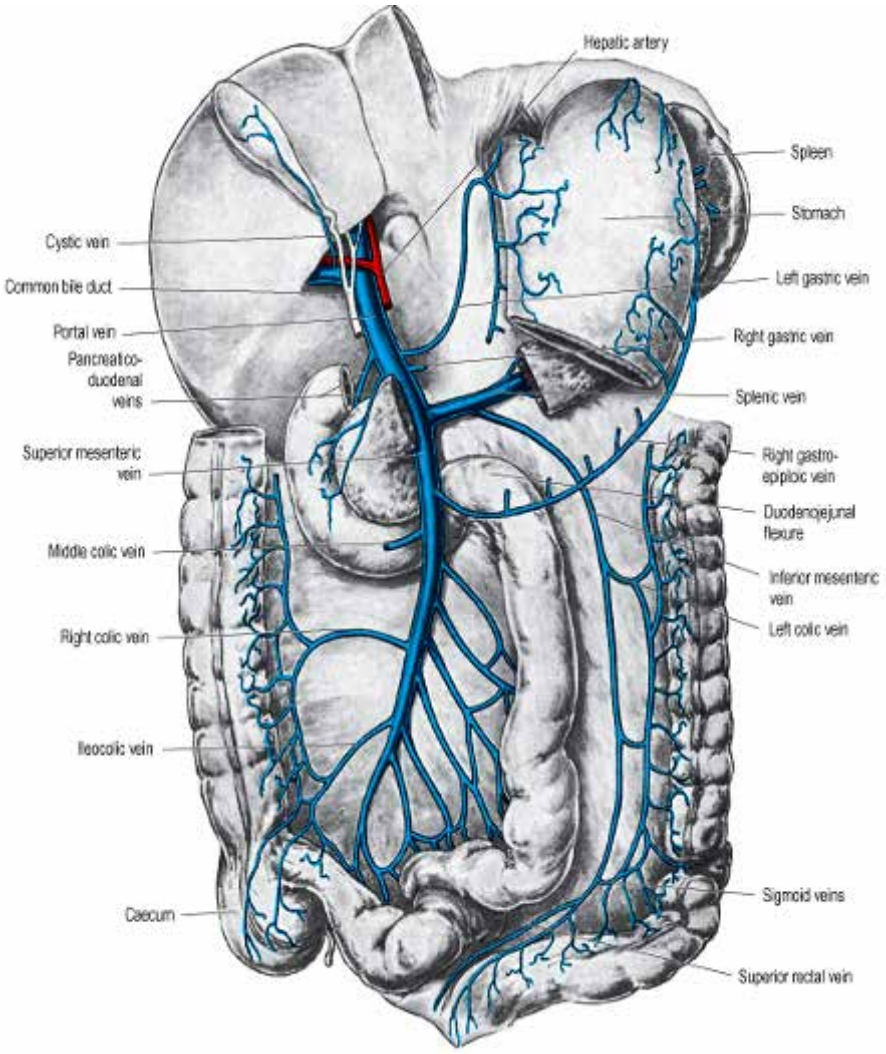

Fig. (2): Diagram illustrating union of SMV with Splenic vein forming main portal vein *(Gray, 2004)*.

From this it will seen that the blood of the portal system passes through two sets of minute vessels:

a) The capillaries of the digestive tube, spleen, pancreas, and gall bladder.

b) The sinusoids of the liver. ***(Gray, 2004)***.

The portal vein is about 8 cm in length, and is formed at the level of the second lumber vertebra by the junction of the superior mesenteric and lineal veins, the union of these veins takes place in front of the (IVC) and behind the neck of the pancreas. It passes upward behind the superior part of the duodenum and then ascends in the right border of the lesser omentum to the right extremity of the porta hepatis, where it divides into a right and a left branch which accompany corresponding branches of hepatic artery into the substance of the liver. In the lesser omentum, it is placed behind and between the common bile duct and hepatic artery, the former line to the right of the latter.

The portal vein is surrounded by hepatic plexus of nerves, and is accompanied by numerous lymphatic vessels and some lymph glands.

The right branch of the portal vein enters the right lobe of the liver, but before doing so generally receive the cystic vein. the left branch longer but of smaller caliber than the right, crosses the left sagittal fossa it is joint in front by a fibrous cord,

the ligamentum teres, and is united to the (IVC) by a second fibrous cord, the ligamentum venosum.

The main right and left portal veins are in the hilar fissure. The portal bifurcation may be extra hepatic, intra hepatic, or located right to the entrance of the liver. On the right, there are usually two sectoral portal branches (anterior and posterior), on the left there are two part of the main portal vein: the extra hepatic portion (the horizontal part), and the intra hepatic portion (the umbilical vertical part).

In general the sectoral branch divides into several segmental portal branches, which in turn supply the various segments. One segmental branch usually supplies segments II, VI, and VII and more rarely segments III segments IV, V and VIII are commonly supplied by more than one segmental branches, which further divide into small veins leading to the portal venule of the liver acinus ***(Madoff et al., 2003).***

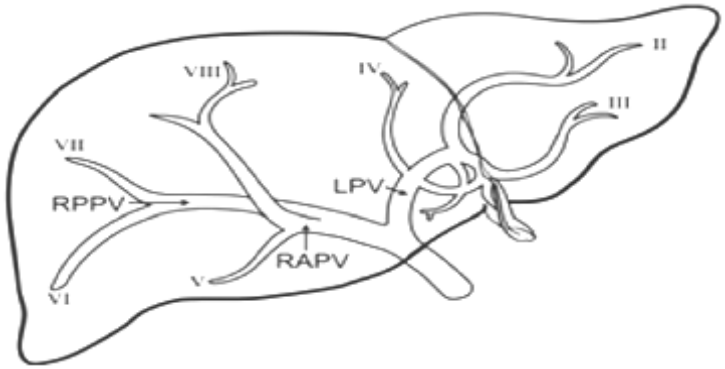

Fig. (3): Diagram illustrating the portal venous system *(Gray, 2004).*

The tributaries of portal vein are:

1. Lienal 4 pyloric.
2. Superior mesenteric 5 cystic.
3. Coronary (gastric) 6 paraumblical.

(Gray, 2004).

1- Lienal vein (splenic vein): it passes from left to right grooving the upper and back part of pancreas, below the lineal artery and ends behind the neck of pancreas by uniting at right angle with the superior mesenteric to form the portal vein. The lienal vein is of large size, but is not tortuous like the artery.

Tributaries:

- Short gastric veins.
- Left gastroepiploic vein.
- Pancreatic vein.
- Inferior mesenteric vein. ***(Gray H., 2004).***

2- Superior mesenteric vein: it begins in the right iliac fossa by the union of the veins which drain the terminal part of the ileum, the ceacum, and vermiform appendix, and ascend between the two layers of mesenteric artery. Behind the neck of pancreas it unites with the lienal vein to form the portal vein.

Tributaries: beside the tributaries which correspond with the branches of the superior mesenteric artery the intestinal, ileocolic, right colic, and middle colic veins, the superior mesenteric vein is joined by:

- Right gastroepiploic vein.
- Pancreaticodudenal veins.

3- Coronary vein (gastric vein): it derives tributaries from both surfaces of the stomach, it runs from right to left along the lesser curvature of the stomach, between the two layers of lesser omentum, to the esophageal opening of the stomach, where it receives some esophageal veins. It then turns backward and passes from left to right behind the omental bursa and ends in the portal vein ***(Gray, 2004).***

4- Pyloric vein: its of small size, and runs from left to right along the pyloric portion of the lesser curvature of the stomach, between the two layers of lesser omentum, to ends in the portal vein.

5- Cystic vein: it drains the blood from the gall bladder and accompanying the cystic duct, usually ends in the right branch of the portal vein.

6- Paraumblical veins: in the coarse of ligamentum teres of the liver and of the middle umbilical ligament, small veins (paraumblical) are found which establish an anastomosis between the veins of the anterior abdominal wall and the

portal, hypo gastric, iliac veins. The best marked of these veins is one which commences at the umbilicus and runs backward and upward in, or on the surface of ligamentum teres between the layers of the falciform ligament to end in the portal vein ***(Gray H., 2004).***

The landmarks that we use to describe the normal anatomy of the portal venous system at the liver are the main and right portal vein, the lateral segment and umbilical portion of the left portal vein, the ligamentum teres, the inferior vena cava, and the fossa for the gall bladder. The cantlie line is defined as a line passing through the gall bladder towards the inferior vena cava and corresponds to the median fissure. It serves as a boundary between the right and left lobes ***(Gallego et al., 2002).***

Conventional portal vein anatomy was accepted as the MPV bifurcating into the RPV and LPV, then the RPV divides into RAPV and RPPV. Any deviation from this pattern was regarded as variant anatomy ***(Atasoy, 2006).***

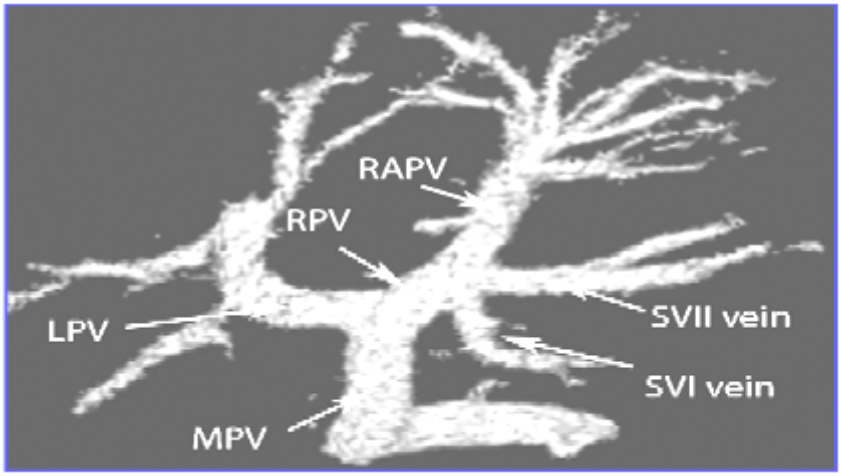

Fig. (4): Volume rendered picture illustrating the anatomy of trifurcation of portal vein, the MPV gives RPV and LPV the RPV divides into RAPV and RPPV *(Atasoy, 2006)*.

Branching Variants of the Portal Vein:

Variants in the normal branching pattern of the intrahepatic portal vein have been reported since 1957 and occur in approximately 20%. The most common patterns include trifurcation of the main portal vein (7.8%–10.8%), right posterior segmental branch arising from the main portal vein (4.7%–5.8%), and right anterior segmental branch arising from the left portal vein (2.9%– 4.3%).

A spectrum of branching variants of the portal vein associated with malposition of the gallbladder has been described in recent years. Findings comprise an abnormal course of the horizontal portion of the left portal vein and an

abnormal umbilical portion that is located above the gallbladder fossa. The gallbladder is deviated to the left and may lie to the left of or astride the ligamentum teres. The Cantlie line does not serve as a boundary between the right and left lobes in these cases.

The theory proposed to explain these findings is abnormal regression of the left umbilical vein with persistence of the right umbilical vein.

The persistent right umbilical vein would form a right umbilical portion of the left portal vein.

Since a whole spectrum of this variant has been reported, it has yet to be established whether all anomalous umbilical portions originate from a right umbilical vein. Knowledge of these variants is important because ligation of the left portal vein during liver resection or split liver transplantation in some of these cases may lead to necrosis of more than 80% of the liver... ***(Gallego et al., 2002).***

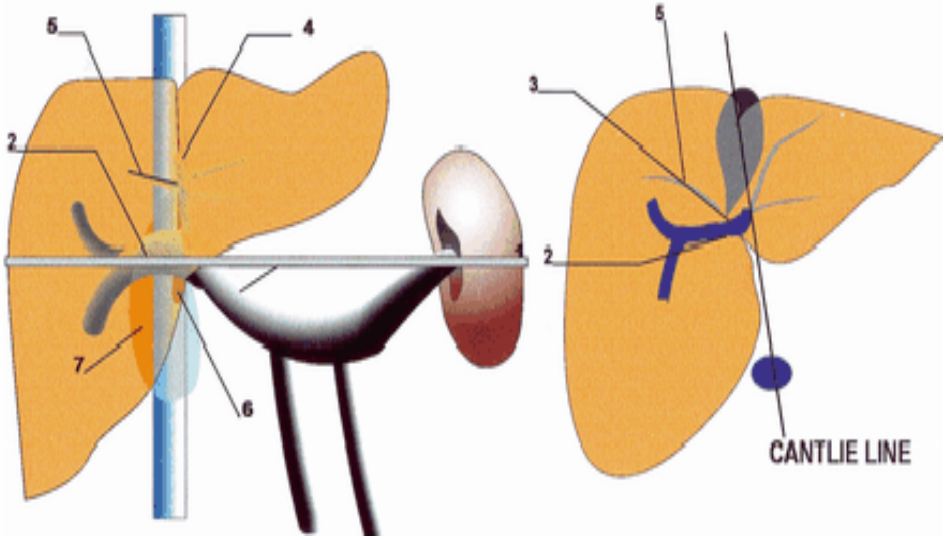

Fig. (5): Diagram illustrating portal vein anomalies associated with malposition of the gall bladder, coronal left and axial right diagram shows that the first branch to split is the RPPV, the main portal (1) courses superiorly giving the RAPV and a small ascending umbilical portion of LPV (4) The gall bladder (7) is located astride the umbilical ligament and does not serve as a boundary between the right and left lobes 2 = RPV, 3 = horizontal portion of the LPV, 5 = branch to segment IV, 6 = ligamentum teres ***(Gallego et al., 2002).***