

Study of the Anatomical variations of the liver in Human

Abstract

The liver is the largest abdominal organ. Variations of the liver can occur in the form of external morphology and the internal branching pattern of the hepatic vasculature. Knowledge about the normal and variant anatomy is essential for the interventional radiologist and the hepatobiliary surgeons for a better postoperative results.

Aim: To describe the anatomical variations of the hepatic artery and portal vein (PV) within the liver in terms of branching pattern and determine the frequency of each pattern.

Material and Methods: The morphological features were studied using 70 formalin fixed livers. The branching pattern of the hepatic vasculature was studied using 100 contrast enhanced computed tomography and 15 formalin fixed livers each for hepatic artery and PV using modified luminal casting technique.

Results: The morphological variations include fissures in the right, left, caudate and quadrate lobes of the liver (81.4 %), elongated left lobe or Beaver's lobe or Netter's type 4 (12.86 %), Netter type 2 liver (1.43%), pons hepatis (22.9 %), conical shaped right lobe (18.57%), notched border (10%) and accessory lobe (12.86%). Variations in caudate lobe including underdeveloped and hypertrophied caudate and papillary process were noted. Variations in the extra-hepatic branching of the vasculature was found in 22%. The most common variation was the replaced right hepatic artery (RHA), seen in 13%. The normal intra-hepatic branching pattern was observed in 53.33%. The RHA gave rise to cystic artery and artery to caudate lobe. In 6.6%, the

cystic artery arose from left hepatic artery and in 6.6%, the artery to caudate lobe arose from left hepatic artery. Caudate lobe also received dual supply from RHA. The right anterior division of RHA, in addition to its supply to segments V and VIII, it also supplied caudate lobe (20%), cystic artery (6.67%), segment IV (6.67%) and segment VI (6.67%). The right posterior division in addition to its supply to segments VI and VII, it also supplied gall bladder (6.67%), caudate lobe (6.67%), segment V (13.33%) and VIII (13.33%). Radiologically, the normal PV anatomy was seen in 89%. The most common variation was trifurcation of PV (5 %). In one case the left PV gave a branch to segment VII which has not been encountered earlier. Using the modified luminal casting technique all the 15 specimens displayed Type I PV anatomy. Variations were encountered in the intra-hepatic branching pattern and the most common variant pattern observed was the right posterior segmental division supplying segment VIII and only in one case a rare left PV variation, in which it gave branches to segments V and VIII was noted.

Conclusion: In this study, various morphological variations of liver were observed. Variations in the segmental supply was observed which has not been studied in detail previously in the Indian population. In both hepatic arterial and PV branching patterns, the variations on the left side are infrequent. A prior knowledge of such variations will help the interventional radiologist to reduce misinterpretations and subsequent misdiagnosis and guide the hepatobiliary surgeon in minimizing iatrogenic complications.