

Anatomy of Hepatic Resectional Surgery



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KEYWORDS

- Liver anatomy • Hepatic resections • Parenchymal-sparing resections
- Intraoperative management

KEY POINTS

- Liver anatomy can be variable, and understanding of anatomic variations is crucial to performing hepatic resections, particularly parenchymal-sparing resections.
- Anatomic knowledge is a critical prerequisite for effective hepatic resection with minimal blood loss, parenchymal preservation, and optimal oncologic outcome.
- Each anatomic resection has pitfalls, about which the operating surgeon should be aware and comfortable managing intraoperatively.

LIVER ANATOMY

Historical Definitions

Historically, the liver was described as having 2 anatomic lobes, the larger right lobe and the smaller left lobe. These lobes are separated on the anterior surface of the liver by the falciform ligament, and on the inferior surface by the ligamentum teres as it enters the umbilical fissure. The liver is invested by peritoneum except on its posterior surface, where the peritoneum reflects to create the right and left triangular ligaments. The area between the folds of peritoneum that create the triangular ligaments is devoid of peritoneum and is referred to as the bare area. The retrohepatic inferior vena cava (IVC) lies within this bare area on the undersurface of the liver. The gastrohepatic ligament attaches to the ligamentum venosum, which separates the historically defined right and left lobes of the liver on its posterior surface (**Fig. 1**). This common early definition of liver anatomy was based on external landmarks and has no real relationship to functional anatomy. In fact, the liver does not have reliable external landmarks for most current functional definitions.

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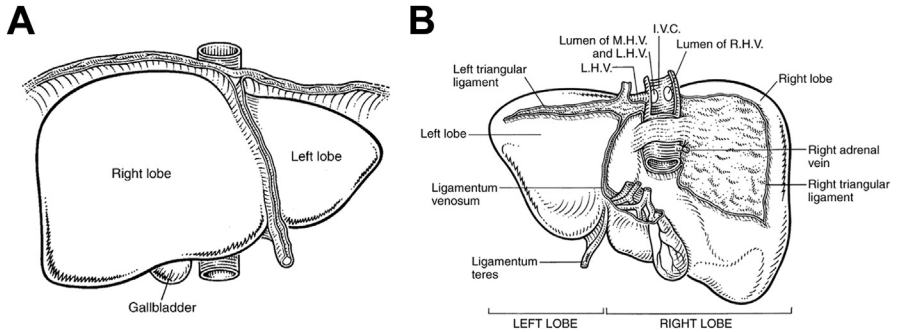


Fig. 1. The external anatomy of the liver as seen from the anterior (A) and posterior (B) surfaces. (From Blumgart LH, Hann LE. *Surgical and radiologic anatomy of the liver, biliary tract, and pancreas*. In: Jarnagin WR, Blumgart LH, eds. *Blumgart's surgery of the liver, biliary tract and pancreas*. 5th edition. Philadelphia: Elsevier; 2012; with permission.)

Vascular Anatomy

The hepatic veins drain the liver directly into the suprahepatic IVC. The larger right hepatic vein has a short 1 cm extrahepatic course, while the smaller middle and left hepatic veins usually join a common trunk 1 to 2 cm in length before entering the IVC separately from the right hepatic vein. Occasionally, the left and middle hepatic veins will drain separately into the IVC. The umbilical vein typically runs anterior to the umbilical fissure and most commonly drains into the left hepatic vein, but can join into the middle hepatic vein or join both the middle and left hepatic veins as a trifurcation. Although intrahepatic venous branching can be variable, there are common branches found in most cases. The right hepatic vein provides the dominant drainage of the posterior sector, and its branches typically drain from the right into the main trunk. The middle hepatic vein commonly drains a large right-sided branch which serves as the principal drainage of segment VIII. Segment IV typically derives its venous drainage from branches of the left hepatic and umbilical veins. There are variable and typically numerous retrohepatic venous branches that drain directly from the caudate lobe into the vena cava. Accessory hepatic veins are common and most frequently involve the right side of the liver as an inferior right hepatic vein draining directly into the vena cava independent of the right hepatic vein.

The hepatic artery and portal vein inflow to and biliary drainage of the liver have many anatomic variations. With conventional anatomy, the portal vein, common bile duct, and hepatic artery run in the porta hepatis. The portal vein sits posteriorly, while the bile duct runs anteriorly and to the right of the portal vein; the hepatic artery runs anteriorly and to the left of the portal vein.

The hepatic artery arises from the celiac axis and becomes the proper hepatic artery after giving off the gastroduodenal and right gastric arteries. It then branches into the right and left hepatic arteries. The left branch extends toward the base of the umbilical fissure and gives off branches to the caudate lobe and segments II-IV. Often the left hepatic artery branches into lateral and medial branches extrahepatically that feed segments II, II, and IV, respectively. The segment IV branch can also arise from the right hepatic artery and was historically referred to as the middle hepatic artery. The right hepatic artery usually passes posterior to the common hepatic duct, although it passes anteriorly in about 10% to 20% of cases. The right hepatic artery typically splits into an anterior and posterior branch, which can often be dissected in an extrahepatic location.

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