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ANATOMICAL FEATURES OF THE LIVER AND THEIR SURGICAL IMPORTANCE

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Abstract
The liver is the largest internal organ of the human body and plays a central role in metabolism, detoxification, bile production, and immune regulation. Understanding its detailed anatomy, including segmental structure, vascular architecture, and biliary pathways, is essential for modern hepatobiliary surgery. This article provides an overview of the macroscopic and microscopic anatomy of the liver and discusses its clinical and surgical significance in procedures such as hepatic resection, liver transplantation, and minimally invasive hepatobiliary interventions.

Keywords: Liver anatomy, hepatic segments, portal triad, hepatobiliary surgery, vascular anatomy.

Introduction

The liver is a vital organ located in the right upper quadrant of the abdomen, responsible for a wide range of physiological processes. Its complex architecture—divided into lobes, segments, and functional units—allows efficient blood filtration, metabolic regulation, and bile synthesis. Because of its unique dual blood supply and intricate biliary system, precise anatomical knowledge is crucial for surgeons to minimize complications during hepatic procedures.

The development of advanced surgical techniques, such as anatomic liver resection and laparoscopic hepatectomy, has further increased the importance of understanding liver anatomy in both clinical practice and medical education.

Gross Anatomy of the Liver

The liver occupies the right hypochondriac and epigastric regions and consists of two major surfaces: diaphragmatic and visceral.

Lobes

Traditionally, the liver is divided anatomically into **right**, **left**, **quadrate**, and **caudate** lobes. However, **Couinaud's classification** divides the organ into **eight functionally independent segments**, each with its own vascular inflow, outflow, and biliary drainage. This segmentation is the basis for modern hepatic surgery.

Ligaments

The liver is supported by several peritoneal folds:

- Falciform ligament
- Coronary and triangular ligaments

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- Hepatogastric and hepatoduodenal ligaments

The last structure (hepatoduodenal ligament) contains the **portal triad**.

Microscopic Anatomy

Hepatic tissue is composed of:

- **Hepatocytes** arranged in plates,
- **Sinusoids** lined with Kupffer cells,
- **Portal triads** (hepatic artery, portal vein, bile duct),
- **Central veins** forming the classic liver lobule.

The acinar model (Rappaport acinus) divides the microstructure into zones (1–3), important for understanding hypoxia, toxicity, and metabolic gradients.

Vascular Anatomy

A unique feature of the liver is its **dual blood supply**:

- **Portal vein** (≈70–75% of blood flow),
- **Hepatic artery** (≈25–30% of oxygenated blood).

The hepatic veins (right, middle, left) drain into the inferior vena cava and correspond to the functional segmentation of the liver.

Understanding vascular variations is critical during liver resection and transplantation, as up to **40% of individuals** have arterial or portal venous anatomical variations.

Biliary Anatomy

The biliary tree begins within hepatocytes and forms:

- Intrahepatic ducts,
- Right and left hepatic ducts,
- Common hepatic duct,
- Common bile duct.

Anatomic variations in the biliary system are common and may lead to complications during cholecystectomy, ERCP, or liver transplantation.

Clinical and Surgical Significance

1. Hepatic Resection

Segmental anatomy allows surgeons to remove only diseased segments while preserving healthy tissue.

Important surgical landmarks include:

- Cantlie's line,
- Hepatic veins,
- Segmental pedicles.

2. Liver Transplantation

Precise vascular and biliary anatomy is essential for graft preparation, anastomosis, and preventing postoperative ischemia or biliary leaks.

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3. Minimally Invasive Hepatobiliary Surgery

Laparoscopic and robotic approaches require detailed knowledge of segmental borders, vascular structures, and safe dissection zones.

4. Trauma Surgery

The liver is frequently injured due to its size and vascularity. Knowledge of segmental vasculature is essential for controlling hemorrhage.

Conclusion

The liver's complex anatomy, including its segmental arrangement, vascular dual supply, and biliary architecture, forms the foundation of modern hepatobiliary surgery. Detailed anatomical understanding reduces operative risks, increases surgical precision, and improves outcomes in hepatic resection, transplantation, and minimally invasive procedures. As surgical technologies evolve, comprehensive knowledge of liver anatomy remains essential for clinicians and medical students.

References

1. Couinaud, C. (1999). Liver anatomy: Portal (and suprahepatic) segmentation. World Journal of Surgery, 23(1), 71–75. https://doi.org/10.1007/PL00013159
2. Standring, S. (Ed.). (2020). Gray's Anatomy: The Anatomical Basis of Clinical Practice. 42nd ed. Elsevier.
3. Moore, K., Dalley, A., & Agur, A. (2018). Clinically Oriented Anatomy. 8th ed. Wolters Kluwer.
4. Nagino, M., et al. (2012). Anatomic basis of hepatic surgery. Annals of Surgery, 255(4), 708–718. https://doi.org/10.1097/SLA.0b013e31824b36c7
5. Clavien, P. A., et al. (2016). Liver surgery and transplantation: An overview. The Lancet, 387(10036), 1097–1107. https://doi.org/10.1016/S0140-6736(15)00322-2
6. Huang, T. L., et al. (2011). Biliary anatomy variations in hepatic surgery. Journal of Hepato-Biliary-Pancreatic Sciences, 18(3), 343–349. https://doi.org/10.1007/s00534-010-0339-7
7. Abdalla, E. K., et al. (2004). Vascular anatomy for hepatic surgery. Surgical Oncology Clinics of North America, 13(2), 247–268. https://doi.org/10.1016/j.soc.2003.11.004
8. Belghiti, J. (2000). Hepatic resection and vascular control. HPB Surgery, 2(2), 1–10.
9. Jarnagin, W. R. (2017). Blumgart's Surgery of the Liver, Biliary Tract and Pancreas. 6th ed. Elsevier.
10. Li, M., et al. (2020). Advances in laparoscopic liver surgery. Hepatobiliary Surgery and Nutrition, 9(5), 625–638. https://doi.org/10.21037/hbsn.2020.02.04.

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