



Liver Anatomy Quiz: Test Your Knowledge

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Abstract

Understanding liver anatomy and anatomic hilar vascular variants is important for the practicing surgeon. This knowledge is essential for cholecystectomy, hepatobiliary, pancreatic, and upper GI surgery. The attached quiz is intended to provide a liver anatomy teaching guide for surgical oncology, transplant, and HPB fellows; general surgery residents; and medical students, as well as a refresher for general and GI surgeons. It is hoped that dissemination will serve as a valuable teaching tool for surgeons at all levels of training.

Liver Anatomy Exam: 75 Questions, Multiple Choice/Matching

1. Liver segmental anatomy is named after which physician that defined the hepatic segments in the 1950s:

- A. Giulio Arantius
- B. J Cantlie
- C. Claude Couinaud
- D. Thomas Starzl
- E. Henri Bismuth

2. Current liver resection terminology was coined at which IHPBA meeting/consensus?

- A. 1998 Madrid
- B. 2000 Brisbane
- C. 2002 Tokyo
- D. 2004 Washington D.C.
- E. 2006 Edinburgh

3. The liver is divided into 2 lobes or hemi-livers.

- A. True
- B. False

4. A replaced right hepatic artery originates from which structure?

- A. Aorta
- B. Superior mesenteric artery
- C. Celiac axis
- D. Splenic artery
- E. Left gastric artery

5. A replaced left hepatic artery originates from which structure?

- A. Aorta
- B. Superior mesenteric artery
- C. Celiac axis
- D. Gastroduodenal artery
- E. Left gastric artery

6. Venous drainage of the hepatic segments is through which hepatic veins?

- A. Right, middle, left, and short hepatic veins
- B. Right, left, and center hepatic veins
- C. Right, left, and short hepatic veins
- D. Right, left, and long hepatic veins
- E. Right, middle, left, and long hepatic veins

7. The right lobe of the liver includes which segments?

- A. 2, 3, 4
- B. 1, 2, 3, 4
- C. 5, 6, 7, 8

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- D. 3, 4, 5, 6
E. 1, 2, 7, 8

8. The left lobe liver includes which segments?

- A. 2, 3, 4
B. 1, 2, 3, 4
C. 5, 6, 7, 8
D. 3, 4, 5, 6
E. 1, 2, 7, 8

9. Regarding segmental hepatic anatomy, which of the following is the most accurate statement?

- A. The right lobe is divided into medial and lateral segments.
B. The right lobe is divided into anterior and posterior segments.
C. The left lobe is divided into medial and lateral segments.
D. The left lobe is divided into anterior and posterior segments.
E. Both A and D are true.
F. Both B and C are true.

10. The venous drainage of the caudate lobe is into which structure?

- A. Left hepatic vein
B. Middle hepatic vein
C. Right hepatic vein
D. Inferior vena cava
E. Portal vein

11. For hepatic lobar anatomy, which of the following is correct?

- A. The falciform ligament separates the right and left lobes of the liver.
B. The plane from the gallbladder bed to the IVC (Cantlie's line) separates the right and left lobes.
C. The falciform ligament separates the left lateral and left medial segments.
D. Both A and B are correct.
E. Both B and C are correct.

12. The portal vein is formed from confluence of which veins?

- A. Splenic vein and inferior mesenteric vein
B. Splenic vein and superior mesenteric vein
C. Splenic vein and gastric vein
D. Superior mesenteric vein and inferior mesenteric vein
E. None of the above

13. With severe portal HTN, portal blood flow is often:

- A. Hepatofugal.
B. Hepatopetal.
C. Diverted through the coronary vein.
D. Both A and C are correct.
E. Both B and C are correct.

14. The left medial hepatic segment is also known as:

- A. Segment IV
B. Quadrate lobe
C. Caudate lobe
D. Both A and C
E. Both A and B

15. A replaced right hepatic artery typically courses:

- A. Posterior to the portal vein
B. Anterior to the portal vein
C. In the gastrohepatic ligament
D. Both A and C are correct
E. Both B and C are correct

16. Conventional or normal hepatic artery blood flow is which of the following:

- A. Aorta to celiac axis to hepatic artery proper to common hepatic artery to R/L hepatic arteries
B. Aorta to celiac axis to common hepatic artery to hepatic artery proper to R/L hepatic arteries
C. Aorta to common hepatic artery to celiac axis to hepatic artery proper to R/L hepatic arteries
D. None of the above

17. A central liver resection for gallbladder cancer typically involves removing all or a portion of which hepatic segments?

- A. 5 and 4B
B. 5 and 4A
C. 5 and 6
D. 5 and 8
E. 6 and 7

18. A right hepatic trisectionectomy (or trisegmentectomy) removes which segments?

- A. 1, 2, 3, 4, 5
B. 2, 3, 4, 5, 6
C. 2, 3, 4, 5, 8
D. 1, 5, 6, 7, 8
E. 4, 5, 6, 7, 8

19. A left hepatic trisectionectomy (or trisegmentectomy) removes which segments?

- A. 1, 2, 3, 4, 7
- B. 2, 3, 4, 5, 8
- C. 1, 2, 3, 4, 6, 7
- D. Both A and B are correct.
- E. Both B and C are correct.

20. The liver has how many segments?

- A. 5
- B. 6
- C. 7
- D. 8
- E. 10

21. Arantius' ligament is the:

- A. Ligamentum venosum
- B. Obliterated ductus venosus
- C. Obliterated hepatic vein
- D. Both A and B
- E. Both A and C

22. Aberrant biliary anatomy with the right anterior or posterior hepatic duct draining into left hepatic duct occurs what percent of time?

- A. 5%
- B. 10%
- C. 25%
- D. 60%
- E. 80%

23. The fissure of Gans:

- A. Is embryologically present 70% of time
- B. Contains the right posterior sectoral pedicle
- C. Is also referred to as Rouviere's sulcus
- D. All of the above
- E. None of the above

24. The right hepatic artery crosses:

- A. Posterior to the common hepatic duct 88% of time and anterior to common hepatic duct 12% of time
- B. Posterior to the common hepatic duct 12% of time and anterior to common hepatic duct 88% of time
- C. Posterior to the common hepatic duct 50% of the time
- D. Posterior to the common hepatic duct 100% of the time
- E. None of the above

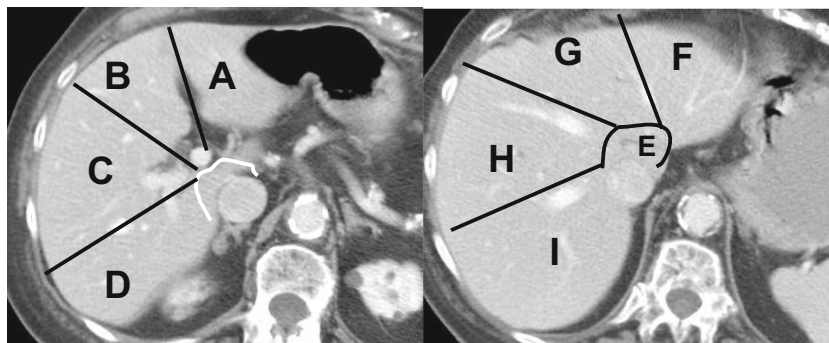
25. The left and middle hepatic veins form a common trunk before inserting into the supra-hepatic IVC in what % of time?

- A. 20%
- B. 40%
- C. 60%
- D. 80%
- E. 95%

26. The segment 4 portal vein branches originate from which vessel?

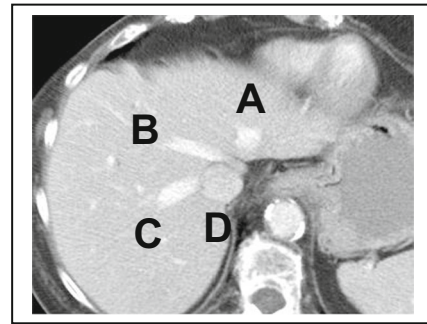
- A. Right PV
- B. Left PV
- C. Main PV
- D. Caudate vein
- E. None of the above

27–35. Match the hepatic segments on the CT scan images:



Segment

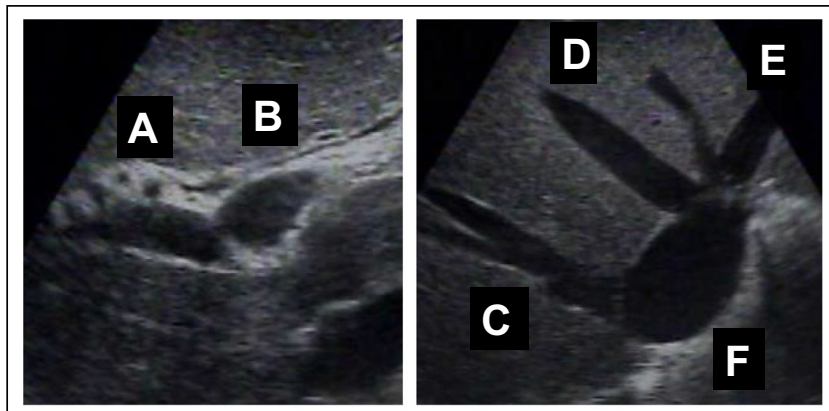
- 27. 1 _____
- 28. 2 _____
- 29. 3 _____
- 30. 4A _____
- 31. 4B _____
- 32. 5 _____
- 33. 6 _____
- 34. 7 _____
- 35. 8 _____



36–39. Match the hepatic structures on the CT image:

- 36. IVC _____
- 37. RHV _____
- 38. MHV _____
- 39. LHV _____

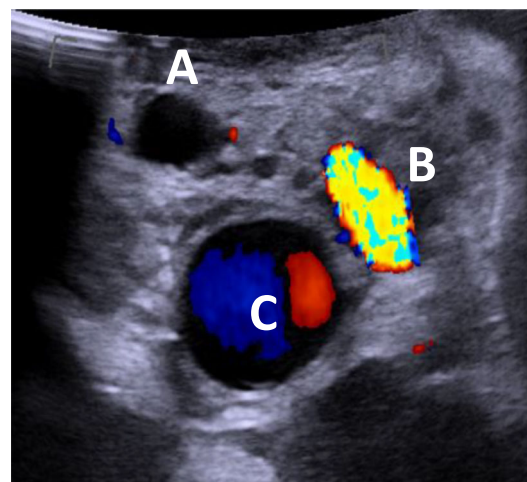
40–45. Match the hepatic structures on the US images:



- 40. LPV _____
- 41. RPV _____
- 42. IVC _____
- 43. RHV _____
- 44. MHV _____
- 45. LHV _____

46–48. Label the hilar structures on the ultrasound:

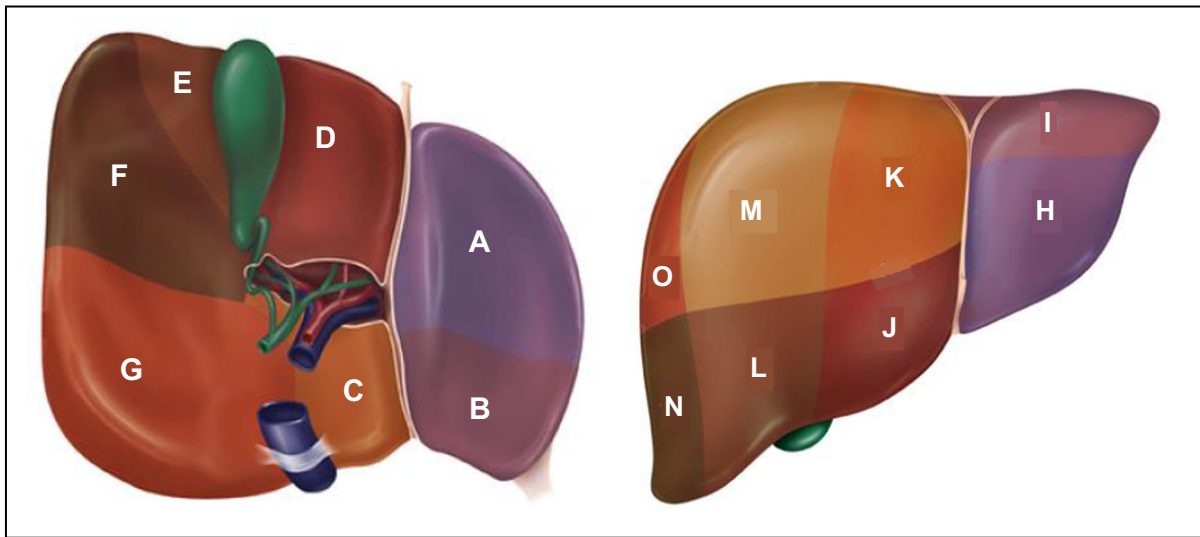
- 46. Common hepatic duct _____
- 47. HA _____
- 48. PV _____



49. In a healthy adult, what is the minimum percent of future liver remnant typically needed to allow for extended lobectomy or trisectionectomy?
- 90%
 - 70%
 - 50%
 - 25%
 - 10%
50. The hepatoduodenal ligament contains which structures?
- Portal vein
 - Hepatic artery
 - Common Bile duct
 - All of the above
 - A and B only
51. The space passing behind the hepatoduodenal ligament to enter the lesser sac is known as:
- Epiploic foramen
 - Duodenal tunnel
 - Foramen of Winslow
 - Both A and B
 - Both A and C
52. The round ligament is also known as:
- Ligamentum teres
 - Arantius ligament
 - Ductus venosum
 - Left triangular ligament
 - Falciform ligament
53. The cystic artery most commonly arises from the:
- Hepatic artery proper
 - Common hepatic artery
 - Right hepatic artery
 - Left hepatic artery
 - Gastroduodenal artery
54. Suspensory ligaments of the liver include:
- Falciform ligament
 - Left triangular ligament
 - Right triangular ligament
 - Round ligament
 - All of the above
55. The left lateral segment/section is made up of which hepatic segments?
- 1 and 2
 - 2 and 3
 - 3 and 4
 - 4 and 5
 - 5 and 8
56. When placing a hepatic artery infusion (HAI) pump, the tip of the catheter tubing should be in the:
- Right hepatic artery
 - Hepatic artery proper
 - Common hepatic artery
 - Gastroduodenal artery
 - Celiac axis
57. Surgical strategies to enhance operability of liver tumors include:
- Right portal vein embolization
 - ALPPS
 - Two-stage hepatectomy
 - Combining liver resection with ablation
 - All of the above
58. In Budd-Chiari syndrome:
- The portal veins are thrombosed.
 - The hepatic veins are thrombosed.
 - Ascites is rarely present.
 - A hypercoagulable work-up should be done.
 - Both B and D are correct.
59. When considering future liver remnant for hepatic trisectionectomy:
- 20–25% future liver remnant is usually adequate for normal liver.
 - > 30% future liver remnant is preferred in fatty liver.
 - > 40% future liver remnant is recommended for severe fibrosis or cirrhotic liver.
 - ICG clearance is helpful for cirrhotic livers.
 - All of the above.
60. Gilbert's disease:
- Is a hyperbilirubinemia with serum T bili usually > 5
 - Is a progressive disease that usually leads to liver failure
 - Requires treatment with plasmapheresis
 - Is an autosomal recessive disease with mildly elevated levels of unconjugated bilirubin and normally no serious consequences
 - All of the above

61–75. Match the letter to the correct liver segment: 1, 2, 3, 4A, 4B, 5, 6, 7, 8.

(A segment may be used more than once)



Segment #

61. A. _____
 62. B. _____
 63. C. _____
 64. D. _____
 65. E. _____
 66. F. _____
 67. G. _____
 68. H. _____
 69. I. _____
 70. J. _____
 71. K. _____
 72. L. _____
 73. M. _____
 74. N. _____
 75. O. _____

Answer Key: Liver Anatomy Exam (Correct Answers Are Highlighted) ¹⁻⁶

1. Liver segmental anatomy is named after which physician that defined the hepatic segments in the 1950s:

- A. Giulio Arantius
 B. J Cantlie
 C. **Claude Couinaud**
 D. Thomas Starz
 E. Henri Bismuth

Claude Couinaud published his classic description of liver anatomy in 1954 in the French literature. Couinaud C, Lobes de segments hepaticques: Notes sur l'architecture anatomique et

chirurgical de foie, *Presse Méd.* 1954; 62:709–715. Giulio Arantius was an Italian anatomist who made many contributions to human anatomy, fetal circulation, and science. James Cantlie was a Scottish surgeon who described the midline of the liver between the right and left lobes based on autopsy findings in 1887. This line passes from the gallbladder fossa down to the inferior vena cava. Thomas Starzl was a pioneer in the field of organ transplantation and performed the world's first liver transplant in 1963 in Denver, CO. Henri Bismuth is a French pioneer in hepatobiliary surgery and is credited with developing the split-liver technique for liver transplantation that allows two patients to be transplanted from only one liver donor.

2. Current liver resection terminology was coined at which IHPBA meeting/consensus?

- A. 1998 Madrid
 B. **2000 Brisbane**
 C. 2002 Tokyo
 D. 2004 Washington D.C.
 E. 2006 Edinburgh

Confusion existed in the literature regarding liver resection terminology. The Brisbane 2000 Nomenclature of Hepatic Anatomy and Resections was established to standardize liver resection terminology.

3. The liver is divided into 2 lobes or hemi-livers

- A. **True**
 B. False

4. A replaced right hepatic artery originates from which structure?

- A. Aorta
- B. **Superior mesenteric artery**
- C. Celiac axis
- D. Splenic artery
- E. Left gastric artery

5. A replaced left hepatic artery originates from which structure?

- A. Aorta
- B. Superior mesenteric artery
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- D. Gastroduodenal artery
- E. **Left gastric artery**

6. Venous drainage of the hepatic segments are through which hepatic veins;

- A. **Right, middle, left, and short hepatic veins**
- B. Right, left, and center hepatic veins
- C. Right, left, and short hepatic veins
- D. Right, left, and long hepatic veins.
- E. Right, middle, left, and long hepatic veins.

7. The right lobe of the liver includes which segments?

- A. 2, 3, 4
- B. 1, 2, 3, 4
- C. **5, 6, 7, 8**
- D. 3, 4, 5, 6
- E. 1, 2, 7, 8

8. The left lobe liver includes which segments?

- A. **2, 3, 4**
- B. 1, 2, 3, 4
- C. 5, 6, 7, 8
- D. 3,4,5,6
- E. 1,2,7,8

9. Regarding segmental hepatic anatomy, which of the following is the most accurate statement?

- A. The right lobe is divided into medial and lateral segments.
- B. The right lobe is divided into anterior and posterior segments.
- C. The left lobe is divided into medial and lateral segments.
- D. The left lobe is divided into anterior and posterior segments.
- E. Both A and D are true
- F. **Both B and C are true.**

10. The venous drainage of the caudate lobe is into which structure?

- A. Left hepatic vein
- B. Middle hepatic vein
- C. Right hepatic vein
- D. **Inferior vena cava**
- E. Portal vein

11. For hepatic lobar anatomy, which of the following is correct?

- A. The falciform ligament separates the right and left lobes of the liver.
- B. The plane from the gallbladder bed to the IVC (Cantlie's line) separates the right and left lobes.
- C. The falciform ligament separates the left lateral and left medial segments.
- D. Both A and B are correct.
- E. **Both B and C are correct.**

12. The portal vein is formed from confluence of which veins?

- A. Splenic vein and inferior mesenteric vein
- B. **Splenic vein and superior mesenteric vein**
- C. Splenic vein and gastric vein
- D. Superior mesenteric vein and inferior mesenteric vein
- E. None of the above

13. With severe portal HTN, portal blood flow is often:

- A. Hepatofugal.
- B. Hepatopetal.
- C. Diverted through the coronary vein.
- D. **Both A and C are correct.**
- E. Both B and C are correct.

Normal blood flow is from the portal vein through the liver (hepatopetal flow). In the setting of cirrhosis and portal hypertension, blood flow reverses away from the liver (hepatofugal flow) and often passes through the dilated coronary vein and/or re-canalized umbilical vein.

14. The left medial hepatic segment is also known as:

- A. Segment IV
- B. Quadrate lobe
- C. Caudate lobe
- D. Both A and C
- E. **Both A and B**

The left medial segment of the liver is also known as segment IV or the quadrate lobe of the liver. Hence, it has 3 names that refer to the same segment.

15. A replaced right hepatic artery typically courses;

- A. **Posterior to the portal vein**
- B. Anterior to the portal vein
- C. In the gastrohepatic ligament
- D. Both A and C are correct
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- D. None of the above

17. A central liver resection for gallbladder cancer typically involves removing all or a portion of which hepatic segments?

- A. **5 and 4B**
- B. 5 and 4A
- C. 5 and 6
- D. 5 and 8
- E. 6 and 7

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- A. 1, 2, 3, 4, 5
- B. 2, 3, 4, 5, 6
- C. 2, 3, 4, 5, 8
- D. 1, 5, 6, 7, 8
- E. **4, 5, 6, 7, 8**

19. A left hepatic trisectionectomy (or trisegmentectomy) removes which segments?

- A. 1, 2, 3, 4, 7
- B. **2, 3, 4, 5, 8**
- C. 1, 2, 3, 4, 6, 7
- D. Both A and B are correct
- E. Both B and C are correct.

20. The liver has how many segments?

- A. 5
- B. 6

- C. 7
- D. **8**
- E. 10

Liver segmental anatomy was described by Claude Couinaud in 1954.

21. Arantius' ligament is the:

- A. Ligamentum venosum
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- C. Obliterated hepatic vein
- D. **Both A and B**
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- E. None of the above

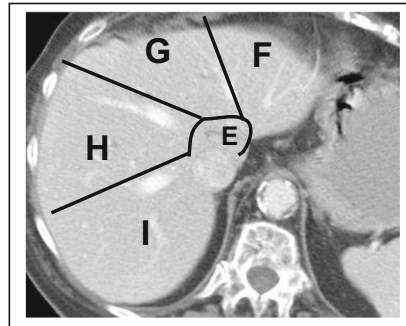
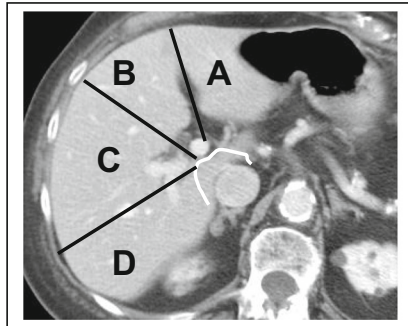
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- A. 20%
- B. 40%
- C. 60%
- D. 80%
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26. The segment 4 portal vein branches originate from which vessel?

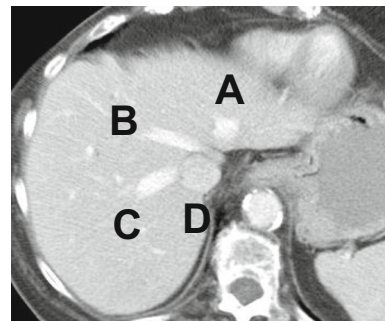
- A. Right PV
- B. **Left PV**
- C. Main PV
- D. Caudate vein
- E. None of the above

27–35. Match the hepatic segments on the CT scan images:



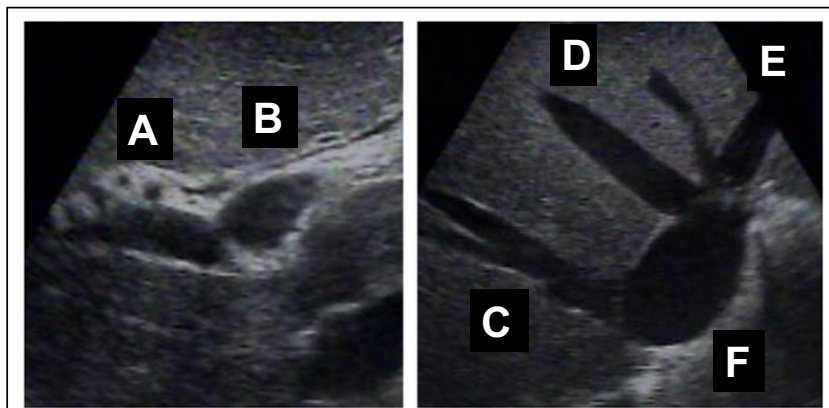
- Segment
- 27.1 E
 - 28.2 F
 - 29.3 A
 - 30.4A G
 - 31.4B B
 - 32. 5 C
 - 33. 6 D
 - 34. 7 I
 - 35. 8 H

36–39. Match the hepatic structures on the CT image:



- 36. IVC D
- 37. RHV C
- 38. MHV B
- 39. LHV A

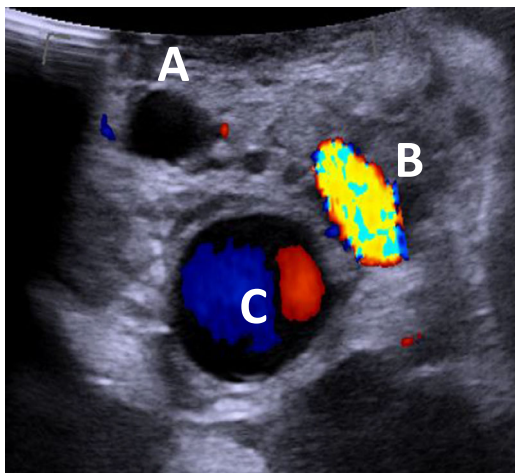
40–45. Match the hepatic structures on the US images:



40. LPV _____ **B** _____
 41. RPV _____ **A** _____
 42. IVC _____ **F** _____
 43. RHV _____ **C** _____
 44. MHV _____ **D** _____
 45. LHV _____ **E** _____

46–48. Label the hilar structures on the ultrasound:

46. Common hepatic duct _____ **A** _____
 47. HA _____ **B** _____
 48. PV _____ **C** _____



49. In a healthy adult, what is the minimum percent of future liver remnant typically needed to allow for extended lobectomy or trisectionectomy?

- A. 90%
 B. 70%
 C. 50%
 D. **25%**
 E. 10%

50. The hepatoduodenal ligament contains which structures?

- A. Portal vein
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51. The space passing behind the hepatoduodenal ligament to enter the lesser sac is known as:

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- C. Foramen of Winslow
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54. Suspensory ligaments of the liver include:

- A. Falciform ligament
 B. Left triangular ligament
 C. Right triangular ligament
 D. Round ligament
 E. **All of the above**

55. The left lateral segment/section is made up of which hepatic segments?

- A. 1 and 2
 B. **2 and 3**
 C. 3 and 4
 D. 4 and 5
 E. 5 and 8

56. When placing a hepatic artery infusion (HAI) pump, the tip of the catheter tubing should be in the:

- A. Right hepatic artery
 B. Hepatic artery proper
 C. Common hepatic artery
 D. **Gastroduodenal artery**
 E. Celiac axis

When placing a hepatic artery infusion (HAI) pump, the tip of the catheter tubing should be in the gastroduodenal artery just prior to the hepatic artery. The goal is to perfuse the entire liver via the hepatic artery proper and right/left hepatic artery branches. A 5-cm gastro-duodenal devascularization should be done to avoid mal-perfusion of chemotherapy to the duodenum which can lead to ulceration/bleeding.

57. Surgical strategies to enhance operability of liver tumors include:

- A. Right portal vein embolization
- B. ALPPS
- C. Two-stage hepatectomy
- D. Combining liver resection with ablation
- E. **All of the above**

58. In Budd-Chiari syndrome:

- A. The portal veins are thrombosed.
- B. The hepatic veins are thrombosed.
- C. Ascites is rarely present.
- D. A hypercoagulable work-up should be done.
- E. **Both B and D are correct.**

59. When considering future liver remnant for hepatic trisectionectomy:

- A. 20–25% future liver remnant is usually adequate for normal liver.

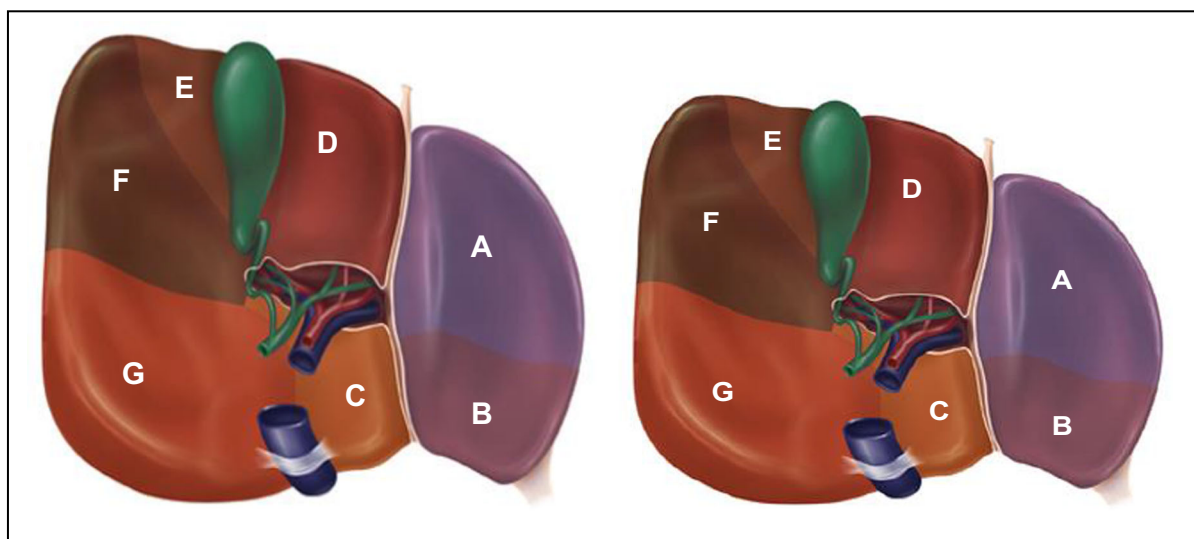
- B. >30% future liver remnant is preferred in fatty liver.
- C. >40% future liver remnant is recommended for severe fibrosis or cirrhotic liver.
- D. ICG clearance is helpful for cirrhotic livers.
- E. **All of the above.**

60. Gilbert’s disease:

- A. Is a hyperbilirubinemia with serum T bili usually > 5
- B. Is a progressive disease that usually leads to liver failure
- C. Requires treatment with plasmapheresis
- D. **Is an autosomal recessive disease with mildly elevated levels of unconjugated bilirubin and normally no serious consequences**
- E. All of the above

61–75. Match the letter to the correct liver segment: 1, 2, 3, 4A, 4B, 5, 6, 7, 8.

(A segment may be used more than once)



- Segment #
- 61. A. 3
 - 62. B. 2
 - 63. C. 1
 - 64. D. 4B
 - 65. E. 5
 - 66. F. 6
 - 67. G. 7
 - 68. H. 3
 - 69. I. 2
 - 70. J. 4B

- 71. K. 4A
- 72. L. 5
- 73. M. 8
- 74. N. 6
- 75. O. 7

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