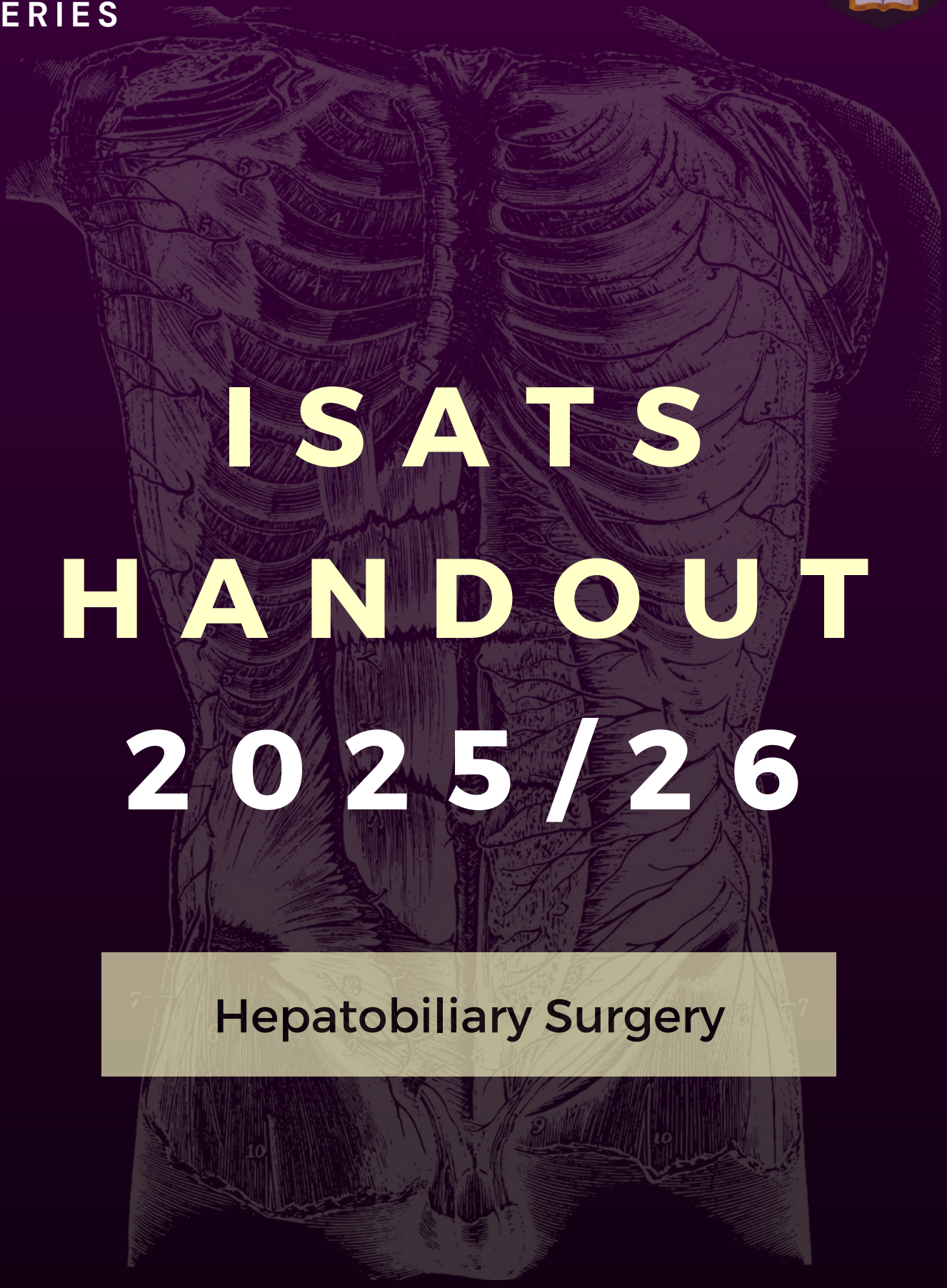
INTERNATIONAL SURGICAL ANATOMY TEACHING SERIES



ISATS HANDOUT 2025/26

Hepatobiliary Surgery

High Yield | Surgical Relevance | Approved for CPD Hours

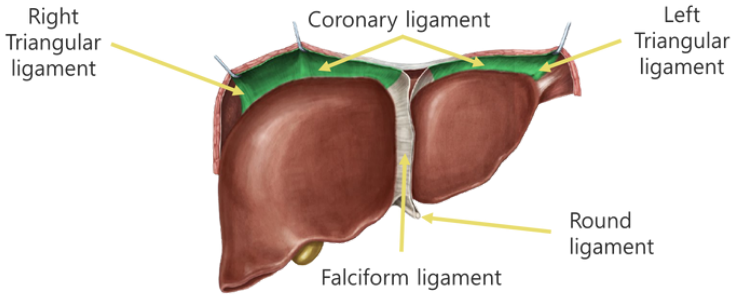
HEPATOBILIARY ANATOMY

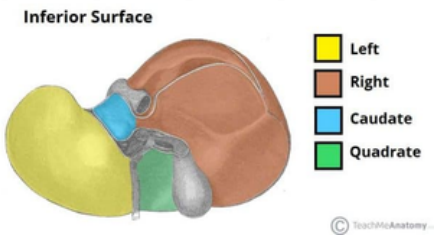
***Objectives**: Understand the anatomy of the liver and the respective neurovascular supply.*

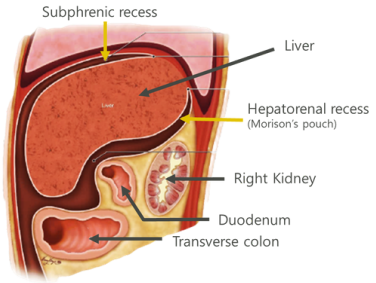
The Liver

Surfaces

- **Diaphragmatic** *(anterior, superior)*
  - Smooth, domed
  - Lies against the inferior diaphragm
  - Covered with visceral peritoneum (Glisson's capsule)
- **Visceral** *(posterior, inferior)*
  - Covered with visceral peritoneum
    - Except gallbladder fossa, porta hepatis
  - Related structures:
    - Gallbladder
    - Oesophagus
    - Right Kidney & Adrenal Gland







Lobes

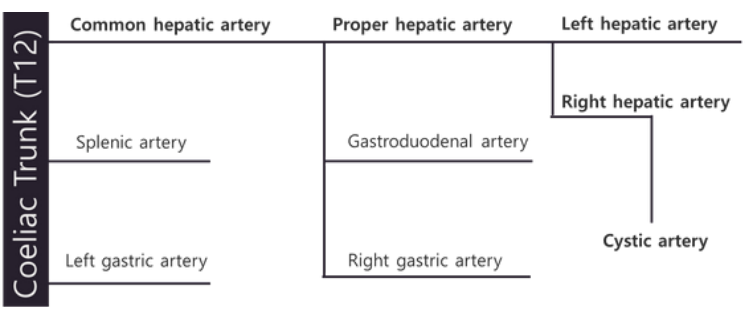
- **Right** and **Left lobe** separated superficially by the falciform ligament
- **Quadrate** and **caudate** lobes: functionally distinct lobes located on the visceral surface of the right lobe

Segments (Couinaud Classification)

- Divides the liver into **8 functionally independent segments**
- Each segment has its own vascular inflow, outflow, and biliary drainage
- **Clinical importance:** liver resection

Ligaments

- **Falciform ligament** → Abdominal wall
- **Coronary ligament** → Diaphragm
- **Triangular ligament** → Diaphragm
- **Hepatogastric ligament** → Stomach
- **Hepatodudenal ligament** → Duodenum



Hepatic Recesses

- **Subphrenic recess**
  - Separates the diaphragmatic liver surface from the diaphragm
- **Hepatorenal recess**
  - Separates the visceral liver surface from the kidney

NEUROVASCULAR SUPPLY

Arterial Supply (+ portal vein!)

- Branches from the **Coeliac trunk** (T12)
- Right hepatic artery (hepatic artery proper)
- Left hepatic artery (hepatic artery proper)

Venous Drainage

- Hepatic veins -> Inferior vena cava

Innervation

- Hepatic plexus
- Sympathetic: coeliac plexus
- Parasympathetic: vagus nerve
- Glisson's capsule: lower intercostal n. branches

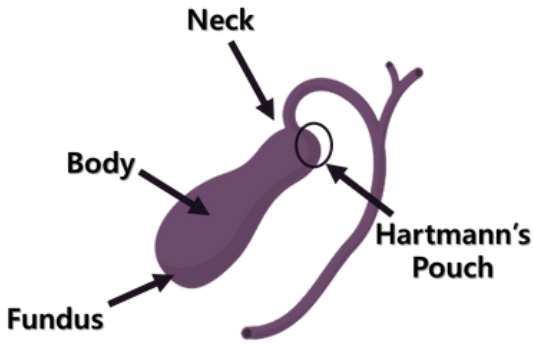
HEPATOBILIARY ANATOMY

***Objectives**: Understand the anatomy of the liver, gallbladder, biliary tree, pancreas and their respective neurovascular supply. Apply anatomical knowledge in context of laparoscopic cholecystectomy*

The Gallbladder

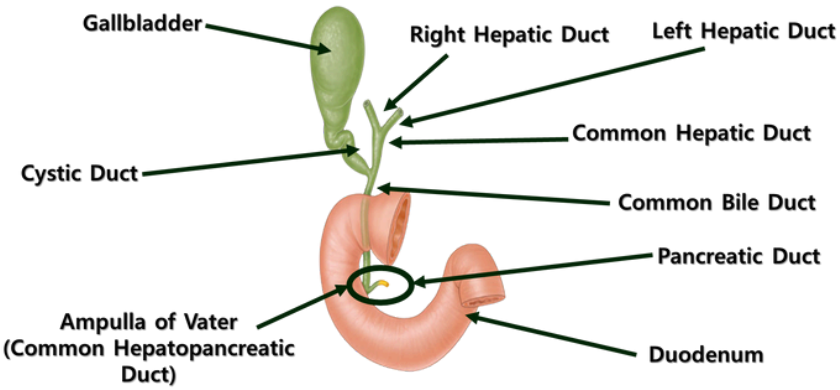
Structure

- **Fundus:** Projecting from the inferior liver border
- **Body:** Located in the gallbladder fossa
- **Neck:** Mucosal folds forming spiral fold
  - **Hartmann's Pouch** - gallstones likely to get stuck here

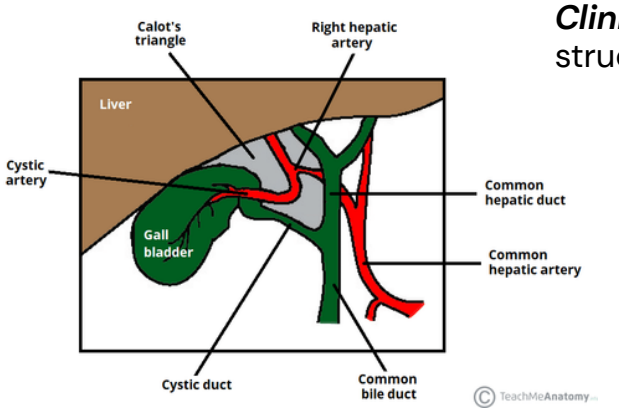


The Biliary Tree

- Duct system that connects **liver** (bile synthesis) to **gallbladder** (bile storage) and **pancreas** (digestive enzymes)
- Allows mixture of bile and pancreatic secretion into **duodenum**



Calot's Triangle



- Borders:
  - Medial - **Common Hepatic Duct**
  - Inferior - **Cystic Duct**
  - Superior - **Inferior surface of Liver**
- Contents:
  - **Right Hepatic Artery**
  - **Cystic Artery**
  - **Lymph Node of Lund**

Clinical Relevance: resection & identification of structures during laparoscopic cholecystectomy

NEUROVASCULAR SUPPLY

Arterial Supply

- Branches from the **Celiac trunk** (T12)
- Cystic artery (typically right hepatic a.)

Venous Drainage

- Neck: Cystic vein -> portal vein
- Fundus & body: hepatic sinusoids

Innervation

- Hepatic plexus
- Sympathetic & sensory: coeliac plexus
- Parasympathetic: vagus n.

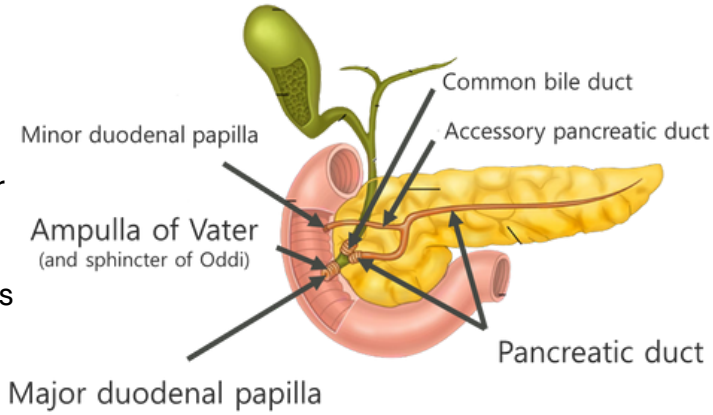
HEPATOBILIARY ANATOMY

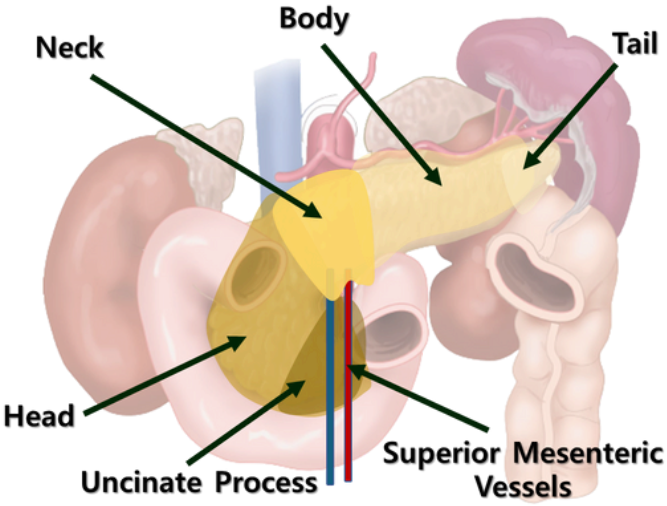
Objectives: *Understand the anatomy of the liver, gallbladder, biliary tree, pancreas and their respective neurovascular supply. Apply anatomical knowledge in context of laparoscopic cholecystectomy*

The Pancreas

Structure

- **Head:** Projecting from the inferior liver border
- **Uncinate process:** projects from lower head, **posterior** to superior mesenteric vessels
- **Neck:** **anterior** to superior mesenteric vessels
- **Body:** elongated, joins neck and tail
- **Tail:** not retroperitoneal





- **Ampulla of Vater** = joint common bile and pancreatic duct
- **Sphincter of Oddi** = muscle that opens and closes the Ampulla of Vater
- **Major duodenal papilla** = part of the duodenum where the ampulla of Vater joins

NEUROVASCULAR SUPPLY

Arterial Supply

- Head and neck:
  - Superior pancreaticoduodenal branches
  - Inferior pancreaticoduodenal branches
- Body and tail:
  - Dorsal pancreatic artery (splenic a.)
  - Greater pancreatic artery (splenic a.)

Innervation

- Celiac ganglia
- Sympathetic: T6-T12
- Parasympathetic: vagus n.

Lymphatic Drainage

- Coeliac, superior mesenteric, and splenic nodes
- Drain into paraaortic lymph nodes

Venous Drainage

- Head and neck: pancreatic veins -> superior mesenteric v. -> **portal vein**
- Body and tail: pancreatic veins -> splenic v. -> **portal vein**

HEPATOBILIARY ANATOMY

Test yourself

1) Label the structures of the biliary tract

A)

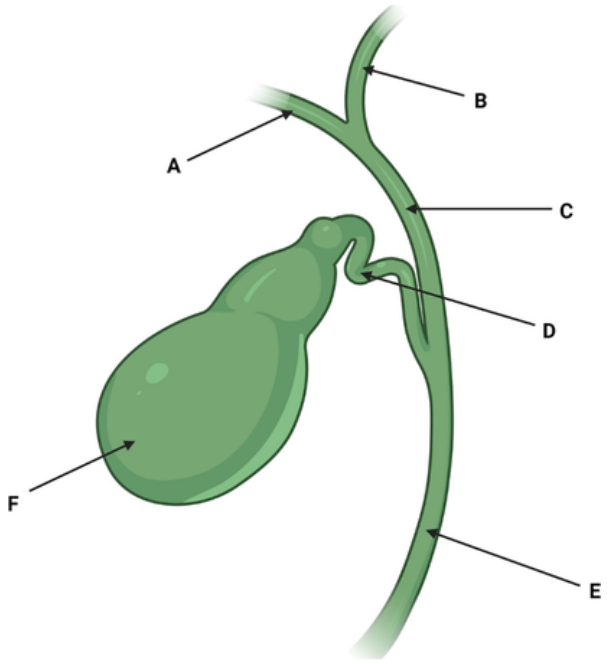
B)

C)

D)

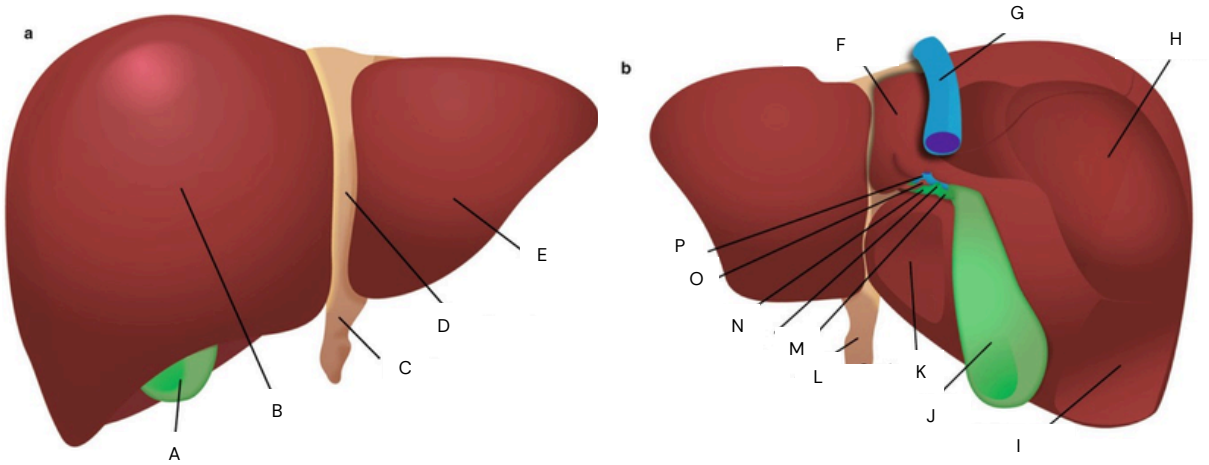
E)

F)



2) Label the diagram

A)
B)
C)
D)
E)
F)
G)
H)
I)
J)
K)
L)
M)
N)
O)
P)



HEPATOBILIARY ANATOMY

Test yourself

MCQ 1

Calot's triangle is an important surgical landmark during cholecystectomy. Which structure forms its inferior border?

A. Cystic artery
B. Common hepatic duct
C. Cystic duct
D. Right hepatic artery
E. Portal vein

MCQ 2

During cholecystectomy, the cystic artery is usually ligated. It most commonly arises from which vessel?

A. Left hepatic artery
B. Right hepatic artery
C. Gastroduodenal artery
D. Common hepatic artery
E. Superior mesenteric artery

MCQ 3

A liver surgeon resects a hepatocellular carcinoma involving segment VIII. Which major hepatic vein lies closest to this segment and is at greatest risk?

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

MCQ 4

A patient has biliary colic and an ultrasound shows Mirizzi syndrome, where a stone compresses the common hepatic duct. Which structure is usually responsible for this compression?

A. Cystic duct
B. Spiral valve of Heister
C. Hartmann's pouch
D. Common bile duct
E. Left hepatic duct

MCQ 5

During ERCP, a stricture is seen in the mid–common bile duct. Which nearby artery crosses posterior to the duct and may be relevant in surgical repair?

A. Splenic artery
B. Gastroduodenal artery
C. Right hepatic artery
D. Left hepatic artery
E. Inferior pancreaticoduodenal artery

MCQ 6

A patient with a high common bile duct injury post-cholecystectomy needs a Roux-en-Y hepaticojejunostomy. Which duct will the surgeon anastomose to the jejunum?

A. Cystic duct
B. Right hepatic duct
C. Left hepatic duct
D. Common hepatic duct remnant
E. Accessory right hepatic duct

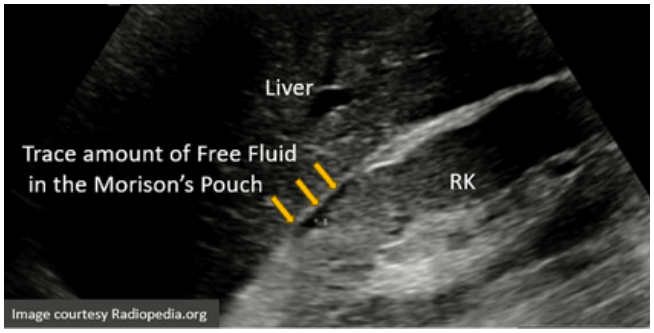
HEPATOBILIARY ANATOMY

Test yourself

OSCE Station - Case Based Discussion

You are an FY2 in HPB surgery and are called to assess a 54-year-old woman with sudden onset severe right upper quadrant pain, shoulder tip pain, and hypotension. She has a background of long-standing oral contraceptive use and known hepatic adenoma >5cm, which was being monitored.

On arrival, she looks pale, sweaty, and tachycardic (HR 128). BP is 82/50, RR 24, saturations 97% on air.



RK = Right kidney

Her abdomen is distended with marked RUQ tenderness and guarding. FAST scan shows free fluid in Morrison's pouch and perihepatic region. CT abdomen shows a ruptured hepatic adenoma in segment VII/VIII, with ongoing intraperitoneal bleeding.

Q1. What is the immediate management of this patient?

Q2. Why is this situation life-threatening? Explain using liver anatomy.

Q3. What are the immediate management options to control the bleeding?

Q4. What bloods would you arrange?

Q5. What risk factors explain why this patient's hepatic adenoma ruptured?

Q6. Following stabilisation, what definitive management might be required?

Q7. What long-term complications should this patient be counselled about? pancreas?

Answers
Labels 1: A = R. hepatic duct, B = L. hepatic duct, C = common hepatic duct, D = cystic duct, R = common bile duct, F = gallbladder
Labels 2: A = gallbladder, B = R. lobe, C = round ligament, D = falciform ligament, E = L. lobe, F = Caudate lobe, G = IVC, H = renal impression, I = colic impression, J = gallbladder, K = Quadrate lobe, L = round ligament, M = cystic duct, N = hepatic duct, O = Hepatic artery, P = Portal vein
MCQs: 1 = C, 2 = B, 3 = C, 4 = C, 5 = B, 6 = D
OSCEs:
1) ABCDE, activate major haemorrhage protocol, fluid resuscitation and early blood products, urgent cross-match, keep NPO and O2 as needed, discuss urgent with HPB consultant/IR
2) The liver is highly vascular which recieves 25% of the cardiac output. It has dual supply from the portal vein and hepatic artery. Segments VII/VIII lie near the major hepatic vessels and can rupture which can lead to massive bleeding into the perihepatic spaces including Morrison's and right subphrenic space. Bleeding into the peritoneal space can quickly cause shock. Adenomas are prone to rupture because they conatin abnormal arteries, and thin-walled sinusoids.
3) IR (first-line), hepatic artery embollisation of bleeding branches. If unstable or IR unavailable, emgerency laparotomy with ligation of bleeding vessels.
4) Bloods - FBC, U&E, LFT, Iron Profile, Coagulation profile, AFP, Amylase
5) Long-term oestrogen exposure (OCP), large adenoma (>5cm)
6) Elective liver resection of the adenoma, discontinuation of oestrogen-containing medications, serial imaging
7) re-bleeding from tumour, development of hepatocellular carcinoma.