

INTERNATIONAL SURGICAL  
ANATOMY TEACHING  
SERIES



# ISATS HANDOUT 2023/24

Hepatobiliary Surgery

# HEPATOBILIARY ANATOMY

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

## 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 anterior stomach

### Lobes

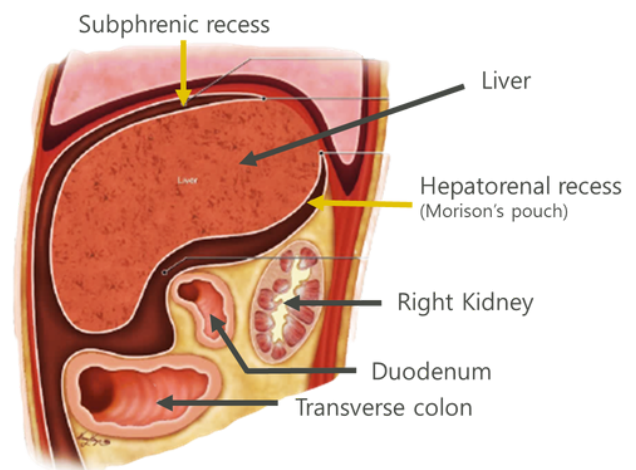
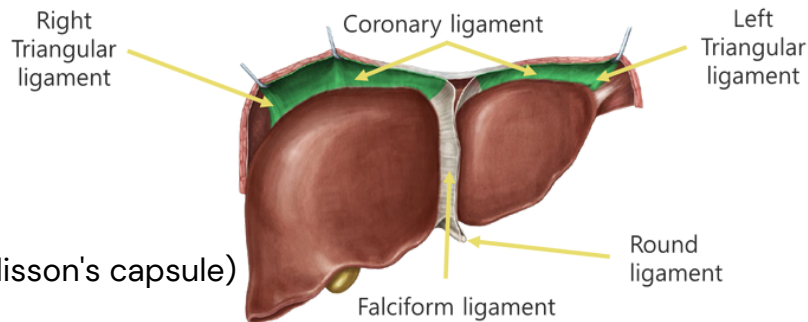
- **Right** and **Left lobe** separated superficially by the falciform ligament
- **Quadrante** and **caudate** lobes: functionally distinct lobes located on the visceral surface of the right lobe

### 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
- **Hepatoduodenal ligament** → Duodenum



### Hepatic recesses

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

### 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

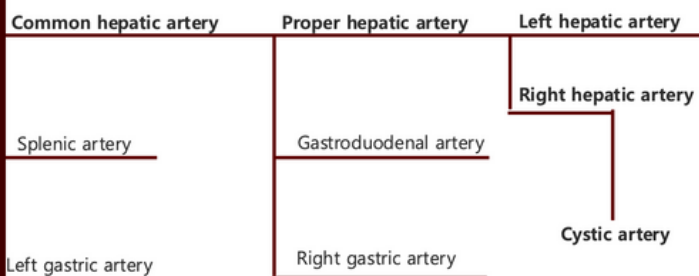
- Hepatic plexus
- Sympathetic: celiac plexus
- Parasympathetic: vagus n.

Glisson's capsule: lower intercostal n. branches

#### Lymphatic Drainage

- Anterior: hepatic lymph nodes
- Posterior: phrenic and posterior mediastinal lymph nodes

Coeliac Trunk (T12)

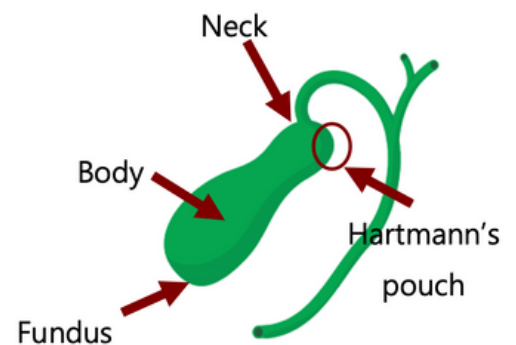


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## The Gallbladder Structure

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



Biliary colic:

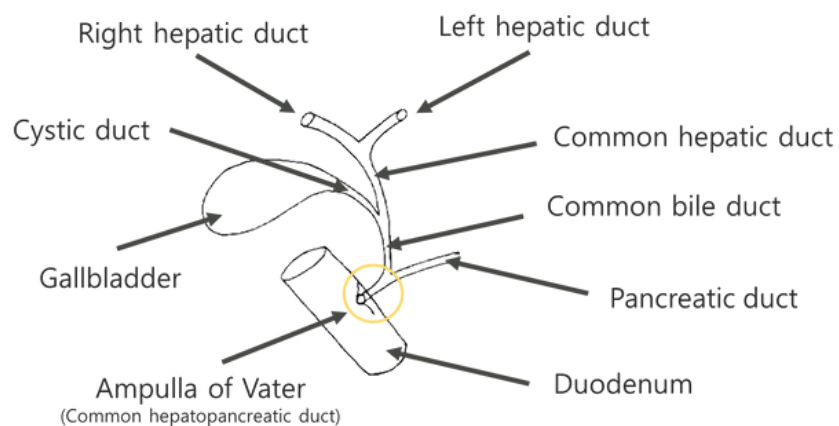
- **Impacted gallstone** in gallbladder neck
- **Recurring RUQ pain**, precipitated by fatty foods

Acute Cholecystitis:

- **Constant RUQ pain**
- **Signs of inflammation** (fever, lethargy)
- Positive **Murphy's sign**

Cholangitis:

- **RUQ pain**
- **Fever**
- **Jaundice**
- **Hypotension**
- **Confusion**



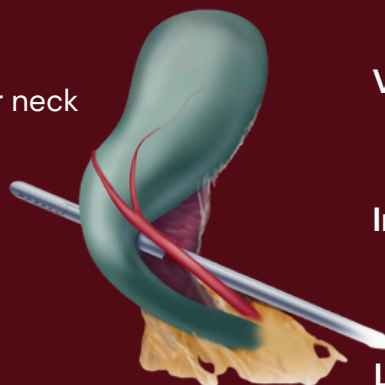
## NEUROVASCULAR SUPPLY

### Hepatocystic triangle

- Borders:
  - **Superior:** inferior liver border
  - **Inferior:** cystic duct, gallbladder neck
  - **Medial:** common hepatic duct

### Calot's triangle

- Borders:
  - **Superior:** cystic artery
  - **Inferior:** cystic duct
  - **Medial:** common hepatic duct



**Surgical Importance:** resection and identification of structures during laparoscopic cholecystectomy

### 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.

### Lymphatic Drainage

- Cystic lymph nodes → hepatic lymph nodes
- → coeliac lymph nodes



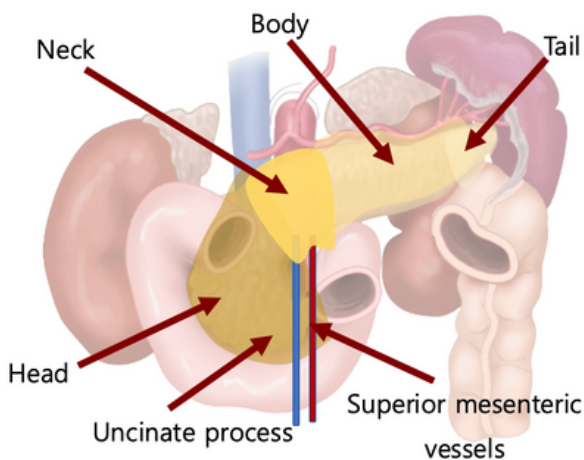
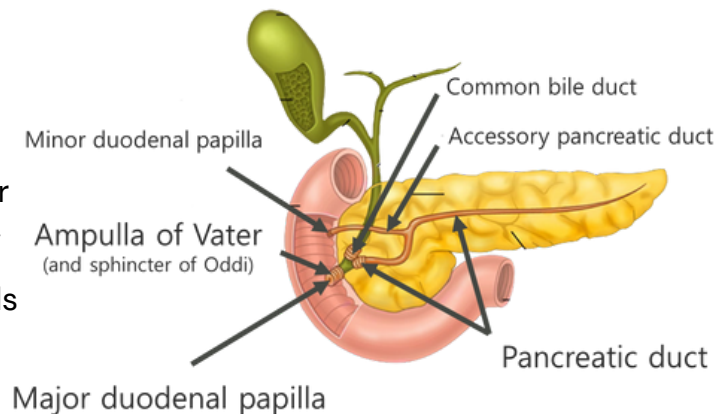
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## The Pancreas

### 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.)

### Venous Drainage

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

### Innervation

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

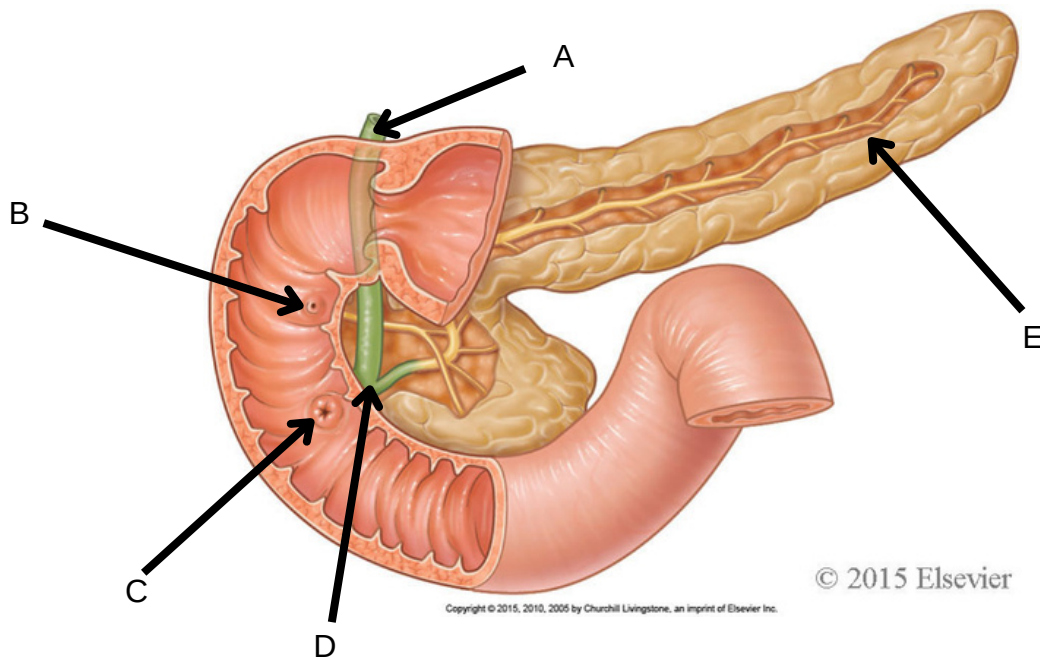
### Lymphatic Drainage

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

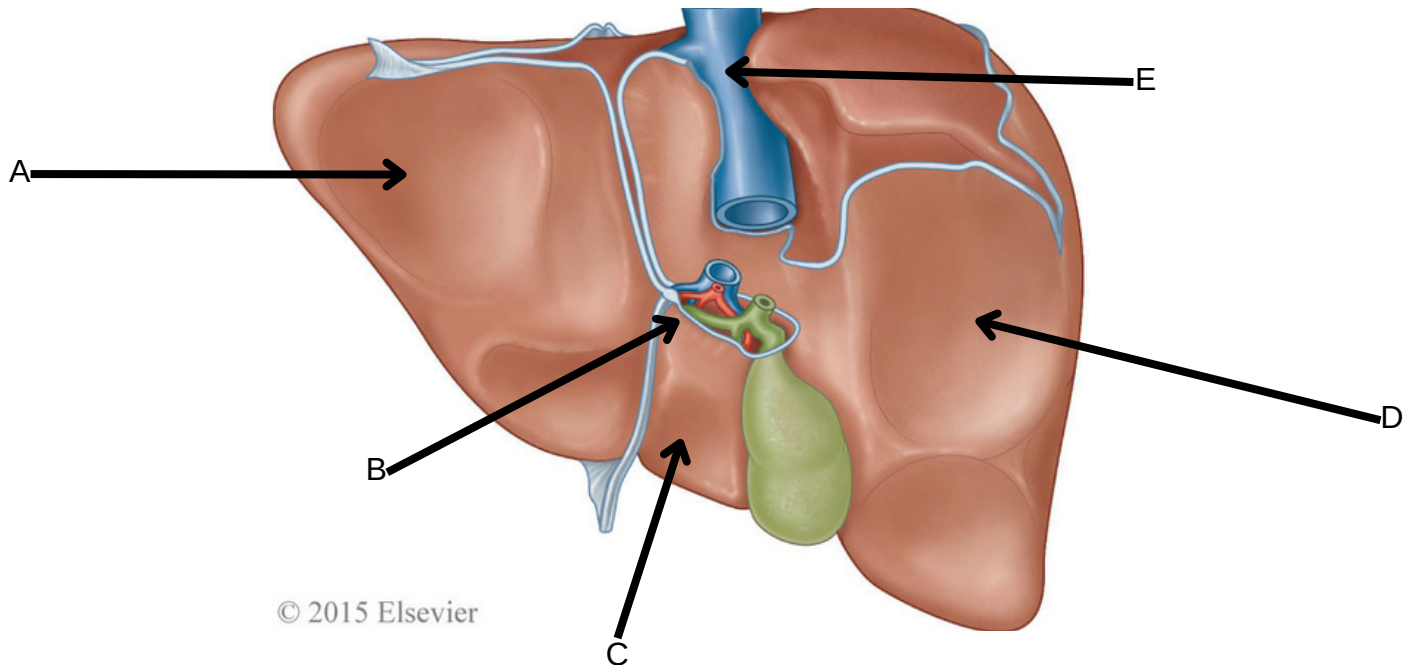
# HEPATOBILIARY ANATOMY

## Test yourself

### 1) Label the structures



### 2) Label the structures



# HEPATOBILIARY ANATOMY

## Test yourself

### MCQ 1

What is the clinical relevance of Couinaud's classification?

- A. Whipple procedure
- B. Liver resection
- C. Cholecystectomy
- D. Identification of metastatic disease
- E. Caudate lobe resection

### MCQ 2

The Falciform ligament attaches which two structures?

- A. Liver and abdominal wall
- B. Liver and duodenum
- C. Liver and stomach
- D. Liver and diaphragm
- E. Liver and gallbladder

### MCQ 3

What is the clinical relevance of the epiploic foramen?

- A. Allows for easier access to retroperitoneal organs
- B. Allows for the expansion of the liver in liver disease
- C. Blood and Pus can accumulate in this area
- D. Anastomosis can form here in liver haemorrhage
- E. Morrison's pouch can be accessed here

### MCQ 4

What is contained within the hepatoduodenal ligament?

- A. Common hepatic artery and splenic artery
- B. Portal triad
- C. Right and left gastric arteries
- D. Cystic artery and right hepatic artery
- E. Minor pancreatic duct

### MCQ 5

A 45-year-old female presents to her GP with consistent pain in her right upper quadrant. This has been going on for a while. The GP notices that she has yellowing of her sclera and a fever of 38.5.

What is your most likely diagnosis?

- A. Primary biliary cholangitis
- B. Ascending cholangitis
- C. Pancreatic cancer
- D. Biliary colic
- E. Cholecystitis

### MCQ 6

A 40-year-old female presents with a 3 week history of right upper quadrant pain. She describes the pain as a pain that comes and goes and usually worse after a weekly takeaway. The GP calculates her BMI to be 55.

What is the most likely diagnosis?

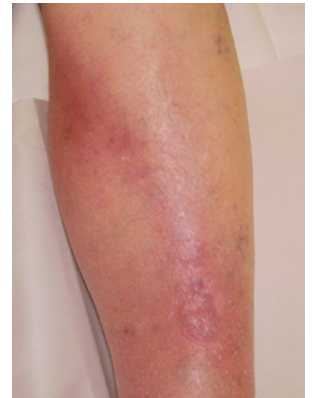
- A. Primary biliary cholangitis
- B. Ascending cholangitis
- C. Pancreatic cancer
- D. Biliary colic
- E. Cholecystitis

# HEPATOBILIARY ANATOMY

## Test yourself

### OSCE Station – Case Based Discussion

You are an F1 on your general surgery rotation. You come across a 75 year old patient who appears well in herself but you notice that she appears very cachectic. You check her notes and realise she has a BMI of 16.5. On examination, she has a small palpable mass in her RUQ and yellowing of her skin. You also notice a swollen left leg which appears red upon systems review.



- Q1. What differentials would you give for this patient's jaundice?
- Q2. What is the most common cause of her swollen leg?
- Q3. What is the likely diagnosis & cause of this patient's symptoms and why?
- Q4. What investigations would you arrange?
- Q5. How would this patient be managed?
- Q6. What additional support might this patient need?
- Q7. What is the most common surgery for tumours of the head of the pancreas?

Labels 1: A = Bile duct, B = Minor duodenal papilla, C = Major duodenal papilla, D = Hepatopancreatic ampulla, D = Major duodenal papilla, E = Pancreatic duct  
 Labels 2: A = gastric impression, B = Porta hepatis, C = Quadrate lobe, D = gastric impression, E = IVC  
 MCQs: 1 = B, 2 = A, 3 = A, 4 = B, 5 = B, 6 = D  
 OSCEs: 1) Jaundice can be pre-hepatic, hepatic, or post-hepatic. This patient = post-hepatic. Either intramural gallstones; mural = cholangiocarcinoma / strictures; extra-mural = e.g. pancreatic cancer. 2) This is known as Trousseau's syndrome. This is when clot clots form around the body commonly in the extremities. It is associated with pancreatic cancer. 3) Cancer of the head of the pancreas most likely Dx due to painless nature, needs to be excluded 4) Bloods: FBC, LFTs, U&Es, clotting screen, hepatitis screen; Imaging: CT abdomen. Q5) Pancreatic cancer MDT – Staging – PET. Chemotherapy or surgery if respectable (Whipple) 6) Psychological support, pain management, nutritional support 7) Whipple's procedure.