
NATIONAL SURGICAL
ANATOMY TEACHING
SERIES



NSATS HANDOUT 2022/23

Liver and Gallbladder

High Yield | Surgical Relevance | CPD Accredited

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

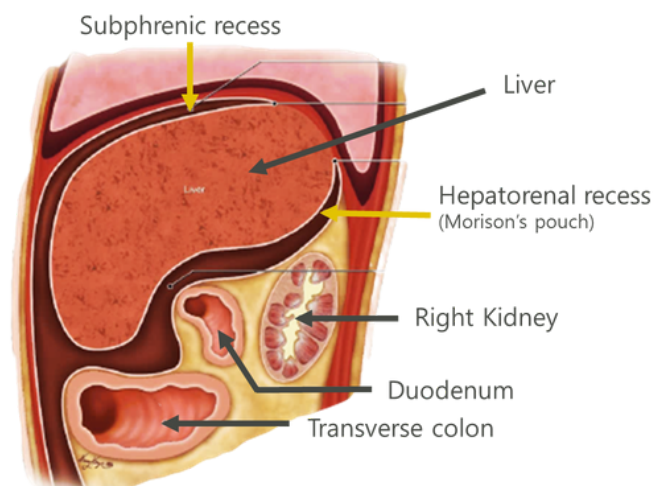
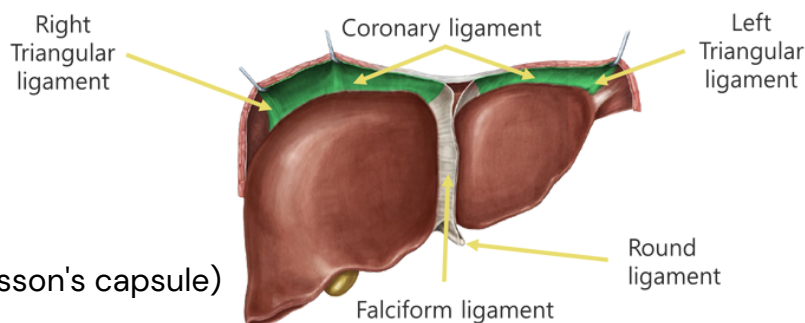
- **Right** and **Left lobe** separated superficially by the falciform ligament
- **Quadrate** and **caudate** lobes: functionally distinct lobes located on the visceral surface of the right lobe

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
- **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

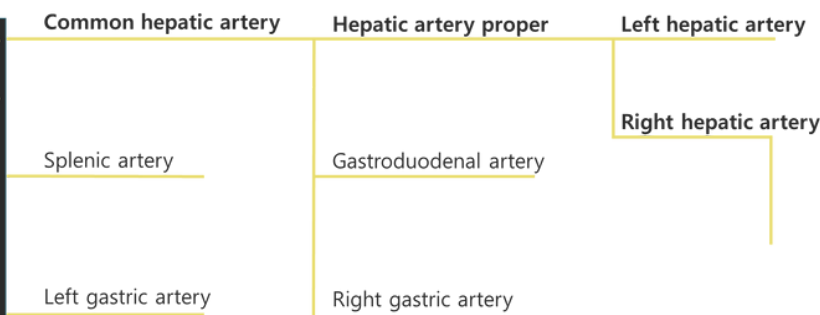
- Hepatic plexus
- Sympathetic: celiac plexus
- Parasympathetic: vagus n.

Glisson's capsule: lower intercostal n. branches

Lymphatic Drainage

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

Coeliac Trunk (T12)



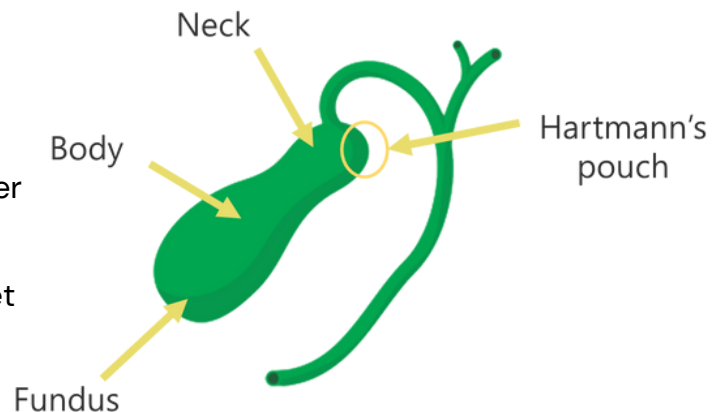
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The Gallbladder

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:

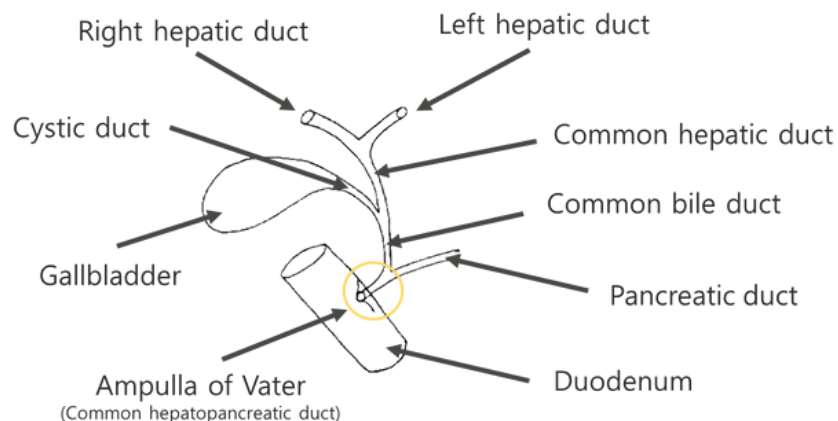
- **Constant RUQ pain**
- **Signs of inflammation** (fever, lethargy)
- Positive **Murphy's sign**

Cholangitis:

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

Charcot's Triad

Reynold's Pentad



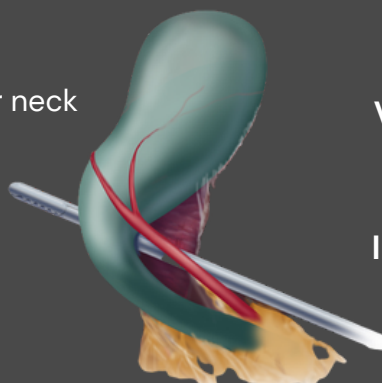
NEUROVASCULAR SUPPLY

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

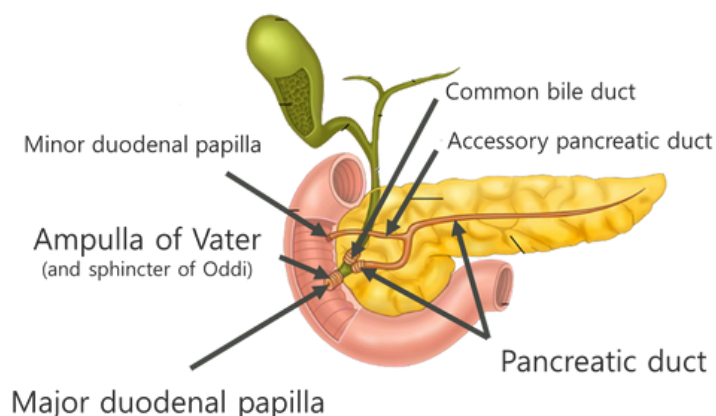
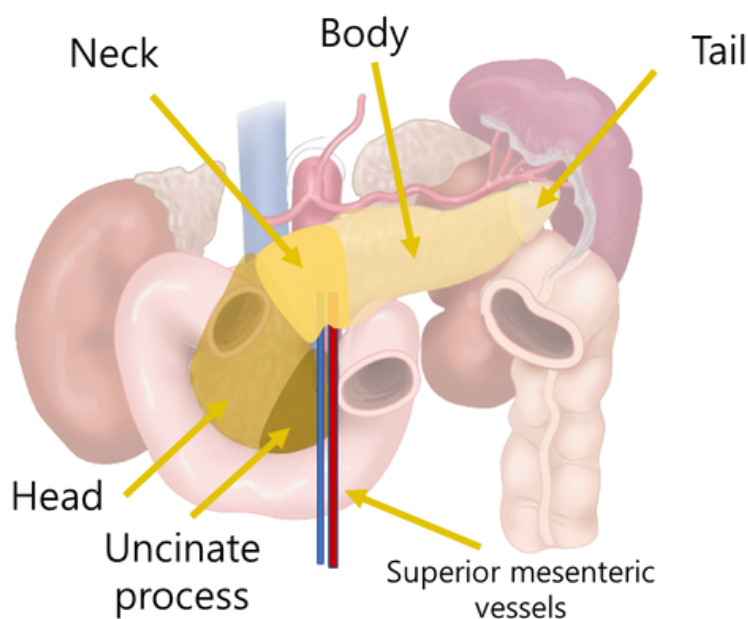
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The Pancreas

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



Remember:

- **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.

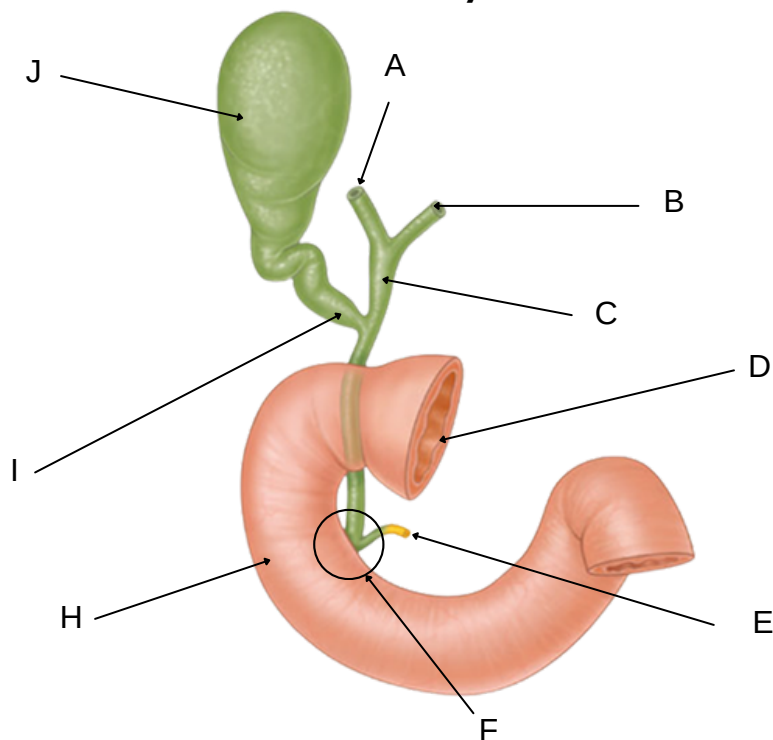
Lymphatic Drainage

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

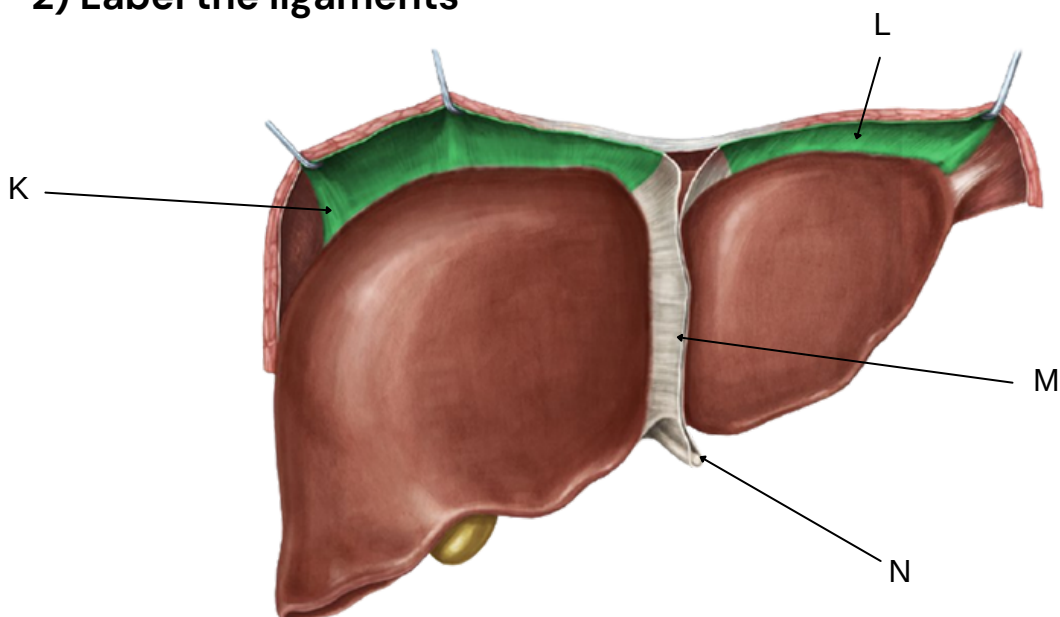
HEPATOBIILIARY ANATOMY

Test yourself

1) Label the structures of the biliary tree



2) Label the ligaments



HEPATOBILIARY ANATOMY

Test yourself

MCQ 1

What part of the liver forms Segment 1 in Couinaud's classification?

- A. Right lobe
- B. Left lobe
- C. Gallbladder fossa
- D. Quadrate lobe
- E. Caudate lobe

MCQ 2

What two structures need to be identified during a laparoscopic cholecystectomy as careless dissection would lead to bleeding?

- A. Cystic artery & common hepatic duct
- B. Cystic artery & cystic duct
- C. Cystic artery & right hepatic artery
- D. Right & left hepatic arteries
- E. Cystic artery & common hepatic artery

MCQ 3

What anatomical space can a surgeon access via the epiploic foramen?

- A. Greater sac
- B. Lesser sac
- C. Least sac
- D. Subphrenic recess
- E. Morrison's pouch

MCQ 4

Which of the following structures does an accessory pancreatic duct open into

- A. Common bile duct
- B. Major duodenal papilla
- C. Minor duodenal papilla
- D. Major pancreatic duct
- E. Minor pancreatic duct

MCQ 5

A 64-year-old gentleman presents to A&E with a two-day history of increasingly severe pain in his right upper quadrant. He has also felt feverish and lethargic. Examination reveals a tender right upper quadrant and a positive Murphy's sign. No signs of jaundice. Which of the following is currently your most likely diagnosis?

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

MCQ 6

A 62-year-old male presents with a 3-month history recurring right upper quadrant pain. He mentions that the pain often occurs after he has a takeaway or a particularly fatty meal. He has no significant medical history. Murphy's sign is negative. 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

During an A&E nightshift you see an elderly gentleman who has presented because he noticed that his skin has gotten more yellow than usual over the last few weeks. He delayed seeing a GP but became worried when one of his nieces who is a medical student warned him this could be a sinister symptom. He is surprised he does not have any other symptoms, stating that surely it can't be that bad as he is not even in any pain. You recognise a red flag symptom and arrange further investigations.



- Q1. What differentials would you give for this patient's jaundice?
- Q2. What is the likely diagnosis & cause of this patient's symptoms and why?
- Q3. What investigations would you arrange?
- Q4. How would this patient be managed?
- Q5. What additional support might this patient need?
- Q6. What are the potential complications of a pancreaticoduodenectomy?

Answers
 Labels 1: A = right hepatic duct, B = left hepatic duct, C = common hepatic duct, D = common bile duct, E = (main) pancreatic duct, F = Ampulla of Vater, H = duodenum, I = cystic duct, J = gallbladder;
 Labels 2: K = (right) triangular ligament, L = coronary ligament, M = falciform ligament, N = round ligament
 MCQs: 1 = E, 2 = B, 3 = B, 4 = C, 5 = E, 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) Cancer of the head of the pancreas most likely Dx due to painless nature, needs to be excluded 3) Bloods: FBC, LFTs, U&Es, clotting screen, hepatitis screen; Imaging: CT abdomen. Q4) Pancreatic cancer MDT – Staging – PET. Chemotherapy or surgery if resectable (Whipple) 5) Psychological support, pain management, nutritional support 6) Complications include bleeding, infection, delayed gastric emptying