MIDLANDS SURGICAL ANATOMY TEACHING SERIES

MSATS HANDOUT 2021/22

High Yield | Surgical Relevance | CPD Accredited

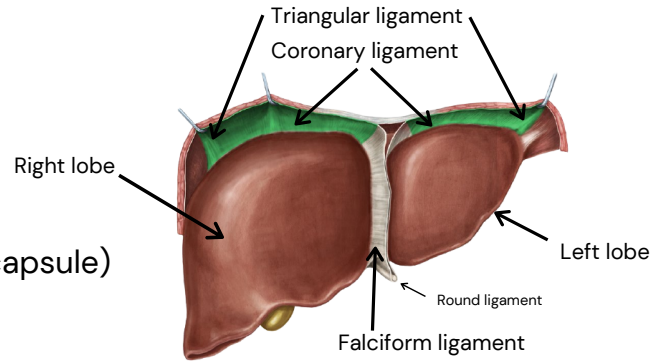
HEPATOBILIARY ANATOMY

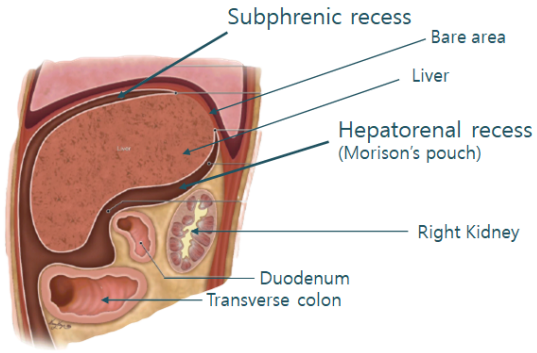
***Objectives**: Understand the anatomy of the liver, gallbladder, biliary tree, pancreas and their respective neurovascular supply. Apply anatomical knowledge in context of stone disease and laparoscopic cholecystectomy*

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
    - Superior duodenum
    - Lesser omentum
    - Large intestine





Lobes

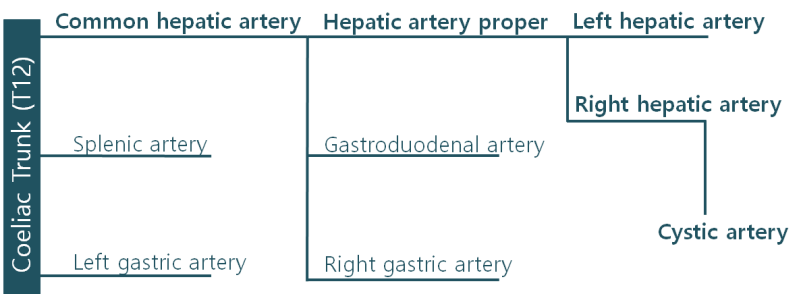
- **Right** and **Left lobe** separated superficially by the falciform ligament
- **Quadrate** and **caudate** lobes: functionally distinct lobes located on the visceral surface of the right lobe

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

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

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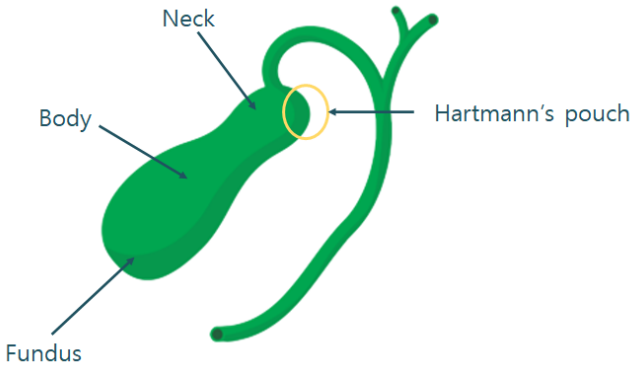
The Gallbladder

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



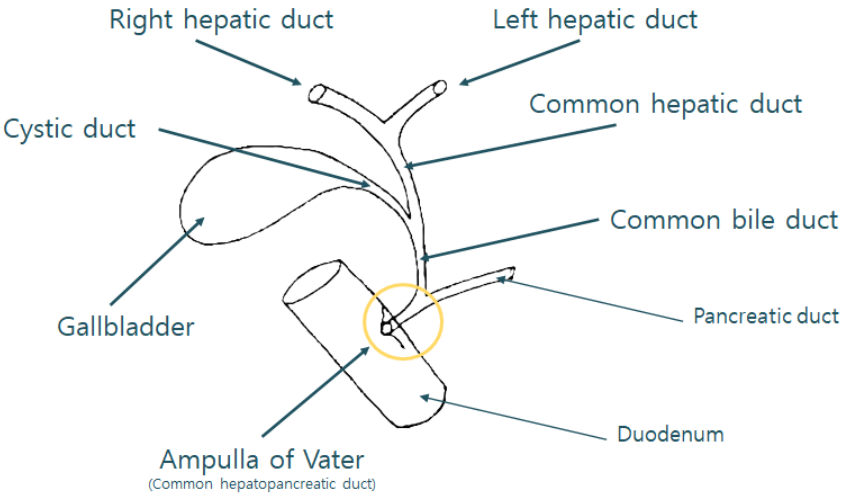
Biliary colic:
- Impacted gallstone in gallbladder neck
- Recurring RUQ pain, precipitated by fatty foods

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



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

Obstructive jaundice causes:
- Intramural= gallstones
- Mural: cholangiocarcinoma, stricutres
- Extra-mural: pancreatic cancer, lymphoma

Calot's triangle

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

Surgical Importance: resection and 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.

Lymphatic Drainage

- Cystic lymph nodes -> hepatic lymph nodes -> coeliac lymph nodes

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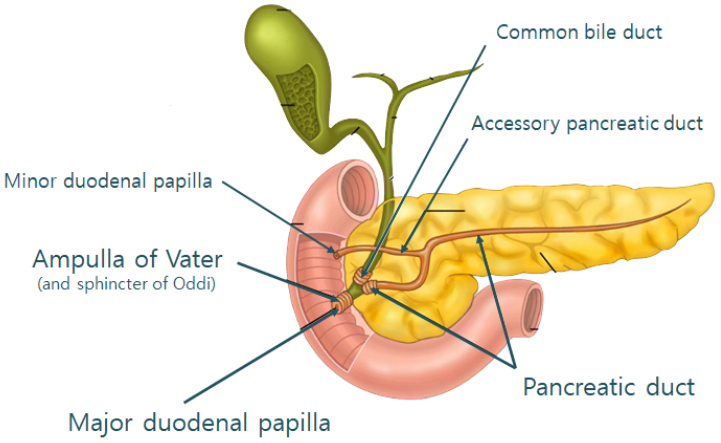
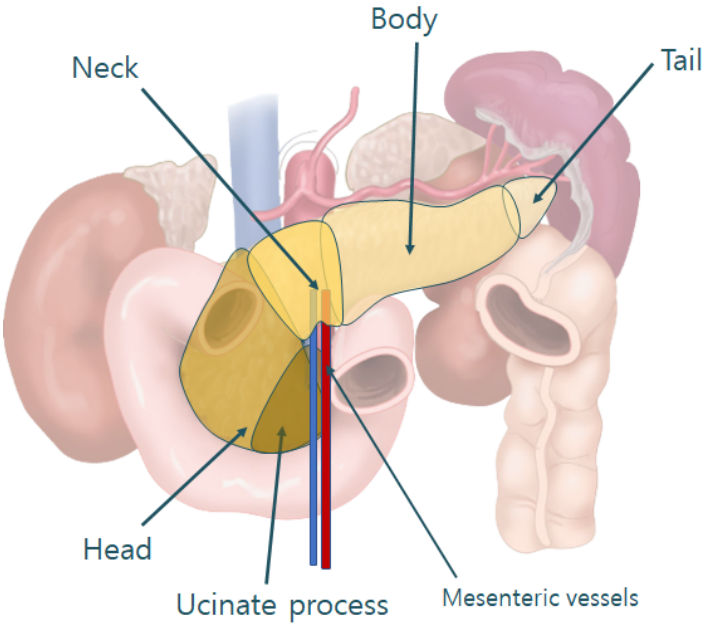
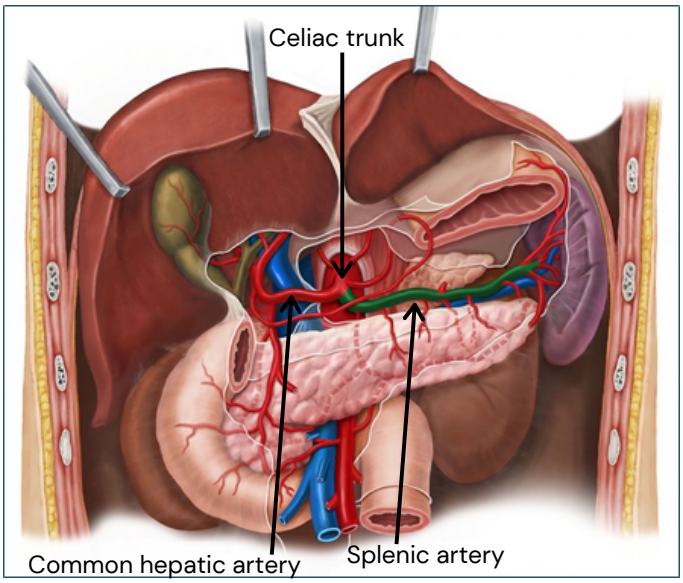
The Pancreas

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







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

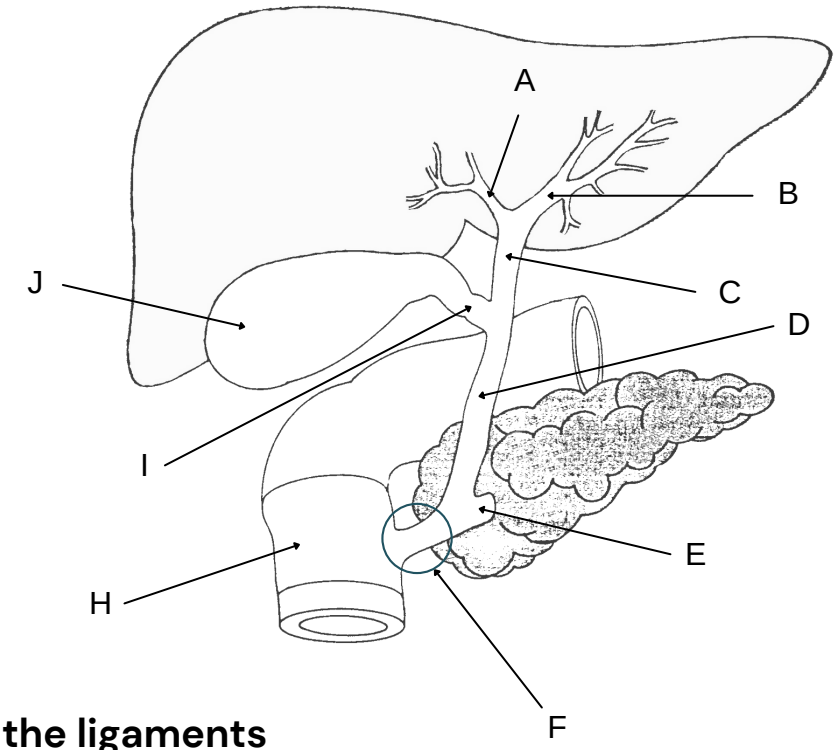
Venous Drainage

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

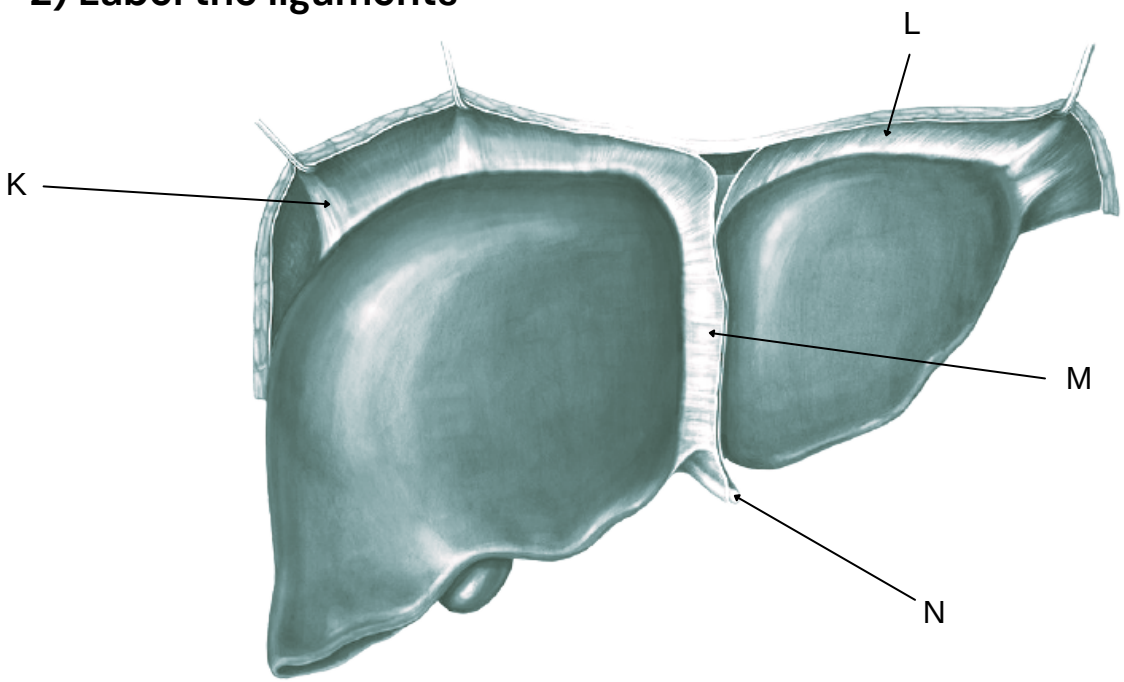
HEPATOBILIARY ANATOMY

Test yourself...

1) Label the structures of the biliary tree



2) Label the ligaments



HEPATOBILIARY ANATOMY

Test yourself...

MCQ 1
Of the following, which is NOT a cause of obstructive jaundice?

A. Gallstones
B. Cholangiocarcinoma
C. Stricture
D. Pancreatic cancer of the tail
E. Lymphoma

MCQ 2
What artery needs to be identified during a laparoscopic cholecystectomy as careless dissection would lead to bleeding?

A. Superior mesenteric artery
B. Splenic artery
C. Cystic artery
D. Cholecystic artery
E. Pancreaticoduodenal artery

MCQ 3
Which of these aortic branches supply most of the hepatobiliary system

A. Coeliac trunk
B. Superior mesenteric artery
C. Inferior mesenteric artery
D. Hepatobiliary artery
E. Brachiocephalic artery

MCQ 4
Which of the following structures does the ampulla of Vater 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 this morning he noticed that he looks yellow. Examination reveals jaundice, a tender right upper quadrant and a negative Murphy's sign.
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 of weight loss, dyspepsia, painless jaundice, dark urine, pale stools and epigastric discomfort. He underwent an endoscopy 2 months ago, which was unremarkable. He has no significant medical history. Murphy's sign is negative. What is the most likely diagnosis?

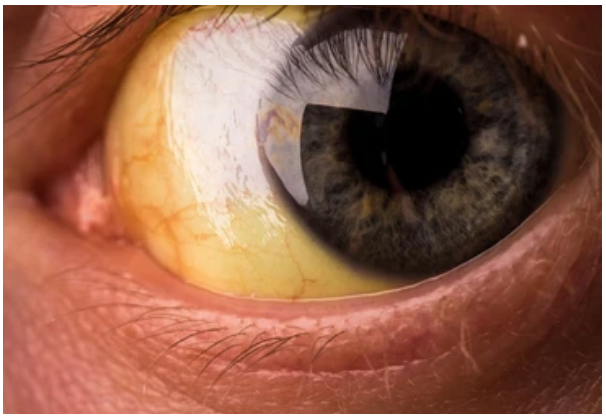
A. Primary biliary cholangitis
B. Ascending cholangitis
C. Pancreatic cancer
D. Biliary colic
E. Cholecystitis

HEPATOBILIARY ANATOMY

Test yourself...

OSCE Station - Case Based Discussion

During an A&E nightshift you see a middle-aged woman who complains of recurrent episodes of stabbing right upper-abdominal pain. While taking a history, you notice that she is sweating and that her eyes have a slight tint of yellow. She has also noticed that her stools are paler than usual and have not been flushing well. She has no history of weight loss, she drinks 5 units of alcohol per week and works as a chef in a fast-food restaurant. You recognise an eponymous triad of symptoms and arrange further investigations.



Q1. What differentials would you give for this patients jaundice?

Q2. What is the likely diagnosis & cause of this patients symptoms and why?

Q3. What investigations would you arrange?

Q4. How would this patient be managed?

Q5. Who would you refer this patient to?

Q6. What are the potential complications of a laparoscopic cholecystectomy?

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 = D, 2 = C, 3 = A, 4 = C, 5 = B, 6 = C
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) Patient with Charcot's Triad = RUQ pain, jaundice & fever (sweating). Cholangitis, most likely due to gallstones (fatty food?) 3) Bloods: FBC, CRP, LFTs, blood cultures; USS; ERCP. Q4) A-E assessment if unstable / suspecting sepsis. IV access, fluids, routine bloods, cultures, broad spectrum IV antibiotics (as per local guidelines), analgesia 5) surgical referral, high dependency unit if septic 6) Complications include bleeding, infection, perforation of gallbladder.