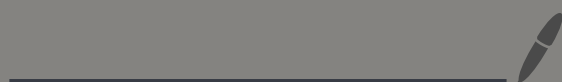


Civer



Anatomy

• Ligaments

- Right Triangular Ligament: Fixes entire right lobe of liver to under surface of Right hemidiaphragm.

- Left triangular ligament: Fixes left lobe of liver to diaphragm.

- Falciform ligament :
 - Remnant of Umbilical vein
 - Attaches liver to front body wall.
 - Divides liver into Left and Right Hepatic lobes.

• Blood Supply

- 80% from portal vein
- 20% from hepatic artery

• Venous drainage

- Hepatic sinusoids → Interlobular veins → Sublobular veins → Hepatic veins → IVC

- Hepatic veins
 - Right - has small extrahepatic course
 - Middle
 - Left

• Porta hepatis / Hilum

- Contents from Anterior to Posterior:
 - Hepatic Duct
 - Proper Hepatic Artery
 - Portal Vein

• Fissures

- Major Fissures: Run through Parenchyma; Not visible on surface.

- Middle/Main Portal Fissure: **Cantlie's Line**
 - Contains middle hepatic vein.
 - Separates liver into Right and Left Hemi-livers.
 - Extends from mid point of Gall bladder fossa to mid point of IVC.

Right Portal Fissure:

- Contains Rt. Hepatic Vein
- Divides liver into Right Anterior (medial) and Right Posterior (lateral) Sectors.

- Left Portal Fissure:

- Contains left hepatic vein
- Separates left medial sector [segment III and IV] from left lateral sector [segment II]

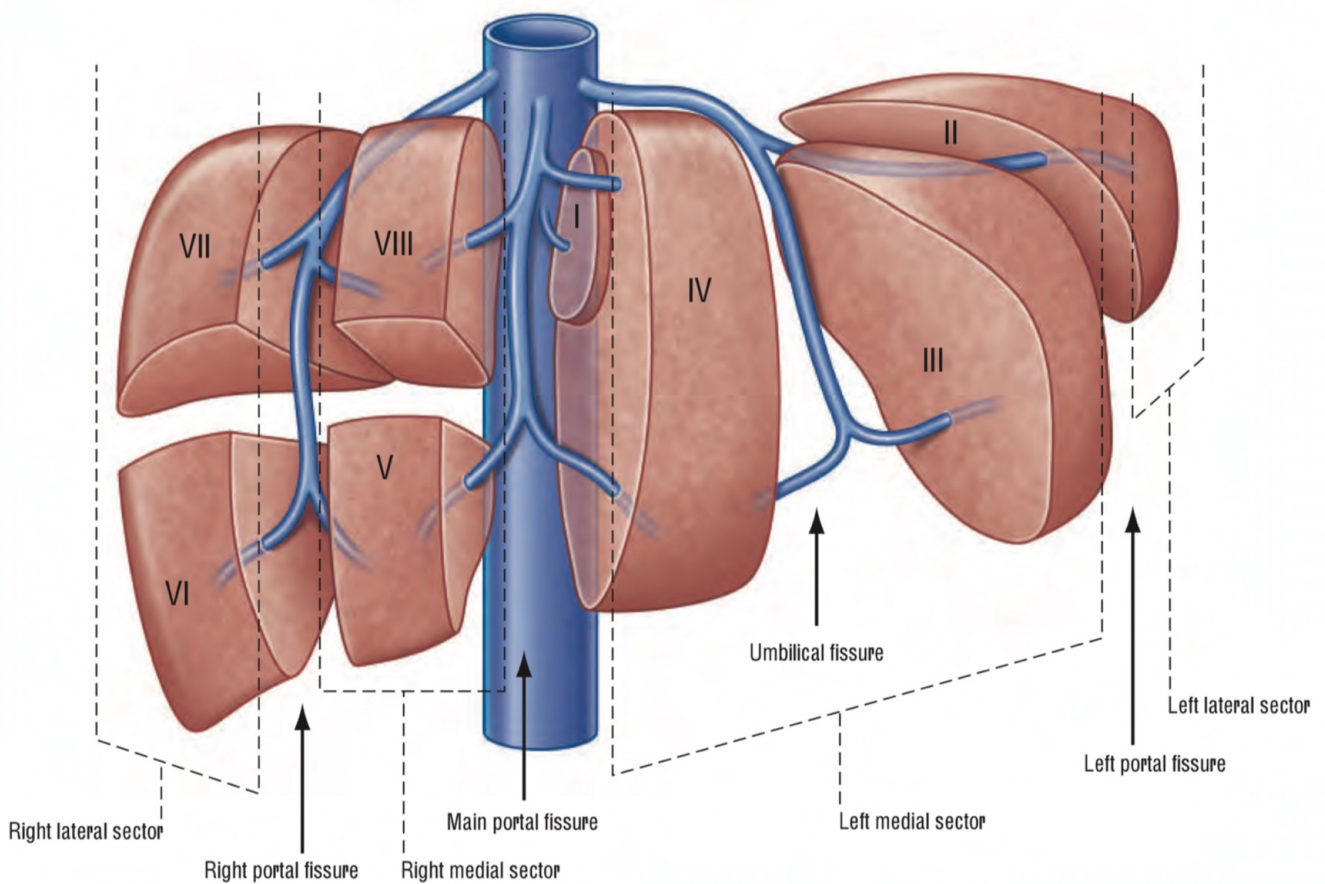
- Minor Fissures:

- Umbilical Fissure - Fissure for ligamentum teres [free edge of Falciform lig]
- Venous Fissure - Fissure for ligamentum venosum [Remnant of ductus venosus]
- Fissure of Gans - Rouvière's sulcus

★ Replaced Right Hepatic Artery arising from Sup. mesenteric artery is most common anomaly of Hepatic artery.

Segmental anatomy

- Division by Couinaud
- Basis - Distribution of portal venous branches in parenchyma.
- Division by Major and minor fissures
- Segments - 8
- Sectors - 4 — Left lateral - Segment II
Left medial - Segment III and IV
Right Anteromedial - Segment V and VIII
Right Posterolateral - Segment VI and VII
- Segment I : Spigelian lobe / Caudate lobe - Autonomous segment
- Each of the segments are considered as a functional unit with a branch of Hepatic artery, Portal vein, bile duct and is drained by a branch of hepatic vein.



Pyogenic Liver Abscess

• <u>Causative Organisms</u> (Polymicrobial)	• E. coli (most common) • Klebsiella pneumoniae (m/c organism in Asia) (m/c gas forming abscess) • S. aureus (m/c organism in children with chronic granulomatous disease) • Bacteroides fragilis • Enterococcus faecalis
• <u>Route</u>	• Portal vein - Appendicitis, colitis, diverticulitis • Hepatic artery - Septicemia • Biliary tree - Ascending cholangitis • Direct invasion - Subphrenic abscess, perinephric abscess; Penetrating injuries
• <u>Clf</u>	• fever, chills, rigors • Right upper quadrant pain • Anorexia, vomiting • Tender Hepatomegaly
• <u>Dx</u>	• Ioc - USG - oval hypoechoic lesions • CT - Cluster sign
• <u>Investigations</u>	• CBC - Leukocytosis, Anaemia • Blood culture - Positive in 50% cases • Serum Bilirubin ↑ • Alkaline Phosphatase ↑ (most common)
• <u>Mx</u>	• Broad spectrum antibiotics x 4-8 weeks [combination of Ampicillin, Gentamycin, Metronidazole] • Early aspiration if patient does not respond by USG guided Pigtail catheter.

Amoebic liver abscess

• <u>Agent</u>	Entamoeba histolytica
• <u>Pathogenesis</u>	• Causes flask shaped ulcers in bowel • Reaches liver through portal circulation • M/c site - Posterosuperior aspect of right lobe
• <u>Clf</u>	• Fever • Weight loss, Anorexia • Pain in Rt. Hypochondrium
• <u>Dx</u>	• Ioc - USG / CECT • <u>Other investigations:</u> - Aspartate aminotransferase ↑ - PT / INR ↑ - Serology - Amoebic fluorescent antibody test - Aspiration of abscess → Anchovy sauce pus
• <u>Complications</u>	① Rupture - into pleural space - Massive pleural effusion - into peritoneum - Peritonitis - Subdiaphragmatic abscess ② Direct extension → Amoebic lung abscess ③ Haematogenous spread - Splenic abscess - Metastatic brain abscess
• <u>Mx</u>	• Metronidazole 800mg thrice a day X 10 days [Tissue amoebicide] • If disease does not respond - Aspiration of abscess (Percutaneous drainage) ↳ Other indications - Secondary infection - Impending rupture - Large abscess [$>5\text{cm}$] - Left lobe abscess [Can rupture in pericardium] - Pregnancy • After treatment with Luminal Amoebicide - Diloxanide furate 500mg TID x 10 day.

♥ Chloroquine 300mg can also be used as tissue amoebicide.

Clinical features	Pyogenic abscess	Amebic abscess
Age	>50 years	20–40 years
Male:Female ratio	1.5:1	10:1
Solitary vs multiple	Solitary 50%	Solitary 80%
Location	Right liver	Right liver
Travel to endemic area	No	Yes
Alcohol	Common	Common
Most common symptom	Fever with chills	Abdominal pain
Most common lab abnormality	Elevated ALP	Elevated ALP
Jaundice and elevated bilirubin	More common	Less common
Diagnosis	Positive blood culture	Positive antiamebic antibodies

Hydatid Cyst

Agent *Echinococcus granulosus*

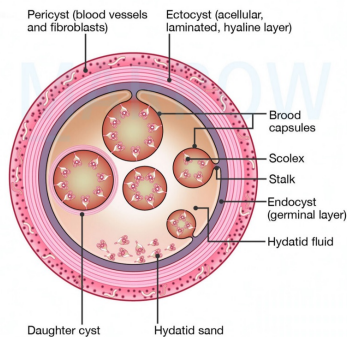
• *Echinococcus multilocularis* → Multiple cysts → Malignant Hydatid disease

• Definitive host - Dog
Intermediate host - Sheep
Accidental immediate host - Man

• Most common organ affected: Liver > Lungs

Cyst structure

Structure of the hydatid cyst (Cross section)



Symptoms

Asymptomatic
Dragging abdominal pain
Vomiting

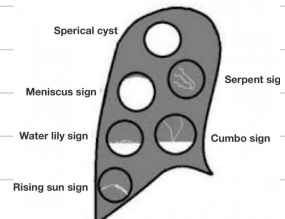
Signs

• Hepatomegaly
• Hydatid thrill — May be present on rare occasions.
keep 3 fingers over liver → Percuss over middle finger → Impulse felt on other 2 fingers

Radiological signs

• Meniscus / Double arch / Crescent moon sign
• Onion peel / Cumbo sign
• Serpent sign
• Water lily sign
• Rising sun sign

— due to collapsed cyst floating in cystic fluid or a collapsed or detached membrane



• Complications :

- ① Rupture
- ② Jaundice
- ③ Suppuration
- ④ Calcification

• Investigations

• Ioc - USG

Gharbi Classification:

Type	USG features	Stage
CE1	Univesicular fluid collection	Active cyst
CE2	Multivesicular fluid collection; daughter cysts separated by septae; Honeycomb appearance	
CE3A	Waterlily sign - fluid collection with detached membrane	Transitional cyst
CE3B	Daughter cysts present in solid matrix	
CE4	Cysts in heterogenous matrix with no daughter cysts	Inactive cyst
CE5	Solid cystic wall	

• Screening test of choice - Indirect haemagglutination and ELISA

• Best imaging modality - CT scan.

• Mx

• CE1 / CE3a [<5cm - Albendazole 400 mg Oral BID
>5cm - Albendazole + PAIR

• CE2 / CE3b [PAIR contraindicated
Large bore percutaneous treatment
Albendazole + Surgery

• CE4 / CE5 [PAIR contraindicated
Observation [USG every 6 months]

• PAIR Puncture - Aspiration - Injection - Reaspiration

- ① Puncture of cyst under image guidance
- ② Aspiration of cyst contents
- ③ Injection of scolicidal agent in cyst cavity
- ④ Reaspiration

• Indications:

- Relapse cyst, infected cyst, cyst > 5cm.
- Surgery is contraindicated
- Pregnant women; children < 3 years
- Type CE1 and CE3a

• CLL:

- Cysts in lung
- Cysts communicating with bile duct
- Honeycomb cysts
- Inaccessible cysts
- Hyperechogenic cysts
- Calcified cysts

• Scolicidal Agents:

- Hypertonic saline (most common)
- Cetrinide
- Alcohol
- Sodium Hypochlorite
- Povidine iodine

* Formalin is not used as it causes Sclerosing cholangitis.

• Surgeries

- Excision
- Cystopericystectomy
- Capitonage - Spiral suturing of bottom of cavity
- Hepatic Resection - For multiple cysts.

* Neurotropical echinococcosis - Echinococcus vogeli and E. oligarthrus

Benign tumors

• Haemangioma

- Most common benign tumor of liver [usually solitary]
- Clf: Asymptomatic
 - Large compressive masses may cause vague abdominal symptoms.
 - Seen in women >45 years
- Kasabach-Merritt syndrome: Syndrome of thrombocytopenia and consumptive coagulopathy. Normal LFT and tumor markers.
- Dx: IDC - CECT → Asymmetrical Nodular peripheral enlargement
 - Non contrast phase - Hypodense
 - Arterial phase - Peripheral Nodular involvement
 - Washout phase - Homogenous enhancement
- MRI - Light bulb sign
- Mx: Observation → If symptomatic → Enucleation with inflow control.

• Focal Nodular Hyperplasia

- 2nd most common benign tumor of liver
- F>M [2-5th decade of life]
- Etiology - Secondary vascular insult to liver.
- Histopath - Hepatocytes
Bile duct structure
Kupffer cells - Hot spot on Tc 99m scan (sulphur colloid)
- Clf - Asymptomatic / Incidental diagnosis
- IDC - CECT → central stellate scar (due to central arteriole)
- Mx - Observation
 - ~~No~~ No risk of malignant conversion

- **Hepatic adenoma**
 - Females > Males [3rd-5th decade of life]
 - Strong association with OC pills.
 - Malignant conversion in 10% cases
 - Histopath: Sheets of Hepatocytes
No bile duct structures (Hepatic architecture is not maintained)
 - Clf: Asymptomatic
Abdominal pain
 - Complications: Malignant conversion
Spontaneous rupture (m/c cause of Non traumatic haemoperitoneum).
 - Idc: CECT
 - Mx: All liver adenomas must be resected.
 - Bordeaux classification:
 - ① Inflammatory: Max risk of bleeding
 - ② HNF1 α mutated: Max risk of being multiple
 - ③ β -catenin mutated: Max risk of malignant conversion

Malignant tumors

LAQ

• Classification

- ① Metastases [M/C from Colorectal Ca]
- ② Primary Liver tumors
 - └ Hepatocellular Carcinoma
 - └ Fibrolamellar Carcinoma
 - └ Hepatoblastoma
- ③ Vascular
 - └ Angiosarcoma
 - └ Haemangioendothelioma

• Colorectal Metastases

- Resection - future Liver remnant [FLR] should be 25% of preoperative volume [Chemotherapy induced Liver damage may require larger FLR].
- Portal vein embolisation (Nimura's technique) - causes compensatory Hypertrophy in proposed FLR
- ALPPS procedure : Associating Liver Partition and Portal vein ligation for Staged Hepatectomy
 - ↳ Maximises hypertrophy of FLR
 - Used in selective patients
 - Significant operative mortality [10%] and morbidity [50%].
- Predictors of poor outcome in cases of metastatic conditions of Liver:
 - Lymph Node positive primary
 - Disease free interval < 12 months
 - More than 1 tumor
 - Tumor size > 5cm
 - Serum CEA > 200 ng/ml

Liver tumors - One liners:

Most common benign - Haemangioma

Most common malignant - Metastases from other sites

Most common primary malignant - Hepatocellular Ca

Most common malignant in children - Hepatoblastoma

• Hepatoblastoma

Most common primary Hepatic tumor of childhood.

Tumor of fetal hepatocytes.

Most cases present before 3 years of age [Median age - 18 months].

- Clf:
- Mass
 - Anaemia
 - Thrombocytosis

- Dx:
- CECT
 - Serum Alpha fetoprotein elevated.

Mx:

- Localised - Chemotherapy + resection

- Metastasis to Lungs → 50% can be successfully treated by Resection of hepatic tumor, chemotherapy and Resection of pulmonary mets

Staging of Pediatric liver tumors:

Stage	Feature
Stage I	No metastases, tumor completely resected
Stage II	No metastases, tumor grossly resected with microscopic residual disease, or tumor rupture or tumor spill at the time of surgery
Stage III	No distant metastases, tumor unresectable or resected with gross residual tumor, or positive lymph nodes
Stage IV	Distant metastases regardless of the extent of liver involvement

Hepatocellular Carcinoma

• Risk Factors

- HCCs are typically hypervascular.
- Receive blood supply from Hepatic Artery.
- Has tendency to invade Portal vein.
- Infections
 - Hepatitis B
 - Hepatitis C
- Toxins
 - Alcoholic cirrhosis
 - Aflatoxins
 - Anabolic steroids
- Genetic
 - Haemochromatosis
 - α 1-antitrypsin deficiency
- Autoimmune chronic hepatitis Primary biliary cirrhosis
- Others
 - DM
 - Obesity
 - Non alcoholic steatohepatitis
 - Cirrhosis
 - Wilsons disease
 - Thorotrast exposure [$\uparrow$ HCC, RCC, Cholangiocarcinoma]
 - Vinyl chloride $\rightarrow$ $\uparrow$ risk for Angiosarcoma

• Clf

- 4th to 6th decade
 - $\sigma > \eta$
 - Abdominal pain
 - Abdominal mass
 - Anorexia, Weight loss
- [* Jaundice is uncommon and is usually a late feature]

• Dx

- Ioc - Triple phase CT (differentiates HCC from mets)

	Non contrast	Arterial Phase	Washout phase
HCC	Hypodense	Hyperdense	Hypodense
Metastasis	Hypodense	Hypodense	Hypodense

- MRI: T_1 weighted - variable
 T_2 weighted - Hyperintense

- Trucut biopsy $\rightarrow$ Confirm diagnosis

- PET-CT $\rightarrow$ Staging

- Tumor markers
 - α fetoprotein (most common)
 - DIIKKA II (Protein induced vitamin K antagonist)/ Des γ -carboxy Prothrombin
 - Glycipan
 - HepPar-I
 - Neurotensin B- For fibrolamellar variant

- Imp Scores
 - ① Child Pugh Score:
 - Evaluate risk of Portocaval shunt procedures
 - Predict surgical outcomes of intra abdominal surgical procedures in Cirrhotic patients.

- Components:
 - Albumin level
 - Bilirubin
 - Prothrombin time
 - International normalised ratio
 - Encephalopathy
 - Ascites

A - 5 - 6

B - 7 - 9

C - 10 - 15

- ② MELD score: Model for End stage liver disease.
 - Assess progress in cirrhosis
 - Assess and prioritize patients awaiting transplantation.

- Components:
 - Creatinine
 - Bilirubin
 - International Normalised Ratio
 - Serum sodium

- Scores to determine oncological outcomes of HCC:

① CLIP (Cancer of Liver Italian Program)

- Tumor size
- Child pugh score
- AFP
- Portal vein thrombosis

② OKUDA Staging

- Serum Bilirubin
- Serum Albumin
- Tumor size
- Ascites

③ BCLC (Barcelona Clinic Liver Cancer Staging System)

- Tumor Score
- Child Pugh Score
- Performance Status

• Mx

① Surgical

Resection

Orthotopic Liver transplant [Live donor (LDLT) ; Deceased donor (DDLT)]

② Ablative

Percutaneous ethanol injection (PEI) [Rarely used]

Thermal Ablation [Cryotherapy, microwave, Radiofrequency]

Nd-YAG Laser ablation

③ Transarterial

Embolization

Chemoembolisation [TACE]

④ Radiotherapy

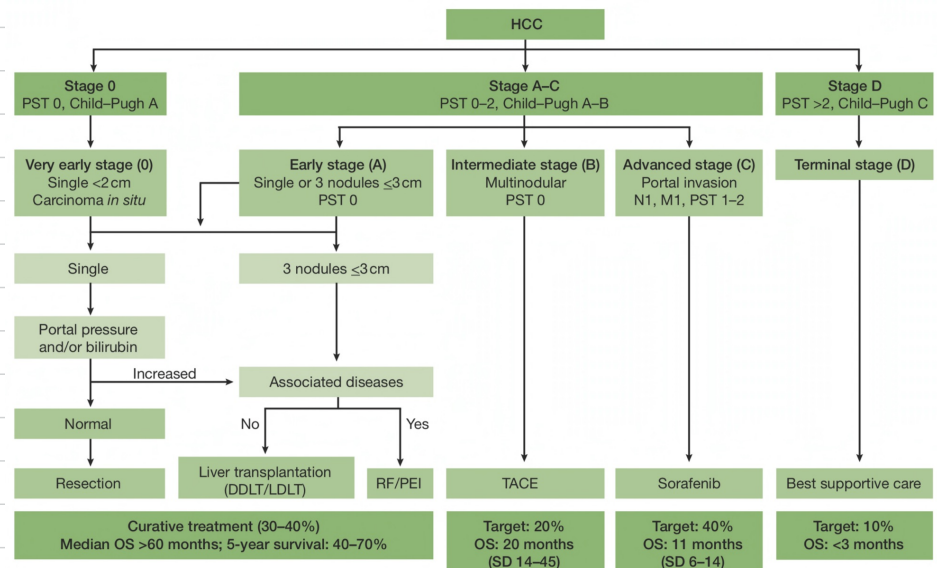
- Combination transarterial and ablative

External beam radiation

⑤ Systemic

Chemotherapy (Sunitinib / Sorafenib)

Immunotherapy



BCLC Guidelines

✱ Most important prognostic factor: *Stage of disease*

✱ most common site of distant metastasis: *Lungs*

HCC

Fibrolamellar Ca

• ♂: ♀	2:1 to 8:1 [♂ preponderance]	No gender predilection
Age	50-60 years	20-30 years
• Tumor	Invasive	Well circumscribed
• Resectability	<25%	50-75%
• Lobe	Right lobe	Left lobe
• Cirrhosis	Usually present	Usually absent
• m/c Tumor Marker	α Feto Protein	Neurotensin B

Liver transplant indications :

Adult

Non-cholestatic (65%)

- Viral hepatitis B and C
- Alcoholic
- Cryptogenic

Cholestatic (14%)

- Primary biliary cirrhosis
- Primary sclerosing cholangitis

Autoimmune (5%)

Malignant neoplasm (2%)

Miscellaneous (14%)

Children

Biliary atresia (58%)

Inborn errors of metabolism (11%)

Cholestatic (9%)

- Primary sclerosing cholangitis
- Alagille syndrome

Autoimmune (4%)

Viral hepatitis (2%)

Miscellaneous (16%)