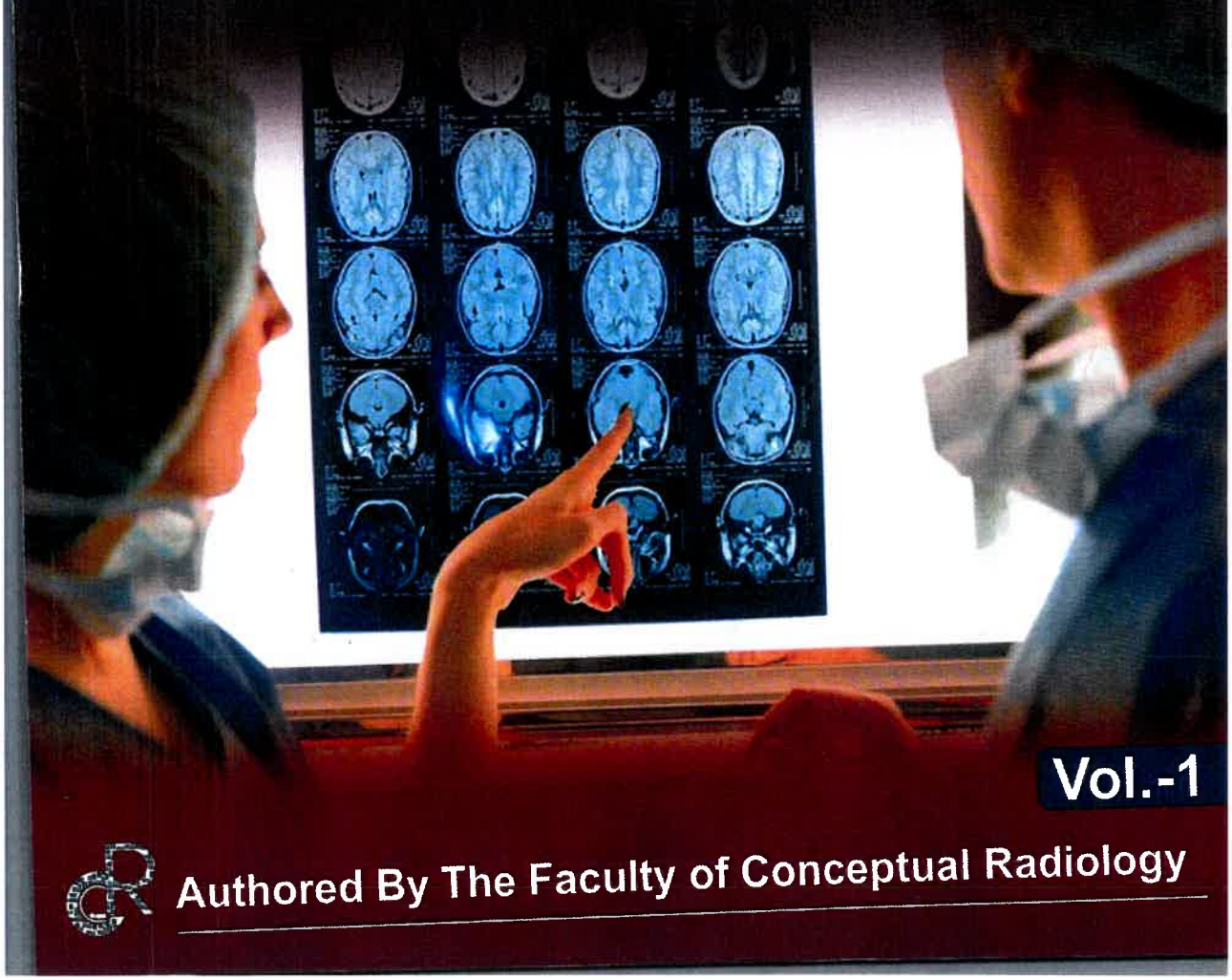
Conceptual Radiology

Concepts in Radiology

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Vol.-1

Authored By The Faculty of Conceptual Radiology

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Section 1

Abdominal Radiology

CHAPTER 1.1

Approach to Liver Lesions

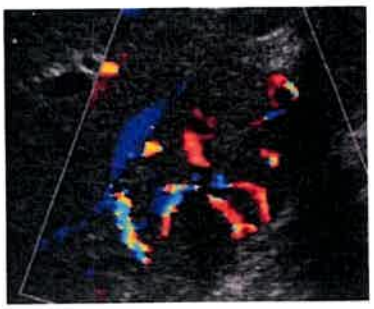
Clinical features

- Age
- Sex – benign lesions mc in females, malignant lesions & cirrhosis mc in males.
- Symptoms
- Viral infection (Hep B/ Hep C)
- Exposure to drugs
- AFP – positive in 50-60% HCC
- PREVIOUS IMAGING

1) Imaging modalities – USG

- US - initial examination
- Some common benign lesions (cysts; hemangiomas) - characteristic appearance on US
- Color Doppler - real-time -vascular versus nonvascular nature of liver lesions

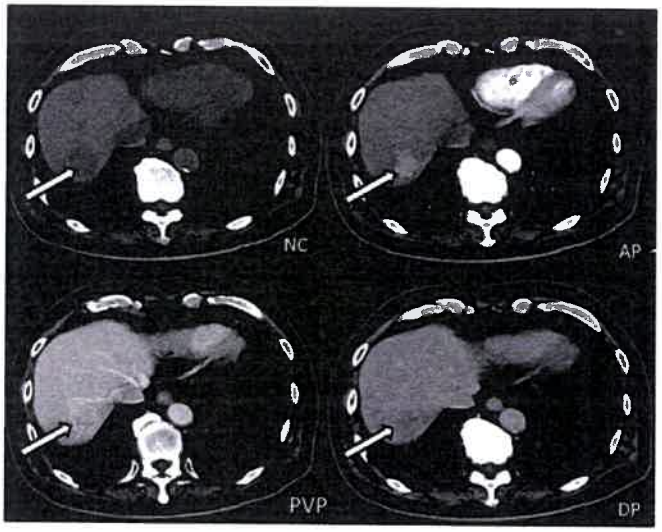


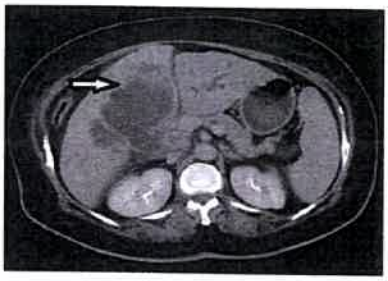


2) Imaging modalities – MPCT

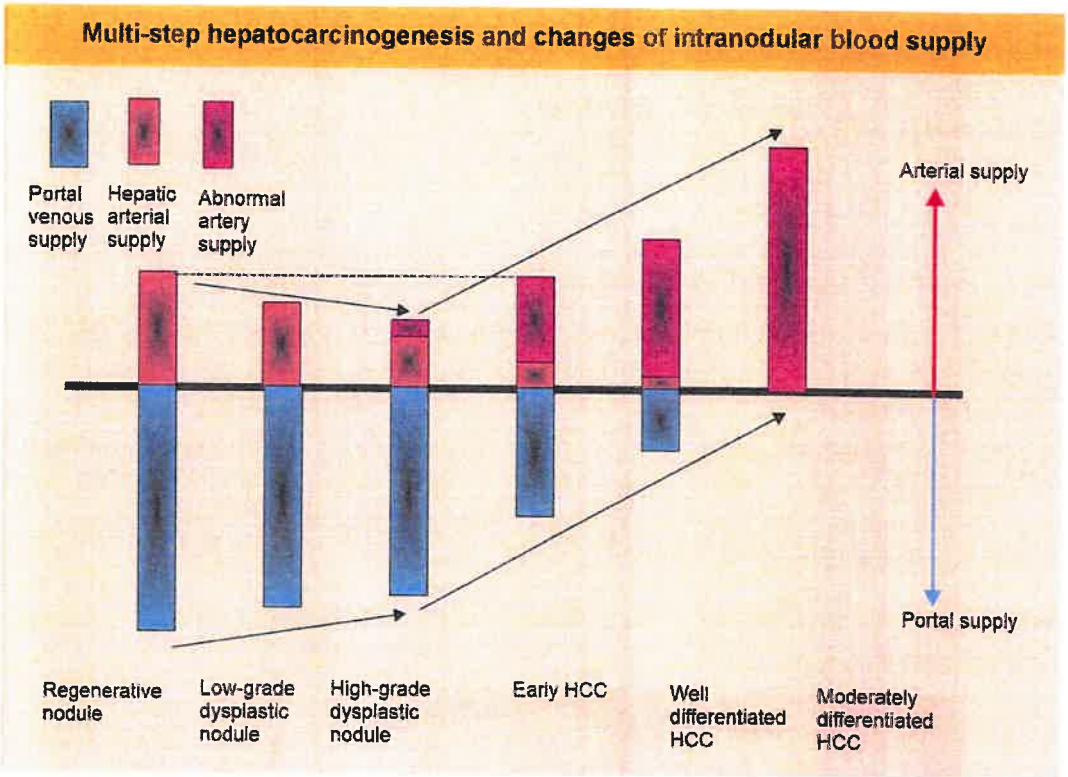
- NCCT/ Virtual Non contrast images: baseline
  - Diffuse changes - Fat infiltration, iron deposition
  - Focal changes - Subtle calcification, Hemorrhage, Focal fat
- Contrast study:
  - Late Arterial phase: 30-40secs
  - Portal phase: 60-70secs
  - Delayed: 3-5min
- Washout:
  - Retention in blood pool: Hemangioma
  - Retention in fibrous tissue: intrahepatic cholangiocarcinoma /FNH

Scan the QR code(s) on this page with any QR scanner or the eConceptual App to directly access related study materials, providing more insights and a deeper understanding of the topic. Alternatively, you can search on the eConceptual App using the code starting with '#' located below the QR code for quick access to the related content.





- Blood supply



3) Imaging modalities – MRI

- Advantages over CT:
  - Higher soft tissue contrast resolution
  - Greater sensitivity to IV gadolinium-based contrast agents
  - Excellent depiction of fluid (biliary tree, or cystic lesions)
  - Absence of ionizing radiation
- Limitations

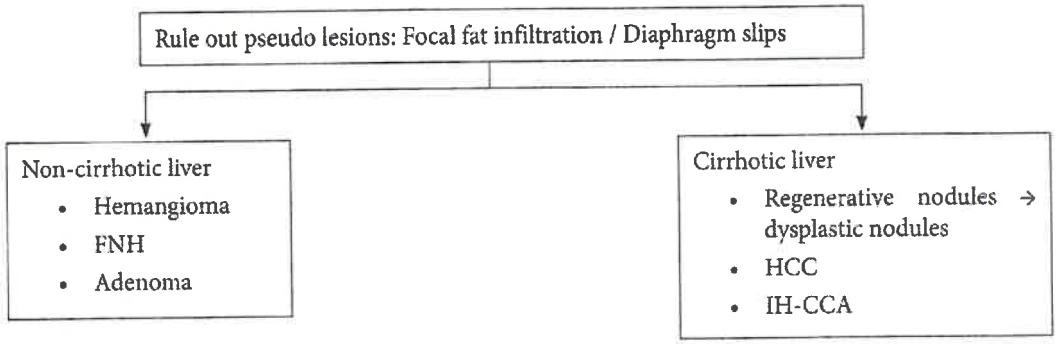
  - Long acquisition time
  - Less spatial resolution
  - Ascites gross – dielectric artefact
- SEQUENCES: Breath-hold or respiratory triggered sequences
- Initial TRUFisp/HASTE for planning
- Axial Fat suppressed FSE T2W
- In & opposed phase T1W GRE – microscopic fat: HCC & Hepatic adenoma
- Diffusion weighted imaging – HCC and shine through hemangioma
- Contrast Enhanced 3D-GRE sequence (VIBE)
  - +/- Subtraction
  - +/- Hepatobiliary phase
  - +/- MRCP

Contrast agent	Biliary Excretion	Hepatocellular phase time
Gadoxetic acid (EOVIST)	50%	20 min
Gadobenate dimeglumine (MULTIHANCE)	5%	1-2 hours

Indications for hepatobiliary phase:

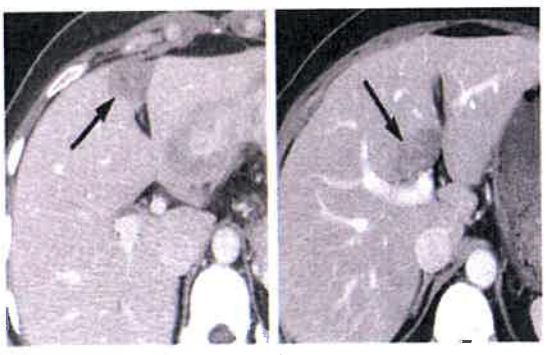
- FNH
- Well differentiated HCC — functional hepatocytes
- Metastasis

- Approach



- **CASES:**

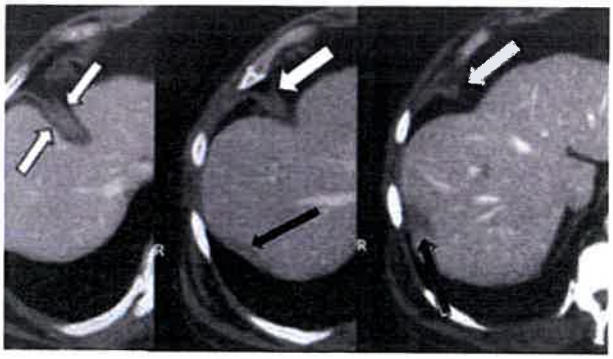
1) Focal fatty infiltration



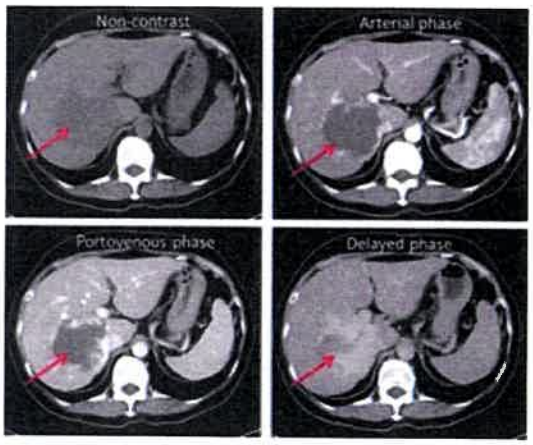
a. b.

- Posterior aspect of segment IV
- The lesion appears hypoattenuating, with no mass effect, and contains normal vessels.

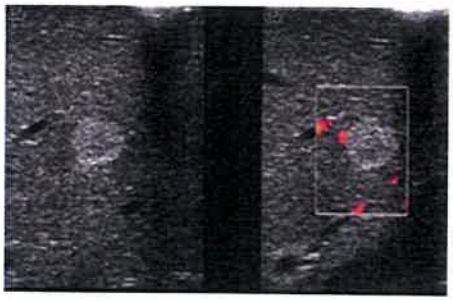
2) Diaphragm slips



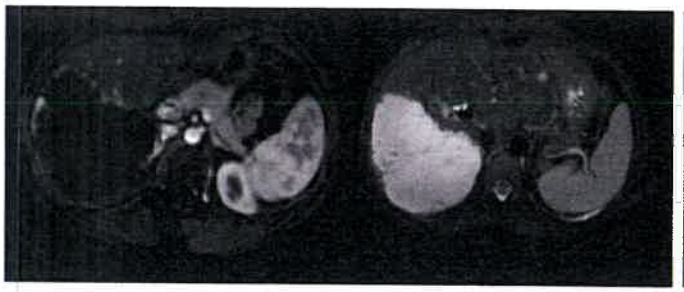
3) Hemangioma



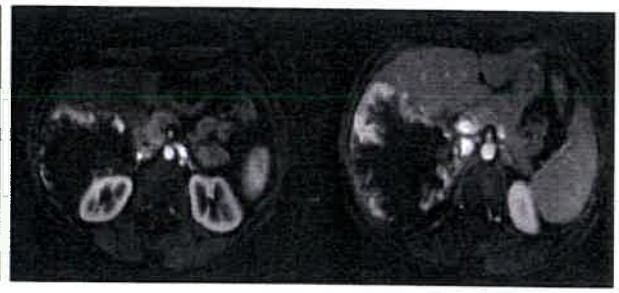
Arterial phase: peripheral nodular non continuous enhancement → venous phase: centripetal filling in Matches blood pool



USG – hyperechoic with posterior acoustic enhancement

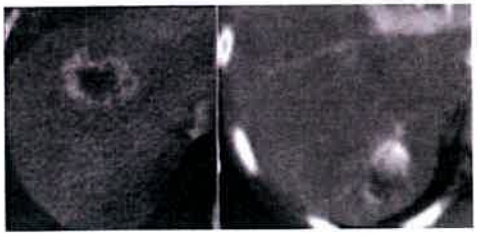


T2W – light bulb sign

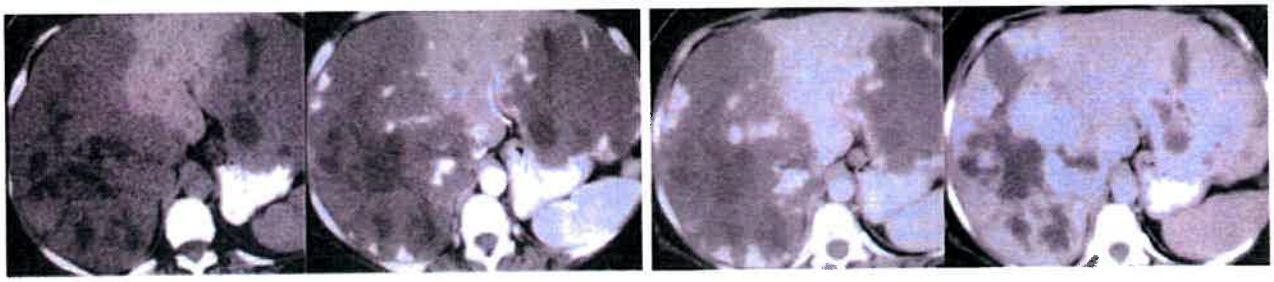


DWI – T2 shine through

- Hemangioma –
  - Most common primary liver tumor.
  - Complications – Giant hemangiomas - >10 cm
    - Rupture
    - Kasabach-Merritt syndrome – consumption coagulopathy
    - DWI – shine through
    - T2W - hyperintense
    - Hemangioma enhancement patterns:

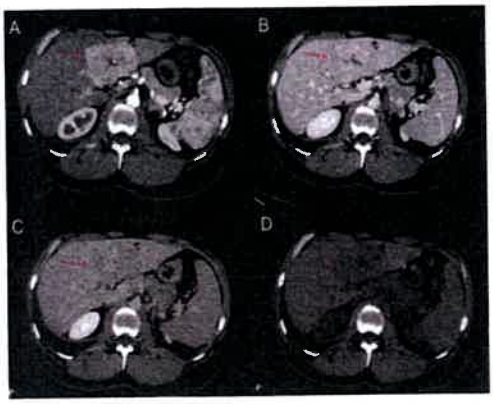


Both are arterial phase.
A- Metastasis from Ca breast
-Continuous ring/rim enhancement
B- Nodular /patchy

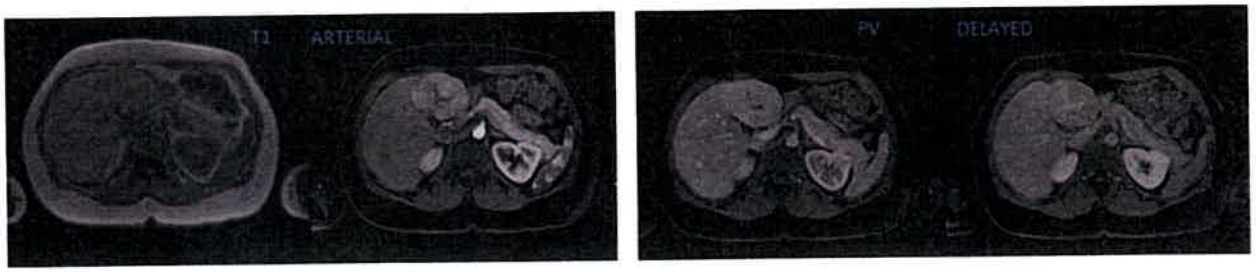


Atypical hemangioma

4) Focal nodular hyperplasia: FNH



Arterial enhancement + scar enhancement delayed

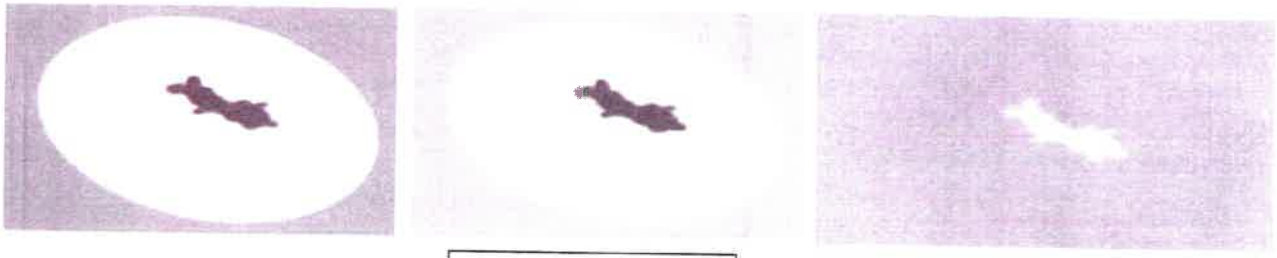


- FNH –
  - Female >> male
  - Reactive change to abnormal dystrophic vessels in central scar
  - Normal hepatocytes +
  - Solitary mass without a capsule.
  - Often beneath the surface of liver.
  - Associated with vascular abnormalities- Budd-Chiari, HHT
  - HEPATOCYTE SPECIFIC PHASE – hyperintense





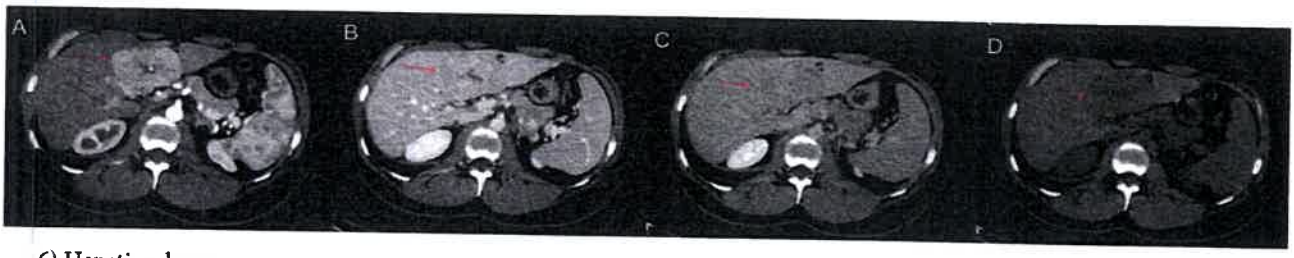
Spoke wheel pattern



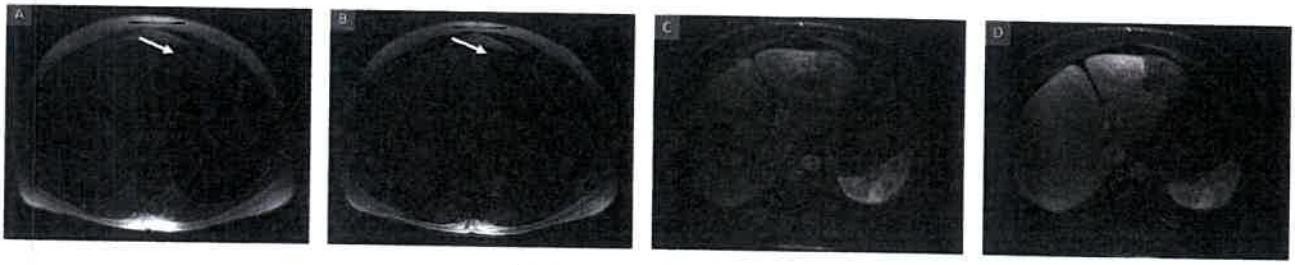
A- Arterial
B- Venous
C- Delayed

5) Fibrolamellar HCC –

- Younger age
- Normal AFP
- Central fibrous scar
- Punctate calcification 50%
- MRI: low signal scar on T1W and T2W hypointense (in contrast to FNH)
- Delayed enhancement of scar
- DD – FNH, HCC with scar



6) Hepatic adenoma

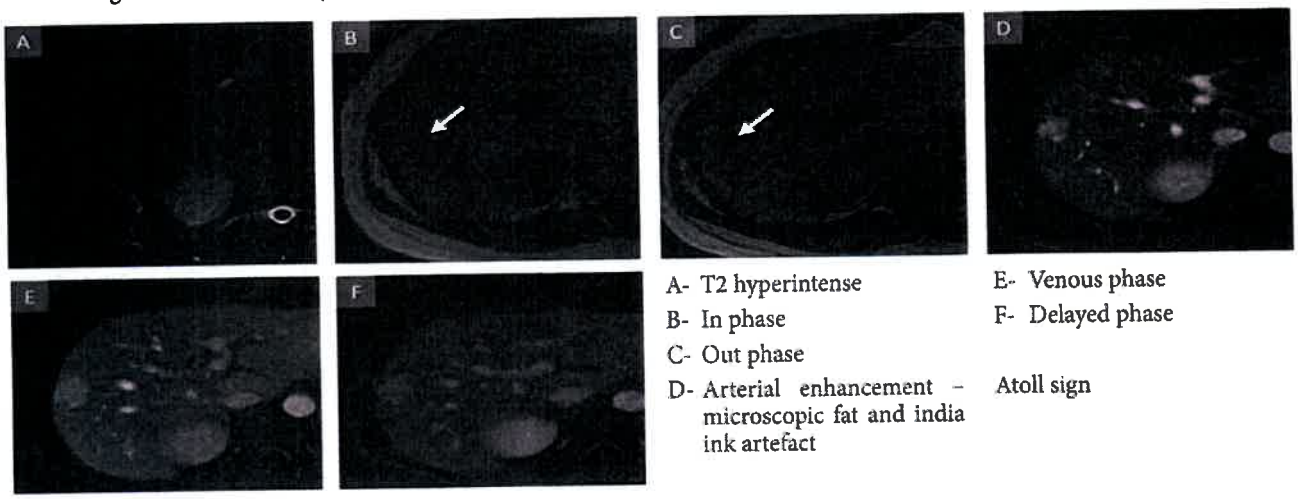


HNF1 mutated Adenoma

- Adenoma
  - Solitary (80%); Females (90%).
  - Predisposing factors - oral contraceptives, anabolic steroids, Von gierke's disease
  - Contains - fat & glycogen
  - Complications – Rupture, bleeding, necrosis
  - Malignancy in 5% cases

	Inflammatory	HNF-1 alpha mutated	B-catenin mutated	Unclassified
T1 weighted imaging	Isointense to mildly hyperintense	Isointense to hyperintense	Isointense to hyperintense	No known specific findings
T2 weighted imaging	Marked T2 hyperintense Atoll Sign: incomplete T2 hyperintense rim	Isointense to hyperintense	Poorly demarcated T2 hyperintense	
Post-contrast imaging	Arterial enhancement that persists on late phases	Variable arterial enhancement that does not persist on later phases	May mimic HCC with arterial enhancement with washout poorly demarcated scar that enhances in the portal venous phase	
			Isointense or hyperintense on hepatobiliary phase	
In-phase and out-of -phase imaging	May have focal mild signal loss	Diffuse signal loss on out- phase images	Commonly no signal loss	
Prevalence rate Risk for malignant transformation	40% - 50% of cases	30%-40% of cases have No to low risk	15%-20% of cases Up to 46%	10% 14%

- Diagnosis –Inflammatory Adenoma



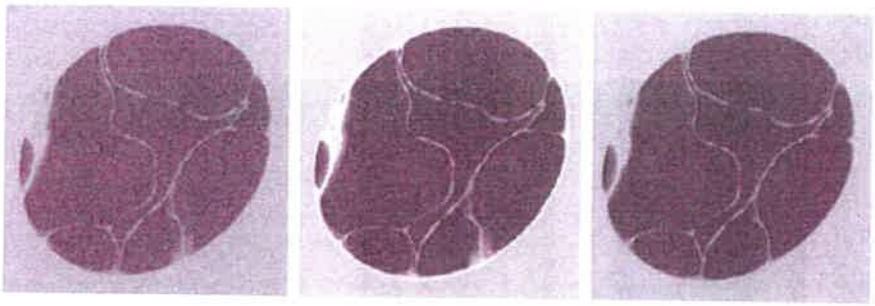
A- T2 hyperintense
B- In phase
C- Out phase
D- Arterial enhancement – microscopic fat and india ink artefact
E- Venous phase
F- Delayed phase

Atoll sign

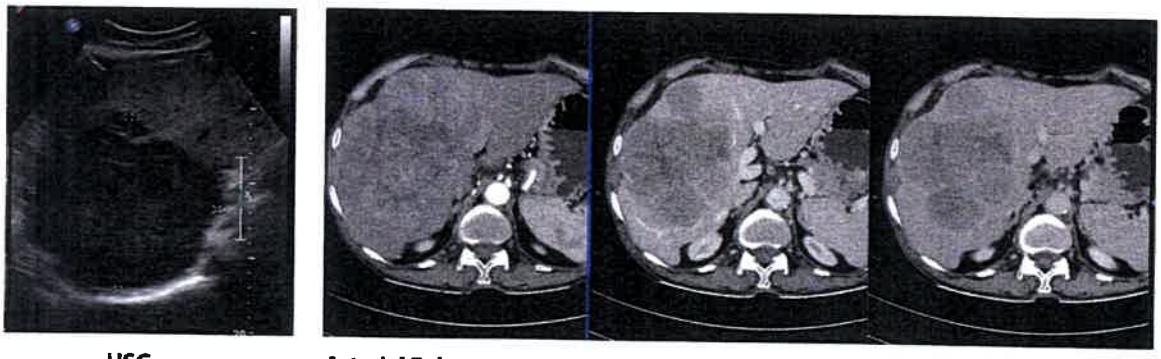
7) Biliary Cystadenoma



- Biliary cystadenoma
  - Multi locular cystic liver mass;
  - Originates from bile duct.
  - Usually right hepatic lobe.
  - Adults, Females >> males.
  - Malignant transformation to cystadenocarcinoma.

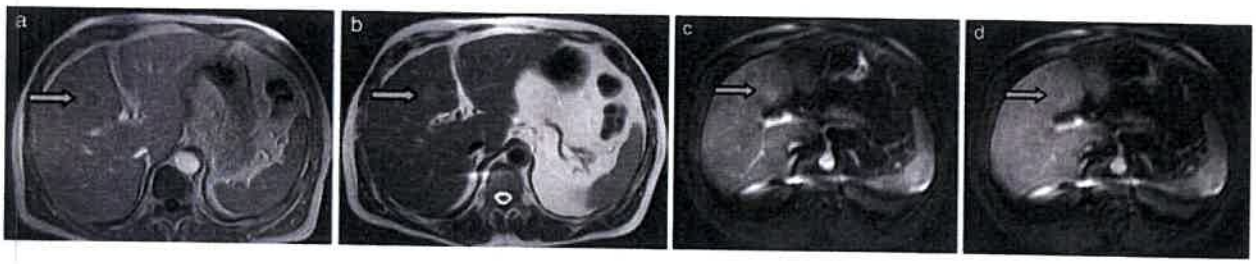


8) HCC



USG **Arterial Enhancement** **Venous Washout** **Delayed Capsule**

- Diagnosis –HCC

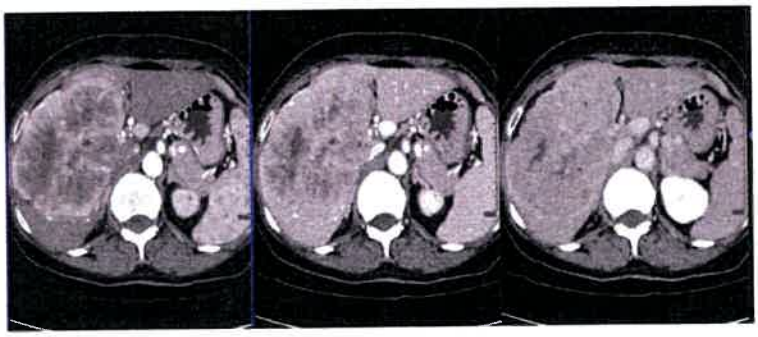


- HCC
  - AFP elevated in 30-60%
  - 3 Patterns - Solitary; multifocal, diffusely infiltrating

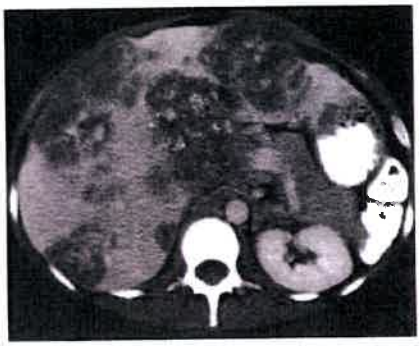


Solitary **Multifocal** **Infiltrating**

9) Mass forming intrahepatic Cholangiocarcinoma –
- 10% of all cholangiocarcinomas
- Ductal dilatation peripheral to mass
- Capsular retraction
- Peripheral arterial enhancement
- Delayed and persistent enhancement + peripheral washout
- Satellite lesions
- Peripheral Diffusion restriction

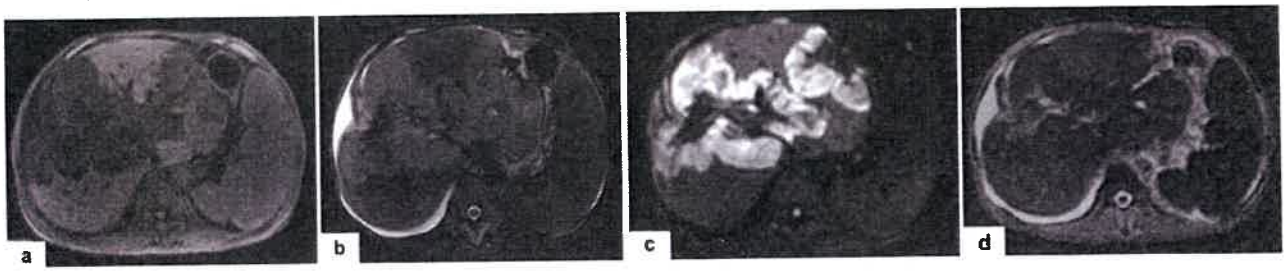


10) Hemangioendothelioma



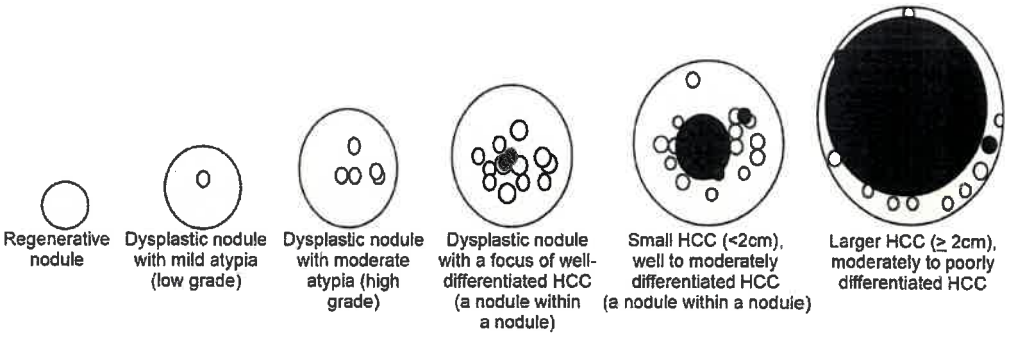
Peripheral lesion
Central supply
Lollipop appearance
Capsular retraction → pseudocirrhosis seen in Ca breast metastasis

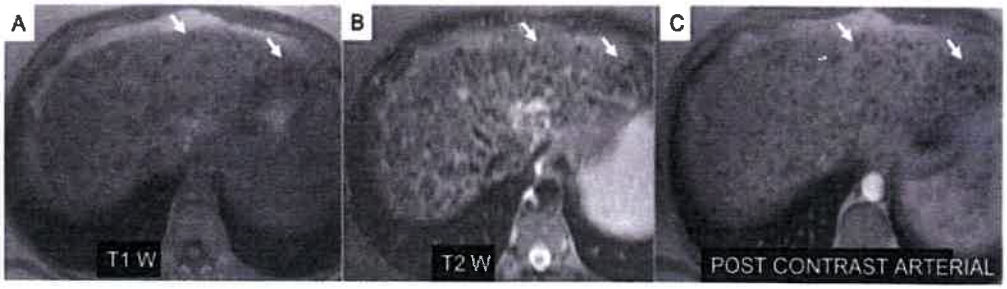
11) Lymphoma



12) Hepatocellular nodules in Cirrhosis

Lesion	T1 W image	T2 W image	Contrast enhancement pattern
Regenerative nodule	Variable	Hypointense	Enhances during portal venous phase
Dysplastic nodule	Hyperintense	Hypointense	Enhances during portal venous phase
HCC (small)	Hypointense	Hyperintense	Enhances during arterial phase
HCC (large)	Heterogeneous	Hyperintense	Enhances during arterial phase





Regenerative nodule: no enhancement

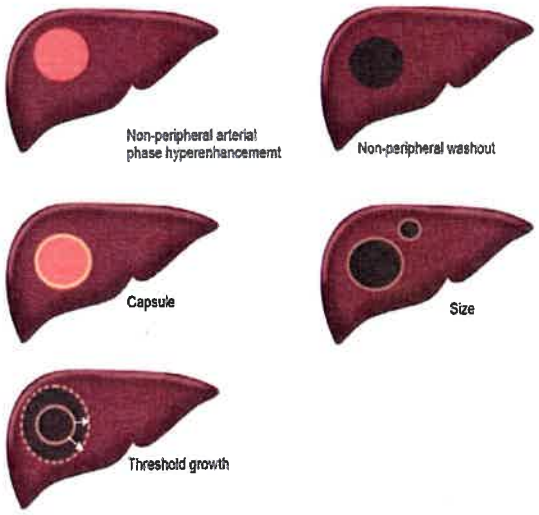
LIRADS

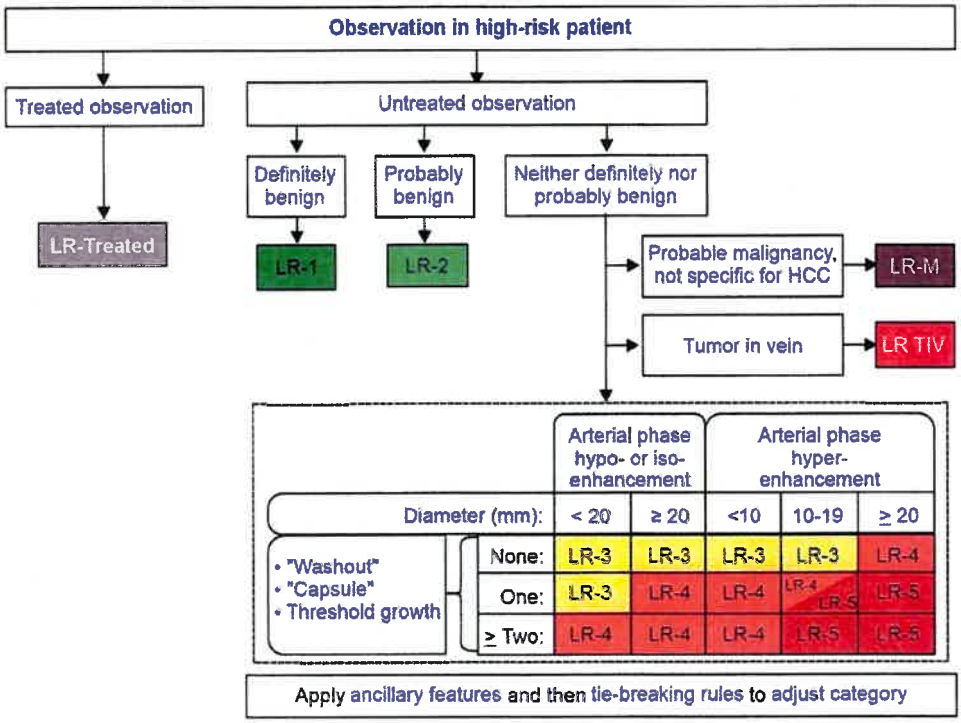
Use LI-RADS	Do not use LI-RADS
Cirrhosis **Hep B- virus** **Current or prior HCC**	< 18 years Cirrhosis due to congenital hepatic fibrosis Cirrhosis caused by vascular disorder: • Budd-Chiari • Portal vein occlusion • Diffuse nodular regenerative hyperplasia • Cardiac congestion

LR-1	Definitely benign
LR-2	Probably benign
LR-3	Intermediate probability for HCC
LR-4	Probably HCC
LR-5	Definitely HCC
LR-5V	Definitely HCC with Tumor in Vein
LR-M	probably Malignant, not specific for HCC

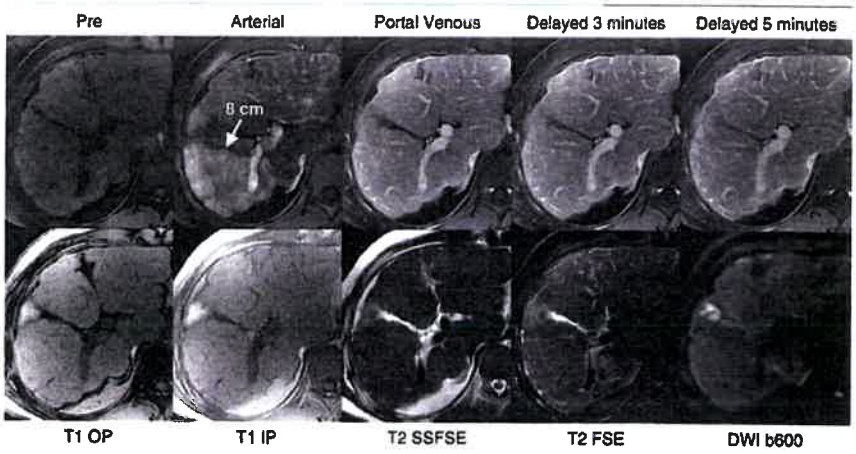
Major feature	Definition
Arterial phase hyperenhancement	Enhancement in the arterial phase that unequivocally is greater than that of liver.
Arterial phase hypo- or iso-enhancement	Enhancement in the arterial phase that is less than that or equivalent to that of liver.
Diameter	The largest dimension (outer edge to outer edge) of an observation.

Washout appearance ("washout")	Visually assessed temporal reduction in enhancement relative to liver from an earlier to a later phase resulting in portal venous phase hypoenhancement or delayed phase hypoenhancement.
Capsule appearance ("capsule")	Peripheral rim of smooth hyper-enhancement in the portal venous phase or delayed phase that unequivocally is thicker or more conspicuous than the rims surrounding background nodules.
Threshold growth	Diameter increase of a mass by a minimum of 5 mm and, depending on the time interval between examinations, by the following amounts: Time interval — Diameter increase ≤ 6 months — ≥ 50% >6 months — ≥ 100% A new ≥ 10 mm mass also represents threshold growth, regardless of the time interval. A new < 10 mm mass does not represent threshold growth.





- **51-year-old man with cirrhosis status post –liver biopsy –**

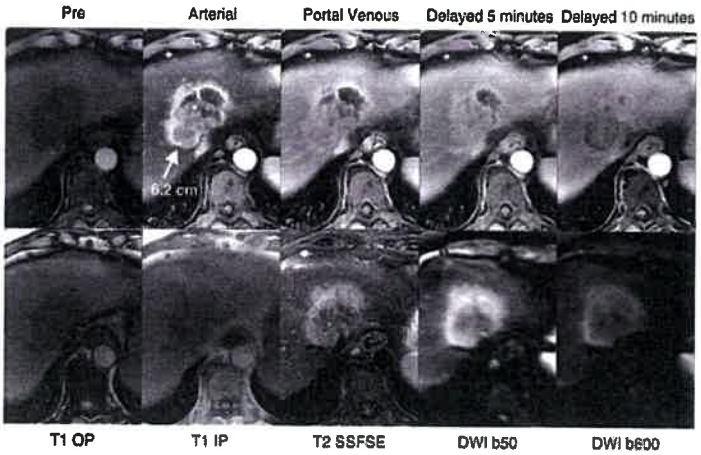


- AP fistula
- THAD – transient hepatic attenuation difference defect
- LR-1

LR -1:

Define benign entities	Probable benign entities
Cyst	Probable
Hemangioma	cyst
Vascular anomaly	Hemangioma
Perfusion alteration	Vascular anomaly
Hepatic fat deposition or sparing	Perfusion alteration
Hypertrophic pseudomass	Hepatic fat deposition or sparing
Confluent fibrosis	Hypertrophic pseudomass
Focal scar	Confluent fibrosis
Observation that spontaneously disappears at follow -up	Focal scar
	LR-2 cirrhosis-associated nodule

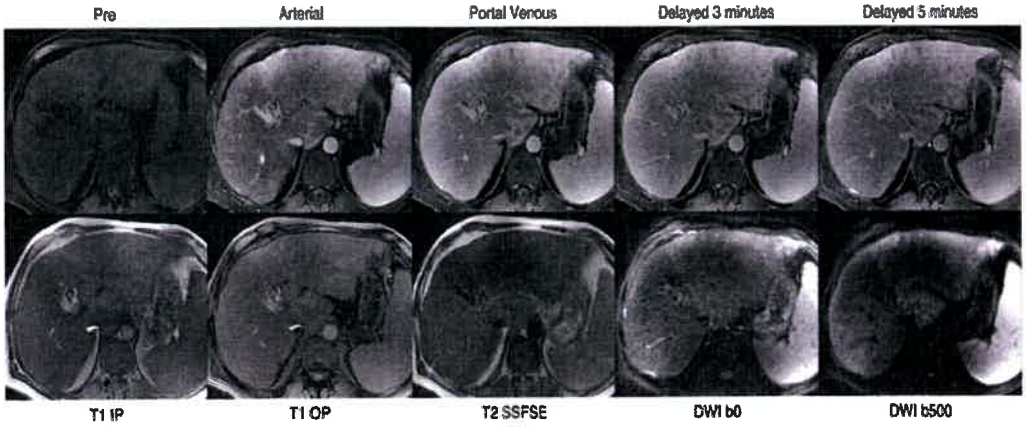
- **62 year old man with cirrhosis –**



- LR-M

- IH-CCA
- Peripheral diffusion restriction.

Favor HCC	Favor ICC
• Diffuse arterial phase hyperenhancement • Diffuse washout appearance • Capsule appearance • Distinctive rim • Intralesional fat • Nodule-in-nodule or mosaic architecture • Diffuse T 1 hyperintensity not attributable to extracellular pooling[1] • Round or oval shape	• Arterial phase peripheral rim enhancement • Peripheral washout appearance • Portal venous and delayed/transitional phase progressive concentric enhancement. • ± Markedly restricted diffusion • Target appearance at DWI • Target appearance in the hepatobiliary phase • Liver surface retraction • Biliary obstruction disproportionate to that expected based on size of mass • Lobulated shape



- LR-5

Imaging Feature Suggestive of Tumor in vein
Occluded vein with any of the following
• Moderately to markedly expanded lumen
• Ill – defined walls
• Restricted diffusion
• Contiguity with LR-5 observation
Obscured, partially visualized vein
Heterogeneous enhancement of vein not attributable to mixing artifact

13) Metastasis –

- Liver is second only to regional lymph nodes as a site for metastases
- Far more common than primary liver cancer
- Colon, stomach, pancreas, breast are common primary sites
- US: 'target' appearance, central necrosis, calcification, echogenic, predominantly cystic
- MRI: majority low signal on T1W and high signal on T2W images, signal parallels that of the spleen