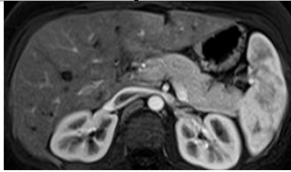


## FOCAL LIVER LESION (MALIGNANT)



**Kartik S Jhaveri, MD FRCPC**  
Professor, UoT  
Director Abdominal MRI

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## OVERVIEW

### Classification

#### HCC

#### Cholangiocarcinoma

#### Metastases

#### Other Uncommon Malignant Tumors

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## WHO CLASSIFICATION

### • Epithelial

- ☐ HCC
- ☐ Intrahepatic CCA
- ☐ BiliarcystadenoCA
- ☐ Hepatoblastoma
- ☐ Undifferentiated CA
- ☐ Combined HCC-CCA

### • Non-Epithelial

- ☐ Epithelioid haemangioendothelioma
- ☐ Angiosarcoma
- ☐ Embryonal sarcoma (undifferentiated sarcoma)
- ☐ Rhabdomyosarcoma

### • Miscellaneous

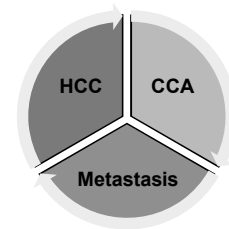
### • Hemopoietic & lymphoid tumours

### • Secondary Tumors

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## Malignant Solid Lesion

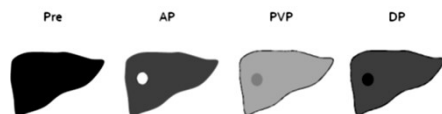


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## HCC-DIAGNOSTIC CRITERIA

- ▶ AP hyperenhancement
- ▶ Washout

No need for biopsy to confirm the diagnosis of HCC



Diagnostic criteria for HCC in high-risk patients  
AASLD practice guidelines  
Hepatology 2011;53:1020

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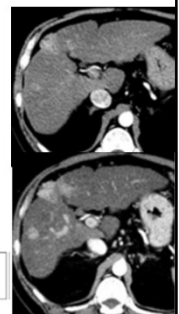
## HCC – CT TECHNIQUE

### Scan Timing for HCC: 64-slice CT

- ▶ Contrast: **2 mL/kg** (maximum of 180 mL); injection rate, 5 mL/s
- ▶ Pre
- ▶ AP: Ao 100 HU + **20 seconds**
- ▶ PVP: Ao 100 HU + **60 seconds**
- ▶ DP: 3 minutes after initiation of IV injection

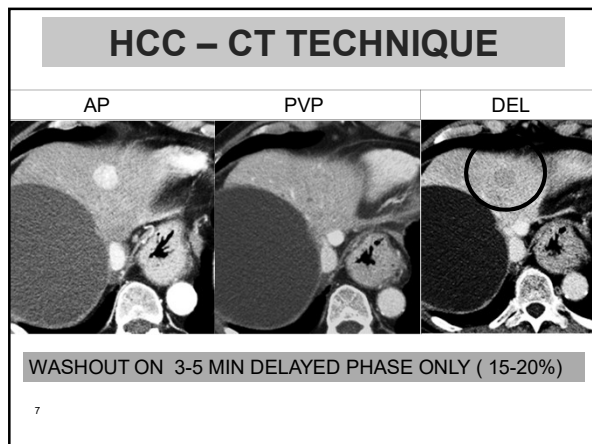
- ▶ Early AP for CTA
  - Minimal delay after Ao 180 HU
  - Contrast volume: 80-100 mL
- ▶ Late AP for HCC diagnosis
  - 20s delay after Ao 100 HU
  - Contrast volume: 2 mL/kg

Later AP acquisition  
More contrast volume

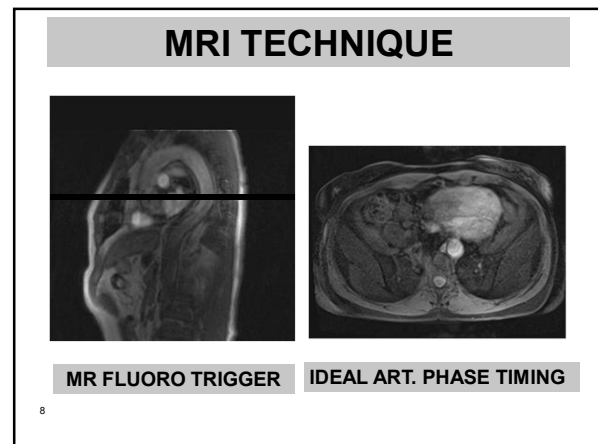


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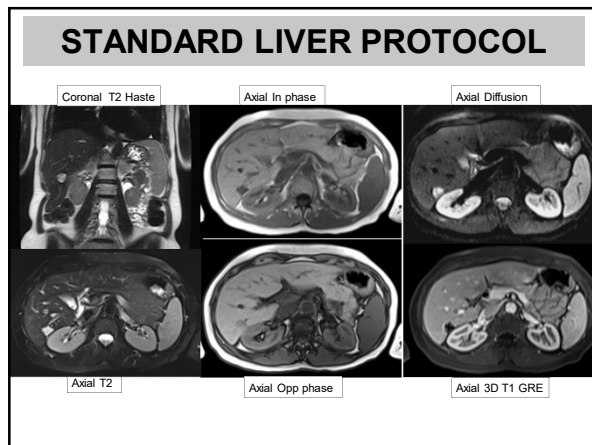
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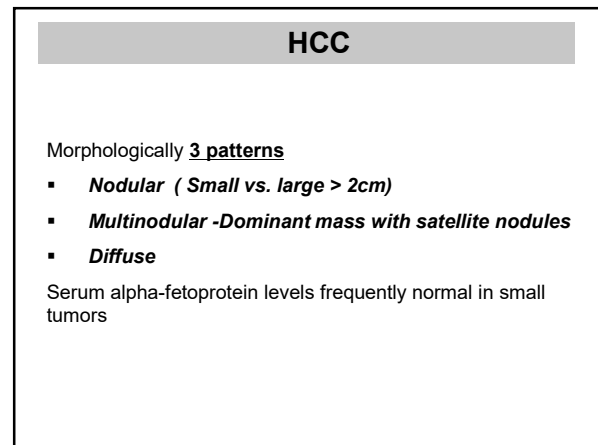
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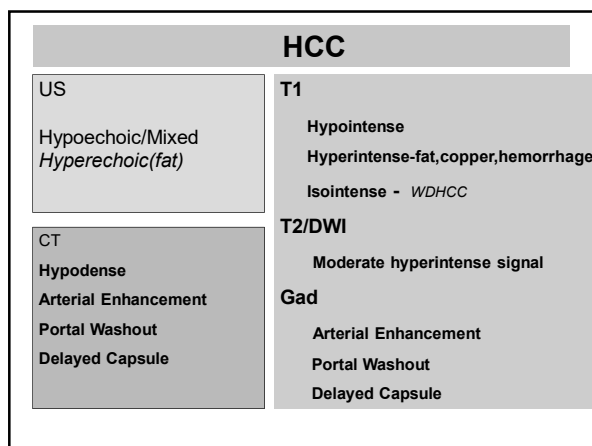
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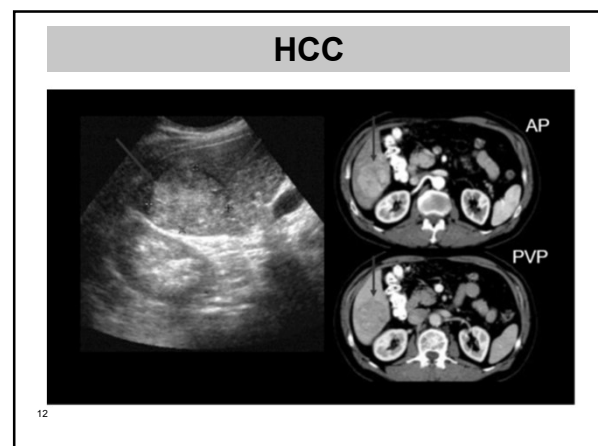
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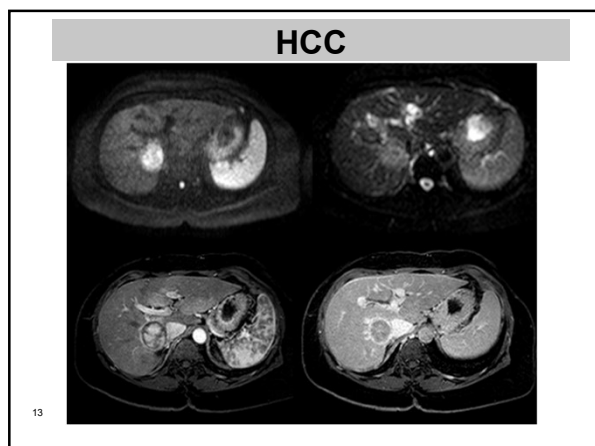
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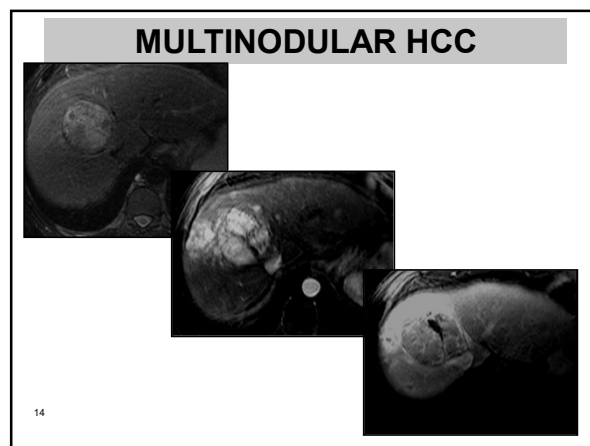
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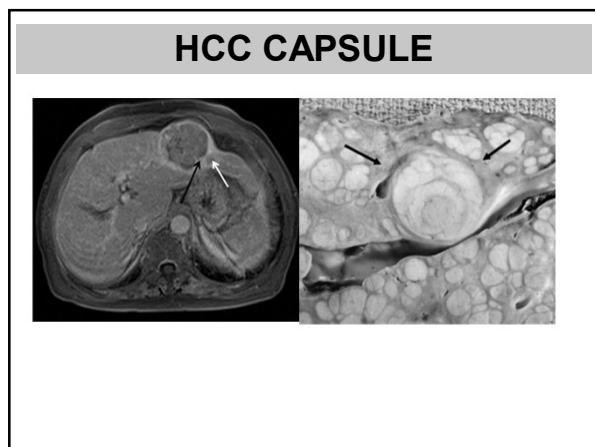
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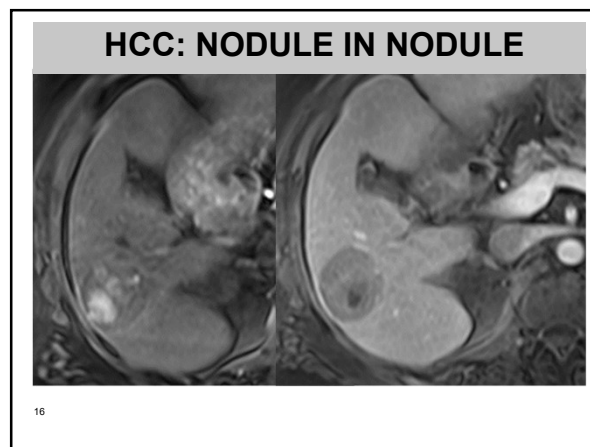
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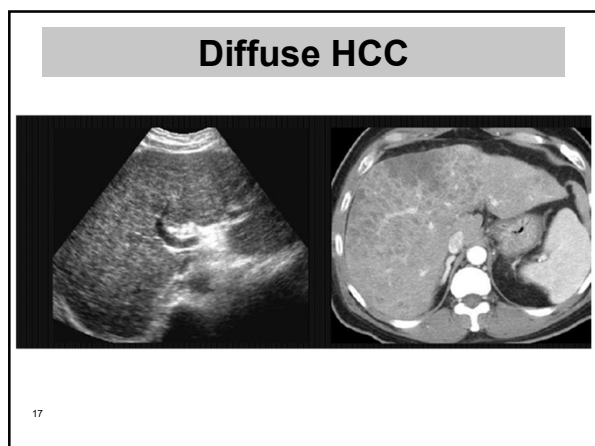
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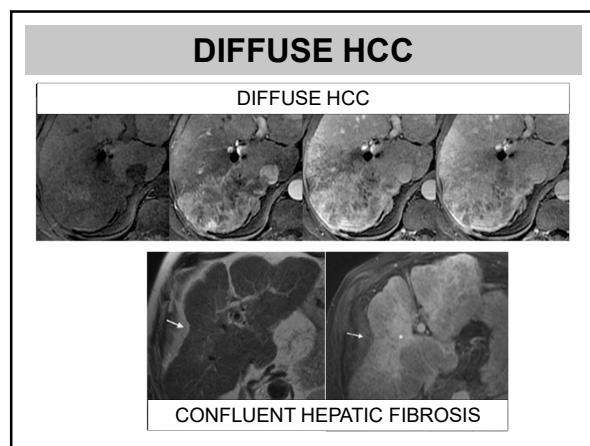
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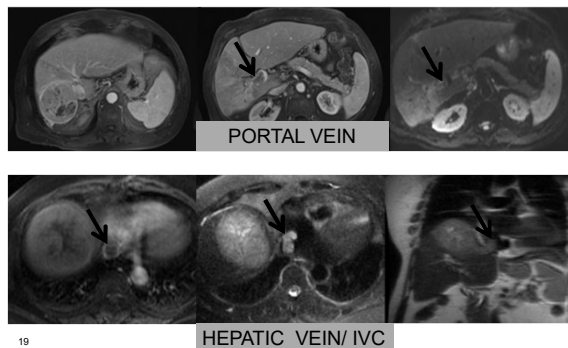


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## VENOUS INVASION



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## Challenges in Diagnosis of HCC

- **AP hyper + washout on dynamic imaging**
  - Very high specificity (> 95%)
  - Moderate sensitivity (45-65%) for small (1-2 cm) lesions
- **Atypically enhancing HCCs on CT, MRI ( 40%)**
  - HCCs not showing “arterial enhancement”
  - HCCs not showing “washout” sign
- **Differentiation between HCC and other mimickers**
  - Arterially enhancing pseudolesions/shunts
  - Other Arterially enhancing focal liver lesions

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## HCC :Strategies Beyond Vascularity

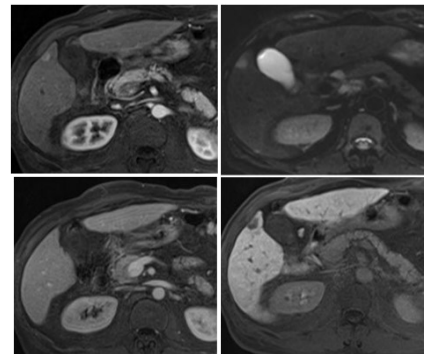
- Ancillary Morphological features: **Fat, Capsule,T2**
- Use of functional MR sequences: **DWI**
- Use of Liver specific contrast agents: **Gd-EOB-DTPA**

Kim S *Am J Roentgenol.* 2009 Jun;192(6):1675-81  
Ahn SS *Radiology.* 2010 May;255(2):459-66  
Martino MD, *Radiology* 2010 256: 806-816  
Park G, *Br J Radiol.* 2010 Dec;83(996):1010-6

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## HCC : Gd-EOB-DTPA , DWI



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## HCC : Gd-EOB-DTPA

Nakamura *JMRI* 2012  
Baek et al *Clin Radiol* 2012  
Bartolozzi C. *Abdom Imaging* 2013  
YooSH. *Ann Surg Oncol* 2013  
Bashir M et al *JMRI* 2013

META - ANALYSIS	SEN	SPEC	SROC/AUC	
Junqiang L et al . <i>JMRI</i> 2014	0.92	0.95	0.98	
Liu X et al <i>PLoS One.</i> 2013	0.91	0.95	0.978	

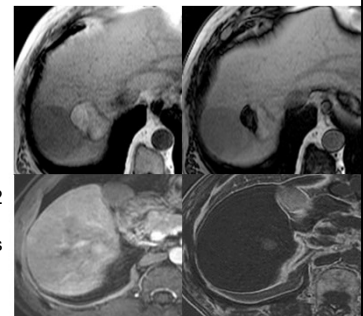
Choi et al. *Ann Surg Oncol* 2014  
More accurate BCLC staging > CT  
~93% VS 80%.

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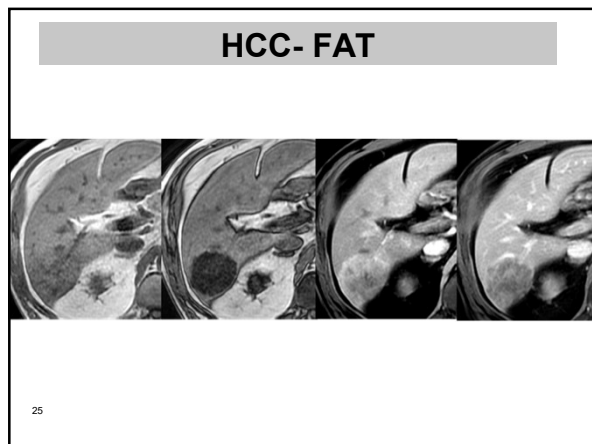
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## HCC- FAT

- Intravoxel or Bulk Fat
- Upto 20% HCC
- Fat in Nodule favors HCC (LI-RADS)
- Typically Grade 1 or 2
- Favourable Prognosis



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## FIBROLAMELLAR HCC

Younger age, No underlying liver disease

Tumor markers negative

Better prognosis

Large well circumscribed mass

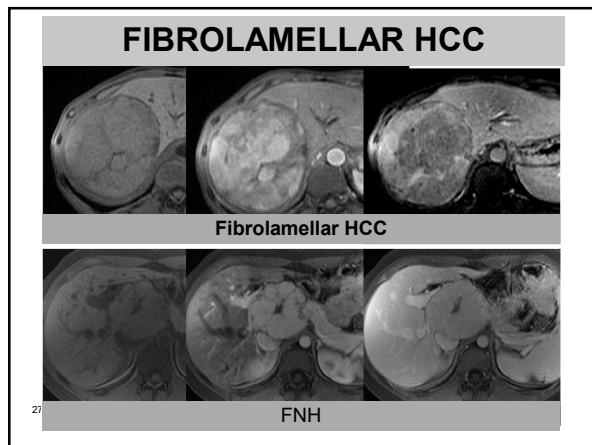
**Heterogeneous enhancement** (Compare FNH)

**Central scar Hypo on T1 and T2 with no enhancement on Gad** (Compare FNH)

**Central calcifications** in 30%-70%

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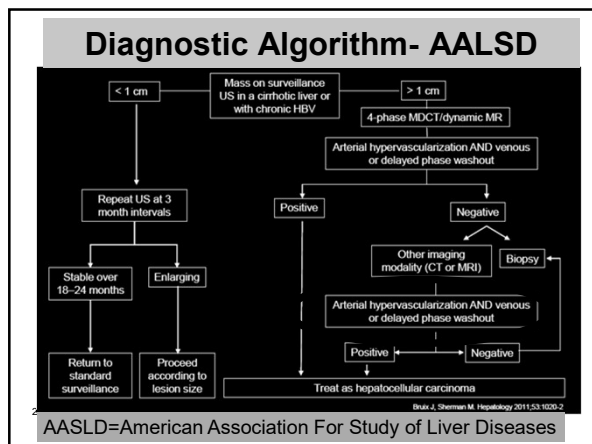
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## HCC REPORTING SYSTEMS

AASLD 2011	SVFN 2014	LI-RADS 2018
Comprehensive management system for HCC. Includes algorithm for US-based surveillance and CT-MRI based diagnosis of HCC.	GDEN policy for liver transplant candidates with HCC (in USA). Includes CT and MRI criteria for HCC to determine eligibility and priority for liver transplantation.	Comprehensive imaging diagnosis system for HCC.
Patients at risk for HCC in a surveillance program.	Patients with HCC considered for liver transplantation.	All patients at risk for HCC.
Radiologists with expertise in liver imaging.	Radiologists at liver transplantation centers.	All radiologists.
<ul style="list-style-type: none"> <li>HCC</li> <li>Indeterminate</li> <li>Benign</li> </ul>	<ul style="list-style-type: none"> <li>Benign features HCC</li> <li>Class 5A: 10-19 mm</li> <li>Class 5B: 20-50 mm</li> <li>Class 5C: &gt; 50 mm or tumor in vein</li> <li>Treated definite HCC</li> <li>Class 5T (Treated)</li> <li>Non-diagnostic exam</li> <li>Class 0</li> </ul>	<ul style="list-style-type: none"> <li>Uncertain interpretation</li> <li>LR-1: definitely benign</li> <li>LR-2: probably benign</li> <li>LR-3: intermediate probability</li> <li>LR-4: probably HCC</li> <li>LR-5: definitely HCC</li> <li>LR-5V: tumor in vein</li> <li>LR-M: probably malignant, not specific for HCC</li> <li>Treated observations: LR-Treated</li> </ul>
US for surveillance; CT and MRI with extracellular agents for diagnosis.	CT and MRI with extracellular agents.	CT, MRI with extracellular agents. Provides guidance for use of MRI with hepatobiliary agents, although these have not been validated prospectively for primary diagnosis of HCC.
<ul style="list-style-type: none"> <li>Arterial phase hyper-enhancement</li> <li>Washout appearance</li> <li>Diameter</li> </ul> <p>These features apply only to &gt; 10 mm observations detected at surveillance ultrasound</p>	<ul style="list-style-type: none"> <li>Arterial phase hyper-enhancement</li> <li>Washout appearance</li> <li>Capsule appearance</li> <li>Diameter</li> <li>Diameter increase over time</li> </ul>	<ul style="list-style-type: none"> <li>Arterial phase hyper-enhancement</li> <li>Washout appearance</li> <li>Capsule appearance</li> <li>Diameter</li> <li>Diameter increase over time</li> <li>Visibility at surveillance ultrasound</li> <li>Multiple ancillary features</li> </ul>
No	No	Yes
No	No	Yes
No	Yes	Yes
Perspective single-center European studies show that nodules > 10 mm detected by surveillance ultrasound, with arterial phase hyper-enhancement and washout, are > 90% specific for HCC.	Large prospective multi-center study in progress.	Pending
Mitchell D et al. Hepatology 2014 JULY.		

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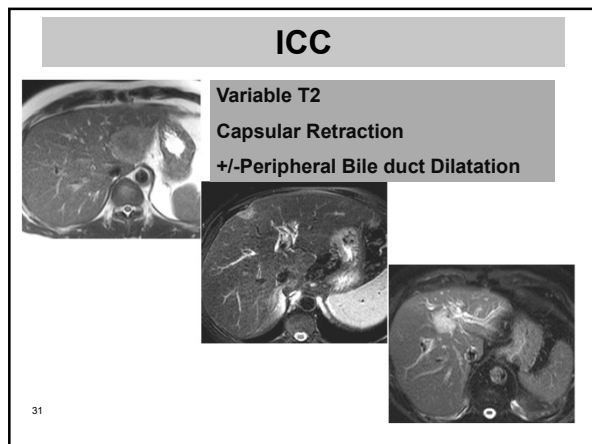
## LI-RADS CATEGORIES

LR-NC	Not categorizable (image omission or degradation)
LR-1	Definitely benign
LR-2	Probably benign
LR-3	Intermediate probability of HCC
LR-4	Probably HCC
LR-5	Definitely HCC
LR-M	Probably or def. malignant, not necessarily HCC
	Tumor in vein

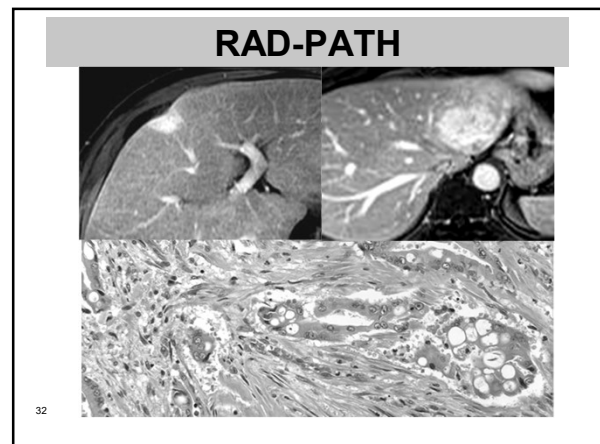
[www.acr.org/LI-RADS](http://www.acr.org/LI-RADS)

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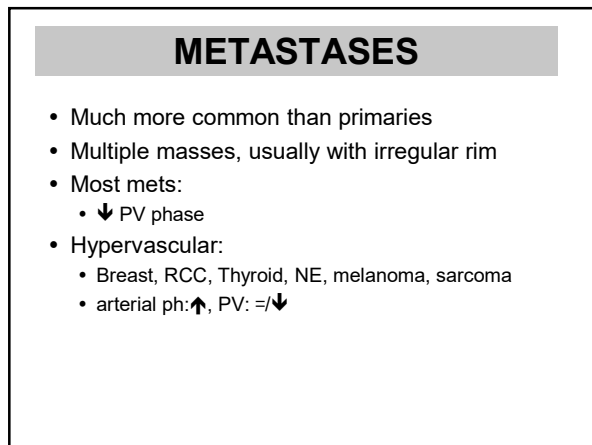
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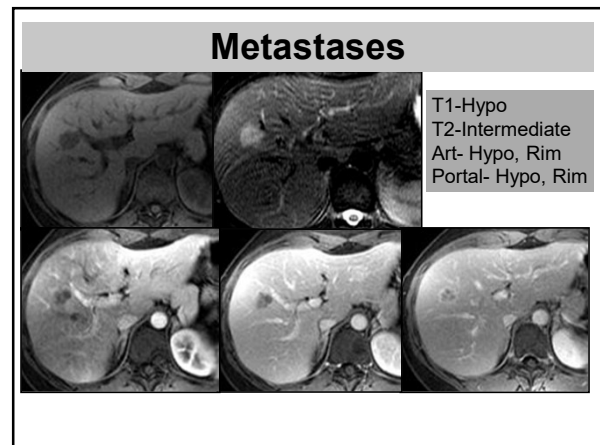
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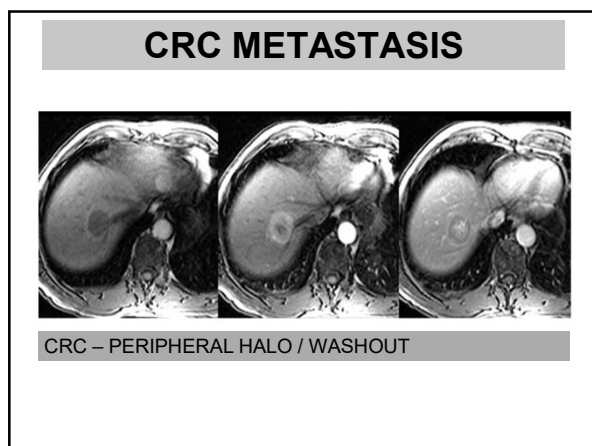
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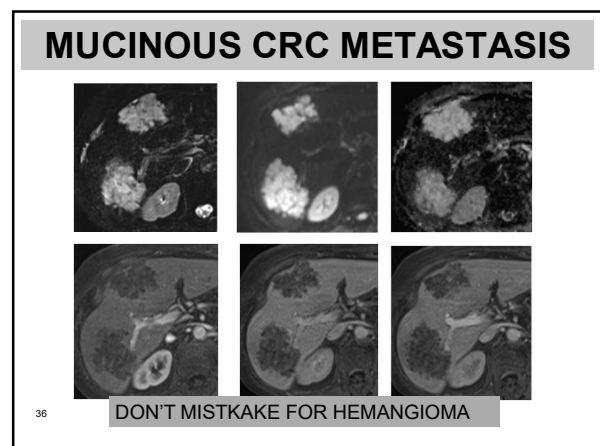
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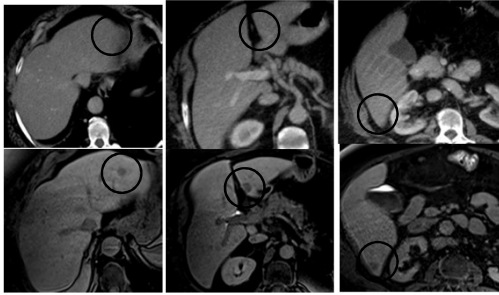


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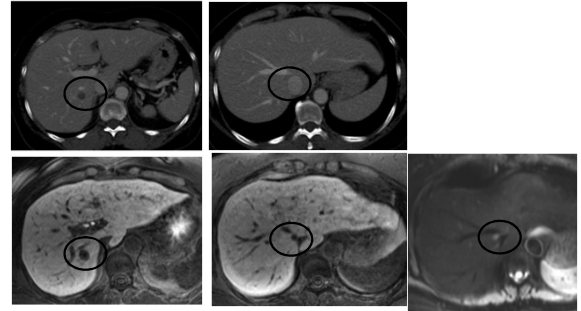
### GD-EOB-DTPA LIVER MR- Metastases



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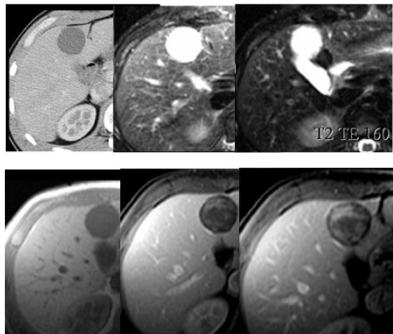
### SURGICAL PLAN - LOCATION



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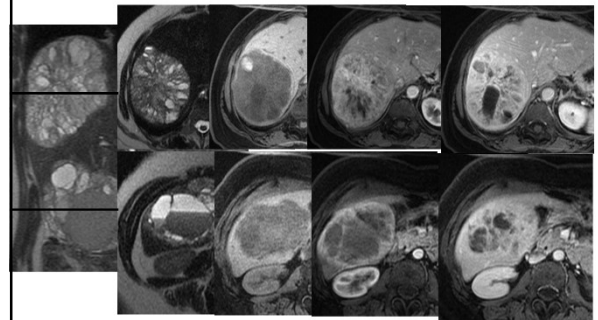
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### CYSTIC METASTASIS- SARCOMA



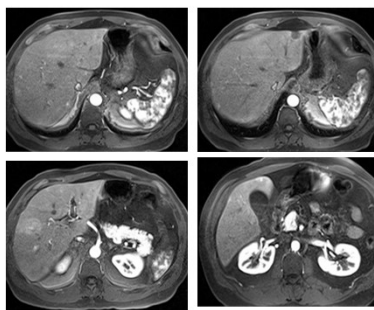
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### NEUROENDOCRINE METASTASES



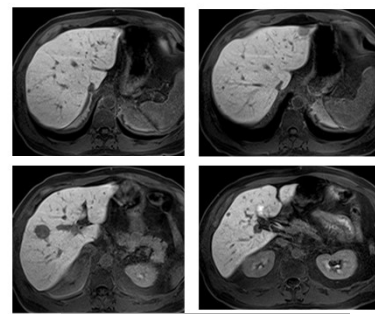
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### NEUROENDOCRINE METASTASES



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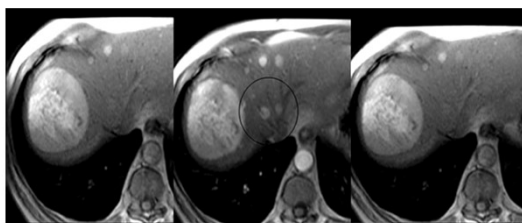
### NEUROENDOCRINE METASTASES



HEPATOBILIARY CONTRAST

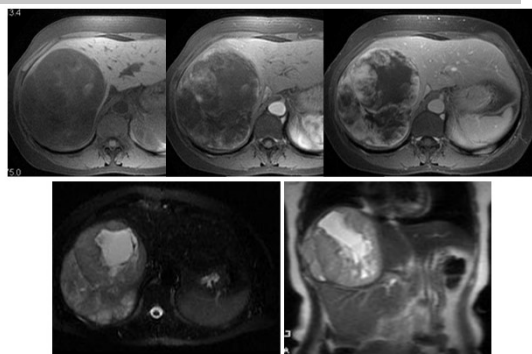
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### MELANOMA –T1 HYPERINTENSE



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### ANGIOSARCOMA



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