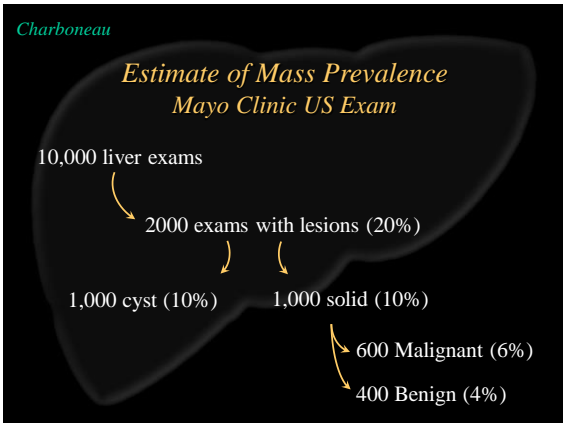
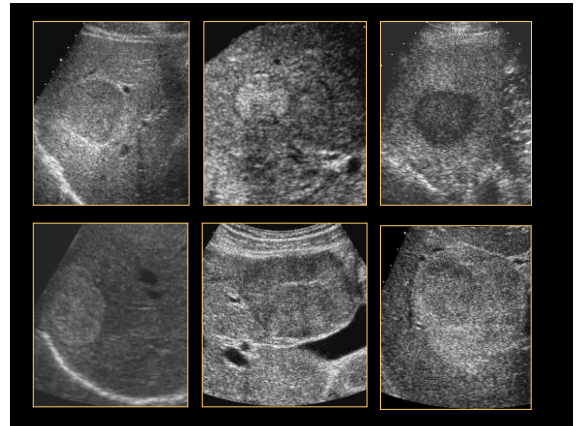


Solid Liver Masses

Mani Montazemi, RDMS
 Director of Ultrasound Education & Quality Assurance
 Baylor College of Medicine
 Division of Maternal-Fetal Medicine
 Maternal Fetal Center Imaging Manager
 Texas Children's Hospital, Pavilion for Women
 Houston Texas
 &
 Clinical Instructor
 Thomas Jefferson University Hospital - Radiology
 Department
 Philadelphia, Pennsylvania



Solid Liver Lesions

Clinically Insignificant (work-up stops)	Clinically Significant (work-up continues)
- Cavernous hemangioma	- Metastasis
- FNH	- HCC
- Focal fatty liver	- Adenoma

Represent almost 90% of all solid liver masses

In most cases you can reliably differentiate significant from insignificant by US imaging

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Liver Masses

Ultrasound features of typical hemangioma rarely overlap with appearance of metastasis, HCC or adenoma

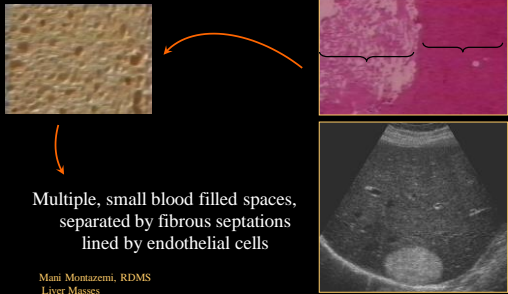
Mets HCC Adenoma

Cavernous Hemangioma

- Most common benign liver lesion
- Incidence 4 -7% at autopsy or imaging
- Asymptomatic lesion of no clinical significance
- Radiological importance
 - Differentiate from significant masses

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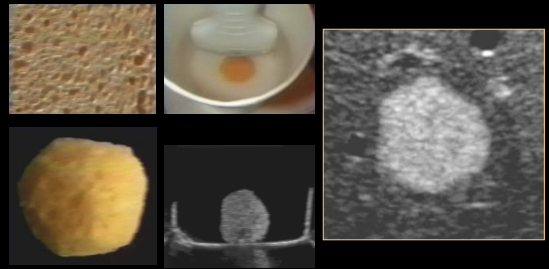
Cavernous Hemangioma



Multiple, small blood filled spaces, separated by fibrous septations lined by endothelial cells

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Cavernous Hemangioma

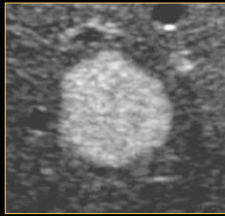


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Cavernous Hemangioma

Typical Appearance:

- Homogeneous
- Hyperechoic
- Small < 3cm
- Sharp margin, often scalloped
- Solitary
- No hypoechoic halo



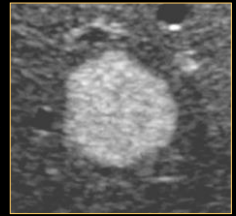
Junction of hemangioma with adjacent liver is sharp and one cell layer thick

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Cavernous Hemangioma

Typical Appearance:

- Homogeneous
- Hyperechoic
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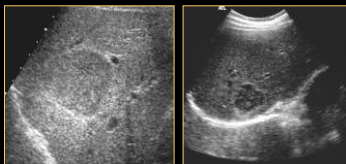
Junction of hemangioma with adjacent liver is sharp and one cell layer thick

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Uncommon Sonographic Appearance

Cavernous Hemangioma

- Echogenic rim - Due to smaller vascular spaces at outer edge of the tumor seen in pathological specimen



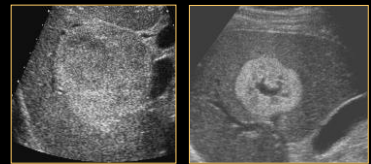
Farrell & Charboneau et al JUM 2001

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Uncommon Sonographic Appearance

Cavernous Hemangioma

- Echogenic rim - Due to smaller vascular spaces at outer edge
- Hypoechoic center - caused by collagen scar

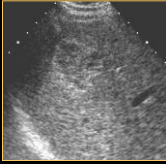


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Uncommon Sonographic Appearance

Cavernous Hemangioma

- Echogenic rim - Due to smaller vascular spaces at outer edge
- Hypochoic center - caused by collagen scar
- Lobulated border






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Uncommon Sonographic Appearance

Cavernous Hemangioma

- Echogenic rim - Due to smaller vascular spaces at outer edge
- Hypochoic center - caused by collagen scar
- Lobulated border
- Hypochoic


Moody et al Radiology 1993

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Uncommon Sonographic Appearance

Cavernous Hemangioma

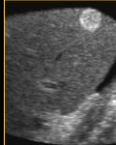

- Echogenic rim - Due to smaller vascular spaces at outer edge
- Hypochoic center - caused by collagen scar
- Lobulated border
- Hypochoic
- Posterior enhancement - non-specific



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Remember

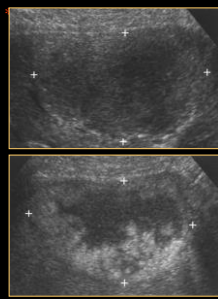
- For many hemangiomas there is no change in acoustic enhancement
- For some malignant masses there is acoustic enhancement

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Cavernous Hemangioma

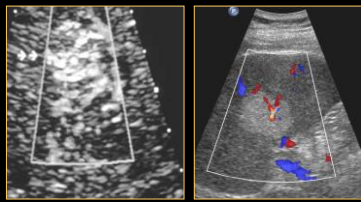
- Vascular lesions – CT / MRI
- IV contrast
 - peripheral puddling
 - gradual centripetal fill in



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Cavernous Hemangioma

- Flow is too slow to produce a Doppler shift
 - if see flow, ↑ concern for CA



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Cavernous Hemangioma

- Fibrosis
- Thrombosis
- Hemorrhage
- Necrosis



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Cavernous Hemangioma? "further evaluation CT, MR, RN, Bx"

- High risk patient
 - H/O cancer
 - Cirrhosis

Prevalence of CH



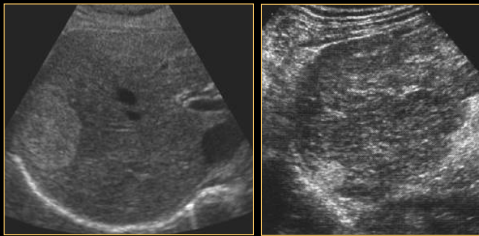
Normal liver 4-7%



Cirrhotic liver <2%

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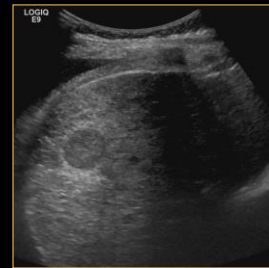
Cavernous Hemangioma? "further evaluation CT, MR, RN, Bx"



Any solid mass in a cirrhotic pt should be considered HCC until proven otherwise

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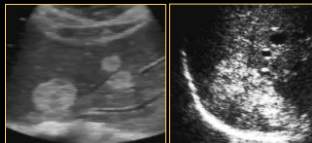
Cavernous Hemangioma? "further evaluation CT, MR, RN, Bx"



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Cavernous Hemangioma? "further evaluation CT, MR, RN, Bx"

- High risk patient
 - H/O cancer
 - Cirrhosis
- Unusual features
 - Multiple in 20% of cases
 - Large

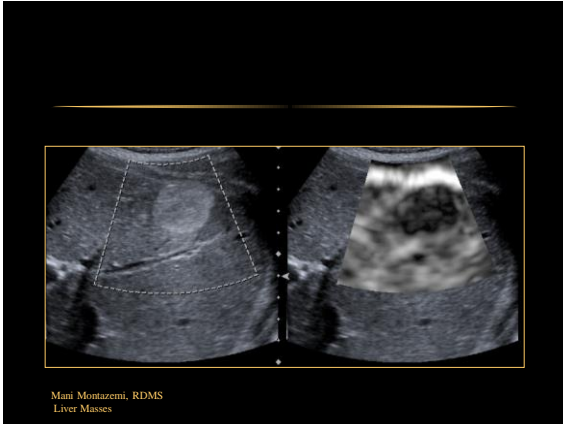


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Cavernous Hemangioma? "further evaluation CT, MR, RN, Bx"



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Simulators of Cavernous Hemangioma

- Hyperechoic, but attenuate sound
- Hyperechoic, but has hypoechoic halo

Colon
Neuroendocrine

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Hypoechoic Halo – Exception!

- Neuroendocrine metastasis
- Extremely rare
 - Neuroendocrine 1/100,000 vs. CH 4000/100,000
- Patients usually symptomatic
- Patients usually have established diagnosis
- Almost always multiple & advanced when first detected

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Benign vs. Malignant Liver Masses

- Value of hypoechoic halo (n=100)
- Halo presence – Malignant
- Halo absence – Benign
- Accuracy 87%

Wernecke et al, ACR, Nov 1992

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Increased awareness of value of halo

“You see what you look for and recognize what you know”

L.H. Garland, MD

- Higher resolution US systems

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Take Home Massage

Thin Thick

Complete Incomplete

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Causes of Hypoechoic Halo

- Histopathologically, has been shown to be caused by
 - An outer zone of proliferating malignant cells

Outer layer

"Hypoechoic"
Due to homogeneous layer of cancer cells

"Hyperechoic"
Due to heterogeneous necrosis

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Causes of Hypoechoic Halo

- Histopathologically, has been shown to be caused by
 - An outer zone of proliferating malignant cells
 - Compression of adjacent liver

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Causes of Hypoechoic Halo

- Histopathologically, has been shown to be caused by
 - An outer zone of proliferating malignant cells
 - Compression of adjacent liver
 - Vascular spaces – dilated sinusoids, or a fibrotic rim

Pulse Inversion Harmonic Imaging

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Remember

Peripheral hypoechoic halo is most evident during real-time exam

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Hypoechoic Halo

Role of Sonographer

- Document presence or absence
- Communicate to radiologist

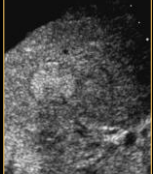

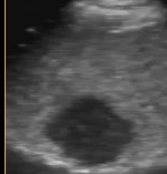
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Diagnostic Challenge

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Liver Malignancy

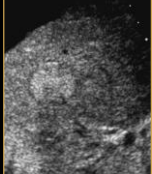

“halo visibility depends on echogenicity of tumor”

Hyperechoic Tumor	Isoechoic Tumor	Hypoechoic Tumor
		
Visible halo	Visible halo	“No” Visible halo

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Liver Malignancy


“halo visibility depends on echogenicity of tumor”

Mass With Halo	Hypoechoic Mass
	

Significant Mass
Metastasis, HCC, Adenoma, etc.

Hepatic Adenoma

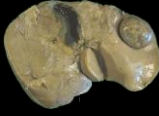
- **Rare** benign tumor
- Hepatocytes
 - few Kupffer cells
 - no bile ducts
 - no capsule



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Hepatic Adenoma


- Clinically significant
 - High association with spontaneous hemorrhage
 - Pain
 - Possible transformation to HCC
- Associated with
 - Women: BCP (dose & duration)
 - Men: anabolic steroids
 - Children: glycogen storage disease



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Hepatic Adenoma

- If small
 - Homogeneous
 - Hypoechoic



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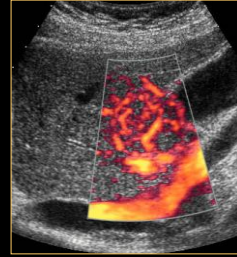
Hepatic Adenoma

- Typical appearance is similar to other significant (malignant) masses
 - Heterogeneous
 - Hypochoic
 - Peripheral halo



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Hepatic Adenoma



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Focal Nodular Hyperplasia

- Second most common benign liver tumor
- Usually occurs in females (85%)
- More commonly detected today because of early phase (arterial) contrast material on spiral CT
- Like hemangioma, it is almost always clinically insignificant - Low risk of hemorrhage

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Focal Nodular Hyperplasia

- Typically homogenous (90%), similar in echotexture to liver parenchyma (50%), No halo (70%)
 - rarely: Ca⁺⁺, cystic areas

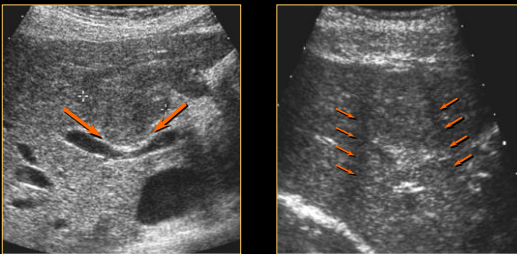


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*hard to detect
"Stealth lesions"*

Role of Sonographer

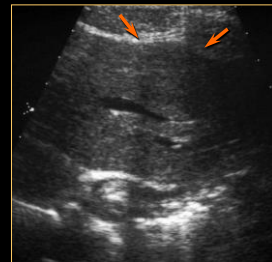
Subtle Signs of A Liver Mass



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Liver Masses

Role of Sonographer

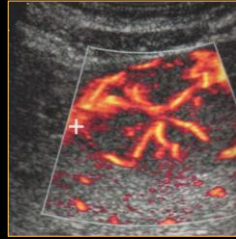
Subtle Signs of A Liver Mass



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Focal Nodular Hyperplasia

- May have a color flow pattern of vessels radiating peripherally from a central feeding artery

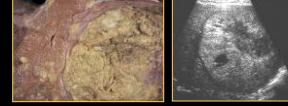


Spoke - Wheel Pattern

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Hepatocellular Carcinoma

- The most common primary malignancy of the liver
- Associated with chronic liver disease
 - Cirrhosis
 - Viral hepatitis B,C
- Major health problem in sub-Saharan Africa & Asia
 - High prevalence of hepatitis



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Liver Masses

Hepatocellular Carcinoma

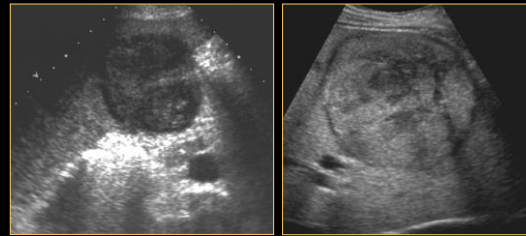
US appearance depends on:

- Size of the mass
- Pathologic features
- Echogenicity of the surrounding liver



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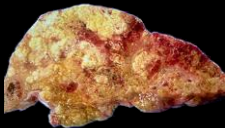
Hepatocellular Carcinoma



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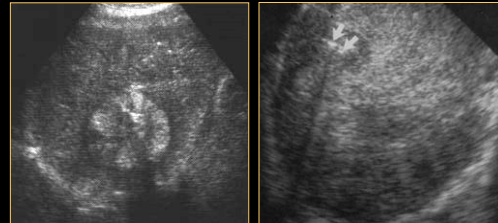
Hepatocellular Carcinoma

- Metastasis & multifocal HCC are indistinguishable



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Hepatocellular Carcinoma



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Hepatocellular Carcinoma

- Blood flow around the periphery & penetrating into the mass



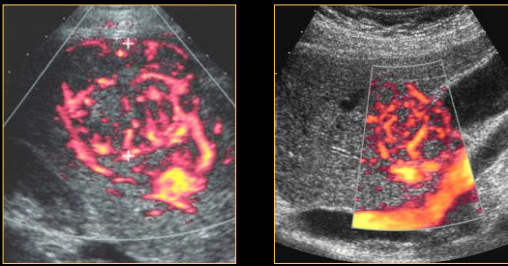
Tanaka's "basket sign"

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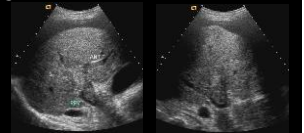
Caution



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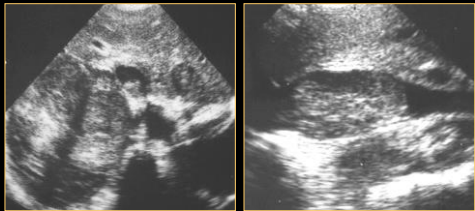
HCC – Complications

- High propensity for vascular invasion
 - PV > HV & IVC
 - Arterial-portal shunts
 - Tumor thrombus with arterial signals
- Necrosis, hemorrhage, infection



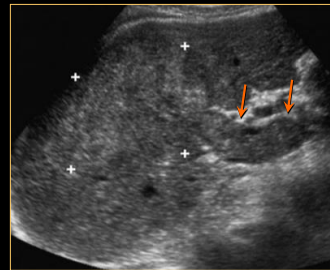
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HCC – Complications



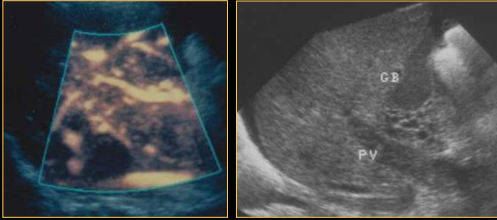
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HCC – Complications



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Tumor vs. Bland Thrombus



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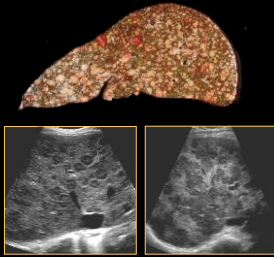
Liver Metastases

- The most common malignant liver lesion in North America
- The lungs & liver are the most frequent sites of distant metastatic disease

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Liver Metastases

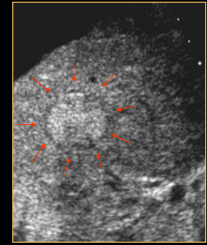
- Multiple (90%)



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Liver Metastases

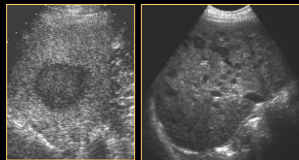
- Multiple (90%)
- Single



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Liver Metastases

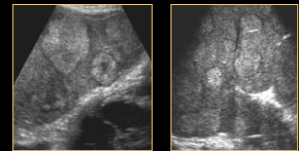
- Multiple (90%)
- Single
- Most are hypoechoic
 - Any size
 - Single / multiple



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Liver Metastases

- Multiple (90%)
- Single
- Most are hypoechoic
- Hyperechoic



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Liver Metastases

- Multiple (90%)
- Single
- Most are hypoechoic
- Hyperechoic
- Calcified



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Calcified Liver Metastases

- Colon
- Ovary
- Breast
- Stomach
- pancreas
- Melanoma
- Leiomyosarcoma
- Osteosarcoma
- Fibrolamellar HCC
- Calcified abscess & hematoma



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Liver Metastases

- Multiple (90%)
- Single
- Most are hypoechoic
- Hyperechoic or Isoechoic
- Calcified
- Target appearance



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Liver Metastases

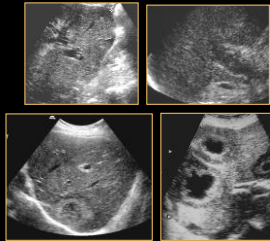
- Multiple (90%)
- Single
- Most are hypoechoic
- Hyperechoic or Isoechoic
- Calcified
- Peripheral hypoechoic halo
- Target appearance
- Diffuse parenchymal infiltration



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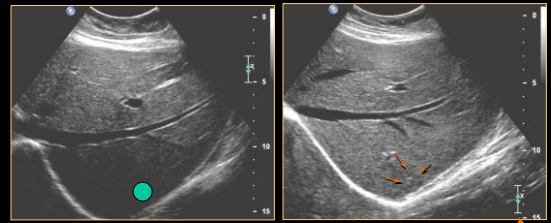
Liver Metastases – Complications

- Biliary duct obstruction
- Vascular invasion
- Necrosis
- Hemorrhage
- Infection



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Liver Masses

Scanning Techniques




Why this image is better?

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Liver Masses



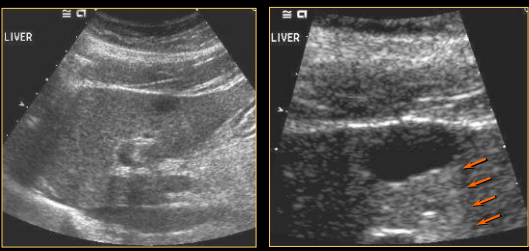
How Would You Characterize This Mass?



- A. Hypoechoic
- B. Hyperechoic
- C. Isoechoic
- D. Anechoic**
- E. Cystic
- F. Solid

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How Would You Characterize This Mass?



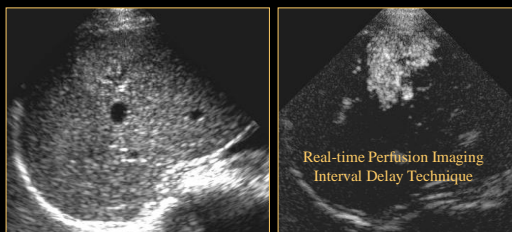
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Do you See Any Mass ?



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How About Now ?



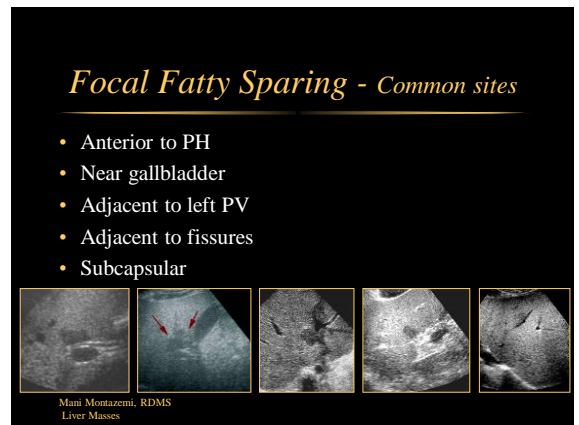
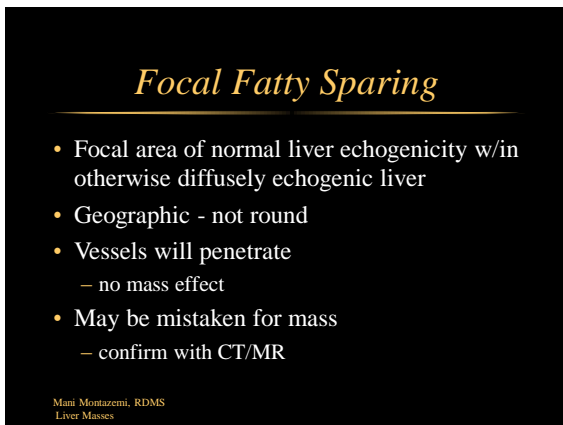
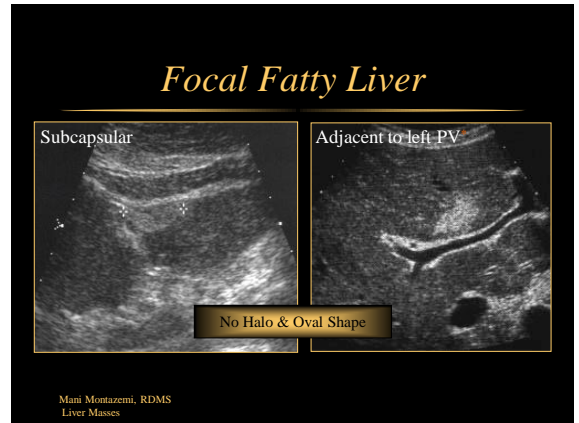
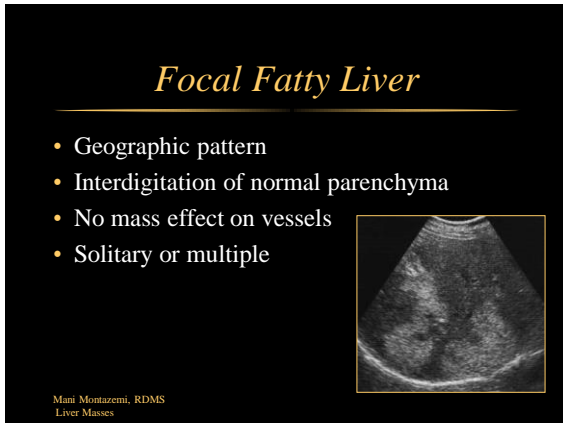
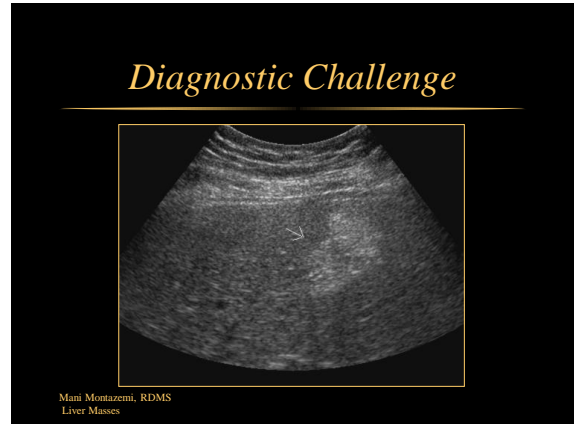
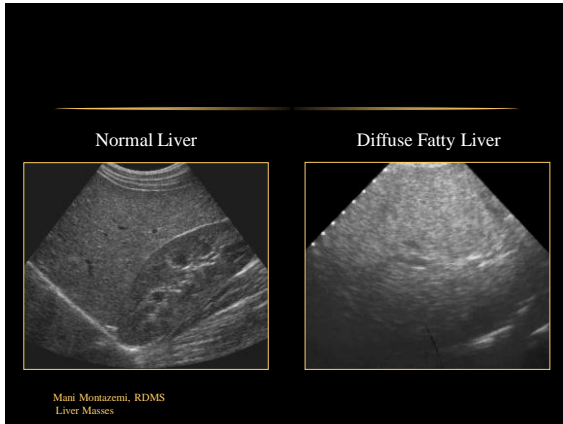
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Fatty Liver

- Common
- Predisposing conditions
 - Obesity, alcohol use, diabetes, idiopathic
- Pathology
 - Fat deposition in hepatocytes
- Diffuse or focal



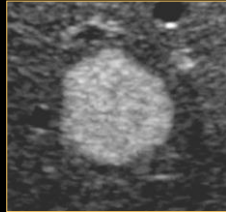
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Summary

- Most cavernous hemangiomas are reliably differentiated from significant masses

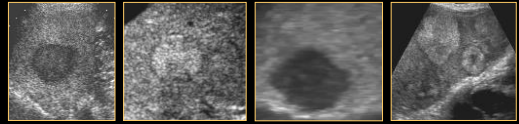
Homogeneous & Hyperechoic
Solitary, Small < 3cm
Sharp margin, often scalloped
No hypoechoic halo



Mani Montazemi, RDMS
Liver Masses

Summary

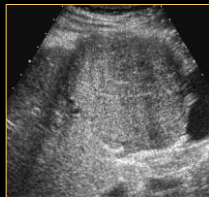
- Most significant masses
 - Have a peripheral halo
 - Hypoechoic
 - Multiple



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Summary

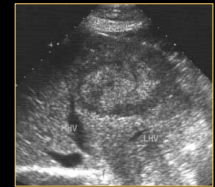
- FNH – most are
 - Homogenous, isoechoic, without halo
- ↓
- Confirmatory exam
 - CT, MR, RN, Biopsy



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Liver Masses

Summary

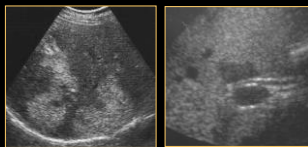
- Adenoma
 - Most appear as significant lesions and are not confused with cavernous hemangioma



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Liver Masses

Summary

- Focal Fatty – most appear as
- Hyperechoic, geographic pattern
- Hypoechoic, focal fatty sparing



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Liver Masses

Solid Liver Lesions

Clinically Insignificant (work-up stops)	Clinically Significant (work-up continues)
– Cavernous hemangioma	– Metastasis
– FNH	– HCC
– Focal fatty liver	– Adenoma

Differentiate insignificant from significant mass by ultrasound criteria

