Approach of liver mass

How should we go?

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Liver mass

Goal

- diagnosis
  (benign, malignant)
- treatment
Liver mass approach

**Diagnosis**

- clinical finding
- laboratory test
- imaging study
- liver mass biopsy
Liver mass approach

**Diagnosis**

- clinical finding
- laboratory test
- imaging study
- liver mass biopsy
Liver mass

approach

Clinical findings

history

age, sex, habitat

hepatitis B / C infection or cirrhosis

primary cancer

physical examination
Liver mass approach

**Diagnosis**

- clinical finding
- laboratory test
- imaging study
- liver mass biopsy
Liver mass approach

Laboratory test

- liver function test: alkaline phosphatase
- hepatitis B/C serology
- tumor marker: CEA, CA\text{19-9}, AFP
- special blood test: amebic titer
- indirect hemagglutination test test
<table>
<thead>
<tr>
<th>Marker/Tumor</th>
<th>Accuracy</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>+</th>
<th>-</th>
<th>Predictive Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AFP/HCC</strong></td>
<td>81.3%</td>
<td>77.2%</td>
<td>93.4%</td>
<td>97.2%</td>
<td>58.1%</td>
<td></td>
</tr>
<tr>
<td><strong>CEA/CRLM</strong></td>
<td>52.8%</td>
<td>81.2%</td>
<td>44.4%</td>
<td>30.2%</td>
<td>88.9%</td>
<td></td>
</tr>
<tr>
<td><strong>CEA/CCC</strong></td>
<td>40%</td>
<td>66.7%</td>
<td>38.9%</td>
<td>7%</td>
<td>94.4%</td>
<td></td>
</tr>
<tr>
<td><strong>CA19-9/METAS</strong></td>
<td>60.9%</td>
<td>25.6%</td>
<td>76.4%</td>
<td>32.2%</td>
<td>70.1%</td>
<td></td>
</tr>
<tr>
<td><strong>CA19-9/CCC</strong></td>
<td>80.4%</td>
<td>87.5%</td>
<td>80%</td>
<td>22.6%</td>
<td>99%</td>
<td></td>
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</tbody>
</table>

**AFP** = alphafetoprotein (0-10 ng/ml), **CEA** = carcinoembryonic antigen (0-3 ng/ml)  
**CA19-9** = 0-37 U/ml, **HCC** = hepatocellular carcinoma, **CCC** = cholangiocarcinoma,  
**CRLM** = colorectal liver metastasis
Liver mass approach

Diagnosis

- clinical finding
- laboratory test
- imaging study
- liver mass biopsy
Liver mass approach

**Imaging study**

- Ultrasonography
- CT scan (spiral dynamic)
- MRI (dynamic MRI)
- Liver scintigraphy
- Angiography
## Factor for imaging decision

<table>
<thead>
<tr>
<th>Imaging modality</th>
<th>Sensitivity</th>
<th>Invasiveness</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultrasonography</td>
<td>+++</td>
<td>0</td>
<td>+</td>
</tr>
<tr>
<td>Nuclear medicine</td>
<td>++</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>CT scan</td>
<td>++++</td>
<td>++</td>
<td>+++</td>
</tr>
<tr>
<td>MRI</td>
<td>++++</td>
<td>0</td>
<td>+++++</td>
</tr>
<tr>
<td>Angiography</td>
<td>+++</td>
<td>++++</td>
<td>+++++</td>
</tr>
</tbody>
</table>

Sensitivity = \[\text{true positive fractions} = \frac{\text{true positive}}{\text{true} + \text{false positive}}\]
## BENIGN LESIONS OF THE LIVER

### TABLE 2 -- MODALITIES FOR EVALUATION OF HEPATIC LESIONS

<table>
<thead>
<tr>
<th>Imaging Modality</th>
<th>Internal Hemorrhage or Necrosis</th>
<th>Calcifications</th>
<th>Vascularity</th>
<th>Hepatocyte Function</th>
<th>Kupffer's Cell Activity</th>
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</thead>
<tbody>
<tr>
<td>Ultrasound</td>
<td>X</td>
<td>X</td>
<td>Color Doppler</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>CT scan</td>
<td>X</td>
<td>Noncontrast</td>
<td>Optimal with three-phase examination</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>MR imaging</td>
<td>X</td>
<td>--</td>
<td>Gd-DTPA enhancement</td>
<td>MN-DPDP or Gd-BOPTA enhancement</td>
<td>Uptake of SPIO or USPIO particles</td>
</tr>
<tr>
<td>Nuclear scintigraphy</td>
<td>--</td>
<td>--</td>
<td>Tc-99m red blood cell study</td>
<td>Tc-99m IDA-derivatives</td>
<td>Tc-99m sulfur colloid study</td>
</tr>
</tbody>
</table>

Gd-DTPA = Gadopentetate dimeglumine; MN-DPDP = manganese dipyrdoxal diphosphate; Gd-BOPTA = gadolinium-benzzyloxypropionic tetraacetate; SPIO = superparamagnetic iron oxide; USPIO = ultrasmall superparamagnetic iron oxide.
Liver mass approach

Ultrasonography

- noninvasive imaging/ commonest usage
- cystic or solid lesion
- follow up size of the lesion
Cystic liver mass
Solid liver mass
Liver mass approach

**CT scan**

Spiral dynamic

( dual or triple phase: arterial, portal and delayed phase)

CT arterial portography ; small tumor 0.5 cm.
CT scan
(not spiral triple phase)
Hepatocellular carcinoma

Arterial phase

Portal phase
Arterial phase enhancement patterns of 100 focal liver lesions

<table>
<thead>
<tr>
<th>Enhancement pattern</th>
<th>HCC</th>
<th>Hemangioma</th>
<th>FNH</th>
<th>metas</th>
<th>other</th>
<th>total</th>
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<tbody>
<tr>
<td>homogeneous</td>
<td>13</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>0</td>
<td>23</td>
</tr>
<tr>
<td>abnormal internal</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>10</td>
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<tr>
<td>vessel or variegated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>peripheral puddle</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>complete ring</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>40</td>
<td>2</td>
<td>49</td>
</tr>
<tr>
<td>incomplete ring</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>no enhancement</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>total</td>
<td>31</td>
<td>9</td>
<td>5</td>
<td>53</td>
<td>2</td>
<td>100</td>
</tr>
</tbody>
</table>

1 cholangiocarcinoma, 1 abscess
abnormal internal vss.
complete ring
homogeneous
incomplete ring
Liver mass approach

MRI

cavernous hemangioma

metastatic islet cell, carcinoid, melanoma

HCC in cirrhosis

characterize cystic fluid
Cirrhotic Nodules

- RN
- Low grade DN
- High grade DN
- Borderline nodule
- Small HCC (2cm)
- Overt HCC
Current Thinking

DN is a premalignant lesion and a marker for hepatocarcinogenesis.
Cirrhotic Nodules

Find HCC !!!
Can MRI distinguish benign from malignant nodules?
<table>
<thead>
<tr>
<th></th>
<th>$T1$</th>
<th>$T2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>RN</td>
<td>hypo-iso</td>
<td>hypo-iso</td>
</tr>
<tr>
<td>DN</td>
<td>hyper</td>
<td>hypo</td>
</tr>
<tr>
<td>HCC</td>
<td>hypo-hyper</td>
<td>hyper</td>
</tr>
</tbody>
</table>

Matsui, Radiology 1989

Choi, AJR 1993
Dysplastic Nodule

T1: hyper

T2: hypo
HCC

T1: hypo

T2: hyper
## Cirrhotic Nodules: Current

<table>
<thead>
<tr>
<th>$T1$</th>
<th>$T2$</th>
<th>Type</th>
<th>$Dx$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypo</td>
<td>Hypo</td>
<td>B</td>
<td>RN/DN</td>
</tr>
<tr>
<td>Hyper</td>
<td>Hypo</td>
<td>B – M</td>
<td>RN,DN,HCC</td>
</tr>
<tr>
<td>Any</td>
<td>Hyper</td>
<td>M</td>
<td>HCC</td>
</tr>
</tbody>
</table>

Glenn et al, Radiology 2001

Earls et al, Radiology 1996
MRI - focal nodular hyperplasia (FNH)
Liver mass approach

**Liver scintigraphy**

- Size of mass < 2-2.5 cm
- $^{99m}$Tc sulfur colloid scan: FNH
- Radiolabeled RBC scan: Cavernous hemangioma
Liver mass approach

**Angiography**

- rarely used in diagnosis
- preoperative evaluation for hepatectomy
- transarterial chemoembolization
Liver mass approach

Diagnosis

- clinical finding
- laboratory test
- imaging study
- liver mass biopsy
Liver mass approach

Liver mass biopsy

invasive

complication: seeding tumor

(Takamori, et al 5.1%-HCC)

well diff. HCC-adenoma-FNH-normal liver cell

Torzilli et al: accuracy of preoperative data

(clinical, tumor marker, imaging)
<table>
<thead>
<tr>
<th>Type of tumor</th>
<th>accuracy</th>
<th>sensitivity</th>
<th>specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HCC</strong></td>
<td>99.0%</td>
<td>100%</td>
<td>98.9%</td>
</tr>
<tr>
<td><strong>CCC</strong></td>
<td>99.6%</td>
<td>100%</td>
<td>99.5%</td>
</tr>
<tr>
<td><strong>Metastasis</strong></td>
<td>99.1%</td>
<td>100%</td>
<td>98.8%</td>
</tr>
<tr>
<td><strong>Benign liver tumor</strong></td>
<td>98.7%</td>
<td>57.1%</td>
<td>100%</td>
</tr>
</tbody>
</table>
Liver mass approach

Liver mass biopsy

unfit patient

alternative treatment
Liver abscess
Liver mass approach

- **Phase I**: preliminary diagnosis
- **Phase II**: advanced imaging and special laboratory
- **Phase III**: invasive study
- **Phase IV**: treatment plan
Liver mass approach

- **Phase I**: preliminary diagnosis
- **Phase II**: advanced imaging and special laboratory
- **Phase III**: invasive study
- **Phase IV**: treatment plan
Liver mass approach

**Phase I**: preliminary diagnosis

( clinical, laboratory, basic imaging)

- suspect benign
  - cyst
- questionable
  - solid tumor
- suspect malignant
  - HCC, CCC, CRLM
Simple cyst
Ruptured HCC
Liver mass approach

- **Phase I**: preliminary diagnosis
- **Phase II**: advanced imaging and special laboratory
- **Phase III**: invasive study
- **Phase IV**: treatment plan
Liver mass approach

**Phase II**: advanced imaging and special laboratory

- CT scan
- MRI
- E. histolytica titer

**Outcomes**:
- Benign
- Equivocal
- Malignant
Solid liver mass
Hemangioma

Plain film
Arterial phase
Venous phase
Delayed phase
Ruptured HCC - TOCE
Colorectal liver metastasis
cholangiocarcinoma
Liver mass approach

- **Phase I**: preliminary diagnosis
- **Phase II**: advanced imaging and special laboratory
- **Phase III**: invasive study
- **Phase IV**: treatment plan
Liver mass approach

**Equivocal**

( benign liver tumor, cystic tumor, rare malignant tumor)

*phase III*: invasive study

liver mass biopsy, angiography, surgery
Hydatid cyst
Non- simple cyst
Cystic tumor of liver

septation
hemangioma
Liver mass approach

- **Phase I**: preliminary diagnosis
- **Phase II**: advanced imaging and special laboratory
- **Phase III**: invasive study
- **Phase IV**: treatment plan
Liver mass approach

Phase IV: treatment plan

- **Benign**
  - follow up
  - surgery

- **Malignant**
  - resectable
  - unresectable
Liver mass approach

Benign

Follow up: simple cyst, hemangioma

Surgery: symptomatic benign liver tumor

: adenoma : risk of bleeding and malignancy
CT scan of liver cyst
Laparoscopic unroof cyst
hemangioma
Liver mass approach

Malignant liver tumor

*Resectable*: adequate liver reserve

: patient fitness

: complete tumor removal (neuroendocrine tumor)

: no extrahepatic spread (lung metastasis)

*Unresectable*: XRT, TOCE, Chemotherapy, relieve jaundice
Hepatocellular carcinoma
Colorectal liver metastasis
Conclusion
Liver mass

Phase I: preliminary diagnosis
(clinical, lab, basic imaging)

Suspect benign
questionable
Suspect malignant

Phase II: Advanced imaging and special lab.

benign
Equivocal
malignant
Golden Pavillion