Use of Contrast-enhanced Ultrasound in Liver Patients’ Care

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Liver - blood supply -

- PV (0%)
- HA (100%)

Tumor

- PV (0%)
- HA (100%)

Liver

- PV (75%)
- HA (25%)

Graph:
- HA
- PV

Time
Microbubbles in the Liver

Rat Liver, Imagent (perfluorohexane gas with lipid shell)

CEUS in the USA: Radiology

• No FDA approved US contrast agent for radiological applications

• UCSD: 1998~ off label use
  • It is legal to bill for contrast use for widely accepted application

• More institutions using in the USA
  • Liver applications
  • Pediatrics

only USA 😞
CEUS - Advantages -

• **Safety**
  – No ionizing radiation
  – Better safety profile compared to CT and MR contrast agent
  – No risk of nephrotoxicity, permitting safe use in patients with renal insufficiency

• **Easy Accessibility**
  – Can be portable
  – No anesthesia or sedation
  – More available
  – Lower cost

• **Imaging advantages**
  – Real time imaging: high temporal resolution
  – Superior spatial and contrast resolution
  – Pure intravascular agent
  – Can repeat injections
CEUS Liver Applications

- Tumor Imaging
  - Characterization
  - Tumor detection: screening
  - Assessment of treatment efficacy (ablation, chemoembolization, chemotherapy, radiation)

- Vascular Imaging
  - TIPS (transjugular intrahepatic porto-systemic shunt)
  - post OLT (orthotopic liver transplantation)
    HAT, PV patency

- Trauma/liver laceration
Hemangioma: MRI

- T2 w
- T1 w Pre
- Gd 1st pass
- Gd 2nd pass
- Gd 3rd pass
- delay
FNH: MRI
Focal Nodular Hyperplasia: Benign Liver Tumor

Pre  AP  PVP  EqP
FNH: CEUS
FNH: CEUS
MIP
maximum intensity projection
HCC: Hepatocellular Carcinoma

Gd enhanced MRI AP

CEUS

AP

PVP

delay
Metastasis: Colorectal Cancer
48 yo female, s/p OLT 2 weeks ago, suspected HAT

HAT: hepatic artery thrombosis
PVT (portal venous thrombus)

52 yo man with HCV/EtOH cirrhosis, with PVT
PVT: Tumor Thrombus
21 y.o. male with metastatic liver tumors-nasopharyngeal carcinoma-
Radiofrequency Ablation

21 y.o. male with metastatic liver tumors
-nasopharyngeal carcinoma-
Post Ablation

21 y.o. male with metastatic liver tumors -nasopharyngeal carcinoma-
Case

• 77 year old female with well compensated cirrhosis (EtOH) who was found to have a mass in the liver by an ultrasound at OSH
• No contrast CT was done due to chronic kidney disease, GFR ~30
• No MRI was done due to pacemaker
• Biopsy of the lesion was attempted but failed due to the location (adjacent to GB)
77 yo F, cirrhosis
4D CEUS
## Clinical Impact of CEUS

<table>
<thead>
<tr>
<th></th>
<th>Effect Description</th>
<th>Count</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>No effect</td>
<td>24</td>
<td>25%</td>
</tr>
<tr>
<td>B</td>
<td>Increased confidence</td>
<td>31</td>
<td>33%</td>
</tr>
<tr>
<td>C</td>
<td>Could have changed Mx</td>
<td>7</td>
<td>7%</td>
</tr>
<tr>
<td>D</td>
<td>Changed Dx in a minor degree</td>
<td>14</td>
<td>15%</td>
</tr>
<tr>
<td>E</td>
<td>Changed Dx in a major degrees, but did not affect management</td>
<td>1</td>
<td>1%</td>
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<tr>
<td>F</td>
<td>Changed or made the diagnosis, eliminated another test</td>
<td>10</td>
<td>11%</td>
</tr>
<tr>
<td>G</td>
<td>Changed management</td>
<td>8</td>
<td>8%</td>
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</table>

95 contrast ultrasound cases performed for clinical need @ UCSD
CEUS: Current & Future Clinical Use

• Many many advantages!
  – Safety, accessibility, imaging superiority
• Need urgent approval for Radiology applications
• More institutions have started using it off label, including pediatrics
• Future Applications
  – Molecular imaging
  – Therapeutic applications