Ultrasound Guided Procedures
Andrei Lyshchik, M.D., Ph.D.
Interventional Radiology Fellow
Department of Radiology and Radiological Sciences
Vanderbilt University Medical Center
Nashville, TN

Outline
- Background
- Technique and instrumentation
- Clinical applications
- Future developments

PRELIMINARY COMMUNICATIONS
Ultrasound-guided Liver Biopsy
J. Martin Bachman, M.D.; H. H. Hsu, M.D.; T. S. Yoo, M.D.; B. Wood, M.D.
University of Colorado Health Sciences Center
Introduction
Advances in ultrasonic technology (Sibley and Hurley, 1998; McCarthy et al., 1998) have made it possible to perform ultrasound-guided liver biopsy. We hypothesize that this method may provide a safer and more accurate alternative to the conventional needle biopsy.

Sagittal image of normal liver
Sagittal image of two liver metastasis

Current clinical applications
- Biopsy
- Fluid aspiration & drainage
- Vascular access
- Image guided treatments
- MSK applications
- Sonohysterography
Biopsy - Indications

- Focal nodules or masses anywhere
- Elevated LFT's
- Medical renal disease
- Transplant evaluation
- Lymphadenopathy

Biopsy - Indications

- In spite of the dramatic improvement in tumoral diagnosis, percutaneous biopsy continues to be widely used in oncology.
- In patients with cancer detailed information on the tumor molecular composition is important to support correct selection of an appropriate treatment.
- The performance of the biopsy is limited by several factors, among which tumor characteristics such as tumor type, size and location.

Biopsy - Technique

- A physical examination should be done before the procedure
- The pre-biopsy coagulation status should be known.
  - PT / PTT
  - PLT
- Local anesthesia / conscious sedation is indicated
- Sterile field

Biopsy - Technique

- Biopsy guide or free hand
- 22G to 25G for fine-needle aspirates
- 14G to 21G core biopsy needles
- Shortest distance/safest pathway
- Keep needle in plane of beam

Always keep needle in the same plane as the beam

Entry point and angle for a superficial lesion: Aim needle more parallel to the skin
Entry point and angle for a superficial lesion:
Aim needle more parallel to the skin

Entry point and angle for a deep lesion:
Aim needle more perpendicular to the skin

CEUS assisted biopsy
- Targeting of the needle in the vascular, viable areas of several tumors
- Avoiding necrotic / avascular areas in larger tumors or in those with frequent necrosis;
- Targeting of otherwise invisible lesions or those hardly visible (small nodules of HCC on cirrhosis, adenocarcinoma's areas in the prostate)

CEUS assisted biopsy

Image guided drainage
- Paracentesis
- Thoracentesis
- Abscess drainage
- Post-surgical collections
- Lymphocelle treatment
**Paracentesis - Indications**
- Symptomatic ascites
  - Abdominal distension
  - Abdominal discomfort
  - Shortness of breath
- Spontaneous bacterial peritonitis
- Asymptomatic ascites of unknown etiology

**Thoracentesis - Indications**
- Shortness of breath
- Question of infection
- Asymptomatic effusion of unknown etiology
- Recurrent effusions

**Technique**

**Imaging**
- Amount of ascitis
- Fluid composition
- Presence of locations
- Adjacent organs
- Vacular structures
  - Inferior epigastric vessels
  - Intercostal vessels
Vascular access

- Entry for IV therapy
- Entry for diagnostic purposes
- Entry for endovascular procedures

Complications

<table>
<thead>
<tr>
<th>Complication</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arterial puncture</td>
<td>Internal iliac: 6.3-3.4</td>
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<tr>
<td></td>
<td>Subclavian: 3.1-4.9</td>
</tr>
<tr>
<td></td>
<td>Femoral: 98.5-15.0</td>
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<tr>
<td>Hematoma</td>
<td>Internal iliac: &lt;0.1-2.2</td>
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<tr>
<td></td>
<td>Subclavian: 1.2-2.1</td>
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<tr>
<td></td>
<td>Femoral: 3.1-4.6</td>
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<tr>
<td>Hemothorax</td>
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<tr>
<td></td>
<td>0.4-0.6</td>
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<tr>
<td>Pneumothorax</td>
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<tr>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>Total</td>
<td>6.3-12.8</td>
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<tr>
<td></td>
<td>6.2-10.7</td>
</tr>
<tr>
<td></td>
<td>12.8-25.4</td>
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</tbody>
</table>

US vs. blind stick

- Overall success: 100% vs. 88.1%
- First attempt success: 78% vs. 38%
- Skin to vein time: 9.8 sec vs. 44.5 sec
- Carotid puncture: 1.7% vs. 8.3%

Image-guided Treatments

- Radiofrequency
- Liquid nitrogen (cryoablation)
- Microwave
- Laser

Radio-frequency ablation

http://www.radiologyinfo.org
Radio-frequency ablation

Illustration courtesy of Gerald D. Dodd II, MD, University of Colorado

Radio-frequency ablation

http://www.radiologyinfo.org

RFA vs. Surgery

Kudo, Oncology 2010

CEUS assisted liver RFA

Before treatment

Gallotti A. Radiol Med. 2009

CEUS assisted liver RFA

After treatment

Gallotti A. Radiol Med. 2009

CEUS assisted liver RFA

P. Ricci et al. Ultraschall in Med 2009
MSK applications

- Injections
  - Analgetics
  - Steroids
  - Stem cells
- Electrocoagulation / Cryotherapy
- Joint aspiration

Sural nerve block

Stump neuroma treatment

Hip aspiration

New imaging technology

- Multiplanar Imaging
- Multimodality Image Fusion
- Needle tracking

3D Imaging
Multiplanar imaging

Fusion Imaging

Conclusion

- Interventional sonography is an evolving and rapidly developing technology.
- It provides unique advantages of high resolution, real time guidance, lower cost. Thus, making it ideal guiding method in variety of interventional applications.

Needle tracking

Thank you!