Ultrasound-Guided Tissue Sampling: Fine Needle Aspirates & Biopsies

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Ivančić = “Even-Cheech”
Indications for US-guided tissue sampling

**Diagnostic**
- Ultrasonographic lesion detected & additional info needed
  - Focal
  - Diffuse
- Radiographic lesion amenable to sampling
  - Peripheral
- Neoplastic process that warrants staging
  - US normal/abnormal
- Biochemical abnormality associated with a specific organ
- Cholecystocentesis

**Therapeutic/Diagnostic**
- Pleural, peritoneal, or pericardial effusion
- Pyelocentesis/pyelography
- Cyst drainage
- Perinephric
- Introduction of pharmaceutical agents

Tissues to Sample

- Liver
- Spleen
- Kidneys
- Adrenals (if large enough)
- Pancreas
- Bowel mass (if thick enough)
- Lymph nodes
- Prostate
- Lung
- Mediastinal lesions
- Larynx (if mass)
- Thyroid
- Parathyroid
- Bone
- Others I have forgotten
Contraindications for FNA and/or core biopsy

- Inability to obtain acoustic window: Gas/Mineral
- For Core Biopsy: Thrombocytopenia, ↑PT/PTT
- For either procedure: A patient that can’t keep still!
- Be aware that a patient with effusion has an ↑likelihood of hemorrhage

Benefits of US-guided tissue sampling

- Real-time visualization of needle tip within tissue
- Real-time detection and characterization of blood flow in tissue of interest using color Doppler

FNA vs. Core Biopsy: Pros and Cons

<table>
<thead>
<tr>
<th>Fine Needle Aspirate</th>
<th>Core Biopsy</th>
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<tbody>
<tr>
<td><strong>PRO</strong></td>
<td><strong>PRO</strong></td>
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<tr>
<td>Minimally invasive</td>
<td>↑ information relative to FNA</td>
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<tr>
<td>Low risk of complications</td>
<td>Less invasive than sx</td>
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<tr>
<td>Cheap</td>
<td>Less expensive than sx</td>
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<tr>
<td>Quick</td>
<td></td>
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<tr>
<td>Sedation or awake</td>
<td></td>
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<tr>
<td><strong>CON</strong></td>
<td><strong>CON</strong></td>
</tr>
<tr>
<td>Limited information relative to bx</td>
<td>More invasive &amp; expensive than FNA</td>
</tr>
<tr>
<td>Architecture</td>
<td>Higher risk of complications than FNA</td>
</tr>
<tr>
<td>Fibrosis</td>
<td>Need GA</td>
</tr>
</tbody>
</table>

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Patient preparation: FNA

- Fasted
- Calm
- Motionless
  - Infer what you will

Patient preparation: Core biopsy

- Fasted
- General anesthesia
  - Propofol or inhalant gas
- BEFOREHAND...
  - Evaluate
  - Platelet count
  - PT/PTT (Prothrombin Time, Partial Thromboplastin Time)

PT/PTT
Thromboelastography (TEG)

- Tests efficiency of coagulation
- Only test that assesses clot initiation, amplification, propagation, & fibrinolysis
- Evaluates both cellular & plasma components of coag

FNA: Procedure Overview

- 22g is the perfect size
  - Smaller = low cellularity
  - Larger = more hemodilution
- 1.5" needle
  - Occasionally spinal needle
- Skin prep
  - Scrub, alcohol
- Slides available
- Pass needle through tissue
- To aspirate or not to aspirate?
- Speed
Core biopsy: Procedure Overview

- GA
- Skin prep
- Stab incision (11 blade)
- Introduction of biopsy needle
- “Throw” - needle excursion - important!
- 25g needle + saline
- Sample in cassette
- 10% formalin


Core biopsy: Procedure Overview

Proot JVIM 2006: 19% (5/26) cats with liver bx using automated device developed fatal vagotonia associated with pressure wave

http://www.emantec.com/cn/e9.asp?pageid=73

Sampling Intrathoracic Lesions

- PERIPHERAL ONLY!
- Pleural effusion helps
- Limitation: Aerated lung
- FNA 91% diagnostic, 0% complications (Reichle 2000)
Sampling Intrathoracic Lesions

- CT-guided
  - Relatively safe and useful
  - Esp with neoplasia
  - Subclinical pneumo & hemorrhage common when aerated lung penetrated
    (Zekas Vet Radiol 2005)

Sampling Osseous Lesions

- FNA
  - 75-98% diagnostic!
  - May obviate need for bx
    (Samii Vet Radiol 1999)
- Core biopsy
  - Sample entire thickness of bone
  - 100% diagnostic in recent CT study
    (Vignoli JAVMA 2004)
- US or CT-guided

A few of the papers I read for this talk
Literature Take-Home Messages

- Complications rates for core biopsies:
  - Insignificant
    - 5.6-21.9%
  - Significant
    - 1.2-6%
- FNA vs. Core Biopsy
  - Small lesions
  - Cystic lesions
  - Vascular lesions
- Tumor type & sample success
  - Round cell tumors > mesenchymal tumors

Liver
- Hepatic FNA is highly sensitive for suppurative & chronic active inflammation, but not for lymphocytic hepatitis (Weiss 2001)
- Agreement b/t cyto and histo: 30.3% - 51.2% (Wang 2004)
- Cyto from FNA and architecture info from US work in tandem

Spleen
- Cyto/Histo correlation: 61% (Ballegeer 2007)
- FNA and core biopsy can be done safely (Wilson 2011)
  - Adding bx to FNA provides complementary info
- Sampling cavitary masses typically non-diagnostic

Kidneys
- FNA often to rule in/out lymphoma
- Core biopsy to definitively diagnose renal pathology
- Complications: 13.4% dogs, 18.5% cats (Staden 2003)

Pancreas
- Can be sampled safely (Marquardt 1988, Holland 2002)
- Avoid passing through normal tissue to ↓ risk of pancreatitis

Urinary Bladder
- Seeding reported with transabdominal FNA
  - Recommend US-guided catheter placement & targeted negative pressure

Adrenal Glands
- Sampling can be performed if large
- Avoid if pheochromocytoma suspected (hyper/hypotensive crisis)
Fun with Ultrasound!

Literature Take-Home Messages

- Prostate
  - Can be sampled safely
  - Avoid urethra and sublumbar/inguinal vessels
  - Strong correlation (75% agreement) between cytology & histology for prostatic disease (Powers Vet Clin Path 2004)

- Lymph nodes
  - Very good correlation between cytology and histology in dogs (DeSwarte Vet Radiol 2011)

- Laryngeal masses
  - UF of laryngeal masses allows FNA with ↓↓ risk of hemorrhage, edema that would further ↓ lumen (Rudorf Vet Radiol 1998)

Literature Take-Home Messages: MCT

- Dogs with MCT in liver and spleen have significantly shorter survival times
- Alteration in US appearance of these organs is not a reliable predictor of MC infiltration
- Routine US-guided FNA of liver and spleen should be performed in all canine MCT patients at risk for metastasis regardless of US appearance

Book Vet Radiol 2011
Stefanello JVIM 2009
Literature Take-Home Messages: MH

- Malignant histiocytosis often causes hypoechoic nodules in liver, spleen, etc.
- However, US appearance of canine abdominal malignant histiocytosis is non-specific
- Cytology or histopathology is needed for dx

Ramirez Vet Radiol 2002

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Literature Take-Home Messages: Lymphoma

- FNA of spleen and liver in 28 dogs with confirmed lymphoma
- FNA 82-86% diagnostic
- FNA is recommended for detection of lymphoma in the spleen of dogs if the spleen is ultrasonographically abnormal
- FNA is recommended for detection of lymphoma in the liver of dogs regardless of its ultrasonographic appearance

Crabtree et al, Vet Radiol 2010

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Fun with Ultrasound!
On the horizon? Endoscopic Ultrasound

- Indications
  - Intrathoracic soft tissue lesions
  - Space-occupying lesions difficult to evaluate with AUS due to gas
  - Gaschen Vet Radiol 2003

Endoscopic Ultrasound

Abdomen
- Both pancreatic lobes
- Liver
- Lymph nodes
- Gastric wall
- Duodenum
- Colon
Other
- Intrapelvic
- Obese patients

Thorax
- Mediastinum
- Tracheobronchial LNs
- Esophagus
- Pulmonary lesions

CT-guided tissue sampling

- Peripheral thoracic lesions
- Osseous lesions

Useful whenever mineral or gas preclude US
Speaking of CT (and MRI)...

- Food for thought:
- Why not image patients at an institution where "everything could be done all at once" - ?
- Two important reasons:

Dispelling Myths

- "They can rush right into surgery following the scan"

Dispelling Myths

- MOST OF THE TIME, THIS IS NOT WHAT YOU WANT
  - Can be hundreds, sometimes thousands of images to evaluate
  - Assuming patient is stable,
    - Want someone to pore over the images
    - Want someone to consult with fellow radiologists
  - Hence:
Point Two

- Currently conducting cross-sectional imaging off-site
- No one else in San Diego county is using:
  - 64 slice CT
  - 1.5 Tesla MRI
- What does that mean?
  - Speed
  - Image Quality

Questions?

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