ULTRASOUND-GUIDED FNA BIOPSY

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Agenda

- Review 2015 ATA and 2016 AACE guidelines for UGFNA of thyroid nodule
- Review techniques and tips used for thyroid nodule FNA
- Demonstrate common slide preparation methods
- View videos of FNA procedures
Which Nodules Should Undergo Biopsy?

Guideline Recommendations
<table>
<thead>
<tr>
<th>Sonographic Pattern</th>
<th>Estimated malignancy risk</th>
<th>FNA size cutoff</th>
<th>Strength of rec</th>
<th>Quality of evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>High suspicion</td>
<td>&gt;70-90%</td>
<td>≥ 1 cm</td>
<td>Strong</td>
<td>Moderate</td>
</tr>
<tr>
<td>Intermediate suspicion</td>
<td>10-20%</td>
<td>≥ 1 cm</td>
<td>Strong</td>
<td>Low</td>
</tr>
<tr>
<td>Low suspicion</td>
<td>5-10%</td>
<td>≥ 1.5 cm</td>
<td>Weak</td>
<td>Low</td>
</tr>
<tr>
<td>Very low suspicion</td>
<td>&lt; 3%</td>
<td>≥ 2 cm</td>
<td>Weak</td>
<td>Moderate</td>
</tr>
<tr>
<td>Benign</td>
<td>&lt; 1%</td>
<td>No biopsy</td>
<td>Strong</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

One option is surveillance

FNA is not recommended for nodules that do not meet the above criteria, including all nodules < 1 cm

Haugen et al. Thyroid; January 2016
AACE 2016 Nodule Guidelines

Fig. 1. Indications for FNA biopsy according to US findings. Suspicious US findings are markedly hypoechoic nodule, intranodular microcalcifications, more-tall-than-wide shape, and spiculated or lobulated margins. FNA = fine-needle aspiration; US = ultrasonography.
<table>
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<tr>
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<th>Estimated malignancy risk</th>
<th>FNA size cutoff</th>
<th>AACE Level of Evidence</th>
<th>AACE Strength of Rec</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Risk US</td>
<td>50-90%</td>
<td>≥ 1 cm</td>
<td>2</td>
<td>A</td>
</tr>
<tr>
<td>Intermediate Risk US</td>
<td>5-15%</td>
<td>≥ 2 cm</td>
<td>2</td>
<td>A</td>
</tr>
<tr>
<td>Low Risk US</td>
<td>&lt;1%</td>
<td>≥ 2 cm or growing</td>
<td>2</td>
<td>A</td>
</tr>
</tbody>
</table>
Utility of Ultrasound in FNA
Goals of FNA

- Obtain an Adequate Specimen
- Sample the Area of Concern
- Provide Good Material for the Cytopathologist
- Minimize Patient Discomfort
- Make the Right Diagnosis!
Diagnostic Shortcomings

- Inability to assess capsular and vascular invasion with a cytological specimen
- Difficulties with predominantly cystic, highly vascular and calcified nodules
- Inconsistent expertise in interpretation as well as classification
- Poor sampling and improper slide making
Value of Ultrasound Prior to FNA

- Record the size and volume of the nodule
- Record nodule’s ultrasound characteristics
- Selection of needle size and length
- Selection of most suspicious nodules in MNG
- Detect other areas of suspicion
  - Lymph nodes, parathyroid adenoma, etc
- Determine if UG FNA is needed
Preparation

- Explanation of the procedure
- Proper patient position
- Room set-up
- Anti-septic – alcohol, betadine
- Anesthesia
  - None, Ice, Ethyl Chloride, Lidocaine
- Anxiety – pre-medication seldom needed
Pain with FNA

- FNA of thyroid nodules less painful than that of cervical lymph nodes
- Most tolerate the transient pain without the use of local anesthesia
- Using 25g needle/aspiration in 218 patients, FNA pain correlated with:
  - age <25 years, female sex, # nodules biopsied and anxiety

Lo WC et al. Head Neck, 2013 June
Leboulleux S et al. Thyroid 2013 Sep
Techniques to Minimize Discomfort

- Discuss procedure with patient
- Use smallest needle possible
  - 27 gauge for most FNAB
  - 22G for draining cysts
- Avoid sternocleidomastoid muscle
- Enter quickly through skin and then slowly advance
- Fine oscillation and rotation
Anticoagulation

- 593 patients undergoing US-FNA of neck – 788 total lesions
  - 2 hematomas in 144 on anticoagulant
  - 4 on 449 not on anticoagulant
- No significant difference between groups
- Bleeding complications are rare after thyroid nodule FNA
- Patients on aspirin, heparin, clopidogrel or coumadin undergoing neck FNA showed no increased bleeding risk

Anticoagulation

- Bleeding complications are rare after thyroid nodule FNA
- If patient on anticoagulant, consider 10 minute observation for hematoma formation
- Color Doppler to avoid/detect small vessels
- Denham showed does not impact adequacy of cytology

Denham et al. J Ultrasound Med. 2016 Jan
Novel Oral Anticoagulants

- Dabigatran (Pradaxa)
- Rivaroxaban (Xarelto)
- Apixaban (Eliquis)

Mayo Clinic Review: “Patients taking NOACs for stroke prevention in non-valvular a-fib and venous thrombosis prophylaxis do not need to stop therapy prior to or following US-FNA of nodules”

Lyle MA and Dean DS. Thyroid. April 2015
FNA vs. Core Needle Biopsy

- Rare reports of hemorrhage and tumor needle tracking with large CNB
- CNB requires anesthesia and increases local discomfort
- CNB does not consistently add significant accuracy or clarification for follicular neoplasms
- CNB may complement FNA in cases of FNA insufficient samples

NCI Thyroid FNA State of the Science Conference. Diagn Cytopathol 2008 Jun
Setting up for FNA
Monitor Clearly In View
Needles

25g  27g  23g

25g  26g  25g

22g
Needles

- 25-27 gauge needles for most nodules
- 22 gauge for drainage of cyst fluid if needed
- Most nodules can be accessed with 1.25-1.5” needles; 2.5” spinal needles are seldom needed
- Stylet needle if going through thyroid to target
  - Exophytic nodules, lymph nodes, etc
- Echogenic needles not needed
- Needle guides can be used, but generally unnecessary
Fragment of macrofollicle obtained through 27 gauge needle
Aspiration

Pistol grip on syringe with tubing
-Good for cyst drainage
Suction with assistant holding ultrasound probe
Suction using extension tubing
Suction using extension tubing (cyst)
Cytological Diagnosis by Fine Needle Sampling Without Aspiration

ANTOINE ZAJDELA MD, PATRICK ZILLHARDT, MD, AND NICOLE VOILLEMOT MD

The merits of a simplified cytological method of fine needle sampling without aspiration are compared to those of the classical fine needle aspiration techniques in a series of benign and malignant mammary tumors which were subsequently proved histologically. A comparable cellular yield was obtained by both techniques. In a series of 635 benign and malignant breast tumors examined in 1981 with fine needle alone, insufficient cellular yield was recorded in 5.5% of the lesion. The same incidence (6%) was recorded with aspiration techniques in 7877 benign and malignant mammary tumors examined from 1954 to 1980. With the new technique, trauma is reduced and a better perception of the tumor and of its consistency is directly obtained.

Antoine Zajdela (1924-2013)

Fig. 8. Fine needle sampling without aspiration of a thyroid tumor.
Suctionless Zajdela Technique
Suctionless – Bare Needle
Suctionless – Bare Needle
Capillary Action - Zajdela

- Relies on forward motion of the needle as well as surface tension induced capillary action within the needle core (stronger with higher gauge)

- “Spinning” the free needle may improve yield

- May be done with needle only or with needle attached to syringe w/o plunger
Aspiration (FNA) vs. Capillary Action (FNC)

- In a palpation-biopsy study using 2 passes with each technique into 260 nodules, there was no difference in adequacy or accuracy.

- In an US-biopsy study, 88 nodules underwent FNA and 92 underwent FNC, again no difference between the techniques. Concluded that FNC may offer more technical ease.

de Carvalho et al. Endocr Pathol. 2009 Winter;20(4):204-8
**Suction**
- Larger volume of sample
- More blood
- Begin sampling once in target

- Avascular nodules
- Lymph nodes
- Parathyroids
- Complex cysts
- Drain cysts

**Suction-less**
- Smaller volume of sample
- Less blood
- Simpler

- Vascular nodules
- Superficial nodules
- Most nodules
Ultrasound Visualization for Fine Needle Aspiration Biopsy
Ultrasound-guided FNA Biopsy

- Variety of Aspiration Techniques
  - Parallel versus Perpendicular imaging
  - Syringe holder or not
  - Suction versus suction-less

- Have monitor clearly visible

- Echogenic needles not necessary

- Maximize cellular yield and minimize blood
  - Dwell time: Keep under 6-10 seconds

- Quality Slide preparation
Methods of Approach

parallel

perpendicular
Parallel Approach
Line up the needle with the azimuthal plane of the transducer. Commit to the line and insert needle before looking up the monitor.
Parallel approach without assistant
Parallel: Better reflection with more shallow approach
Perpendicular Approach
Technique of Ultrasound-Guided FNA

BEVEL OF NEEDLE
Perpendicular Approach – Free Hand (no assistant holding probe)
Look for superficial vessels
Less transducer pressure to confirm
Pull Skin Tight

Don’t pass through US gel

Eyes on Monitor!
Dwell-Time

- First pass most likely to be best as hemorrhage begins to occur
- 2-5 seconds of back-and-forth motion
- Blood in hub: too long of a dwell time
- Position needle in the peripheral 2-5 mm of nodules undergoing cystic degeneration
Number of Passes

- **IF Rapid On-Site Evaluation (ROSE) available**
  - 2-3 passes from different regions then assess
  - Additional passes if inadequate
    - Adequate: >6 groups of >=10 follicular cells
  - Additional passes for special studies

- **Without ROSE**
  - 2-8 passes from different sites (average 3-4 passes)
  - Either all in liquid transport OR slides with rinse into transport media
Special Situations

- Hypervascular nodules
- Peripherally calcified nodules
- Predominately cystic nodules
- Deep biopsy
Hypervascular Nodules

- Capillary action
- Reduce dwell time
- 1-2 Rapid thrusts after gentle positioning needle just outside the nodule
- Subsequent FNAs at different sites of nodule
Interrupted Eggshell FNA Approach

Kim DW. Clinical Imaging 2012, E-pub
Predominantly Cystic Nodules

- Target Solid Component

- Direct needle into solid component without traversing the cystic part if possible

- Drain cyst fluid then FNA solid component
  - Try w/one puncture (exchange syringe)
Spinal Needle for Deep Biopsy
Insufficient US-FNA Samples

- If a common problem (>10% of your samples):
  - Use ROSE to determine adequacy
  - Take an FNA/slide-making course
  - Alter technique(s)
  - Consider LBC

- Approach to Insufficient FNA
  - Repeat FNA if not benign US phenotype
  - Surgery if overt malignant US findings
  - Discuss w/ pathologist and observe select cases
  - Consider CNB if expert-repeat FNA still insufficient

Slide Preparation

- **Goals**
  - Monolayer Dispersion of cells
  - Avoid distortion or crush artifact
  - Avoid prolonged time per pass (clot/blood)

- **Slides versus liquid based preparation**

- **Fixation and staining**
  - Pap versus Wright Stain
  - Pathologist preference
Smear Technique
Smear Technique
Book Method

- Let capillary action spread the sample out over the slides
Pull Apart Like Opening a Book

Two Mirror Image Slides
1 → Alcohol Fix for Pap Stain
1 → Diff-Quik for On-Site Eval
Smear Technique – Book Method
Smear Technique – One step
Rinsing material from the syringe
TG, Ct, PTH, Flow cytometry, DNA/RNA analysis, etc.
After the FNA

- Consider observation for 30 minutes post-procedure if needle >23 g, especially if CNB
- If on anticoagulant, observe for 10 minutes to confirm no hematoma formation
- If hematoma: ice and pressure; observe until stabilization confirmed
- Local pain/bruising: ice pack, acetaminophen
- Counsel patient of how results will be relayed
Biopsy Techniques - Summary

- Goal is acquisition of quality diagnostic material and presentation for cytology
- Achieve competency in several techniques to best fit the clinical need
- Avoid excessive dwell time and excessive blood on slides
- Good technique results in a quick and near painless procedure
- Prepare high quality slides