US-Guided FNA of Pediatric Thyroid Nodules: Practical Tips for Success
US-Guided FNA of Pediatric Thyroid Nodules: Practical Tips for Success

A Play in 3 Acts

Directed by
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ACTS

Prologue

Nodule Selection

Technical Considerations

Act 1

The Adequate Sample

Act 2

Intermission

Sedation

Act 3

Complications

Epilogue

Post-procedure Care
PROLOGUE:

NODULE SELECTION
Recommendations for FNA

• 2015 American Thyroid Association ATA Guidelines for Children with Thyroid Nodules
• Risk stratification into categories of suspicion for malignancy based on composite of US features including solid composition, irregular margins and echogenic foci
• Nodule size considered in adults but not children
• Referring physician preference

<table>
<thead>
<tr>
<th>Sonographic pattern</th>
<th>US features</th>
</tr>
</thead>
<tbody>
<tr>
<td>High suspicion</td>
<td>Solid hypoechoic nodule or solid hypoechoic component of a partially cystic nodule with one or more of the following features: irregular margins (infiltrative, microlobulated), microcalcifications, taller than wide shape, rim calcifications with small extrusive soft tissue component, evidence of ETE</td>
</tr>
<tr>
<td>Intermediate suspicion</td>
<td>Hypoechoic solid nodule with smooth margins without microcalcifications, ETE, or taller than wide shape</td>
</tr>
<tr>
<td>Low suspicion</td>
<td>Isoechoic or hyperechoic solid nodule, or partially cystic nodule with eccentric solid areas, without microcalcification, irregular margin or ETE, or taller than wide shape</td>
</tr>
<tr>
<td>Very low suspicion</td>
<td>Spongiform or partially cystic nodules without any of the sonographic features described in low, intermediate, or high suspicion patterns</td>
</tr>
<tr>
<td>Benign</td>
<td>Purely cystic nodules (no solid component)</td>
</tr>
</tbody>
</table>
By the Numbers

- 3: Maximum nodules per session
- 2: Initial number of passes per nodule (with additional passes if cytology slides inadequate)
- 6: Preferred maximum number of passes per nodule
- 8: Size in mm of minimum nodule diameter technically feasible for FNA
My background

• University hospital
• Pediatric and adult US
• 10 years of personal experience performing US guided thyroid FNA
• 1000 to 1500 adult patients
• 35 pediatric patients. Age range 8 to 18 years, most over 14 years old
ACT 1:

TECHNICAL CONSIDERATIONS
Positioning of Patient

- Supine, neck extended
- Rolled towel under shoulders
- Turn head away from side of nodule to flatten neck and increase exposed area
Preparation of Instrument Tray

- 10-cc syringes attached to 25-G needles, withdrawn to 2 cc mark (2 for each nodule)
- 1% lidocaine for local anesthesia via 25-G needle
- Sterile drapes
- Chloraprep for skin
Team members

- US technologist controls US machine
- Radiologist stands on patient’s left so US monitor can be viewed comfortably.
- On-site cytopathologist to immediately verify adequacy of specimen and reduce number of passes
The transducer

- Linear high frequency, 10-12 MHz
- Free-hand without needle guide
- Radiologist controls both transducer and needle
- Cleansed transducer vs. probe cover
- Lidocaine used as coupling agent (US gel can result in artifact on aspirate slides)
- Single focal zone to maximize frame rate
The needle approach

- Probe positioned transverse or oblique transverse relative to patient’s neck
- Long axis/ Parallel approach with needle parallel to long axis and scanning plane of transducer
- 45 degree entrance angle allows visualization of entire length of needle as it is advanced through superficial tissues into nodule
- 1½-inch 25-G needle (Alternative: 22- or 23 –G)
Needle insertion

- Real time adjustment of needle direction
- If parallel position of needle is lost, retract and readjust while keeping transducer still
- If visualization of needle tip is lost, find it by trans-locating transducer (keep constant 90 degree angle to skin surface without angulation)
- Inform patient when to stop and start swallowing
To aspirate or not to aspirate

- **Aspiration technique**
  - Continuous visualization of needle tip in nodule
  - Apply to and fro motion with simultaneous suction on plunger
  - Release suction before needle removed

- **Capillary technique**
  - Apply for and fro motion without suction on plunger
  - Simultaneous rotation of syringe and needle on axis
  - Preferred for vascular lesions?
More needle “tips”

• Combination approach (5 seconds capillary, 5 seconds aspiration)
• About 20-40 needle excursions per pass (Count to 10)
• Needle excursion: as long as possible
• Needle motion: Quick and vigorous preferred over slow and gentle
• Shorter needle dwell time to minimize blood and motion in patients unable to suspend swallowing
Color Doppler

- Intervening vessels
- Internal carotid artery and internal jugular vein
- Degree of vascularity of nodule
- Delineate margins of difficult to visualize nodules
ACT 2:

THE ADEQUATE SAMPLE
Making slides

• Aspirate is lodged in needle hub (not syringe) and extruded immediately (to avoid clotting) onto a slide by depressing syringe plunger

• A portion of aspirate is transferred from this slide to another with smearing action

• Thus, aspirate from each pass is used to make two slides

• Excess aspirate in needle hub injected into vial of cytolyte solution by withdrawing and pushing syringe 2-3 times (all passes together in one vial) to be spun down later for use as cell block
Making slides

• Both slides from the pass air dried
• One slide stained immediately with Diff-Quik and examined under microscope on site for adequacy, not necessarily diagnosis
• The other slide is sent to pathology lab for later evaluation using Bethesda System for Reporting Thyroid Cytopathology
Definition of “adequate” cytology

- Adequate=diagnostic
- Minimum of six groups of follicular cells, each comprising at least ten cells
- Well preserved, well stained
- Not obscured by blood.
- Non-diagnostic = cytologic diagnosis cannot be made due to limited quality or quantity of follicular cells or colloid
INTERMISSION:

SEDATION
• Most patients do not require sedation
• Distraction, reassurance, parent present
• One patient required conscious sedation
• One patient required general anesthesia
• Local anesthesia recommended even with conscious sedation
ACT 3: COMPLICATIONS
Complications

- Hemorrhage around thyroid
- Hemorrhage into cystic or solid nodule
- Manifest immediately
- Document stability of hematoma immediately after procedure and after 30 minute delay
- Clinically insignificant
Major Complications

- Internal carotid artery intramural hematoma
- Stability over several days
- Resorbed after several weeks
EPILOGUE:

POST-PROCEDURE CARE
• Compression for 1-2 minutes at each FNA site (Optional)
• Patient applies compression with ice pack for 30 minutes in Radiology Department
• Patient examined and given instruction sheet before release
• Refrain from strenuous activity, NSAIDS for 24 hours
• Acetaminophin if necessary
• If persistent or worsening pain or swelling >24 hours, call referring physician or radiology emergency room
CAST

Nodules to Know and How to Approach Them

The Nodule Abutting a Vessel

The Very Deep Nodule

The (Nearly) Entirely Cystic Nodule

The Nodule with Calcified Rim
The Nodule Abutting a Vessel

• Traditional approach precluded by intervening vessel

• Internal carotid artery or internal jugular vein

• Alternative approaches:
Advanced technique: Perpendicular/short axis

• Needle inserted adjacent to long side of transducer at midpoint
• Needle tip not seen continuously as it advances to nodule, but as echogenic dot only when needle enters scan plane
• Adjust skin entrance site as needed so that needle path is straight down, without angling to right or left
• Alternate advancing needle and shallow angling transducer to allow needle tip to be seen at periodic intervals as it advances
Alternative approaches: Stand on patient’s right

- Requires radiologist to look over shoulder to see US monitor
- Allows use of parallel/long axis approach
The Very Deep Nodule

- Nodule more than 2 cm deep
- Spinal needle 25-G
- Requires two sets of hands on sterile field
- Needle inserted with stylet, which is removed once tip is in nodule
- Capillary technique without syringe
- Once needle is removed, syringe with plunger withdrawn to 2 cc is immediately attached
The (Nearly) Entirely Cystic Nodule

- Aspirate any solid components in wall or mural nodule
- Then aspirate fluid
- For low cellularity samples, abundant colloid can fulfill criteria for cytological adequacy
The Nodule with Calcified Rim

- If rim discontinuous, attempt at FNA worthwhile as needle may often be inserted into nodule through gaps in calcification
- If rim continuous, needle tip bounces off calcification and aspiration not possible
Cerit M et al. Ultrasound-guided thyroid nodule fine-needle biopsies—comparison of sample adequacy with different sampling techniques, different needle sizes, and with/without onsite cytological analysis. Endokrynol Pol 2015; 66: 295–300. DOI: 10.5603/EP.2015.0037


Francis GL et al. Management guidelines for children with thyroid nodules and differentiated thyroid cancer. Thyroid 2015; DOI: 10.1089/thy.2014.0460

Haugen BR et al. 2015 American Thyroid Association management guidelines for adult patients with thyroid nodules and differentiated thyroid cancer. Thyroid 2016; DOI: 10.1089/thy.2015.0020

Izquierdo R et al. Ultrasound-guided fine-needle aspiration in the management of thyroid nodules in children and adolescents. Thyroid 2009. DOI: 10.1089=thy.2009.0058


The End
Thank you!