FINE NEEDLE ASPIRATION BIOPSY
QUESTION 1

Which **ONE** of the following options is **NOT** considered to be an advantage of a Fine Needle Aspiration (FNA) procedure?

A. Simple and safe  
B. Rapid processing  
C. High sensitivity and specificity  
D. Less expensive than surgical procedures  
E. All of the above
Which is the largest size (gauge) needle acceptable for classification as a **FINE** needle for aspiration?

- A. 22G
- B. 18G
- C. 26G
- D. 23G
FINE NEEDLE ASPIRATION BIOPSY

• Removal / sampling of cells, using a FINE needle, from a SUSPICIOUS mass, for DIAGNOSTIC purposes.

• Viable cells can be obtained as well as material for microbiological culture and other ancillary tests.

• Virtually any lesion can be reached with a fine needle.
ADVANTAGE OF FNA

- Performed on outpatient basis (rooms, clinic, bedside)
- Material obtained for other ancillary tests

✓ Simple and safe:
  - Best method to obtain tissue for morphologic diagnosis
  - No scar
  - Does not interfere with further study of the lesion
  - No anesthetic risk

✓ Accurate: high sensitivity and specificity

✓ Fast: rapid processing

✓ Economic: far less expensive than diagnostic surgery
CORE VS FNA BIOPSY SAMPLING
INDICATIONS

- Neoplastic or reactive / inflammatory
- Benign or malignant
- Inflammatory aetiology (organism / culture)
- Scarce resources
- On site:
  - Representative (enough cells)
  - Clinical emergencies
  - Patient management
CONTRAINDICATIONS

• Uncooperative or excessively apprehensive patient
• Bleeding diathesis, anticoagulant therapy
• Seriously impaired lung function
• Highly vascular lesions *
• Suspected hydatid cyst *
• Stridor *
• Organ specific
COMPLICATIONS

- Serious complications are very rare, especially for superficial targets
- Hematoma, hemorrhage
- Vasovagal reaction, seizures
- Transient nerve paresis
- Tumour necrosis
- Local infection
- Pneumothorax
- Seeding of needle tract (testis / kidney)
COMPLICATIONS OF DEEP ORGAN FNA

- Pneumothorax
- Air embolism
- Subcutaneous emphysema
- Pancreatitis
- Bile peritonitis
- Sepsis
- Seeding of needle tract
- Spillage of tumour - upstaging
DEEP-SEATED ORGAN ASPIRATES

- Diagnostic Imaging
  - Fluoroscopy
  - Ultrasound
  - CT
- Coagulation studies
- Local anaesthesia
- Heparinised syringe
- Observation post-procedure
CYST

• Empty cyst and send ALL fluid to laboratory.

• In discolored breast cysts and ALL thyroid cysts aspirate residual mass (if any) and bed of cysts (if none).
BLOODY ASPIRATES

• If blood aspirated, remove needle, apply pressure for 1 min, repeat aspirate using new smaller needle and syringe.

• If still bloody, try aspirating using no suction

• If still bloody consider vascular lesion eg Kaposi sarcoma, hemangioma
ANCILLARY STUDIES

- Flow Cytometry
- Immunocytochemistry
- PCR / ISH
- Electron microscopy
- Cell culture – chromosome analysis
- Culture
  - Mycobacteria – Bactec, MGIT
  - Fungal, bacteria – Sterile saline
INTERPRETING RESULTS

FNA IS HIGHLY SENSITIVE AND SPECIFIC

BUT:

• Correlation with clinical and radiological data is essential
• Absence of proof is not proof of absence
• False positive results are rare, if there is clinical doubt further investigation is mandatory.
DIAGNOSING MYCOBACTERIAL LYMPHADENITIS IN CHILDREN USING FINE NEEDLE ASPIRATION BIOPSY

- Should FNAB be the first line diagnostic procedure in tuberculosis suspects with peripheral lymphadenopathy?
GRANULOMA
NECROTISING INFLAMMATION
IDENTIFICATION OF ORGANISM

• Overall sensitivity: 20 – 70%

✓ Ziehl-Neelsen
✓ Fluorescence
✓ Auramine-rhodamine
✓ Auramine-O
✓ Acridine-orange
✓ Papanicolaou
Negative Imprint
Papanicolaou induced autofluorescence
To evaluate the **diagnostic yield** and **time to diagnosis** of fine needle aspiration biopsy (FNAB) versus routine respiratory specimens collected from children with a palpable peripheral lymph node mass and symptoms suspicious of tuberculosis.

• Retrospective review laboratory records of the Cytology Unit at Tygerberg Hospital

• All children (< 13 years) in whom a FNAB specimen was collected together with other mycobacterial specimens (within 30 days of the FNAB) during the 4-year period January 2003 to January 2007

• The diagnostic yield and time to diagnosis were compared.

• If the patient had 3 gastric washings and 1 induced sputum, and only one of these was positive, for the comparative analysis this was regarded as a positive result.
## Table 3 Specimen type, yield and organisms cultured in 95 patients

<table>
<thead>
<tr>
<th>Specimen type</th>
<th>Number of specimens</th>
<th>Consecutive specimens collected No (% specimen type)</th>
<th>Culture positive No (% specimens)</th>
<th>TB No. (%)</th>
<th>M. bovis BCG No. (%)</th>
<th>NTM No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FNAB</td>
<td>95</td>
<td>51 (54)</td>
<td>51 (54)</td>
<td>36 (71)</td>
<td>15 (30)</td>
<td>0</td>
</tr>
<tr>
<td>Gastric aspirates</td>
<td>143</td>
<td>11 (14)</td>
<td>39 (27)</td>
<td>30 (77)</td>
<td>8 (21)</td>
<td>1 (3)</td>
</tr>
<tr>
<td>Induced sputum</td>
<td>15</td>
<td>6 (60)</td>
<td>6 (60)</td>
<td>6 (100)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sputum</td>
<td>11</td>
<td>5 (71)</td>
<td>5 (71)</td>
<td>5 (100)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Nasopharyngeal aspirates</td>
<td>10</td>
<td>3 (43)</td>
<td>5 (71)</td>
<td>4 (80)</td>
<td>1 (20)</td>
<td>0</td>
</tr>
<tr>
<td>Non–respiratory specimens</td>
<td>26a</td>
<td>3 (12)</td>
<td>2 (8) (CSF)</td>
<td>1 (4) (pus swab)</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
**Table 4** Diagnostic yield of Fine Needle Aspiration Biopsy (FNAB) compared to standard respiratory specimens (*M bovis* BCG excluded)

<table>
<thead>
<tr>
<th>Standard respiratory specimens</th>
<th>FNAB negative</th>
<th>FNAB positive</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>All gastric aspirates negative</td>
<td>25(37%)</td>
<td>19(28%)</td>
<td>44(65%)</td>
</tr>
<tr>
<td>Any gastric aspirate positive</td>
<td>3(4%)</td>
<td>21(31%)</td>
<td>24(35%)</td>
</tr>
<tr>
<td>Total</td>
<td>28(41%)</td>
<td>40(59%)</td>
<td>68(100%)</td>
</tr>
<tr>
<td>All other respiratory specimens negative</td>
<td>2(17%)</td>
<td>4(33%)</td>
<td>6(50%)</td>
</tr>
<tr>
<td>Any other respiratory specimen positive</td>
<td>0</td>
<td>6(50%)</td>
<td>6(50%)</td>
</tr>
<tr>
<td>Total</td>
<td>2(17%)</td>
<td>10(83%)</td>
<td>12(100%)</td>
</tr>
</tbody>
</table>

*Wright et al Int J Tuberc Lung Dis 2009*
Table 6 Time to bacteriologic diagnosis from start of specimen collection (*M. bovis* excluded)

<table>
<thead>
<tr>
<th>Specimen type</th>
<th>Mean days</th>
<th>Std. Dev</th>
<th>Minimum</th>
<th>Maximum</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>FNAB(^a) cytology and/or culture</td>
<td>7.1(^b)</td>
<td>10.3</td>
<td>2.0</td>
<td>43.0</td>
<td>4.2 - 10.1</td>
</tr>
<tr>
<td>All respiratory specimens</td>
<td>22.5(^b)</td>
<td>17.5</td>
<td>2.0</td>
<td>83.0</td>
<td>15.8 - 29.1</td>
</tr>
<tr>
<td>Gastric aspirates</td>
<td>21.4</td>
<td>14.7</td>
<td>11.0</td>
<td>83.0</td>
<td>15.2 - 27.6</td>
</tr>
<tr>
<td>Other respiratory specimens</td>
<td>27.2</td>
<td>25.1</td>
<td>9.0</td>
<td>77.0</td>
<td>0.8 - 53.5</td>
</tr>
</tbody>
</table>

Note here. \(^b\)The t-test of difference in the mean days to diagnosis for these two modalities is significant at p \(<\) .001

Figure 1 Time to diagnosis Fine Needle Aspiration Biopsy versus all respiratory specimens

Wright et al Int J Tuberc Lung Dis 2009
SUMMARY

• Mycobacterial infection was diagnosed in 70/95 (73.3%) patients.
• Cases without respiratory specimens (6) and cases with *M* bovis *BCG* (15) were excluded from comparative analysis.
• In the remainder, FNAB was positive in 45/74 (60.8%) cases, and any respiratory specimen in 29/74 (39.2%) cases (p < 0.001).
• Mean time to bacteriologic diagnosis with FNAB was 7.1 days (95% CI 4.1-10.1) compared to 22.4 days (95% CI 15.8-29.1) for any respiratory specimen (p < .001)
• In this study FNAB showed a better yield than respiratory specimens (gastric aspirates and/or other respiratory specimens), even when all these specimens were combined as a single test.
Mycobacterial Transport medium for routine culture of Fine Needle Aspiration Biopsies

Cost comparison
MGIT tube R34
TB transport bottle R6
### Table 1
The mycobacterial yield and time to positive culture achieved with fine needle aspiration biopsy and variable timing of MGIT* inoculation

<table>
<thead>
<tr>
<th>Timing of MGIT* inoculation</th>
<th>Total no specimens</th>
<th>Mycobacterial culture</th>
<th>Time to positive culture</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Positive</td>
<td>Negative</td>
</tr>
<tr>
<td><strong>Bedside vs. immediate laboratory inoculation from transport bottle</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bedside</td>
<td>150</td>
<td>53 (35.3%)</td>
<td>97 (64.7%)</td>
</tr>
<tr>
<td>Immediate laboratory</td>
<td>150</td>
<td>55 (36.7%)</td>
<td>95 (63.3%)</td>
</tr>
<tr>
<td><strong>Subset - matched pairs: delayed vs. immediate laboratory inoculation from transport bottle</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delayed laboratory (day 7)</td>
<td>31</td>
<td>11 (35.5%)</td>
<td>20 (64.5%)</td>
</tr>
<tr>
<td>Immediate laboratory (day 0)</td>
<td>31</td>
<td>13 (41.9%)</td>
<td>18 (58.1%)</td>
</tr>
</tbody>
</table>

*Wright  et al Arch Dis Child 2010*
Diagnostic yield of fine needle aspiration biopsy in HIV-infected adults with suspected mycobacterial lymphadenitis

- Retrospective laboratory-based study
- Bacteriological yield of clinically suspected mycobacterial tuberculous lymphadenitis following FNAB in adults, specifically HIV-positive patients
- Tygerberg Hospital FNAB clinic, 368 patients
- Diagnostic yield for diagnosing mycobacterial lymphadenitis in adults using FNAB was 79.7%. A significant difference ($p<0.01$) was found between the diagnostic yield in HIV positive and HIV negative population
- Warrants expediting HIV-infected patients’ aspirates for Xpert® MTB/RIF testing.
Xpert® MTB/RIF adults

• 48/50 patients referred for FNAB at Tygerberg Hospital, South Africa, mycobacterial lymphadenitis.

• Positive cytomorphology with direct visualization of the organism and/or positive tuberculosis culture served as the reference standard.

• RESULTS:
  • 30 (62.5%) were diagnosed with tuberculosis (TB)
  • Xpert® MTB/RIF identified 29 of these cases
  • Sensitivity and specificity of 96.7% (29/30) and 88.9% (16/18) respectively, including 6/6 (100%) of the smear negative culture positive cases.
  • Xpert® MTB/RIF correctly identified Rifampin resistance in 1/2 cases.

Xpert® MTB/RIF children

• 72/110 children referred for FNAB at Tygerberg and Dora Nginza Hospitals, South Africa, mycobacterial lymphadenitis.

• Positive cytomorphology with direct visualization of the organism and/or positive tuberculosis culture served as the reference standard.

• RESULTS:
  • 40 (55.5%) were diagnosed with tuberculosis (TB)
  • Xpert® MTB/RIF identified 32 of these cases
  • Sensitivity and specificity of 80% and 93.8% respectively
  • Xpert® MTB/RIF did not identify Rifampin resistance in the 1 case identified

Coetze ,L et al XPERT® MTBFIF for rapid diagnosis of paediatric diagnosis of paediatric tuberculosis lymphadenitis utilising FNAB submitted for publication 2013
THE FNA PROCEDURE
- Consent

- Anaesthesia
  - Sedation in children – oral sedation and paracetamol
  - Topical anaesthetic may be used
  - Local anaesthetic for deep organ aspirates

- Position

- Equipment

- Procedure
Glass slides with GROUND GLASS edges

Cotton wool

Cytology Fixative
PROCEDURE

Always perform a minimum of 2 needle passes that yield 4 slides

Each pass yields 2 slides:
1 air dried for Diff Quik stain (cytoplasmic)
1 spray fixed for Papanicolaou stain (nuclear)

Always use sterile needle and syringe for each pass
• Introduce needle
• Maintain **1-2cc suction** throughout aspirate
• **Aspirate** using cutting motion in alternative paths until material appears in **hub of needle**
• **Release suction** before withdrawing needle
• **Remove needle** from syringe, introduce 5-10cc **air** into syringe.
• **Re-attach needle** and holding needle onto syringe, use air to express material in needle onto glass slide

• **Touch needle tip**, cutting edge of needle, on glass slide 1cm from frosted end
• Place second slide parallel to first, and, maintaining gentle pressure, pull 2 slides apart (smear)
• **Spray fix** bottom slide with fixative from distance of about 30cm until wet
• Other slide is **air dried**
• Time restriction **10-15s**
• **Repeat procedure**
• TB culture ~ rinse needle and syringe in TB culture medium (Bactec, MGIT tube – consult laboratory)