To Core or Not to Core: The number of core samples obtained during computed tomography guided lung biopsy does not increase the rate of complications

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Disclosures

• No conflict of interest to declare on behalf of the presenter and/or research team
Introduction: Lung Cancer

• Lung cancer is the second most prevalent cancer in Canada, and is the country’s leading cause of cancer-related death among men and women (Canadian Cancer Society, 2013)

• Early and accurate diagnosis is the key for the optimal treatment of lung cancer patients

• Suspicious lung lesions can be histologically sampled via a percutaneous needle biopsy
Introduction: CT-TTNB

- Computed tomography-guided transthoracic needle biopsy (CT-TTNB) of the lung is considered a safe and effective diagnostic tool for the sampling of potentially malignant lesions.

- The procedure has inherent risk factors, ranging from mild to severe complications, and in rare cases, death.
Introduction: CT-TTNB Imaging

Upper two images: LUL lung lesion; prone views; 19-G coaxial needle in situ

Lower two images: RUL lung lesion; decubitus position; 19-G coaxial needle in situ

Figure 1: CT-guided lung lesion biopsy SJHH, Hamilton
Introduction: Possible Complications

**Minor:**
- Pneumothorax
- Thoracostomy tube placement
- Minor hospitalization (observation or nominal treatment)

**Major:**
- Air embolism
- Hemoptysis requiring hospitalization or specific therapy
- Chest tube placement requiring prolonged admission, pleurodesis, or catheter exchange
- Death

*Source: SIR-ACR Standards of Practice (2010)*
## SIR-ACR Guidelines

### Table 1: Complication rate guidelines and recommended QI thresholds

<table>
<thead>
<tr>
<th></th>
<th>Complication</th>
<th>Complication rate range (%)</th>
<th>Suggested QI Threshold (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Minor</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pneumothorax</td>
<td>12-45</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>Thoracostomy tube placement</td>
<td>2-15</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td><strong>Major</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air embolism</td>
<td>0.06-0.07</td>
<td>&lt;0.1</td>
<td></td>
</tr>
<tr>
<td>Hemoptysis requiring therapy</td>
<td>0.5</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Thoracostomy tube placement requiring therapy</td>
<td>1-2</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

*Source: SIR-ACR Standards of Practice (2010)*
Objectives

• To examine whether certain patient demographic or clinical factors are associated with complications in CT-guided lung biopsies

• To compare the experience at SJHH with accepted ACR-SIR guidelines for quality assurance

• To make possible recommendations for an improved standard of care
Methods

• Retrospective cohort analysis of all CT-TTNB conducted at St. Joseph’s Healthcare Hamilton (SJHH) over a 12-month period (July 2011- June 2012)
• Patient data abstracted from electronic medical records and Vmax Encore PFT System database
• Coding for complication severity was based on SIR-ACR guidelines
• Univariate analysis was used for comparison; continuous variables described using independent t-test and categorical using chi square
Methods: Dataset Components

• Demographic Information
  ▫ Sex, age, diagnosis of COPD, FEV1 and DLCO values

• Procedural Details
  ▫ # of tissue samples obtained, immediate complication events, follow-up details such as hospital admission for observation, date of discharge, need for additional therapies

• Clinical Information
  ▫ cTNM staging, lesion size and location, final pathology
Results: Descriptive Statistics

- 304 patients
  - 49% male; mean age 68.5 ± 11.4 [range 22-89]
  - 26.6% (81/304) with COPD

- 93.4% of biopsies (284/304) were diagnostic

- Mean number of tissue samples obtained: 3.3 ± 1.0 [range 1-8]

- Mean lesion size (mm): 32.3 ± 22.7 [range 5-160]
## Results

<table>
<thead>
<tr>
<th>Clinical Staging (AJCC 7th Edition)</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 0</td>
<td>28.8%</td>
</tr>
<tr>
<td>Stage IA/IB</td>
<td>20.7%</td>
</tr>
<tr>
<td>Stage IIA/IIB</td>
<td>23.8%</td>
</tr>
<tr>
<td>Stage IIIA/IIIB</td>
<td>14.1%</td>
</tr>
<tr>
<td>Stage IV</td>
<td>8.1%</td>
</tr>
<tr>
<td>Metastatic Disease</td>
<td>4.5%</td>
</tr>
</tbody>
</table>

### Pathology

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undefined non-small cell lung cancer</td>
<td>10.1%</td>
</tr>
<tr>
<td>Adenocarcinoma</td>
<td>37.5%</td>
</tr>
<tr>
<td>Squamous cell carcinoma</td>
<td>12.6%</td>
</tr>
<tr>
<td>Bronchioalveolar carcinoma</td>
<td>1.1%</td>
</tr>
<tr>
<td>Benign diagnosis</td>
<td>20.2%</td>
</tr>
<tr>
<td>Non-diagnostic</td>
<td>7.2%</td>
</tr>
<tr>
<td>Not specified</td>
<td>11.2%</td>
</tr>
</tbody>
</table>
Results

- Complications:
  - Post-biopsy pneumothorax: 32.9% (100/304)
  - Chest tube insertion: 5.9% (18/304)
  - Self-limiting hemoptysis: 5.9% (18/304)
  - Self-limiting parenchymal hemorrhage: 19.1% (58/304)
## Results

### Table 2: SJHH complications vs. SIR-ACR Standards of Practice (2010)

<table>
<thead>
<tr>
<th></th>
<th>Complication</th>
<th>Complication rate range (%)</th>
<th>Suggested QI threshold (%)</th>
<th>SJHH comp. rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor</td>
<td>Pneumothorax</td>
<td>12-45</td>
<td>45</td>
<td>32.9</td>
</tr>
<tr>
<td></td>
<td>Thoracostomy tube placement</td>
<td>2-15</td>
<td>20</td>
<td>5.9</td>
</tr>
<tr>
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<td>Air embolism</td>
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<td>3</td>
<td>2.0</td>
</tr>
</tbody>
</table>
Results

- **Older age** (p=0.025), **lower DLCO values** (p=0.014), and **smaller lesions** (p=0.003) were significantly associated with an increased risk of complications.

- **Lesion location and number of tissue samples obtained and passages** were **not** associated with complication events (p>0.05).
Discussion

- Complications associated with lung biopsy are not uncommon, but most events are mild and do **not** require intervention.

- **Older patients** may be more prone to complications due to general frailty

- Low **DLCO values** are an indicator of impaired lung function, as well as predictors of poor lung cancer resection outcomes

- **Smaller lesions** are more difficult to biopsy, and may thus cause increased parenchymal bleeding and/or require a greater number of needle passes
Conclusions

• The complication rates at SJHH after CT-TTNB for lung cancer diagnosis were in line with ACR-SIR guidelines

• In our experience, complication rates were **not** impacted by the number of tissue samples collected

• Thus, completing additional passages **through the coaxial needle** in an attempt at obtaining a definitive tissue diagnosis should **not** be considered unsafe
Recommendations

• Added precautions should be taken with patients displaying any or all of the risk factors (old age, low DLCO values, and/or small lesion size). This includes:
  ▫ Informing patient of increased risk of procedure
  ▫ Ensuring patient lies stably in order to minimize bleeding or pneumothorax
References


• Lung cancer statistics (2013). *Canadian Cancer Society*. 