post procedural patient monitoring for CT-guided thoracic biopsies- safety of a novel approach

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Aims and objectives

Thoracic biopsy is a frequently performed procedure and has been associated with marked patient benefits. Computed tomography have been employed over the years for the purposes of diagnosis, staging, prognostic assessment and monitoring of most thoracic pathologies [1-4]. Currently, the list of clinical indications for CT-guided thoracic biopsy includes histological diagnosis of undetermined mediastinal, chest wall and lung lesions, diagnosis of hilar lesions following negative bronchoscopy, focal parenchymal infiltrates in which an infectious organism cannot be isolated, as well as biopsy or re-biopsy of malignancy for targeted therapy [5-9].

A major concern in the performance of CT-guided biopsies of the thoracic region is the risk of complications during and after the procedure, and the recovery time in a busy clinical setting. Potential complications associated with the procedure include pneumothorax, pulmonary hemorrhage, hemoptysis and air embolism [10-14]. Some of these complications have been reported to occur within the first two hours, with majority occurring in the first 24 hours. As such, post-biopsy care remains an important aspect in ensuring successful outcomes of the procedure. However, post-biopsy care has varied considerably over the years, especially, with regards to recovery time. Several studies have recommended a post-biopsy care of between 1 to 4 hours, with a study done by Dennie et al advocating for as short as 30 minutes of post-biopsy care in patients without pneumothorax [15-17].

In this initial study, we report our experience with 30 minutes of post-biopsy care in patients who presented with no complications after the post-biopsy scan, providing a starting point for similar algorithms to be explored in a randomized control study to establish the observation. Derived benefits included reduction in hospital costs, patients' early return to work and our ability to optimally utilize procedural space and ancillary staff.
Methods and materials

Patient population

This retrospective study involved patients who were referred to our centre (Spectra Health Imaging and Interventional Radiology) for CT-guided thoracic biopsies from January 2010 to December 2017. Patients who required significant sedation or anaesthesia were excluded from the study.

CT-guided Thoracic Biopsy Procedure

Patients were first taken through the process of breath holding before the procedure. A pre-biopsy scan of the affected organ was then obtained using 64-slice multidetector computed tomography scanner (Somatom Definition AS; Siemens, Erlagen, Germany), Somatom Emotion eco (16-slice configuration, Siemens, Erlagen, Germany) and GE Light Speed VCT 64-slice (GE healthcare, Milwaukee, USA). Biopsies were then performed with the patient placed either supine, prone or in a lateral decubitus position to facilitate sampling of the lesion from a position closest to the body surface. Intravenous iodinated contrast (Omnipaque\textsuperscript{TM} 350mgI/ml) was administered when appropriate. Under aseptic conditions, local anaesthesia with 1% lidocaine (5-10mL) was used. Under CT guidance, the thoracic biopsies were performed with a 16-gauge (Gauge Size and Needle Length=16g x 16cm; length of Sample Notch=1.9cm) BARD Coaxial system (Bard Peripheral Vascular, Inc.) for deep structures and 14-gauge (Palium Needle, 14G x 100 mm, M.D.L. Srl-Via Tavani 1A) for superficial and chest wall lesions. All patients underwent tissue core biopsies, in which only one puncture was made, and an average of 4-6 specimens taken with the coaxial system. None of the mediastinal biopsies required trans-pulmonary approach.

Post-biopsy care

Post-biopsy CT scan was performed immediately for all the cases using contrast. Patients without post-biopsy complications were made to lie down for 30 minutes in a lateral decubitus position. During this time, patients' blood pressure and pulse were checked every 10 minutes, and also analgesics and/or antibiotics were given depending on patient’s pain level or risk factors respectively. Patients without post-biopsy complications were discharged after 30 minutes, and given a hot line to call in case of any complications. There was a follow-up call by a nurse after 24 hours to inquire about any complications and the general condition of the patient. During the follow-up call, patients were asked whether they had experienced delayed symptoms such as worsening pain, generalized discomfort and shortness of breath.
A flow chart showing the proposed patient treatment algorithm after CT-guided thoracic biopsy is shown in figure 1.
**Figure 1:** Flow chart showing the proposed patient treatment algorithm after CT-guided thoracic biopsy. PTX= Pneumothorax; ER= Emergency room

**Fig. 3:** Flow chart showing the proposed patient treatment algorithm after CT-guided thoracic biopsy.

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Results

A total of 440 patients who were referred for CT-guided thoracic biopsies within the study period were included. The mean age of the patients was 52.2 ± 18.3 years, with the maximum and minimum age being 83 years and 8 years respectively. A greater percentage of the patients were males (n=264, 60.0 %), with a female population of 40.0% (n=176). Thoracic regions indicated for CT-guided biopsies within the period of study included mediastinal, lung, pleural and chest wall. The mean lesion diameter was 8.7cm, with a range of 1.2-18.4cm. Two hundred and sixty-six of the lesions on which biopsies were performed had a diameter ranging from 4.0-10.0 cm, whereas 28 were less than 4 cm. The 16-guage BARD Coaxial system and 14-gauge Palium were used in 315 and 125 patients respectively.

Post-biopsy complications were recorded at a rate of 6.4% (n=28), with 4.1% (n=18) been pneumothorax and pulmonary hemorrhage and hemoptysis accounting for 2.3% (n=10). The complications were recorded only in the lung (n=26) and pleural (n=2) biopsies. No relevant complications were recorded in those who presented with no post-biopsy complications (n=412) on follow-up, except for worsening pain (n=88), generalized discomfort (n=22) and shortness of breath (n=13). Also, no contrast allergies and fatalities were recorded during the entire duration of the study. The distribution is shown in Table 1.
Table 1: Characteristics of the Study Population and Complications

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Study population (n=440)</th>
<th>Presence of complication (n=28)</th>
<th>Absence of complication (n=412)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>264</td>
<td>21</td>
<td>243</td>
</tr>
<tr>
<td>Female</td>
<td>176</td>
<td>7</td>
<td>169</td>
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<tr>
<td><strong>Thoracic region</strong></td>
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</tr>
<tr>
<td>Mediastinal</td>
<td>240</td>
<td>0</td>
<td>240</td>
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<tr>
<td>Lung</td>
<td>185</td>
<td>26</td>
<td>159</td>
</tr>
<tr>
<td>Pleural</td>
<td>8</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Chest wall</td>
<td>7</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td><strong>Lesion diameter</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 4cm</td>
<td>28</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>4 – 10cm</td>
<td>266</td>
<td>15</td>
<td>251</td>
</tr>
<tr>
<td>&gt; 10 cm</td>
<td>146</td>
<td>3</td>
<td>143</td>
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<td><strong>Needle size</strong></td>
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<tr>
<td>14-gauge</td>
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<td>3</td>
<td>122</td>
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<tr>
<td>16-gauge</td>
<td>315</td>
<td>25</td>
<td>290</td>
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<tr>
<td><strong>Post-biopsy complications</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Pneumothorax</td>
<td>18</td>
<td></td>
<td>412</td>
</tr>
<tr>
<td>Pulmonary haemorrhage and haemoptysis</td>
<td>10</td>
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<td></td>
</tr>
<tr>
<td>None</td>
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<td></td>
<td></td>
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<tr>
<td><strong>Reported delayed symptoms</strong></td>
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<td></td>
</tr>
<tr>
<td>Worsening pain</td>
<td>88</td>
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<tr>
<td>Generalized discomfort</td>
<td>22</td>
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<tr>
<td>Shortness of breath</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>317</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 1: Flow chart showing the proposed patient treatment algorithm after CT-guided thoracic biopsy. PTX = Pneumothorax; ER = Emergency room.

Fig. 3: Flow chart showing the proposed patient treatment algorithm after CT-guided thoracic biopsy.

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**Fig. 1:** A CT scan of the chest in lung window of a lesion in the lower lobe of the right lung of a 32-year-old man which confirmed a bronchial cancer. A biopsy needle in situ with a posterior access and trajectory.

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**Fig. 2:** Post biopsy CT scan showing no complication

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Conclusion

This initial study has shown that thirty minutes of post-biopsy care could be sufficient for patients who present with no complications after a post-procedural scan in CT-guided thoracic biopsies, providing a starting point for similar algorithms to be explored in a randomized control study to establish the observation. This approach has the potential to significantly reduce medical costs and enable optimal utilization of procedural space and ancillary staff. The algorithm proposed in this study however appears to be more appropriate for larger lesions, and that further studies are needed to evaluate its suitability in smaller lesions.
Personal information

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References


