Transbronchial needle aspiration: initial experience in routine diagnostic bronchoscopy

Kay-Leong Khoo*, Gerald S.W. Chua, Amartya Mukhopadhyay, T.K. Lim

Division of Respiratory Medicine, Department of Medicine, National University Hospital, 5 Lower Kent Ridge Road, Singapore 119074, Singapore

Summary

Background: Transbronchial needle aspiration (TBNA) has been shown to be useful not only for the diagnosis and staging of lung cancer, its most widely studied indication, but also for many of other clinical indications. Despite this, it remains largely underutilized, mainly because of concerns with poor yield, safety, lack of experience of the bronchoscopist, and lack of cytopathological support.

Objective: To study the clinical utility and yield of TBNA as an adjunct to other conventional procedures in diagnostic bronchoscopy at a centre that was relatively inexperienced with this technique, but where there was availability of rapid on-site evaluation (ROSE). Most of the major indications for TBNA in both malignant as well as benign disease were included.

Setting: University Teaching Hospital naïve to the procedure.

Patient and methods: Forty-five consecutive patients who underwent TBNA as part of diagnostic bronchoscopy during a 2-year study period.

Results: TBNA gave a yield of 65% for evaluation of mediastinal disease, both benign and malignant. The overall diagnostic utility for all indications was 71% and there were no complications.

Conclusions: We conclude that TBNA is a useful and safe adjunct to diagnostic bronchoscopy in routine clinical practice. It has a satisfactory yield even with an inexperienced team, if used with ROSE.

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KEYWORDS

Bronchoscopy; Transbronchial needle aspiration; Diagnostic utility; Yield; Rapid on-site evaluation

Introduction

Transbronchial needle aspiration (TBNA) is a technique usually performed with a flexible bronchoscope, that provides cytological or histological sampling of mediastinal lesions that lie adjacent to the tracheobronchial tree and peribronchial, submucosal, endobronchial, as well as peripheral lesions.

The transbronchial puncture of mediastinal lymph nodes via a rigid bronchoscope was first described in 1949 by Argentine surgeon Eduardo Schieppati. In a later publication he described his results with this technique in a series of patients the majority of whom had suspected bronchogenic or esophageal carcinoma, and concluded that:

This method is free of great risks and, in my opinion, its application could be extended to other diseases, i.e., mediastinal tumors, Hodgkin’s disease, sarcoidosis and lymphogranuloma. This method permits the exploration of important areas which are difficult to approach by any other means.

In the early 1980s, Wang and Terry then introduced an apparatus needle for performing needle aspiration by using a flexible bronchoscope and this led to the birth of modern TBNA. True to the words
of Schieppati written more than 30 years ago, TBNA is at present gaining increasing popularity, due to its expanding clinical applications.

Despite the many indications for TBNA, it has remained a largely underutilized technique. The possible reasons for this include concern with its safety (complications and fear of damaging the bronchoscope), lack of familiarity with the equipment and needles, lack of expertise and training, lack of adequate cytopathological support, and low yield or unpredictable results. Different operators with varying degrees of expertise may obtain a wide range of sensitivities with TBNA. One of the factors affecting the yield is that there is a learning curve in this technique. Haponik et al. demonstrated the effect of education and experience in improving the yield from 21.4% to 47.6% over a 3-year study period. Rong and Cui reported a yield of 20% during their initial experience with TBNA. This immediately increased to 60% when the authors chose to use CT guidance to ensure needle placement on-site. Subsequent to that, the usefulness of real-time guidance with CT fluoroscopy to improve yield has also been studied.

Our aim was to study the diagnostic utility and yield of TBNA in a centre that was relatively naive to the procedure, as an adjunct to routine clinical practice.

Materials and methods

Setting: A university hospital where TBNA had been only attempted sporadically in the past. We prospectively collected data on all TBNA performed at the National University Hospital, Singapore, between August 1, 2000 and July 31, 2002. They were all performed by a pulmonologist who had limited experience with the technique, having done a total of 10 supervised TBNA during his training at another centre, and one unsupervised TBNA prior to the start of the study, and 2 fellows-in-training who were taught the technique for the first time by the aforementioned. The decision to perform the TBNA was either made on review of a prebronchoscopy CT chest that showed mediastinal disease or a peribronchial lesion that was deemed suitable for TBNA, or decided upon at the time of bronchoscopy whereby either one of the 3 bronchoscopist in the study felt that it would be useful, e.g. for submucosal and endobronchial disease.

Technique: Bronchoscopy was performed using standard flexible videobronchoscopes (Olympus Optical Co. Ltd., Japan). During the procedure, specimens were obtained by TBNA, with or without other conventional diagnostic procedures such as bronchoalveolar lavage, bronchial brushings, endobronchial forceps biopsy, and transbronchial lung biopsy. There was an attempt to perform the TBNA before other procedures to avoid endobronchial contamination. However, there were occasions when TBNA was done after other procedures were performed as a second line procedure, for example when endobronchial forceps biopsy caused excessive bleeding or failed to yield adequate tissue in cases of submucosal lesions.

All TBNA specimens were obtained with a Wang/Mill-rose MW 222 cytology needle (Bard Endoscopic Technologies, Massachussets, USA). The techniques employed for wall penetration were the jabbing and hub against wall method. Aspirated specimens were blown onto a slide using the "smear technique", air-dried for Diff-Quik staining and immediately reviewed by an experienced cytologist at the bronchoscopy suite (rapid on-site evaluation or ROSE). The remaining samples were fixed with ethanol for Papanicolaou staining and the excess material flushed into a container with normal saline for further processing for cell-block.

Results

TBNA was performed at 49 sites in 45 consecutive patients, all of whom were undergoing diagnostic bronchoscopy during the 2-year study period. In 42 patients, bronchoscopy was planned after review of the chest CT Scans by the team. Three patients did not have a CT chest at the point of bronchoscopy and TBNA was done for suspected submucosal disease in all 3 cases. The total number of passes taken for each site was between 1 and 8, and this included passes taken by the fellows-in-training, with a mean of 3.1 passes per site. If only 1 pass was made, this was because ROSE was positive on the first pass. Thirty-five specimens yielded a diagnosis on-site with ROSE. Three adequate specimens were positive only after further processing and the remaining 11 specimens were reported as inadequate.

The majority of TBNA were done for evaluating mediastinal lesions on chest CTs (n = 26). The other indications included peribronchial masses on chest CT (n = 7), suspected submucosal disease (n = 9), and endobronchial tumors (n = 7). (see Table 1).

Seventeen of the 26 TBNA performed for evaluating mediastinal lesions were positive, giving a yield of 65.4% for this indication. The disease was due to malignancy in 23 cases; 2 showed granulomatous inflammation from sarcoidosis and one
showed acid fast bacilli from tuberculosis. The majority of TBNA performed for mediastinal lesions were at the subcarinal site ($n = 20$); 4 were right paratracheal, and 2 left paratracheal (see Table 2). Of the 26 patients who had TBNA for mediastinal disease, 4 had additional TBNA done at a different site, one for suspected submucosal disease, and three for an endobronchial lesion.

Seven patients had a peribronchial mass that was deemed suitable for TBNA on reviewing the prebronchoscopy chest CT. Five were positive for malignancy, and one showed necrosis with epithelioid cells suggestive of tuberculosis. Eight of the 9 TBNA that were done for suspected submucosal disease were positive for malignancy. All 7 TBNA of endobronchial lesions were positive: one for recurrent endobronchial Wilms tumor, three for non-small cell carcinoma and 3 for small cell carcinoma (see Table 2).

Overall, TBNA was positive in 35 of 49 sites giving an overall yield of 71.4%. No complications related to the TBNA were documented. Neither was there any damage to the bronchoscopes.

### Discussion

The aim of the study was to determine the utility and yield of TBNA as an adjunct to diagnostic bronchoscopy in routine clinical practice, in relatively inexperienced hands. Whilst de Castro et al.\textsuperscript{12} have actually suggested that at least 50 TBNA procedures are necessary to become proficient in the technique, the bronchoscopist involved in this study was actually performing his 12th TBNA and second unsupervised TBNA at the start of study. Despite relative inexperience, it was a safe procedure with none of the documented complications.\textsuperscript{13}

The well studied and predominant utility of TBNA has been in the staging of bronchogenic carcinoma.\textsuperscript{14–17} However, it has also been used to evaluate mediastinal lymphadenopathy from non-malignant conditions such as Sarcoidosis\textsuperscript{18–21} and mycobacterial infection.\textsuperscript{22,23} The diagnostic usefulness of modern TBNA has been extended beyond evaluation of mediastinal lymphadenopathy and non-surgical staging of lung cancer, to include sampling of peripheral, submucosal and endobronchial tumors.\textsuperscript{24–29} Basically the technique can be used to access lesions that are beyond the tracheobronchial tree such as mediastinal lymph nodes and masses, peribronchial lesions, and lesions within the submucosa. However, these lesions should be within reach of the 13 mm long needle and permit aspiration via the endoluminal approach.

We did not examine its utility for a specific indication such as the staging of bronchogenic carcinoma. Instead, we looked at its use when appropriate for known clinical indications in the

### Table 1 Indications for TBNA and results.

<table>
<thead>
<tr>
<th>Indication</th>
<th>$n$</th>
<th>Diagnostic Result</th>
<th>Yield (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation of mediastinal lymphadenopathy</td>
<td>26</td>
<td>See Table 2</td>
<td>65.5</td>
</tr>
<tr>
<td>Peribronchial mass without endobronchial lesion</td>
<td>7</td>
<td>Necrotizing granuloma</td>
<td>57.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-small cell lung cancer</td>
<td></td>
</tr>
<tr>
<td>Suspected submucosal disease</td>
<td>9</td>
<td>Non-small cell lung cancer</td>
<td>88.9</td>
</tr>
<tr>
<td>Endobronchial tumor</td>
<td>7</td>
<td>Small cell lung cancer</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Metastatic Wilms</td>
<td>100</td>
</tr>
</tbody>
</table>

### Table 2 Diagnostic TBNA for evaluation of mediastinal masses and lymphadenopathy.

<table>
<thead>
<tr>
<th>Result</th>
<th>Site of TBNA</th>
<th>$n$</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-small cell lung cancer</td>
<td>Subcarinal</td>
<td>15</td>
<td>80.8</td>
</tr>
<tr>
<td></td>
<td>Right paratracheal</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Left paratracheal</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Small cell lung cancer</td>
<td>Subcarinal</td>
<td>2</td>
<td>7.7</td>
</tr>
<tr>
<td>Non-caseating granuloma</td>
<td>Subcarinal</td>
<td>2</td>
<td>7.7</td>
</tr>
<tr>
<td>Acid fast bacilli, necrosis</td>
<td>Subcarinal</td>
<td>1</td>
<td>3.8</td>
</tr>
</tbody>
</table>

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setting of diagnostic bronchoscopy in routine clinical practice. Thus it was used as an addition to the routine conventional diagnostic procedures available to the bronchoscopist in both benign as well as malignant diseases. The indications included all the major indications listed above with the exception of its utility in peripheral mass lesions whereby we felt that the procedure of choice would still be a guided transthoracic needle aspiration.

Though the numbers in this study are relatively small, we wanted to describe our initial experience with this technique. At our teaching institution, TBNA had only been performed sporadically prior to the study by another pulmonologist who did not employ ROSE and subsequently abandoned the technique, due to concerns with poor yield. The pulmonologist involved in this study also did not utilize ROSE during his first 10 supervised TBNA's at another institution, and shared the same concern, and therefore decided to embark on this study.

We tried to improve the yield by utilizing ROSE since we revisited this technique. ROSE proved to be very useful in determining the adequacy of the sample and therefore limiting the number of passes taken, and it has also been shown to increase the yield. In addition, most patients had tomographic evaluation prior to a planned TBNA.

With the above measures, a satisfactory yield was obtained even without on-site CT guidance. We conclude that despite relatively inexperienced hands, TBNA remained a useful adjunct in routine diagnostic bronchoscopy. It was safe even with our limited experience, and relatively easy to perform.

In our opinion, an important factor in contributing to the satisfactory yield despite inexperience since revisiting this largely underutilized technique was ROSE.

References

