Endobronchial ultrasound transbronchial needle aspiration: a hybrid method

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Background: Conventional transbronchial needle aspiration (cTBNA) was first performed approximately 30 years ago; however TBNA was not widely adopted until the development of endobronchial ultrasound transbronchial needle aspiration (EBUS-TBNA). Current EBUS-TBNA needle sizes are limited to 21- and 22-gauge. In order to determine whether a 19-gauge (19G) needle in EBUS-TBNA can further improve the diagnostic yield and simplify the methodology of EBUS-TBNA we developed a hybrid method. Here we report our initial experience in assessing the feasibility of performing EBUS-TBNA using a conventional 19G TBNA needle.

Methods: Ten patients with diagnosed or suspected lung cancer with or without lymphadenopathy (LAD) were sampled for diagnostic and/or staging purposes. Patients with suspected benign processes were sampled only for diagnosis. A 19G cTBNA needle was deployed through the working channel of the EBUS bronchoscope. Samples obtained were evaluated for cyto- and histopathologic adequacy.

Results: All 10 patients successfully underwent hybrid 19G EBUS-TBNA. All samples were considered adequate for cyto- and histopathologic evaluation.

Conclusions: Hybrid EBUS-TBNA utilizing a 19G cTBNA needle through an EBUS scope is feasible and may be able to reliably acquire histologic specimens.

Keywords: EBUS; TBNA; 19-gauge needle; histology; cytology

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Introduction

Conventional transbronchial needle aspiration (cTBNA) was first performed approximately 30 years ago however was never widely adopted until the development of endobronchial ultrasound transbronchial needle aspiration (EBUS-TBNA) (1,2). Conventional TBNA is performed first through procedural planning using a chest CT and correlating the images to landmarks within the airway to select a puncture site. This is followed by a "blind" needle biopsy through the airway wall. During EBUS-TBNA the same initial planning is performed followed by real time ultrasonographic (US) visualization and biopsy of the target lesion. Since its introduction EBUS-TBNA has proven to be more dependable and attractive to the bronchoscopist than cTBNA (3-5).

Figure 1 Device used to fix and stabilize a conventional TBNA needle to the EBUS scope. EBUS-TBNA, endobronchial ultrasound transbronchial needle aspiration.

The performance of TBNA with or without EBUS are essentially the same, passing a needle through the airway wall, however factors above and beyond real time US-guidance that may make EBUS-TBNA more effective are the 35 degree of angle at the exit of the needle from the working channel of the bronchoscope and the stiffness of the EBUS needle. These factors have eliminated the difficulty of obtaining an adequate angle of entry and the consequent need for a more flexible needle in cTBNA.

In order to determine whether a 19-gauge (19G) needle in EBUS-TBNA can further improve the diagnostic yield and simplify the methodology of EBUS-TBNA we developed a hybrid method. Here we report our initial experience in assessing the feasibility of performing EBUS-TBNA using a conventional 19G TBNA needle.

Materials and methods

Patients with diagnosed or suspected lung cancer with or without mediastinal or hilar lymphadenopathy (LAD) were sampled for diagnostic and/or staging purposes. Patients with suspected benign processes were sampled only for diagnosis. An EBUS bronchoscope with a 2.2 mm working channel was employed. The 19G needles used in performing TBNA were the WANG MW319 (Conmed, Utica, NY, USA) or an Excelon 19G (Boston Scientific, Marlborough, MA, USA). Standard staging technique was employed in patients with suspected or known malignancy (6). In patients with suspected benign disease the most prominent lesion was sampled initially.

Hybrid method

Instead of using a standard EBUS-TBNA needle that is fixed to the bronchoscope via a locking mechanism we utilized a conventional 19G TBNA needle through the working channel of the EBUS bronchoscope. The needle was fixed in place using a device that locked it in place onto the bronchoscope (*Figure 1*) lessening the natural tendency to be pushed back into the scope when resistance is met during initial puncture.

MW319

After insertion of the MW319 needle into the working channel of the bronchoscope, the first biopsy was taken without retracting the inner 21G needle. Biopsy was performed by moving the 21G needle back and forth within the lesion 3–5 times under suction. The second aspiration biopsy was taken with the inner 21G needle retracted into the 19G needle, the exposed 19G needle was then used to obtain a "core" specimen for surgical pathology.

Excelon

The excelon needle was inserted into the working channel of the EBUS bronchoscope then passed through the airway wall under ultrasound guidance. Once seen on US, the needle was passed back and forth within the lesion 3–5 times.

Three full needle passes were performed at each target lesion. The specimens were then processed for rapid on-site cytopathology as well as full histo- and cytopathologic evaluation based on the practices of the institution at which the procedure was performed.

Results

Patient 1—left upper lobe lesion with a high suspicion of primary lung carcinoma. TBNA with the MW319 needle was used to obtain cytology and histology specimens at lymph node (LN) stations 4R, 7, 4L and 11L. The specimens were diagnostic for adenosquamous lung cancer at LN stations 7, 4L and 11L. The histology specimen obtained by the 19G needle contributed to the diagnosis of

mixed cell type.

Patient 2—right lower lobe mass of 8 cm in size with a normal mediastinum by CT and PET scan. Transbronchial biopsy with of the RLL mass was diagnostic of squamous cell lung carcinoma. EBUS-TBNA performed for staging with MW319 needle for cytology and histology specimen at station 4L, 7, and 11R. All specimens were negative for malignancy with histological cores revealing anthracotic lymphoid tissue. The patient was referred for surgical resection.

Patient 3—bilateral pulmonary nodules with a normal mediastinum. EBUS-TBNA of 4L using the MW319 needle showed adequate lymphoid material but was negative for malignancy on the cytology slides.

Patient 4—right upper lobe nodule with station 4R LAD noted on chest CT. EBUS-TBNA was performed with the MW319 needle for cytology and histology. All specimens obtained were positive for small cell carcinoma, core specimens showed small cell carcinoma with extensive necrosis.

Patient 5—LAD suspicious for sarcoidosis. EBUS-TBNA was performed using the MW319 needle for cytology and histology at LN stations 11R, 11L and 7. All specimens were diagnostic for non-caseating granuloma compatible with sarcoidosis.

Patient 6—history of adenocarcinoma previously treated with stereotactic body radiotherapy, now with a chest CT suggestive of metastatic recurrence. EBUS-TBNA of the subcarinal LN was performed using the 19G Excelon needle for cytology and histology. The specimen was positive for adenocarcinoma, was sent for molecular analysis and was found to be adequate for further testing.

Patient 7—left lower lobe mass with hilar and mediastinal LAD. EBUS-TBNA of the 4R LAD using the 19G Excelon needle for cytology and histology. Both cytologic and histologic evaluation showed adenocarcinoma. The samples were then sent for molecular analysis and were found to be adequate.

Patient 8—bilateral pulmonary nodules and adenopathy seen on CT. All were FDG-avid on PET/CT. EBUS-TBNA using the 19G Excelon needle of LN stations 4R, 4L and 11L showed adequate lymphoid material but no malignancy on both cytologic and histologic specimens. Bronchoalveolar lavage showed mycobacterium avium intracellulare infection.

Patient 9—patient presenting with progressive weakness, found to have moderate sized hilar and mediastinal adenopathy. EBUS-TBNA using the 19G Excelon needle of LN stations 4R, 7 and 4L showed non-caseating granuloma compatible with sarcoidosis on all specimens.

Patient 10—patient presenting with progressive weakness, found to have a large left lower lobe mass and small adenopathy. EBUS-TBNA using the 19G Excelon needle of LN stations 7 and 11L revealed adequate lymphoid material. TBNA of the mass showed lymphoma on the core histologic specimen.

Conclusions

Conventional TBNA has been employed for approximately 30 years with some reports indicating use of a histology needle as being associated with increased diagnostic yields (7,8). Recent development of EBUS-TBNA has validated and popularized the technique of TBNA as it provides the operator with real-time US visualization of target lesions. The ability to visualize and biopsy target lesions external to the airways under real time US is perhaps one of the most important advances in recent medical history. The value of EBUS goes beyond increasing the diagnostic yield of TBNA as it plays a vital role in teaching the performance of and in understanding the interplay of TBNA and lung anatomy in relation to the location of LN (9).

In this feasibility study we have shown that the performance of EBUS-TBNA using a conventional 19G histology needle is not only possible but may potentially lead to improvements in diagnostic yield due to the ability to acquire histological specimens. Previous reports have suggested that larger gauge EBUS needles are associated with the acquisition of significantly better histology samples (10). As of now there is no commercially available dedicated 19G EBUS-TBNA needle as there is in the 21G and 22G sizes. Due to this we utilized conventional TBNA needles through the working channel of the EBUS scope. This approach may be considered a potential simplification to the performance of EBUS as the current available needles can at times be cumbersome to operate, especially to those practitioners who are previously versed in cTBNA (11,12). In addition, use of a conventional 19G is not only effective but appears able to assist in the consistent procurement of histological specimens.

One procedure note that should be discussed is the use of a fixation device to anchor the scope and needle catheter together (*Figure 2*). The device allows for application of a major principal of EBUS-TBNA which is to fix the needle to the scope there by alleviating two of the most common mistakes performed during TBNA. In standard TBNA

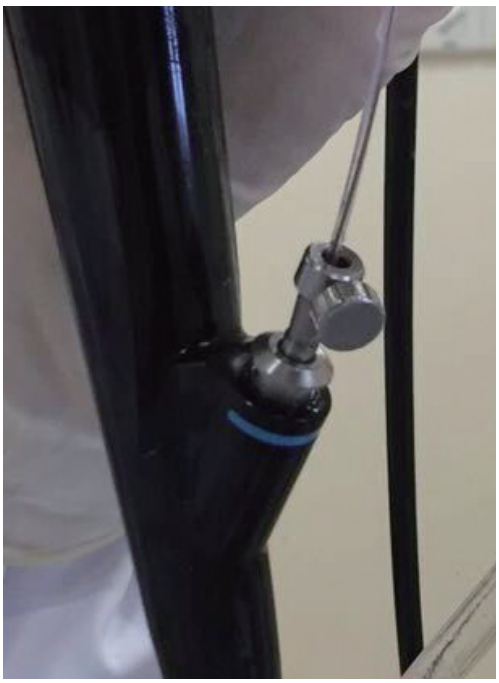

Figure 2 A 19-gauge (19G) TBNA needle inserted through the fixing device and into an EBUS scope in preparation for biopsy. EBUS-TBNA, endobronchial ultrasound transbronchial needle aspiration.

the most common mistake is overextension of the needle catheter out of the tip of the scope, which leads to a loss of scope stiffness and support of the needle catheter making puncture through the airway less effective. The second most common issue found during TBNA when there is a lack of or inadequate fixation of the needle catheter to the scope is backward migration of the catheter and needle into the working channel of the scope during puncture through the airway wall. In our hybrid method the needle catheter is fixed to the EBUS scope to anchor the needle and to prevent it from been pushed back into the channel of the scope when resistance is met during puncture.

The primary limitation of our study was that it is a feasibility trial that was not powered to detect an improvement in diagnostic yield or specimen adequacy (cytologic or histologic). In addition, the study was not randomized in its use of 19G needle types rather it was left to facility discretion and available equipment.

An important note to this study is that EBUS-TBNA may not be available at all institutions due to its high cost to acquire, maintain and operate. This makes the continued teaching of cTBNA all that more important and highlights the educational aspect that EBUS bring to the bronchoscopist in better understanding the endo- and extra-luminal airway anatomy.

One of the potential strengths of this hybrid method is the simplification of EBUS-TBNA which may lead to its wider application, improved patient care and superior tissue acquisition. This last point is of great importance as targetable tumor genes are continuing to be discovered. An increasing number of targetable genes makes 'adequate tissue' a moving target with not only more tissue but tissue containing dense, high quality tumor being required. Future studies are needed to further delineate this technique and should aim to compare the efficacy of the 19G needle with the largest (21G) standard EBUS needle and even with one another as the MW319 has a unique needle (21G) in needle (19G) design developed to decrease specimen contamination from retained airway wall debris. Finally, further investigation into the quality of specimen obtained from 19G needle for molecular analysis should be encouraged.

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None.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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