Original Article

Utility and safety of endobronchial ultrasound-guided transbronchial needle aspiration in patients with mediastinal and hilar lymphadenopathy: Western region experience

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Abstract:

AIMS: The aim of the study was to evaluate the clinical utility and safety of endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA) in patients with mediastinal and hilar lymphadenopathy and to explicitly describe the utility of this procedure in patient's outcome.

METHODS: A retrospective review and analysis was conducted on 52 patients with mediastinal or hilar lymphadenopathy who underwent EBUS-TBNA from June 2012 to June 2016. All the patients were evaluated by computed tomography (CT) chest with contrast before EBUS examination. Enlarged mediastinal or hilar lymph node was defined as >1 cm short axis on the enhanced CT.

RESULTS: Among the 52 patients studied, 57.7% were presented with mediastinal or hilar lymphadenopathy for diagnosis and 42.3% presented with suspected mediastinal malignancy. Paratracheal stations were the most common site for puncture in 33 lymph nodes (43%). The best diagnostic yield was obtained from subcarinal stations and the lowest yield from the hilar stations. Surgical biopsies confirmed lymphoma in six patients, tuberculosis (TB) in three, sarcoidosis in two and one had metastatic adenocarcinoma of unknown primary. The sensitivity, specificity, positive predictive value, and negative predictive value of EBUS-TBNA for diagnosis of mediastinal and hilar lymph node abnormalities were 78.6%, 100%, 100%, and 80%, respectively. The diagnostic yield of EBUS-TBNA in malignant and benign conditions was 79.0%.

CONCLUSIONS: EBUS-TBNA is a safe and efficacious procedure which can be performed using conscious sedation with high yields. It can be used for the staging of malignancies as well as for the diagnosis of inflammatory and infectious conditions such as sarcoidosis and TB.

Keywords:
Diagnosis, endobronchial ultrasound-guided transbronchial needle aspiration, mediastinal and hilar lymphadenopathy, safety, utility

Mediastinal and hilar lymphadenopathy is a common condition that is encountered by general internists, pulmonologists, and thoracic surgeons. The differential diagnosis includes malignant or benign conditions such as inflammatory or infectious causes.[1] Many cases require histopathological evaluation to establish the underlying etiology or staging purposes in cases of malignancy.

Several techniques are available to obtain pathological samples of mediastinal or hilar lymph nodes including mediastinoscopy, conventional bronchoscopic transbronchial

needle aspiration (TBNA), computed tomography (CT)-guided needle aspiration, and endoscopic esophageal ultrasound.[2] The need for general anesthesia, need for operating theater or hospital admission, variation in yield, difficulty to access certain lymph node stations, and complications are well-known limitations of these techniques.[2] Therefore, a dedicated scope with a built-in ultrasonic probe has been developed to obtain real-time transbronchial fine-needle aspiration of enlarged mediastinal and hilar lymph nodes at various locations.[1,2]

Over the last decade, the utilization of endobronchial ultrasound TBNA (EBUS-TBNA) became more popular. Several studies have established the utility and safety of this procedure. The American College of Chest Physicians (ACCP) lung cancer directions have recommended EBUS-TBNA over surgical staging as a best first step with an overall median sensitivity of 89% and median negative predictive value of 91%.[3] Furthermore, this modality is also useful in the evaluation of benign conditions such as sarcoidosis and tuberculosis (TB).[4,5]

Several studies were published worldwide; however, only one study has been published from Saudi Arabia.[6] Raddaoui *et al*. reported an overall diagnostic yield of 78.8%. We aimed to report our initial experience with this technology and to explicitly demonstrate the clinical utility of this procedure in patients' outcome.

Methods

Patients' characteristics
The ethical approval for conducting the present study was obtained from the Biomedical Ethics Research Committee. The study was according to the principles of Helsinki Declaration. A retrospective chart review was conducted on 52 patients with mediastinal or hilar lymphadenopathy who were referred to the interventional pulmonology service for EBUS-TBNA between June 2012 and June 2016. The procedure was indicated to establish the diagnosis of an enlarged lymph node of unknown cause or to accurately stage patients with lung cancer. All the patients were evaluated by CT chest with contrast before EBUS examination. Mediastinal or hilar lymph nodes that measure >1 cm in short axis on enhanced CT are considered as enlarged and prompt consultation to the interventional pulmonology service for evaluation.

Endobronchial ultrasound procedure
Most procedures were performed as outpatient under conscious sedation using fentanyl and midazolam as well as lidocaine 1%–2% for topical anesthesia. Informed consent about the procedure was obtained from all

patients. Then, Olympus (BF UC260FW) EBUS scope was inserted orally through a bite block to perform EBUS-TBNA. This is a dedicated bronchoscope fitted with linear ultrasound probe that enables real-time TBNA. The EBUS bronchoscope has an outer diameter of 6.9 mm, a working channel of 2.2 mm, and endoscopic viewing optics at a 30° oblique angle. The ultrasonic transducer is convex and mounted at the tip of the bronchoscope that enables a 50° sector views parallel to the long axis of the bronchoscope [Figure 1a]. The scanning was carried out at a frequency of 7.5 MHz with a penetration of 20–50 mm. Images were obtained by contacting the probe or by attaching a balloon on the tip and inflating with water. The ultrasound image was managed by an Olympus ultrasound processor (EU-ME1) and viewed along with the conventional bronchoscopy image on the same monitor. EBUS examination of the trachea and main stem bronchi was performed to localize the adjacent lymph nodal station in relation to the major vessels with the help of the CT scan.

Lymph node sampling procedure
Once the target lymph node station was identified by ultrasound, the dedicated 21-gauge needle (NA-201SX-4021) was inserted into the working channel to perform real-time TBNA [Figure 1b]. Then, the needle punctured the designated lymph node under direct EBUS guidance [Figure 1c]. The stylet was removed after moving it back and forth to dislodge any bronchial cells or cartilage. Then, the suction syringe was attached to obtain a real-time sampling of the lymph node by moving the needle 10–15 times within the lymph node. Finally, the needle was retrieved, and the aspirated material was smeared onto glass slides. Then, the smears were air-dried and stained immediately with Shandon Kwik-Diff stain for rapid on-site evaluation (ROSE) by
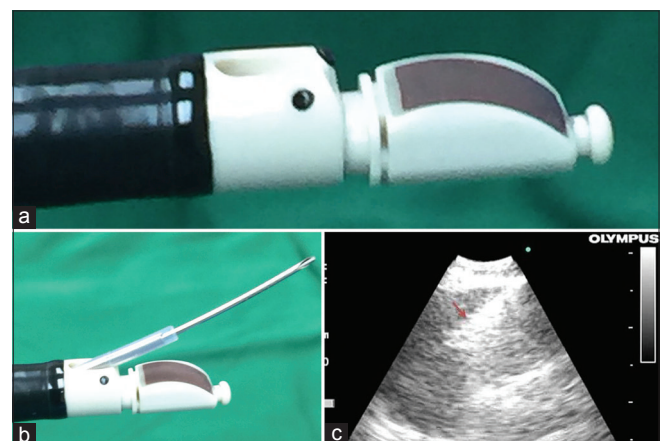

Figure 1: (a) Tip of the endobronchial ultrasound bronchoscope (BF UC260FW) with the linear curved-array ultrasonic transducer. (b) Tip of the endobronchial ultrasound bronchoscope (BF UC260FW) with dedicated transbronchial needle aspiration needle is inserted through the working channel. (c) Endobronchial ultrasound image of the needle (arrow) puncture of the lymph node

cytopathologist to confirm adequate cell material and to look for the cells of interest for a specific diagnosis. The remaining samples were collected in cytology collection fluid (Sure Path, Germany) and further analyzed in the cytology laboratory. Tissue fragments and cores were fixed in 95% formalin and stained with hematoxylin and eosin (Thermo Scientific, Ohio, USA).

While performing EBUS for non-small-cell lung carcinoma (NSCLC) staging, we followed the following approach. After systemic evaluation of the mediastinum by EBUS, we first sample the highest N stage nodal station >5 mm to avoid contamination. If malignancy in the highest N stage nodal station is confirmed by ROSE, then sampling of lower nodal station is not required. On the other hand, if malignancy is not confirmed by ROSE after three passes per nodal station, then usually sampling two more nodal stations >5 mm if found will be done.

Diagnosis of malignancy was based on the identification of malignant cells on the TBNA specimen and was confirmed on surgical resection if needed. Patients with malignant diseases were managed accordingly. Diagnosis of sarcoidosis or TB was confirmed based on the clinical, radiological, and pathological identification of noncaseating or caseating granulomas, respectively. In addition, aspirates with positive acid-fast bacilli or positive mycobacterium TB culture were needed to confirm TB. All patients with sarcoidosis or TB diagnosis underwent at least 1 year of clinical and radiological follow-up to ensure stability or improvement in their condition. This, therefore, rules out a false-negative diagnosis of malignancy.

Statistical analysis

The statistical analysis was performed employing Statistical Package for the Social Sciences Version 16 (Chicago, IL, USA). The quantitative data were shown in the form of mean and standard deviation (SD) and the qualitative data in number and percentage. The sensitivity, specificity, positive predictive value, negative predictive value, and accuracy were calculated by utilizing the standard definitions.

Results

EBUS-TBNA was performed on 52 patients. There were 31 (60%) males and mean age of patients was 53 years (range: 18–76). The main indication for EBUS was to diagnose cases with mediastinal or hilar lymphadenopathy in thirty patients (58%) or for diagnosis and staging of suspected mediastinal malignancy in 22 patients. Twenty-eight patients (54%) were diagnosed with a malignant condition [Table 1]. All the procedures were completed under conscious

Table 1: General characteristics of cases

Characteristic	Result	Percentage
Gender, male/female	31/21	60/40
Age (mean), years	53	18-76
Indication of procedure*		
Diagnosis	30	58
Diagnosis and staging	22	42
Location of the lymph node biopsied		
Mediastinal (single station)	26	50
Hilar	6	11.5
Multiple stations	20	38.5
Final diagnosis of cases		
Malignant	28	53.8
NSCLC/adenocarcinoma	10	19.2
NSCLC/squamous	5	9.6
SCLC	2	3.8
Lymphoma	6	11.5
Metastatic adenocarcinoma	4	7.7
Metastatic squamous cell carcinoma	1	1.9
Benign	24	46.2
Sarcoidosis	15	28.8
TB	9	17.3

*Diagnosis = Patients with mediastinal lesions with no previous diagnosis, *Diagnosis and staging = Patients with radiologically suspected mediastinal malignancy without previous diagnosis. NSCLC = Non-small-cell lung carcinoma, SCLC = Small cell lung cancer, TB = Tuberculosis

sedation using a combination of midazolam and fentanyl in 47 patients and only midazolam in five patients. Topical lidocaine (1%–2%) was used in all patients. Most of the patients, i.e., 44 (85%) had EBUS as an outpatient. All the patients tolerated the procedure quite well, and there were no complications.

We performed 203 biopsies of 76 lymph nodes. The mean number of needle passes per lymph node station was three (range: 1–5). Mean (SD) lymph node size was 1.6 (0.56) cm (range: 0.8–3.6) as measured during EBUS examination. EBUS-TBNA was performed from a single mediastinal lymph node station in 26 patients. Paratracheal stations were the most common site for puncture in 33 lymph nodes (43%) [Table 2]. Among the 76 lymph nodes biopsied, 59 were successful and specific diagnosis was established. Therefore, the overall diagnostic yield concerning the lymph nodes was 78%. The best diagnostic yield was obtained from subcarinal stations and the lowest yield from the hilar stations [Table 2]. However, the differences were not statistically significant.

Adequate lymphocytic material was obtained in 47 patients (90%). Therefore, analyzing the diagnostic yield for the 52 patients instead of the lymph nodes, EBUS-TBNA established a definitive diagnosis in 41 patients (79%) [Figure 2]. Surgical biopsies were performed in the 11 patients (21%) who had inadequate cellular material or nondiagnostic samples. Surgical biopsies in five patients confirmed lymphoma, three
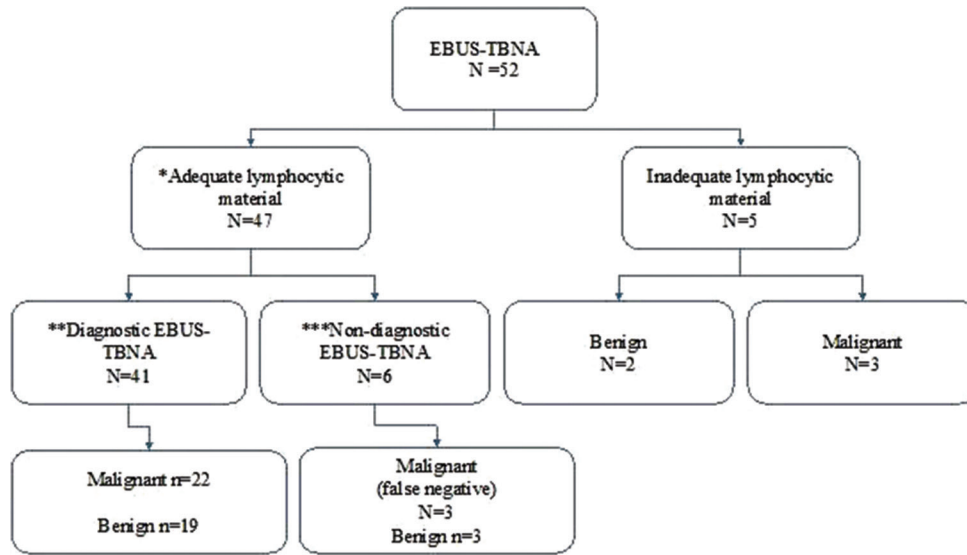
Figure 2: Results of endobronchial ultrasound-guided transbronchial needle aspiration of the studied patients. *Adequate (evaluable) lymphocytic population seen on the endobronchial ultrasound-guided transbronchial needle aspiration cytology slides. Cytology specimens will be considered inadequate if it contains blood or endobronchial cells with only a few lymphocytes. **Diagnostic sample if positive for "cells of interest" either malignant cells, caseating, or non-caseating granuloma. ***Nondiagnostic if it showed only normal or reactive lymphocytes without specific diagnosis

Table 2: Results of real-time endobronchial ultrasound-guided transbronchial needle aspiration by lymph node location

Lymph node station	Nodes (n)	Lymphocyte positive (n)	Diagnosis established from biopsy (n)	Lymph node diagnosed (%)
Paratracheal	33	30	26	79
Sub-carinal	24	21	20	83
Hilar	19	16	13	68
Total	76	67	59	78

patients had TB, two patients had sarcoidosis, and one patient had metastatic adenocarcinoma of unknown primary. The sensitivity, specificity, positive predictive value, and negative predictive value of EBUS-TBNA for diagnosis of mediastinal and hilar lymph node abnormalities were 78.6%, 100%, 100%, and 80%, respectively [Table 3].

The diagnostic yield of EBUS-TBNA in malignant and benign conditions was 79% and disease-specific yield is shown in Table 4. EBUS-TBNA was useful and provided significant management guidance to the patients studied [Tables 5 and 6]. Eleven patients avoided mediastinoscopy because of positive N2, N3 disease by EBUS-TBNA, and hence, chemotherapy was the best treatment option [Table 5]. Sarcoidosis and TB patients demonstrated radiological stability or resolution on follow-up imaging with or without treatment [Table 6].

Discussion

In this study, EBUS-TBNA enabled a specific diagnosis in 79% of the patients studied. This study documents the advantage of EBUS-TBNA in establishing the diagnosis of mediastinal and hilar lymph nodes. In addition, the procedure was safe, well tolerated, and did not

Table 3: Comparison of real-time endobronchial ultrasound-guided transbronchial needle aspiration results with final diagnosis in mediastinal and hilar lymph nodes

Final diagnosis	EBUS-TBNA result		
	Malignant	Benign	Total
Malignant	22	6	28
Benign	0	24	24
Total	22	30	52

EBUS-TBNA = Endobronchial ultrasound-guided transbronchial needle aspiration

require hospital admission or administration of general anesthesia.

The diagnostic yield of EBUS-TBNA in nonselected patients is not consistent among different studies. Studies from experienced centers reported a diagnostic yield of 88%–97%.[1,2,7-9] Yasufuku et al. published the first study with the diagnostic yield of 97%.[2] The largest study was done on 502 patients and showed a diagnostic yield of 94%.[1] Other centers reported a diagnostic yield of 74%–78%[6,10] and the diagnostic yield in this study (79%) falls somewhere in between these yields of different studies. Variation in yield depends on hospital volume of cases, bronchoscopist skills, pathologist experience, lymph node size, and a number of lymph nodal station

biopsied.[11] A health center that carried out at least 100 or more EBUS-TBNA biopsy techniques every year than another center would be related with an odds ratio of $1.003^{100} = 1.35$. In this manner, every 100 unit increment in hospital volume increases the chances of a diagnosis by another 35%.[11] Therefore, the highest diagnostic yield is reported from centers that perform many cases annually.

The ideal type of sedation during EBUS procedure is still controversial. In contrast to mediastinoscopy, EBUS has the advantage of being carried out under conscious sedation. All of the cases in this study were performed in the endoscopy unit under moderate sedation which is similar to most published studies.[12] However, EBUS was also performed in the operating theater under general anesthesia in few studies.[13-15] These three studies compared moderate and deep sedation during EBUS with regard to diagnostic yield, patient's comfort, and complications. Yarmus *et al*. reported statistically significant advantage in employing deep sedation on diagnostic yield in a multivariable analysis.[16] In contrast, no difference in the diagnostic yield was found in a prospective study.[17] Patient's comfort was also similar in both moderate and deep sedation types.[17,18] Therefore, until further studies favor a sedation type over another, EBUS can be performed with either way of sedation.

Role of EBUS-TBNA in lung cancer staging is well established in the most recent international guidelines.[3,19,20] EBUS-TBNA is currently the recommended method of choice over mediastinoscopy for lung cancer patients with suspected N2 or N3 involvement.[3,19,20] This recommendation was based on higher EBUS sensitivity and specificity based on more publications over the past decade. However, international guidelines proposed different recommendations about how many and which lymph node stations should be sampled and which level of thoroughness is necessary for different

Table 4: Diagnostic yield of endobronchial ultrasound-guided transbronchial needle aspiration according to each disease

	Diagnosis obtained by EBUS-TBNA	
Final diagnosis	***n***	***n* (%)**
Malignant	28	22 (79)
NSCLC/adenocarcinoma	10	10 (100)
NSCLC/squamous	5	5 (100)
SCLC	2	2 (100)
Lymphoma	6	1 (17)
Metastatic adenocarcinoma	4	3 (75)
Metastatic squamous	1	1 (100)
Benign	24	19 (79)
Sarcoidosis	15	13 (87)
TB	9	6 (67)

NSCLC = Non-small-cell lung carcinoma, SCLC = Small cell lung cancer, TB = Tuberculosis, EBUS-TBNA = Endobronchial ultrasound-guided transbronchial needle aspiration

Table 5: Details of lesions targeted, cytology result, and outcomes of patients undergoing endobronchial ultrasound-guided transbronchial needle aspiration for diagnostic and staging purposes

Patient	LN station aspirated	Cytology result	Outcome
1	11L	Adenocarcinoma	Metastatic adenocarcinoma/GI origin, chemotherapy
2	7, 10L	Inadequate material	VATS guided tissue biopsy confirmed lymphoma, chemotherapy
3	4R	NSCLC/adenocarcinoma recurrence	EGFR mutation positive, targeted therapy
4	2L, 4R, 7	SCLC	Primary tissue diagnosis, chemotherapy
5	7	NSCLC/adenocarcinoma	Avoided mediastinoscopy as N2 disease confirmed, chemotherapy
6	4R, 7	NSCLC/adenocarcinoma	Avoided mediastinoscopy as N2 disease confirmed, chemotherapy
7	4R, 10R	NSCLC/squamous cell carcinoma	Confirmed negative mediastinum and N1 disease, surgical resection
8	4R	NSCLC/squamous cell carcinoma	Avoided mediastinoscopy as N2 disease confirmed, chemotherapy
9	4R	SCLC	Primary tissue diagnosis, chemotherapy
10	4R	NSCLC/squamous cell carcinoma	Avoided mediastinoscopy as N2 disease confirmed, chemotherapy
11	4L, 4R, 7	NSCLC/squamous cell carcinoma	Avoided mediastinoscopy as N3 disease confirmed, chemotherapy
12	4R	NSCLC/adenocarcinoma	Avoided mediastinoscopy as N2 disease confirmed, chemotherapy
13	10L	Reactive lymphocytes	VATS guided tissue biopsy confirmed lymphoma, chemotherapy
14	7	NSCLC/squamous cell carcinoma	Avoided mediastinoscopy as N2 disease confirmed, chemotherapy
15	4R	Adenocarcinoma	Metastatic adenocarcinoma/breast origin, chemotherapy
16	4R	NSCLC/adenocarcinoma	Avoided mediastinoscopy as N2 disease confirmed, chemotherapy
17	4R	NSCLC/adenocarcinoma	Avoided mediastinoscopy as N2 disease confirmed, chemotherapy
18	10L	NSCLC/adenocarcinoma	Confirmed negative mediastinum and N1 disease, surgical resection
19	4R	NSCLC/adenocarcinoma	Avoided mediastinoscopy as N3 disease confirmed, chemotherapy
20	2R	Noncaseating granuloma	Case of lower esophageal cancer confirmed negative mediastinum with N0 disease, surgical resection. Sarcoidosis, stability on follow-up CT
21	7, 10R	NSCLC/adenocarcinoma	Confirmed negative mediastinum and N1 disease, surgical resection
22	4R, 10R	NSCLC/adenocarcinoma	Avoided mediastinoscopy as N2 disease confirmed, chemotherapy

NSCLC = Nonsmall-cell lung carcinoma, SCLC = Small cell lung cancer, CT = Computed tomography, EGFR = Epidermal growth factor receptor, VATS = Video-assisted thoracoscopic surgery, GI = Gastrointestinal, LN = Lymph node

Table 6: Details of lesions targeted, cytology result, and outcomes of patients undergoing endobronchial ultrasound-guided transbronchial needle aspiration for diagnostic purposes

Patient	LN station aspirated	Cytology result	Outcome
1	4R, 7	Lymphocytes with caseating granuloma	Resolution with anti-TB treatment
2	7, 10R	Lymphocytes with caseating granuloma	Resolution with anti-TB treatment
3	2L, 4L, 4R, 10R	Noncaseating granuloma	Sarcoidosis, resolution on follow up CT
4	4R, 7	Noncaseating granuloma	Sarcoidosis, resolution on follow-up CT
5	7, 10R	Inadequate material	VATS-guided tissue biopsy confirmed lymphoma, chemotherapy
6	7, 10R	Noncaseating granuloma	Sarcoidosis, resolution on follow-up CT
7	4L	Noncaseating granuloma	Sarcoidosis, stability on follow-up CT
8	4R	Lymphocytes with caseating granuloma	Resolution with anti-TB treatment
9	7	Noncaseating granuloma	Sarcoidosis, resolution on follow-up CT
10	7	Lymphocytes with caseating granuloma	Resolution with anti-TB treatment
11	4R, 7	Noncaseating granuloma	Sarcoidosis, resolution on follow-up CT
12	4R	Lymphocytes with caseating granuloma	Resolution with anti-TB treatment
13	7	Reactive lymphocytes	Mediastinoscopy-guided tissue biopsy-confirmed TB, resolution with anti-TB treatment
14	7	Noncaseating granuloma	Sarcoidosis, resolution on follow-up CT
15	7	Noncaseating granuloma	Sarcoidosis, resolution on follow-up CT
16	7	Noncaseating granuloma	Sarcoidosis, resolution on follow-up CT
17	4R	Reactive lymphocytes	Mediastinoscopy-guided tissue biopsy confirmed TB, resolution with anti-TB treatment
18	4R, 7	Noncaseating granuloma	Sarcoidosis, resolution on follow-up CT
19	7, 10R	Noncaseating granuloma	Sarcoidosis, stability on follow-up CT
20	4R	Reactive lymphocytes	Mediastinoscopy-guided tissue biopsy confirmed lymphoma, chemotherapy
21	4R	Inadequate material	Mediastinoscopy-guided tissue biopsy confirmed sarcoidosis, stability on follow-up CT
22	4R, 10R	Lymphocytes with caseating granuloma	Resolution with anti-TB treatment
23	10R	Inadequate material	VATS-guided tissue biopsy-confirmed Sarcoidosis, resolution on follow-up CT
24	4R	Noncaseating granuloma	Sarcoidosis, stability on follow-up CT
25	4R, 10L	Squamous cell carcinoma	Metastatic squamous cell carcinoma/uterine origin, chemotherapy
26	10R	Reactive lymphocytes	VATS-guided tissue biopsy confirmed metastatic adenocarcinoma, chemotherapy
27	7, 10R	Malignant lymphoma	Chemotherapy
28	11L	Reactive lymphocytes	VATS-guided tissue biopsy confirmed TB, resolution with anti-TB treatment
29	7	Adenocarcinoma	Metastatic adenocarcinoma/breast origin, chemotherapy
30	7, 10R	Inadequate material	VATS-guided tissue biopsy confirmed lymphoma, chemotherapy

TB = Tuberculosis, CT = Computed tomography, VATS = Video-assisted thoracoscopic surgery, LN = Lymph node

situations.[20] European guidelines suggest a complete assessment of mediastinal and hilar nodal stations, and sampling of at least three different mediastinal nodal stations (4 R, 4 L, and 7) in patients with NSCLC and an abnormal mediastinum by CT or CT-positron emission tomography (Recommendation Grade D).[20] On the other hand, the ACCP guidelines suggested four levels of thoroughness to serve as a guide. Level A involves complete sampling of each node in each major mediastinal node station (2R, 4R, 2 L, 4 L, 7, and possibly 5 or 6), while level B involves a systematic sampling of each node station. Level C involves a selective sampling of suspicious nodes only and level D involves very limited or no sampling with only visual assessment.[3] In cases of suspected NSCLC, systemic evaluation of the mediastinum is initially conducted by EBUS. Then, the highest N stage nodal station >5 mm is sampled. If malignancy in the highest N stage nodal station is confirmed by ROSE, then sampling of lower nodal station is not required. However, if malignancy is not confirmed by ROSE after three passes per nodal station then usually sampling two more nodal stations >5 mm if found will be done. In the present study, the sensitivity and specificity of EBUS-TBNA to accurately diagnose malignancy was 86.7% and 100%, respectively. This result is lower than median sensitivity of 89% from pooled study results.[3] This difference is likely related to sample size, different study population, and variation in centers experience with this technique. In this study, 11 patients avoided mediastinoscopy and declined surgical treatment based on accurate staging of N2, N3 diseases, three patients underwent surgical resection based on accurate staging of N1 disease. Further, one patient with lower esophageal cancer

had confirmed N0 disease based on EBUS-TBNA and underwent surgical resection.

Several studies have also confirmed EBUS-TBNA utility in obtaining adequate tissue material for molecular biology. Specific mutations such as epidermal growth factor receptor, K-ras, EML4-anaplastic lymphoma kinase, and P53 can be tested on material obtained by EBUS-TBNA.[21,22] In this study, EBUS-TBNA was performed on one patient for this specific indication and was able to obtain adequate material.

EBUS-TBNA has also been proven to be helpful in diagnosing benign conditions such as sarcoidosis and TB. The efficacy and safety of EBUS-TBNA in the diagnosis of sarcoidosis was documented by a systematic review and meta-analysis of 553 patients from 15 studies.[4] Agarwal et al. reported a pooled diagnostic accuracy of 79% and a diagnostic yield in the range of 54% to 93% for EBUS-TBNA.[4]

The EBUS-TBNA diagnostic yield for sarcoidosis of this study was 87%. The diagnosis of sarcoidosis in fifteen patients was confirmed by the presence of noncaseating granuloma in specimens obtained by EBUS-TBNA (13 patients) or surgical biopsy (2 patients) and documentation of radiological improvement or stability after 1-year minimum follow-up.

TB can also be accurately diagnosed by EBUS-TBNA. Madan et al. reported their initial 1-year experience with EBUS-TBNA that showed a high yield of 84.8% for the diagnosis of TB in TB endemic area.[5] Furthermore, EBUS-TBNA had a high diagnostic yield for TB of 79% even in areas with low TB prevalence.[23] The determination of TB was attained either by positive acid-fast bacilli smears on the aspirate or the appearance of necrotizing granuloma in the setting of positive tuberculin skin test results and proper clinical situation. In this study, the diagnostic yield for TB was 67% which is lower than other studies.[23] The lower diagnostic yield in this study may be related to the small sample size of the studied patients and variation in TB prevalence between different countries. It is important to note that conventional TBNA is simpler, safe, less expensive modality, and provides high diagnostic yield for sarcoidosis and TB.[24,25] In our institution, conventional TBNA was carried out for cases of suspected sarcoidosis or TB before the acquisition of EBUS in 2012. However, after the procurement of EBUS, we have changed our practice focus to EBUS and rarely use conventional TBNA.

ROSE for specimen adequacy is helpful during conventional TBNA. ROSE improves the diagnostic yield of conventional TBNA, reduce the need for other diagnostic procedures, and decrease the number of passes per lymph node.[26] However, the role of ROSE in the setting of EBUS-TBNA is controversial. Studies have demonstrated that ROSE does not influence the diagnostic yield in EBUS-TBNA techniques; however, it might lessen the quantity of required aspirations and the quantity of other techniques required.[27-29] In this study, all EBUS-TBNA were carried out with the presence of ROSE; therefore, there was not any comparative data.

EBUS-TBNA has an excellent safety profile. Varela-Lema et al. published a systematic review of 15 studies of EBUS-TBNA that included 1627 patients without any complication.[30] Furthermore, only two complications occurred in a meta-analysis of 11 studies that included 1299 patients.[31] However, sporadic cases of infectious complications such as infectious pericarditis, mediastinal abscesses, and mediastinitis have been reported.[32-34] In this study, no procedure or sedation-related complications were experienced, and all the patients tolerated the procedure fairly well and discharged on the same day.

The retrospective nature of this study is the major limitation. In addition, the small number of cases, possibly due to a lack or low physician awareness about this relatively new technology, so patients are probably referred for mediastinoscopy rather than EBUS. Furthermore, lung cancer, which is the main indication for the procedure, ranked 5th among male and 15th among female in Saudi Arabia and 50% of patients present with distant metastasis.[35,36] Besides, this is a single-center/single operator study with the suboptimal use or lack of an effective referral system between different governmental institutions. Even with the encouraging results of this technology, expensive equipment and accessories and the requirement for training limit the quick spreading of this technique. Up till this date, EBUS procedure is performed in only three institutions in Saudi Arabia. Therefore, future research should be directed to multicenter collaboration to address outstanding issues such as the best use of ROSE, ideal sedation type, and the role of EBUS simulation.

Conclusions

EBUS-TBNA is a safe and efficacious technique that can be conveniently carried out by employing conscious sedation with yields that are adequate for evaluation. It can be used for the staging of malignancies as well as for the diagnosis of inflammatory and infectious conditions such as sarcoidosis and TB. This procedure has a high yield, good sensitivity, and high specificity. The best use of EBUS-TBNA depends on an adequate collaboration between the pathologist, the bronchoscopist, and the cytotechnologist.

Conflicts of interest

There are no conflicts of interest.

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