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ORIGINAL ARTICLE

Efficacy of TBNA needles for EBUS during fiberoptic bronchoscopy?

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Abstract

Conventional transbronchial needle aspiration (cTBNA) biopsy is a diagnostic minimally invasive technique applied using fibreoptic bronchoscopy (FOB) in the evaluation of mediastinal/hilar lymph nodes. With the development of endobronchial ultrasound (EBUS) devices, transbronchial aspiration needles have been revised for use according to the EBUS guidelines. The main aim of this research was to evaluate the diagnostic success of transbronchial aspiration needles that was produced for EBUS when it was applied with FOB instead of conventional TBNA. A retrospective examination was made with the data of 35 patients applied with FOB TBNA, using needles specifically designed for EBUS and 36 patients with conventional TBNA (cTBNA group), for lung cancer staging or the diagnosis of mediastinal lymphadenopathy between November 2018 and November 2019. Seventy-two and sixty procedures performed on 71 patients were included in the study. Diagnostic efficiency for TBNA and cTBNA groups were 91.4% and 83.3%, respectively. Conventional TBNA is still acceptable when the low cost and ease of application are taken into consideration. In conclusion, improvement of current conventional TBNA needles similar to EBUS-TBNA needles for more efficient aspiration capacity could be the first stepto increasing the TBNA diagnostic yield. Nevertheless, further studies are needed to confirm our results.

Keywords: Conventional transbronchial needle aspiration, endobronchial ultrasound, fiberoptic bronchoscopy

Abbreviations: Transbronchial needle aspiration (TBNA), fibreoptic bronchoscopy (FOB), lymph nodes(LN), conventional TBNA (cTBNA)

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Introduction

Conventional transbronchial needle aspiration (TBNA) biopsy is a diagnostic minimally invasive technique applied using fibreoptic bronchoscopy (FOB) [1]. Transbronchial needle aspiration was applied for the first time in 1949 by Eduardo Schieppati with a rigid bronchoscope [2]. With the development of the fibreoptic bronchoscope in 1967, Shigeto Ikeda, achieved success in the field of bronchoscopy. TBNA biopsy applied with a fibreoptic bronchoscope was first described by Ko-Pen Wang in 1981[3]. Then, in 2004, EBUS TBNA was introduced, which provided a sampling of mediastinal and hilar lymph nodes with real-time ultrasonographic imaging [4]. Until the EBUS, conventional TBNA was considered the standard bronchoscopic modality for lymph node (LN) sampling to investigate etiologies of mediastinal and hilar lesions [5]. Conventional TBNA was used primarily by sampling mediastinal/hilar lymph node tissue for diagnosis and staging of lung carcinoma [6,7]. With the introduction of the use of EBUS devices, transbronchial aspiration needles were revised for use according to the EBUS guidelines. The increasing use of revised TBNA in the EBUS guidelines created a need for comparison with conventional TBNA. The Lung Cancer Guidelines (American College of Chest Physicians) stated that the diagnostic success rates were reported as 78% for cTBNA and 89% for EBUS-TBNA in a meta-analysis [8]. In randomized, controlled studies, the diagnostic success of EBUS-TBNA has been determined to be higher in lung cancer and sarcoidosis disease [9-13]. Despite the better results of EBUS-TBNA, it has the disadvantage of requiring a specially developed device with a higher price and experienced staff for the specific procedure [14]. Therefore, there is wider availability of TBNA applied with FOB and this continues to be important in clinical practice. Although there are many studies in the literature that have evaluated the diagnostic success of EBUS-TBNA and cTBNA, to our knowledge, there are no studies that were investigating the use of transbronchial aspiration needles produced only for the use of EBUS, applied with FOB with tomographic anatomy guidance without ultrasonography. The main aim of this research was to present the diagnostic success of transbronchial aspiration needles produced for EBUS-TBNA application when applied with FOB compared with standard cTBNA.

Materials and Methods

Ethical committee approval and informed consent

This study was approved by the Ethics committee of Afyonkarahisar Health Sciences University (2011-KAEK-2;2020/6).

Patient and procedures

A retrospective examination was made with the data of 35 patients applied with FOB TBNA, using needles specifically designed for EBUS and 36 patients with conventional TBNA (cTBNA group), for lung cancer staging or the diagnosis of mediastinal lymphadenopathy between November 2018 and November 2019. All the procedures were performed under conscious sedation and local anesthesia. The procedures were applied by a bronchoscopist with 8 years of EBUS-TBNA experience (about 200 EBUS-TBNA procedures per year), using a 22-gauge cytology needle of EBUS-TBNA (model OmniTip-Ultra Pentax) via fiberoptic bronchoscopy (Pentax). In the cTBNA group, a 19-gauge WANG cTBNA needle (Cook Medical Inc., Bloomington, IN, USA) was used. The EBUS needle was fixed to the fiberoptic bronchoscopy device. The length of the sheath was adjusted tomographic image. Lymph node stations were classified according to the American Thoracic Society mapping system [15]. Before taking all the samples, the tomographic anatomy was evaluated carefully by the bronchoscopist.

All possible lymph-node stations were sampled starting from N3 to N1 localization in cases of multiple station involvement in the presence of suspicious malignant lesions. Rapid on-site cytology examination (ROSE) was not available in our bronchoscopy setting. After stabilization of the TBNA catheter in the scope, the sheath of the needle was removed from the tip of the scope and screwed for a safe procedure in the same way as for EBUS applications. The “hub against wall” method was used for all penetrations to the targeted lymph nodes or masses.

After adjustment of the needle size according to the caliber of the lesion, the needle was pushed through the intercartilaginous space with a quick thrust maneuver. The stylet was removed and aspiration and preparation of samples (cell block and smears) were applied in the same way as for the EBUS procedure.

Statistical analysis

All statistical analyses were performed using the Statistical Package for Social Sciences software (SPSS, version 25). Data were presented using descriptive statistics. Continuous variables were expressed as mean ± standard deviation (SD) values and categorical variables as number (n) and percentage (%).

Results

The characteristics of the participants involved in the study are outlined in Table 1. Seventy-two and sixty procedures performed on a total of 71 patients in TBNA and cTBNA groups, were included in the study, respectively. The mean age was 54 years [58 in the TBNA group (Using needles specifically designed for EBUS) and 50 in the cTBNA group]. Both in the TBNA and cTBNA groups, patients were predominantly male (71% and 66%, respectively).

Most frequent sampling was taken from the lymph nodes station 7 in 26 subjects (36.1%) in the TBNA group and 36 subjects (36.1%) in the cTBNA group.

Table 1. Clinical characteristics of the patients in both groups

	TBNA (Using needles specifically designed for EBUS)	**cTBNA**
Age, Years (range)	58 (20-84)	50 (18-80)
Gender; Male/Female	25/10	24/12
Number of patients	35	36
Number of procedures	72	60
Symptoms, N(%)		
Cough	15 (42.8)	18 (30.0)
Dyspnea	14(40.0)	15 (25.0)
Chest pain	9 (25.7)	11 (18.3)
Weight loss	7 (20)	5 (8.3)
Hemoptysis	5 (14.2)	4 (6.7)
Dysphagia	1 (2.8)	0

Table 2. Sampled lymph nodes during fiberoptic bronchoscopy procedure

Nodal Station	**TBNA(n (%)) (Using needles specifically designed for EBUS)**	**cTBNA(n(%)) (WANG needle)**
2R	1 (1.4)	0
4R	25 (34.7)	15 (25)
4L	4 (5.5)	2 (3.3)
7	36 (50.0)	37 (61.6)
10R	2 (2.7)	2 (3.3)
11R	1 (1.4)	1(1.7)
11L	3 (4.2)	3 (5.0)
Total	72	60

Distribution of lymph node stations sampled during both groups were outlined in Table 2.

Diagnoses in the TBNA group were 31.4% for non-small cell lung cancer and 14.2% for small-cell lung cancer. Other benign diagnoses were outlined in Table 3. Additionally, diagnoses during cTBNA procedures also were also shown in Table 3. Diagnostic efficacy for TBNA and cTBNA groups were 91.4% and 83.3%, respectively. No complications were observed in any case during or after both procedures. All the patients were discharged on the same day of sampling.

Discussion

The application of cTBNA provides a tissue sample for cytological or histological evaluation. TBNA is indicated in the diagnosis of mediastinal lymph node growth. Generally, lymph node growths emerge in diseases such as sarcoidosis, tuberculosis, lymphoma, and bronchogenic carcinoma metastases. The determination of mediastinal spread is important for staging and appropriate treatment in bronchogenic carcinoma. The success rate of conventional TBNA in lung carcinoma mediastinal staging has been reported as 78% (confidence interval 71%-84%) [16]. In the subcarinal lymph gland, factors such as lymph gland size >1.5cm and diagnosis of small-cell lung carcinoma, increase the diagnostic success of conventional TBNA [17].

With the start of the EBUS-TBNA application in the 2000s, the biopsy needles used in conventional TBNA were revised for use with the EBUS device. The revised needles had the features of being able to be fixed to the bronchoscopy device and the margin could be determined with the advancement of the biopsy needle. Also, the most important advantage of this needle is its longer length than the conventional needle. EBUS needle is stiffer and longer than conventional needles. A longer EBUS needle resulted in better target reach and better sampling. Additionally, the stiffer needles of EBUS better for puncturing the bronchial wall. Other technological advantages are the echogenicity of the needle, which is not a useful feature in the conventional method. However, needle stiffness and a lack of flexibility of the EBUS bronchoscope resulted in less angulation for penetrating the endobronchial Wall [18]. In a study by Hert et al, EBUS-TBNA used via EBUS probe was compared with conventional TBNA, and other than the subcarinal station, better results were determined in all other stations [9]. ACCP Lung Cancer Guidelines 3rd edition reported a sensitivity of 89% and a negative predictive value of 91% for EBUS-TBNA in lung cancer mediastinal lymph node staging [8]. Based on these results, the guidelines recommended EBUS-TBNA as the first step in lung cancer mediastinal staging rather than surgical staging.

Table 3. Distribution of pathological diagnosis among both study groups

Nodal Station	TBNA n=35		cTBNA n=36	
	N	%	N	%
Small cell lung carcinoma	5	14.2	1	2.8
Non-small celllung carcinoma	11	31.4	9	25
Adenocarcinoma*	7	63.6	3	33.3
Squamous cell carcinoma*	3	27.2	2	22.2
Malignant epithelial tumour*	1	9.1	4	44.4
Sarcoidosis	6	17.1	12	33.3
Tuberculosis	2	5.6	1	2.8
Anthracosis	5	14.2	4	11.1
Benign lymph node	3	8.6	3	8.3
Non-diagnostic	3	8.6	6	16,7

*Percentage represents the percentage within the diagnosis of non-small cell lung carcinoma

EBUS-TBNA and conventional TBNA have also been compared in diseases other than bronchogenic carcinoma which results in mediastinal lymphadenopathy. In sarcoidosis disease, EBUS-TBNA has been determined to have higher diagnostic success, and when combined with transbronchial biopsy, the diagnostic rates were increased. In the same study, it was reported that when conventional TBNA was combined with endobronchial and transbronchial biopsy, the diagnostic success was similar to that of EBUS-TBNA & transbronchial biopsy [19]. In the diagnosis of lymphoma, the diagnostic success of conventional TBNA is limited, and there are diagnostic difficulties in EBUS-TBNA in the diagnosis of the same disease [20]. In many studies, diagnosis of lymphoma with EBUS-TBNA is challenging, it ranging from 57%-90% in various studies with an average of about 60% [21-24]. In the present study, there was no diagnosis of lymphoma.

Conventional TBNA has been reported to be efficient in the diagnosis of intrathoracic tuberculous lymphadenitis [25]. In both groups we also get diagnosis of tuberculosis in 3 patients (2 in the TBNA group and 1 in the cTBNA group).

Considering its simplicity, the availability of conventional TBNA continues to contribute to the diagnosis of patients worldwide [26]. In addition, the initial capital cost of the equipment and the maintenance of repair costs are significantly lower versus EBUS [27].

In the literature, studies have shown that EBUS-TBNA and cTBNA have close diagnostic performance when evaluating 4R, 7, and 11R lymph node stations [28]. It is relatively easy to locate these lymph nodes of stations. This facilitates localization of the needle-related point and relatively simplifies sampling with cTBNA [29]. The limitation to the use of cTBNA for diagnosis is the lack of skills and insufficient experience. In the present study, lymph node sampling was performed by an experienced bronchoscopist using transbronchial aspiration needles manufactured for EBUS application in the TBNA group. Lung malignancy was diagnosed the most frequently, followed by sarcoidosis. In the cTBNA group, sarcoidosis was determined most frequently, followed by lung malignancy.

TBNA procedure does not require special equipment such as ultrasonography, is low-cost and easily accessible, it seems to be more useful than EBUS-TBNA. In addition, there are still difficulties in acquiring the necessary training for EBUS. It has been determined in studies that more than 100 EBUS-TBNA procedures are necessary to acquire sufficient skill [30-32]. Therefore, despite the advantages, this procedure remains underutilized [33-34]. Küpeli et al. reported that TBNA can be easily learned and sufficient skill could be gained [35]. It has also been shown that the applications can be successfully learned without training presented by an interventional pulmonologist [36].

In our study, there were some limitations. Our study was conducted in only one institution. Therefore, bronchoscopy technique, node sample processing, and selection criteria may differ between different centers. Second, our study did not attempt to examine the cost-effectiveness of the proposed approach. However, we believe that the improvement of new conventional transbronchial aspiration needles could be potentially cost-effective.

Conclusion

As a result, there are still difficulties in accessing EBUS devices due to high costs and gaining the required training facilities for EBUS. Conventional TBNA is still acceptable when the low cost and ease of application are taken into consideration. By using EBUS-TBNA needles as conventional TBNA procedures during fiberoptic bronchoscopy, we achieved a high diagnostic rate without any complication. Improvement of new aspiration needles similar to needles produced for EBUS procedurewith lower costs could be the first step on improving cTBNA diagnostic efficacy. Consequently, further studies designed as multicenter involvement with larger populations are warranted to confirm our findings.

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Conflict of interest

We have no conflicts of interest to disclose.

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