

Comparative study between Conventional Transbronchial Needle Aspiration(C-TBNA) and Endobronchial Ultrasound Guided Transbronchial Needle Aspiration (EBUS-TBNA) in the Diagnosis of Mediastinal Lymphadenopathy

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Abstract

Background: Many different types of lymphadenopathies, both benign and malignant, can affect the mediastinum. Pathology is used to confirm the diagnosis. One minimally invasive method for diagnosing mediastinal and hilar diseases is TBNA, which stands for transbronchial needle aspiration. TBNA can be performed blindly or guided by endobronchial ultrasound, with the choice often depending on availability and operator preference.

Objective: In order to evaluate the relative merits of EBUS-TBNA and conventional TBNA for the diagnosis of mediastinal lymphadenopathy, we will be comparing the two procedures.

Patients and Methods: From February 2023 to February 2025, 40 patients referred to the Endoscopy Unit of the Chest Department at Al-Azhar University Hospitals and International Medical Center in Cairo were evaluated prospectively for undiagnosed mediastinal lymphadenopathy. Twenty patients each were assigned to group A (c-TBNA) and group B (EBUS-TBNA).

Results: There was no statistically significant difference in diagnostic yield between the two groups ($P=0.288$). In group A, 65% of patients were diagnosed, while 35% were not. In group B, 80% of patients were diagnosed, and 20% were not. Regarding the yield of biopsied subcarinal lymph nodes, there was no statistically significant difference ($P=0.67$) between the groups that were investigated. Results of biopsied LN from all stations except 7 showed a statistically significant difference ($P=0.011$) between the groups that were investigated. Regarding the occurrence of complications, there was no statistically significant difference ($P=0.241$) among the groups that were evaluated.

Conclusion: Minimally invasive techniques such as conventional and EBUS-guided TBNA are associated with lower patient risk and acceptable safety profiles. The results they give for benign and malignant growth of the mediastinal and/or hilar lymph nodes are substantial. Because of its higher diagnostic yield, particularly for lymph nodes outside of the subcarinal area, EBUS-TBNA is the gold standard for identifying unexplained mediastinal lymphadenopathy.

Keywords: Mediastinal lymphadenopathy; c-TBNA; EBUS-TBNA

1. Introduction

Pathology remains the gold standard when it comes to mediastinal lymphadenopathy, which encompasses both benign and malignant diseases like sarcoidosis and lung cancer. Diagnosing mediastinal lymphadenopathy still relies heavily on bronchoscopy.¹

In the late 1970s, the first evidence of C-

TBNA using flexible bronchoscopy emerged.² Since then, a number of international studies have verified its usefulness, safety, and cost-effectiveness, especially for the detection of hilar/mediastinal lymphadenopathy. Lymph node size and location, underlying illness type, operator skill, and other procedural and clinical parameters appear to influence the diagnostic yield of c-TBNA.³

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The creation of (EBUS-TBNA) is a more recent result of technological advancements.⁴ The echoendoscope allows the operator to see the lymph nodes and their surroundings in real-time, which helps them to precisely aim the needle.⁵

In addition, EBUS-TBNA is not accessible at some institutions due to the increased expenses, time constraints, and specialized ultrasound-related abilities required for everyday practice. Despite the use of both methods, operators' practical assessments, rather than predetermined diagnostic algorithms, typically dictate which one is used.⁶

The purpose of this research is to evaluate the relative merits of EBUS-TBNA and conventional TBNA for the detection of mediastinal lymphadenopathy, as well as their respective safety profiles.

2. Patients and methods

Between February 2023 and February 2025, 40 patients referred to the Endoscopy Unit of the Chest Department at Al-Azhar University Hospitals and International Medical Center in Cairo for unidentified mediastinal lymphadenopathy were included in this prospective study.

Inclusion criteria:

A minimum of one hilar or mediastinal lymphadenopathy measuring more than 1 cm (short axis) on a computed tomography (CT) scan in one lymph node station is required for patients who are 18 years old or older.

Exclusion criteria:

A patient experiencing hypoxemia that is challenging to treat. Uncontrolled bleeding disorder. Unstable hemodynamic status. Ignoring the need for informed consent.

The study included two groups:

Group-A (C-TBNA group): traditional transbronchial needle aspiration was performed on twenty individuals whose mediastinal lymphadenopathy had not been previously diagnosed.

Group-B (EBUS- TBNA group): Twenty patients who had mediastinal lymphadenopathy but had not been diagnosed received transbronchial needle aspiration with endobronchial ultrasonography.

Bronchoscopy technique:

Following the acquisition of the patient's written consent, the procedure was set to proceed. Under general anesthesia, the patient was placed in a supine posture, and a laryngeal mask was used to secure their airways for all procedures. The initial airway examination was conducted with the usual flexible bronchoscope. A minimum of three samples were taken from

each lymph node location. We used the International Association for the Study of Lung Cancer's (IASLC) new worldwide lymph node map to pinpoint where to put the lymph node station. Immediate fixation in 95% alcohol and histological core fixation were performed after specimens were drawn from the needle lumen and pushed onto slides using air from the syringe. Two glass slides were utilized to press and spread the specimen. Rose wasn't a factor. All biopsies were sent out for cytological, histological, and immunohistochemical analysis when needed.

In group (A):

Figure (1-A) shows the conventional bronchoscope (PENTAX MEDICAL E819-j10) with a needle passed through its operating channel. Preoperative chest computed tomography with contrast medium augmentation was used to select the target lymph nodes. Successfully penetrating the tracheobronchial wall with a needle requires a mix of methods, one of which is jabbing. At the level of the chosen lymph node station, a 21-gauge needle (Figure 2-A, ENDO-TICHNIK W. Griesat, Germany) was introduced into the bronchial wall and rapidly moved back and forth fifteen to twenty times. While the TBNA needle was being agitated inside the lymph node, suction was manually administered to it using a 20 mL syringe.

In group (B):

Figure (1-C) shows the Hitachi HI VISION Avius, Japan, and Figure (1-B) shows the PENTAX EB-1970UK, a flexible bronchoscope integrated with a convex probe operating at 7.5 MHz that was used to conduct the EBUS-TBNA. One way to get US images is to touch the probe directly. Another option is to attach an inflated balloon with a little amount of saline (less than 0.5 mL) to the tip of the probe. When taking lymph node samples, TBNA was performed using a 22-gauge needle (Echo Tip-Ultra 22, Figure 2-B). In order to avoid damaging the scope, the needle was fixed after it had been advanced through the scope's channel to the sheath. Under real-time ultrasound guidance, the needle was inserted into the target lymph node, and after puncturing it, the stylet was removed. The needle was then fanned through the target lymph node, and 15 to 20 to-and-fro movements were performed, either with or without the use of a negative suction syringe.



Figure 1. Bronchoscope (A), EBUS scope (B), and Hitachi ultrasound (C) used in this study.

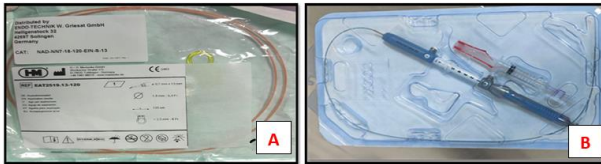


Figure 2. C-TBNA needle (A) and EBUS-TBNA needle (B) used in this study.

Statistical analysis

The 25th version of the Statistics Package for the Social Sciences was used to examine the data. The qualitative data were presented using percentages and frequencies. (Mean $\pm$ SD) was the way continuous quantitative data was presented. The middle value of a discrete set of integers, calculated by dividing the sum of values by the number of values, is called the mean or average. The dispersion of a group of values can be measured by looking at their standard deviation (SD). The closer the values are to the set mean, the lower the SD, and the more dispersed the values are, the higher the SD.

We regarded a probability (P-value) to be significant if it was less than 0.05, highly significant if it was less than 0.001, and insignificant if it was greater than 0.05. When comparing two groups, the independent sample T-test (T) is used (with continuous quantitative data). Non-parametric categorical data were compared using the chi-square test.

3. Results

Table 1. Comparison of studied groups as regard demographic data.

		GROUP A (N= 20)	GROUP B (N= 20)	STAT. TEST	P-VALUE
AGE	Mean $\pm$ SD	43.4 $\pm$ 17.1	42.1 $\pm$ 15.9	T= 0.259	0.797 NS
	Min – Max	19 – 67	18 – 70		
SEX	Males	14 70.0%	12 60.0%	X ² = 0.44	0.51 NS
	Females	6 30.0%	8 40.0%		

X2: Chi-square test. NS: P>0.05 is considered non-significant.

This table shows:

No statistically significant difference between studied groups as regard demographic data.

Table 2. Comparison of studied groups (A and B) as regard diagnosis.

HISTOPATHOLOGY		GROUP A (N= 20)	GROUP B (N= 20)	X ²	P- VALUE
DIAGNOSIS	Diagnosed cases	13 65.0%	16 80.0%	1.129	0.288 NS
	Not diagnosed	7 35.0%	4 20.0%		
NATURE OF DIAGNOSED CASES	Benign	7 35.0%	8 40.0%	.171	0.557 NS
	Malignant	6 30.0%	8 40.0%		

X2: Chi-square test. NS: P>0.05 is considered non-significant.

This table shows:

No statistically significant difference between studied groups as regard yield of diagnosis and nature of pathology in diagnosed cases.

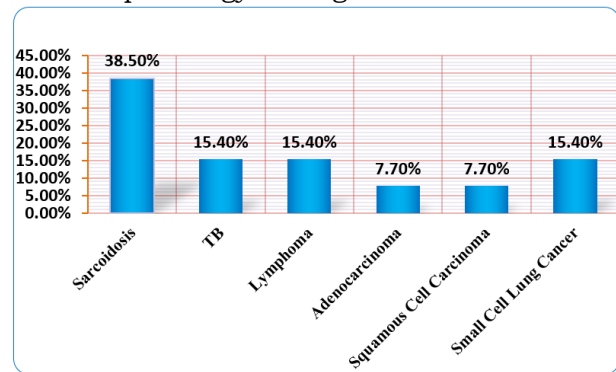


Figure 3. Description of pathology of diagnosed patients in studied group (A).

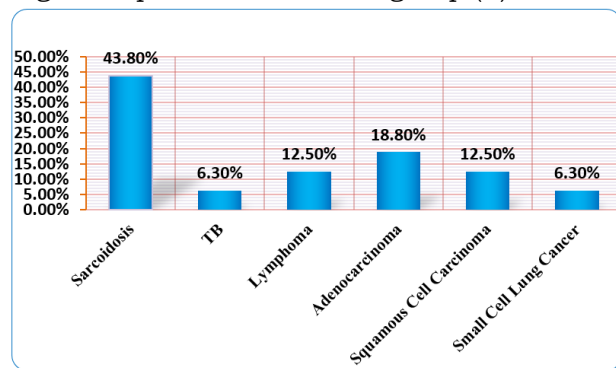


Figure 4. Description of pathology of diagnosed patients in studied group (B).

Table 3. Comparison of studied as regard results of biopsied subcarinal lymph nodes.

HISTOPATHOLOGY		GROUP A (N= 15)	GROUP B (N= 15)	X ²	P-VALUE
RESULTS	Positive	11 73.3%	12 80.0%	0.186	0.67 NS
	Negative	4 26.7%	3 20.0%		

X2: Chi-square test. NS: P>0.05 is considered non-significant.

This table shows:

No statistically significant (P=0.67) difference between studied groups as regard results of biopsied subcarinal lymph nodes.

Table 4. Comparison of studied groups as regard results of biopsied LNs from all sites except station 7.

BIOPSIED LNS FROM ALL SITES EXCEPT STATION (7)	GROUP A		GROUP B		X ²	P-VALUE
	n = 44		n = 69			
Positive LNs results	18	40.9%	45	65.2%	6.44	0.011 S
Negative LNs results	26	59.1%	24	34.8%		

X²: Chi-square test. S: P<0.05 is considered significant.

This table shows:

A statistically significant (P=0.011) difference between studied groups as regard results of biopsied LN from all sites except station 7 (subcarinal).

Table 5. Comparison between studied groups regarding post procedure complications.

COMPLICATION	C- TBNA GROUP (A)		EBUS- TBNA GROUP(B)		X ²	P
	n=20	%	n=20	%		
ABSENT	17	85%	19	95%	5.12	0.241 NS
MINOR	2	10%	1	5%		
BLEEDING PNEUMOTHORAX	1	5%	0	0%		

X²: Chi-square test. NS: P>0.05 is considered non-significant.

This table shows:

No statistically significant (P=0.241) difference between the studied groups regarding incidence of complications.

4. Discussion

The demographic analysis showed no significant differences in age and sex between Groups A and B. The mean age in Group A was 43 ± 17.1 years, compared to 42 ± 15.9 years in Group B. Group A consisted of 14 males (70%) and six females (30%), while Group B included 12 males (60%) and eight females (40%). These findings are consistent with Puri et al.,⁷ who studied 52 patients (33 males, 63.5%, and 19 females, 36.5%). Similarly, Gupta et al.,⁸ reported a mean age of 43.4 years (range: 18–68) in their TBNA procedure analysis.

In the current study, 13 patients (65%) in the cTBNA group (Group A) were diagnosed, while seven patients (35%) were not. Conversely, in the EBUS-TBNA group (Group B), 16 patients (80%) were diagnosed, whereas four patients (20%) were not diagnosed. Our results show that EBUS-TBNA had an 80% diagnostic yield for mediastinal lymphadenopathy, while cTBNA had a yield of 65%. At the statistical level, however, there was no discernible difference in diagnostic results between the two approaches (P=0.288).

These results align with those of Shen et al.,⁹ when they looked at the use of ultrasound guidance versus unguided transbronchial needle aspiration (TBNA) to diagnose benign mediastinal lymphadenopathy. A total of 76.84% of EBUS-TBNA cases and 61.31% of cTBNA cases were diagnosed (no statistically significant difference, P > 0.05).

This also agrees with the study conducted by Herth et al.,¹⁰ that comprised 200 individuals (100 divided across two groups). As an alternative to traditional TBNA, half of the patients were guided by EBUS during the procedure. While traditional TBNA had a diagnostic yield of 71%, EBUS guidance achieved 80% (difference not significant, P > 0.05).

On the other hand, Arslan et al.,¹¹ discovered that EBUS-TBNA had a significantly higher diagnostic yield (68.2% vs. 33.3% for cTBNA; P=0.028).

Also, Navani et al.,¹² reported a significantly higher diagnostic yield for EBUS-TBNA (85%) compared to cTBNA (60%) in a multicenter study of 400 patients.

The current study demonstrated that EBUS-TBNA had a higher detection rate for both benign lesions (40% vs. 35%) and malignant lesions (40% vs. 30%) compared to c-TBNA, but no significant statistical differences between the two groups. Specifically, in group A, sarcoidosis was diagnosed in 5 patients (38.5%), tuberculosis (TB) in 2 patients (15.4%), lymphoma in 2 patients (15.4%), adenocarcinoma in 1 patient (7.7%), squamous cell carcinoma in 1 patient (7.7%), and small cell lung cancer in 2 patients (15.4%) while in group B, Sarcoidosis was diagnosed in 7 patients (43.8%), TB in 1 patient (6.3%), lymphoma in 2 patients (12.5%), adenocarcinoma in 3 patients (18.8%), squamous cell carcinoma in 2 patients (12.5%), and small cell lung cancer in 1 patient (6.3%).

These findings are in line with Mousa et al.,¹³ who reported that 43.3% of patients undergoing EBUS-TBNA were diagnosed with malignant lesions, while 56.7% had benign lesions, with sarcoidosis being the most common diagnosis (46.7%).

Similarly, Allam et al.,¹⁴ found that sarcoidosis accounted for 37.7% of EBUS-TBNA diagnoses, whereas malignancy was identified in 25.2% of cases.

In contrast, Arslan et al.,¹¹ observed that malignant lesions were more prevalent, with non-small cell lung carcinoma diagnosed in 23% of patients in the cTBNA group compared to 33.3% in the EBUS-TBNA group.

Additionally, Liran et al.,¹⁵ reported malignancy as the most frequent diagnosis with EBUS-TBNA, whereas sarcoidosis was more common in the cTBNA group. These variations may be attributed to differences in patient demographics, disease prevalence, or operator expertise.

Regarding the results of biopsied subcarinal lymph nodes, there was no statistically significant difference (P=0.67) between the studied groups. The total number of biopsied subcarinal lymph nodes was 15 in each group. In group A (cTBNA group), 11 patients (73.3%) had positive results,

while four patients (26.7%) had negative results. In group B (EBUS-TBNA group), 12 patients (80%) had positive results, and three patients (20%) had negative results.

Regarding the results of biopsied lymph nodes from all sites except station 7, there was a statistically significant difference ($P=0.011$) between the studied groups. In group A, the total number of biopsied lymph nodes from all stations except subcarinal lymph nodes was 44, with positive results in 18 stations (40.9%) and negative results in 26 stations (59.1%). In group B, the total number of biopsied lymph nodes from all stations except subcarinal lymph nodes was 69, with positive results in 45 stations (65.2%) and negative results in 24 stations (34.8%).

These results were in harmony with those of Herth et al.,¹⁰ who randomized 200 patients with mediastinal involvement into two groups: one receiving EBUS-TBNA and the other cTBNA. Patients were categorized into group A (subcarinal lymph nodes) and group B (other lymph nodes). Each group had half the patients undergoing EBUS-TBNA and the other half cTBNA. In group A, the yield was 74% for cTBNA and 86% for EBUS-TBNA, with no significant difference. The yields in group B were significantly different ($P<0.001$), with cTBNA yielding 58% and EBUS-TBNA yielding 84%.

Additionally, we found that the results were in line with Arslan et al.,¹¹ According to the study, the yield of traditional TBNA was 33.3% (4/12) in group A (patients with subcarinal lymph nodes), while in the EBUS-guided group it was 62.5% (5/8); however, the difference was not statistically significant ($P=0.362$). The yield of EBUS-TBNA was considerably higher than that of conventional TBNA in group B (patients lacking subcarinal lymph nodes) (33.3% (6/18) vs. 68.2% (15/22); $P=0.028$).

No major complications were reported in the current study; however, three patients (15%) in the cTBNA group experienced minor complications: two had minor bleeding, and one developed pneumothorax. In the EBUS-TBNA group, only one patient (5%) experienced minor bleeding. Statistically, the difference in complications between the groups was not significant.

These findings align with the study conducted by Farrag et al.,¹⁶ who reported no serious complications related to cTBNA, with minor, non-life-threatening bleeding occurring in 21.7% of cases, controlled with saline and adrenaline.

Furthermore, Mousa et al.,¹³ documented that complications from EBUS-TBNA were limited to minor hemorrhage in one case (3.3%), with no other complications reported in the remaining cases.

Additionally, Bauwens et al.,¹⁷ in his EBUS TBNA study reported one patient had a pneumothorax that requiring intercostal drainage.

In contrast, Herth et al.,¹⁰ did not have any problems with the procedure or harm to the bronchoscope when using EBUS-TBNA or cTBNA.

The research carried out by Arslan et al.¹¹ also found no complications.

4. Conclusion

Minimally invasive techniques such as conventional and EBUS-guided TBNA are associated with lower patient risk and acceptable safety profiles. The results they give for benign and malignant growth of the mediastinal and/or hilar lymph nodes are substantial. Because of its higher diagnostic yield, particularly for lymph nodes outside of the subcarinal area, EBUS-TBNA is the gold standard for identifying unexplained mediastinal lymphadenopathy.

Disclosure

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Authorship

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There are no conflicts of interest.

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