Diagnostic Value of EBUS in Mediastinal and Hilar Lymph Nodes

Mediastinal ve Hiler Lenf Nodlarının Tanısında EBUS'un Yeri

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ABSTRACT

Objective: One of the indications for endobronchial ultrasound (EBUS) is the diagnosis of mediastinal and/or hilar lymphadenopathy. The aim of this study is to report the place of EBUS probe using a single- channel bronchoscope that allows TBNA after localisation of lymph nodes under ultrasound in the diagnosis of mediastinal and hiler lymph nodes.

Material and Method: Retrospectively, 45 patients were enrolled with a proven lymph node on CT and an indication for TBNA for diagnosis. Lymph nodes were verified under local anesthesia by EBUS and sampled using a Wang 22 gauge cytology needle. The EU-M30s model EBUS and UM-BS 20-26 R Olympus ultrasonic probe was used. Procedures were applied through Pentax EB 1970 model bronchoscope.

Results: TBNA procedures were performed using a flexible bronchoscope and a 22-gauge Wang needle in 45 consecutive patients (23 women (51.1%); mean age, 47±15 years [+/- SD] (17-74)) who had mediastinal or hilar adenopathy identified on chest CT The average number of needle passes was 5.0±1.8 (2-9) per patient. A total of 85 lymph nodes were sampled. Adequate material was found in all of the patients (100%). In 36 (80.0%) of the cases the adequate material was diagnostic. The diagnostic value of EBUS TBNA was 82.4% in sarcoidosis, 60% in tuberculosis and 100% in small cell lung carcinoma and nonsmall cell lung carcinoma.

Conclusion: EBUS guided TBNA of mediastinal and hilar lymph nodes is a safe approach which increases the percentage of adequate material and diagnostic yield.

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ÖZET

Amaç: Endobronşiyal ultrasonun (EBUS) endikasyonlarından biri de mediastinal veya hiler lenf nodlarının tanısında kullanımıdır. Çalışmamızın amacı tek kanallı bronkoskop eşliğinde EBUS probu kullanılarak lenf nodunun lokalizasyonu sonrası yapılan TBİA'nın mediastinal veya hiler lenf nodlarının tanısında yerini göstermekti.

Gereç ve Yöntem: BT'sinde kanıtlanmış lenf nodu olan ve tanı için TBİA endikasyonu olan prospektif 45 hasta çalışmaya dahil edildi. Lenf nodları önce lokal anestezi altında EBUS ile verifiye edildi ve Wang 22 gauge sitoloji iğnesi ile örneklendi. EU-M30s model EBUS ve UM-BS 20-26 R Olympus ultrasonik probu kullanıldı. Prosedürler Pentax EB 1970 model bronkoskop ile uygulandı.

Bulgular: TBİA'ları fleksibıl bronkoskop içinden 22 gauge Wang iğnesi ile uygulandı. 45 vakanın 23 tanesi (%51.1) kadındı ve hastaların ortalama yaşı 47 ±15 (17-74) idi. Ortalama örnekleme sayısı 5.0±1.8 (2-9) idi. Toplamda 85 lenf nodu örneklendi.Tüm hastalardan yeterli materyal elde edildi (%100). 36 (%80) vakada yeterli materyal aynı zamanda tanısaldı. EBUS TBİA'nın tanısal değeri sarkoidozda %82.4, tüberkülozda %60, küçük hücreli akciğer kanseri ve küçük hücre dışı akciğer kanserinde %100 bulundu.

Sonuç: Mediastinal ve hiler lenf nodlarının EBUS rehberliğinde TBİA ile örneklenmesi yeterli materyal alımının ve tanısal oranın artmasını sağlayan güvenli bir yaklaşımdır.

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Anahtar sözcükler: Endobronşiyal ultrason, transbronşiyal iğne aspirasyonu, tanı

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INTRODUCTION

Transbronchial needle aspiration (TBNA) is a well-established bronchoscopic technique [1,2]. Conventional TBNA is a blind procedure. The accuracy of TBNA varies widely in the literature (*i.e.* 20 to 89%) [3,4]. Important factors that can influence the results of TBNA are estab-

lished lymph node enlargement on CT, lymph node size, site of the lymph node, the kind of needle used, number of aspirates performed, the ability and experience of the operators, and the availability of rapid on-site evaluation (ROSE) [5]. Recently, there has been significant interest in imaging-assisted TBNA. Procedure guidance with the

Figure 1. Ultrasonic probe with driving unit and processor

Figure 2. Probe placed in the working channel of the bronchoscope

aid of CT fluoroscopy [6] as well as endobronchial ultrasound (EBUS) [7,8] has been shown to be feasible and simple to perform. Those studies suggested a significant increase in yield. In previously published studies, it was shown that endobronchial ultrasound (EBUS) with TBNA was highly accurate and cost effective as a diagnostic tool [9].

In the present study, we aimed to investigate the diagnostic value of EBUS guided TBNA performed with a 22-gauge Wang cytology needle, in patients with mediastinal and/or hilar adenopathy identified by chest CT. This study was also designed to address the question of whether EBUS-guided TBNA can increase the value of TBNA in mediastinal or hilar lympadenopaties.

MATERIAL and METHOD

Between October 2006 and June 2007, EBUS-guided transbronchial needle aspiration (TBNA) evaluation of mediastinal lesions were carried out in 45 patients without any known diagnosis but with enlarged mediastinal lymph nodes on their CT scan. Patient selection was

based on CT findings showing mediastinal lymph node enlargement (>1 cm in short-axis dimension). Lymph node status was classified according to the international staging system reported by Mountain and Dressler [10]. To be included in this study, patients were required to have a mediastinal lymph node accessible by EBUS-TBNA with a short diameter of 10 to 30 mm on axial chest CT. Informed consent was obtained from all patients before the procedures. All the prospectively recorded data were evaluated retrospectively.

Bronchoscopy was performed in standard fashion under local anesthesia using xylocaine (maximum 8mg/kg) and conscious sedation using midazolam (0.07-0.1 mg/kg; maximum 5mg) for flexible endoscopy. All EBUS-TBNA procedures were performed as described below. Lymph node size on chest CT scan, number of passes, diagnosis, and complications were recorded. A positive result was either a specific diagnosis (*e.g.* malignant cells) or a lymphocyte-positive specimen, indicating that sampling of the lymph node was successfully achieved. All patients with a negative result underwent a surgical biopsy procedure (mediastinoscopy or surgical mediastinal lymph node dissection).

EBUS

EBUS technique, using a radial probe (RP) with a rotating transducer at the distal tip, which produces a 360° image to the long axis of the bronchoscope, was used. Through a bronchoscope with a 2.8-mm working channel (Pentax EB 1970 and Olympus Excera and Olympus p 40D; Olympus; Tokyo, Japan), a flexible ultrasound probe with a 20-MHz transducer (UM-BS 20-26 R Olympus ultrasonic probe with driving unit MH-240 and processor EU-M 30s; Olympus) was introduced (Figure 1). The probe was placed through a guide sheath in the working channel of the bronchoscope [11,12] (Figure 2). The probe was positioned near the target area, where a balloon surrounding the probe has to be inflated with water
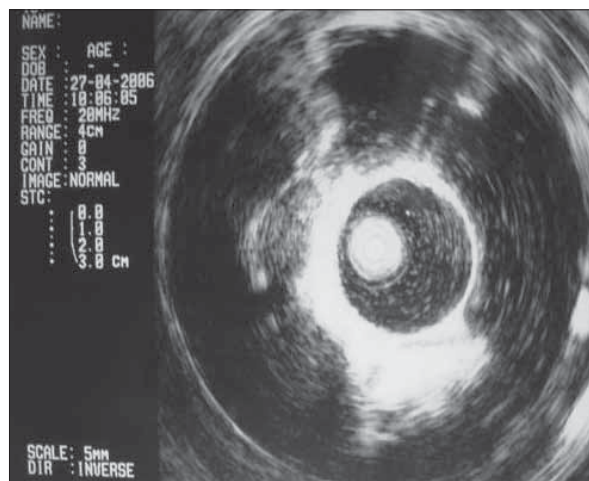
Figure 3. Location of the lymph node on Thorax CT

Figure 4. Visualized lymph node

Table 1. Types of sampled lymph nodes

Lymph node/ ratio	Number	Percent
Subcarinal	38	44.7%
Hilar	29	34.1%
Paratracheal	18	21.2%
Total	**85**	**100%**

Table 2. Final diagnosis of the patients and diagnostic ratios

	Nondiagnostic	Diagnostic	Total
Tuberculosis	4 (40%)	6 (60%)	10 (22.2%)
	44.4%	16.7%	
Sarcoidosis	3 (17.6%)	14 (82.4%)	17 (37.8%)
	33.3%	38.9%	
NSCLC	0	6 (100%)	6 (100%)
	0	16.7%	
SCLC	0	9 (100%)	9 (20%)
	0	25%	
Lymphoma	2 (100%)	0	2 (4.4%)
	22.2%		
Reactive	0	1 (100%)	1 (2.2%)
hyperplasia		2.8%	

in order to ensure coupling with the airway wall and transmission of the ultrasound waves. The probe was used to visualize the lesion (Figures 3 and 4). The exact location of the target lymph nodes and their relation to the tracheobronchial tree were noted. Once the target lymph node was identified, the probe was then removed from the working channel, and the needle was placed through the sheath and remained in place in order to stabilize the lesion during the TBNA [7,13]. Consequently, the actual TBNA procedure was performed without real-time needle monitoring.

RESULTS

The main indications for TBNA were in the diagnosis of enlarged lymph nodes. Forty five consecutive patients (23 women (51.1%); mean age, 47+/-15 years [+/- SD] (17-74)) who had mediastinal or hilar adenopathy identified on CT of the chest were examined.

The average number of needle passes was 5.0±1.8 [2-9] per patient and 2.56 per localization. A total of 85 lymph nodes were sampled, of whom 38 (44.7%) were subcarinal, 29 (34.1%) were hilar and 18 (21.2%) were paratracheal. EBUS-TBNA was used to sample 85 lymph nodes: thirty eight (44.7%) in station 7, eighteen (21.2%) in station 4 and twenty nine (34.1%) in station 10 (Table 1). No diagnostic difference was detected due to localization of the lymph node (p>0.05).

TBNA was performed in one location in 14 patients (31.1%). Most of the patients needed sampling from two locations (21 patients; 46.7%). The procedure was performed in three and four different locations in 8 and 2 patients respectively (17.8% and 4.4%). Adequate material was found in all of the patients (100%). In 36 (80.0%) of the cases the adequate material was diagnostic. All patients without a specific diagnosis, irrespective of the presence or absence of lymphocytes in the specimens, underwent a surgical biopsy procedure. End diagnoses included tuberculosis (n=10), sarcoidosis (n=17), carcinoma (n=15), lymphoma (n=2) and reactive hyperplasia (n=1). The diagnostic value of EBUS TBNA in the mediastinal and hiler lymph nodes was 82.4% in sarcoidosis, 60% in tuberculosis and 100% in small cell lung carcinoma and nonsmall cell lung carcinoma (Table 2).

Carcinoma patients had no definitive lesions by chest CT except for intrathoracic lymphadenopathy. In all of the 15 carcinoma patients (100%) and 3 patients with lymphoma, adequate materials were obtained. However, diagnosis of lymphoma could not be made by cytologic examination of TBNA. The rate of diagnostic success by TBNA was similar in tuberculosis and sarcoidosis (60% vs 82.4%), which appeared lower than for intrathoracic lymphadenopathy due to carcinoma (100%). No complications, either related to the procedure or to bronchoscopic damage, other than minimal hemorrhage, were observed with the use of EBUS TBNA.

DISCUSSION

TBNA is a well-established bronchoscopic technique but remains underutilized, and the yield varies widely [14]. This fact may be due to the long learning curve.

Additionally, conventional TBNA is a relatively blind technique preventing target visualization. This makes accessing smaller lymph nodes and nodes in some locations more difficult. Limited options currently exist to improve yield. Important factors that can influence the results of TBNA are established lymph node enlargement on CT, lymph node size, site of the lymph node, kind of needle used, number of aspirates performed, the ability and experience of the operators, and the availability of ROSE [5]. The most commonly recommended are ROSE and, recently, the passing of the needle up to seven times into one target [15]. ROSE is not available at all institutions and is expensive [16]. Also, passing a needle seven times into a nodal target is time-consuming and increases the chance of damaging the bronchoscope.

Recently, a new adjunct to bronchoscopy has being used to increase the yield. Our study evaluates this alternative to conventional procedures. EBUS offers an unique way of imaging airway and parabronchial structures during a bronchoscopy procedure [17-19]. The procedure is safe and minimally invasive, and does not require general anesthesia or hospitalization [18,19]. The complication rate is extremely low, and several studies have not reported any complications at all [8,17,18,20]. Likewise, no complications, either related to the procedure or to bronchoscopic damage, other than minimal hemorrhage in one case, were observed in our study.

Several studies have been conducted using EBUS for the localization of mediastinal nodes. In a prospective study of 242 patients with enlarged mediastinal nodes (mean diameter 1.7 cm) at chest CT, all target nodes could be identified by EBUS, independently of size or location. Adequate samples were obtained in 86% of cases and malignant lymph node involvement was assessed in 72 % of cases [7]. In our study, all target nodes were identified independently of size and location, and also adequate samples were obtained from all patients.

A randomized trial of the use of EBUS in the guidance of TBNA procedures has been reported previously [23]. In the study by Shannon, no significant difference was found between EBUS guidance and conventional TBNA. In that study ROSE was also used in all patients, potentially masking any benefit of image guidance. On the other hand, another large (n=200) randomized trial by Herth et al, between conventional TBNA and TBNA after EBUS localization for mediastinal staging of enlarged nodes, demonstrated that EBUS guidance significantly increased the yield of TBNA in all stations (84 versus 58%), [22]. In our study, significant increase was reported by EBUS guidance TBNA when compared with the conventional TBNA done by the same pulmonologist reported earlier. In that study, TBNA procedures were performed using a flexible bronchoscope and a 22-gauge Wang needle in 60 consecutive patients Adequate lymph node sampling was obtained from 59 patients (98%) and diagnosis was made in 45 of 60 patients (75%) [24], whereas in our study, adequate lymph node sampling was made in all patients (100%) and accuracy was 90.9%.

The end diagnosis made by conventional TBNA was tuberculosis in 13 of 20 cases (65%) cytologically [24], whereas in our study the diagnostic value of EBUS TBNA was 60% in tuberculosis (6 out of 10). No significant difference was found, mainly because of the sample size. Another reason for the low diagnostic rates in both of the studies is the use of 22-gauge needles. It has been shown that using 19-gauge needles to collect samples suitable for histological examination was better than 22-gauge needles in the diagnosis of benign mediastinal lymph nodes [26-28]. Our study suggests that EBUS guided TBNA performed using a Wang 22-gauge needle is a useful and safe method in the diagnosis of HIV-negative adult patients with intrathoracic lymph nodes due to tuberculosis, which is responsible for most of the benign intrathoracic lymph node enlargements in our country [29].

Sarcoidosis is in general a benign disease; however, tissue analysis is necessary for differential diagnoses from other causes of intrathoracic lymph nodes. The usual method of obtaining diagnostic tissue is TBB. However, TBB carries significant complications [5]. In some cases, further invasive procedures might be needed, such as mediastinoscopy or open-lung biopsy. In our earlier study, 16 of 20 patients with sarcoidosis (76%) were successfully diagnosed by TBNA with a 22-gauge needle. In our study, 13 of 17 patients with sarcoidosis (82.4%) were successfully diagnosed by EBUS guided TBNA with a 22-gauge needle.

The value of EBUS guided TBNA is particularly evident in the staging and diagnosis of lung carcinoma [5,21]. In our earlier study, diagnostic material was obtained from 100% of patients with carcinoma (15 of 15 patients). Two of three patients with lymphoma provided adequate but nondiagnostic material. Likewise, in this study with EBUS guided TBNA, diagnostic material was obtained from all of the patients with carcinoma (15 of 15 patients), but from none of the two patients with lymphoma even though adequate material was taken.

In conclusion, similar to the literature, our experience with EBUS-guided TBNA showed that sampling with EBUS-guided TBNA is important for diagnosis. We consider that EBUS guidance should be considered a routine adjunct to bronchoscopy before referring the patient directly to more invasive procedures such as mediastinoscopy.

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