

# Endoscopic ultrasound (with an echobronchoscope)-guided fine-needle aspiration for diagnosis of a mediastinal lesion in a mechanically ventilated patient: A case report and systematic review of the literature

Kuruswamy Thurai Prasad, Inderpaul Singh Sehgal, Nalini Gupta<sup>1</sup>, Navneet Singh, Ritesh Agarwal, Sahajal Dhooria

## Abstract

Endobronchial ultrasound (EBUS)-guided transbronchial needle aspiration (TBNA) is routinely used for accessing mediastinal lymph nodes and masses. However, in patients with respiratory failure, who are being mechanically ventilated through an endotracheal tube, EBUS-TBNA may not be feasible due to several reasons. In such patients, the esophageal route offers a useful alternative for accessing mediastinal lesions. Herein, we describe a 50-year-old man with a mediastinal mass, who was being invasively ventilated for respiratory failure. Endoscopic ultrasound (with an echobronchoscope)-guided fine-needle aspiration was performed, which revealed a diagnosis of small cell carcinoma. Appropriate cancer chemotherapy resulted in successful liberation of the patient from mechanical ventilation. We have also performed a systematic review of literature for reports of endoscopic diagnostic procedures for mediastinal/hilar lesions in critically ill patients.

**Keywords:** Bronchoscopy, echobronchoscope, endobronchial ultrasound, interventional pulmonology, lung cancer, mediastinal mass

## Access this article online

**Website:** [www.ijccm.org](http://www.ijccm.org)

**DOI:** 10.4103/0972-5229.192057

**Quick Response Code:**



## Introduction

Endosonographic procedures, including endobronchial ultrasound (EBUS)-guided transbronchial needle aspiration (TBNA) and endoscopic ultrasound (EUS)-guided fine-needle aspiration (FNA) are routinely used for accessing mediastinal and hilar lymph nodes and masses.<sup>[1,2]</sup> In patients with hypoxemia, excessive cough, raised intracranial tension, or with central airway obstruction due to lesions compressing the trachea; EUS-FNA may be safer than EBUS-TBNA as it employs the esophageal route.<sup>[3]</sup> However, patients with central airway obstruction requiring mechanical

ventilation are often managed in respiratory care units, where EUS-FNA may not be available. In this situation, the pulmonologist can use the EBUS scope for performing a technique known as EUS (with an echobronchoscope)-guided FNA (EUS-B-FNA). This procedure has been reported to have a good diagnostic performance in the evaluation of mediastinal lesions.<sup>[3,4]</sup> Herein, we describe a patient with respiratory failure due to airway obstruction by a mediastinal tumor, who was

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

## From:

Departments of Pulmonary Medicine and <sup>1</sup>Cytology, Postgraduate Institute of Medical Education and Research, Chandigarh, India

## Correspondence:

Dr. Sahajal Dhooria, Department of Pulmonary Medicine, Postgraduate Institute of Medical Education and Research, Chandigarh - 160 012, India.  
E-mail: [sahajal@gmail.com](mailto:sahajal@gmail.com)

**For reprints contact:** [reprints@medknow.com](mailto:reprints@medknow.com)

**How to cite this article:** Prasad KT, Sehgal IS, Gupta N, Singh N, Agarwal R, Dhooria S. Endoscopic ultrasound (with an echobronchoscope)-guided fine-needle aspiration for diagnosis of a mediastinal lesion in a mechanically ventilated patient: A case report and systematic review of the literature. *Indian J Crit Care Med* 2016;20:608-12.

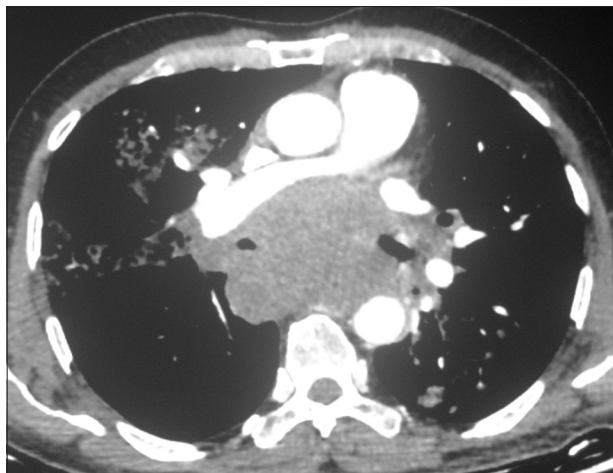
being mechanically ventilated. The diagnosis could be successfully established using EUS-B-FNA.

### Case Report

A 50-year-old man presented to the emergency department with stridor of 1-week duration. He also complained of progressive cough and breathlessness for 2 months. There was a significant reduction in appetite and he had lost 5 kg of his body weight. On admission to our facility, the patient was drowsy. Physical examination revealed an afebrile patient with a heart rate of 120 beats/min, respiratory rate of 38 breaths/min, and blood pressure of 80/50 mmHg. His oxygen saturation was 91% while breathing 40% oxygen. Contrast-enhanced computed tomography (CT) of his chest revealed the presence of a mass in the subcarinal region encasing the lower trachea and main bronchi and consolidation in the right upper lobe [Figure 1].

The patient was intubated with an endotracheal tube (7.0 mm internal diameter) and mechanically ventilated. Resuscitation with fluids and vasopressors was performed. He was initiated on intravenous co-amoxiclav (1.2 g thrice a day). Shock recovered after 48 h and tachycardia resolved. However, the patient could not be weaned off the ventilator over the next 5 days. On the 6<sup>th</sup> day, EUS-B-FNA of the subcarinal mass was performed. Cytological examination showed loosely cohesive clusters and dispersed population of small-sized tumor cells with hyperchromatic nuclei showing focal nuclear molding suggestive of small cell carcinoma of the lung [Figure 2].

The final clinicoradiological stage was IIIb (T4 N3 M0), but the patient had a poor performance status (Eastern cooperative oncology group score of 4). Placement of a



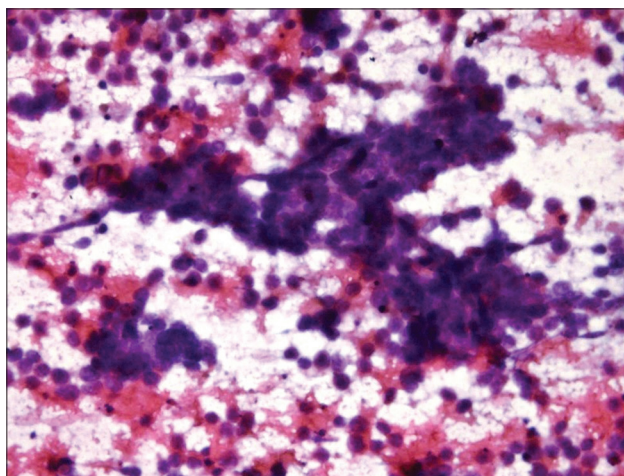
**Figure 1:** Mass in the subcarinal region encasing both the main bronchi and causing compression of the pulmonary vessels

metallic tracheobronchial Y-stent was considered but was not performed as the patient's legal representative refused consent. Chemotherapy with cisplatin 100 mg (85% of 60 mg/m<sup>2</sup> of body surface area [BSA]) and irinotecan 160 mg (90% of 100 mg/m<sup>2</sup> of BSA) were administered. After a week, the patient was successfully weaned off the ventilator and was discharged to home care. The patient received three more cycles of chemotherapy. However, the disease progressed and the patient succumbed to his illness 3 months after the diagnosis.

### Discussion

The index case illustrates the utility of EUS-B-FNA in accessing mediastinal lesions in mechanically ventilated patients, where EBUS-TBNA may be technically difficult or not feasible. A diagnosis of advanced lung cancer was made and the administration of palliative chemotherapy enabled liberation from mechanical ventilation.

Mediastinal or hilar lesions in critically ill patients can be approached endoscopically by the pulmonologist through the airway using TBNA that can be performed with or without EBUS guidance. Both conventional and EBUS-guided TBNA have been described in patients with respiratory failure, who are mechanically ventilated through an endotracheal tube;<sup>[5-7]</sup> however, they are not performed frequently. This is because a small-sized endotracheal tube does not allow the entry of the echobronchoscope (insertion tube diameter, 6.9 mm). Further, as the procedure requires a few minutes, significant hypoxia may occur in patients with a poor respiratory reserve. The index patient was being ventilated with a small-sized endotracheal tube (internal



**Figure 2:** Photomicrograph of the aspirate from the mediastinal mass obtained by endoscopic ultrasound (with an echobronchoscope)-guided fine-needle aspiration showing loosely cohesive clusters and dispersed population of small-sized tumor cells with hyperchromatic nuclei showing focal nuclear molding suggestive of small cell carcinoma. Background shows nuclear debris (H and E, ×40)

**Table 1: Published reports of endoscopic diagnostic interventions for accessing mediastinal/hilar lesions in critically ill patients**

Author (year), country	n	Intervention	Age in years	Sex (n)	Indication (n)	IMV (n)	Lymph node/ mass accessed	Diagnosis from procedure (n)	Change in management, n (%)	Final diagnosis (n)	Final outcome (n)
Ghamande et al. (2002), USA <sup>[6]</sup>	8	cTBNA	Mean 59.1	Male (4), female (4)	Mediastinal mass (2), hilar mass (2), mediastinal lymphadenopathy (4)	8	Subcarinal node/mass (4), paratracheal node/mass (2), hilar mass (2)	PTLD (1), lung cancer (4), reactive (3)	5 (62.5)	PTLD (1), lung cancer (5), no malignancy/infection (2)	Survived (4), died (2), unknown (2)
Koh (2014), Singapore <sup>[7]</sup>	6	EBUS-TBNA	43-75	Male (4), female (2)	Mediastinal lymphadenopathy/ mass (5), mediastinal and hilar lymphadenopathy (1)	6	Subcarinal node (3), left hilar node (1), lower right paratracheal node (2), anterior mediastinal mass (1), right paratracheal mass (1)	Adenocarcinoma (2), SCLC (1), poorly differentiated carcinoma (1), anaplastic large cell lymphoma (1), atypical squamous cells (1)	5 (83.3)	Adenocarcinoma (2), SCLC (1), poorly differentiated carcinoma (1), anaplastic large cell lymphoma (1), unknown (1)	Survived (2), died (4)
Chichra et al. (2015), USA <sup>[5]</sup>	1	EBUS-TBNA	58	Male (1)	Right hilar mass (1)	1	Right hilar mass (1)	Cryptococcus infection (1)	1 (100)	Disseminated cryptococcosis (1)	Died (1)
Fritscher- Ravens et al. (2000), Germany <sup>[10]</sup>	3	EUS-FNA	60-78	Male (2), female (1)	Suspected mediastinal abscess (2), mediastinal lymphadenopathy (1)	2	Mediastinal collection (2), EUS-FNA of subcarinal node (1)	Mediastinal abscess (bacterial) (1), mediastinal hematoma (1), no evidence of metastasis (1)	3 (100)	Mediastinal abscess (bacterial) (1), mediastinal hematoma (1), lung cancer without mediastinal involvement (1)	Survived (2), died (1)
Fritscher- Ravens et al. (2003), Germany <sup>[9]</sup>	18	EUS-FNA	Median 60	Male (17), female (1)	Suspected posterior mediastinitis (18)	15	Mediastinal collections (18)	Detected mediastinal lesions and identified infectious organism (16), false negative (1), true negative (1)	16 (88.9)	Mediastinitis (17) (bacterial [15], fungal [1], tuberculosis [1]), no mediastinitis (1)	Survived (12), died (6)
Varadarajulu et al. (2008), USA <sup>[11]</sup>	1	EUS-FNA	55	Male (1)	Suspected mediastinal abscess (1)	1	Aspiration and drainage of mediastinal abscess (1)	Mediastinal abscess (1)	1 (100)	Mediastinal abscess (1)	Survived (1)
Mohamadnejad et al. (2011), Iran <sup>[15]</sup>	7	EUS-FNA	28-76	Male (4), female (3)	Mediastinal mass/ lymphadenopathy (7)	NA	Subcarinal node (1), paraesophageal node (1), aortopulmonary node (1), mediastinal mass (4)	NSCLC (3), SCLC (1), NHL (1), necrosis (1), reactive (1)	6 (85.7)	NSCLC (3), SCLC (1), NHL (1), histoplasmosis (1), pneumonia (1)	Survived (1), died (6)
Berzosa et al. (2013), USA <sup>[8]</sup>	12	EUS-FNA	NA	NA	Mediastinal mass/ lymphadenopathy (12)	NA	Not mentioned mass (4)	Metastatic cancer (3), disseminated fungal infection (2), reactive (7)	6 (50)	Metastatic cancer (3), disseminated fungal infection (2), reactive adenopathy (7)	Unknown (12)

Contd...

**Table 1: Contd..**

Author (year), country	n	Intervention	Age in years	Sex (n)	Indication (n)	IMV (n)	Lymph node/ mass accessed	Diagnosis from procedure (n)	Change in management, n (%)	Final diagnosis (n)	Final outcome (n)
Abouzghaib et al. (2011), USA <sup>[14]</sup>	1	EUS-B-FNA	50	Male (1)	Mediastinal mass (1)	1	Mediastinal mass (1)	NSCLC (1)	1 (100)	NSCLC (1)	Unknown (1)
Bhaskar et al. (2014), USA <sup>[13]</sup>	4	EUS-B-FNA	16-62	Male (2), female (2)	Mediastinal lymph adenopathy (4)	4	Subcarinal node (4), lower left paratracheal node (1)	Cryptococcus infection (1), MRSA infection (1), adenocarcinoma (2)	4 (100)	Disseminated cryptococcosis (1), MRSA infection (1), adenocarcinoma (2)	Unknown (4)
Index case (2016), India	1	EUS-B-FNA	50	Male (1)	Subcarinal mass (1)	1	Subcarinal mass (1)	SCLC (1)	1 (100)	SCLC (1)	Died (1)

†TBNA: Conventional transbronchial needle aspiration; EBUS-TBNA: Endobronchial ultrasound-guided transbronchial needle aspiration; EUS-B-FNA: Endoscopic ultrasound (with an echobronchoscope)-guided fine-needle aspiration; EUS-FNA: Endoscopic ultrasound-guided fine-needle aspiration; IMV: Invasive mechanical ventilation; MRSA: Methicillin-resistant *Staphylococcus aureus*; NA: Not available; NHL: NonHodgkin lymphoma; NSCLC: Nonsmall cell lung cancer; PTLT: Posttransplant lymphoproliferative disorder; SCLC: Small cell lung cancer

diameter of 7.0 mm) and he had significant hypoxemia. Thus, TBNA was not technically feasible in the index case.

EUS may be useful in such patients as the access is through the esophagus, thus not compromising ventilation.<sup>[8-11]</sup> EUS offers access to lymph node stations 5 (para-aortic), 8 (paraesophageal), and 9 (pulmonary ligament) in addition to stations 4 L (left lower paratracheal) and 7 (subcarinal). However, this procedure is usually performed by gastroenterologists and many respiratory Intensive Care Units may not have easy access to this technology, especially at the bedside. EUS-B-FNA, which is performed by the pulmonologist with the same echobronchoscope used to perform EBUS-TBNA overcomes this limitation. Moreover, the introduction of the EBUS scope (6.9 mm in diameter) may be easier than the introduction of the EUS scope (12–14 mm in diameter) in patients who also have esophageal narrowing.<sup>[12]</sup> Due to these reasons, EUS-B-FNA was preferred in the index patient. CT-guided FNA was not employed as it would have entailed a high risk of pneumothorax due to the central location of the mass.

A systematic review of the PubMed database using the search string: (EBUS OR “endobronchial ultrasound” OR “endoscopic ultrasound” OR echobronchoscope OR echoendoscope OR endosonography OR “transbronchial needle aspiration”) AND (ICU OR “intensive care unit” OR “critically ill” OR “mechanical ventilation\*” OR “mechanically ventilated” OR intubated OR “endotracheal tube”) yielded 10 reports (62 patients) of endoscopic interventions (conventional TBNA, EBUS-TBNA, EUS-FNA, or EUS-B-FNA) for mediastinal/hilar lesions in critically ill patients [Table 1].<sup>[5-11,13-15]</sup> Forty-six patients could be diagnosed successfully resulting in an overall yield of 74.2%; there were no major complications. Moreover, the diagnostic information obtained from the procedure led to a change in the treatment decision in most of these patients (49/62; 79%). In our case, EUS-B-FNA allowed institution of appropriate chemotherapy and facilitated liberation of our patient with advanced lung cancer from mechanical ventilation, an event not commonly encountered in clinical practice.<sup>[16]</sup>

**Conclusion**

The index case demonstrates that EUS-B-FNA is a valuable addition to the armamentarium of the pulmonologist for diagnosing mediastinal lesions in critically ill patients, including situations such as respiratory failure, which preclude a diagnostic bronchoscopy and EBUS-TBNA.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

### References

- Dhooira S, Aggarwal R, Aggarwal AN, Bal A, Gupta N, Gupta D. Differentiating tuberculosis from sarcoidosis by sonographic characteristics of lymph nodes on endobronchial ultrasonography: A study of 165 patients. *J Thorac Cardiovasc Surg* 2014;148:662-7.
- Sharma M, Eeka RS, Somasundaram A, Shoukat A, Kirnake V. Endoscopic ultrasound in mediastinal tuberculosis. *Lung India* 2016;33:129-34.
- Dhooira S, Aggarwal AN, Singh N, Gupta D, Behera D, Gupta N, *et al.* Endoscopic ultrasound-guided fine-needle aspiration with an echobronchoscope in undiagnosed mediastinal lymphadenopathy: First experience from India. *Lung India* 2015;32:6-10.
- Dhooira S, Aggarwal AN, Gupta D, Behera D, Aggarwal R. Utility and safety of endoscopic ultrasound with bronchoscope-guided fine-needle aspiration in mediastinal lymph node sampling: Systematic review and meta-analysis. *Respir Care* 2015;60:1040-50.
- Chichra A, Lama KW, Koenig SJ. Respiratory failure with hilar mass: Role of endobronchial ultrasound-guided transbronchial needle aspiration in the medical intensive care unit. *Lung India* 2015;32:178-81.
- Ghamande S, Rafanan A, Dweik R, Arroliga AC, Mehta AC. Role of transbronchial needle aspiration in patients receiving mechanical ventilation. *Chest* 2002;122:985-9.
- Koh MS, Ong TH, Phua GC, Anantham D. Feasibility of endobronchial ultrasound in mechanically ventilated patients. *Ann Acad Med Singapore* 2014;43:238-40.
- Berzosa M, Davies SF, Gupta K, Debol SM, Li R, Miranda D, *et al.* Diagnostic bedside EUS in the intensive care unit: A single-center experience. *Gastrointest Endosc* 2013;77:200-8.
- Fritscher-Ravens A, Schirrow L, Pothmann W, Knöfel WT, Swain P, Soehendra N. Critical care transesophageal endosonography and guided fine-needle aspiration for diagnosis and management of posterior mediastinitis. *Crit Care Med* 2003;31:126-32.
- Fritscher-Ravens A, Sriram PV, Pothman WP, Füllekrug B, Jäckle S, Thonke F, *et al.* Bedside endosonography and endosonography-guided fine-needle aspiration in critically ill patients: A way out of the deadlock? *Endoscopy* 2000;32:425-7.
- Varadarajulu S, Eloubeidi MA, Wilcox CM. The concept of bedside EUS. *Gastrointest Endosc* 2008;67:1180-4.
- Gupta K, Mallory S. Small-caliber endobronchial ultrasonic videoscope: Successful transesophageal and transgastric FNA after failed passage of a standard ultrasonic endoscope. *Gastrointest Endosc* 2007;66:574-7.
- Bhaskar N, Shweihat YR, Bartter T. The intubated patient with mediastinal disease – A role for esophageal access using the endobronchial ultrasound bronchoscope. *J Intensive Care Med* 2014;29:43-6.
- Abouzgheib W, Shweihat Y, Bartter T. Oesophageal applications of the convex curvilinear ultrasound bronchoscope; an illustrative case series. *Respirology* 2011;16:965-8.
- Mohamadnejad M, Leblanc JK, Sherman S, Al-Haddad M, McHenry L, Cote GA, *et al.* Bedside endoscopic ultrasound in critically ill patients. *Diagn Ther Endosc* 2011;2011:529791.
- Soares M, Darmon M, Salluh JI, Ferreira CG, Thiéry G, Schlemmer B, *et al.* Prognosis of lung cancer patients with life-threatening complications. *Chest* 2007;131:840-6.