




## Case Report

# Enhancing diagnostic precision: Electromagnetic navigation bronchoscopy with cryobiopsy in pulmonary and mediastinal lesions – A case study

**Dawid Kordykiewicz<sup>1</sup>** , **Monika Szaj<sup>2</sup>**, **Jarosław Pieróg<sup>1</sup>**, **Konrad Ptaszyński<sup>3</sup>**,  
**Tomasz Grodzki<sup>1</sup>**, **Janusz Wójcik<sup>1</sup>**, **Janek Szymański<sup>2</sup>**, **Karina Witkiewicz<sup>2</sup>**,  
**Małgorzata E Wojtyś<sup>1</sup>**

<sup>1</sup> Department of Thoracic Surgery and Transplantation, Pomeranian Medical University in Szczecin, Poland

<sup>2</sup> Regional Hospital for Lung Diseases, Szczecin, Poland

<sup>3</sup> Department of Pathology and Forensic Medicine, School of Medicine, Collegium Medicum, University of Warmia and Mazury in Olsztyn, Poland

### ARTICLE INFO

#### Article history

Received: November 5, 2023

Accepted: November 22, 2023

Available online: February 1, 2024

#### Keywords

Thoracic surgery

Cancer diagnosis

Lung nodules

Image-guided biopsy

#### Doi

<https://doi.org/10.29089/paom/175728>

#### User license

This work is licensed under a Creative Commons Attribution – NonCommercial – NoDerivatives 4.0 International License.



### ABSTRACT

**Introduction:** A minimally invasive approach in the diagnosis of peripheral pulmonary lesions may pose a challenge for thoracic surgeons when selecting the most appropriate technique. Electromagnetic navigation bronchoscopy (ENB) is an innovative technique used in the diagnosis of lung tumors.

**Aim:** Evaluation of the merits of ENB in patient manifesting undiagnosed pulmonary and mediastinal lesions, while concurrently investigating its influence on the determination of the ultimate therapeutic strategy.

**Case study:** The 73-year-old male patient with a suspicious lung mass was admitted to the hospital for diagnosis and subsequent treatment. The patient underwent an invasive diagnosis of lung and mediastinum using ENB with cryobiopsy. The histopathological examination revealed adenocarcinoma and lymphoma cells, ultimately guiding the initiation of appropriate therapeutic measures.

**Results and discussion:** Among the available methods, those with the highest diagnostic yield and safety should be chosen. Precise diagnosis of pulmonary lesions holds paramount importance for guiding appropriate treatment in cases of suspected malignancy.

**Conclusions:** ENB with cryobiopsy proves effective diagnosis in case of peripheral lesions that are difficult to access for classical techniques.

## 1. INTRODUCTION

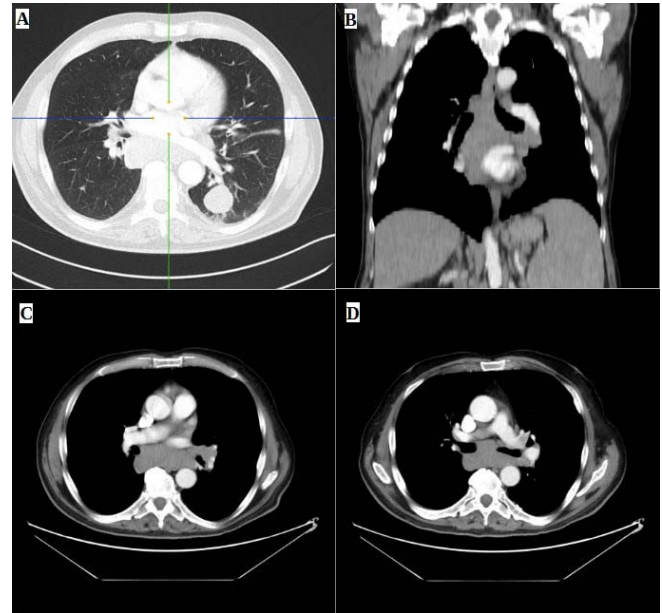
Lung cancer is responsible for the largest number of cancer-related deaths in the world.<sup>1</sup> The precise diagnostics of pulmonary lesions assumes paramount significance in directing optimal therapeutic interventions. Advancements in contemporary invasive diagnostics became a challenge when selecting the most suitable technique.<sup>2</sup> In lesions located proximally to central airways, endobronchial ultrasound needle aspiration seems to be the optimal choice, but in inaccessible regions, electromagnetic navigation bronchoscopy (ENB) with cryobiopsy has emerged as a preeminent method within this domain.

## 2. AIM

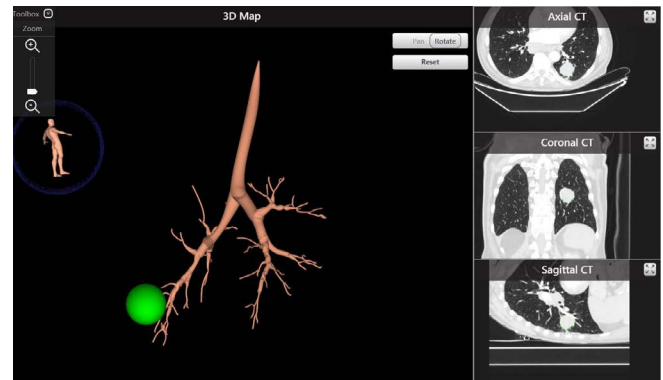
The objective of this article is to elucidate the advantages of employing this method in patients presenting with undiagnosed lesions in the lung and mediastinum, while also examining the impact of histopathological results and their influence on the selection of the final treatment approach.

## 3. CASE STUDY

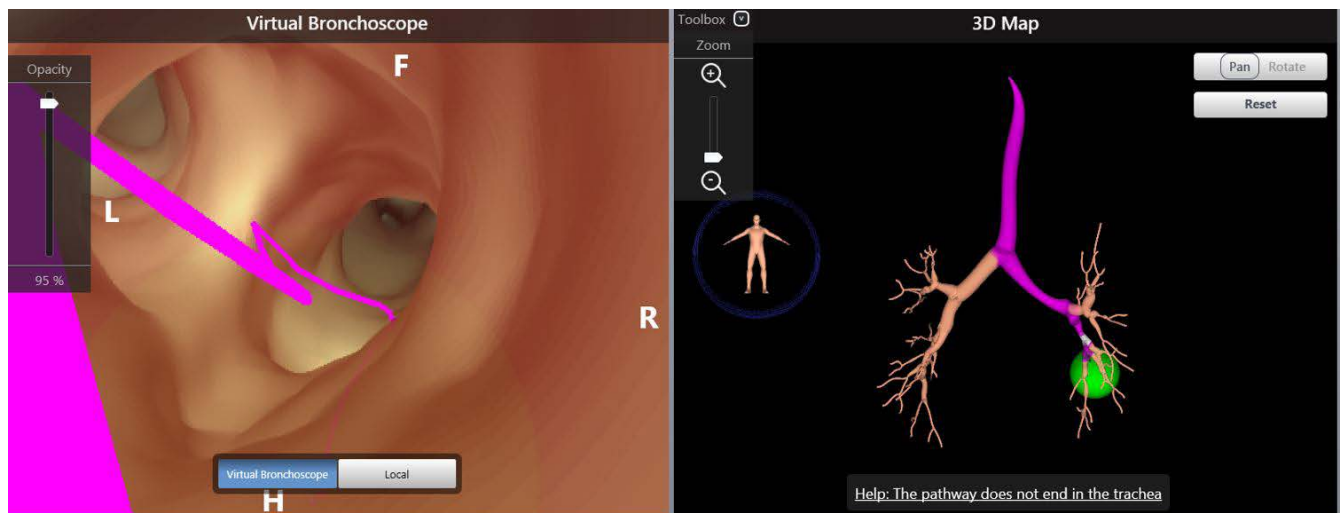
A 73-year-old male patient was admitted to the department for invasive diagnostic procedures due to suspected non-small cell lung cancer. In his medical history a significant weight loss of 17 kg over the past 6 months were noted. The patient had received 3 doses of COVID-19 vaccination, had a history of nicotine consumption amounting to 30 pack-years, but had ceased smoking for a decade. Additionally, he had a stage 4 chronic lymphocytic leukemia, hypertension, and had previously contracted COVID-19 infection 4 months prior. Previous chest CT scan revealed a pathological mass (3.7 × 3.7 cm) in 10th segment of the left lung with polycyclic contours undergoing heterogeneous contrast enhancement, areas of atelectasis. Furthermore, there were



**Figure 1.** CT scan: Axial plane (A,C,D) and coronal plane (B). Pathological mass in the left lung and numerous enlarged lymph nodes in mediastinum.



**Figure 2.** SuperDimension Navigation System 3D Map – Determining the position of the pathological mass in relation to the airways.



**Figure 3.** Transbronchial mapping in SuperDimension Navigation System. Selecting the best route to the lesion.

multiple enlarged lymph nodes in the axillary, supraclavicular, paratracheal, and left hilar regions (Figure 1). Additionally, minor osteolytic lesions up to 0.5 cm in diameter were observed in the ribs.

Bronchofiberoscopy did not reveal any discernible tumor-related endobronchial changes, but the brush swab of the 10<sup>th</sup> segment bronchus in the left lung yielded non-small cell carcinoma cells. Notably, no cancer cells were detected in the biopsy of the enlarged supraclavicular lymph nodes. The patient was qualified for invasive diagnosis of lung cancer using bronchial navigation with cryobiopsy (Figures 2 and 3).

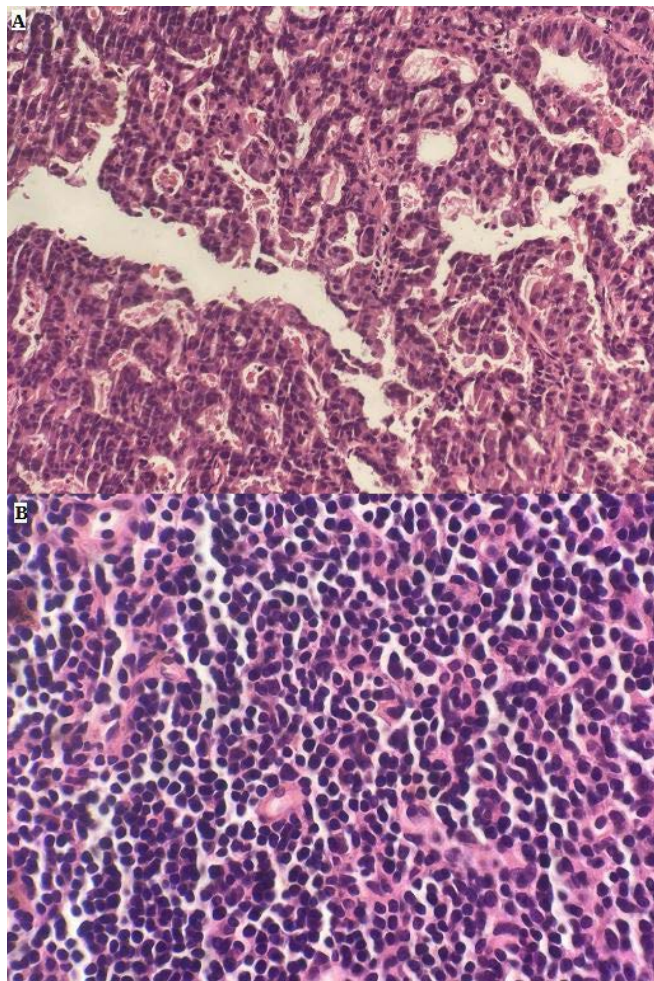
Under general anesthesia, the patient was intubated with a tracheoscope. Guided by the CT image of the chest, a small laser incision was made through the membranous part of the right main bronchus, and then a 1.1 mm cryo probe was inserted into the mediastinum and sections of the mediastinal tumor were taken. Subsequently, using the bronch-navigation, the sensor reached about 1 cm from the tumor in the 10<sup>th</sup> segment of the left lung and transbronchial needle aspiration was performed. This area was brushed and sec-

tions were taken with a 1.1 mm cryo probe. Material for culture, acid-fast bacillus (AFB), cytology and cytocheck were collected. The procedure was conducted without any untoward complications. The histopathological examination revealed adenocarcinoma cells in the lung tumor: CK7+, p40-, TTF1-, CK20+, CDX2+, Napsin A-. It was difficult to exclude the secondary nature of the tumor in the form of a metastasis of colorectal cancer. Immunohistochemistry of mediastinum biopsy showed: LCA+, CD20+, cyclin D1-, CD5± (scattered positive cells), CK7-. CD56-, Ki67 8% -corresponding to small B-cell lymphoma (Figure 4).

The following day, a control X-ray examination was performed. There were no signs of pneumothorax. The patient did not report any symptoms. Based on the results, it was decided to plan a colonoscopy to exclude a secondary nature of the lesion.

In colonoscopy 3 polyps were found and removed with a cold loop. First in the area of the appendix (3–4 mm), 2nd in sigmoid colon (7 mm) and 3rd in the rectum near the anal canal (8 mm). Sigmoid and rectal polyp were recovered for histopathological examination which revealed tubular adenoma with low-grade dysplasia in cecum.

After oncological reconciliation, the patient decided to refuse the surgical treatment due to his poor condition. Consequently, the multidisciplinary board decided to abstain from PET-CT diagnostics and referred him to the hematology department for chemotherapy and radiotherapy.



**Figure 4. (A) Endobronchial cryobiopsy showing features of adenocarcinoma (HE, 200×). (B) Mediastinal tumor cryobiopsy showing numerous CD20 positive and CD5 positive small lymphocytic cells of B small lymphocytic lymphoma (HE, 200×).**

#### 4. DISCUSSION

Transthoracic biopsy is the method of choice for peripheral lesions that are inaccessible to classic bronchoscopy. An emerging and increasingly preferred alternative is ENB. Despite sharing a similar operational principle with virtual bronchoscopic navigation (VBN), there is no definitive demonstration of a significant advantage of one method over the other. Nevertheless, ENB exhibits higher specificity and comparable sensitivity when contrasted with VBN.<sup>3</sup> The biopsy site is determined based on the pre-procedural CT images. An electromagnetic sensor is placed around the patient's chest to track the current position of the biopsy tools and compare them with the previously obtained 3D images of the airways. The advantage of this method is also the possibility of diagnosing lymph nodes located in the mediastinum and lung hilum.<sup>2</sup> Mediastinal changes, characterized by their proximity to vital structures, pose challenges in terms of examination. ENB enables precise navigation and minimally invasive access to these intricate anatomical regions. In the case presented, it facilitated the identification of two distinct pathologies in the same patient – adenocarcinoma and lymphoma. Remarkably, the entire procedure was completed in a single session, sparing the patient the inconvenience of subsequent examinations.

Transbronchial cryobiopsy is emerging as an increasingly favored approach for diagnosing pulmonary lesions, particularly proving valuable for nodules with a diameter

less than 20 mm.<sup>4</sup> Adding this method to ENB allows increased diagnostic possibilities. In contrast to conventional biopsy techniques, cryobiopsy enhances the accuracy of material collection from suspicious lesions primarily due to the larger sample volume it provides.<sup>5</sup> This feature proves especially advantageous in immunohistochemistry and genetic investigations.<sup>6,7</sup> In the case presented, the histopathological results were successfully obtained from all collected samples, and the use of immunohistochemical examination facilitated rapid diagnosis.

Authors have observed notably high effectiveness in using ENB to diagnose peripheral pulmonary lesions. Zhang's work, for instance, reports a commendable sensitivity of 82% and outstanding specificity of 100%.<sup>8</sup> In different systematic reviews and meta-analysis, the diagnostic yield was over 78%.<sup>9</sup> Moreover, in the same study by Folch, ENB was characterized as a remarkably safe method, with a mere 2% risk of pneumothorax and a risk of bleeding and respiratory failure below 1%. One of its key advantages over surgical biopsy lies in the reduced occurrence of complications, leading to shorter hospitalization durations. These results are also confirmed in the practice of our center. Furthermore, in this case, we also did not observe any complications during the control X-ray examination and observation of the patient.

ENB not only streamlines the process of diagnostic biopsies but also proves valuable for marker placement and subsequent radiation therapy. A notable limitation of ENB is its associated cost; however, ongoing technological advancements and its growing popularity are rendering it increasingly economically feasible. This is especially noteworthy when considering the reduction in complications and the avoidance of more invasive procedures, which result in quicker and more precise diagnoses.<sup>10</sup>

## 5. CONCLUSIONS

- (1) ENB with cryobiopsy proves to be a precise and secure method for diagnosing pulmonary and mediastinal lesions.
- (2) ENB with cryobiopsy demonstrates a high diagnostic yield, especially in the context of peripheral lesions that pose challenges for traditional techniques.

## Conflict of interest

The authors declare that they have no conflict of interest.

## Funding

This study has no funding.

## References

- <sup>1</sup> Siegel RL, Miller KD, Fuchs HE, Jemal A. Cancer statistics, 2022. *CA Cancer J Clin.* 2022;72(1):7–33. <https://doi.org/10.3322/caac.21708>.
- <sup>2</sup> Shinagawa N. A review of existing and new methods of bronchoscopic diagnosis of lung cancer. *Respir Investig.* 2019;57(1):3–8. <https://doi.org/10.1016/j.resinv.2018.08.004>.
- <sup>3</sup> Qian K, Krinsky WS, Sarkar SA, Deng Y. Efficiency of electromagnetic navigation bronchoscopy and virtual bronchoscopic navigation. *Ann Thorac Surg.* 2020;109(6):1731–1740. <https://doi.org/10.1016/j.athoracsurg.2020.01.019>.
- <sup>4</sup> Taton O, Bondue B, Gevenois PA, Rimmelink M, Leduc D. Diagnostic yield of combined pulmonary cryobiopsies and electromagnetic navigation in small pulmonary nodules. *Pulm Med.* 2018;2018:6032974. <https://doi.org/10.1155/2018/6032974>.
- <sup>5</sup> Takemura C, Imabayashi T, Furuse H, et al. Thoracic SMARCA4-deficient undifferentiated tumor diagnosed by transbronchial mediastinal cryobiopsy: A case report. *Thorac Cancer.* 2023;14(10):953–957. <https://doi.org/10.1111/1759-7714.14830>.
- <sup>6</sup> Pertzov B, Gershman E, Izhakian S, et al. The Lung-Vision navigational platform for peripheral lung nodule biopsy and the added value of cryobiopsy. *Thorac Cancer.* 2021;12(13):2007–2012. <https://doi.org/10.1111/1759-7714.14003>.
- <sup>7</sup> Poniatowska-Broniek G, Sikorska M, Sulik M, Nawrocki S, Maruszak K, Gizelbach-Żochowska K. Diagnostic difficulties in recognizing B-cell lymphomas in mediastinal tumors – three case studies. *Pol Ann Med.* 2010;17(1):71–83. [https://doi.org/10.1016/S1230-8013\(10\)70008-4](https://doi.org/10.1016/S1230-8013(10)70008-4).
- <sup>8</sup> Zhang W, Chen S, Dong X, Lei P. Meta-analysis of the diagnostic yield and safety of electromagnetic navigation bronchoscopy for lung nodules. *J Thorac Dis.* 2015;7(5):799–809. <https://doi.org/10.3978/j.issn.2072-1439.2015.04.46>.
- <sup>9</sup> Folch EE, Labarca G, Ospina-Delgado D, et al. Sensitivity and Safety of Electromagnetic Navigation Bronchoscopy for Lung Cancer Diagnosis: Systematic Review and Meta-analysis. *Chest.* 2020;158(4):1753–1769. <https://doi.org/10.1016/j.chest.2020.05.534>.
- <sup>10</sup> Brady JJ, Chang R, Rudoler S. Thoracic surgeon performed electromagnetic navigational bronchoscopy: new modality, new diagnosis. *Indian J Thorac Cardiovasc Surg.* 2015;31(3):266–268. <https://doi.org/10.1007/s12055-015-0370-9>.