

Results and complications of percutaneous co-axial trans-thoracic biopsy in lung masses: our clinical experience

 Adnan Özdemir¹,  Mehmet Hamdi Şahan²

¹Department of Radiology, Faculty of Medicine, Kırıkkale University, Kırıkkale, Türkiye

²Department of Radiology, Faculty of Medicine, Gaziantep University, Gaziantep, Türkiye

Received: 27.06.2024

Accepted: 20.07.2024

Published: 29.07.2024

Cite this article: Özdemir A, Şahan MH. Results and complications of percutaneous co-axial trans-thoracic biopsy in lung masses: our clinical experience. J Radiol Med. 2024;1(3):42-45.

Corresponding Author: Adnan Özdemir, dradnanozdemir@gmail.com

ABSTRACT

Aims: The aim of our study was to evaluate the diagnostic rates and procedure-related complications in lung masses undergoing computed tomography (CT)-guided percutaneous coaxial trans-thoracic biopsy (PCTTB).

Methods: We retrospectively analyzed 117 patients who underwent CT-guided PCTTB between January 2016 and December 2018. A 64 slice Multislice-CT was used in each patient. A core biopsy was performed with a 16–18-gauge needle using the co-axial method. The demographic characteristics of the patients, post-procedural diagnosis rates, and complications were evaluated.

Results: Of 117 patients, 93 were male (mean age 67.9±10.8 years) and 24 were female (mean age 64.2±15.2 years). The pathologic evaluation of three patients was reported as “insufficient material”. The diagnostic sensitivity of CT-guided PCTTB was 97.4%. Malignant lesions were detected in 70 patients (59.8%) and benign lesions in 44 patients (37.9%). The most common complication was pneumothorax, which occurred in 24 (20.5%) patients. A thoracic tube was inserted in three of these patients, while the others were discharged with follow-up. Other complications were hemorrhage (10.3%) and hemoptysis (12%), respectively. While mortality in CT-guided biopsy was associated with air embolization in some studies, mortality was not present in our study.

Conclusion: CT-guided PCTTB lung biopsies have a high diagnostic rate and acceptable complications. Percutaneous coaxial trans-thoracic biopsy should be the first choice in all appropriate cases.

Keywords: Trans-thoracic biopsy, malignant, pneumothorax, hemorrhage, hemoptysis

*This article was published as an oral presentation at the Turkish Thoracic Radiology Association symposium on 20-21 April 2019.

INTRODUCTION

Lung biopsies can be classified into four groups according to the route of access to the lesion: percutaneous transthoracic, bronchoscopic, video-assisted thoracoscopic surgery (VATS), and open surgical biopsies.¹ Bronchoscopic biopsy is limited to centrally located tumors that can be seen through the airways.² VATS and open surgical lung biopsies provide larger specimens but have higher morbidity and mortality.^{1,3} Ultrasound (US) and computed tomography (CT) are the two most commonly used guidance techniques for percutaneous lung biopsy.⁴ Since US waves cannot pass through air-containing lung tissue, US-guided biopsy can only be performed for lesions adjacent to the thoracic wall, and its use is limited.¹ CT-guided procedures are the current standard for transthoracic needle biopsy of pulmonary masses.^{5,6} It is a less-invasive method with high accuracy and reliability.⁷ It often prevents unnecessary surgical procedures with tissue diagnosis. In malignant lesions, it is also preferred to determine the cell type since pathologic diagnosis and cell type determine the treatment modality.⁸

Although PCTTB is a reliable method, complications such as pneumothorax and hemothorax may rarely occur.⁹ There are reports of serious complications such as air embolism and rare deaths following a lung biopsy.¹⁰

In our study, we aimed to evaluate the diagnostic rates and procedure-related complications of lung masses undergoing CT-guided PCTTB.

METHODS

This retrospective study was conducted at Kırıkkale University Faculty of Medicine according to the principles of the Declaration of Helsinki. Ethics Committee Approval was obtained from Kırıkkale University Clinical Researches Ethics Committee (Date: 03.09.2019, Decision No: 19/07). This article was published as an oral presentation at the Turkish Thoracic Radiology Association symposium on 20-21 April 2019. We retrospectively analyzed 117 patients



who underwent CT-guided PCTTB between January 2016 and December 2018. Demographic characteristics, post-procedural diagnosis rates, and complications were evaluated.

For each patient prior to PCTTB, we obtained a low-dose axial CT scan on a 64-detector scanner using multislice computed tomography (MSCT) (Brilliance 64; Philips Medical System, Best, the Netherlands) under the following imaging parameters: 120 kVp, 30 mA per slice, 0.75-second rotation time, and collimation of 8×5 mm. Axial images were scanned with a 2-3 mm section thickness. All PCTTBs were performed by experienced interventional radiologists (AÖ, MHS) using an automated biopsy needle.

The bleeding parameters of all patients were checked before biopsy (INR and platelet count). Patients whose values were not suitable for the procedure (INR>1.5, platelet count<50,000) were given the necessary treatments, and after the control values were checked, patients with improvement were included in the procedure. Patients taking antiplatelet and anticoagulant drugs such as aspirin and coumadin were discontinued at least 5 days before the procedure. All patients were informed about the purpose, method, and possible complications of the biopsy procedure, and informed consent forms were obtained from all patients.

The PCTTB procedure was started by placing the patient in the appropriate position, in a way to cover the shortest distance, and by placing a metal marker (Figure 1). A local anesthetic was applied to the subcutaneous distance to the entry localization. Repeated control CT sections were obtained to access the lesion. All biopsy procedures were performed with an 18–20-gauge Tru-cut biopsy needle using a 10-15 cm long coaxial needle (Figure 2). The tissue sample was sent to the pathology department in a sterile container containing formol. After the biopsy was completed, control CT sections were obtained to evaluate pneumothorax and/or hemorrhage. The patients were followed up in the clinic, and PA chest radiographs were taken at the second hour. SPSS for Windows 20.0 (SPSS, Inc., Chicago, IL, USA) software program was used for analysis.

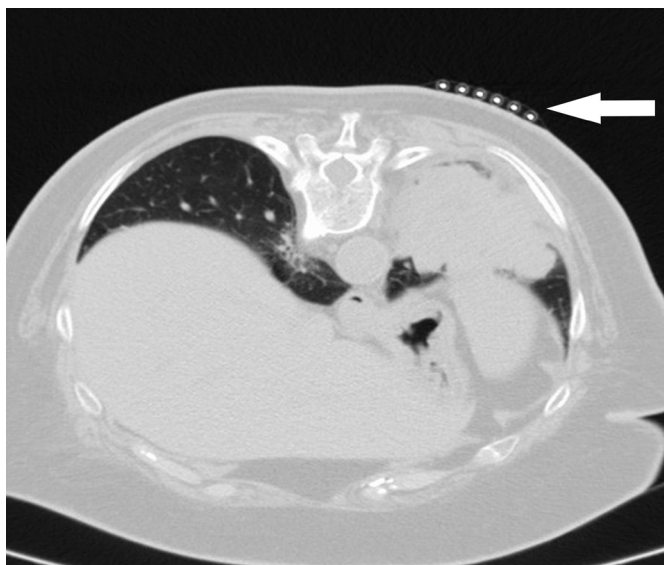


Figure 1. CT-guided PCTTB from left lower lung mass. Preprocedure scan with a grid on the skin is also shown. . (white arrow)

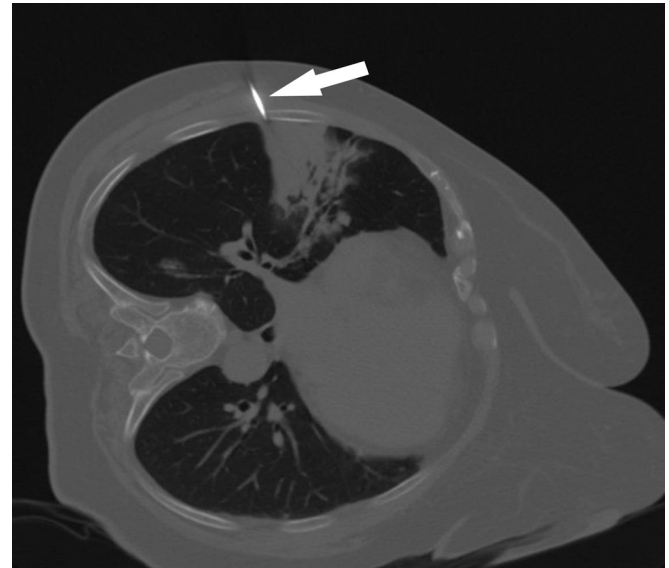


Figure 2. Axial CT scan of mass on the left lung in patient is presented. The outer cannula of a co-axial biopsy device is inserted within the lesion. (white arrow)

RESULTS

Of the 117 patients who underwent PCTTB, 93 were male (mean age 67.9±10.8 years) and 24 were female (mean age 64.2±15.2 years). The pathologic evaluation of three patients was reported as “insufficient material”. The diagnostic sensitivity of CT-guided PCTTB was 97.4%. Malignant lesions were detected in 70 patients (59.8%) and benign lesions in 44 patients (37.9%). The most common malignant lesion was adenocarcinoma, while the most common benign lesion was nonspecific findings (Tables 1, 2).

Table 1.

Benign Lesions	Frequency (n)
Non-specific findings (congestion, inflammation, fibrosis...)	30
Anthraxosis	4
Pneumonia	3
Necrotizing granulomatous lesion	3
Hamartoma	2
Thymoma	2

Table 2.

Malignant Lesions	Frequency (n)
Adenocarcinoma	32
Squamous cell carcinoma	29
Small cell carcinoma	2
Sarcomatoid	2
Metastasis (colorectal carcinoma, renal cell carcinoma, malignant mesenchymal tumor)	5

The most common complication was pneumothorax, which was observed in 24 (20.5%) patients (Figure 3). A thoracic tube was inserted in three of these patients, while the others were discharged with follow-up. Other complications included hemorrhage in 12 patients (10.3%) and hemoptysis in 14 patients (12%). While mortality in CT-guided biopsy was associated with air embolization in some studies, mortality was not present in our study.

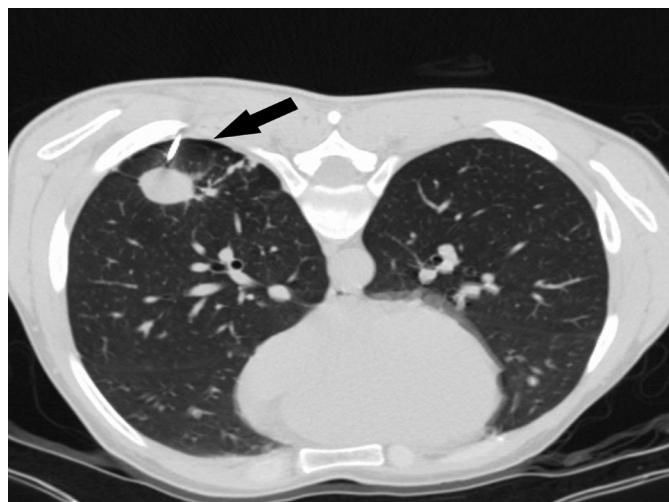


Figure 3. Axial CT scan, Pneumothorax occurring during the procedure is observed. (black arrow)

DISCUSSION

CT-guided PCTTB is currently the most commonly used method for the pathologic diagnosis of pulmonary lesions because of its high diagnostic yield and acceptable complications.¹

A CT-guided lung biopsy can be performed as a fine needle aspiration or Tru-cut. An aspiration biopsy provides a cytologic diagnosis, while a Tru-cut biopsy provides a tissue diagnosis. The sensitivity in malignant lesions is around 95% in both, whereas in benign lesions, the sensitivity is reported to be 80% with a Tru-cut and 20-50% with an aspiration biopsy. In our study, the pathologic evaluation of three patients was reported as “insufficient material”. The diagnostic sensitivity of our study was 97.4%.

The most common complication of transthoracic percutaneous needle biopsy is pneumothorax, with a frequency of 0-61%, and chest tube drainage is required in 1.6% to 17% of pneumothorax cases. Tomiyama¹¹ published the results of a CT-guided needle biopsy of pulmonary lesions in 9,783 patients. Pneumothorax was the most common complication and occurred in 35% of the 6,881 cases. In the Şahan et al. study, pneumothorax was the most common complication, with 23.8% (20/84).¹² Two of these 20 patients required chest tube drainage. In our study, the rate of pneumothorax was 20.5% (n:24) and the need for a chest tube was 7.3% in these patients, which is consistent with the literature.

Advancing the needle in the parenchyma during breath holding, not crossing the fissure bulla with the needle, and traveling as little as possible in the lung parenchyma are the methods that can be applied to prevent the development of pneumothorax.¹³ Recent studies have also reported that post-procedural administration of autologous blood clots through the coaxial needle may also be beneficial.¹⁴

Pneumothorax develops immediately after the biopsy procedure or within the first hour.¹³ Therefore, it is recommended that the patient should be under observation and evaluated for asymptomatic pneumothorax with an

outpatient PA chest radiograph.¹³ In our study, PA chest radiographs were obtained from the patients who underwent biopsy in the second hour after the procedure.

Pulmonary hemorrhage is the second most common complication, and its frequency has been reported to vary between 5-27% in studies.^{3,15} Tuncel et al.¹⁶ found this rate to be 28%. Hemoptysis is another complication and is usually self-limiting.³ In our study, hemorrhage was observed in 12 patients (10.3%) and hemoptysis in 14 patients (12%).

Other rare complications with high morbidity and mortality include systemic air embolism, pericardial tamponade, and hemothorax, which require a multidisciplinary approach. The mortality rate has been reported to be less than 1% in studies.¹ In our patient group, mortality or the aforementioned major complications were not observed.

Our study has some limitations, and these are retrospective in nature. Other limitations include not specifying the lesion size, localization, and depth distance.

CONCLUSION

CT-guided PCTTB lung biopsies have a high diagnostic rate and acceptable complications. Percutaneous coaxial trans-thoracic biopsy should be the first choice in all appropriate cases.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of Kırıkkale University Faculty of Medicine Clinical Researches Ethics Committee (Date: 03.09.2019, Decision No: 19/07).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

REFERENCES

1. Manhire A, Charig M, Clelland C, et al. Guidelines for radiologically guided lung biopsy. *Thorax*. 2003;58(11):920-936.
2. Herth FJF, Eberhardt R, and Ernst A. The future of bronchoscopy in diagnosing, staging and treatment of lung cancer. *Respiration*. 2006;73(4):399-409.

3. Düzgün F, Tarhan S. Perkütan transtorasik akciğer ve kemik biyopsileri. *Trd Sem.* 2015;(3):182-191.
4. Cheng YC, Tsai SH, Cheng Y, et al. Percutaneous transthoracic lung biopsy: comparison between C-arm cone-beam CT and conventional CT guidance. *Transl Oncol.* 2015;8(4):258-264.
5. Hiraki T, Mimura H, Gobara H, et al. CT fluoroscopy-guided biopsy of 1,000 pulmonary lesions performed with 20-gauge coaxial cutting needles: diagnostic yield and risk factors for diagnostic failure. *Chest.* 2009;136:1612-1617.
6. Brenner DJ, Hall EJ. Computed tomography—an increasing source of radiation exposure. *N Engl J Med.* 2007;357(22):2277-2284.
7. Sivri, M. Bilgisayarlı tomografi eşliğinde transtorasik akciğer biyopsisi yapılan hastaların sonuçlarının değerlendirilmesi ve komplikasyonlara eşlik eden risk faktörlerinin belirlenmesi. 2016
8. Cohen BR, Leitner O, Ronah R, Guber A, Griffel B, Geiger B: immunocytochemical characterization of lung tumors in fine-needle aspiration. *Cancer.* 1990;66(8):1817-1827.
9. Berquist TH, Bailey PB, Cortese DA, et al. Transthoracic needle biopsy: accuracy and complication in relation to location and type of lesion. *Mayo Clin Proc.* 1980;55(8):475-481.
10. Sinner WN. Complications of percutaneous transthoracic needle aspiration biopsy. *Acta Radiol Diag.* 1976;17(6):813-828.
11. Tomiyama N, Yasuhara Y, Nakajima Y, et al. CT-guided needle biopsy of lung lesions: a survey of severe complication based on 9783 biopsies in Japan. *Eur J Radiol.* 2006;59(1):60-64.
12. Şahan MH, Inal M, Muluk NB, Doğan A, Atasoy P. The diagnostic value of CT-guided percutaneous Co-axial trans-thoracic biopsy (PCTTB) and evaluation of the pathologic examination. *Current Med. Imaging.* 2019;15(5):479-488.
13. Boskovic T, Stanic J, Pena-Karan S, et al. Pneumothorax after transthoracic needle biopsy of lung lesions under CT guidance. *J Thorac Dis.* 2014;6(1):99-107.
14. Lang E K, Ghavami R, Schreiner V C, Archibald S, Ramirez J. Autologous blood clot sealto prevent pneumothorax at CT-guided lung biopsy. *Radiology.* 2000;216(1):93-96.
15. Takeshita J, Masago K, Kato R, et al. CT-guided fine-needle aspiration and core needle biopsies of pulmonary lesions: a single center experience with 750 biopsies in Japan. 2015;204(1):29-34.
16. Tuncel P, Ergun O, Çetin N, Türkmenoğlu TT, Durmaz HA, Hekimoğlu B. CT-guided percutaneous transthoracic lung biopsy: one center experience. *Ortadoğu Tıp Dergisi.* 2018;10(1):57-63.