Journal of Experimental and Clinical Medicine
https://dergipark.org.tr/omujecm

Research Article

J Exp Clin Med
2025; 42(1): 53-57
doi: 10.52142/omujecm.42.1.11

Histopathological and radiological correlation of lung mass lesions with transthoracic biopsy and endobronchial biopsy

Saim TÜRKOĞLU [1,*], **Tuba OĞUZSOY** [2]

[1]Department of Radiology, Faculty of Medicine, Yuzuncu Yıl University, Van, Türkiye
[2]Department of Pathology, Prof Dr Cemil Taşçıoğlu City Hospital, İstanbul, Türkiye

Received: 25.07.2024 • **Accepted/Published Online:** 17.03.2025 • **Final Version:** 28.03.2025

Abstract

The aim of this study is to correlate radiological CT imaging approaches to the lesion and pathology results in lung lesions. In this study, lung biopsy pathology results of 54 cases sent to the pathology department between 2020-2023 were compared with existing radiological CT images. The cases were grouped pathologically as benign and malignant, and the malignant cases were classified according to their tumor types. Radiologically, the cases were divided into groups as benign or malignant, peripheral or centrally located. In this study, core biopsies of a total of 54 cases, 15 female (27.7%) and 39 (72.3%) male, were evaluated. The average age of the patients was found to be 61.1 (21-95). Of a total of 54 lung solid mass lesions, 38 (70.4%) were peripheral and 16 (29.6%) were centrally located. In the radiological double-blind evaluation, 29 (53.7%) of the cases were diagnosed as malignant, while 24 (44.4%) were pathologically diagnosed as malignant. While squamous cell carcinoma (SCC), the most common pathologically malignant tumor, was seen in 9 cases, the second most common small cell carcinoma (SCLC) was detected in 7 cases. In conclusion, pathology and radiological imaging in lung lesions are important in early diagnosis, effective treatment and prolonged survival, and correctly performed radiological imaging and histopathological correlation with biopsy with today's interventional techniques in early suspicious cases have an important place in reducing morbidity and mortality.

Keywords: Lung cancer, transthoracic biopsy, histopathology, malignant, benign

1. Introduction

Lung cancers have a significant impact on the public health system as they are the most common disease with 2.1 million cases worldwide and are the leading cause of cancer deaths. According to epidemiological studies, it is twice as common in men as in women, and the rate is gradually increasing in middle-aged men (1, 2).

Solitary lesions detected in the lung are very common and early diagnosis and treatment of these lesions are very important because of the possibility of mortality. Therefore, the diagnosis should be made with a careful and accurate pathological and radiological approach.

The first method used in lung parenchyma imaging is direct chest radiography. Although its cost, radiation dose, availability and ease of performance are quite successful compared to its diagnostic approach; It has been observed that it can miss 10-15% of symptomatic infiltrative diseases, 30% of bronchiectasis and 60% of emphysematous diseases. For this reason, multi-slice Computed Tomography (CT) methods are needed (3, 4). The most reliable imaging method for lung parenchymal lesions is contrast-enhanced CT, and in these imaging, the next step is taken in the preliminary diagnosis according to the morphological or density difference according to the contour edge features of the lesion.

The decision for lung biopsy based on CT findings is discussed by the radiologists and clinicians with a joint decision on the necessity of biopsy. CT imaging plays an important role in evaluating the characteristics of the lesion and determining the best approach for biopsy. Some of the criteria for lung biopsy based on CT findings are as follows (5):

1. Location of the Lesion:

Peripheral Lesions: Transthoracic biopsy is usually the first choice for lesions located close to the outer edge of the lung. These lesions can be more easily accessed with a needle inserted through the chest wall.

Central Lesions: Lesions close to the central airways or the hilum are usually attempted to be histopathologically established using endobronchial biopsy or bronchoscopy

*Correspondence: mdsaimturkoglu@gmail.com

because these masses are closer to the airways.

Subpleural Lesions: Lesions close to the pleura or chest wall are usually easier to sample percutaneously with transthoracic biopsy. Inaccessible or deep lesions: Deep lesions located in difficult-to-reach areas and close to vascular structures are preferred for endobronchial ultrasound (EBUS) guided biopsy.

2. Lesion Size: Lesions 1 cm and larger are generally easier to target and sample during biopsy, but smaller lesions are more difficult to obtain adequate biopsy samples and require greater precision and experience in imaging-guided procedures.

3. Shape and Border Features: For example, spiculated borders are a sign of malignancy, especially lung cancer. However, more regular-circumscribed lesions are more likely to be benign. However, they do not exclude malignancy, especially if they are rapidly growing.

4. Density and Contrast Enhancement: Heterogeneous Density may indicate malignancy. If there is an air-filled space in a cavitary lesion, it may indicate certain types of malignancy, such as infection, tuberculosis, or squamous cell carcinoma. Biopsy allows differentiation between benign and malignant lesions. Contrast Enhancement can also be a sign of malignancy, as cancerous tissues usually show increased blood supply and therefore increased contrast.

5. Lymphadenopathy: Enlarged lymph nodes seen with a lung mass on CT increase the suspicion of metastasis or primary lung cancer.

6. Growth Over Time or Rapid Growth is suspicious for malignancy, especially small cell lung cancer or metastasis.

Stable or Slow Growth, on the other hand, tends to be benign lesions, but malignant lesions can present with rapid changes.

7. Location Relative to Other Structures: If the lesion is near large blood vessels such as the aorta or pulmonary artery, the risk of bleeding during biopsy may be increased. In such cases, advanced imaging techniques or other approaches may be preferred. Lesions that appear to invade adjacent structures are highly suspicious for malignancy.

8. Calcification Pattern: A lesion with central or popcorn-like peripheral calcification is usually benign.

9. Presence of Associated Features such as Atelectasis or Pneumonitis may indicate malignancy or an infectious process. Presence of Pleural Effusion The presence of pleural effusion, especially if exudative, may be associated with malignancy. Considering all these findings, biopsy and histopathological diagnosis should be performed on suspicious lesions (6).

Transthoracicor bronchial biopsy is recommended for benign and/or malignant cases in CT scans detected incidentally in the lung or in the presence of symptoms.

The pathology results are guiding in terms of the preoperative medical treatments of the case, the type of operation, molecular studies and targeted treatments.

In addition to diagnostic H&E stains in transthoracic or bronchoscopic biopsies sent from lung lesions, immunohistochemical stains are often used and molecular and next-generation sequencing are used to determine further targeted treatments.

Although pathological examination is the gold standard in the diagnosis of lung cancer, the importance of early diagnosis reveals the importance of accurate and reliable radiology.

2. Materials and Methods

Cases whose CT findings were suggestive of malignancy or were considered benign but malignancy could not be excluded, and whose medical treatment was considered by the clinician to be planned and whose biopsy was indicated were included in the study.

In this study, 59 cases with a pathological diagnosis were retrospectively evaluated between June 2020 and 2023, at Van Training and Research Hospital. 5 cases were not included in the study because they were reported as inadequate in pathology. Retrospective CT scans of patients with sufficient pathology specimens and a pathological diagnosis were examined, and a total of 54 cases were evaluated and included in the study.

Statistical data of the study; Variables are presented as mean ± standard deviation. SPSS Windows version 21.0 package program (SPSS Inc., Chicago, IL, USA) was used for statistical analysis.

2.1. Radiological evaluation:

The study was conducted retrospectively by examining the cases in which the radiological examination images of the patients were positive from the Picture Archiving and Communication Systems (PACS), which is radiological data archiving system. Images of the patients were obtained using 16-slice Computed Tomography (Siemens, medical solution); CT images obtained with a slice thickness of 3 mm, a dose of 120 kV, and without contrast during the biopsy were evaluated. For the study, axial image data taken from the PACS (karpacs wiever v.1.0) system was examined.

In this study, after radiologists and clinicians made a decision for biopsy together, CT images of the cases were evaluated by a second radiologist for biopsy decision. In case of discrepancy between the radiologists, a third radiologist was consulted. Lung lesions were defined as benign or malignant according to their location, central or peripheral, and morphological features, and the probability of benign or malignant was evaluated. Lung biopsy procedures:

Under CT guidance, an opaque marker was placed on the skin level and the entry point was determined at the lesion level. Then, following local anesthesia (Prilocaine2%)

injection under the skin.

Using the coaxial system, the lesion level was reached with the coaxial needle and sheath, then the needle part of the coaxial needle was removed and the tru-cut biopsy needle was advanced to the lesion over the needle sheath, and a tissue piece was removed in at least 2 pieces with a thick needle. It was taken and sent to pathology in formalin. To reduce the possibility of pneumothorax, if air was seen in the pleural space, it was tried to be minimized by negative aspiration with a 10cc syringe. The last control image was taken and complications such as pneumothorax, hemothorax or parenchymal hemorrhage were tried to be seen and the treatment plan was made accordingly.

2.2. Pathological evaluation:

Transthoracic and bronchoscopic biopsies sent to the pathology. H&E slides prepared from sections obtained from 10% buffered formalin-fixed, paraffin-embedded tissues, and immunohistochemical studies were taken from the archive and re-evaluated. The cases were divided two categories: benign lesions and malignant lesions. Non-diagnostic biopsies were not included in the study. Malignant lesions were grouped as small cell lung carcinoma (SCLC), adenocarcinoma, squamous cell carcinoma (SCC), mucoepidermoid carcinoma, large cell neuroendocrine carcinoma, lymphoma and metastases. The results of the pathology specimens were compared with Computed Tomography images.

3. Results:

There were 54 patients diagnosed with core biopsy. The gender rate of these cases was %27.8 female (15 cases) and %72.2 male (39 cases) The average age of the patients was 61.1 years, and the age range was 21–95 years. Localization of the lung lesions were 70.4% peripheral (38 cases) and 29.6% (16 cases) were centrally located. Transthoracic biopsy was performed in 36 patients and EBUS was performed in 18 patients. In the double-blind radiological evaluation, 46.3% (25) of the cases were interpreted as benign and 53.7% (29) as malignant. Pathologically, 30 (55.6%) cases were diagnosed as benign and 24 (44.4%) as malignant. Pathologically malignant cases are as follows; 9 patients were reported as SCC, 7 patients as SCLC, 3 patients as adenocarcinoma, 3 patients as renal cell carcinoma metastasis, 1 patient as lymphoma and 1 patient as large cell neuroendocrine carcinoma.

Of the pathologically confirmed malignant cases, 20 (83.3%) were men and 4 (16.7%) were women. The average age among malignant cases was 60.3 years; the average age was 56.7 years for women and 61.0 years for men. In the radiological and pathological comparison, the correct diagnosis was made radiologically with a sensitivity of 66.67% (95% confidence interval) and a specificity of 60%.

4. Discussion

Since lung cancers are among the most common causes of cancer-related death, the distinction between malignant and benign is of critical importance. Studies show that although survival rates for lung cancer are increasing, as in all cancers, survival rates are among the cancers with the lowest rates due to late diagnosis.

CT has an important place in the diagnosis of lung lesions, especially small lung nodules and lung cancers. Treatments for lung lesions require a multidisciplinary approach, radiologically, pathologically and clinically. For this reason, the earliest pathological diagnosis of patients and early treatment of these cases are very important. Targeted therapies, which have become increasingly important in lung cancer in particular, increase the need for molecular studies and the importance of pathological correlation.

High-resolution computed tomography has increased success rates in detecting small lung lesions and indistinct ground-glass opacity lesions (7).

Solid can be benign or malignant. Solitary pulmonary nodules are defined as nodules smaller than 3 cm surrounded by lung parenchyma. While 10-70% of radiologically described solitary pulmonary nodules are lung cancers, 80% of the remaining are granulomas from benign lesions. If the lesion density is <20 HU, it usually suggests cystic lesions such as simple parenchymal cysts, abscess or hydatid cysts. Lesions >20 HU are considered as solid density lesions and re-evaluated. Morphological features of the lesion; It is evaluated according to the contours of the lesion, whether it contains calcification, the central-peripheral location of the calcification, and whether it is solid or semi-solid. Histopathological verification should be performed for every patient considered malignant. For this purpose, the appropriate biopsy method, accompanied by radiological findings, should be preferred with a low complication rate and a high probability of diagnosis.

While transthoracic lung biopsies (Fig. 1) are an important procedure for peripherally located lesions, fiberoptic bronchoscopes and endobronchial ultrasonographies are more often important for histopathological sampling in centrally located lesions, as they are technically easier and have fewer complications.

CT-guided transthoracic biopsies (TTBx) have a sensitivity of 90% in diagnosis. Although invasive methods have very successful results in diagnosis. TTBx has complications, especially in peripherally located lesions. Pneumothorax is the most common complication and may occur at rates of 17% and 42%, and pulmonary bleeding may occur secondary to invasive procedures at a rate of 27% (7). In our study, there was only one patient who underwent tube thoracostomy with significant and clinical implications. Alveolar hemorrhage was detected as a procedure complication in 6 patients, which was not clinically significant but was reflected in imaging findings.

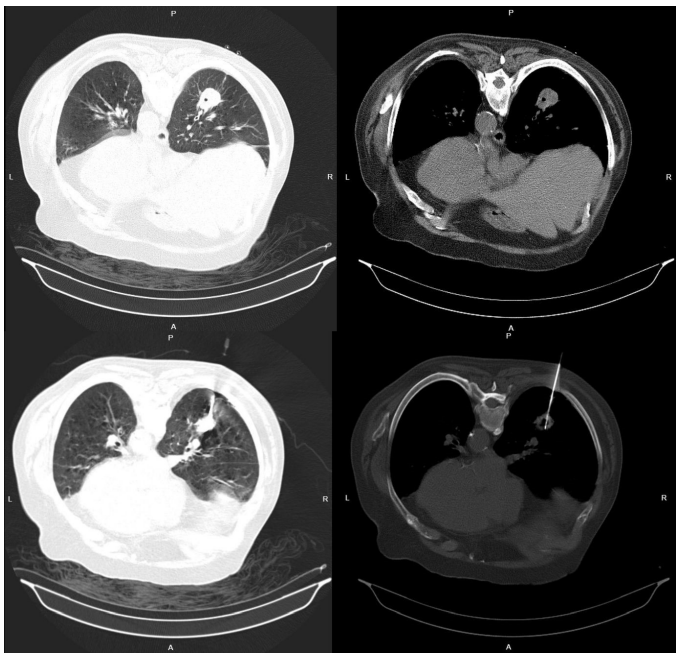

Fig. 1. An 80-year-old male patient with a central necrotic thick-walled lesion in the lower lobe of the right lung received the pathological diagnosis of malignant neoplasia as a result of transthoracic biopsy performed in the prone position. During and after the procedure, a mild pneumothorax, which is not clinically significant, is observed in the posterior due to minimal pleural separation.

Although lung cancer has recently increased in the female population due to the increase in smoking among women, it is seen on average 2 times more frequently in men than in women (1-9). In our study, 20 of 24 malignant cases were detected in male patients, in line with the literature. The average age of occurrence of lung cancer is over 60 years of age in men and women worldwide, and the average age of occurrence is 70, but non-small cell carcinomas, especially adenocarcinomas, can also be seen under the age of 55. In our study, the average age of malignant cases was evaluated as 60.3 years, and since these cases also included metastatic lesions, it was thought that they were proportionally different from the literature. The fact that the average age of women (56.75) is lower than that of men supports existing studies (9)

Pathologically, lung cancers are divided into two main categories: small cell lung cancers and non-small cell lung cancers. Non-small cell cancers are as follows; adenocarcinoma, squamous cell carcinoma, neuroendocrine carcinomas (large cell neuroendocrine carcinomas) and carcinoids (9). Although the most common cancers change over time, the most common non-small cell carcinomas in recent data are adenocarcinomas, accounting for more than 40% of all cancers. The rate of SCCs has decreased in recent years with changes in smoking habits (10-11) (Fig. 2).

We thought that the difference observed in our study proportionally with the literature would be due to the small number of cases and factors such as smoking and air pollution.

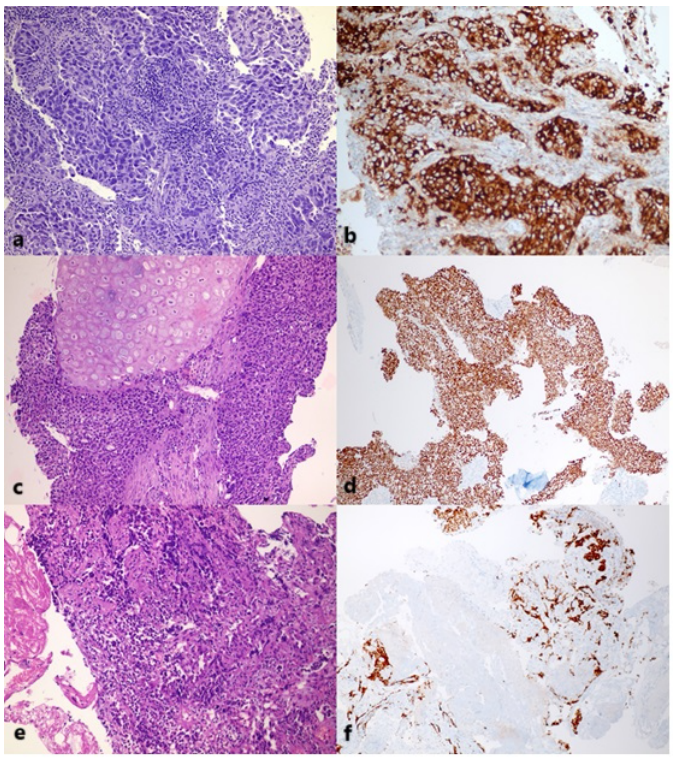

Fig. 2. a: Solid poorly differentiated adenocarcinoma with large hyperchromatic nuclei and pleomorphic gland formations. 200 X H&E; **b:** Adenocarcinoma, strong cytoplasmic immunoexpression in tumor area. 200 X Napsin A; **c:** Squamous cell carcinoma, cartilage tissue invasion. 200X H&E; **d:** Squamous cell carcinoma, strong nuclear immune expression 100 X P63; **e:** Small cell lung carcinoma with widespread crush artifacts, small hyperchromatic nuclei, and no cytoplasm visible. 200 X H&E; **f:** Strong nuclear immunoexpression in area of small cell lung carcinoma. 100X TTF-1

Lung cancers are classified as central or peripheral, depending on their radiological location. While SCLC and SCC are often centrally located, adenocarcinomas are more peripherally located. Of our 3 adenocarcinoma cases, 2 were found to be peripherally located, 2 of the SCCs were centrally located, 7 were peripherally located, and 5 of the SCLCs were centrally located and 1 was peripherally located. Although adenocarcinomas and SCLCs were proportionally compatible with the studies in our cases, the incompatibility observed in SCCs was associated with the numerical limitation of our case series (8, 11, 12).

Pathology and radiological imaging of lung lesions are important for early diagnosis, effective treatment and prolonged survival. Since lung cancers are in the first place in cancer deaths, the distinction between malignant lesions and benign lesions is of critical importance. Careful and accurate radiological imaging is the first step in approaching the patient. Although the radiological and pathological correlation in our study was lower than previous studies, this rate is higher in large case series.

Ethical Statement

Approval was obtained from Van Training and Research Hospital Ethics Committee of Science Health University on

June 7th, 2023, with and reference number 2023/12-07.

Conflict of interest

Authors declare that there is no conflict of interest for this article.

Funding

No financial support was received from any institution or organization for this study.

Acknowledgments

None to declare.

Authors' contributions

Concept: S.T., Design: T.O., Data Collection or Processing: S.T., Analysis or Interpretation: S.T., Literature Search: T.O., S.T., Writing: S.T., T.O.

References

1. Stabellini N, Bruno DS, Dmukauskas M, Barda AJ, Cao L, Shanahan J, et al. Sex Differences in Lung Cancer Treatment and Outcomes at a Large Hybrid Academic-Community Practice. JTO Clin Res Rep. 2022 Mar 9;3(4):100307. doi: 10.1016/j.jtocrr.2022.100307.

2. Cruz. "Lung Cancer 2020: Epidemiology, Etiology, and Prevention." Clinics in chest medicine 41 1 (2020): 1-24 . DOI: 10.1016/j.ccm.2019.10.001

3. Worthy S. High resolution computed tomography of the lungs. BMJ. 1995 Mar 11;310(6980):615-6. doi: 10.1136/bmj.310.6980.616.

4. Mathieson JR, Mayo JR, Staples CA, Müller NL. Chronic diffuse infiltrative lung disease: comparison of diagnostic accuracy of CT and chest radiography. Radiology. 1989 Apr;171(1):111-116. DOI: 10.1148/radiology.171.1.2928513.

5. Jaffé, J. L., et al. (2017). CT Imaging of Lung Neoplasms. Seminars in Roentgenology, 52(1), 19-28.

6. Miller, R. H., & Turcios, N. L. (2017). Lung Cancer and its Radiological Evaluation. Clinical Chest Medicine, 38(2), 215–230.

7. Hu B, Ren W, Feng Z, Li M, Li X, Han R, et al. Correlation between CT imaging characteristics and pathological diagnosis for subcentimeter pulmonary nodules. Thorac Cancer. 2022 Apr;13(7):1067-1075. doi: 10.1111/1759-7714.14363.

8. Şahin C, Yılmaz O, Üçpınar BA, Uçak R, Temel U, Başak M, et al. Computed Tomography-guided Transthoracic Core Needle Biopsy of Lung Masses: Technique, Complications and Diagnostic Yield Rate. Sisli Etfal Hastan Tip Bul. 2020 Mar 25;54(1):47-51. doi: 10.14744/SEMB.2019.46338.

9. Thandra KC, Barsouk A, Saginala K, Aluru JS, Barsouk A. Epidemiology of lung cancer. Contemp Oncol (Pozn). 2021;25(1):45-52. doi: 10.5114/wo.2021.103829.

10. Wang S, Dong L, Wang X, Wang X. Classification of Pathological Types of Lung Cancer from CT Images by Deep Residual Neural Networks with Transfer Learning Strategy. Open Med (Wars). 2020 Mar 8;15:190-197. doi: 10.1515/med-2020-0028.

11. Zheng, Min-Wen. "Classification and Pathology of Lung Cancer." Surgical oncology clinics of North America 25 3 (2016): 447-68 .

12. Cohen JG, Reymond E, Jankowski A, Brambilla E, Arbib F, Lantuejoul S, Ferretti GR. Lung adenocarcinomas: correlation of computed tomography and pathology findings. Diagn Interv Imaging. 2016 Oct;97(10):955-963. doi: 10.1016/j.diii.2016.06.021.