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18F-FDG PET/CT FINDINGS IN SYNCHRONOUS DOUBLE PRIMARY LUNG ADENOCARCINOMAS: A CASE REPORT

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ABSTRACT

Synchronous double primary lung cancers are uncommon in clinical practice and are frequently misdiagnosed as pulmonary metastases. Because treatment strategies and prognosis differ significantly between these two conditions, distinguishing synchronous primary lung cancers from intrapulmonary metastatic disease is of great clinical importance. Whole-body PET/CT (Positron Emission Tomography/Computed Tomography) using the radiotracer 18F-FDG provides superior capability in assessing the metabolic characteristics of pulmonary lesions, thereby aiding in the evaluation of their malignant potential. We present a case of synchronous double primary lung cancers diagnosed based on whole-body PET/CT findings, along with a review of similar cases previously reported in the literature.

Keywords: Lung cancer; PET/CT; Multiple primary lung cancer; Synchronous MPLC; 18F-FDG; Pulmonary adenocarcinoma.

1. INTRODUCTION

Lung cancer is the third most common cancer in Vietnam, with approximately 24,426 newly diagnosed cases and the second highest cancer-related mortality rate according to GLOBOCAN 2022 [1]. It is also the second most frequently diagnosed malignancy in both men and women. Multiple primary lung cancer (MPLC) is defined as the occurrence of two or more primary lung tumors in a single patient, in which each lesion represents an independent primary malignancy rather than intrapulmonary metastasis from another pulmonary tumor. The concept of MPLC was first introduced by Martini N and colleagues in 1975 [2]. MPLC is classified into synchronous and metachronous subtypes. Synchronous MPLC refers to tumors identified simultaneously or within 6 months according to the classical criteria, whereas metachronous MPLC is defined when the second tumor is detected more than 6 months after the diagnosis of the initial lesion [3]. This interval was subsequently extended to at least 4 years in later classification systems [4].

In recent years, positron emission tomography (PET) and integrated positron emission tomography/computed tomography (PET/CT) using 18F-fluorodeoxyglucose (18F-FDG) have demonstrated substantial value in evaluating the metabolic characteristics of pulmonary lesions. PET/CT has a sensitivity exceeding 95% and a specificity greater than 75% for differentiating benign from malignant pulmonary lesions, as well as for the assessment of solitary pulmonary nodules [5–7]. PET/CT plays an important role in characterizing metabolic activity, determining the independent nature of multiple lesions, guiding biopsy site selection, and facilitating individualized treatment planning in patients suspected of having multiple primary lung cancers. Herein, we present a case of synchronous double primary lung cancers detected on whole-body 18F-FDG PET/CT, highlighting the important role of this imaging modality in diagnosis and therapeutic decision-making.

2. CASE PRESENTATION

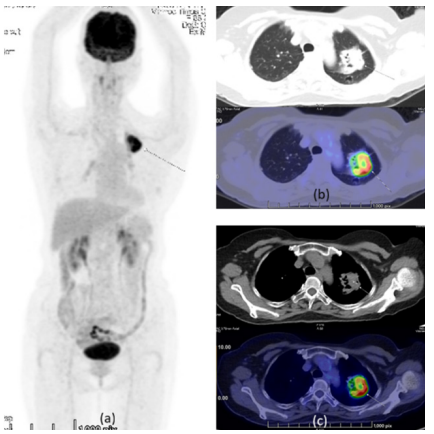
A 64-year-old woman with good performance status presented without respiratory symptoms, including persistent cough, dyspnea, chest pain, or hemoptysis. She had no smoking history, no history of chronic pulmonary disease, and no prior diagnosis of malignancy. Family history was unremarkable for lung cancer or other related malignancies. A left pulmonary lesion was incidentally detected on chest computed tomography, and the patient subsequently underwent whole-body 18F-FDG PET/CT for further evaluation and disease staging.

The patient fasted overnight prior to imaging, and the blood glucose level was 6.5 mmol/L at the time of examination. Sixty minutes after intravenous administration of 6.0 mCi of 18F-FDG, low-dose non-contrast CT was performed using helical acquisition with a slice thickness of 5.0 mm and image reconstruction at 3.75 mm (120 kV, Noise Index 7.0, Auto Smart mA mode). PET acquisition from the skull vertex to the mid-thigh was subsequently performed on a Discovery MI DR PET/CT system (GE Healthcare) using static acquisition mode with a 256 × 256 matrix. PET images were attenuation-corrected using CT data. Standardized uptake values (SUVs) were calculated as the maximum SUV (SUVmax) within the region of interest and expressed in g/mL.

PET/CT imaging demonstrated a solid hypermetabolic mass in the left upper lobe with markedly increased FDG uptake (SUVmax 13). The lesion showed no evidence of pleural invasion but was associated with adjacent atelectatic

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change, fibrosis, calcification, and pleural retraction.

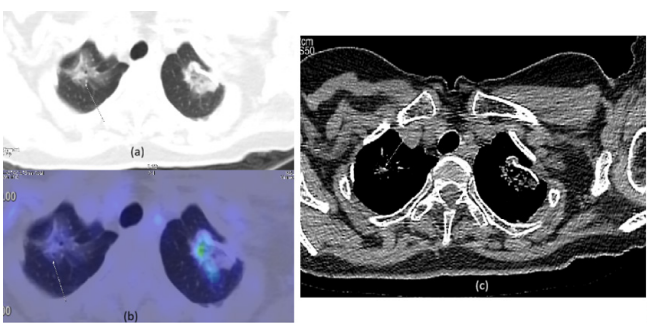


(a) Three-dimensional whole-body PET image demonstrating a hypermetabolic lesion in the left upper lobe. (b) Lung-window CT and fused PET/CT images showing a left upper lobe mass (arrow) measuring 35 × 28 mm, without pleural invasion and with markedly increased FDG uptake. (c) Mediastinal-window CT and fused PET/CT images demonstrating a heterogeneous-density mass in the left upper lobe (arrow).

Figure 1. CT, PET, and fused PET/CT images.

In addition to the lesion described above, a ground-glass opacity was identified in the right apical lung, demonstrating mild FDG uptake with an SUVmax of 2.9. Internal calcification and bronchiectatic changes were also noted within the lesion. No enlarged or hypermetabolic mediastinal or hilar lymph nodes were identified, and no abnormal focal FDG uptake suggestive of distant metastasis was detected on whole-body PET/CT imaging.

Based on the morphological and metabolic characteristics observed on PET/CT, the hypermetabolic solid lesion in the left upper lobe was considered highly suggestive of a primary malignant pulmonary tumor, as previously suspected, and was clinically staged as cT2N0M0. The right apical lesion was initially considered more likely to represent post-inflammatory fibrotic change. However, histopathological confirmation by biopsy was recommended to exclude the possibility of a second primary lung malignancy. Subsequently, tuberculosis workup, including bronchoscopic evaluation, yielded negative results. The patient then underwent biopsy of the right pulmonary lesion for histopathological examination.



(a) Lung-window CT image demonstrating a ground-glass lesion in the right apical lung (arrow). (b) Fused PET/CT image showing mild FDG uptake within the lesion. (c) Adjusted-window CT image demonstrating small internal calcifications within the lesion.

Figure 2. CT and PET/CT images.

Histopathological examination of the right pulmonary lesion revealed adenocarcinoma with lepidic and acinar patterns. Immunohistochemical analysis showed negative ALK (D5F3) expression and negative PD-L1 (SP263) expression with a tumor proportion score (TPS) <1%.

The left pulmonary lesion was diagnosed as lung adenocarcinoma, solid pattern. Immunohistochemical staining demonstrated strong and diffuse nuclear positivity for TTF-1, strong and diffuse cytoplasmic positivity for Napsin A, and strong diffuse membranous and cytoplasmic positivity for CK7. P40 staining was negative. PD-L1 expression was positive with a TPS of 50%.

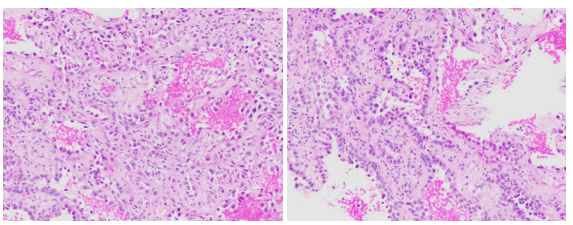


Figure 3. Hematoxylin and eosin (H&E)-stained histopathological image of the right apical pulmonary lesion.

Although both the left and right pulmonary lesions were diagnosed as adenocarcinoma, the two tumors demonstrated distinct histopathological and immunohistochemical characteristics. The left upper lobe tumor showed a solid growth pattern with strong PD-L1 expression (TPS 50%), whereas the right apical lesion demonstrated acinar and lepidic patterns with minimal PD-L1 expression (TPS <1%). These findings supported the hypothesis of two independent primary lung tumors rather than intrapulmonary metastasis.

Accordingly, the two lesions differed in histological subtype and showed no evidence of metastatic spread between tumors, fulfilling the diagnostic criteria for synchronous multiple primary lung cancers according to the Martini and Melamed criteria and the 8th edition IASLC recommendations. The patient subsequently underwent surgical treatment and radiotherapy in Japan.

Table 1. Clinical timeline of the patient

Time point	Clinical course
Routine health examination	A lesion in the left upper lobe was incidentally detected on chest CT
After initial detection	Whole-body 18F-FDG PET/CT was performed for further evaluation and disease staging
PET/CT examination	PET/CT demonstrated a markedly hypermetabolic mass in the left upper lobe and a mildly hypermetabolic ground-glass lesion in the right apical lung
After PET/CT	Bronchoscopy and tuberculosis workup were performed, with negative results
Biopsy of the right pulmonary lesion	Histopathological examination revealed adenocarcinoma with lepidic and acinar patterns
Histopathological evaluation of the left pulmonary lesion	Histopathological examination revealed adenocarcinoma, solid pattern, with PD-L1 TPS of 50%
Final diagnosis	Synchronous multiple primary lung cancers (synchronous MPLC)
Treatment	The patient subsequently underwent surgical treatment and radiotherapy in Japan

3. DISCUSSION

The concept of multiple primary lung cancer (MPLC) was first introduced by Martini N and colleagues in 1975 [2]. The Martini and Melamed criteria remain the classical diagnostic standard; however, the classification criteria have subsequently been revised, expanded, and systematized over time. From the original Martini and Melamed criteria proposed in 1975 to the WHO classification updated in 2021, the diagnostic approach has evolved from reliance solely on histopathological findings to the integration of detailed histological assessment, molecular profiling, and imaging characteristics in order to more accurately differentiate separate primary lung tumors from intrapulmonary metastase [8].

Table 2. Evolution of diagnostic criteria for differentiating multiple primary lung cancer (MPLC) from intrapulmonary metastasis (IPM)

Year	Author / Organization	Key Features	Major Contributions
1975	Martini N & Melamed	First diagnostic criteria based on histopathology and tumor location.	Established the foundation for differentiating separate primary lung cancer (SPLC) from intrapulmonary metastasis (IPM).
1995	Antakli et al. (modified criteria)	Incorporated molecular features and immunohistochemical markers.	Provided a more updated classification reflecting tumor biological characteristics.
2003/ 2013	American College of Chest Physicians (ACCP)	Systematized clinical diagnostic criteria and added temporal criteria.	Distinguished synchronous from metachronous tumors.
2016	International Association for the Study of Lung Cancer (IASLC)	Introduced comprehensive histologic assessment (CHA) and genomic analysis.	Established modern criteria that are currently the most widely adopted.
2021	World Health Organization (5th Edition)	Standardized the integration of histopathological, molecular, and imaging findings.	Represents the most recent internationally recommended diagnostic standard.

The present case demonstrated synchronous multiple primary lung cancers identified based on distinct histopathological characteristics between the two tumors and the absence of metastatic disease on PET/CT imaging. Differentiating MPLC from intrapulmonary metastasis is of major clinical importance because it directly influences prognosis and the selection of potentially curative treatment strategies. By simultaneously providing metabolic information through FDG uptake and detailed anatomical characterization, PET/CT facilitates the distinction between lesions with different metabolic activities while also excluding mediastinal nodal involvement and distant metastases. Previous studies have shown that PET/CT altered treatment strategies in approximately 20–30% of patients with lung cancer owing to more accurate disease staging [9]. In addition to its diagnostic value, PET/CT also plays an important role in prognostic assessment and follow-up evaluation. Quantitative parameters such as SUVmax, metabolic tumor volume (MTV), and total lesion glycolysis (TLG) have been shown to correlate closely with recurrence risk and overall survival, particularly in patients presenting with multiple pulmonary lesions.

In the present case, although both lesions were adenocarcinomas, the degree of PD-L1 expression and FDG uptake differed markedly between the two tumors. Several previous studies have demonstrated a positive association between high PD-L1 expression and elevated SUVmax values [10]. The mild FDG uptake observed in the right-sided ground-glass lesion on PET imaging prompted a more aggressive diagnostic approach with tissue biopsy rather than simple radiological follow-up or consideration as metastatic disease. This finding directly influenced subsequent therapeutic decision-making and further highlighted the important role of PET/CT in clinical management.

4. CONCLUSION

Multiple primary lung cancer (MPLC) refers to the occurrence of two or more primary lung malignancies with distinct origins arising simultaneously or at different time points in different regions of the lungs. This case highlights the important role of PET/CT in suggesting the independent nature of synchronous pulmonary lesions, particularly when combined with histopathological and molecular immunohistochemical findings.

Patient consent for publication

The patient received a full explanation regarding the purpose of this case report and provided written informed consent for the publication of the associated clinical information and imaging findings. All personal information was anonymized and kept confidential throughout the publication process.

Conflict of interest

The authors declare no conflicts of interest related to this study.

REFERENCES

[1] Bray F, Laversanne M, Sung H, Ferlay J, Siegel RL, Soerjomataram I, et al. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2024;74:229–63. https://doi.org/10.3322/caac.21834

[2] Martini N, Melamed MR. Multiple primary lung cancers. J Thorac Cardiovasc Surg. 1975;70:606–12.

[3] Li J, Yin B, Liu Y, Huang H. Bilateral synchronous double primary lung cancer: A case report. Clinical Case Reports. 2024;12:e8635. https://doi.org/10.1002/ccr3.8635

[4] Chen C, Huang X, Peng M, Liu W, Yu F, Wang X. Multiple primary lung cancer: a rising challenge. J Thorac Dis. 2019;11:S523–36. https://doi.org/10.21037/jtd.2019.01.56

[5] Vansteenkiste J, Fischer BM, Dooms C, Mortensen J. Positron-emission tomography in prognostic and therapeutic assessment of lung cancer: systematic review. The Lancet Oncology. Elsevier; 2004;5:531–40. https://doi.org/10.1016/S1470-2045(04)01564-5

[6] Gould MK, Maclean CC, Kuschner WG, Rydzak CE, Owens DK. Accuracy of Positron Emission Tomography for Diagnosis of Pulmonary Nodules and Mass LesionsA Meta-analysis. JAMA. 2001;285:914–24. https://doi.org/10.1001/jama.285.7.914

[7] Vansteenkiste JF, Stroobants SG. The role of positron emission tomography with 18F-fluoro-2-deoxy-D-glucose in respiratory oncology. Eur Respir J. 2001;17:802–20. https://doi.org/10.1183/09031936.01.17408020

[8] Chou T-Y, Dacic S, Wistuba I, Beasley MB, Berezowska S, Chang Y-C, et al. Differentiating Separate Primary Lung Adenocarcinomas From Intrapulmonary Metastases With Emphasis on Pathological and Molecular Considerations: Recommendations From the International Association for the Study of Lung Cancer Pathology Committee. J Thorac Oncol. 2025;20:311–30. https://doi.org/10.1016/j.jtho.2024.11.016

[9] Takeuchi S, Khiewvan B, Fox PS, Swisher SG, Rohren EM, Bassett RL, et al. Impact of initial PET/CT staging in terms of clinical stage, management plan, and prognosis in 592 patients with non-small-cell lung cancer. Eur J Nucl Med Mol Imaging. 2014;41:906–14. https://doi.org/10.1007/s00259-013-2672-8

[10] Takada K, Toyokawa G, Tagawa T, Kohashi K, Akamine T, Takamori S, et al. Association Between PD-L1 Expression and Metabolic Activity on 18F-FDG PET/CT in Patients with Small-sized Lung Cancer. Anticancer Res. 2017;37:7073–82. https://doi.org/10.21873/anticanres.12180