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CASE REPORT

Tumor-to-tumor metastasis: lung cancer within a thymoma

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Abstract
Tumor-to-tumor metastasis is a rare phenomenon. We present a rare case of an 83-year-old man with pulmonary squamous cell carcinoma and thymoma. Thymectomy and superior segmentectomy of the left lower lobe were successfully performed on the patient. This thymoma had a region of lung cancer. Metastasis from other tumors to thymoma is rare, and we found a report that described a pancreatic carcinoma metastasizing to thymoma. We report an extremely rare case of metastasis from lung cancer to a thymoma.

Keywords Tumor-to-tumor metastasis · Thymoma · Lung cancer · Pulmonary squamous cell carcinoma

Introduction

Tumor-to-tumor metastasis is a rare phenomenon. In a previous investigation, it was found that renal cell carcinoma and meningioma were common recipients, whereas lung and breast cancers were common donors [1]. Here, we present a case of pulmonary squamous cell carcinoma that metastasized to a thymoma. To our knowledge, such a case has not been reported previously.

Case report

An 83-year-old man was hospitalized owing to pneumonia and chronic obstructive pulmonary disease. He underwent computed tomography (CT), and a mass shadow in the left lower lobe of the lung and a mediastinal mass were found. According to the results of CT-guided lung biopsies, squamous cell carcinoma and thymoma were diagnosed. On performing positron emission tomography (PET), F-18 fluorodeoxyglucose uptake was detected in the lung tumor and thymoma. Thus, we made our final diagnoses of lung cancer (T1N0M0) and thymoma [clinical stage I (Masaoka classification)]. The patient underwent thymectomy and superior segmentectomy of the left lower lobe. The excised lung tumor measured 35 × 25 × 18 mm and showed notching. The thymoma measured 70 × 45 × 40 mm and appeared as a solid tumor covered with a capsule (Fig. 1a, b).

In microscopic examination, the lung tumor consisted of tumor cells forming solid nests with keratinization and coagulative necrosis. Vascular invasion was seen, but pleural invasion was not observed. In immunohistochemical examination, the tumor cells showed diffuse positivity for p40, but negativity for CD5 and c-kit. The findings supported the diagnosis of primary lung squamous cell carcinoma, and the margin was negative.

Meanwhile, the thymic tumor was consisted of abundant small lymphocytes and slightly polygonal cells around the dense fibrous capsule, which was classified as a type B1 thymoma. In this tumor, the solid growth of atypical epithelioid tumor cells was focally seen. In immunohistochemical examination, the tumor cells showed diffuse positivity for p40, but negativity for CD5 and c-kit, and these findings were similar to those of lung cancer. Therefore, this lesion was considered as metastatic lung cancer. The margin was negative, and lymph nodes attached in the excised tumor showed no metastasis. The patient was followed up with

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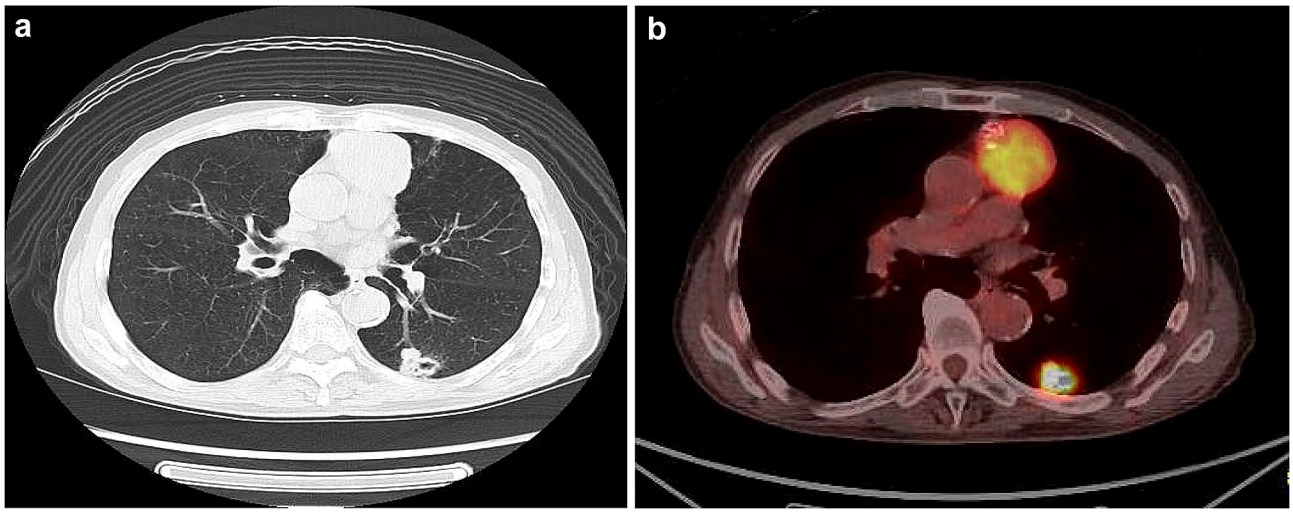

Fig. 1 **a** Lung cancer and thymoma by CT (lung cancer; 35 × 25 mm, thymoma; 70 × 45mm). **b** Lung cancer and thymoma by PET

CT, and he showed no evidence of recurrence 2 years after the surgery.

Discussion

Tumor-to-tumor metastasis is relatively rare. This phenomenon was first documented by Fried et al. in 1930. They reported a case of a meningioma with cancer cells from a bronchogenic carcinoma [2]. For the diagnosis of tumor-to-tumor metastasis, the tumors should meet certain criteria. In 1968, Campbell et al. proposed the following criteria for diagnosis: (1) > 2 primary tumors are present; (2) the recipient tumor is a true benign or malignant tumor; and (3) the metastatic tumor shows true metastasis with established growth in the host tumor (no collision tumor or embolization of tumor cells). It is important for the metastatic region to morphologically and immunohistochemically resemble the primary tumor, which is another criterion. A metastatic tumor showing spread in lymphoid tissue is excluded from the criteria given by Campbell et al. [3]. In our case, lung cancer and thymoma were simultaneously present, and these neoplasms did not collide with each other. The major histology of primary thymic carcinoma is squamous cell carcinoma. In the immunohistochemistry analysis, the squamous cell carcinoma was positive for p40 in various organs, and the positivity of both lung tumor and lesion in thymoma in our case were consistent with the morphological diagnosis. In addition, therefore, we used the CD5 and c-kit, which were useful for the diagnosis of thymic carcinoma [4]. In our case, both the lung tumor and lesion in thymoma were negative for CD5 and c-kit; therefore, we diagnosed the lesion in thymoma as metastasis of lung squamous cell carcinoma (Fig. 2).

In this case, cancer-to-cancer spread was accidentally revealed by postoperative pathological examination. The tumor was a squamous cell carcinoma, and it had not spread to lymph nodes. As mentioned, the common recipient of tumor-to-tumor metastasis is renal cell carcinoma, which is probably because renal cell carcinoma has rich blood flow and the tumor cells have large amounts of lipid and glycogen [5]. Lung cancer is one of the most common donor cancers. Lung tissues have a large vascular bed, and respiratory movement causes tumor tissues to separate easily. The tumor cells can enter the vessels of the body via the pulmonary vein and eventually enter the systemic circulation. Metastasis from other tumors to thymoma is rare, and we found a report that described a pancreatic carcinoma metastasizing to the thymoma [6]. Thymosin α1 plays an important role in immune function [7] and is important in the treatment of melanoma [8]. It has been reported that the immunoreactivity of thymosin α1 in thymoma is higher than that in the normal thymus [9], and this may be associated with infrequent metastasis from other tumors to a thymoma. It is also possible that pathologists could overlook microscopic metastasis within a thymoma; therefore, it is important to publish reports mentioning the possibility of metastasis to thymoma.

Conclusion

We report an extremely rare case of metastasis from lung cancer to a thymoma. Our findings might help in the treatment of patients with such tumor-to-tumor metastasis.

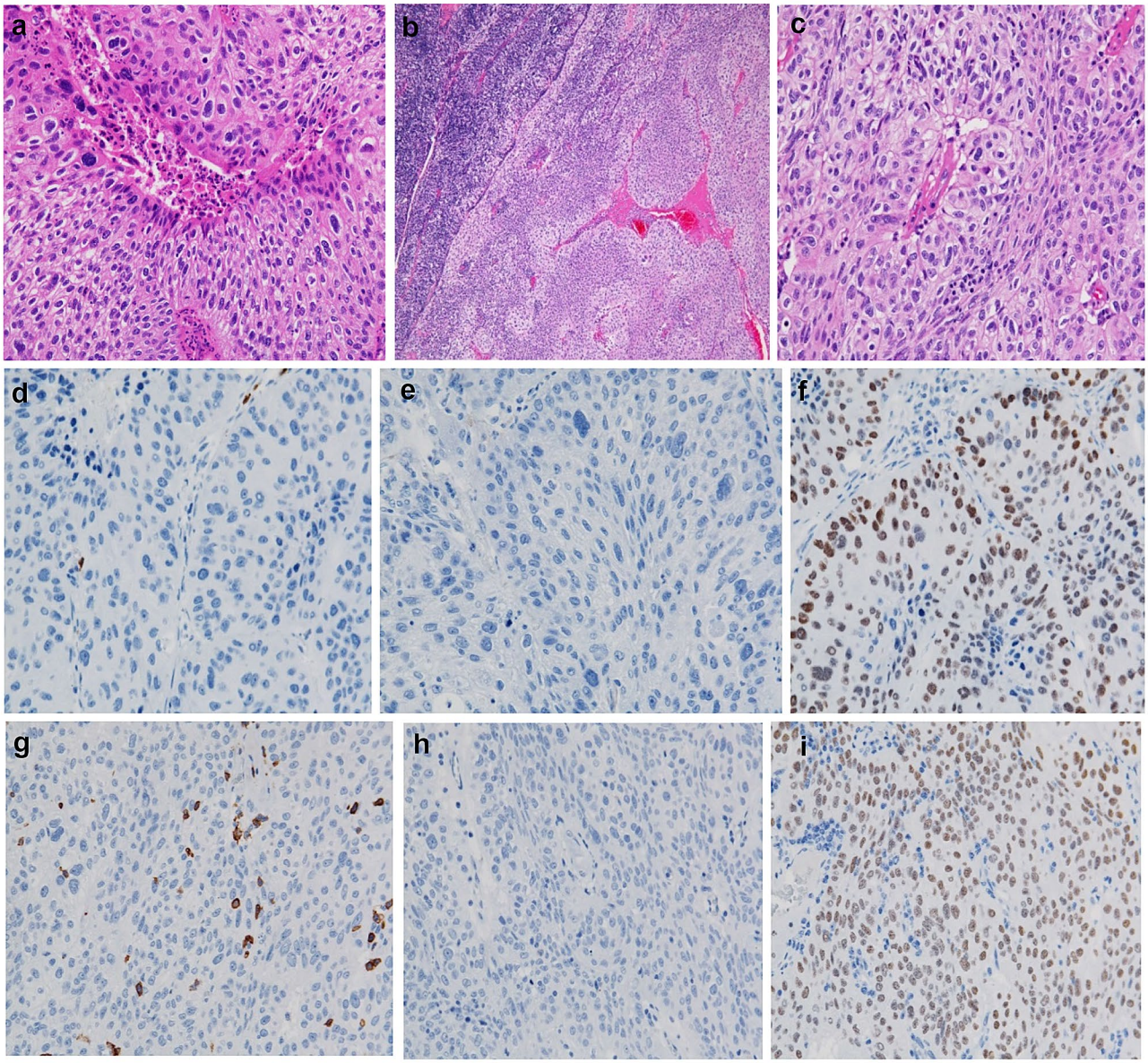

Fig. 2 **a** Pulmonary squamous cell carcinoma (HE, ×20). **b** Metastasis from pulmonary squamous cell carcinoma to thymoma (HE, ×4). **c** Pulmonary squamous cell carcinoma in thyomoma (HE, ×20). **d** Pulmonary squamous cell carcinoma (CD5, ×40). **e** Pulmonary squamous cell carcinoma (c-kit, ×40). **f** Pulmonary squamous cell carcinoma (p40, ×40). **g** Pulmonary squamous cell carcinoma in thyomoma (CD5, ×40). **h** Pulmonary squamous cell carcinoma in thyomoma (c-kit, ×40). **i** Pulmonary squamous cell carcinoma in thyomoma (p40, ×40)

Compliance with Ethical Standards

Conflict of interest The authors declare that there is no conflict of interests regarding the publication of this paper.

Consent An informed consent was provided by the patients.

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