Benign Schwannoma Mimicking Metastatic Lesion on F-18 FDG PET/CT in Differentiated Thyroid Cancer

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Abstract We report a case of benign schwannoma mimicking metastatic carcinoma. A 55-year-old female with papillary thyroid carcinoma underwent total thyroidectomy. F-18 fluorodeoxyglucose positron emission tomography/computed tomography (FDG PET/CT) demonstrated a focal hypermetabolic lesion with maximum standardized uptake value (SUVmax) 5.3 at the right chest wall. Conventional chest CT demonstrated a 5.4 cm ovoid mass lesion between the intercostal muscles and liver. Pathology revealed a schwannoma by tumor excision. This case demonstrates that benign schwannoma may demonstrate FDG uptake mimicking metastatic carcinoma.

Keywords Schwannoma · Mimicking carcinoma · F-18 FDG PET/CT · Differentiated thyroid cancer

Introduction

Schwannoma is a benign nerve sheath tumor that typically arises from the spinal nerve roots and the cervical, sympathetic, vagus, peroneal, and ulnar nerves in the head, neck, and flexor surfaces of the upper and lower extremities [1]. F-18 fluorodeoxyglucose positron emission tomography/computed tomography (FDG PET/CT) imaging is increasingly accepted as a modality for staging and restaging of many malignancies. However, increased FDG uptake, other than being present in malignant lesions, could also be present in benign inflammatory or granulomatous lesions [2]. These benign lesions of FDG uptake may lead to false-positive results for cancer. We present a case of benign chest wall schwannoma mimicking metastatic carcinoma on F-18 FDG PET/CT.

Case

A 55-year-old woman with well-differentiated papillary thyroid carcinoma was seen in June 2006 because of a palpable neck mass. She underwent a total thyroidectomy and the pathologic stage was T2N0M0. After thyroidectomy, she received I-131 ablation therapy (1.1 GBq). Her thyroglobulin level without thyroxine treatment was 0.1 ng/ml at the time of first iodine ablation therapy, with negative thyroglobulin antibody finding. The first post-therapy whole-body scan acquired 72 h after 1.1 GBq of I-131 showed only focal uptake in the thyroid bed area, and no abnormal uptake suggesting metastasis. After 3 years, F-18 FDG PET/CT was performed to search for tumor recurrence or metastasis of known thyroid cancer and other hidden malignancy. When F-18 FDG PET/CT was performed, serum thyroglobulin level with thyroxine treatment was 0.1 ng/ml, neck ultrasonography revealed no evidence of metastasis and she was asymptomatic. F-18 FDG PET/CT showed a soft tissue mass lesion with FDG uptake with maximum standardized uptake value (SUVmax) 5.3 in the right chest wall (Fig. 1b). It was initially considered to be metastatic or other soft tissue malignant disease, because of high FDG uptake and history of thyroid cancer. To evaluate the mass characteristics, subsequent contrast-enhanced thoracic CT was performed. The scan demonstrated a 4.2 cm ovoid mass lesion with central enhancing portion and peripheral hypodense area between the intercostal muscles and the liver (Fig. 1a). The CT finding was suggestive of neurogenic tumor or metastasis. For diagnosis, ultrasonographic biopsy was performed; the obtained tissue was not adequate for diagnosis. After 10 months, follow-up CT was performed. The CT demonstrated that the chest wall mass increased in size (5.4 cm). For accurate diagnosis and a proper therapeutic plan, mass excision was performed. The tumor arising from the intercostal nerve was surgically removed without

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Fig. 1 A 55-year-old woman with papillary thyroid cancer. **a** Contrast-enhanced thoracic CT scan showed a 5.4 cm ovoid mass lesion between the intercostal muscles and liver (*red arrow*). The mass had a central enhancing portion and peripheral hypodense area. **b** F-18 FDG PET/CT showed soft tissue mass lesion with FDG uptake (SUVmax 5.3) in right chest wall (*red arrow*), which was proven to be schwannoma by histological examination

entering the pleural space. Macroscopically, a yellowish and encapsulated ovoid tumor was found. The tumor weighed 21 g and measuring $5.8 \times 2.6 \times 2.5$ cm. The cut surfaces of the tumor were glistening yellow from mass with myxoid areas and focal cystic change, but hemorrhage or necrosis was not identified. Microscopic analysis reported a benign schwannoma, consisting of spindle cells. On immunohistochemical investigation, 100 % immunoreactivity for S-100 was found, which supported the final diagnosis. These findings were consistent with a benign schwannoma (Fig. 2).

Discussion

Schwannoma is generally a benign, slow-growing, and encapsulated tumor originating from the nerve sheath that usually occurs in the extremities, and the head and neck region [3]. Most schwannomas are solitary, except in patients with neurofibromatosis who develop multiple tumors [4]. They most

Fig. 2 Histological diagnosis (magnification $\times 100$). The mass was a cytologically bland spindle cell lesion with Verocay bodies and alternating dense fibrous and loosely cellular areas (Antoni A and B patterns). Immunohistochemical stains were obtained, which were strongly positive for S-100 and negative for CD 34, confirming the diagnosis of a benign schwannoma

commonly affect patients in their third decade of life and show no preference for occurrence in either sex [5]. Schwannoma is often grouped together with neurofibroma, which is a benign nerve sheath tumor arising centrally from a peripheral nerve. Resection is performed only if they are symptomatic, moderately large, or exhibit rapid growth.

Microscopically, schwannoma displays a biphasic pattern with areas of highly ordered cellularity (Antoni A) and other, less cellular areas where a copious myxoid matrix predominates (Antoni B). The global degree of cellularity varies widely among lesions. Beaulieu et al. [1] reported that FDG uptake in soft tissue and neural schwannoma was variable, but frequently high, and postulated that it may be due to overexpression of one of the glucose transporter proteins by the tumor cells, in particular glucose transporter type 3, which is found in all human tissues and is the major glucose transporter on the neuronal surface.

Benign soft tissue masses and soft tissue sarcomas may have overlapping clinical and imaging features [6]. Clinical symptoms may be of diagnostic value in differentiating benign and malignant tumors. Pain at rest is rare with benign tumors but almost always present if malignant and neurogenic deficits are also rare in benign tumors [7]. Our patient was also relatively asymptomatic. Biopsy of an indeterminate mass is usually the most specific method for obtaining an accurate diagnosis.

F-18 FDG PET/CT is increasingly used in clinical oncology, because it allows functional imaging of viable tumor tissue [6]. The use of F-18 FDG PET/CT for the detection and monitoring of patients with musculoskeletal lesions has also been reported [8]. Several previous studies have reported the usefulness of F-18 FDG PET/CT in distinguishing high-grade soft tissue sarcomas from low-grade or benign soft tissue

tumors [9–12]; however, considerable overlap in the SUV has been observed between benign and malignant lesions [13, 14]. The large accumulation of FDG in benign soft tissue tumors has been reported in giant cell tumors of tendon sheath, sarcoidosis, and desmoids [13, 14]. The SUV of schwannoma has been reported to show a wide variation of 0.33–3.7 [15], 1.75 ± 0.84 [11], and 0.7–2.84 [14]. Therefore, F-18 FDG PET/CT seems to be limited in distinguishing schwannoma from other malignant peripheral nerve sheath tumor. In the present case, F-18 FDG PET/CT showed focal FDG uptake in the right chest wall. As a result of a 5.4 cm ovoid mass lesion with a central enhanced portion, as well as a peripheral hypodense area between intercostal muscles and the liver in the contrast-enhanced CT scan, the following are strongly suspected in a differentiated thyroid cancer patient: relative high FDG uptake (SUVmax 5.3) in the F-18 FDG PET/CT, increase in the size of mass at CT follow-up, and metastatic or other malignant lesions. But, the biopsy finding verified schwannoma. Schwannoma was not considered first in this case, because FDG uptake was relatively low in the benign soft tissue tumor.

In summary, this case demonstrates benign schwannoma mimicking metastasis in a differentiated thyroid cancer patient. When focal FDG uptake is found in the chest wall in the F-18 FDG PET/CT of cancer patients, benign tumor such as schwannoma should be taken into consideration, as well as metastasis. Further studies of imaging and biopsy are advised for accurate diagnosis.

References

1. Beaulieu S, Rubin B, Djang D, Conrad E, Turcotte E, Eary JF. Positron emission tomography of schwannomas: emphasizing its potential in preoperative planning. *AJR Am J Roentgenol*. 2004;182:971–4.
2. Kostakoglu L, Hardoff R, Mirtcheva R, Goldsmith SJ. PET-CT fusion imaging in differentiating physiologic from pathologic FDG uptake. *Radiographics*. 2004;24:1411–31.
3. Hide IG, Baudouin CJ, Murray SA, Malcolm AJ. Giant ancient schwannoma of the pelvis. *Skeletal Radiol*. 2000;29:538–42.
4. Enzinger FM, Weiss SW. Soft-tissue tumors. St. Louis: C.V. Mosby; 1998.
5. Murphey MD, Smith WS, Smith SE, Kransdorf MJ, Temple HT. From the archives of the AFIP. Imaging of musculoskeletal neurogenic tumors: radiologic-pathologic correlation. *Radiographics*. 1999;19:1253–80.
6. Strauss LG, Conti PS. The applications of PET in clinical oncology. *J Nucl Med*. 1991;32:623–48. discussion 49–50.
7. Ogose A, Hotta T, Morita T, Yamamura S, Hosaka N, Kobayashi H, et al. Tumors of peripheral nerves: correlation of symptoms, clinical signs, imaging features, and histologic diagnosis. *Skeletal Radiol*. 1999;28:183–8.
8. Kern KA, Brunetti A, Norton JA, Chang AE, Malawer M, Lack E, et al. Metabolic imaging of human extremity musculoskeletal tumors by PET. *J Nucl Med*. 1988;29:181–6.
9. Schulte M, Brecht-Krauss D, Heymer B, Guhlmann A, Hartwig E, Sarkar MR, et al. Fluorodeoxyglucose positron emission tomography of soft tissue tumours: is a non-invasive determination of biological activity possible? *Eur J Nucl Med*. 1999;26:599–605.
10. Lodge MA, Lucas JD, Marsden PK, Cronin BF, O'Doherty MJ, Smith MA. A PET study of 18FDG uptake in soft tissue masses. *Eur J Nucl Med*. 1999;26:22–30.
11. Aoki J, Watanabe H, Shinozaki T, Takagishi K, Tokunaga M, Koyama Y, et al. FDG-PET for preoperative differential diagnosis between benign and malignant soft tissue masses. *Skeletal Radiol*. 2003;32:133–8.
12. Adler LP, Blair HF, Makley JT, Williams RP, Joyce MJ, Leisure G, et al. Noninvasive grading of musculoskeletal tumors using PET. *J Nucl Med*. 1991;32:1508–12.
13. Watanabe H, Inoue T, Shinozaki T, Yanagawa T, Ahmed AR, Tomiyoshi K, et al. PET imaging of musculoskeletal tumours with fluorine-18 alpha-methyltyrosine: comparison with fluorine-18 fluorodeoxyglucose PET. *Eur J Nucl Med*. 2000;27:1509–17.
14. Aoki J, Endo K, Watanabe H, Shinozaki T, Yanagawa T, Ahmed AR, et al. FDG-PET for evaluating musculoskeletal tumors: a review. *J Orthop Sci*. 2003;8:435–41.
15. Ahmed AR, Watanabe H, Aoki J, Shinozaki T, Takagishi K. Schwannoma of the extremities: the role of PET in preoperative planning. *Eur J Nucl Med*. 2001;28:1541–51.