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CLINICAL CASE REPORT

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Case Reports on the Differentiation of Malignant and Benign Intratracheal Lesions by ^{18}F-FDG PET/CT

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Abstract: Malignant tracheal tumors (primary and secondary) are rare and benign tumors of the tracheobronchial tree are also rare. Few reports have been issued on the ^{18}F-fluorodeoxyglucose (^{18}F-FDG) positron emission tomography (PET) findings of tracheal tumors or benign nontumorous tracheal lesions, which have been mainly studied by computed tomography (CT). The author reports 2 cases of intratracheal lesions with quite different ^{18}F-FDG PET/CT findings. The first case was of a 73-year-old woman with colon cancer treated by hemicolectomy and subsequent adjuvant chemotherapy. Follow-up ^{18}F-FDG PET/CT after 6 years revealed a hypermetabolic fungating mass (SUVmax: 5.8) in the distal trachea and biopsy confirmed intratracheal metastasis. The second case involved a 61-year-old man with tongue cancer who underwent mouth floor mass excision and right supraomohyoid neck dissection with submental flap reconstruction. Tracheal lesion was incidentally found during a ^{18}F-FDG PET/CT follow-up study conducted 1 year later. A benign intratracheal condition with low FDG uptake (SUVmax: 1.2) and the lesion was not visualized by neck CT 4 months later. ^{18}F-FDG PET/CT uptake was helpful in differentiating benign and malignant intratracheal lesions.

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Abbreviations: ^{18}F-FDG PET = ^{18}F-fluorodeoxyglucose positron emission tomography, CT = computed tomography, DOE = dyspnea on exertion, SUVmax = maximum standardized uptake value.

INTRODUCTION

Malignant and benign tumors of the tracheobronchial tree are rare and in adults the majority are malignant.[1,2] Intratracheal metastasis is a secondary malignant tumor and extremely rare, although it can be an initial manifestation of recurrence.[3] The signs and symptoms of these tumors are nonspecific and chest radiographs are rarely diagnostic.[2] Computed tomography (CT) is regarded as the standard imaging tool for the diagnosis and evaluation of these tumors and benign intratracheal nontumorous lesions.[4–6] However, ^{18}F-fluorodeoxyglucose positron emission tomography (^{18}F-FDG PET) can provide metabolic information and aid the differentiation of malignant and benign tumors, although few reports are available on the topic. The author reports a rare case of intratracheal metastasis from colon cancer and a case of a benign intratracheal nontumorous condition encountered during tongue cancer follow-up by ^{18}F-FDG PET/CT, which in these 2 cases effectively differentiated benign and malignant lesions.

CASE PRESENTATION

Case 1

This case involved a 73-year-old woman with a history of colon cancer treated by hemicolectomy and subsequent adjuvant chemotherapy. In addition, she had lung and soft tissue metastasis, which were treated by chemotherapy and surgery. Follow-up ^{18}F-FDG PET/CT after 6 years revealed a hypermetabolic fungating mass (SUVmax: 5.8) about 15 mm in size in the distal trachea (Fig. 1A and B). We report it as a malignant lesion that can be both primary and metastasis. Fiberoptic bronchoscopy revealed a multinodular fungating mass in the distal trachea and carina corresponding to the abnormality noted on the ^{18}F-FDG PET/CT scan. Biopsy revealed metastatic adenocarcinoma from colon cancer. Immunohistostaining for Hematoxylin and Eosin (H & E, ×100) and thyroid transcription factor-1 (TTF-1) was negative for lung primary tumor (Fig. 2A and B). Cytokeratin 20 and caudal type homeobox 2 (CDX-2) for intestinal differentiation were positive (Fig. 2C and D). Her symptoms included dyspnea on exertion (DOE) and a cough. She was treated by radiation therapy and symptoms were improved.

Case 2

Second case involved a 61-year-old man who underwent mouth floor mass excision and right supraomohyoid neck dissection with submental flap reconstruction for tongue cancer. Subsequently, a tracheal lesion was incidentally found during a ^{18}F-FDG PET/CT follow-up study conducted 1 year later. In this case, ^{18}F-FDG uptake was at the same level as background activity (SUVmax: 1.2) within a well-defined intratracheal mass-like lesion about 7 mm in size (Fig. 3A and B). The patient had no respiratory symptoms and the lesion was reported as probably benign, such as mucus secretion. No biopsy was performed and the lesion was not visualized by neck CT 4 months later (Fig. 3C).

DISCUSSION

In the tracheobronchial tree, primary malignant and benign tumors, and secondary malignant tumors may occur.[1] Primary malignant tracheal tumors are usually arising from the respiratory epithelium and salivary glands, while most benign tumors are of mesenchymal origin.[1,7,8] The most common primary malignant tumor in the trachea is squamous cell carcinoma and adenoid cystic carcinoma is also common.[1,2] Secondary tracheal malignant tumors arise by direct tumor invasion or

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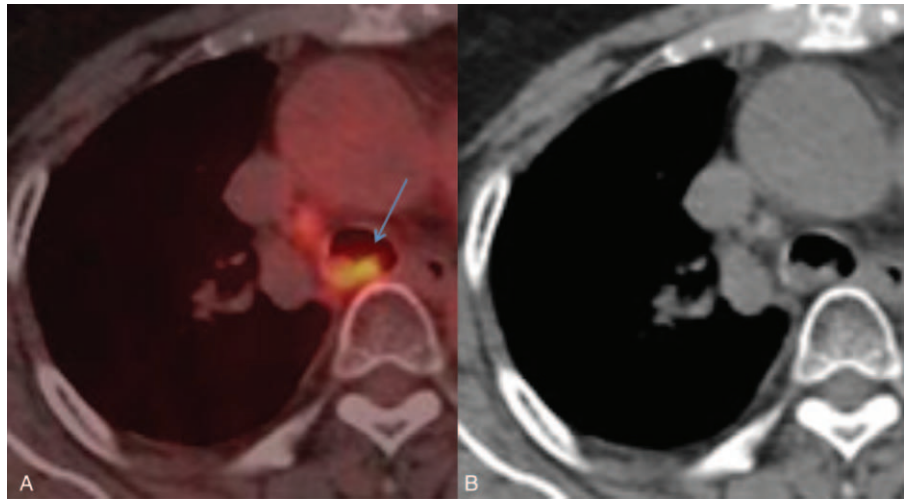

FIGURE 1. Case 1 (A and B): intratracheal metastasis from colon cancer in a 73-year-old woman. ^{18}F-FDG PET/CT image showing high ^{18}F-FDG uptake (SUVmax: 5.8) within the intratracheal fungating mass (arrow) with an irregular margin (A). Noncontrast CT scan of a combined PET/CT obtained at the level of the distal trachea shows a fungating mass about 15 mm in size in the distal trachea (B).

hematogenous metastasis, but direct invasion is most common.[3] Computed tomography (CT) is the standard imaging modality for the diagnosis.[2] The CT manifestations are similar in both primary and secondary malignant tumors and those of benign tumors are usually nonspecific. ^{18}F-FDG PET/CT can provide anatomic and metabolic information regarding these tumors. Tracheal metastasis has been documented from 1890 and the most common primary neoplasms are those of the kidney, breast, colon, thyroid, or melanoma although others have been described.[9,10] Primary tumors in the tracheobronchial tree can cause respiratory symptoms, but metastases are usually asymptomatic or show nonspecific symptoms and early diagnosis is difficult.[1,2] Tracheal metastasis usually treated with tracheal resection, radiation therapy, endotracheal debridement, endobronchial stents, along with chemotherapy, and the mean overall survival is 1 to 2 years after diagnosis.[10] Symptoms such as dyspnea, cough, hemoptysis, wheezing, or stridor developed during evaluations of cancer patients, tracheal metastasis should be considered.

Benign tracheal tumors are uncommon,[1,2,11] and almost all benign tumors are of mesenchymal origin.[7] Benign tracheal lesions (tumor and nontumorous condition) by ^{18}F-FDG PET

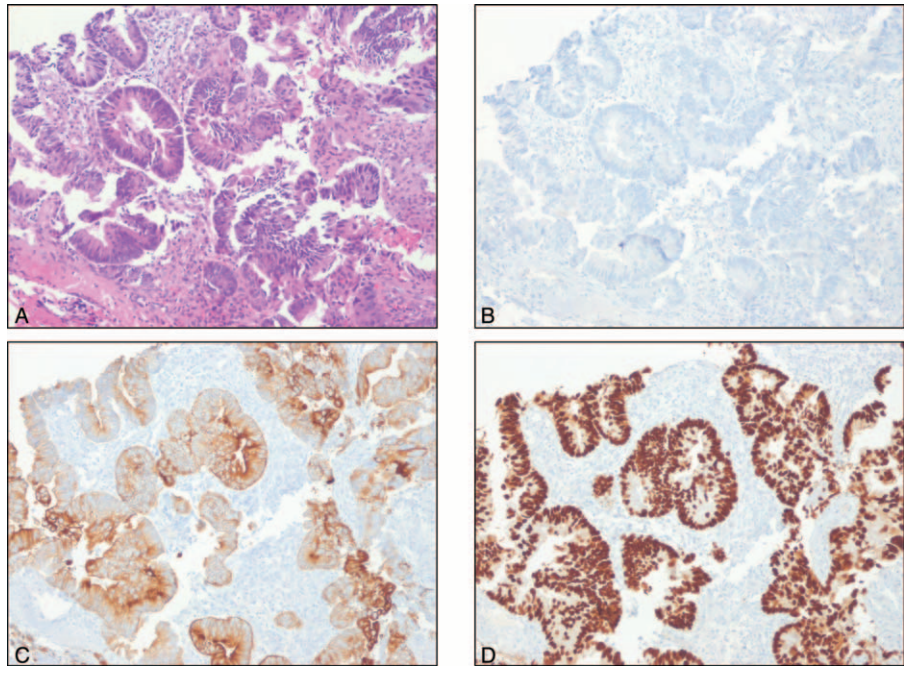

FIGURE 2. Case 1 (A–D): immunohistochemical staining for Hematoxylin and Eosin (H & E, ×100) and thyroid transcription factor-1 (TTF-1) (B) in the specimen showed negative for lung primary tumor. Cytokeratin 20 (C) and caudal type homeobox 2 (CDX-2) (D) for intestinal differentiation were positive and confirmed that this lesion was a metastatic adenocarcinoma that originated from colon cancer.

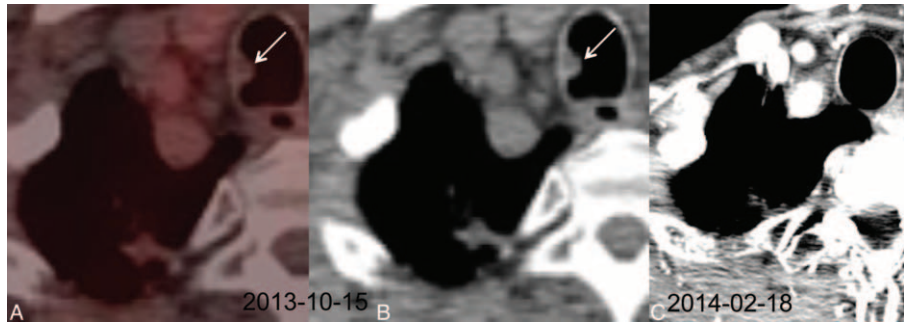

FIGURE 3. Case 2 (A–C): benign intratracheal condition in a 61-year-old man. ^{18}F-FDG PET/CT scan showing faint uptake with respect to background activity (SUVmax: 1.2) (A) within a well-defined intratracheal mass-like lesion about 7 mm in size on the noncontrast CT scan of a combined PET/CT (B). The lesion was not observed by 4-months follow-up contrast-enhanced neck CT obtained at the same level (C).

study were mainly on the benign tumors and most are hamartomas and squamous cell papillomas.[1] Benign tumors are usually well demarcated, round, and $\leq$2 cm in diameter, and tend to be asymptomatic until they occlude 50% to 75% of the luminal diameter.[1,2] In general, benign tumors show faint or no 18F-FDG uptake, whereas malignant tumors generally show high 18F-FDG uptake. However, carcinoid tumors may show low FDG uptake and atypical pulmonary hamartoma may show high 18F-FDG uptake mimicking malignancy.[1]

Other benign nontumorous intratracheal lesions have been mainly studied by CT, and to our knowledge, no reports have been issued on their ^{18}F-FDG PET or PET/CT findings. A previous CT study[4] reported that adherent mucus and foreign body aspiration can appear as soft tissue nodules. Adherent mucus, which tends to exhibit low attenuation, is probably the most commonly encountered tracheobronchial tree abnormality seen on CT images. The differentiation of mucus and true tumors is usually easy, but may be difficult when mucus is thick and tenacious. Other benign nontumorous lesions, such as tracheal stenosis caused by prolonged intubation and tuberculosis or histoplasmosis, can show concentric soft tissue thickening. Sclerosing tracheitis[5] also can exhibit diffuse circumferential tracheal thickening and inflammatory pseudotumor[6] appears as a tumor-like lesion on the CT image. However, ^{18}F-FDG PET/CT scan can provide anatomic and metabolic information on these benign nontumorous lesions, as occurred in our second case. In this case, the patient had no respiratory symptoms and the tracheal lesion disappeared without treatment at his 4-month follow-up by neck CT, which indicated that the lesion was not a tumor, but rather a common benign condition. These findings indicate when an intratracheal lesion shows mild or faint ^{18}F-FDG uptake, a CT follow-up study is a better choice than an invasive study.

The author reports a rare case of intratracheal metastasis and of a benign nontumorous condition, and that these 2 cases had quite different ^{18}F-FDG uptake intensities. ^{18}F-FDG PET/CT was helpful in differentiating benign and malignant intratracheal lesions.

Ethical Approval

All the procedures performed in the study involving human participant were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all patients for being included in the study.

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