FDG PET/CT in the Detection of Pancreatic Metastasis in a Patient with Follicular Thyroid Carcinoma and Negative I-131 Whole Body Scan Findings

Hae Jung Na, Bo Hyun Kim, Ji Ryang Kim, Min Young Oh, Sang Mi Kim, Byeong Gu Song, Dong Hun Shin, Won Jin Kim, Yun Kyung Jeon, Sang Soo Kim, Hyung Il Seo and In Ju Kim

Abstract

We identified a rare follicular thyroid carcinoma (FTC) metastasis to the pancreas in a patient of FTC. A 65-year-old woman presented at our hospital for evaluation of a pancreatic mass. She had a history of FTC. After total thyroidectomy, I-131 whole body scan showed increased I-131 uptake in the thyroid bed, but there was no evidence of distant metastasis. However, F-18 FDG PET/CT showed a mass with FDG uptake in the pancreatic head. Follow-up PET/CT showed FDG uptake in the pancreatic head and thyroid bed. Pylorus-preserving pancreaticoduodenectomy was performed. Histopathological examination supported the diagnosis of metastatic FTC to pancreas.

Key words: follicular thyroid cancer, pancreas, metastasis, positron emission tomography (PET)

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Introduction

Thyroid cancer is the most common endocrine malignancy, and follicular thyroid carcinoma (FTC) is the second most common type of thyroid malignancy, accounting for approximately 5% of cancers in iodine intake-sufficient countries. While FTC usually remains localized to the thyroid gland, distant metastasis is observed in a minority of patients, with a reported incidence ranging from 4% to 15% (1-3). Metastatic FTC significantly contributes to disease morbidity and has been found to be associated with a 10-year survival of 40-45% (2). Therefore, among patients with well-differentiated thyroid carcinoma (DTC), metastatic disease and a more aggressive clinical course are often observed in those with FTC due to the propensity for vascular invasion and hematogenous spread (4). The hematogenous route is most often involved, either by way of the systemic circulation or occasionally via the paravertebral plexus. Lymphatic spread, although less common, is also possible (5). FTC metastasizes most commonly to the lungs and bones (5). Other sites of distant metastasis are rare or relatively rare and include the brain, breast, liver, kidneys, muscle and skin (3, 6). However, metastatic FTC extending to the pancreas has not been previously reported.

We herein report the case of a 65-year-old woman who developed FTC metastasis to the pancreas with negative I-131 whole body scan (WBS) and positive fluorine-18 fluorodeoxyglucose positron emission tomography/computed tomography (F-18 FDG PET/CT) findings.

Case Report

A 65-year-old woman presented to our hospital for an evaluation of a mass in the pancreatic head. Her past surgical history included right middle lobectomy with mediastinal lymph node (LN) dissection for adenocarcinoma of the lung (T1N0M0) in February 2008 and left hemithyroidectomy...
without LN dissection for a follicular neoplasm at a local hospital in April 2010. A histopathological examination of left thyroid mass revealed a 2.6×2.1×1.5 cm widely invasive follicular carcinoma with capsular and lymphovascular invasion. Following completion of thyroidectomy of the right thyroid gland, diagnostic I-131 WBS showed an increased uptake of I-131 in the thyroid bed without evidence of distant metastasis. After the initial thyroid surgery, the level of thyroid-stimulating hormone (TSH) stimulated serum thyroglobulin (Tg) was 32.8 ng/mL (reference range: 1-50 ng/mL) and the titer of anti-Tg antibodies was 28.2 IU/mL (reference range: 0-60). During the follow-up period, F-18 FDG PET/CT was performed to detect lung cancer recurrence. A scan showed a 1.8×2.3 cm hypermetabolic mass (maximal standardized uptake value, SUVmax: 27.9) on the pancreatic head in addition to multiple lung nodules without FDG uptake (Fig. 1A). The serum Tg level was 148.8 ng/mL and the anti-Tg antibody titer was 18.1 IU/mL under TSH suppression with levothyroxine (TSH: 0.01 μIU/mL, normal range: 0.3-5.0 μIU/mL). Multiple lung metastases and pancreatic malignancy were suspected. Therefore, 7.4 GBq (200 mCi) radioactive iodine ablation therapy was administered in October 2010. Post-therapeutic I-131 WBS showed an increased uptake in the thyroid bed, although no evidence of distant metastasis was noted at any site, including the lungs and pancreas (Fig. 1B). Following the administration of total thyroidectomy and radioactive iodine ablation therapy, the patient received levothyroxine at a dose of 150 μg per day. At that time, we recommended surgical excision of the pancreatic mass; however, the patient refused surgery and she was no longer followed up at our hospital. In May 2013, an abdominal CT scan performed at the local hospital revealed that the size of the mass in the pancreatic head had increased (Fig. 2A).

At the present visit, a physical examination revealed that the patient was in good general condition with no abdominal tenderness. The results of blood tests performed on the day of admission, including a complete blood count, electrolytes and chemistry tests, were all normal. Thyroid function tests showed a TSH level of 0.02 μIU/mL (normal range: 0.3-5.0 μIU/mL), a T3 level of 154.0 ng/dL (normal range: 80-170 ng/dL) and a free T4 level of 1.82 ng/dL (normal range: 0.75-2.00 ng/dL). The serum Tg level was 378.4 ng/mL (reference range: 1-50 ng/mL) and the anti-Tg antibody titer was 38.9 IU/mL (reference range: 0-60).

An imaging work-up, including magnetic resonance imaging of the pancreas and F-18 FDG PET/CT, was performed. A contrast-enhanced T1-weighted transverse image of the pancreas showed a hypervascular mass in the pancreatic head, measuring 3.0×2.5 cm (Fig. 2B). A F-18 FDG PET/CT scan was performed with a dedicated PET-CT scanner (Biograph40, SIEMENS, Knoxville, TN, USA). The patient fasted for at least eight hours before F-18 FDG injection, and PET/CT imaging was performed 60 minutes after the injection of F-18 FDG (5 MBq per kilogram of body weight). F-18 FDG PET/CT revealed a mass with an FDG uptake in the pancreatic head and a focal FDG uptake in the left thyroid bed (Fig. 3). Thyroid ultrasound images showed a mass in the left thyroid bed. Fine needle aspiration (FNA) of the left thyroid bed was performed, the results of which revealed a follicular neoplasm of the Hürthle cell type. These findings suggested the local recurrence of FTC based
on the patient’s previous history of widely invasive FTC. However, the imaging modalities did not reveal any evidence of lung cancer recurrence. The patient elected to undergo surgical excision of the pancreatic mass, owing to the increased size of the mass. Therefore, pylorus preserving pancreaticoduodenectomy and revision central neck dissection were performed. An examination of the surgical resection specimen revealed a 3.0×2.2 cm mass in the pancreatic head. A histopathological examination of the pancreatic mass demonstrated metastatic FTC (Fig. 4). Following resection of the pancreatic metastasis and revision neck dissection, the serum Tg level decreased to 10.1 ng/mL. Chest CT, abdominal CT and I-131 WBS were performed to evaluate cancer recurrence in November 2013. However, there was no evidence of recurrence in the pancreas or neck, and no interval changes of multiple small nodules were noted in either lung.

**Discussion**

In this article, we reported a case of pancreatic metastasis of FTC with an elevated Tg level in addition to positive F-18 FDG PET/CT and negative I-131 WBS findings. FTC is the second most common DTC (7). Although papillary thyroid carcinomas (PTCs) are generally more common than FTC, FTC is more prone to spread hematogenously, especially to the lungs and bones, at a rate of 5-20% (8). The pancreas is a rare site of metastasis in FTC patients.
mon malignancies that metastasize to the pancreas include renal cell carcinoma, lung cancer, medullary thyroid carcinoma, lymphoma, alveolar rhabdomyosarcoma and esophageal cancer (6, 9).

Following total or near total thyroidectomy and the administration of radiiodine ablation therapy for DTC, routine follow-up methods for detecting recurrence include I-131 or I-123 WBS, neck US and measurements of the serum Tg and anti-Tg antibody levels. The use of F-18 FDG PET/CT is limited primarily to the postoperative surveillance of known DTC lesions, as F-18 FDG PET-CT can be negative in DTC patients in which the lesions retain the ability to trap iodine. Furthermore, the use of F-18 FDG PET in the management of DTC is not considered to be a routine procedure due to its high cost and poor specificity. In addition, increased FDG accumulation due to the high glycolytic rate of inflammatory cells at sites of inflammation or infection can cause false positive results. However, it is well known that the primary clinical application of F-18 FDG-PET/CT is to localize disease in Tg-positive (>10 ng/mL), I-131 WBS-negative patients (10). A discordance was noted in this case between the findings of F-18 FDG PET-CT and I-131 WBS; this discrepancy was attributed to the fact that less differentiated or de-differentiated thyroid cancer tissues lose the ability to concentrate iodine due to disruption of the sodium iodide symporter (NIS) and tend to utilize more glucose (10, 11). Even high-dose I-131 therapy is quite ineffective in treating FDG-positive metastatic thyroid cancers. Therefore, in patients with Tg-positive and I-131-negative tumors, the complete surgical removal of iodine-negative lesions is the only curative treatment option (12).

Pancreatic metastases often remain asymptomatic for long periods before diagnosis (6). In the current case, the patient presented with a mass in the pancreatic head without symptoms for three years. The metastasis to the pancreas was detected on F-18 FDG PET/CT, although the mass was negative for I-131. Therefore, the use of F-18 FDG PET/CT in combination with measurement of the Tg level is important in defining the management strategy in patients with DTC with negative I-131 WBS findings.

Due to the rarity of thyroid carcinoma-derived pancreatic metastases, the exact pathogenesis of these lesions is not well understood. However, the hematogenous route has been well described (6). To date, only a few cases of metastasis of PTC to the pancreas have been reported. For example, Alzahrani et al. reported a case of pancreatic metastases from PTC that was treated with sorafenib therapy (13). In addition, Borschitz et al. reported a case of metastases of follicular variant PTC to the pancreas (14). To our knowledge, the present case is the first to involve FTC metastasis to the pancreas diagnosed on F-18 FDG PET/CT in a pa-

Figure 4. A: Tumor cells exhibiting invasion into the pancreatic parenchyma [Hematoxylin and Eosin (H&E) staining ×200]. B: At higher magnification, areas of this lesion show colloid and follicular carcinoma cells (H&E staining ×400). The nuclei are pleomorphic and irregular. C: Immunohistochemically, the tumor cells display positive staining for thyroglobulin. D: The tumor cells demonstrate positive staining for CD56.
tient with an elevated Tg level and negative I-131 WBS findings.

In conclusion, FTC is generally associated with an excellent prognosis. However, metastatic disease and a more aggressive clinical course may be observed. Moreover, FTC can involve unusual metastatic presentations and patterns. This is a very rare case in which FTC metastasized to the pancreas. While I-131 WBS was negative following the administration of radioiodine ablation therapy, F-18 FDG PET/CT revealed undetected metastasis. Although unusual, secondary tumors of the pancreas may originate from the thyroid gland. Therefore, metastatic malignancies, such as FTC, should be considered in the differential diagnosis of pancreatic lesions.

The authors state that they have no Conflict of Interest (COI).

References