111In-Pentetreotide uptake in a follicular adenoma of the thyroid gland: a pitfall for 111In-Pentetreotide scintigraphy

M. ÜYSÉL1, S. EZİDEN2, E. WARDELMANN3 and H.-JUERGEN BERSACK6

1Trakya University Medical Faculty. Department of Nuclear Medicine. Edirne-Turkey.
2Rheinische-Friedrich-Wilhelms University Medical Faculty, Department of Nuclear Medicine. Bonn. Germany.
3Rheinische-Friedrich-Wilhelms University Medical Faculty, Department of Pathology. Bonn-Germany.

INTRODUCTION

111In-pentetreotide is used for the evaluation and therapy planning of somatostatin receptor positive neuroendocrine tumors and their metastases. In thyroid benign disorders, such as Grave’s disease and ophthalmopathy, Hashimoto and De Quervain thyroiditis, nodular goiter, toxic adenoma as well as malignant tumors, such as papillary, follicular, anaplastic, and medullary thyroid carcinoma, and non-functioning metastases of differentiated thyroid carcinoma uptake of 111In-pentetreotide was observed1-3. Recently, 111In-pentetreotide accumulation in a thyroid gland mimicking a metastasis of a previously operated, renal-cell carcinoma in a patient with multiple endocrinological neoplasm was published4. 111In-pentetreotide uptake was observed in normal functioning colloidal thyroid nodules, multinodular, nodular, colloidal nodule with chronic thyroiditis, cellular colloid nodule, and in endemic goiter1,7,8. Accumulation of 111In-pentetreotide in various tissues and organs such as pituitary gland, spleen, liver, kidney and urinary bladder, in colon, sarcoidosis, tuberculosis, ventral hernia, paraplebic renal cyst, granuloma etc. was also reported1,3,5.

CASE REPORT

A 54 year-old men with the suspicion of a neuroendocrine tumor of the pancreas was referred to the Department of Nuclear Medicine. The patient underwent a somatostatin receptor scintigraphy after injection of 200MBq of 111In-Pentetreotide. Four and 24 hour post injection thoracic and abdominal planar images and a Single Photon Emission Computed Tomography (SPECT) study were acquired. 111In-Pentetreotide scintigraphy showed discrete uptake of the radiotracer in the head of the pancreas (fig. 1) and focal uptake in...
In-pentetreotide uptake in the 24h planar image was higher compared to the 4h image, and decreased after 48 hours. Thyroid ultrasonography revealed a 27 × 14 × 18 mm sized iso-echoic homogenous thyroid lesion of the right thyroid lobe with good vascularization in the Duplex scan, and a second, echopenic nodule with a diameter of 5 mm located below this lesion (fig. 3). On 99mTc-pertechnetate scintigraphy (fig. 4), the lesion was a cold lesion suggesting a possible malignant tumor suggestive for a metastasis of the neuroendocrine tumor. The patients thyroid hormone tests were normal. The tumor was removed surgically. The histopathological diagnosis was a thyroglobulin-positive follicular thyroid adenoma. The lesion was negative for serotonin or chromogranin A.
DISCUSSION

According to the uptake of octreotide in various thyroid lesions such as C-cell (medullary thyroid) carcinoma, activated lymphocytic infiltration (Hashimoto’s thyroiditis, Grave’s disease)\(^{13-15}\), it is concluded that the presence of somatostatin receptors in these cells is responsible for octreotide uptake. This is supported by in vitro and in vivo studies on the effect of somatostatin on the thyroid gland. Ahren et al.\(^{15}\) found a blocking effect of somatostatin after systemic administration of thyroid hormones induced by injection of TSH in humans. An inhibiting effect (being more pronounced in neoplastic thyroid tissue) of somatostatin on basal and TSH-stimulated adenylate cyclase activity in normal and neoplastic thyroid tissue was reported by Sipersstein et al.\(^{15}\). In experimental studies it was shown that somatostatin inhibits the growth of thyroid cells\(^{11}\), DNA synthesis in thyroid cells\(^{15}\), and the proliferation of thyroid cell lines\(^{15}\). However, Hoelting et al.\(^{14}\) reported that octreotide has a stimulatory effect at low concentrations and an inhibitory effect at high concentrations regarding the growth and invasion of follicular thyroid cell lines. This was not observed in animals.

Recently, high expression of mRNA for the somatostatin receptor subtype 3 (SSTR3) and SSTR5 and weak expression of mRNA for SSTR1 and SSTR2 was reported in normal thyroid tissue\(^{15}\). Although the expression of mRNA of SSTR does not always accurately reflect the level or the presence of the SSTR in thyroid cells, the positive uptake of octreotide in benign and malignant thyroid tissues indicates the presence of SSTRs in thyroid cells. Additionally, it may be possible that octreotide uptake in activated lymphocyte infiltration does contribute to the octreotide uptake in differentiated thyroid carcinoma, autoimmune thyroiditis and Grave’s disease. In Hurthle cell carcinoma, mainly the SSTR2 expression, and in follicular adenoma, papillary and follicular thyroid carcinoma, SSTR1, SSTR3, SSTR4 and SSTR5 expression was found\(^{14}\). In normal parafollicular C-cells and medullary thyroid carcinoma, all subtypes of somatostatin receptors were found\(^{11}\). Tisel et al.\(^{11}\) reported on the positive uptake of \(^{111}\)In-pentetreotide in six patients with Hurthle cell lesion presenting with a cold thyroid nodule by cold\(^{99mTc}\)-pertechnetate scintigraphy. In two patients thyroidectomized previously because of Hurthle cell carcinoma, they found positive uptake of \(^{111}\)In-pentetreotide in pulmonary metastases being negative in the I-131 scan.

The somatostatin receptor subtypes SSTR2—which has the highest affinity to octreotide—SSTR3 and SSTR5 are the target receptors for octreotide. Since the follicular thyroid cells express mainly SSTR3, and SSTR5 subtypes, it may be concluded that these two subtypes are responsible for the uptake of \(^{111}\)In-pentetreotide in our case with follicular adenoma. Adding a 48h planar image might contribute to the differential diagnosis of benign or malignant lesion, as in the present adenoma the uptake decreased after 48 hours.

ACKNOWLEDGEMENT

Dr. M. Yüksel was supported by a grand of TUBITAK-DFG (Scientific and Technical Research Council of Turkey-Deutsche Forschungs-gemeinschaft).

REFERENCES


