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SHORT COMMUNICATION

Fortuitous discovery of non-fluorocholine-fixing papillary carcinoma of vesicular variant of the thyroid

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Abstract

Purpose Characterization of thyroid nodules is crucial to propose surgical intervention for histological verification. Cervical ultrasound potentially combined with fine needle aspiration is recommended, and fluorocholine positron emission tomography (FCH-PET), commonly used in prostatic cancers, has been evaluated in the diagnosis of thyroid cancers in recent publications.

Methods We present two cases of patients with multinodular thyroid and primary hyperparathyroidism. The preoperative assessment consisted of an ultrasound, a MIBI scintigraphy and an FCH-PET in favor of a parathyroid adenoma.

Results The imaging examinations pointed to a diagnosis of a parathyroid adenoma. In both cases, papillary thyroid carcinoma, missed by FCH-PET, was discovered incidentally at a distance from the parathyroid adenoma during the surgical procedure.

Conclusions These are the first descriptions of thyroid papillary carcinoma without preoperative FCH-PET identification. These clinical cases are contrary to recent publications showing a benefit of this examination in the diagnosis of thyroid cancers.

Keywords ^{18}F-Choline PET-CT · Differentiated thyroid cancer · PET-CT · Papillary thyroid carcinoma · Thyroid incidentaloma

Purpose

Very few recent publications have discussed a growing role of ^{18}F-fluorocholine positron emission tomography (^{18}F-FCH PET/CT) in detecting occult thyroid carcinoma. This incidental finding gave a hope for a new modality to differentiate between benign and malignant thyroid tumors. This is particularly important as statistics have shown an increasing number of thyroid cancers diagnosed in their early stages thanks to sophisticated imaging modalities [1, 2].

Despite the fact that cervical ultrasound and fine needle aspiration remain the reference tests in diagnosing thyroid cancer [3], the need for less invasive technique is rising substantially in all the fields of medicine and of course when dealing with such nodules in the thyroid.

^{18}F-FCH PET/CT is commonly used in monitoring prostate carcinomas. It reflects lipid metabolism, principally the turnover of cell membranes, and is very sensitive in detecting cancerous tissue of prostatic origin. ^{18}F-FCH PET/CT is not specific to prostatic tumors and FCH uptake may correspond to other primary cancers or inflammatory lesions [4].

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Some incidental findings were published in literature describing a fixating phenomenon of fluorocholine on papillary thyroid carcinoma nodules [5–13]. In this piece of work, we describe two cases to emphasize that clinicians should be cautious when using ^{18}F-FCH PET/CT as a diagnostic modality for thyroid malignant nodules.

Patients

A 62-year-old woman was referred to the ENT outpatient clinic by her endocrinologist for a suspected primary hyperparathyroidism. Her blood investigations were the following: parathyroid hormone level of 145 pg/ml; a corrected calcium level of 2.75 mmol/l with no abnormalities in the rest of the blood test. Three imaging examinations were performed. An ultrasound revealed a multi-nodular thyroid with a dominant upper right pole nodule being 22 mm and TIRADS 4A score (Fig. 1) as well as a hypoechoic nodule, sized 19 mm and located at the lower right pole of the thyroid, compatible with a parathyroid adenoma. The second modality, a MIBI scintigraphy, showed no suspected fixation, while the third modality, using an ^{18}F-FCH PET/CT, showed correspondingly no thyroid pathology. However, the CT scan images of the ^{18}F-FCH PET/CT revealed a hypermetabolic extra-thyroid focus located in the right inferior pole compatible with a parathyroid adenoma.

Initially, right hemi-thyroidectomy combined with right lower parathyroidectomy was performed and sent for fresh frozen section (FFS) which revealed highly suspicious nodule carcinoma with capsular rupture. Consequently, a total thyroidectomy was performed. The final histopathological findings confirmed the adenomatous nature of the resected parathyroid as well as a carcinomatous nature of the upper right polar thyroid nodule. Precisely, the resected tumor consisted of a 9 mm-long axis papillary carcinoma with follicular and focal papillary architecture, infiltrating the thyroid capsule without lymphatic or vascular embolism. Due to the suspicious nature of the nodule preoperatively, right VIA and B level lymph node excision was performed, revealing a millimetric-level VIB micro-metastasis without capsular rupture (Fig. 2). The surgical follow-up was unremarkable.

A second patient, a 66-year-old, non-insulin-dependent diabetic patient presented with a primary hyperparathyroidism associated with chronic hypercalcemia treated with cinacalcet. Parathyroid hormone level was = 263 pg/mL. Three imaging examinations were performed: (1) ultrasound found a voluminous right lobar nodule (55 mm long axis), classified as TIRADS III; (2) a MIBI scintigraphy located an extra-thyroid nodule (14 mm on long axis) in the upper right pole, compatible with a parathyroid adenoma, and an overactive MIBI composition of the voluminous right thyroid nodule; and (3) an ^{18}F-FCH PET/CT revealed a hypermetabolic extra-thyroid nodule (13 mm long axis) near the upper right pole, superimposable on the MIBI scintigraphy image (Fig. 3).

The intervention consisted of a right hemithyroidectomy associated with an upper right parathyroid adenoma

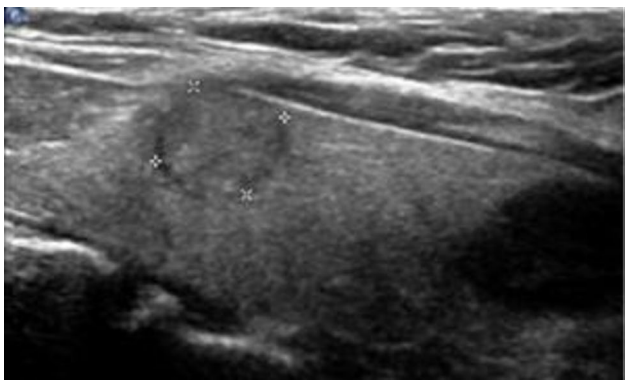

Fig. 1 Cervical ultrasound of a 62-year-old woman. Lobar superior right thyroid nodule TIRADS IVA

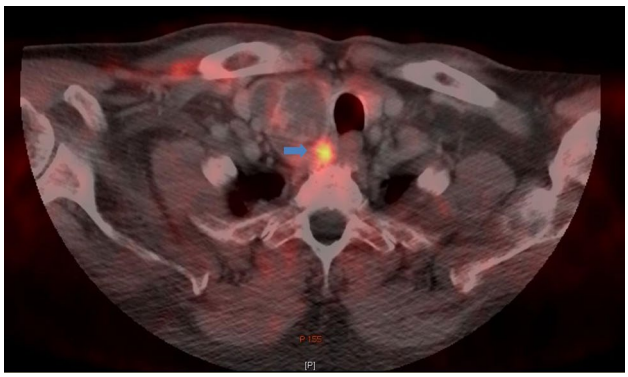

Fig. 2 FCH-PET axial view of a 66-year-old male. Hyperfixation of fluorocholine in the upper right parathyroid gland indicated with arrow

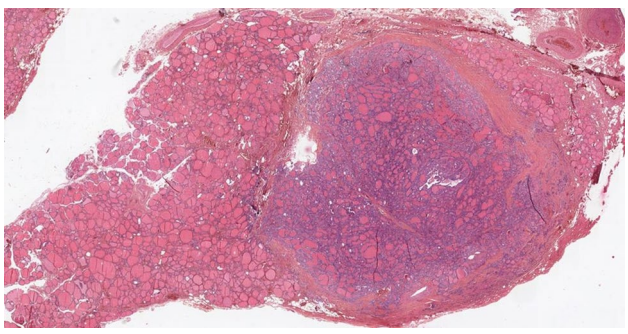

Fig. 3 Histological section of thyroid papillary carcinoma of vesicular and highly focal papillary architecture, infiltrating the capsule in a 66-year-old man

excision. The histological examination confirmed: (1) the adenomatous nature of the parathyroid; (2) the benign nature of the voluminous right lobar nodule. Histological examination confirmed the presence of a second nodule in the medial side of the thyloid lobe of 9 mm, which was not described on ultrasound. It was characterized as a microcarcinoma of mixed papillary and follicular architecture, 9 mm long, encapsulated, without emboli or extra-thyroid extension.

Discussion

As discussed previously, the ^{18}F-FCH PET/CT scan is used routinely in monitoring prostate carcinomas. Incidental thyroid fixations have been demonstrated in few cases that raised some discussion of its use as an imaging option to diagnose thyroid cancers. ^{18}F-FCH PET/CT is an approved imaging test to localize precisely the parathyroid adenomas, especially in cases where adenoma identification by cervical ultrasound and MIBI scintigraphy is impossible [4]. However, its place in the assessment of nodular dystrophies or thyroid cancers is not yet clearly defined.

The most recent publications describe fluorocholine uptake in thyroid cancer (which suggests high sensitivity), but also uptake corresponding to benign nodules (suggesting low specificity) [5–13]. Lalire et al. presented a case of an incidental finding of two fluorocholine-fixing thyroid nodules, corresponding to a papillary carcinoma and a medullary carcinoma of the thyroid confirmed by histological examination [5]. Likewise, Thanseer et al. published an article comparing the efficiency of ultrasound, MIBI scintigraphy and ^{18}F-FCH PET/CT imaging in the preoperative localization of parathyroid lesions in 54 patients with primary hyperparathyroidism and accidentally discovered one case of papillary thyroid carcinoma hypermetabolic on ^{18}F-FCH PET/CT [6].

Hodolics et al. found a 1.9% of unexpected uptake in the the head and neck region (incidentalomas) on an ^{18}F-FCH PET/CT performed for prostate cancer on a retrospective multicenter series. Among these cases, two cases of thyroid fixation were examined and histological verification was performed, confirming one case of thyroid papillary carcinoma and one case of thyroid adenoma [7]. In addition, Eccles et al. inadvertently identified one case of thyroid papillary cancer [8] and one case of lymphoma in the follow-up of a patient with prostate cancer [9].

Four additional studies also revealed abnormalities of thyroid fixation in prostate cancer follow-up, but these finally were all characterized as benign thyroid nodules [10–13].

These different publications show an abnormal uptake of the choline tracer by thyroid cancers. In this case report we present the first observation of a couple of cases of thyroid cancer that were not uptaking fluorocholine. These cases suggest that the sensitivity of ^{18}F-FCH PET/CT to diagnose thyroid cancers is not completely reliable as a precise diagnostic tool compared to what has been published previously.

The observation in this presented study suggest that carcinomatous tissues' uptake of fluorocholine requires cautious interpretation. This could be due to relatively small-sized carcinomas (9 mm-long axis in both cases). However, the diagnostic sensitivity of ^{18}F-FCH PET/CT is within the limits of the latest generation PET system used (> 4 mm). The presence of an adjacent parathyroid adenoma competing for the tracer may be a possible cause of impairment of carcinomatous uptake. However, in our observation, the distance between the neoplastic tissue and the parathyroid tissue was greater than 4 mm, making this hypothesis unlikely. Finally, the histological nature of carcinoma in the second patient may have played a role in the fixation of fluorocholine. Follicular variants of papillary carcinomas have never been described to fix the tracer. It is possible that this subtype, considered to be a non-aggressive carcinoma, does not fix fluorocholine, unlike the other forms. However, the first patient presented an aggressive form of this type of cancer with a thyroid capsular invasion and a ganglionic micrometastasis, which should have responded well to this marker.

Conclusion

The role of ^{18}F-FCH PET/CT in the diagnosis of thyroid cancers remains questionable, particularly in cases that present uncertain ultrasound characterization. Not only being expensive and irradiating as an imaging tool, it has a low specificity in identifying such malignant tissues according to our findings. To the best of our knowledge, we have not found any published case of thyroid cancer missed by ^{18}F-FCH PET/CT.

Further observations with large number of similar cases should be studied and published to propose for sure a certain role of ^{18}F-FCH PET/CT as a diagnostic imaging alternative for thyroid carcinoma.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

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