

## Clinical note

Unusual  $^{18}\text{F}$ -FDG PET/CT finding of an oxyphil parathyroid adenoma in a patient with Hodgkin's Lymphoma

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## ABSTRACT

Malignancy-associated hypercalcemia is a complication of advanced tumours that is associated to a poor prognosis. Thorough evaluation to establish its cause is essential because some patients may actually have undiagnosed primary hyperparathyroidism.

We report a case of a patient affected by Hodgkin's Lymphoma and persistent hypercalcemia with an incidental  $^{18}\text{F}$ -FDG PET/CT finding in the anterior neck region, not ascribable to malignancy, confirmed with  $^{99\text{m}}\text{Tc}$ -sestamibi scintigraphy. It was removed by minimally invasive surgery. It was shown to be an oxyphil parathyroid adenoma localized in an unusual site.

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Hallazgo casual  $^{18}\text{F}$ -FDG PET/TC de adenoma de paratiroides oxifílico en paciente con linfoma de Hodgkin

## RESUMEN

La hipercalcemia es una complicación de tumores avanzados y se asocia a un mal pronóstico. Llevar a cabo una evaluación para establecer la causa es esencial dado que algunos pacientes oncológicos pueden presentar hipercalcemia por hiperparatiroidismo primario no diagnosticado.

Se describe el caso de un paciente con linfoma de Hodgkin y con hipercalcemia persistente en el cual un estudio  $^{18}\text{F}$ -FDG PET/TC mostró una lesión en la región anterior del cuello, no atribuible a la neoplasia inicial, confirmada por  $^{99\text{m}}\text{Tc}$ -sestamibi y resecaada con cirugía mínimamente invasiva. Era un adenoma oxifílico de paratiroides de localización ectópica.

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## Palabras clave:

$^{18}\text{F}$ -FDG PET/TC

Linfoma de Hodgkin

Hipercalcemia

Adenoma de paratiroides

Oxifílico

## Introduction

Malignancy and primary hyperparathyroidism (PHPT) are the most common causes of hypercalcemia, accounting for more than 90% of cases.

So-called "humoral hypercalcemia" is a common complication of malignancy caused by a heterogeneous group of tumour-derived factors that break normal calcium homeostasis. It occurs in up to 20% of cancer patients, most often in metastatic breast cancer, lung cancer and multiple myeloma.<sup>1</sup> Less frequently, hypercalcemia may be associated with Hodgkin's lymphoma (HL) and non Hodgkin lymphoma (NHL), presenting in 5% and 15% of patients respectively, with a calcitriol-mediated hypercalcemia.<sup>2</sup> The

development of this malignancy complication is often associated with a poor prognosis.

On the other hand, increased serum calcium levels are also detected in patients with PHPT, a benign disease with a relatively favourable course, due to a single parathyroid adenoma in 80–85% of cases.<sup>3</sup> It has an ectopic localization in 4–20% of cases<sup>4</sup> and the functioning oxyphil histological form is uncommon.<sup>5</sup>

The role of  $^{18}\text{F}$ -fluorodeoxyglucose positron emission tomography/computed tomography ( $^{18}\text{F}$ -FDG PET/CT) in identifying malignant disease is well established, while it is not a routine diagnostic tool in the detection and localization of hyperfunctioning parathyroid adenomas.

We report a case of a patient affected by HL and persistent hypercalcemia with an incidental  $^{18}\text{F}$ -FDG PET/CT finding in the anterior neck region, confirmed with  $^{99\text{m}}\text{Tc}$ -sestamibi scintigraphy and removed by minimally invasive radioguided parathyroidectomy (MIRP). It was shown to be an oxyphil parathyroid adenoma localized in an ectopic site. The combination of the  $^{18}\text{F}$ -FDG PET/CT finding, clinical history, laboratory tests, unusual site, histological form and radioguided surgical treatment, make this case report

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relevant, as it may contribute to a better management of complex situations and to avoid diagnostic pitfalls.

### Clinical case

A 38-year-old male patient was referred to Nuclear Medicine Department to perform staging  $^{18}\text{F}$ -FDG PET/CT for a HL diagnosed by left axillary lymph node biopsy. He reported a history of fever over the previous two months, with unexplained weight loss and presented rapidly growing, painless swelling of the left axillary lymph nodes. Biochemical studies showed: haemoglobin: 8.8 g/dL, total leukocyte count:  $2.5 \times 10^3/\text{mm}^3$ , platelet count:  $18.3 \times 10^3/\text{mm}^3$ , lactate dehydrogenase: 621 IU/L (normal range: 105–333), total calcium: 13.8 mg/dl (normal range: 8.5–10.5) and phosphorus levels: 2.2 mg/dl (normal range: 2.5–4.9).

$^{18}\text{F}$ -FDG PET/CT images were acquired using a Discovery STE scanner (GE Healthcare, Waukesha, WI, USA). One hour after the injection of  $^{18}\text{F}$ -FDG (4.6 MBq/kg), a non-contrast CT scan and subsequent emission scan (2.5 min/bed, 3D mode) were obtained from the root of the thighs to the base of the skull. The attenuation-corrected  $^{18}\text{F}$ -FDG PET/CT images demonstrated radiopharmaceutical uptake in the left paratracheal site, and in the ipsilateral axillary and intrapectoral lymph nodes (Fig. 1A). No bone lesions were found.

After 3 months of chemotherapy, he performed an interim  $^{18}\text{F}$ -FDG PET/CT that showed the persistence of radiopharmaceutical uptake in the left paratracheal site (SUV max 10.5). The previously observed lymph nodes  $^{18}\text{F}$ -FDG uptake was no longer present (Fig. 1B and C).

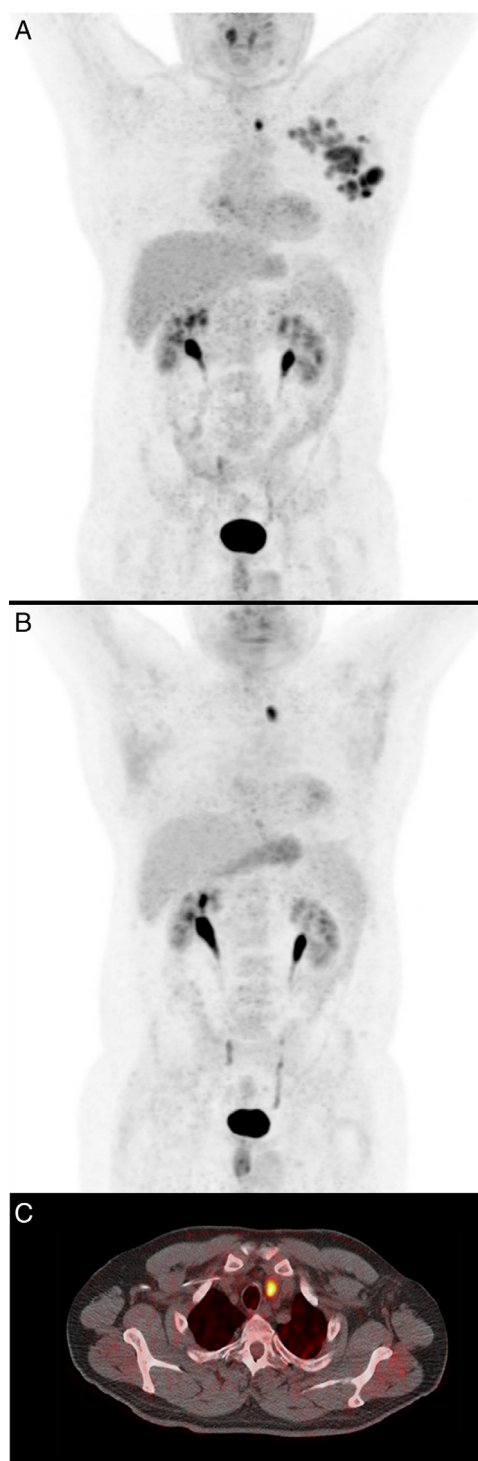
Due to excessive asthenia, the onset of widespread bone pain, nausea and dyspepsia, as well as the persistence of high serum calcium levels with low phosphorus levels, serum intact PTH (iPTH) was assayed, showing an abnormal value of 78 pg/ml (normal range: 10–65). Based on clinical and laboratory data and with the support of the  $^{18}\text{F}$ -FDG PET/CT findings, a PHPT was suspected.

The patient underwent neck ultrasonography that revealed an oval shaped mass (18 mm  $\times$  20 mm) with a hypoechoic echostructure located under the left thyroid lobe.

Subsequently, the patient consulted a specialist for parathyroid surgery, which brought him to our attention to complete the functional evaluation. Dual-phase parathyroid scintigraphy was performed using a gamma camera Infinia (GE Healthcare, Milwaukee, WI, USA), LEHR collimator, 140 keV, 256  $\times$  256 matrix (including the mediastinum in the field-of-view). 740 MBq of  $^{99\text{m}}\text{Tc}$ -sestamibi were injected intravenously and two static planar images of the neck were acquired: the “early” one at 20 min and the “late” one at 2 h after the injection. A focal area of intense  $^{99\text{m}}\text{Tc}$ -sestamibi uptake below the inferior pole of the left thyroid lobe, in the upper mediastinum, in the left medial position, was observed, suggestive of an ectopic parathyroid adenoma. A vector profile was applied on the images,<sup>6</sup> to improve the anatomical adenoma localization and facilitate interpretation of the images (Fig. 2A and B).

Due to the diagnostic suspicion, surgical workup was advised and carried out performing treatment by MIRP. One hour after the injection of 50 MBq of  $^{99\text{m}}\text{Tc}$ -sestamibi, the patient was transferred to the surgery room where, using a gamma probe (MR-100, 11C, Pol.hi.tech), the surgeon was directly guided to identify the parathyroid adenoma (“in vivo”: 46 counts/s), localized behind the trachea above the aortic arch, surrounded by residual thymus tissue. The gamma probe was also used to control the radical excision of the adenoma by measuring the radioactivity on the surgery bed (“background”: 12.5 counts/s).

Histological examination of the removed gland revealed an oxyphil parathyroid adenoma, which presented as an oval shaped,



**Figure 1.** (A) Staging  $^{18}\text{F}$ -FDG PET/CT (Maximum Intensity Projection, MIP image) shows pathological uptake in the left paratracheal site, in the ipsilateral axillary and intrapectoral lymph nodes. (B, C) Interim  $^{18}\text{F}$ -FDG PET/CT (coronal MIP image and axial slice of fusion PET/CT) shows no radiopharmaceutical uptake in the left axillary and intrapectoral lymph nodes but a focal area of pathological uptake in the left paratracheal site persisted (SUV max 10.5).

hard and encapsulated mass, maximum diameter of 2 cm and weighing 6.15 g (Fig. 2C).

Recovery was uneventful and the patient was discharged 24 h after MIRP. During the following months, iPTH, calcium and phosphorus levels remained constantly within the normal range and

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