

## Clinical note

Radioguided hepatic resection with L-DOPA in metastatic medullary thyroid carcinoma<sup>☆</sup>

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## ABSTRACT

**Introduction:** Medullary carcinoma accounts for 1–2% of all thyroid malignancies. 13–20% of patients present with distant metastasis, with 45% of the cases affecting the liver.

**Presentation of case:** A 50-year-old woman, diagnosed with medullary thyroid cancer, was treated with total thyroidectomy and a modified neck dissection in 1999. Two lymph node recurrences in the neck were treated with surgical resection; during surveillance, she developed elevated calcitonin levels, the recurrence site was identified with <sup>18</sup>F-FDOPA PET/CT in the liver. Metabolic activity was not associated with a visible lesion in CT, MRI nor ultrasound. Radioguided surgery with L-DOPA allowed an anatomic resection of segments IVb and V.

**Discussion:** In patients with medullary carcinoma and elevated calcitonin during surveillance, <sup>18</sup>F-FDOPA PET/CT is an option to evaluate the site of recurrence. Radioguided resection was feasible in this patient, whose hepatic recurrence was not visible with any other imaging method.

**Conclusion:** Radioguided hepatic resection with L-DOPA in metastatic medullary thyroid carcinoma is feasible when the recurrence site is not anatomically identified by any other imaging studies.

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## Resección hepática radioguiada con L-dopa en el cáncer de tiroides medular metastásico

## RESUMEN

**Introducción:** El carcinoma medular representa el 1-2% de todas las neoplasias tiroideas malignas. El 13-20% de los pacientes presentan metástasis a distancia, afectando al hígado en el 45% de los casos.

**Presentación De Un Caso:** Una mujer de 50 años de edad, diagnosticada de cáncer tiroideo medular, fue sometida a tiroidectomía total y disección del cuello modificada en 1999. Se trataron con resección quirúrgica dos recidivas ganglionares en el cuello; durante el periodo de vigilancia, la paciente desarrolló niveles elevados de calcitonina, identificándose la localización de la recidiva en el hígado mediante PET/TC con <sup>18</sup>F-FDOPA. La actividad metabólica no se asoció a lesión visible en TC, RM y ecografía. La cirugía radioguiada con L-DOPA permitió la resección anatómica de los segmentos IVb y V.

**Discusión:** En pacientes con carcinoma medular y elevación de calcitonina durante el periodo de vigilancia, PET/TC con <sup>18</sup>F-FDOPA es una opción para evaluar la localización de la recidiva. La resección radioguiada fue posible en esta paciente, cuya recidiva hepática no resultó visible con ningún otro método de imagen.

**Conclusión:** La resección hepática radioguiada con L-DOPA en el cáncer de tiroides medular metastásico es factible cuando la localización de la recidiva no puede identificarse anatómicamente mediante otros estudios de imagen.

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## Introduction

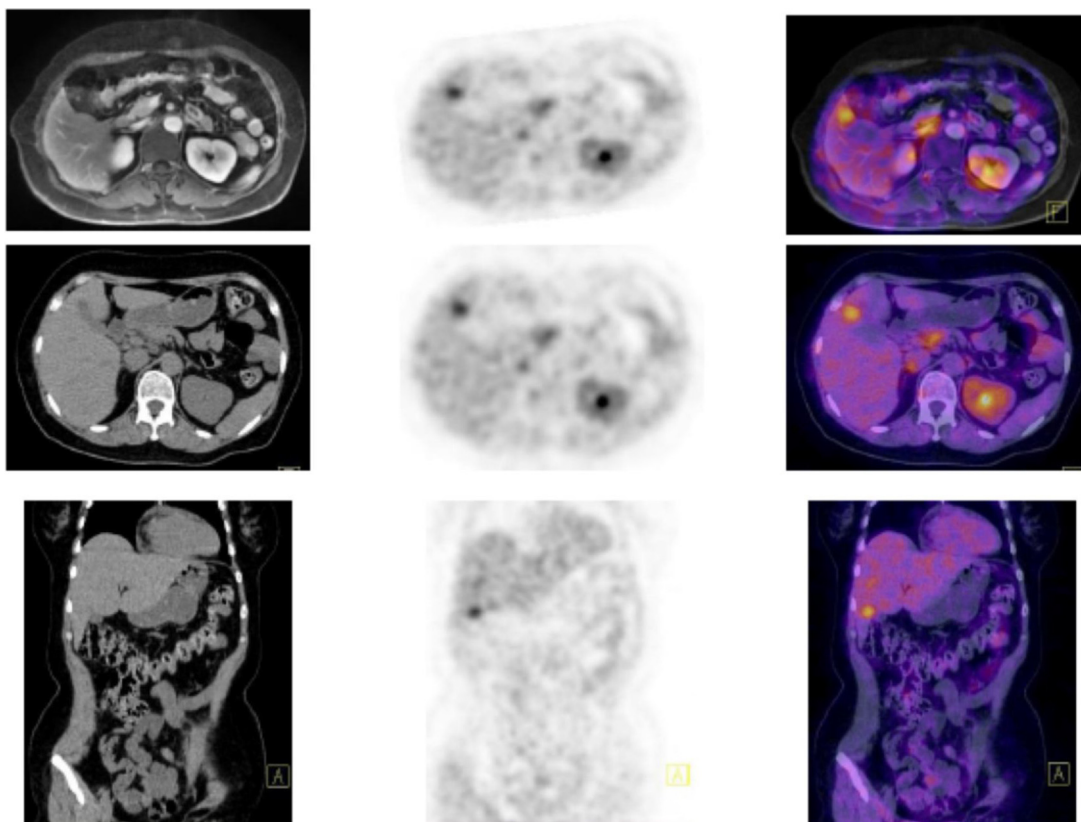
Medullary thyroid carcinoma (MTC) accounts for 1–2% of all thyroid neoplasms. It originates from the parafollicular cells: the

early ultimobranchial body develops from the pharyngeal endoderm and is subsequently invaded by neural crest cells, forming the mature structure. The ultimobranchial body, in turn gives rise to the parafollicular cells.<sup>1,2</sup> The usual sites of metastasis are the liver, lungs, and bones. Liver metastases occur in about 45% of patients with MTC.<sup>3,4</sup> MTC may present in the hereditary or sporadic variants. The first represents 25–30% of the cases, and the latter is more frequent, reaching 70–75%. The hereditary presentation is part of type 2 multiple endocrine neoplasia (MEN-2). PET/CT with <sup>18</sup>F-FDOPA has better sensitivity and specificity in patients with high serum calcitonin levels.<sup>1,9</sup>

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**Fig. 1.** Upper left image: Axial MRI in T1 with contrast did not show liver lesions. Middle images:  $^{18}\text{F}$ -FDOPA showed abnormal focal uptake in the liver. Upper right image:  $^{18}\text{F}$ -DOPA PET/MRI axial images showed abnormal uptake in adjacent to gallbladder. Middle and inferior left images: Axial and coronal CT images of the liver without contrast did not show liver lesions. Middle and inferior right images:  $^{18}\text{F}$ -FDOPA PET/CT axial and coronal slices showed abnormal uptake adjacent to the gallbladder, excluding uptake in the gallbladder (in some patients it is the elimination pathway, and may represent a pitfall).

Surgery is the treatment of choice in patients with total thyroidectomy and complete resection of the neck disease, and represents the only possibility of cure for MTC. Regional lymph-node disease and distant metastases has an impact on the prognosis (13–20%).<sup>8,9</sup>

The goal in patients with distant metastatic disease is to treat the symptoms, and control all measurable disease. Surgical resection or radiofrequency ablation (RFA) are considered in patients with isolated hepatic metastases.<sup>1,8,9</sup> Around 13% of cases present with metastatic disease at diagnosis, the overall 10-year survival at this stage being 40%.<sup>10</sup>

### Case report

We report the case of a 50-year-old woman without prior relevant medical history. In 1999 she was diagnosed with medullary thyroid cancer, and treated with total thyroidectomy and a left selective neck dissection including levels II, III and IV. Histologic analyses showed 12/58 metastatic lymph nodes. She relapsed in 2000, and a central neck dissection including level VII was performed; 1/17 lymph nodes with medullary thyroid metastases were found. External beam radiation therapy was given to a total dose of 60 Gy to the mediastinum. Then in 2008 during follow up, a PET/CT and a MIBI scan showed tumoral activity in the right neck, level III. With these findings a level I–III right selective neck dissection was performed. However, no disease was found in the histologic assessment. In 2010, a PET showed an abnormal parathyroid lymph node, and tumor resection was performed.

After five years in remission, the calcitonin level elevated to 743, and CEA was 35.7. A  $^{18}\text{F}$ -DOPA PET/CT scan showed tumoral activity in the liver in segment IVb (17 mm × 12 mm; SUVmax 3.2) and segment V (17 mm × 14 mm; SUVmax 4.9). However, no

anatomic lesion was seen in CT, MRI or in the intraoperative ultrasound (Figs. 1 and 2). After multidisciplinary review, the patient was programmed for radioguided surgery and anatomic resection including segments IVb and V (Figs. 3–5). The final histopathological report showed medullary carcinoma in the hepatic parenchyma and in a periportal lymph node (Fig. 3). She was discharged on post-operative day 6. No systemic treatment was administered, and she is now under surveillance.

### Imaging protocol

The patient was injected with 135 MBq (5 mCi) of  $^{18}\text{F}$ -DOPA 2 h prior to the surgical procedure. PET/CT (mCT LSO; Siemens®, Erlangen, Germany) was performed 1 h after intravenous administration of the radiotracer with previous oral administration of carbidopa. A low-dose helical CT transmission scan [pitch 0.8, 50 mAs, 120 kV (peak)] was performed. PET image acquisition started at a mean time of 59 min after tracer injection. PET was then performed with 2 min per bed position at a sufficient number of bed positions to cover the anatomic regions from the top of the head to the feet. Raw CT data were reconstructed into 5-mm thick sections of transverse images, and reformatted sagittal and coronal CT images were generated. CT-based attenuation-corrected PET images were reconstructed and visualized on a high-resolution colored monitor. PET and CT images could be viewed on a continuous fusion scale from PET only to CT only images using image fusion software (Syngo by Siemens®).

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