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DOI:
10.1016/S2213-8587(16)30311-4

Citation for published version (APA):

Published in:
The Lancet Diabetes and Endocrinology

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Localisation of an occult thyrotropinoma with $^{11}$C-Methionine PET-CT before and after somatostatin analogue therapy

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Abbreviated title: Detection of occult TSHoma with $^{11}$C-Methionine PET

Key words: $^{11}$C-Methionine PET, pituitary, TSHoma

Word Count: text 298; figure 1.
A 75-year-old woman presented with tiredness, palpitations and enlargement of a longstanding goitre. Unexpectedly, thyrotropin (TSH) was not suppressed [6.3 mU/L; reference range (RR) 0.35–5.5] despite markedly raised thyroid hormones [free thyroxine (FT4) 89.1 pmol/L (RR 10–19.8); free triiodothyronine (FT3) 11.7 pmol/L (RR 3.0–6.5)]. Following exclusion of laboratory assay interference, a thyrotropin-releasing hormone (TRH) test showed an attenuated response (TSH 0 minutes 6.1 mU/L, 20 minutes 6.8 mU/L, 60 minutes 8.5 mU/L), raising suspicion of a thyrotropinoma (TSHoma). However, pituitary MRI was reported as normal. The patient was referred for further evaluation. On repeat MRI the pituitary gland was noted to show mild asymmetry (right>left) (figure A). Functional imaging with 11C-Methionine PET-CT (Met-PET) demonstrated intense tracer uptake (denoting active peptide synthesis) on the right side of the sella (figure A – red ‘hot spot’). Treatment with depot somatostatin analogue (SSA) led to resolution of symptoms and normalization of thyroid function (TSH 0.6 mU/L, FT4 12.5 pmol/L, FT3 3.8 pmol/L).

Repeat Met-PET showed absence of the right-sided focal ‘hot spot’ (figure B). Fourteen months into treatment, the patient developed hypoglycaemic episodes, which resolved following discontinuation of SSA. However, thyrotoxicosis recurred (TSH 4.3 mU/L, FT4 38.1 pmol/L, FT3 11.6 pmol/L), and repeat Met-PET revealed reappearance of the right-sided ‘hot spot’ (figure C). At pituitary surgery a micro-TSHoma was resected from the right side of the gland (figure D). The patient remains in clinical and biochemical remission 14 months post-surgery and is eutopituitary.

To our knowledge, this is the first example of a microTSHoma being unmasked by functional imaging before and after endocrine manipulation (in this case SSA therapy). As MRI does not reliably detect all pituitary microadenomas (e.g. Cushing’s; microprolactinoma), we believe this novel ‘endocrine switch’ approach could find wider application in the management of such occult tumours.
Contributors

OK, PE and MG collected the data. All authors contributed to the writing of the report. OK, AH and MG performed the image analysis. NA and HC interpreted the imaging studies. KA reviewed the histopathology. ND & RJM performed the surgical procedure.

The patient gave her written informed consent for publication of this case report.

Declaration of interest

OK and MG are supported by an unconditional award from Ipsen Ltd.

Figure legend

Figure: Imaging and histopathological findings

(A) SE (Spin Echo) MRI (top panel) and $^{11}$C-methionine PET-CT co-registered with SPGR (Spoiled Gradient Recalled Acquisition) MRI (bottom panel) at presentation. Repeat imaging (B) during, and (C) following discontinuation of, SSA therapy. (D) Microscopic appearance (top panel) and positive TSH immunohistochemistry (bottom panel) of resected adenoma.
Prior to somatostatin analogue

On somatostatin analogue

Off somatostatin analogue

Fig. 1 Koulouri et al