The value of $^{18}$FDG-PET for localization of ectopic Cushing’s syndrome due to occult bronchial carcinoid

Utilidad del PET-FDG$^{18}$ en la búsqueda del sindrome de Cushing ectópico por carciinoide bronquial oculto

Ectopic secretion (ES) of adrenocorticotropic hormone (ACTH) occurs in approximately 10% of patients with ACTH-dependent Cushing’s syndrome. Approximately 50% of cases are caused by intrathoracic tumors, most of which are small bronchial carcinoids (BCs) which are very difficult to locate and which are only found after years of search. Imaging techniques routinely used for BC localization include computed tomography (CT), magnetic resonance imaging (MRI), scans using somatostatin receptor analogues (OctreoScan®) and positron emission tomography with fluorodeoxyglucose ($^{18}$FDG-PET), which is far less widely used.

We report a case where BC was located using the latter procedure 6 years after its presentation.

A 27-year-old female patient with an unremarkable personal and family history consulted in 2001 for hirsutism and acne over the previous 6 months. A physical examination revealed a moon face, abdominal striae, central obesity, and muscle atrophy with proximal weakness, all of these signs suggesting hypercortisolism. Supplemental tests showed hyponatremia (2.7 mEq/L), high urinary cortisol levels (947 and 19,746 mcg/24h), an absence of plasma cortisol inhibition (17 mcg/dL) after dexamethasone 1mg in the evening, a paradoxical response of plasma cortisol after the administration of dexamethasone 8mg as a single evening dose (33 mcg/dL), and high ACTH levels (57 and 88 pg/mL). Pituitary MRI revealed no lesion, and catheterization of petrosal sinuses showed no gradient. Based on these findings, an ACTH-dependent ectopic Cushing’s syndrome (ECS) was considered as the most probable diagnosis. However, both the chest X-rays and pulmonary CT and OctreoScan® were normal. An abdominal CT scan only showed bilateral adrenal hyperplasia. Because of the severe clinical signs of the patient and the impossibility of detecting the origin of the condition, treatment was started with ketoconazole at increasing doses because of persistent poor control. Multiple radiographic examinations (planar OctreoScan®, CT and MRI of chest and abdomen, PET, vaginal US) were periodically performed, always with normal results. Three years later, after rejecting ketoconazole treatment (urinary cortisol 934 and 1321 mcg/24h with ketoconazole 600mg/day), laparoscopic bilateral adrenalectomy was performed, resulting in decreased urinary cortisol levels (538–611 mcg/24h) and ACTH levels ranging from 266 to 491 pg/mL. Finally, in 2007, a $^{18}$FDG-PET scan (Fig. 1) showed a pathological 1.5 cm deposit in the hilar region of the left lung, which was confirmed by a subsequent OctreoScan-SPECT (Fig. 2). CT and MRI (in STIR sequence) detected this

![Figure 1](image_url) Coronal plane of $^{18}$FDG-PET showing hyperuptake by a small pathological focus, 1.5 cm in size, in the left hilar region (arrow) with physiological tracing throughout the rest of the body.
same infrahilar, low uptake, a hyperintense 1-cm nodule suggesting a carcinoid tumor. Based on these findings, a left inferior lobectomy was performed which confirmed
the presence of an atypical 1.1-cm BC and a hilar adenopa-
thy with immunohistochemistry positive for ACTH. After
surgery, ACTH levels decreased to less than 5 pg/mL. The
patient remains free of disease three years after surgery.

In the past, ES of ACTH was caused in most cases by
small cell lung carcinoma. However, in more recent series BC
has been the leading cause. These tumors often pose seri-
ous diagnostic and localization problems for the following
reasons: (1) due to their slow growth, they induce a clini-
cal picture virtually indistinguishable from CS of a pituitary
origin, (2) laboratory results are equivocal (plasma cortisol
suppression following dexamethasone administration in 50% of
cases), the response to metyrapone, moderate ACTH ele-
vations, and (3) most tumors are small (less than 2 cm in
size), indistinguishable from normal blood vessels, and are
therefore difficult to visualize using conventional imaging
techniques.  

Imaging techniques routinely used for ECS localization
include CT of the chest and abdomen (with special attention
to lungs) and MRI. However, these techniques do not achieve
diagnosis in 30–50% of cases even after repeated scans over
time, and an OctreoScan® is usually performed. Since the
value of the OctreoScan® depends on the type and degree
of expression of somatostatin receptors, on lesion size and
location, and on the amount of radioactivity taken up by
the lesion, this procedure is not always diagnostic and some
tumors stay hidden. In the reported case, this could have
been due to: (1) the small size of the tumor (although various
studies have reported that this variable does not influence
positivity in an OctreoScan®), (2) the initial inhibition
of somatostatin receptor expression by elevated hypercor-
tisolism, which decreased following adrenalectomy to a
level allowing for receptor expression (although positive
results have been reported in some patients with severe
hypercortisolism)1, or (3) low receptor expression due to
tumor atypia.  

In order to achieve better results, planar OctreoScan®
images should be combined with single-photon emission
computed tomography (SPECT). This has been shown to
clearly improve the sensitivity of planar OctreoScan®. Their
association would therefore be useful in the event of a nor-
mal OctreoScan® when a neuroendocrine tumor is highly
suspected (as occurred in our case) or planar images are
difficult to assess. 

18FDG-PET is an essential procedure in oncology used
for the detection and monitoring of lesions with intense
metabolic activity, high proliferation activity, and which are
usually poorly differentiated. However, since its sensitivity
depends on the metabolic turnover of the tumor (which is
lower in carcinoids and other slowly growing tumors), BCs
have traditionally been considered as 18FDG-PET negative.
The value of 18FDG-PET in these conditions is currently
controversial. Thus, Pacak et al.,2 after analyzing a series of 17
patients with occult ECS (normal MRI/CT), concluded that
18FDG-PET provided no additional information as compared
to conventional tests, as it did not detect any tumor not
previously detected by CT or MRI. By contrast, there are

Figure 2 OctreoScan-SPECT image showing a pathological deposit of radioactive tracer in the hilar region of the left lung (arrow)
with physiological deposit in the rest of the body.
Enteral nutrition for management of diabetic enteropathy: a case report

Nutrición enteral en el manejo de la enteropatía diabética: a propósito de un caso

Autonomic neuropathy with gastrointestinal tract involvement is an underdiagnosed complication of diabetes mellitus. Neuropathy occurs in most patients as gastroparesis with or without associated enteropathy. The usual sign of enteropathy is alternating intestinal rhythm, with constipation predominating over diarrhea, together with normal stools. However, it is estimated that up to 20% of diabetic patients may experience diarrhea as a symptom of intestinal involvement by neuropathy.

We report the case of a 38-year-old female patient with severe diabetic enteropathy. She had been diagnosed with type 1 diabetes at 20 years of age, usually had a poor metabolic control, and had been admitted to hospital several times for hypoglycemic decompensation and diabetic ketoacidosis, secondary in most cases to infection. Chronic complications included mild diabetic retinopathy; advanced diabetic nephropathy with stage IV chronic renal disease and a glomerular filtration rate of 24 mL/min as estimated by MDRD (Modification of Diet in Renal Disease),


References


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