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INTERESTING MEDICAL IMAGE

Adrenocorticotropic Hormone-Secreting, Subcentimetre Lung Carcinoid Identified by ^{68}Gallium-DOTATATE Positron Emission Tomography Scan

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إفراز هرمون القشرة الكظرية من ورم الكارسينويد الرئوي والذي تم تشخيصة بأستخدام التصوير المقطعي بواسطة لنظير المشع جاليوم^{68}

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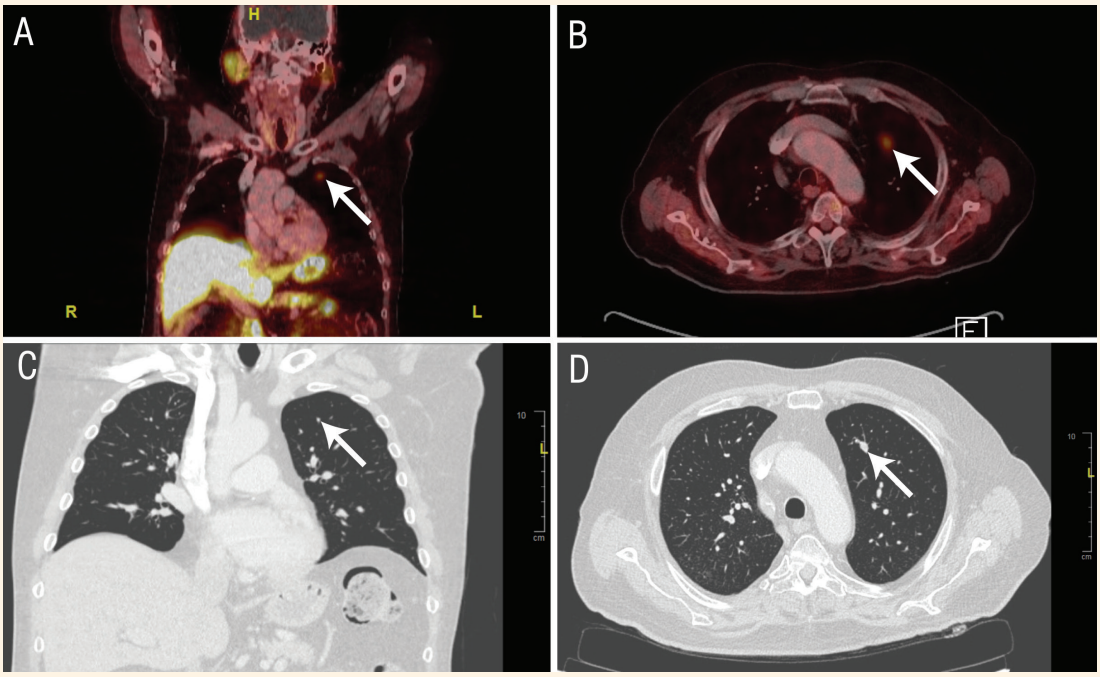

Figure 1: ^{68}Ga-DOTATATE positron emission tomography/computed tomography (PET/CT) with contrast scans of a 64-year-old male patient with ectopic Cushing's syndrome showing the (**A**) coronal and (**B**) axial views of fused DOTATATE PET/CT and (**C**) coronal and (**D**) axial views of chest CT with an abnormal signal in the left upper lung nodule (arrows).

A 64-year-old male patient presented to the endocrine clinic at David Geffen School of Medicine, University of California, Los Angeles, USA, in 2018 with fatigue and weight gain for 1.5 years and bilateral thigh muscle pain and weakness for a few months. He also had hypertension and type-2 diabetes but no known osteoporosis. Physical examination noted Cushingoid features—such as truncal obesity and proximal amyotrophy; therefore, Cushing's syndrome was suspected. He did not take corticosteroids. Levels of 24-hour urinary free cortisol, midnight salivary cortisol, morning cortisol levels after 1 mg dexamethasone and random morning adrenocorticotropic hormone (ACTH) were elevated over multiple measurements [Table 1]. Subsequently, the patient was diagnosed with ACTH-dependent Cushing's syndrome. Pituitary magnetic resonance imaging (MRI) scans showed normal pituitary gland without evidence of

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Table 1: Laboratory investigations of a 64-year-old male patient with ectopic Cushing's syndrome

Investigation	Measurement one	Measurement two	Measurement three	Measurement four	Normal range
24-hour urinary free cortisol levels in μg/day	95.5	198.1	202.9	221.7	≤60
Midnight salivary cortisol levels in μg/dL	0.430	0.736	0.929	-	<0.112
Morning cortisol levels after 1 mg dexamethasone in μg/dL	14	19	-	-	<1.8
Random morning ACTH levels in pg/mL	70	98	99	-	6–59

ACTH = adrenocorticotropic hormone.

pituitary or suprasellar masses. Inferior petrosal sinus sampling demonstrated no lateralisation or central-to-peripheral ACTH gradient before or after corticotropin-releasing hormone administration, suggesting a peripheral source of ACTH secretion. Computed tomography (CT) scans of the neck, chest, abdomen and pelvis for a recent trauma did not identify clear tumours in the lungs, pancreas or other organs. ^{68}Gallium(Ga)-DOTATATE positron emission tomography (PET)/CT scan with contrast showed a 9 × 6 mm, left upper lobe pulmonary nodule with a maximum standardised uptake value of 3 as the only abnormal finding [Figure 1]. The patient underwent left upper lung lobe wedge resection. At 8:00 a.m. on post-operative day 1, ACTH level was 2 pg/ml and cortisol 4 μg/dL; on post-operative day 2, at the same time, ACTH level was 7 pg/ml and cortisol 2 μg/dL, indicating complete remission of ACTH-dependent Cushing's syndrome. Surgical histology revealed a low-grade neuroendocrine tumour which is a typical lung carcinoid without lymph node metastasis. Immunocytochemistry showed a positive expression of ACTH. The patient was treated with hydrocortisone with a plan of gradual dose tapering. He was followed-up for eight months post-operatively. All Cushingoid features, including hypertension and diabetes, disappeared after the tumour resection.

Comment

The current patient had elevated levels of 24-hour urine free cortisol and midnight saliva cortisol and unsuppressed levels of morning cortisol after taking dexamethasone. These findings are a clear indication of Cushing's syndrome, which is defined as autonomous cortisol over-production.[1] As his random morning ACTH levels were also elevated, his Cushing's syndrome was ACTH-dependent.[1] Although the vast majority of ACTH-dependent Cushing's syndromes are caused by ACTH-secreting pituitary tumours, some are caused by ACTH-secreting tumours from other organs (e.g. ectopic Cushing's syndrome), such as the lungs and pancreas.[2] The normal pituitary gland of this patient revealed by an MRI scan suggested ectopic Cushing's syndrome, which was confirmed by inferior petrosal sinus sampling.[1,2] Locating an ectopic ACTH-secreting tumour can be challenging as it is often small and difficult to find by conventional imaging such as CT, MRI including diffusion weighted imaging, octreotide scan or fluorodeoxyglucose PET.[3,4] ^{68}Ga-DOTATATE PET utilises a positron-emitting radioisotope-linked somatostatin analogue and has much higher spatial resolution and sensitivity than an octreotide scan in identifying neuroendocrine tumours, which comprise most ectopic ACTH-secreting tumours.[2,5,6] As shown in the current case, ^{68}Ga-DOTATATE PET is usually combined with contrast-enhanced CT and is the most sensitive imaging method in locating a covert ectopic ACTH-secreting tumour.[3]

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