Can Abdominal CT Features Predict Autonomous Cortisol Secretion in Patients with Adrenal Nodules?

Christopher Lan, MS2, Machelle Wilson, PhD[2], Thomas W. Loehfelm, MD, PhD[1], Michael J. Campbell, MD[3], Michael T. Corwin , MD[1].
[1]Department of Radiology, [2]Department of Public Health Services, [3]Department of Surgery

Introduction

Adrenal nodules are incidentally discovered in 5% of patients undergoing abdominal CTs. It is estimated that 5-10% of these adrenal incidentalomas have subclinical autonomous secretion of cortisol, termed mild autonomous cortisol secretion (MACS).

The purpose of this study is to determine if CT features of these adrenal nodules and other abdominal CT findings could predict autonomous cortisol secretion, and to identify a nodule size threshold below which MACS is unlikely.

Methods

This was a retrospective study with patients who had a serum cortisol test within 1 year of CT abdomen showing an adrenal nodule. Patients were considered to have no MACS if serum cortisol was ≤ 1.8 µg/dL after the 1-mg dexamethasone suppression test and to have possible or definite MACS if serum cortisol was > 1.8 µg/dL. The following CT features were assessed: nodule length and width, unenhanced nodule attenuation, contralateral adrenal gland thickness, subcutaneous and visceral adipose tissue area, psoas muscle area and density, and unenhanced liver attenuation. Features found to be significant in univariate analyses were then analyzed using logistic regression to estimate the area under the receiver operating characteristic curve.

Results

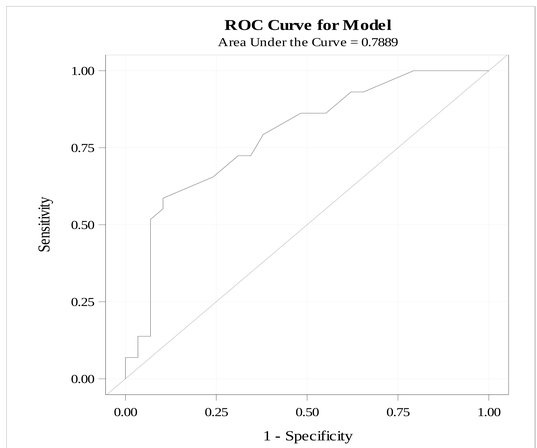
29 patients had no autonomous cortisol secretion, and 29 patients had possible/definitive autonomous cortisol secretion. Nodule length and width were the only two variables that significantly differed between patients with nonfunctional nodules and those with possibly or definitively functional nodules. Contralateral adrenal gland thickness, liver attenuation, psoas muscle thickness, and visceral adipose tissue were not significantly correlated with cortisol secretion.

Using a threshold nodule length of 1.5 cm, the sensitivity and specificity for predicting possible or definite autonomous cortisol secretion was 93.1% and 37.9% respectively.

Manuscript QR Code

Variable	Cortisol > 1.8 µg/dL (n=29)		Cortisol ≤ 1.8 µg/dL (n=29)		p-value
	Mean	Median	Mean	Median	
Nodule length (cm)	2.5	2.5	1.7	1.6	0.0004
Nodule width (cm)	1.8	1.5	1.3	1.3	0.013
Nodule unenhanced attenuation (HU)	12.6	6	7.7	5.6	0.5
Contralateral gland mean limb thickness (cm)	0.36	0.37	0.37	0.32	0.97
VAT (cm^2)	225.4	201	217.8	193.5	0.91
SAT (cm^2)	292.0	275	313.2	267	0.87
Mean psoas area (cm^2)	6.4	6.2	7.4	6.1	0.52
Psoas density (HU)	43.7	41.4	45.0	44.8	0.68
Unenhanced liver attenuation (HU)	41.2	48	51.0	51.5	0.07

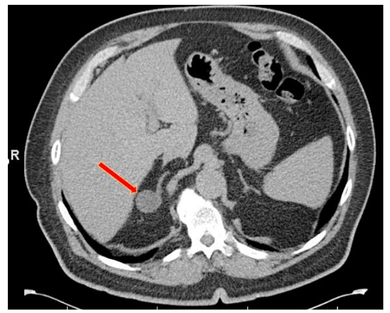
Table 1. Univariate Regression analysis of CT features and serum cortisol level after Dexamethasone suppression test.



Receiver operator characteristic curve for adrenal nodule length in predicting serum cortisol > 1.8 µg/dL after dexamethasone suppression test.

Conclusion

Autonomous cortisol secretion in patients with adrenal nodules correlates with increasing nodule size. A nodule length threshold of 1.5 cm provides 93.1% sensitivity for predicting possible or definite MACS based on the 1-mg Dexamethasone suppression test.



Axial CT showing 2.8 cm right adrenal nodule (arrow) in a patient with MACS

Discussion

Our study confirms the correlation between adrenal nodule size and autonomous cortisol secretion. Our study is unique in that we present a single, easy-to-obtain measurement of the maximum nodule diameter that can predict autonomous cortisol secretion with high sensitivity. Adrenal nodule size may help identify patients who are highly unlikely to have MACS, potentially obviating the need for hormonal evaluation.