

# Radiological formula for differentiating between secreting and non secreting adrenal adenomas

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## Introduction

Benign adenoma is the most common mass among adrenal incidentalomas. A mild increase in cortisol secretion is noted in up to 30% of patients.

## Objectives

- \* investigate whether a relationship exists between radiological and endocrine parameters in patients with typical and atypical adenomas;
- \* investigate whether radiological parameters may predict subclinical glucocorticoid secretion excess.

## Hormonal assessment

\* Cortisol and ACTH samples were taken between 08:00 and 09:00 a.m. after a 12 hr overnight fast

\* On the same day, 1mg dexamethasone was administered at 11:00 p.m

\* Blood samples were taken the following morning (08:00-09:00 a.m.), after a 12 hr overnight fast, for cortisol measurement

Post-dexamethasone suppression test cortisol (post-DST cortisol) values > 50 nmol/L were used to discriminate patients with adenomas associated to subclinical hypercortisolism (secreting adenomas, SA) from non-secreting adenomas (NSA)

## Adrenal CT protocol

\* unenhanced scan; \* arterial phase (45 secs after the i.v. injection of iodinate contrast medium); \* venous phase (60 secs after the injection); \* delayed examination after 15 mins

## General characteristics of patients

Variable	NSA (n=28)	SA (n=9)	A-NSA (n=11)	A-SA (n=7)	P
Age (years)	59.8±12.1	64.9±8.5	55.4±14.3	55.9±11.7	0.302 <sup>§</sup>
Female gender	18 (64.3%)	6 (66.7%)	8 (72.7%)	5 (71.4%)	0.957 <sup>§</sup>
Cortisol after DST <sup>¶</sup> (nmol/L)	28.6±10.3	91.0±51.1 <sup>a</sup>	27.0±9.4	76.5±10.9 <sup>a</sup>	<0.001 <sup>§</sup>

NSA: non-secreting adenoma; SA: secreting adenoma; A-NSA: atypical non-secreting adenoma; A-SA: atypical secreting adenoma; BMI: body mass index <sup>a</sup> P<0.05 SA vs NSA and A-SA vs A-NSA. <sup>¶</sup> The normalized values of basal ACTH and cortisol after dexamethasone-suppression test (DST) were used in the analysis. <sup>§</sup> One-way ANOVA; <sup>§</sup> Pearson chi-square

## Results of univariate and multivariate regressions between radiological parameters and post-DST cortisol

	Univariate analyses			Multivariate analysis		
	r <sup>2</sup>	Coefficient SE	±P	Coefficient SE	±P	
Maximum diameter (cm)	0.222	2.939±0.756	<0.001	-	-	
Minimum diameter (cm)	0.268	3.732±0.848	<0.001	4.166±0.838	<0.001	
E phase (HU)	0.018	0.269±0.275	0.333	0.534±0.235	0.027	
U phase (HU)	0.010	0.432±0.586	0.464	-	-	
D phase (HU)	0.029	0.847±0.669	0.211	-	-	
Absolute wash-out <sup>¶</sup> (AWO; %)	0.004	3.142±6.434	0.627	-	-	
Relative wash-out (RWO; %)	0.002	-0.205±0.578	0.725	-	-	

## The association of the minimum diameter and E accounted for 33.4% of the variability of post-DST cortisol

Post-DST cortisol can be defined by the formula:

$$\text{post-DST cortisol} = \exp [(4.166 \text{ minimum diameter} + 0.534 \text{ E} + 230.115) / 100]$$

The radiological predicting score able to discriminate secreting *versus* non-secreting adenomas resulted in:

$$\text{Score} = 0.1914 \text{ minimum diameter} + 0.0308 \text{ E}$$

post-DST cortisol in nmol/L, minimum diameter in cm, E in HU, 230.115 = constant term computed by the multivariate regression, the coefficients are the natural logarithmic values of the odds ratios

## Conclusions

- \* We confirmed that secreting adenomas, both typical and atypical, have larger dimensions than non-secreting adenomas;
- \* Significant relationship between post-DST cortisol and the minimum diameter of the mass and the HU value in E phase. As known, HU in E phase corresponds to the vascularization of the lesion.
- \* Thus, we hypothesized that a better nodular definition and a higher vascularization of the adenoma might correspond to a higher functional activity.
- \* The score could have a practical implication, since the radiologist might define not only the radiological characteristics of the mass but he might also predict the expected subclinical glucocorticoid secretion.

## Radiological parameters

Variable	NSA (n=28)	SA (n=9)	A-NSA (n=11)	A-SA (n=7)	P <sup>§</sup>
Maximum diameter (cm)	24.3±9.8	35.1±8.1 <sup>a</sup>	23.1±8.3	28.6±9.4	0.016
Minimum diameter (cm)	18.2±8.0	28.0±6.5 <sup>a</sup>	16.9±6.1	25.9±9.4 <sup>a</sup>	0.005
E phase (HU)	71.2±24.1	79.9±11.1	97.7±32.5	101.0±49.6 <sup>b</sup>	0.023
U phase (HU)	-0.3±8.6	2.8±4.8	16.0±10.0	22.6±12.8 <sup>b</sup>	<0.001
D phase (HU)	25.1±11.5	28.2±6.9	42.4±12.4	46.7±16.1 <sup>b</sup>	<0.001
Absolute wash-out <sup>¶</sup> (AWO; %)	65.5±6.9	66.7±7.0	64.5±17.5	61.9±22.5	0.883
Relative wash-out (RWO; %)	67.1±11.2	64.1±8.4	53.5±14.0	48.3±21.6 <sup>b</sup>	0.002

NSA: non-secreting adenoma; SA: secreting adenoma; A-NSA: atypical non-secreting adenoma; A-SA: atypical secreting adenoma; HU: Hounsfield units. <sup>a</sup> P<0.05 SA vs NSA and A-SA vs A-NSA; <sup>b</sup> P<0.05 A-SA vs SA. One-way ANOVA. <sup>¶</sup> The normalized value of AWO was used in the analysis

## Results of univariate and multivariate logistic regression applied in order to find the best radiological pattern for discriminating secreting *versus* non-secreting adenomas

	Univariate analyses			Multivariate analysis		
	OR	95% CI	P	OR	95% CI	P
Maximum diameter (cm)	1.098	1.025-1.177	0.008	-	-	-
Minimum diameter (cm)	1.160	1.058-1.271	0.001	1.211	1.088-1.347	<0.001
E phase (HU)	1.011	0.992-1.030	0.259	1.031	1.004-1.060	0.027
U phase (HU)	1.031	0.989-1.075	0.144	-	-	-
D phase (HU)	1.049	0.998-1.102	0.060	-	-	-
Absolute wash-out <sup>¶</sup> (AWO; %)	1.018	0.651-1.591	0.938	-	-	-
Relative wash-out (RWO; %)	0.972	0.933-1.013	0.178	-	-	-

Score range in our population: 2.89-9.68  
(6.45 - 1.69)

Diagnostic accuracy in differentiating secreting *versus* non-secreting adenomas: 84.9% (P<0.001)

Best cut-off between 7.36 and 7.59

Score > 7.59 = secreting adenoma

Score < 7.36 = non-secreting adenoma

Sensitivity: 81.3% (13/16 patients)

Specificity: 87.2% (34/39 patients)

Positive predictive value: 72.2% (13/18 patients)

Negative predictive value: 91.9% (34/37 patients)

## References

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