

Diagnosis of Cushing's Syndrome Using Scalp Hair Cortisol

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Introduction

- Endogenous Cushing's syndrome (CS) is characterized by overproduction of cortisol
- Diagnosing CS can be challenging due to a lack of specific symptoms
- Limitations of current first-line screening tests (urinary free cortisol, late night salivary cortisol and the dexamethasone suppression test) include:
 - No assessment of long-term cortisol exposure
 - False positive results due to medication use and stress
 - Reliance on patient adherence to instructions
 - Requirement of repeated testing
- Hair cortisol concentrations (HCC) represent long-term cortisol and could be of additional value in diagnosing Cushing's syndrome

Aim: to establish the optimal cut-off value of hair cortisol concentrations (HCC) for the diagnosis of endogenous Cushing's syndrome (CS)

Methods

- Scalp hair samples were collected in:
 - 174 healthy individuals
 - 35 patients with confirmed Cushing's syndrome
 - 20 patients with a clinical suspicion, in whom CS could be excluded (non-CS patients)
- HCC were measured using ELISA

	Healthy (n=174)	non-CS (n=20)	CS (n=35)	Pdiff
Male	74 (43%)	6 (30%)	13 (37%)	0.503
Age	32 (18 - 63)	42 (15 - 79)	50 (15 - 76)	<0.001
BMI	23.5 (16.9 - 43.3)	31.3 (21.4 - 46.6)	29.2 (18.3 - 55.0)	<0.001
HCC, unadjusted	8.4 (6.9 - 10.2)	9.7 (5.5 - 16.8)	157.6 (107.3 - 231.4)	<0.001
HCC, adjusted†	8.3 (6.6 - 10.3)	10.9 (5.4 - 20.9)	143.7 (93.2 - 221.5)	<0.001

Table 1: baseline characteristic, expressed as n (%) or median (range). HCC values are expressed as standardized mean (pg/mg, 95% CI).

Results

- CS patients had higher HCC than controls and non-CS patients ($P < 0.001$, Fig 1, Table 1)
- Patients with ectopic ACTH secretion had higher HCC than individuals with pituitary or adrenal CS ($P < 0.05$, Fig 1)

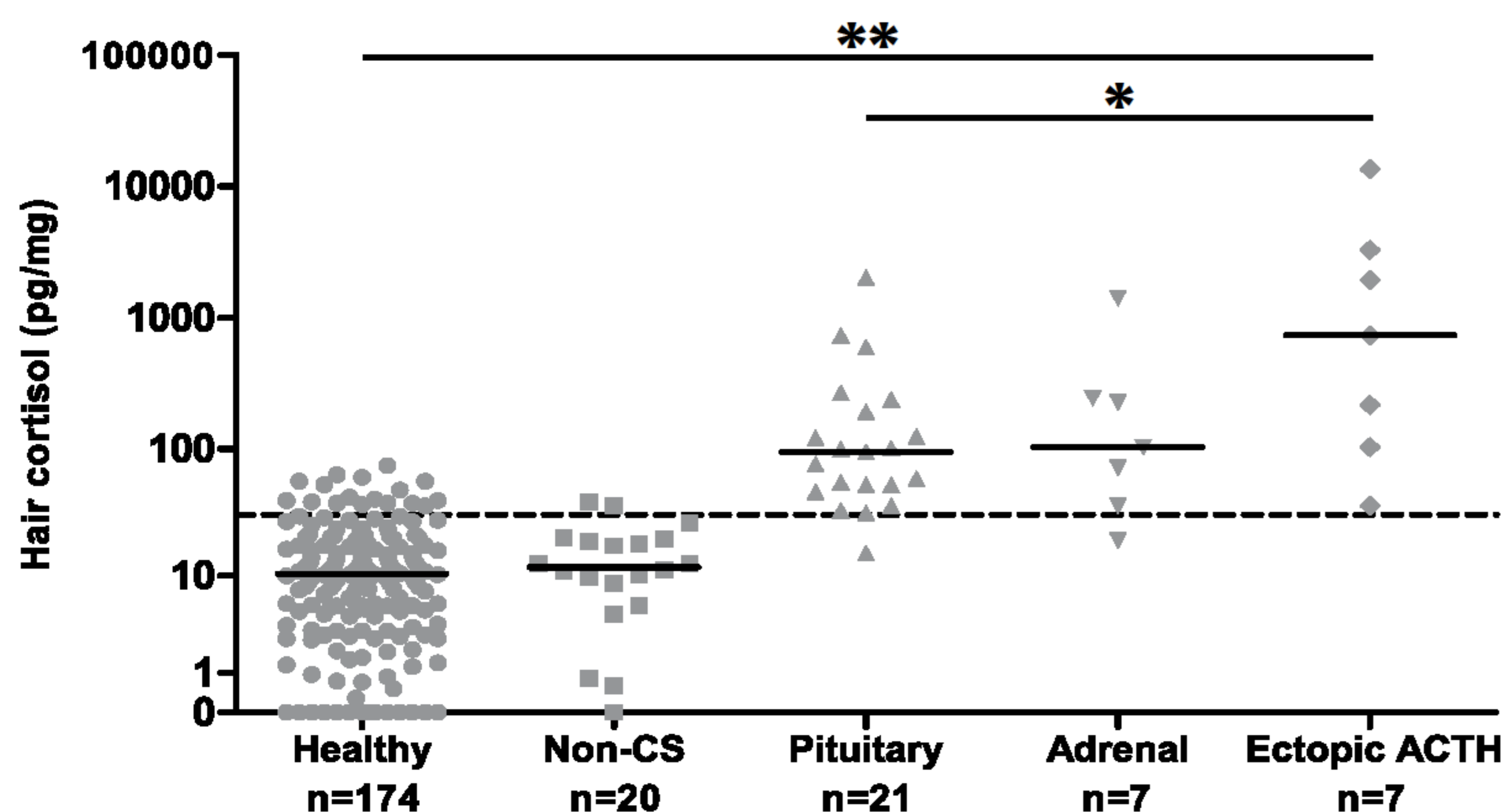


Fig 1: Hair cortisol values for controls, non-CS patients, and CS patients stratified by etiology. * $P < 0.05$, ** $P < 0.001$

- Within CS patients, hair cortisol correlated significantly with urinary free cortisol (Fig 3)

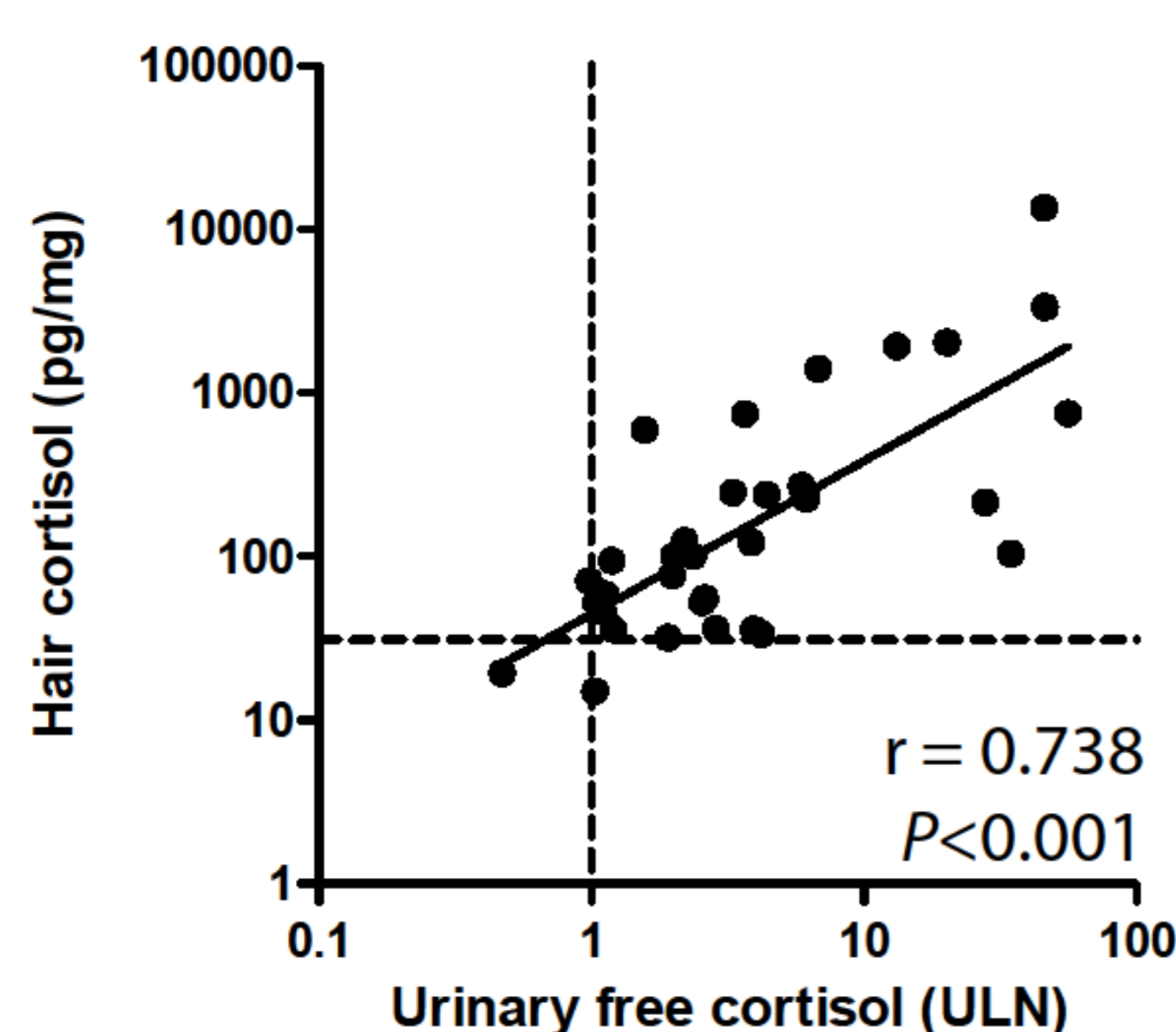


Fig 3: correlation between hair cortisol and urinary free cortisol (upper limit of normal) in CS patients

- At a cut-off value of 31.1 pg/mg (Fig 2):
 - Sensitivity for CS was **94%**
 - Specificity was **90%** vs healthy controls
 - Specificity was **90%** vs non-CS patients

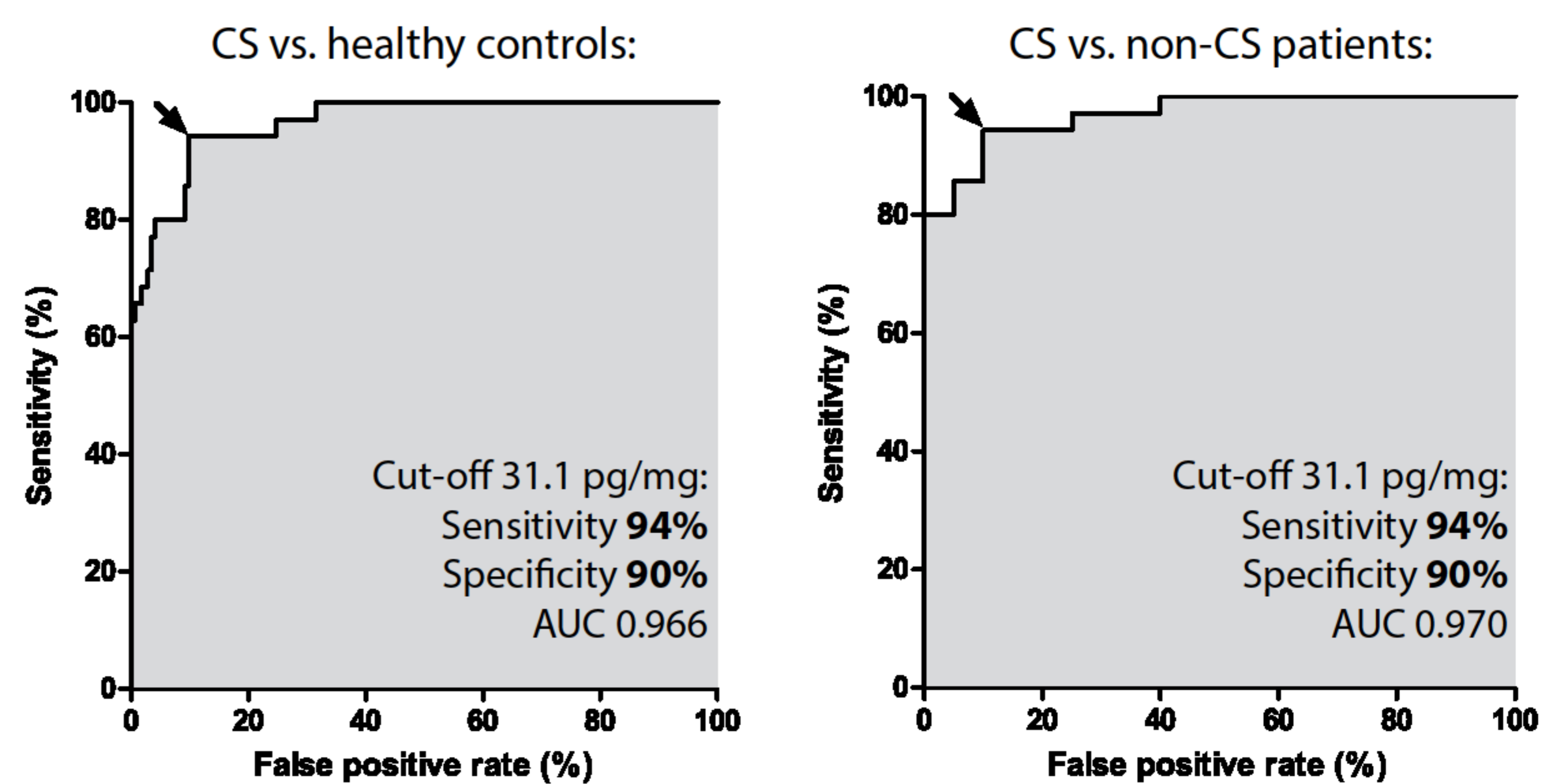


Fig 2: ROC curves for CS diagnosis, when compared to healthy controls (L) or non-CS patients (R). Arrows (↘) indicate the optimal cut-off (31.1 pg/mg).

Conclusion

- Analysis of cortisol in hair can distinguish between patients with and without CS with high diagnostic accuracy
- Our method offers a collection procedure that is easily executed, and is not affected by non-adherence
- Hair cortisol seems to be a valuable screening test for endogenous Cushing's syndrome

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