

Diagnosis of polycystic ovary syndrome (PCOS) in adolescents using MRI

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Background

Polycystic ovary syndrome (PCOS) is the most common ovarian dysfunction, with a prevalence of 6% to 15% of women (1).

Early diagnosis is required to inform patients and start prevention against potential complications – particularly infertility.

Diagnosis in adults: Rotterdam 2003 criteria (2)

2 out of 3
1) Oligo- and/or anovulation
2) Clinical and/or biochemical signs of hyperandrogenism
3) Polycystic ovaries by US ≥ 12 follicles per ovary measuring 2–9 mm in diameter Ovarian volume > 10 cm ³
And exclusion of other aetiologies (congenital adrenal hyperplasia, androgen-secreting tumours, Cushing's syndrome)

Diagnosis in adolescent girls: no consensus (2)

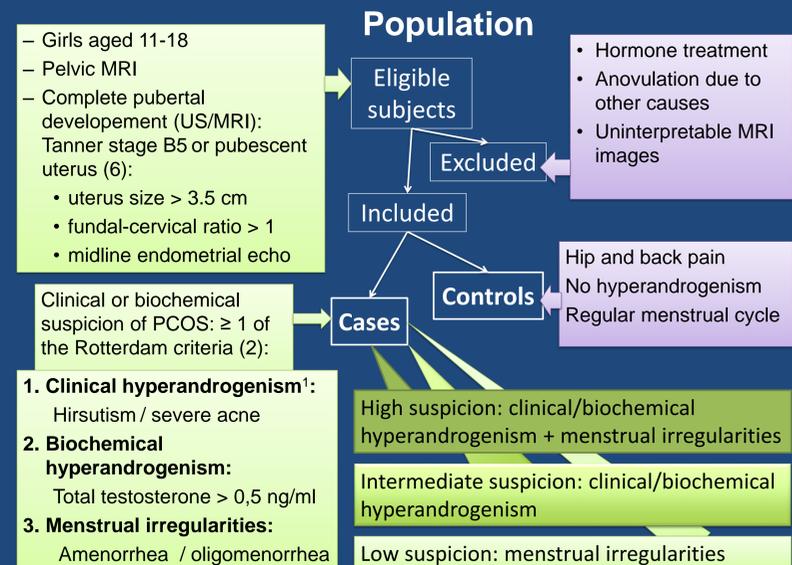
Transvaginal US cannot be used in girls who are virgins, and transabdominal US is of little help in analyzing ovarian morphology in overweight patients (2-4).

MRI is a non-invasive modality unaffected by fat thickness. It offers a valuable alternative for analyzing the follicular characteristics in PCOS, but it has received little study in adolescent girls (5).

Objective: To evaluate the validity and reproducibility of MRI for the diagnosis of PCOS in adolescent girls.

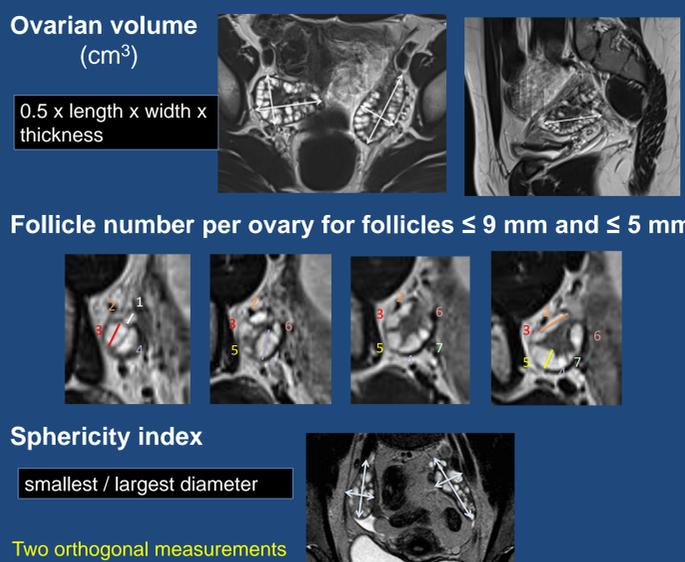
Methods

Prospective (2014-2015) and retrospective (2006-2014) study. Two independent analysis (MF and VH) of 50 randomly-selected MRIs from the PCOS cases.



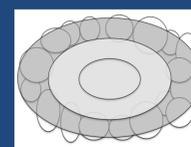
MRI-based diagnostic criteria

Quantitative criteria (both ovaries' average (2)).



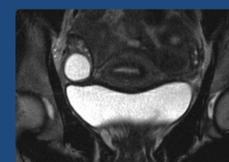
Semi-quantitative criteria

Peripheral distribution of follicles: at least 2/3 in the outermost layer.



Three T2-weighted planes.
Three concentric layers of equal thickness.

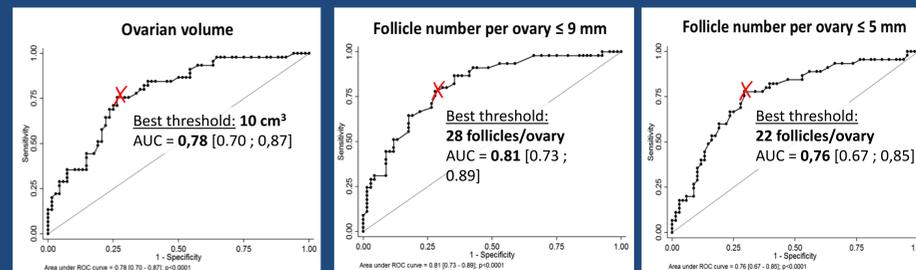
Absence of dominant follicle: unique follicle of diameter 15-28 mm.



Results

Subjects		Clinical and/or biochemical suspicion of PCOS				p**
		High (N=45)	Intermediate (N=8)	Low (N=7)	Controls (n=68)	
Age (years)	Median (IQR)	16.0 (15.0-17.0)	16.5 (15.0-17.0)	16.0 (15.0-17.0)	14.0 (13.0-16.0)	
Menstrual irregularities	Number (%)	44 (97.8)	0 (0.0)	7 (100.0)	0 (0.0)	
Clinical hyperandrogenism*	Number (%)	33 (73.3)	8 (100.0)	0 (0.0)	0 (0.0)	
Total testosterone (ng/L)	Median (IQR)	0.8 (0.6-1.1)	0.6 (0.6-0.8)	0.3 (0.3-0.4)	- (-)	
Ovarian volume	Median (IQR)	11.9 (9.6-18.1)	12.8 (7.4-16.6)	7.2 (5.1-8.2)	6.8 (4.4-9.9)	0.0001
FNPO-9	Median (IQR)	39.5 (31.5-53.0)	29.0 (21.8-45.5)	28.5 (27.0-49.0)	22.0 (16.3-32.5)	0.0003
FNPO-5	Median (IQR)	29.0 (22.0-38.0)	25.3 (17.5-39.5)	23.0 (19.5-36.0)	17.0 (11.5-23.3)	0.0001
Sphericity index	Median (IQR)	0.6 (0.6-0.8)	0.6 (0.6-0.7)	0.6 (0.5-0.7)	0.6 (0.5-0.7)	0.99
Peripheral distribution of follicles	Number (%)	17 (37.8)	3 (37.5)	0 (0.0)	3 (4.4)	0.0001
Absence of dominant follicle	Number (%)	42 (93.3)	7 (87.5)	4 (57.1)	52 (76.5)	0.023

Validity of MRI-based criteria



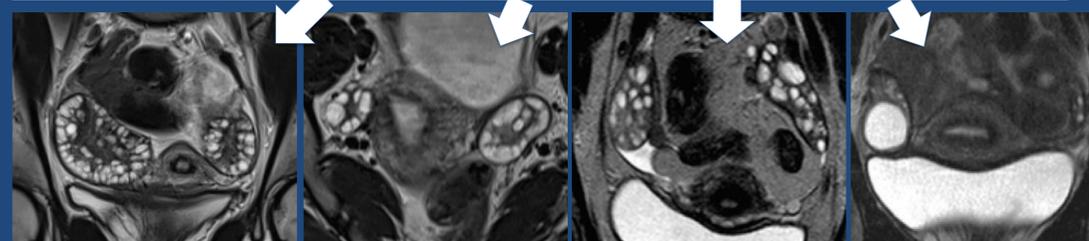
MR criteria	Sensitivity (%) (95% CI)	Specificity (%) (95% CI)
Peripheral distribution of follicles	38 (24 - 54)	96 (88 - 99)
Absence of dominant follicle	93 (82 - 99)	24 (14 - 35)

Abbreviations:
FNPO-9: Follicle number per ovary ≤ 9 mm;
FNPO-5: Follicle number per ovary ≤ 5 mm;
ICC: Intraclass correlation coefficient;
95% CI: Confidence interval of 95 %.

Reproducibility of MRI-based criteria measures

MR criteria	Correlation coefficient	95% CI
Ovarian volume > 10 cm ³	ICC = 0.88	0.81 - 0.93
FNPO-9 ≥ 28 follicles per ovary	ICC = 0.54	0.11 - 0.76
FNPO-5 ≥ 22 follicles per ovary	ICC = 0.60	0.38 - 0.75
Sphericity index ≥ 0.7	ICC = 0.14	-0.09 - 0.37
Peripheral distribution of follicles	Kappa = 0.39	0.10 - 0.60
Absence of dominant follicle	Kappa = 0.73	0.50 - 1.01

Ovarian volume had the best inter-observer reproducibility.



* Ferriman score > 8 ; ** Orthogonal linear trend test after quantile regression (quantitative variables) or logistic regression (binary variables).

Conclusion

MRI is a valuable tool to confirm PCOS in adolescent girls based on clinical and hormonal characteristics when transvaginal US cannot be performed. The most accurate diagnostic criteria by MRI were FNPO ≤ 9 mm, ovarian volume and peripheral distribution of follicles. The most reliable criterion was ovarian volume.

In the future, these MR criteria could be tested in a larger cohort of adolescents with only isolated menstrual irregularities. This would be an important step toward early differential diagnosis of PCOS versus transient physiologic menstrual irregularities which are frequent at puberty.

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