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ANTI-MÜLLERIAN HORMONE (AMH) PHYSIOLOGY AND CLINICAL UTILITY

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Anti-Müllerian hormone (AMH) is a 140 kDa dimeric glycoprotein belonging to the TGF-B (transforming growth factor beta) superfamily.

In the male embryo, AMH is secreted by the Sertoli cells in the testes and plays a fundamental role in the regression of Müllerian ducts. In its absence, Müllerian ducts develop into female inner reproductive organs.

In contrast to boys, AMH levels are low in girls until puberty. AMH is secreted by the granulosa cells of primary and pre-antral ovarian follicles and is regarded as a predictor of the ovarian follicular reserve. AMH reaches undetectable levels after natural or premature menopause.

Polycystic Ovarian Syndrome (PCOS)

PCOS is the most common endocrine condition affecting women of all ages with reproductive, metabolic and psychological consequences. According to the 2023 International Evidence-Based guideline for the Assessment and Management of PCOS, 10–13% of women of reproductive age worldwide are affected by PCOS.

PCOS increases women's risk of:

- Infertility (± 50% of PCOS women)
- Developing type 2 diabetes or pre-diabetes by the age of 40 (± 50% of PCOS women)
- Cardiovascular disease
- Sleep disorders
- High-risk pregnancy
- Premenopausal endometrial cancer

Diagnosis of PCOS is challenging due to the heterogeneity of PCOS symptoms and its similarity to other clinical conditions. As a result, up to 70% of women remain undiagnosed.

Criteria for PCOS

PCOS is diagnosed based on the Rotterdam criteria which includes polycystic ovarian morphology (PCOM), hyperandrogenism and oligo/anovulation.The 2023 International Evidence-based Guideline for the Assessment and management of Polycystic ovary syndrome recommends that PCOS should be diagnosed based on the consensus 2003 Rotterdam criteria.

This requires the presence of 2 of the following:
i) Clinical/biochemical hyperandrogenism
ii) Ovulatory dysfunction including anovulation
iii) Polycystic ovaries on ultrasound, alternatively AMH can now be used instead of ultrasound.

In cases where i) and ii) are present, diagnosis is simplified and iii) is not required. In adolescents i) and ii) are required with iii) not recommended

PCOM is assessed using transvaginal ultrasonography (TVUS). The current international guidelines have defined PCOM as an antral follicular count (AFC) of > 20 per ovary or ovary volume of ≥10ml.

The replacement of TVUS measurement with a simple blood test for assessing PCOM would be clinically advantageous as the lack of easy access and training to TVUS contributes to a delayed diagnosis or underdiagnosis. This will offer women a low cost, convenient option, without evidence of overdiagnosis.

AMH cutoff for PCOM diagnosis

The level of AMH and the number of ovarian follicles measuring 2-9 mm in both ovaries correlate with ovarian primordial follicle number and there is a good correlation between circulating AMH values and follicle count per ovary in women of reproductive age.

De Loos et al undertook a study in a large cohort to correlate serum AMH and TVUS-determined AFC. Their purpose was to derive an AMH cutoff to diagnose PCOM, and to validate this in a separate validation cohort.

A cutoff of 3.2 ng/mL (23 pmol/L) on the Roche AMH Plus immunoassay provided a high sensitivity (88.6%) and specificity (84.6%) irrespective of race or PCOS phenotype. This cutoff is applicable to women aged 25-45 years of age.

Ampath now offers the AMH Plus assay on the Roche platform.

Sample type: Serum (SST).

Use of AMH during in-vitro fertilization (IVF) treatment

Circulating AMH concentration is reflective of ovarian reserve and therefore the capacity to provide eggs for fertilization. Serum AMH has greater value for predicting clinical pregnancy outcome in IVF cycles than age, serum FSH, inhibin B or oestradiol levels.

Females with higher AMH concentrations tend to produce more retrievable oocytes than those with low or undetectable levels. Serum AMH levels have been shown to remain relatively stable during the menstrual cycle and may be measured on any day of the cycle.

AMH is therefore a reliable marker for prediction of response to controlled ovarian stimulation and can add prognostic information to the counselling and planning process for infertile couples seeking treatment.

Predicting the ovarian response following IVF treatment using the AMH Plus Immunoassay (Roche®)

AMH level		Response to ovarian stimulation (number of oocytes at retrieval)	Sensitivity	Specificity
ng/ml	pmol/L			
<0.89	<6.4	Low response:0-3 oocytes	74.4%	79.8%
0.69-1.58	4.9-11.3	Suboptimal response 4-9 oocytes	59.8-67.2%	65.2-73.7%
1.58-2.9	11.3-20.9	Optimal response 10-15 oocytes	67.2-68.5%	72.7-73.7%
>1.99	>14.2	High/hyper response >15 oocytes	88.3%	74.8%

Bosch et al. RBMO 2023; 46(2): 295-301.

Significantly elevated AMH levels can be used to identify females at risk of ovarian hyperstimulation syndrome following gonadotrophin administration.

An individualised dosing regimen of recombinant FSH based on AMH-level and patient weight is used in controlled ovarian stimulation in women undergoing assisted reproductive technology programmes.

AMH for evaluation of children with ambiguous genitalia or bilateral cryptochidism

AMH measurements are used to evaluate testicular function/presence in infants with:

- Disorders of sexual development or ambiguous genitalia.
- To distinguish between cryptorchidism (testicles present but not palpable and a measurable AMH) and anorchidism (absent testicles and undetectable value for AMH).

AMH as a tumour marker for granulosa cell tumours of the ovaries

Serum AMH concentrations may be increased in 76 to 93% of patients with ovarian granulosa cell tumours that comprise approximately 10% of all ovarian tumours. AMH combined with CA125 may be useful for monitoring response to treatment and follow-up of patients with these tumours, allowing earlier detection of recurrences.

REFERENCES

1. De Loos AD, Hund M, Buck K, Meun C, Sillman J, Laven JSE. Antimullerian hormone to determine polycystic ovarian morphology. 2021 Oct; 116 (4): 1149 – 1156.
2. Teede HJ, Tay CH, Laven J, Dokras A et al, on behalf of the International PCOS Network. Recommendations from the 2003 International Evidence-based Guideline for the Assessment and Management of Polycystic Ovary Syndrome. 2023 Aug; 38 (9):1655-1679.
3. Du Plessis M, Anti-Mullerian hormone (AMH): Physiology and clinical utility. Ampath Pathchat Edition no. 28.
4. Roche Diagnostics. Fully automated Elecsys Anti-Mullerian Hormone (AMH) Plus Assay instructions for use and related literature. 2024-08, V 2.0.

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