MAYO CLINIC LABORATORIES

Test Definition: AMH1

Antimullerian Hormone, Serum

Overview

Useful For

Assessing ovarian status, including ovarian reserve and responsiveness, as part of an evaluation for infertility and assisted reproduction protocols

Assessment of menopausal status, including premature ovarian failure

Evaluation of infants with ambiguous genitalia and other intersex conditions

Evaluating testicular function in infants and children

Monitoring individuals with antimullerian hormone-secreting ovarian granulosa cell tumors

Highlights

Antimullerian hormone (AMH) is produced by Sertoli cells of the testis in male individuals and by ovarian granulosa cells in female individuals.

In female individuals, AMH is used as a marker for ovarian reserve and in the assessment of ovarian responsiveness as part of evaluation of infertility and in assistance with reproductive therapy.

In male individuals, AMH is used in the evaluation of disorders of sexual development and male fertility.

Method Name

Electrochemiluminescent Immunoassay (ECLIA)

NY State Available

Yes

Specimen

Specimen Type

Serum

Specimen Required

Supplies: Sarstedt Aliquot Tube, 5 mL (T914)
Collection Container/Tube:
Preferred: Serum gel
Acceptable: Red top
Submission Container/Tube: Plastic vial
Specimen Volume: 1 mL

Collection Instructions: Centrifuge and aliquot serum into plastic vial.

Forms

If not ordering electronically, complete, print, and send a General Request (T239) with the specimen.

Specimen Minimum Volume

0.75 mL

Reject Due To

Gross hemolysis	Reject-acceptable to 1000 mg/dL
Gross lipemia	OK
Gross icterus	Reject-acceptable to 66 mg/dL

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Serum	Refrigerated (preferred)	7 days	
	Ambient	7 days	
	Frozen	180 days	

Clinical & Interpretive

Clinical Information

Antimullerian hormone (AMH), also known as Mullerian-inhibiting substance, is a dimeric glycoprotein hormone belonging to the transforming growth factor-beta family. It is produced by Sertoli cells of the testis in male patients and by ovarian granulosa cells in female patients. Expression during male fetal development prevents the Mullerian ducts from developing into the uterus, resulting in development of the male reproductive tract. In the absence of AMH, the Mullerian ducts and structures develop into the female reproductive tract. AMH serum concentrations are elevated in boys under 2 years old and then progressively decrease until puberty when there is a sharp decline. In female individuals, serum AMH concentrations are very low at birth, peaking after puberty, and decrease progressively thereafter with age, eventually becoming undetectable at menopause.

Because of the gender differences in AMH concentrations, its changes in circulating concentrations with sexual development, and its specificity for Sertoli and granulosa cells, AMH measurement has utility in the assessment of gender, gonadal function, fertility, and as a gonadal tumor marker.

In female individuals, AMH is considered an ovarian reserve marker. It correlates with the primordial follicle pool, has an inverse correlation with chronologic age, predicts ovarian response in assisted reproductive therapy, and has been suggested to be predictive of the timing of the onset of menopause. In contrast to other markers of ovarian reserve that show significant fluctuations during the menstrual cycle, serum AMH concentrations have been shown to be relatively stable. Women with higher concentrations of AMH have a better response to ovarian stimulation and tend to produce more retrievable oocytes than women with low or undetectable AMH. Women at risk of ovarian hyperstimulation

syndrome after gonadotropin administration can have significantly elevated AMH concentrations. Polycystic ovarian syndrome can elevate serum AMH concentrations, because it is associated with the presence of large numbers of small follicles.

AMH measurements are commonly used to evaluate testicular presence and function in infants with intersex conditions or ambiguous genitalia and to distinguish between cryptorchidism and anorchia in male infants.

Serum AMH concentrations are increased in some individuals with ovarian granulosa cell tumors, which comprise approximately 10% of ovarian tumors. AMH, along with related tests including inhibin A and B (INHA / Inhibin A, Tumor Marker, Serum; INHB / Inhibin B, Serum; INHAB / Inhibin A and B, Tumor Marker, Serum), estradiol (EEST / Estradiol, Serum), and cancer antigen 125 (CA25 / Cancer Antigen 125 [CA 125], Serum), can be useful for diagnosing and monitoring these individuals.

Reference Values

Males
<2 years: 18-283 ng/mL
2-12 years: 8.9-109 ng/mL
>12 years: <13 ng/mL

Females
<3 years: 0.11-4.2 ng/mL
3-6 years: 0.21-4.9 ng/mL
7-11 years: 0.36-5.9 ng/mL
12-14 years: 0.49-6.9 ng/mL
15-19 years: 0.62-7.8 ng/mL
20-24 years: 1.2-12 ng/mL
25-29 years: 0.89-9.9 ng/mL
30-34 years: 0.58-8.1 ng/mL
35-39 years: 0.15-7.5 ng/mL
40-44 years: 0.03-5.5 ng/mL
45-50 years: <2.6 ng/mL
51-55 years: <0.88 ng/mL
>55 years: <0.03 ng/mL

Interpretation

Menopausal women or women with premature ovarian failure of any cause, including after cancer chemotherapy, have very low anti-Mullerian hormone (AMH) levels.

While the optimal AMH concentrations for predicting response to in vitro fertilization are still being established, it is accepted that AMH concentrations in the perimenopausal to menopausal range indicate minimal to absent ovarian reserve. Depending on patient age, ovarian stimulation is likely to fail in such individuals.

AMH may be used as a surrogate to antral follicle count (AFC) at day 2 to 4 of the menstrual cycle to determine ovarian reserve. Women with an AFC greater than 15 are identified as having high ovarian reserve. In this context, a Roche AMH concentration greater than 1.77 ng/mL at day 2 to 4 of the menstrual cycle identified women with an AFC greater than 15 with 88.3% sensitivity and 68.3% specificity.(1)

Controlled ovarian stimulation (COS) with exogenous gonadotropin is an essential step of in vitro fertilization protocols. Using the Roche AMH assay, a cut-off of 2.10 ng/mL is correlated with the response categories in women undergoing COS using a gonadotropin-releasing hormone antagonist protocol. A 2.10 ng/mL cutoff provided reliable prediction of hyperresponse to COS.(2) Sensitivity for the detection of hyperresponsive individuals was 81.3%, and the negative predictive value for ruling out hyperresponse was 96.6%. The 2.10 ng/mL cutoff identified 88.9% of individuals with a poor response.(2)

In individuals with polycystic ovarian syndrome, AMH concentrations may be 2- to 5-fold higher than age-appropriate reference range values. Such high levels predict anovulatory and irregular cycles.

In children with intersex conditions, an AMH result above the normal female range is predictive of the presence of testicular tissue, while an undetectable value suggests its absence.

In boys suspected of cryptorchidism, a measurable AMH concentration is predictive of undescended testes, while an undetectable value is highly suggestive of anorchia or functional failure.

Klinefelter syndrome is characterized by accelerated germ cell depletion and occurs in approximately 10% to 12% of men presenting with nonobstructive azoospermia. In these patients, serum AMH concentrations are within the reference interval until puberty, and thereafter, AMH concentrations decline to abnormally low or undetectable levels.

Pubertal delay and congenital hypogonadotropic hypogonadism (HH) share the same clinical manifestation of delayed sexual maturation in prepubertal boys. Levels of gonadotropin and testosterone are very low in prepubertal boys and, therefore, have little clinical significance; thus, AMH measurements are useful in the differential diagnosis of pubertal delay and congenital HH. In individuals with congenital HH, AMH concentrations are abnormally low, while in pubertal delay, AMH concentrations will be within the prepubertal reference interval.

Granulosa cell tumors of the ovary may secrete AMH, inhibin A, and inhibin B. Elevated levels of any of these markers can indicate the presence of such a neoplasm in a woman with an ovarian mass. Levels should fall with successful treatment. Rising levels indicate tumor recurrence or progression.

Cautions

Serum biotin concentrations up to 1200 ng/mL do not interfere with this assay. Concentrations up to 1200 ng/mL may be present in specimens collected from patients taking extremely high doses of biotin up to 300 mg per day. In a study among 54 healthy volunteers, supplementation with 20 mg/day biotin resulted in a maximum serum biotin concentration of 355 ng/mL 1-hour post-dose.

The following drugs may interfere with this test: Cetrotide (cetrorelix), Ovitrelle, Endometrin (progesterone), and follistatin. Do not use this test to analyze specimens from patients who have received 1 or more of these products within 1 to 2 weeks of testing.

There is not a high-dose hook effect at anti-Mullerian hormone (AMH) concentrations up to 1400 ng/mL.

In rare cases, some individuals can develop antibodies to mouse or other animal antibodies (often referred to as human anti-mouse antibodies [HAMA] or heterophile antibodies), which may cause interference in some immunoassays. The

presence of antibodies to streptavidin or ruthenium can rarely occur and may interfere in this assay. Caution should be used in interpretation of results, and the laboratory should be alerted if the result does not correlate with the clinical presentation.

For diagnostic purposes, the results should always be assessed in conjunction with the patient's medical history, clinical examination, and other findings.

AMH immunoassays are not standardized, and values obtained with different assay methods or kits may be different and cannot be used interchangeably.

If using as a tumor marker, test results cannot be interpreted as absolute evidence for the presence or absence of malignant disease.

Clinical Reference

1. Jacobs MH, Reuter LM, Baker VL, et al. A multicentre evaluation of the Elecsys anti-Mullerian hormone immunoassay for prediction of antral follicle count. Reprod Biomed Online. 2019;38(5):845-852
2. Anckaert E, Denk B, He Y, Torrance HL, Broekmans F, Hund M. Evaluation of the Elecsys anti-Mullerian hormone assay for the prediction of hyper-response to controlled ovarian stimulation with a gonadotrophin-releasing hormone antagonist protocol. Eur J Obstet Gynecol Reprod Biol. 2019;236:133-138
3. Bedenk J, Vrtacnik-Bokal E, Virant-Klun I. The role of anti-Mullerian hormone (AMH) in ovarian disease and infertility. J Assist Reprod Genet. 2020;37(1):89-100
4. Xu HY, Zhang HX, Xiao Z, Qiao J, Li R. Regulation of anti-Mullerian hormone (AMH) in males and the associations of serum AMH with the disorders of male fertility. Asian J Androl. 2019;21(2):109-114
5. Grinspon RP, Bergada I, Rey RA. Male hypogonadism and disorders of sex development. Front Endocrinol (Lausanne). 2020;11:211. Published 2020 April 15
6. Kanakatti Shankar R, Dowlut-McElroy T, Dauber A, Gomez-Lobo V. Clinical utility of anti-Mullerian hormone in pediatrics. J Clin Endocrinol Metab. 2022;107(2):309-323. doi:10.1210/clinem/dgab687
7. Saint Paul LP, Debruyne D, Bernard D, Mock DM, and Defer GL. Pharmacokinetics and pharmacodynamics of MD1003 (high-dose biotin) in the treatment of progressive multiple sclerosis. Expert Opin Drug Metab Toxicol. 2016;12:3,327-344
8. Grimsey P, Frey N, Bendig G,et al: Population pharmacokinetics of exogenous biotin and the relationship between biotin serum levels and in vitro immunoassay interference. J Pharmacokinet Pharmacodyn. 2017;2(4),247-256

Performance

Method Description

The Roche Elecsys AMH (anti-Mullerian hormone) assay is a 2-site immunometric sandwich assay using electrochemiluminescence detection. Patient specimen, biotinylated monoclonal AMH-specific antibody, and monoclonal AMH-specific antibody labeled with a ruthenium react to form a complex. Streptavidin-coated microparticles act as the solid phase to which the complex becomes bound. Voltage is applied to the electrode inducing a chemiluminescent emission from the ruthenium, which is then measured against a calibration curve to determine the amount of AMH in the patient specimen.(Package insert: Elecsys AMH, Roche Diagnostics; 2.0 English, 10/2022)

PDF Report

No

Day(s) Performed
Monday through Saturday

Report Available
1 to 3 days

Specimen Retention Time
2 weeks

Performing Laboratory Location
Mayo Clinic Laboratories - Rochester Superior Drive

Fees & Codes

Fees
- Authorized users can sign in to Test Prices for detailed fee information.
- Clients without access to Test Prices can contact Customer Service 24 hours a day, seven days a week.
- Prospective clients should contact their account representative. For assistance, contact Customer Service.

Test Classification
This test has been modified from the manufacturer's instructions. Its performance characteristics were determined by Mayo Clinic in a manner consistent with CLIA requirements. This test has not been cleared or approved by the US Food and Drug Administration.

CPT Code Information
82166

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
AMH1	Antimullerian Hormone, S	83104-0

Result ID	Test Result Name	Result LOINC® Value
AMH1	Antimullerian Hormone, S	83104-0