ANTI-MÜLLERIAN HORMONE

Amh, Müllerian Inhibiting Factor (Mif), Müllerian-Inhibiting Hormone (Mih), Müllerian-Inhibiting Substance (Mis), Anti-Paramesonephric Hormone (Aph)

A hormone, that provokes the regression of male fetal Müllerian ducts.

About Anti-Müllerian hormone

**Function**

Anti-Müllerian hormone (AMH), also known as Müllerian inhibiting substance (MIS) or factor (MIF). AMH plays crucial roles in sexual differentiation and gonadal functions. AMH is produced by Sertoli and granulosa cells in the male and female, respectively. AMH levels are useful in fertility assessment, as it provides a guide to ovarian reserve and identifies women that may need to consider either egg freezing or trying for a pregnancy sooner rather than later if their long-term future fertility is poor.

In the male, AMH is a specific functional marker of the immature Sertoli cell. AMH expression is initiated at the time of fetal differentiation of the seminiferous cords, by the end of the 7th embryonic week, and remains at high levels until the onset of puberty, when it rapidly declines in response to testosterone synthesis and the onset of germ cell meiosis (Pic. 1). The onset of AMH expression and its basal expression level throughout life are independent of gonadotropins.

Females are born with a fixed number of primordial follicles, resting in a dormant state of meiosis II until puberty, until they enter different stages of development. The quantity and the quality of primordial follicle constitute the reserve of an ovary. AMH levels are almost undetectable at birth. The secretion decreases as antral follicles start to grow, and it stops when a follicle reaches 8 mm or undergoes atresia. Preantral and small antral follicles measuring 2 to 8 mm express highest amount of AMH thus making it the earliest marker of ovarian follicular growth. The circulating levels of AMH in adult women reflect the number of remaining primordial follicles. During childhood and adolescence, AMH fluctuations are minimal and each girl maintains her relative level during pubertal transition. During menstrual cycle it is observed that AMH exhibit mild fluctuation. Mild fluctuation can be explained by the fact that dominant follicles lack AMH production, resulting in slight decline during late follicular stage.

**AMH and IVF**

AMH is a good indicator of whether a sufficient number of eggs a female fertility optimal, or whether it has the ability to conceive decreases. Anti-Müllerian hormone level of less than or equal to 5.4 pmol/l (0.8 ng/mL) predicts a low response to ovarian hyperstimulation, while a level greater than or equal to 25.0 pmol/l (3.6 ng/mL) predicts a high response. Follicle stimulating hormone (FSH) and anti-Müllerian hormone (AMH) represent the two most frequently utilized laboratory tests in determining ovarian reserve (OR). A patient’s ovarian reserve (OR) determines prognostic chances of fertility treatments and her treatment options. FSH and AMH, in principle, correlate and cross-corollaries can, indeed, be established. A number of studies recently suggested that AMH, better than FSH, reflects in vitro fertilization (IVF) outcomes, including pregnancy chances.

**Ovarian reserve testing methods**

A combination of AMH and a transvaginal ultrasound to count the number of antral follicles is probably the best way to assess ovarian reserve and future fertility. This combination is sometimes referred to as the Biological Body Clock Test. Accurate assessments of ovarian reserve are crucial and allow for appropriate counselling.
Reference ranges for Anti-Müllerian hormone

At birth, male cord blood has high levels of AMH (mean 148 pmol/L), whereas AMH is undetectable (54%) or very low (95% CI: <2–16) in cord sera from female infants.

At three months of age, AMH levels increase markedly in both sexes, although the concentrations in females (mean 13 pmol/L) remain much lower compared to concentrations in male infants (mean 1047 pmol/L).

During childhood, AMH levels are relatively stable in both sexes, boys having approximately 35 times higher levels than girls. Until pubertal onset, AMH is consequently a sensitive and specific marker of Sertoli cell activity.

With the onset of testosterone synthesis in male puberty, serum AMH levels decline rapidly (mean 50 pmol/L), which clearly overlap with the levels seen in healthy females (Pic. 2).

Pathology

Determination of the serum AMH concentration is used in various ways in clinical pediatrics to determine the presence of testicular tissue in patients with cryptorchidism, suspected anorchia, or more severe Disorders of Sex Development (DSD).

Levels of AMH might also become a useful predictive marker of the spermatogenic response to gonadotropin treatment in young patients with hypogonadotropic hypogonadism.

In woman serum of AMH used as a marker of Premature ovarian insufficiency (POI), a marker in polycystic ovarian syndrome (PCOS) or as a tumor load marker.

PCOS (Polycystic ovary syndrome)

In PCOS women, anti-Müllerian hormone (AMH) is suspected to play a significant role in causing anovulation due to its inhibitory influence on FSH that normally promotes follicular development from the small antral stage to ovulation. Moreover, plasma AMH levels in PCOS patients are two- to threefold higher than in women with normal ovaries, and the severity of the PCOS phenotype correlates with AMH production, which is higher in anovulatory than in ovulatory PCOS patients.

Ovarian Tumors

AMH is exclusively secreted by granulosa cells, it is a reliable marker for diagnosis as well as monitoring for recurrences of tumor. AMH surge is observed up to 16 months prior to clinical recurrence of the tumor itself, suggesting it as a useful marker of granulosa cell activity.

Find more about related issues

Diagnoses

Amenorrhea
The absence of a menstrual period in women of reproductive age.
Learn more at: www.fertilitypedia.org/therapy.diag/amenorrhea

Oligomenorrhea
Light or infrequent menstrual flow at intervals of 39 days to 6 months or 5–7 cycles in a year.
Learn more at: www.fertilitypedia.org/therapy.diag/oligomenorrhea
**Poor ovarian reserve**
A condition of low fertility characterized by low numbers of remaining oocytes in the ovaries or possibly impaired oocyte development or recruitment.
Learn more at: [www.fertilitypedia.org/therapy/diag/poor-ovarian-reserve](http://www.fertilitypedia.org/therapy/diag/poor-ovarian-reserve)

**Premature ovarian failure**
The loss of function of the ovaries before age 40.
Learn more at: [www.fertilitypedia.org/therapy/diag/premature-ovarian-failure](http://www.fertilitypedia.org/therapy/diag/premature-ovarian-failure)

**Undescended testes**
In the case of cryptorchidism one or both testes are absent from the scrotum. It is the most common etiologic factor of azoospermy in the adult.
Learn more at: [www.fertilitypedia.org/therapy/diag/undescended-testes](http://www.fertilitypedia.org/therapy/diag/undescended-testes)

### Organs

**Ovary**
The ovum-producing organs of the internal female reproductive system
Learn more at: [www.fertilitypedia.org/edu/organs/ovary](http://www.fertilitypedia.org/edu/organs/ovary)

**Testes**
Male gonads which produce both sperm and androgens, such as testosterone, and are active throughout the reproductive lifespan of the male.
Learn more at: [www.fertilitypedia.org/edu/organs/testes](http://www.fertilitypedia.org/edu/organs/testes)

### Gallery

**Pic**
The red and blue curves represent the female and male reference ranges.

<table>
<thead>
<tr>
<th>Anti-Müllerian hormone</th>
<th>Age</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Younger than 24 months</td>
<td>ng/mL</td>
<td>Less than 5</td>
</tr>
<tr>
<td></td>
<td>Younger than 24 months</td>
<td>pmol/l</td>
<td>Less than 35</td>
</tr>
<tr>
<td></td>
<td>24 months to 12 years</td>
<td>ng/mL</td>
<td>Less than 10</td>
</tr>
<tr>
<td></td>
<td>24 months to 12 years</td>
<td>pmol/l</td>
<td>Less than 70</td>
</tr>
<tr>
<td></td>
<td>13–45 years</td>
<td>ng/mL</td>
<td>1 to 10</td>
</tr>
<tr>
<td></td>
<td>13–45 years</td>
<td>pmol/l</td>
<td>7 to 70</td>
</tr>
<tr>
<td></td>
<td>More than 45 years</td>
<td>ng/mL</td>
<td>Less than 1</td>
</tr>
<tr>
<td></td>
<td>More than 45 years</td>
<td>pmol/l</td>
<td>Less than 7</td>
</tr>
<tr>
<td></td>
<td>Younger than 24 months</td>
<td>ng/mL</td>
<td>15 to 500</td>
</tr>
<tr>
<td></td>
<td>Younger than 24 months</td>
<td>pmol/l</td>
<td>100 to 3500</td>
</tr>
<tr>
<td></td>
<td>24 months to 12 years</td>
<td>ng/mL</td>
<td>7 to 240</td>
</tr>
<tr>
<td></td>
<td>24 months to 12 years</td>
<td>pmol/l</td>
<td>50 to 1700</td>
</tr>
<tr>
<td></td>
<td>More than 12 years</td>
<td>ng/mL</td>
<td>0.7 to 20</td>
</tr>
<tr>
<td></td>
<td>More than 12 years</td>
<td>pmol/l</td>
<td>5 to 140</td>
</tr>
</tbody>
</table>

### Sources

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