International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Naseer S et al. Int J Reprod Contracept Obstet Gynecol. 2025 Aug;14(8):2514-2517
www.ijrcog.org
pISSN 2320-1770 | eISSN 2320-1789

DOI: https://dx.doi.org/10.18203/2320-1770.ijrcog20252317

Original Research Article

Comparison between anti-Müllerian hormone and antral follicle count for assessment of ovarian reserve

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Received: 30 September 2023
Revised: 20 June 2025
Accepted: 25 June 2025

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ABSTRACT

Background: In general, anti-müllerian hormone (AMH) is positively associated with antral follicle count (AFC). AMH and AFC are correlated with the ovarian response, but their reliability and reproducibility are questionable.
Methods: This is a prospective observational study. A total of 50 patients were selected who visited the hospital for infertility treatment. It was conducted in SKIMS MCH Srinagar over a period of 4 months from January 2023 to April 2023. Karl Pearson's correlation coefficient was employed for assessing correlation between AMH levels and Total AFC. A P value of less than 0.05 was considered statistically significant.
Results: Total of 50 patients were included in the study with mean age of patients being 34.1. The mean BMI of patients was 27.1 and mean duration of infertility was 3.6years. Mean±SD of AFC between age group 26 to 30 was 6.41±9.65 between 31 to 35 was 5.60±4.42 and between 36 to40 was 2.76±2.34, with a p value of 0.012 (statistically significant). Mean±SD of AMH between age 26 to30 was 2.10±1.98 between age 31to35 was 1.83±2.19 and between age 36 to40 was 0.49±0.72.
Conclusion: AMH is considered as most reliable investigation for ovarian reserve testing. However, AFC can be used in place of AMH in poor patients as the cost of AMH is more as they have a strong corelation

Keywords: Pregnancy, Anti-müllerian hormone, Antral follicle count, Infertility

INTRODUCTION

A women's ovarian reserve is defined as the number and quality of follicles and oocytes she owns.[1] It is affected by several factors like age, genetics, and certain environment.[2] The AMH levels are determined by granulosa cells of secondary, pre-antral and small antral follicles up to 6 mm in diameter and hence AMH may represent the number of these follicles.[3]

The number of antral follicles in the ovaries is proportionally related to the size of primordial follicle stock from which they were recruited.[4] Hence, the antral follicle count (AFC) represents the quantitative aspect which determines the expression of ovarian aging.[5] AMH and AFC both are associated positively; that is, patients with good ovarian reserve have high AMH and AFC values, and those with poor ovarian reserve function have low values. A metanalysis has shown that BMI is negatively correlated with AMH in all study populations.[6] AMH also shows variation in different phases of cycle, with a reduction in luteal phase but cycle independent measurement seems appropriate for clinical purposes.[7] The age-related decline of AMH is constant, but, for a given age, AMH levels can vary substantially.[8] AFC also shows variation throughout the cycle so needs to be measured during the early follicular phase. The inter-cycle variability of AFC is also consistent, but generally considered to be of minimal clinical relevance in the prediction of response in IVF.[9] In this study, the data has

been collected from patients who were treated with in vitro fertilization/intracytoplasmic sperm injection (IVF/ICSI) at the reproductive center in our hospital. The relationship between serum AMH level, the ovarian AFC, body mass index (BMI), age and other factors, and ovarian response was analyzed. AMH levels are easy to measure and there are less variations through the different phases of cycle, but there is a lack of a standardized international assay.[10-12] The knowledge gained from the study can better guide clinicians in choosing the most appropriate ovulation promotion regimen, therefore improving the pregnancy rate in infertile women.

METHODS

The study was a prospective observational study. It was conducted in SKIMS MCH Srinagar over a period of 4 months from January 2023 to April 2023. Total 50 patients who visited routine infertility centre of department of OBG SKIMS MCH Srinagar over a period of 4 months, were included in the study. Data collected included age, BMI, AMH, AFC. Blood samples from all patients were stored at -20°C and tested using an enzyme-linked immunosorbent assay kit. The correlation coefficient, r≥0.9900; the relative deviation of the assay results, within 10%; and the coefficient of variation (CV), ≤10%. The antral follicle count (AFC) numbers were counted using the color doppler ultrasonic diagnostic apparatus on day 2.

Study duration

The study was conducted over a period of 4 months from January 2023 to April 2023.

Inclusion criteria

The cases included patients with age ranging from 26 to 40 years, duration of infertility more than 1 years.

Exclusion criteria

History of ovarian cystectomy, PID, endometriosis, POF, no underlying comorbidity, PCOD.

Statistical analysis

Descriptive statistics was calculated in the form of mean ± standard deviation. Pearson correlation and linear regression analysis were done to find out the relationship between the study variables. The statistical analysis was done by SPSS (Statistical Package for Social Sciences), trial version 20.

Continuous variables were expressed as Mean±SD and categorical variables were summarized as percentages. Analysis of variance (ANOVA) test was used for comparing continuous variables. Karl Pearson's correlation coefficient was employed for assessing correlation between AMH levels and Total AFC.A p value of <0.05 was considered statistically significant at two-tailed test.

RESULTS

Total of 50 patients were included in the study. The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). Continuous variables were expressed as Mean±SD and categorical variables were summarized as percentages. Analysis of variance (ANOVA) test was used for comparing continuous variables. Karl Pearson's correlation coefficient was employed for assessing correlation between AMH levels and Total AFC. A p value of less than 0.05 was considered statistically significant. 50 patients were included in the study with mean age of patients being 34.1 (Table 1). The mean BMI of patients was 27.1 and mean duration of infertility was 3.6 years (Table 2).

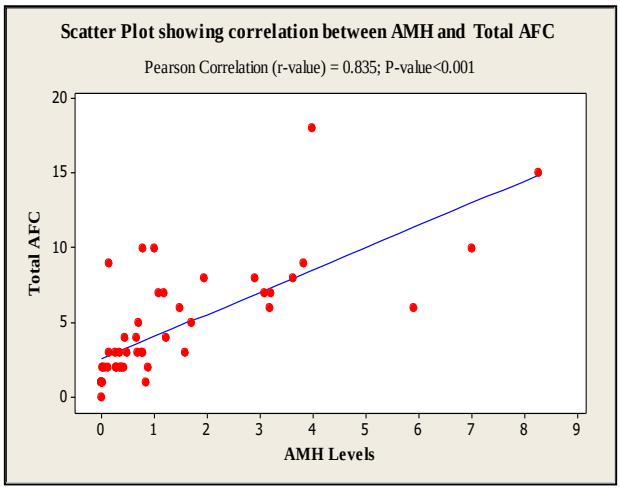

Figure 1: Showing correlation between AMH and total AFC.

Mean±SD of AMH between age 26 to 30 was 2.10±1.98 between age 31to35 was 1.83±2.19 and between age 36 to40 was 0.49±0.72. 85.7% of patients are between age 36-40 years with AMH <1 and a p value of 0.017 which is statistically significant. Thus, with increasing age AMH levels fall and hence serves a good marker for ovarian reserve (Table 3). Mean±SD of AFC between age group 26 to 30 was 6.41±9.65 between 31 to 35 was 5.60±4.42 and between 36 to 40 was 2.76±2.34, with a p value of 0.012 statistically significant (Table 4).

Table 1: Age distribution of study patients.

Age (in years)	Number	%
26-30	14	28
31-35	15	30
36-40	21	42
Total	50	100
Mean±SD=34.1±4.27		

Table 2: Baseline characteristics of study patients.

Parameter	Mean±SD
BMI (Kg/m^2)	27.1±2.43
Duration of infertility (in years)	3.6±1.89
Total ovarian volume	7.3±2.18

Table 3: Distribution of study patients according to serum AMH level.

Serum AMH (ng/ml)	26-30 Years		31-35 Years		36-40 Years		P value
	No.	% age	No.	% age	No.	% age	
< 1.0 (Low)	6	42.9	8	53.3	18	85.7	0.017*
1.0-3.5 (Normal)	5	35.7	5	33.3	3	14.3	
> 3.5 (High)	3	21.4	2	13.3	0	0.0	
Mean±SD	2.10±1.98		1.83±2.19		0.49±0.72		

*Statistically Significant (p value<0.05)

Table 4: Distribution of study patients according to total AFC level

Total AFC	26-30 Years		31-35 Years		36-40 Years		P value
	No.	% age	No.	% age	No.	% age	
< 5 (Low)	6	42.9	8	53.3	17	81.0	0.012*
5-10 (Normal)	5	35.7	4	26.7	3	14.3	
> 10 (High)	3	21.4	3	20.0	1	4.8	
Mean±SD	6.41±9.65		5.60±4.42		2.76±2.34		

*Statistically Significant (p value<0.05)

DISCUSSION

There are many indicators for predicting ovarian response. with advancing age, AMH levels and AFC decrease. There are often discordances in relevant indicators. The AMH level and AFC are the two most accurate indicators for predicting ovarian response.[13] In general, serum AMH levels are strongly positively correlated with AFCs.[14] Authors noted a linear pattern of decline of AMH with age. It was clear from our study that both AMH and AFC showed better correlation with age. There is a high degree of positive correlation between AMH and AFC levels (r=0.835), further the correlation is statistically significant (p value <0.0001). We failed to find a non-linear trend as Dewailly et al.[15]

Limitations of AMH concentration assessment are the absence of international standardization and the high cost; standardization combined with a stable automated assay is likely to enhance its performance in the prediction of ovarian response.[16] Several authors studied age related behaviour of AMH and AFC and found that levels got decreased sometimes becoming undetectable after menopause.[17] AMH was affected not only by the quantity of antral follicles but also by their quality.[18] It had already been shown in infertile women that the discordance between AMH and AFC existed not only due to the technical limitations in counting of the follicles and analytical variability of the AMH assay used but also due to patient-specific factors such as body mass index, PCOS, socioeconomic status, environmental/nutritional factors like vitamin D status. The reason for similar discordance observed in women with normal reproductive performance remains to be explained. The study included a smaller number of patients and had a shorter follow up period. For proper validation of these conclusions, a long term prospective clinical study with large sample size and longer follow up is required these were the limitations of the study.

CONCLUSION

AMH showed better correlation with age than AFC and, therefore, could be a better marker of ovarian aging. Although, AMH is considered to be more effective in predicting the ovarian response but many authors thought that AMH and AFC are having the same level of accuracy and clinical value in prediction of ovarian response. So, those authors emphasis that AFC can be considered as a substitute of expensive AMH estimation in predicting the ovarian response.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Naseer S, Andrabi SU, Andrabi SS. Comparison between anti-Müllerian hormone and antral follicle count for assessment of ovarian reserve. Int J Reprod Contracept Obstet Gynecol 2025;14:2514-7.