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ASSESSMENT OF OVARIAN RESERVE USING ANTI-MÜLLERIAN HORMONE AND ANTRAL FOLLICLE COUNT IN WOMEN WITH POLYCYSTIC OVARY SYNDROME: A PROSPECTIVE STUDY

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Abstract

Introduction: Polycystic ovary syndrome (PCOS) is a common endocrine disorder associated with reproductive and metabolic dysfunction. Assessment of ovarian reserve is important in understanding ovarian function in PCOS. Anti-Müllerian hormone (AMH) and antral follicle count (AFC) are widely used markers of ovarian reserve. This study aimed to assess ovarian reserve using AMH and AFC and to evaluate the correlation between these two parameters in women with PCOS.

Materials and Methods: This prospective observational study was conducted in a tertiary care hospital on 150 women diagnosed with PCOS based on Rotterdam criteria. Serum AMH levels were measured using ELISA, and AFC was assessed by transvaginal ultrasonography. Clinical, hormonal, and anthropometric data were recorded. Statistical analysis was performed using correlation tests, and a p-value <0.05 was considered statistically significant.

Results: The mean age of participants was 27.6 ± 4.3 years. The mean AMH level was 6.42 ± 2.18 ng/mL, and the mean AFC was 24.6 ± 6.8 follicles. A strong positive correlation was observed between AMH and AFC ($r = 0.78$, $p < 0.001$). AMH also showed a mild positive correlation with BMI ($r = 0.32$, $p = 0.02$) and LH/FSH ratio ($r = 0.41$, $p = 0.01$).

Conclusion: Women with PCOS demonstrated elevated AMH and AFC values, indicating increased ovarian follicular activity. A strong correlation between AMH and AFC supports their combined use as reliable markers of ovarian reserve in PCOS for clinical assessment and fertility counseling.

Keywords: Polycystic ovary syndrome, Anti-Müllerian hormone, Antral follicle count, Ovarian reserve, AMH, AFC, Infertility

Introduction

Polycystic ovary syndrome (PCOS) is one of the most common endocrine disorders affecting women of reproductive age and is characterized by chronic anovulation, hyperandrogenism, and polycystic ovarian morphology. It has a prevalence of approximately 6–20% depending on diagnostic criteria used and is frequently associated with metabolic disturbances such as insulin resistance, obesity, and dyslipidemia, in addition to reproductive dysfunction and infertility. [1,2]

Ovarian reserve refers to the quantity and quality of the remaining follicular pool within the ovary and is an important determinant of female reproductive potential. Assessment of ovarian reserve plays a crucial role in reproductive endocrinology, particularly in women with infertility and conditions such as PCOS. Conventional markers of ovarian reserve include serum follicle-stimulating hormone (FSH), estradiol levels, and ultrasound-based antral follicle count (AFC), although these parameters have limitations due to inter-cycle variability and operator dependency. [3]

Anti-Müllerian hormone (AMH), secreted by granulosa cells of pre-antral and small antral follicles, has emerged as a reliable biochemical marker of ovarian reserve. AMH reflects the size of the growing follicle pool and shows minimal intra- and inter-cycle variation, making it a convenient and reproducible marker. In women with PCOS, AMH levels are typically elevated due to increased follicular number, and it has been proposed as both a diagnostic and severity marker of the syndrome. [4,5]

Antral follicle count (AFC), assessed by transvaginal ultrasonography, is another widely accepted marker of ovarian reserve. It reflects the number of small follicles (2–10 mm) present in both ovaries and correlates with the ovarian response to stimulation. However, in PCOS, increased AFC may reflect both true high ovarian reserve and arrested follicular maturation, making interpretation challenging. [6]

Current evidence suggests that both AMH and AFC are reliable predictors of ovarian response to stimulation, and guidelines recommend either of these markers for assessment of ovarian reserve in clinical practice. However, their combined utility and correlation in PCOS patients remain an area of ongoing research. [7]

Therefore, the present study was undertaken to assess ovarian reserve in women with PCOS using AMH and AFC and to evaluate the correlation between these two parameters for better clinical characterization and reproductive counseling.

Material And Methods

Study Design

This prospective observational study was conducted to assess ovarian reserve using Anti-Müllerian Hormone (AMH) and Antral Follicle Count (AFC) in women diagnosed with polycystic ovary syndrome (PCOS).

Study Setting

The study was carried out in the Department of Obstetrics and Gynaecology at a tertiary care teaching hospital

Study Population

Women of reproductive age group attending the outpatient department with clinical symptoms suggestive of PCOS were screened. Those fulfilling diagnostic criteria for PCOS were enrolled in the study.

Diagnostic Criteria for PCOS

PCOS was diagnosed based on the Rotterdam criteria (2003), which required the presence of any two of the following three features after exclusion of related disorders:

1.Oligo- or anovulation

2.Clinical and/or biochemical signs of hyperandrogenism

3.Polycystic ovarian morphology on ultrasonography [1]

Inclusion Criteria
Women aged 18–40 years diagnosed with PCOS based on Rotterdam criteria who consented to participate in the study were included.

Exclusion Criteria
Women with the following conditions were excluded:
- Pregnancy or lactation
- Thyroid dysfunction
- Hyperprolactinemia
- Congenital adrenal hyperplasia
- Ovarian tumors or prior ovarian surgery
- Use of hormonal drugs in the last 3 months

Data Collection
A detailed clinical history including age, menstrual pattern, duration of symptoms, and infertility status was recorded. Physical examination included body mass index (BMI), signs of hyperandrogenism, and general systemic examination.

Hormonal Assessment
Venous blood samples were collected on day 2–5 of the menstrual cycle or on a random day in amenorrheic women. Serum Anti-Müllerian Hormone (AMH) levels were measured using enzyme-linked immunosorbent assay (ELISA). All samples were processed in the institutional clinical laboratory.

Ultrasonographic Assessment
Transvaginal ultrasonography was performed using a high-resolution ultrasound machine. Antral follicle count (AFC) was determined by counting all follicles measuring 2–10 mm in both ovaries. The total AFC was recorded as the sum of follicles in both ovaries.
Outcome Measures
The primary outcome measures were:
Serum AMH levels in women with PCOS
AFC values in both ovaries
Correlation between AMH and AFC

Statistical Analysis
Data were entered into Microsoft Excel and analyzed using appropriate statistical software. Continuous variables were expressed as mean ± standard deviation, and categorical variables as percentages. Correlation between AMH and AFC was assessed using Pearson's correlation coefficient. A p-value of <0.05 was considered statistically significant.

Results
A total of 150 women diagnosed with polycystic ovary syndrome were included in the study. The findings are presented in Tables 1–4 and Figure 1.
The age distribution of study participants is shown in Table 1 and Figure 1. The majority of participants belonged to the 21–25 years age group 52 (34.7%), followed by 26–30 years 48 (32.0%). The mean age of the study population was 27.6 ± 4.3 years. Only a small proportion of participants were in the 36–40 years age group 8 (5.3%), indicating that most women with PCOS in the study were in the early reproductive age group.
The clinical characteristics of the participants are summarized in Table 2. The mean BMI was 26.8 ± 3.9 kg/m². Overweight and obesity were observed in 64 (42.7%) and 38 (25.3%) participants respectively, while 48 (32.0%) had normal BMI. Menstrual irregularity was the most common clinical feature, observed in 142 (94.7%) women, followed by infertility complaints in 96 (64.0%) and hirsutism in 88 (58.7%) cases.

The hormonal profile and ovarian reserve markers are presented in Table 3. The mean serum AMH level was 6.42 ± 2.18 ng/mL. The mean AFC was 24.6 ± 6.8 follicles, indicating increased ovarian follicular activity in PCOS patients. The mean LH/FSH ratio was 1.89 ± 0.74, reflecting endocrine imbalance commonly associated with PCOS.

The correlation between AMH and AFC is shown in Table 4. A strong positive correlation was observed between AMH and AFC ($r = 0.78$, $p < 0.001$), indicating that higher AMH levels were significantly associated with increased antral follicle count. A mild positive correlation was also observed between AMH and BMI ($r = 0.32$, $p = 0.02$) and between AFC and BMI ($r = 0.28$, $p = 0.03$). Additionally, AMH showed a moderate positive correlation with LH/FSH ratio ($r = 0.41$, $p = 0.01$), suggesting an association between ovarian reserve markers and hormonal imbalance in PCOS.

Table 1. Age Distribution of Study Participants

Age Group (Years)	Number (n)	Percentage (%)
18–20	18	12.0
21–25	52	34.7
26–30	48	32.0
31–35	24	16.0
36–40	8	5.3
Total	**150**	**100.0**

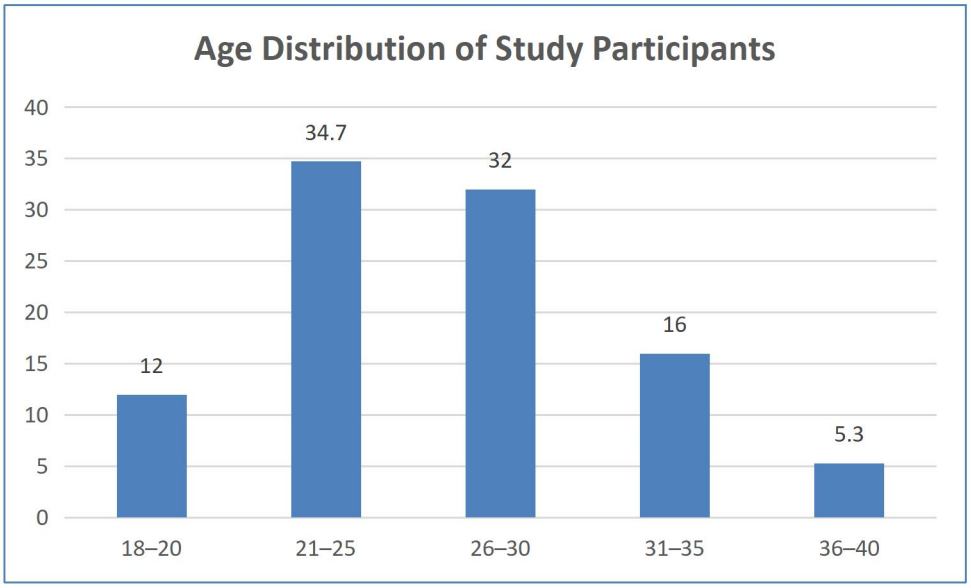


Figure 1 Age Distribution of Study Participants

Table 2. Clinical Characteristics of Study Participants

Parameter	Mean ± SD / n (%)
Age (years)	27.6 ± 4.3
BMI (kg/m²)	26.8 ± 3.9
Overweight (BMI 25–29.9)	64 (42.7%)
Obesity (BMI ≥30)	38 (25.3%)
Normal BMI	48 (32.0%)
Menstrual irregularity	142 (94.7%)
Infertility complaints	96 (64.0%)
Hirsutism present	88 (58.7%)

Table 3. Hormonal Profile and Ovarian Reserve Markers

Parameter	Mean ± SD	Minimum	Maximum
AMH (ng/mL)	6.42 ± 2.18	2.1	12.8
FSH (mIU/mL)	5.21 ± 1.34	2.8	8.9
LH (mIU/mL)	9.84 ± 3.76	4.2	21.5
LH/FSH Ratio	1.89 ± 0.74	0.9	4.2
AFC (total follicles)	24.6 ± 6.8	12	42

Table 4. Correlation Between AMH and AFC in PCOS Patien

Variable Pair	Correlation Coefficient (r)	p-value	Interpretation
AMH vs AFC	0.78	<0.001	Strong positive correlation
AMH vs BMI	0.32	0.02	Mild positive correlation
AFC vs BMI	0.28	0.03	Mild positive correlation
AMH vs LH/FSH ratio	0.41	0.01	Moderate positive correlation

Table 5. Correlation Between TVS and Hysteroscopy Finding

Lesion Type	Detected on TVS (n)	Detected on Hysteroscopy (n)	Agreement (%)
Endometrial polyp	20	26	76.9
Submucous fibroid	28	30	93.3
Endometrial hyperplasia	42	22	52.3
Adenomyosis	12	10	83.3
Normal cavity	18	14	77.8

Discussion

In the present prospective study, ovarian reserve in women with polycystic ovary syndrome (PCOS) was assessed using Anti-Müllerian Hormone (AMH) and Antral Follicle Count (AFC), and a strong positive correlation was observed between the two parameters ($r = 0.78$, $p < 0.001$). The findings highlight the concordance between biochemical and ultrasonographic markers of ovarian reserve in PCOS and support their combined utility in clinical evaluation.

In our study, the mean AMH level was 6.42 ± 2.18 ng/mL, which is higher than the levels typically observed in healthy reproductive-age women. This elevated AMH level is consistent with the increased number of small antral follicles seen in PCOS due to follicular arrest and excessive folliculogenesis. Similar findings were reported by Dewailly et al. (2011)[5], who demonstrated that AMH levels are significantly elevated in PCOS and may reflect both increased follicle number and altered follicular dynamics . Iliodromiti et al. (2013)[4] also confirmed that AMH has good predictive accuracy for ovarian reserve and is strongly correlated with AFC in clinical settings.

The mean AFC in our study was 24.6 ± 6.8, which further supports the presence of increased follicular cohort in PCOS patients. Chang et al. (2011)[6] observed that women with PCOS had significantly higher AFC compared to controls and suggested that AFC is a useful marker for assessing ovarian morphology and response potential in assisted reproduction cycles . However, they also emphasized that elevated AFC in PCOS may not necessarily indicate superior fertility potential but rather reflects arrested follicular development.

We also observed a mild positive correlation between AMH and BMI ($r = 0.32$, $p = 0.02$), as well as between AFC and BMI ($r = 0.28$, $p = 0.03$). This suggests that increasing adiposity may influence ovarian reserve markers. Teede et al. (2016)[2] reported that metabolic dysfunction, particularly obesity and insulin resistance, plays a key role in the pathophysiology of PCOS and may indirectly

affect ovarian function and follicular development . These findings highlight the importance of metabolic evaluation alongside reproductive assessment in PCOS patients.

The moderate positive correlation between AMH and LH/FSH ratio ($r = 0.41$, $p = 0.01$) observed in our study indicates a relationship between ovarian reserve markers and endocrine imbalance. Broekmans et al. (2006)[3] noted that hormonal disturbances in PCOS, particularly elevated LH levels, are associated with altered follicular development and increased AMH secretion from granulosa cells . This supports the hypothesis that AMH is not only a marker of ovarian reserve but also reflects underlying endocrine dysfunction.

The strong correlation between AMH and AFC in our study aligns with findings of Chang et al. (2011)[6], who demonstrated a close relationship between these two markers in women with PCOS and suggested that either marker can be used interchangeably in clinical practice depending on availability and expertise. Similarly, the ASRM Practice Committee (2015)[7] stated that both AMH and AFC are reliable indicators of ovarian reserve, though AMH offers the advantage of cycle-independent measurement.

Overall, our findings reinforce that women with PCOS exhibit increased ovarian reserve markers, but this does not necessarily translate into improved fertility outcomes due to associated anovulation and endocrine dysfunction. The combined use of AMH and AFC provides a more comprehensive assessment of ovarian reserve and may aid in individualized fertility counseling and treatment planning.

Conclusion

This study demonstrated that women with polycystic ovary syndrome exhibit significantly elevated Anti-Müllerian Hormone levels and increased antral follicle count, reflecting enhanced ovarian follicular activity. A strong positive correlation between AMH and AFC indicates that both markers are closely related and reliable in assessing ovarian reserve. The combined use of AMH and AFC provides a more comprehensive evaluation of ovarian function in PCOS. These findings support their clinical utility in diagnosis, reproductive counseling, and individualized fertility management.

Limitations

This study was conducted in a single tertiary care centre with a relatively small sample size, which may limit the generalizability of the findings. The cross-sectional assessment of AMH and AFC did not allow evaluation of longitudinal changes in ovarian reserve. Potential confounding factors such as insulin resistance and androgen levels were not analyzed in detail. Further multicentric studies with larger sample sizes are required to validate these findings.

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