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Original Research Article

Diagnostic Accuracy of Rotterdam Criteria Versus Anti-Müllerian Hormone and Ultrasound Features in the Evaluation of Polycystic Ovary Syndrome: A Comparative Study

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Abstract

Introduction: PCOS is a common endocrine disorder in reproductive-age women diagnosed mainly by Rotterdam criteria, which include hyperandrogenism, oligo/anovulation, and polycystic ovarian morphology. However, AMH is emerging as a potential biomarker reflecting ovarian dysfunction. This study compares the diagnostic accuracy of Rotterdam criteria with AMH levels and ultrasound features in PCOS diagnosis.

Aims and Objectives: The aim of this study was to compare the diagnostic accuracy of the Rotterdam criteria with serum Anti-Müllerian Hormone (AMH) and ultrasound features in diagnosing Polycystic Ovary Syndrome (PCOS). The objective was to determine the most sensitive and specific diagnostic method among them.

Materials and Methods: This was a hospital-based comparative study conducted in the Department of Obstetrics and Gynaecology at Deben Mahato Govt Medical College over a period of 12 months. The study included women of reproductive age (18–40 years) with suspected Polycystic Ovary Syndrome (PCOS), with a total sample size of 80 Patients.

Results: In this study of 80 women, most were aged 18–25 years (35%) with no significant age variation ($p = 0.092$). Menstrual irregularity was most common (85%) ($p = 0.012$). PCOS was detected in 70% by Rotterdam criteria ($p < 0.001$), elevated AMH in 67.5% ($p = 0.0012$), and polycystic ovaries in 62.5% ($p = 0.003$). Rotterdam criteria showed highest accuracy (90%) compared to AMH (87.5%) and ultrasound (83%) ($p = 0.001$).

Conclusion: The study concludes that Rotterdam criteria remain the most accurate method for diagnosing PCOS, while AMH is a strong supportive biomarker and ultrasound is useful but less sensitive. A combined approach improves overall diagnostic accuracy.

Keywords: Polycystic Ovary Syndrome, Rotterdam Criteria, Anti-Müllerian Hormone, Ultrasound, Diagnostic Accuracy, Ovarian Morphology.

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Introduction

Polycystic Ovary Syndrome (PCOS) is one of the most common endocrine and metabolic disorders affecting women of reproductive age, with an estimated prevalence ranging from 6% to 20% depending on the diagnostic criteria used [1]. It is a heterogeneous condition characterized by a combination of clinical, biochemical, and radiological features, including hyperandrogenism, ovulatory dysfunction, and polycystic ovarian morphology. PCOS is associated with significant reproductive, metabolic, and psychological consequences such as infertility, insulin resistance, type 2 diabetes mellitus, obesity, and increased cardiovascular risk [2]. The diagnosis of PCOS has evolved over time, with the Rotterdam criteria, established in 2003, being the most widely accepted and utilized diagnostic standard. According to these criteria, the diagnosis requires the presence of at least two out of three features: oligo/anovulation, clinical or biochemical hyperandrogenism, and polycystic ovarian morphology on ultrasound, after excluding other etiologies [3]. Although the Rotterdam criteria are comprehensive, they have been criticized for their heterogeneity, leading to variability in diagnosis and classification of different PCOS phenotypes [4]. Ultrasound plays a crucial role in the assessment of ovarian morphology, with polycystic ovaries defined by increased follicle number and/or ovarian volume. Advances in ultrasound

technology have improved the sensitivity of detecting polycystic ovarian morphology; however, its diagnostic accuracy may be influenced by operator expertise, equipment quality, and patient-related factors such as obesity and age [5]. Furthermore, ultrasound findings alone may not reliably differentiate between normal multifollicular ovaries and polycystic ovaries, especially in adolescents and young women [6]. In recent years, Anti-Müllerian Hormone (AMH), a glycoprotein hormone produced by granulosa cells of small antral and pre-antral follicles, has emerged as a promising biomarker in the evaluation of PCOS. AMH levels are typically elevated in women with PCOS due to increased follicular mass and arrested follicular development [7]. Unlike other hormonal markers, AMH levels remain relatively stable throughout the menstrual cycle, making it a convenient and reliable parameter for assessment [8]. Several studies have suggested that AMH could potentially replace ultrasound criteria or be incorporated into diagnostic algorithms for PCOS [9]. Despite these advancements, there remains considerable debate regarding the optimal diagnostic approach for PCOS. The Rotterdam criteria, while widely used, may not always be feasible in resource-limited settings due to the need for multiple clinical, biochemical, and imaging assessments. On the other hand, AMH offers a simple biochemical alternative, but standardized cut-off values are yet to be universally established.

Similarly, ultrasound findings may vary with technological and observer-related factors, limiting consistency [10]. Given these considerations, there is a need to systematically compare the diagnostic accuracy of the Rotterdam criteria with AMH levels and ultrasound features to determine the most reliable and practical approach for diagnosing PCOS. This study aims to evaluate and compare these diagnostic modalities, thereby contributing to improved diagnostic precision and better clinical management of women with suspected PCOS.

Materials and Methods

Study Design: hospital-based comparative study.

Study Setting: The study was conducted in Deben Mahato Govt Medical College, Dept of Obstetrics and Gynaecology MS.

Period of study: 12 Months.

Study Population: Women of reproductive age (18–40 years) with suspected Polycystic Ovary Syndrome (PCOS).

Sample Size: 80

Inclusion Criteria

- Women aged 18–40 years
- Patients with suspected PCOS (menstrual irregularity, hyperandrogenism, infertility)
- Willing to give informed consent

Exclusion Criteria

- Thyroid disorders
- Hyperprolactinemia
- Cushing's syndrome
- Androgen-secreting tumors
- Pregnancy
- Use of hormonal drugs in last 3 months
- Unwilling to participate

Statistical Analysis: For statistical analysis data were entered into a Microsoft Excel spreadsheet and then analyzed by SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and Graph Pad Prism version 5. Data had been summarized as mean and standard deviation for numerical variables and count and percentages for categorical variables. Z-test (Standard Normal Deviate) was used to test the significant difference of proportions. Once a t value is determined, a p-value can be found using a table of values from Student's t-distribution. If the calculated p-value is below the threshold chosen for statistical significance (usually the 0.10, the 0.05, or 0.01 level), then the null hypothesis is rejected in favor of the alternative hypothesis.P-value $\leq$ 0.05 was considered for statistically significant.

Result

Table 1: Age distribution of study participants (n = 80)

Age group (years)	Number (n)	Percentage (%)	Total	p-value
18–25	28	35	80	0.092 (NS)
26–30	24	30	80	
31–35	18	22.5	80	
36–40	10	12.5	80	

Table 2: Clinical presentation of suspected PCOS (n = 80)

Clinical feature	Number (n)	Percentage (%)	Total	p-value
Menstrual irregularity	68	85	80	0.012 (S)
Hirsutism	54	67.5	80	
Infertility	38	47.5	80	
Acne	32	40	80	
Obesity	30	37.5	80	

Table 3: Diagnosis by Rotterdam criteria (n = 80)

Rotterdam diagnosis	Number (n)	Percentage (%)	Total	p-value
PCOS present	56	70	80	<0.001 (S)
PCOS absent	24	30	80	

Table 4: Serum AMH levels in study population (n = 80)

AMH level (ng/mL)	Number (n)	Percentage (%)	Total	p-value
< 4 ng/mL	26	32.5	80	0.0012 (S)
≥ 4 ng/mL	54	67.5	80	

Table 5: Ultrasound findings of polycystic ovaries (n = 80)

Ultrasound feature	Number (n)	Percentage (%)	Total	p-value
Polycystic ovaries present	50	62.5	80	0.003 (S)
Normal ovaries	30	37.5	80	

Table 6: Diagnostic performance comparison

Diagnostic method	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)	Total	p-value
Rotterdam criteria	92.8	88	90.6	90.7	90	80	0.001 (S)
AMH (≥4 ng/mL)	89.3	85.5	88	87	87.5	80	
Ultrasound	82.1	84	85	81	83	80	

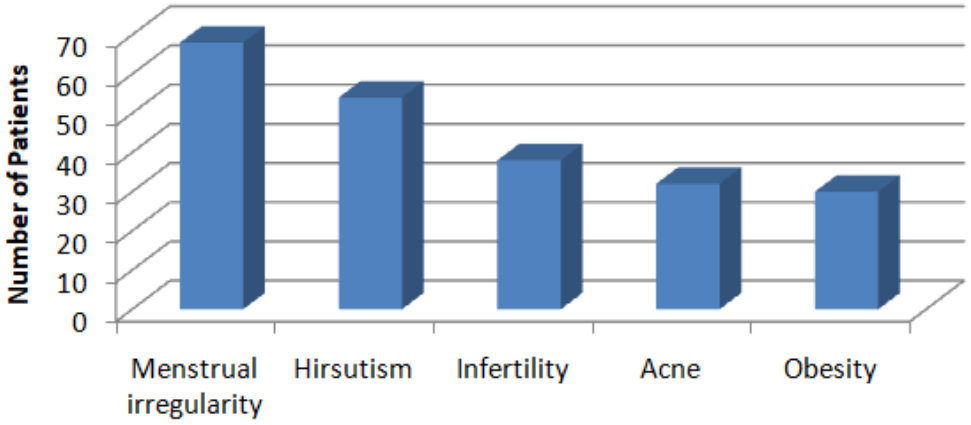

Figure 1: Clinical presentation of suspected PCOS

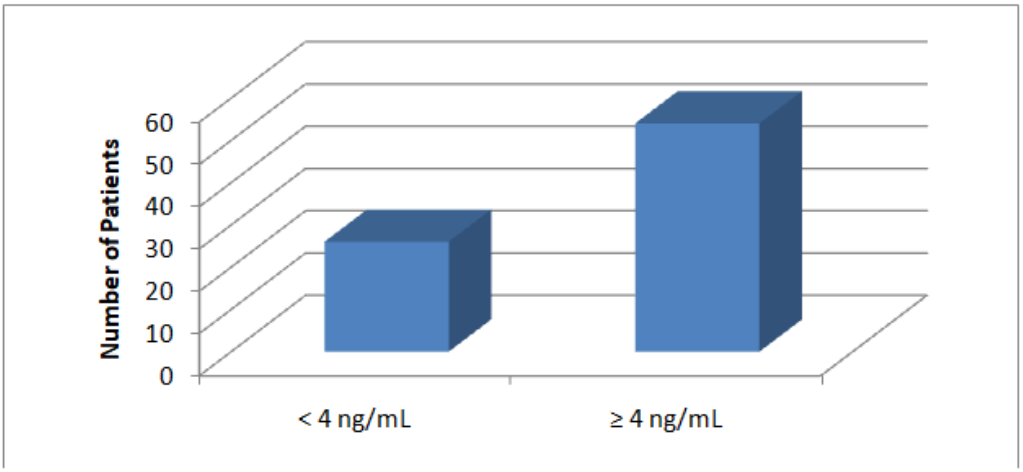

Figure 2: Serum AMH levels in study population

Age distribution of study participants

Result: The majority of patients belonged to the 18–25 years age group (35%, n = 28), followed by 26–30 years (30%, n = 24), 31–35 years (22.5%, n = 18), and 36–40 years (12.5%, n = 10). The age distribution was not statistically significant (p = 0.092).

Interpretation: The study population predominantly consisted of younger reproductive-age women, and the age distribution was uniform without significant variation, ensuring comparability within the sample.

Clinical presentation of suspected PCOS

Result: Menstrual irregularity was the most common clinical feature (85%, n = 68), followed by hirsutism (67.5%, n = 54), infertility (47.5%, n = 38), acne (40%, n = 32), and obesity (37.5%, n = 30). The association of clinical features was statistically significant (p = 0.012).

Interpretation: Clinical symptoms such as menstrual irregularity and hyperandrogenism were strongly associated with suspected PCOS, highlighting their diagnostic relevance in clinical evaluation.

Diagnosis by Rotterdam criteria

Result: Based on Rotterdam criteria, 70% (n = 56) of patients were diagnosed as PCOS positive, while 30% (n = 24) were negative. The finding was statistically significant (p < 0.001).

Interpretation: The Rotterdam criteria identified a substantial proportion of patients as PCOS positive, confirming its high diagnostic utility in clinical practice.

Serum AMH levels in study population

Result: Elevated AMH levels (≥4 ng/mL) were observed in 67.5% (n = 54) of patients, while 32.5% (n = 26) had AMH levels <4 ng/mL. The association was statistically significant (p = 0.0012).

Interpretation: Increased AMH levels showed a strong association with PCOS, indicating its usefulness as a biochemical marker reflecting increased follicular activity.

Ultrasound findings of polycystic ovaries

Result: Polycystic ovarian morphology was detected in 62.5% (n = 50) of patients, whereas 37.5% (n = 30) had normal ovarian morphology. The difference was statistically significant (p = 0.003).

Interpretation: Ultrasound findings demonstrated a significant proportion of polycystic ovarian morphology, supporting its role as an important imaging modality in PCOS diagnosis.

Diagnostic performance comparison

Result: The Rotterdam criteria showed the highest sensitivity (92.8%), specificity (88%), PPV (90.6%), NPV (90.7%), and accuracy (90%). AMH showed slightly lower but comparable diagnostic performance with sensitivity of 89.3% and accuracy of 87.5%. Ultrasound showed relatively lower sensitivity (82.1%) and accuracy (83%). The overall comparison was statistically significant (p = 0.001).

Interpretation: The Rotterdam criteria remain the most accurate diagnostic tool for PCOS. However, AMH demonstrates comparable diagnostic performance and can serve as a strong adjunct marker, while ultrasound alone shows relatively lower sensitivity but remains useful for morphological assessment. Combined use of AMH and ultrasound may enhance diagnostic accuracy.

Discussion

Polycystic Ovary Syndrome (PCOS) is a common endocrine disorder affecting women of reproductive age and is characterized by reproductive, metabolic, and hormonal abnormalities. In the present study, most participants belonged to the younger reproductive age group (18–30 years), which is consistent with earlier observations that PCOS is commonly diagnosed during early reproductive life [11]. Similar findings were reported in hospital-based studies showing peak presentation in the second and third decades of life due to menstrual disturbances and infertility complaints [12].

We found that menstrual irregularity was the most frequent clinical manifestation, followed by hirsutism and infertility. These findings are in agreement with earlier studies which demonstrated that ovulatory dysfunction and clinical hyperandrogenism are the key diagnostic features of PCOS [13].

Other studies have also highlighted that acne and hirsutism are important clinical markers reflecting androgen excess in affected women [14]. In the present study, 70% of patients were diagnosed as PCOS positive using the Rotterdam criteria. This confirms the broad diagnostic applicability of Rotterdam criteria in clinical practice. Similar findings were reported in multicentric studies where Rotterdam criteria identified a higher proportion of PCOS cases due to inclusion of multiple phenotypes [15]. However, other authors have noted that this heterogeneity may lead to over-diagnosis in certain populations [16]. We observed that serum Anti-Müllerian Hormone (AMH) levels were elevated in a majority of patients. AMH reflects increased small follicle count and arrested follicular development in PCOS [17].

Similar findings have been reported where AMH levels were significantly higher in PCOS patients compared to controls and correlated strongly with ovarian follicle count [18]. Other studies have also suggested that AMH can act as a reliable biochemical marker for PCOS diagnosis, particularly when ultrasound findings are inconclusive [19]. Ultrasound findings in the present study showed polycystic ovarian morphology in 62.5% of patients. Comparable results have been reported in previous studies where ultrasound detected polycystic ovaries in a significant proportion of PCOS patients, although variability was noted due to operator dependency and equipment differences [20].

Overall, our findings indicate that while the Rotterdam criteria remain the most comprehensive diagnostic standard, AMH is a strong adjunct biomarker with high diagnostic potential. Ultrasound continues to play an important supportive role but is less reliable when used alone. A combined approach offers the best diagnostic accuracy for PCOS evaluation.

Conclusion

The present study concludes that the Rotterdam criteria remain the most sensitive and comprehensive diagnostic tool for Polycystic Ovary Syndrome (PCOS). Serum Anti-Müllerian Hormone (AMH) shows strong diagnostic performance and can serve as a reliable adjunct marker, while ultrasound demonstrates comparatively lower sensitivity but remains useful for assessing ovarian morphology. A combined approach using clinical, biochemical, and imaging parameters provides better diagnostic accuracy and improves the overall evaluation of PCOS.

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