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Prevalence of Polycystic Ovarian Syndrome in Women of Reproductive Age in Mymensingh Region of Bangladesh – A Sonographic Evaluation

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Abstract

Polycystic ovarian syndrome (PCOS) is a common hormonal disorder affecting 5-15% of women of reproductive age. This cross-sectional study aims to provide a comprehensive understanding of the prevalence of PCOS in women of reproductive age leveraging sonographic evaluation. The study was conducted in the Department of Radiology & Imaging at Community-Based Medical College, Bangladesh (CBMC,B) Hospital, Mymensingh, Bangladesh, between January and December of 2022. Inclusion criteria were women aged between 15 and 45 years with suspected signs and symptoms of PCOS. Those with menstrual irregularities, hirsutism, severe acne, or abnormal hormone levels were excluded. Finally, a total of 120 women were included in the study. Pelvic ultrasounds were performed using a Samsung Sonoace X7 machine with a 3.5 MHz transabdominal transducer. 15(12.5%) were diagnosed with PCOS, while 105(87.5%) were negative. The age distribution shows the most significant group is 21-25 years (46.67%), followed by 15-20 years (24.17%). BMI data reveals the majority are overweight (40.83%), with an average BMI of 31.67%, and fewer in underweight (11.67%), obese (14.17%), and morbidly obese categories (1.67%). Clinical presentations include primary infertility (24.17%), secondary infertility (20.83%), chronic anovulation (15.00%), and no cases of hirsutism. Follicular diameters and ovarian volume were measured using Sono-AVC and VOCAL (3D) methods, with two identified cystic patterns: peripheral and general. Based on sonographic evaluation, our study revealed 12.5% prevalence of PCOS, with higher prevalence in the 21-25 age groups in women of reproductive age in Mymensingh region of Bangladesh.

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Introduction

Polycystic ovarian syndrome (PCOS), also known as polycystic ovary syndrome, is a prevalent hormonal disorder that primarily affects women post-puberty. Affecting 5-15% of women of reproductive age, PCOS leads to hormonal imbalances that result in menstrual irregularities, ovarian cysts, infertility, and various other health issues, including cardiovascular complications, type 2 diabetes mellitus (T2DM), and endometrial cancer.[1] PCOS is acknowledged as a significant reproductive and metabolic disorder due to its impact on the ovaries, with 40% of affected women experiencing insulin resistance, which increases their risk of developing type 2 diabetes mellitus (T2DM).[2] The global prevalence of PCOS is estimated to range between 4% and 20%.[3] According to data from the World Health

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Organization (WHO), approximately 116 million women, or 3.4% of the global female population, are affected by PCOS.[4] A review of studies conducted among Bangladeshi women found a prevalence of POCS ranging from 6.11% to 92.16%, depending on the diagnostic criteria and study population.[5] Diagnosing this complex disorder is challenging because there is no single diagnostic test for PCOS. Identification relies on clinical findings that are diverse and vary significantly, complicating the process of establishing a diagnosis.[6] Previously, the diagnosis of PCOS relied on a combination of clinical and hormonal characteristics, such as elevated serum levels of luteinizing hormone (LH), testosterone (T), and androstenedione, along with decreased levels of sex hormone-binding globulin.[7] The 2003 Rotterdam criteria for diagnosis of PCOS consist of at least two conditions out of the following three: i) irregular menstrual cycles or absence of ovulation, ii) clinical or biochemical signs of excess androgens, and iii) presence of polycystic ovaries as visualized on ultrasound.[8] Transvaginal sonography or ultrasound offers a non-invasive method to assess ovarian morphology and is widely employed for identifying polycystic ovaries. According to the 2003 Rotterdam criteria for ultrasound diagnosis of polycystic ovarian morphology (PCOM) involve the presence of ≥12 follicles measuring 2-9 mm in diameter and an enlarged ovarian volume (>10 cm^3) in either one or both ovaries.[9] The significance of identifying polycystic ovaries through ultrasound in diagnosing PCOS is currently a topic of debate. While the polycystic appearance of ovaries was initially described as characteristic of the disease, it is now understood not to be a distinct pathological entity, as similar findings can occur in other endocrine disorders.[6] Furthermore, the presence of polycystic ovaries is frequent among young, healthy women, with a prevalence ranging from 20% to 30% in those under 36 years of age.[10-12] The high prevalence of the polycystic ovary has further reduced the importance of the ultrasound criteria and raised doubts about its precision. With the advance of imaging technology, numerous efforts have been made to define the ovarian appearance in women with PCOS. The ultrasound criteria of PCOM have been refined over time. Hence, we proposed this study to provide a comprehensive understanding of the prevalence of PCOS in women of reproductive age leveraging sonographic evaluation.

Methods

The cross-sectional study was conducted in the Department of Radiology & Imaging at Community-Based Medical College, Bangladesh (CBMC,B) Hospital, Mymensingh, Bangladesh, between January and December of 2022. Inclusion criteria were women aged between 15 and 45 years having clinically suspected signs and symptoms of polycystic ovarian syndrome (PCOS). Women above 45 years, having menstrual irregularities, hirsutism, severe acne, or abnormal hormone levels were excluded. Finally, a total of 120 women were included in the study. Information on the age and clinical indications was obtained from patient registration logbook. Ultrasound images were assessed based on pelvic ultrasound examination, diagnosis, or impression of the scan images. A Samsung Sonoace X7 machine equipped with a 3.5MHz transabdominal transducer performed a pelvic ultrasound examination. The inter-observer coefficient of variation (SD/mean) was<10 for the

antral follicle count (determined by the independent measures of two observers on 100 patients). Ultrasound measurements were taken in real-time according to a standardized protocol. Only two-dimensional ultrasound was used. The highest possible magnification was used to examine the ovaries. After the longest medial axis of the ovary had been determined, the length and thickness were measured, and the area was calculated using a manual or automatic ellipse to outline the ovary. The ovarian area was used as a variable because its specificity and sensitivity are higher than those of ovarian volume.[13] All follicles but >2 mm in diameter were counted. The diameter of several follicles was calculated by taking the mean of the longitudinal and anteroposterior diameters. Then, the number of follicles measuring >2 mm and <9 mm was established by scanning each ovary from the inner margin to the outer margin in longitudinal cross-section. Fig. 1 illustrates the measurement process for follicular diameters in both longitudinal and transverse views of the ovary. Follicle size is determined by averaging three diameters, with an assessment performed using the Sono-AVC (3D) technique. Hypoechoic follicles are identified and color-coded, with their number and size displayed in the upper-right panel. Ovarian volume is measured by taking the three maximum perpendicular diameters and calculating the volume using the prolate ellipsoid formula. The VOCAL (3D) method is used for this calculation (Fig. 2). Two cystic patterns were noted – the peripheral cystic pattern, where follicles are located around the edge and near the ovarian surface, and the general cystic pattern, where follicles are dispersed throughout the entire ovarian parenchyma (Fig. 3). Data of ovarian area and follicle number were obtained by summing the values for left and right ovaries. All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 27.0 for Windows. Categorical parameters as frequency and percentage. Ethical clearance was obtained from the Ethical Review Committee of Community-Based Medical College, Bangladesh (CBMC,B), Mymensingh, Bangladesh.

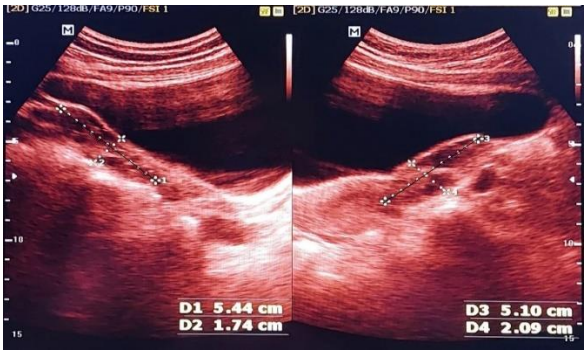

Fig. 1: Antral follicle measurement.

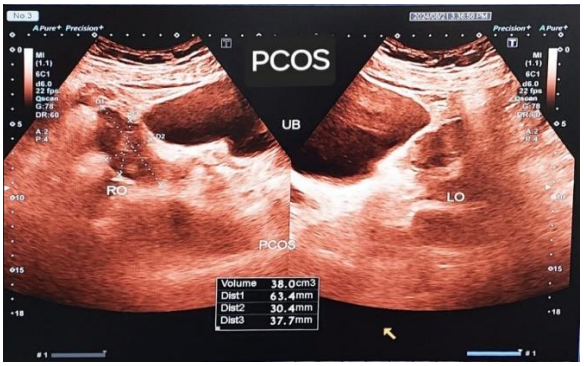

Fig. 2: Ovarian volume estimation.

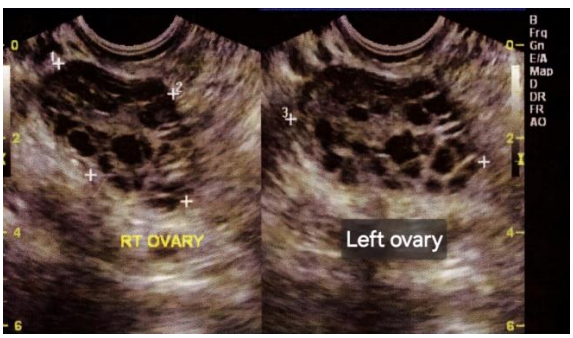

Fig. 3: Patterns of antral follicular distribution in polycystic ovaries.

Results

Among 120 women, the largest group was 21-25 years age group 56(46.67%), followed 15-20 years age group 29(24.17%), 31-35 years age group 19(15.83%), and 26-30 years age group 16(13.33%). Regarding BMI, the most common category was overweight (25-29.9 kg/m²)found in 49(40.83%), followed by normal BMI group (18.5-24.9 kg/m²) found in 38(31.67%), 14(11.67%) underweight individuals (<18.5 kg/m²), 17(14.17%) obese (30-34.9 kg/m²), and 2(1.67%) in morbidly obese category (≥35 kg/m²) (Table-I). Among clinical features, primary infertility was the most common presentation, as found in 29(24.17%), followed by secondary infertility 25(20.83%), chronic anovulation 18(15%), amenorrhea 15(12.50%), and oligomenorrhea 15(12.50%), sexually transmitted diseases (STDs) 11(9.17%), diabetes mellitus 4(3.33%) and obesity/metabolic syndrome 4(3.33%). Notably, no case of hirsutism was observed (Table-II). Based on sonographic evaluation, 12.5% prevalence of PCOS was estimated among our study participants (Fig. 4).

Table-I: Demographical characteristics of the study population (n=120).

Variables	Frequency	Percentage
Age group (in years)		
15-20	29	24.17
21-25	56	46.67
26-30	16	13.33
31-35	19	15.83
Body mass index (kg/m^2)		
<18.5 (underweight)	14	11.67
18.5-24.9 (normal)	38	31.67
25-29.9 (overweight)	49	40.83
30-34.9 (obese)	17	14.17
≥35 (morbid obese)	2	1.67

Table-II: Clinical presentation of the study participants (n=120)

Clinical Presentation	Frequency	Percentage
Primary Infertility	29	24.17
Secondary Infertility	25	20.83
Chronic Anovulation	18	15.00
Amenorrhea	15	12.50
Oligomenorrhea	15	12.50
Sexual Transmitted Disease	11	9.17
Diabetes	4	3.33
Obesity and Metabolic Syndrome	4	3.33
Hirsutism	-	-

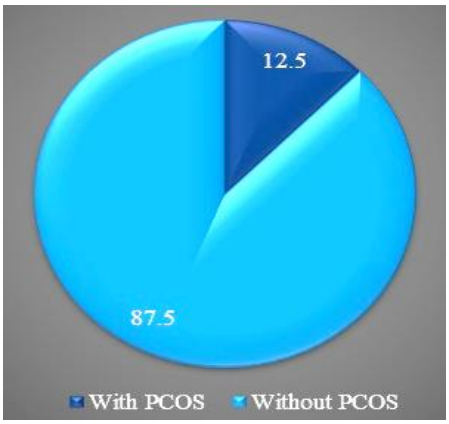

Fig. 4: Prevalence of PCOS among study participants (n=120)

Discussion

This study aimed to evaluate the prevalence of polycystic ovarian syndrome (PCOS) through a sonographic survey of ovaries in women aged 15-35 years. Among 120 women, 15(12.5%) were diagnosed with PCOS. The prevalence was low in the age groups 26-30 and 31-35 years but increased notably in the 15-20 years and 21-25 years age groups. A higher number of ovarian follicles correlates with a greater likelihood of PCOS diagnosis.[14,15] Hudecova *et al.* found ultrasonography to be a reliable diagnostic tool for PCOS, which may explain the higher

incidence observed in the 22-26 years and 27-31 years age groups in this study.[16] Antral follicles, which measure 2-9 mm in average diameter, are a key morphological feature of polycystic ovary syndrome (PCOS), characterized by an increased number of antral follicles per ovary (FNPO). Normally, antral follicles are recruited during each menstrual cycle, with one follicle growing to ovulation following the mid-cycle surge of luteinizing hormone (LH). In PCOS, follicular growth halts at the antral stage, leading to an excessive number of antral follicles (AFCs). The mechanisms behind this excessive follicle formation are not fully understood.[17] Histological studies have shown a two- to threefold increase in the average counts of all follicle stages, from primary to tertiary, in Steine Leventhal ovaries compared to control ovaries.[18,19] Ovarian volume is a key diagnostic criterion for polycystic ovary syndrome (PCOS), with the consensus definition of polycystic ovarian morphology (PCOM) (including an ovarian volume >10 cm^3).[19,20] A study done by Lujan *et al.* found that an ovarian volume of 10 cm^3 had 81% sensitivity and 84% specificity for diagnosing PCOS. The threshold of 26 follicles offered the best balance of sensitivity (85%) and specificity (94%). The lower discriminatory power of ovarian volume might reflect an overlap between controls and PCOS patients.[21] It is important to note that not all polycystic ovaries exceed this volume. The Rotterdam consensus's 10 cm^3 threshold was set empirically by expert opinion, while recent studies suggest lower cutoff values ranging from 6.4 to 7.0 ml.[22-24] Recently, Christ *et al.* proposed a scoring system to evaluate follicle distribution by examining the largest cross-sectional plane of each ovary, with scores ranging from 1 (clear peripheral aggregation with 1 central follicle) to 3 (follicles scattered throughout the ovarian stroma).[25] Developing an objective evaluation index for follicle distribution patterns could offer insights into the underlying pathophysiology of the classic "string-of-pearls" appearance in polycystic ovaries.

This study has several limitations. The sample size of 120 women may not be representative of the broader population in Mymensingh Region of the country which is potentially affecting the generalizability of the findings. The reliance on transabdominal ultrasound alone may also miss cases where a transvaginal approach could have provided more detailed images. Additionally, the study did not assess biochemical markers or clinical symptoms, which are crucial for a comprehensive PCOS diagnosis. Lastly, the exclusion of women with known hormonal imbalances may have led to an underestimation of PCOS prevalence in this cohort.

Conclusion

To conclude, by using sonographic evaluation, we found that 12.5% of the women participated had PCOS. The prevalence was lower in the 15-21 years and 32-49 years age groups, but higher in the 22-26 years and 27-31 years age groups, suggesting a correlation between follicle number and PCOS diagnosis. Sonographic evaluations supported the use of ovarian volume and follicle count as key diagnostic criteria. Despite advancements in imaging and diagnostic criteria, further research is needed to refine these methods and improve diagnostic accuracy for PCOS.

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