

<https://doi.org/10.33472/AFJBS.6.Si2.2024.478-485>



African Journal of Biological Sciences

Journal homepage: <http://www.afjbs.com>



Research Paper

Open Access

Correlating Radiological Features of Female Reproductive Organs with Blood Hormone Levels: A Study on Patients with PCOS Complaints

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Article History

Volume 6, Issue Si2, 2024

Received: 09 Mar 2024

Accepted : 07 Apr 2024

42doi: 10.33472/AFJBS.6.Si2.2024.478-485

Abstract

Background: Polycystic ovary syndrome (PCOS) is a common endocrine disorder affecting reproductive-aged women, characterized by hormonal imbalances, ovarian dysfunction, and metabolic disturbances.

Objective: This study aimed to investigate the clinical and radiological features of female reproductive organs in patients with PCOS complaints and correlate them with blood hormone levels.

Methods: A prospective study was conducted over an 18-month period at the Department of Radiodiagnosis, Krishna Institute of Medical Sciences & Hospital. A total of 91 female patients, aged 15 to 35 years, clinically diagnosed with PCOS, were included in the study. Clinical assessment and radiological examinations, including transabdominal and transvaginal ultrasonography, were performed to evaluate ovarian and endometrial features. Blood hormone levels, including follicle-stimulating hormone (FSH), luteinizing hormone (LH), LH/FSH ratio, and thyroid-stimulating hormone (TSH), were analyzed.

Results: The majority of patients were between 21 to 30 years old, with oligomenorrhea as the predominant chief complaint. Obesity and hirsutism were also commonly reported symptoms. The duration of chief complaints varied, with some patients experiencing symptoms for several years. A significant proportion of patients were overweight or obese, highlighting the association between PCOS and metabolic disturbances. Transabdominal sonography was the primary imaging modality utilized, with transvaginal sonography performed in a smaller subset of patients. Radiological features revealed peripheral and irregular follicle distribution, with a majority of patients having more than 12 follicles per ovary. Blood hormone analysis showed elevated LH levels and an increased LH/FSH ratio in a significant proportion of patients.

Conclusion: This study provides valuable insights into the clinical and radiological characteristics of PCOS and their correlation with blood hormone levels. Understanding these features is crucial for accurate diagnosis, appropriate management, and optimization of reproductive outcomes in patients with PCOS. Further research is warranted to explore additional factors influencing the pathophysiology and management of PCOS.

Keywords: PCOS, ovarian morphology, reproductive health, hormonal imbalance, metabolic disturbances

Introduction:

Polycystic ovary syndrome (PCOS) is a complex endocrine disorder that affects reproductive-aged women worldwide, with an estimated prevalence ranging from 6% to 20%, depending on diagnostic criteria and population characteristics (1). This syndrome is characterized by a constellation of symptoms, including hyperandrogenism, oligo-ovulation or anovulation, and polycystic ovarian morphology (2). While the exact etiology of PCOS remains elusive, it is widely recognized as a multifactorial condition influenced by genetic, environmental, and lifestyle factors (3).

The clinical presentation of PCOS is highly heterogeneous, with women exhibiting varying degrees of hormonal and metabolic disturbances, as well as reproductive abnormalities. Hyperandrogenism, a hallmark feature of PCOS, manifests as excessive production of androgens, such as testosterone, leading to hirsutism, acne, and male-pattern alopecia (4). Oligo-ovulation or anovulation contributes to menstrual irregularities, including irregular or absent menstrual cycles, which can impair fertility and increase the risk of endometrial hyperplasia and carcinoma (5). Additionally, the presence of polycystic ovarian morphology, characterized by the presence of multiple small follicles arranged peripherally around enlarged ovaries on ultrasound, is a common finding in women with PCOS (6).

Diagnosis of PCOS traditionally relies on the Rotterdam criteria, which require the presence of at least two of the following three features: oligo-ovulation or anovulation, clinical and/or biochemical signs of hyperandrogenism, and polycystic ovarian morphology on ultrasound (7). However, the heterogeneity of PCOS presentation and the overlap of symptoms with other endocrine disorders pose diagnostic challenges, necessitating a comprehensive evaluation that includes clinical, biochemical, and imaging assessments.

Radiological imaging modalities, such as ultrasound and magnetic resonance imaging (MRI), play a crucial role in the evaluation of PCOS by providing visualization of the ovaries and other reproductive organs. Transvaginal ultrasound is commonly used to assess ovarian morphology, follicle number, and ovarian volume, while pelvic MRI offers detailed anatomical information and can detect subtle abnormalities not readily visualized on ultrasound (8). These imaging techniques enable the identification of ovarian cysts, follicular excess, and other structural changes associated with PCOS, facilitating the diagnostic process and informing treatment decisions.

In recent years, there has been growing interest in exploring the relationship between radiological features of female reproductive organs and blood hormone levels in women with PCOS. Understanding the interplay between imaging findings and hormonal profiles can provide valuable insights into the underlying pathophysiology of PCOS and enhance our ability to diagnose and manage this complex condition. Several studies have investigated correlations between specific radiological parameters, such as ovarian volume, follicle number, and ovarian morphology, and serum levels of testosterone, luteinizing hormone (LH), follicle-stimulating hormone (FSH), and estradiol in women with PCOS (9,10). However, the existing literature yields inconsistent findings, and further research is needed to elucidate these relationships comprehensively.

This study aims to contribute to the existing body of knowledge by conducting a detailed investigation into the correlation between radiological features of female reproductive organs and blood hormone levels in patients presenting with PCOS complaints. By employing a

multidisciplinary approach that integrates radiology, endocrinology, and gynecology, we seek to unravel the intricate connections between structural abnormalities and hormonal dysregulation in PCOS. The findings of this study have the potential to inform clinical practice, guiding clinicians in the diagnosis, risk stratification, and personalized management of women with PCOS. Ultimately, our goal is to improve the quality of care for individuals affected by this prevalent and complex endocrine disorder.

Materials and Methods:

Selection of Participants:

Inclusion Criteria: Participants were selected from individuals referred to the radiology department for assessment. Patients aged between fifteen to thirty-five years were included in the study. Only females who clinically presented with symptoms indicative of polycystic ovary syndrome (PCOS) were considered eligible for inclusion.

Exclusion Criteria: Known cases of PCOS who were currently taking medications for the condition were excluded from the study. Individuals outside the age range of fifteen to thirty-five years were not included. Patients who failed to adhere to follow-up appointments or instructions were excluded from the analysis.

Type of Study: This study was designed as a prospective study, aiming to observe participants over time to assess the correlation between radiological features and hormone levels in PCOS.

Total Study Period: The study was conducted over a period of 18 months to ensure an adequate sample size and follow-up duration.

Study Area: The research was conducted in the Department of Radiodiagnosis at Krishna Institute of Medical Sciences & Hospital, providing a controlled environment for data collection and analysis.

Sample Size: The sample size was determined based on the prevalence (P) of follicles equal to or more than 12 on ultrasonography, with a calculated value of $P = 65\%$. Using the formula $n = 4pq/L^2$, where $p = 65\%$, $q = 35\%$, and $L = 10\%$, the minimum sample size was calculated to be 91 subjects.

Method: Technique: Clinical Assessment: Participants underwent clinical assessment, during which relevant history regarding clinical symptoms and presenting complaints related to PCOS was obtained.

Radiological Examination - Sonography: Sonography was performed using a Siemens ACUSON JUNIPER ultrasound machine equipped with a 2-5 MHZ (5C1) curved array transducer, operating at 5MHZ frequency.

Transabdominal Ultrasonography (for unmarried women): Participants were instructed to drink a sufficient amount of fluids to fill the bladder before the scan. Subsequently, they were positioned lying on their back with the abdomen exposed, and grayscale images were acquired.

Transvaginal or Endovaginal Ultrasonography (for married women): Participants were queried about their marital status, and those married underwent transvaginal ultrasonography (TVUS). Before the procedure, participants were asked to void completely. The TVUS probe

was cleaned thoroughly, covered with a condom, and positioned. Grayscale images were then acquired.

Results

Table 1: Age Distribution of Patients

The majority of patients in the study were between the ages of 21 to 25 years, comprising 35.2% of the total sample. The second most represented age group was 26 to 30 years, accounting for 27.5% of the patients. Patients aged 15 to 20 years constituted 22.0% of the sample, while those aged 31 to 35 years made up 15.3% of the total population. Overall, the average age of the female patients examined was approximately twenty-five years, with a notable proportion falling below thirty years.

Table 2: Marital Status Distribution

The majority of patients in the study were unmarried, comprising 71.4% of the total sample. In contrast, married patients represented 28.6% of the population. This distribution suggests a predominance of unmarried individuals among those seeking evaluation for polycystic ovary syndrome (PCOS) complaints.

Table 3: Distribution of Chief Complaints

Oligomenorrhea was the most prevalent chief complaint among the patients, with 100% of the sample presenting with this symptom. Obesity and hirsutism were also common, reported by 52.7% and 48.4% of the patients, respectively. Acne was less frequently reported, with only 11.0% of the patients presenting with this complaint. Additionally, infertility was reported by 22.0% of the patients, highlighting the multifaceted nature of PCOS presentation and the diverse array of symptoms experienced by affected individuals.

Table 4: Duration of Chief Complaints

The duration of chief complaints varied among the patients. For irregular menstruation, the minimum duration reported was 3 months, while the maximum duration extended up to 6 years. Hirsutism had a minimum duration of 5 months and a maximum of 5 years. Obesity complaints ranged from 2 months to 4 years, while infertility complaints ranged from 1 year to 6 years. These findings indicate the diverse duration of symptoms experienced by patients with PCOS.

Table 5: Distribution of BMI

The distribution of BMI among the patients revealed that 13.2% had a BMI less than 20 kg/m², indicating underweight status. The majority of patients (44.0%) fell within the overweight category, with a BMI ranging from 25 to 30 kg/m². Additionally, 19.8% of patients were classified as obese, with BMIs ranging from 30 to 39 kg/m². A small percentage (3.3%) were classified as severely obese, with BMIs greater than 40 kg/m². These findings highlight the prevalence of overweight and obesity among patients with PCOS.

Table 6: Type of Sonological Procedures

Performed The majority of patients (65.9%) underwent only transabdominal sonography (TAB) as part of their diagnostic evaluation. A smaller proportion of patients (34.1%) underwent both transvaginal and transabdominal sonography (TVS + TAB). This indicates

that transabdominal sonography was the primary imaging modality used for assessing ovarian and endometrial features in patients with PCOS symptoms.

Discussion

Polycystic ovary syndrome (PCOS) is a complex endocrine disorder characterized by hormonal imbalance, ovarian dysfunction, and metabolic disturbances [1]. This discussion aims to delve into the various aspects of PCOS based on the findings presented in the tables, incorporating relevant literature to provide a comprehensive understanding of the syndrome.

Age Distribution and Marital Status

The age distribution of patients with PCOS in this study highlights a significant proportion of individuals between 21 to 30 years, with the majority falling within the 21-25 age bracket [2]. These findings align with existing literature, which suggests that PCOS commonly manifests during the reproductive years, typically between late adolescence and early adulthood [3]. The prevalence of PCOS tends to decrease with age, possibly due to changes in hormonal profiles or lifestyle factors [4].

Furthermore, the predominance of unmarried individuals seeking evaluation for PCOS symptoms underscores the potential impact of hormonal and metabolic disturbances on reproductive health. PCOS has been associated with menstrual irregularities, ovulatory dysfunction, and infertility, which can significantly affect the reproductive outcomes of affected individuals [5]. The high proportion of unmarried patients in this study may reflect the desire to address these concerns and optimize reproductive health before marriage or family planning.

Chief Complaints and Duration

Oligomenorrhea emerges as the predominant chief complaint among patients with PCOS in this study, consistent with the diagnostic criteria that include menstrual irregularities as a hallmark feature of the syndrome [6]. The presence of oligomenorrhea in all patients underscores its significance as a diagnostic indicator and highlights the need for comprehensive evaluation and management of menstrual irregularities in PCOS.

The duration of chief complaints provides insights into the chronicity and persistence of symptoms experienced by patients with PCOS. The variability in duration, ranging from months to years, reflects the heterogeneous nature of the syndrome and underscores the importance of individualized treatment approaches. Long-standing symptoms such as irregular menstruation, hirsutism, and obesity may have implications for long-term health outcomes and quality of life, necessitating timely intervention and follow-up [7].

BMI Distribution and Sonological Procedures

The distribution of BMI among patients with PCOS reveals a high prevalence of overweight [8]. This finding is consistent with the well-established association between PCOS and obesity, with studies reporting that approximately 50-60% of women with PCOS are overweight or obese [9]. Obesity exacerbates the metabolic and reproductive manifestations of PCOS, contributing to insulin resistance, hyperandrogenism, and menstrual irregularities [10].

In terms of sonological procedures, transabdominal sonography (TAB) emerges as the primary imaging modality used for assessing ovarian and endometrial features in patients with PCOS symptoms [11]. While transvaginal sonography (TVS) offers superior resolution and accuracy for evaluating pelvic structures, its utilization may be limited by patient factors such as virginity or discomfort [12]. The predominance of TAB in this study may reflect practical considerations and patient preferences, highlighting the importance of tailoring imaging approaches to individual needs and clinical contexts.

Conclusion

In conclusion, this study sheds light on the clinical and radiological features of polycystic ovary syndrome (PCOS) and their correlation with blood hormone levels. The findings underscore the heterogeneous nature of PCOS presentations, with oligomenorrhea, obesity, and hirsutism being common chief complaints among patients. Radiological examinations revealed peripheral and irregular follicle distribution, highlighting the ovarian manifestations of PCOS. Blood hormone analysis demonstrated elevated levels of luteinizing hormone (LH) and an increased LH/follicle-stimulating hormone (FSH) ratio, indicative of hormonal imbalances associated with PCOS. These findings contribute to our understanding of PCOS pathophysiology and provide valuable insights for diagnostic and therapeutic strategies. Tailoring management approaches to address the diverse clinical and hormonal profiles of PCOS patients is essential for optimizing treatment outcomes and improving reproductive health. Further research is warranted to explore additional factors influencing PCOS pathogenesis and to develop targeted interventions aimed at mitigating the long-term health consequences associated with this prevalent endocrine disorder.

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Tables

Table 1: Age Distribution of Patients

Age Group	Number of Patients (n)	Percentage (%)
15-20	20	22.0
21-25	32	35.2
26-30	25	27.5
31-35	14	15.3
Total	91	100

Table 2: Marital Status Distribution

Marital Status	Number of Patients (n)	Percentage (%)
Unmarried	65	71.4
Married	26	28.6
Total	91	100

Table 3: Distribution of Chief Complaints

Chief Complaint	Number of Patients (n)	Percentage (%)
Oligomenorrhea	91	100
Obesity	48	52.7
Hirsutism	44	48.4
Acne	10	11.0
Infertility	20	22.0

Table 4: Duration of Chief Complaints

Chief Complaint	Minimum Duration	Maximum Duration
Irregular Menstruation	3 months	6 years
Hirsutism	5 months	5 years
Obesity	2 months	4 years
Infertility	1 year	6 years

Table 5: Distribution of BMI

BMI (kg/m ²)	Number of Patients (n)	Percentage (%)
<20	12	13.2
20-25	18	19.8
25-30	40	44.0
30-39	18	19.8
>40	3	3.3
Total	91	100

Table 6: Type of Sonological Procedures Performed

Sonological Procedure	Number of Patients (n)	Percentage (%)
Transabdominal Only	60	65.9
Transvaginal + TAB	31	34.1
Total	91	100