

Study of Ovarian & Uterine Artery Doppler Findings in Patients with Polycystic Ovary Syndrome**Babanagar S.S.¹, Wadhvani N.D.², Rathor F.S.³**¹Assistant Professor, Dept. of Radio-diagnosis, Dr. D. Y. Patil Medical College, Hospital & Research Institute, Kadamwadi, D.Y. Patil Education Society (Deemed to be University ID - U-0294) Kolhapur, Maharashtra, India²Professor, Dept. of Radio-diagnosis, Dr. D. Y. Patil Medical College, Hospital & Research Institute, Kadamwadi, D.Y. Patil Education Society (Deemed to be University ID - U - 0294) Kolhapur, Maharashtra, India³Fellow in Fetal Medicine, KEM Hospital, Rasta Peth, Pune Maharashtra, India

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Abstract

PCOS is a heterogeneous pathological condition characterized by reproductive disorders, and frequently associated with hyperandrogenism, obesity, and hyperinsulinemia and insulin resistance. Advances in imaging technology have introduced Color Doppler ultrasonography (CD-USG) as a means to assess vascular changes in PCOS, particularly variations in ovarian and uterine blood flow. This was an observational, cross sectional study. Total 140 women with PCOD enrolled in this study with mean age was 22.42±3.20 years. The mean BMI was 28.62±3.41 kg/m², mean FSH was 8.51±3.98 and mean LH was 15.32±4.18. Mean LH/FSH Ratio was 2.38±0.32. Mean follicle count was 13±2. Most common symptoms in women with PCOS was oligomenorrhea 48.2% followed by infertility 28.3%. LH/FSH ratio showed a significant positive correlation with uterine artery PI (p = 0.013). From this study we conclude that, CD-USG is a useful non-invasive method for assessing hemodynamic alterations in PCOS. The results of the study indicate that uterine and ovarian hormonal imbalances are correlated with arterial Doppler indices, which may be useful for PCOS monitoring and early identification. Larger sample numbers and long-term follow-ups are required for additional study to provide standardized Doppler criteria for prediction and diagnosis of PCOS.

Keywords: PCOS, CD-USG, Pulsatile Index, Resistance Index, Ovarian Volume.**DOI:** 10.25258/ijcpr.18.6.68

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Introduction

Polycystic ovarian syndrome (PCOS) was first described by Stein and Leventhal in 1935. [1] PCOS is a heterogeneous pathological condition characterized by reproductive disorders, and frequently associated with hyperandrogenism, obesity, and hyperinsulinemia and insulin resistance and is associated with long-term health risks including type 2 diabetes mellitus, cardiovascular diseases and endometrial hyperplasia. [2,3,4]

PCOS is the most common female endocrinopathy, and its frequency is about 6-8% in the reproductive period. [2] Although polycystic ovaries can be found in approximately 33% of the female population, they are not necessarily associated with the typical symptoms and PCOS, which may be expressed at some time during the fertile life span when provoked by, for example, weight gain or

insulin resistance. [3,4] The condition is diagnosed using the Rotterdam criteria, which require the presence of at least two of the following three features: oligo/anovulation, hyperandrogenism (clinical or biochemical), and polycystic ovarian morphology on ultrasound. Ultrasound assessment of ovarian morphology is considered to be essential in the diagnosis of PCOS and the gold standard for defining polycystic ovary (PCO). [5] The polycystic ovary is the morphological ovarian phenotype in women with the polycystic ovary syndrome. However, not all women with polycystic ovaries demonstrate the clinical and biochemical features that define the PCOS. [5]

Advances in imaging technology have introduced Color Doppler ultrasonography (CD-USG) as a means to assess vascular changes in PCOS, particularly variations in ovarian and uterine blood

flow. [6,7] PCOS is characterized by increased ovarian stromal blood flow, possibly due to elevated levels of vascular endothelial growth factor (VEGF) and insulin resistance-induced hyperperfusion. [8] These vascular abnormalities contribute to follicular dysfunction and menstrual irregularities. CD-USG enables the measurement of parameters such as Pulsatile Index (PI) and Resistance Index (RI), which reflect blood flow resistance and can provide insights into ovarian and uterine vascular status. [9] This study aims to explore whether CD-USG can serve as a reliable diagnostic tool by assessing Doppler parameters in PCOS patients and correlating them with clinical and biochemical markers.

Material & Method

This was an observational, cross sectional study conducted at the Department of Radiology Medical College, Kolhapur from Jan 2025 to Jan 2026. Ethical committee approval was taken. A total of 140 women aged 18-40 years diagnosed with PCOS based on clinical, biochemical and ultrasonography criteria were recruited from the outpatient department during the period. Written informed consent was obtained from all participants. Women with endocrinopathies such as Cushing syndrome, congenital adrenal hyperplasia, hyperprolactinemia, or thyroid disorders, type 2 diabetes mellitus or on pharmacologic treatment affecting metabolic or hormonal parameters or ovarian masses or other structural ovarian abnormalities were excluded.

All patients underwent a thorough history-taking and clinical examination, including assessment of menstrual history, signs of hyperandrogenism (hirsutism, acne, alopecia), and metabolic features (BMI, waist-hip ratio). Laboratory tests included Serum levels of Follicle-Stimulating Hormone

(FSH) and Luteinizing Hormone (LH) and LH/FSH ratio. Ultrasonographic and Doppler evaluations were performed using a 7-13 MHz transducer. For unmarried women, transabdominal ultrasonography was conducted, while married women underwent transvaginal ultrasonography. Parameters assessed included: Ovarian volume, follicle count and follicular distribution. Doppler indices: Pulsatile Index (PI) and Resistive Index (RI) of the ovarian and uterine arteries.

All clinical, biochemical and imaging data were recorded in MS Excel sheet. Statistical analysis was performed using one-way ANOVA to assess differences in Doppler parameters across various clinical subgroups in SPSS software. Pearson's correlation coefficient was used to examine relationships between Doppler indices and biochemical markers. A p-value of <0.05 was considered statistically significant.

Results

Total 140 women with PCOS enrolled in this study with mean age was 22.42 ± 3.20 years. The mean BMI was 28.62 ± 3.41 kg/m², mean FSH was 8.51 ± 3.98 and mean LH was 15.32 ± 4.18 . Mean LH/FSH Ratio was 2.38 ± 0.32 . Mean follicle count was 13 ± 2 . (Table 1)

Most common symptoms in women with PCOD was oligomenorrhea 48.2% followed by infertility 28.3%. (Fig 1)

Table 2 shows the Mean values of USG color Doppler parameters among women with PCOD. These values were individually correlated with biochemical tests performed and statistically significant correlations were observed with only one parameters. LH/FSH ratio showed a significant positive correlation with uterine artery PI ($p = 0.013$). (Table 3)

Table 1: Distribution of women according to clinic-social parameter.

Variables	Mean \pm S.D.
Age (Years)	22.42 ± 3.20
BMI (Kg/m ²)	28.62 ± 3.41
FSH	8.51 ± 3.98
LH	15.32 ± 4.18
LH/FSH Ratio	2.38 ± 0.32
Follicle count	13 ± 2

(LH: Luteinizing hormone, FSH: Follicle stimulating hormone)

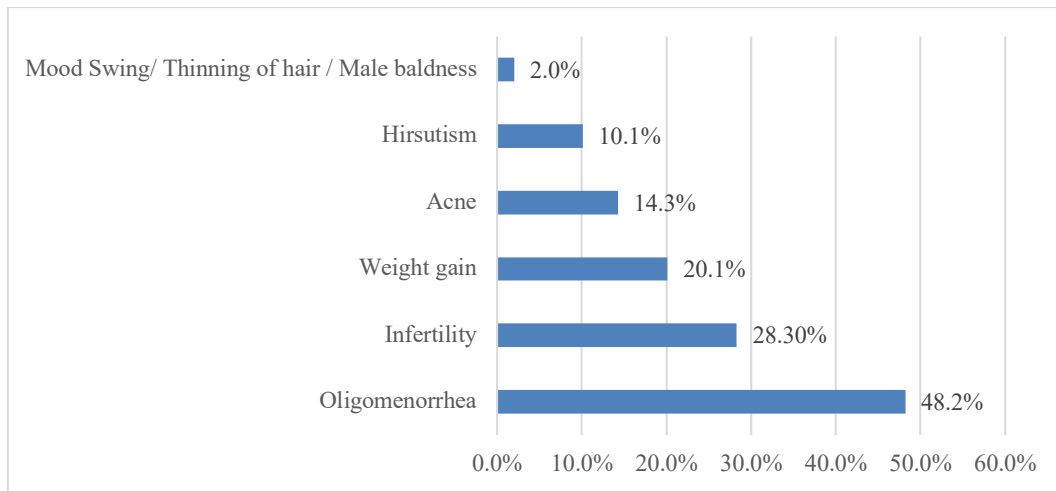


Fig 1: Distribution of women according to symptoms (Total of percentage more than 100% because women present with multiple symptoms.)

Table 2: Mean values of USG color Doppler parameters

Parameter	Mean ± S.D.
Right Ovarian volume (ml)	16.71±3.32
Left Ovarian volume (ml)	16.61±3.22
Right Ovarian artery PI	1.10±0.12
Left Ovarian artery PI	1.10±0.12
Right Ovarian artery RI	0.60±0.15
Left Ovarian artery RI	0.60±0.15
Right Uterine artery PI	0.72±0.08
Left Uterine artery PI	0.71±0.10
Right uterine artery RI	1.98±0.59
Left uterine artery RI	1.95±0.55

Table 3: Correlation between LH-FSH Ratio with USG parameters

LH/FSH Ratio With	r Value	p Value
Mean ovarian volume	-0.118	0.191
Mean ovarian artery PI	0.058	0.499
Mean ovarian artery RI	0.022	0.792
Mean uterine artery PI	0.224	0.012*
Mean uterine artery RI	-0.019	0.798



Fig 2: USG showing increased ovarian volume (>10 ml)

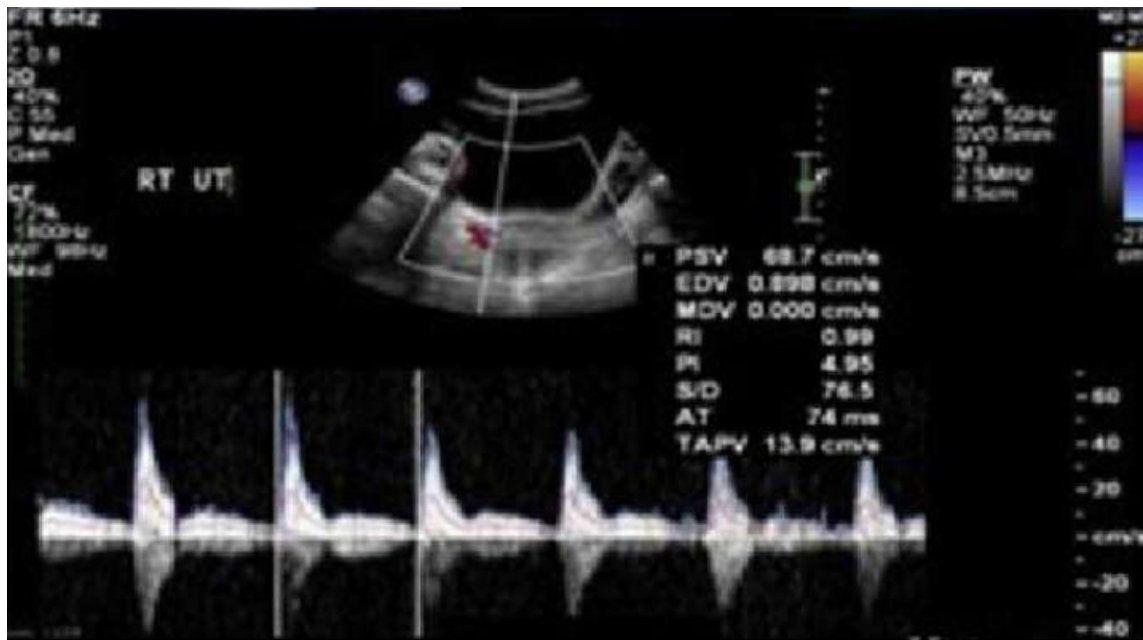


Fig 3: CD-USG in a women with PCOS showing increased RI and PI in right uterine artery

Discussion

PCOS is a heterogenous disorder with convergence of multisystem endocrine derangements and has emerged as one of the leading health issues among women as it affects her fertility. While there are a number of clinical, biochemical and ultrasonographic methods available, diagnosis of PCOS is always delayed till there is gross derangement in ovarian morphology or symptoms become unbearable. Ultrasonography helps in early and precise diagnosis of PCOS. Hence, with this study, we wanted to explore diagnostic methods which can accurately and promptly diagnose PCOS and are reliable.

The results support earlier research showing that PCOS is linked to greater ovarian volume and changes in vascular resistance. [10] The lower pulsatile index (PI) and resistance index (RI) of the ovarian artery indicate enhanced blood flow within the stroma, aligning with the hyperandrogenism and follicular stagnation seen in PCOS. [11]

In contrast, elevated resistance in the uterine artery may lead to endometrial dysfunction and the menstrual irregularities frequently reported by patients with PCOS, which are the main reasons for their visits. [12] The correlation between LH/FSH ratio and uterine artery PI further supports the hypothesis that vascular changes in PCOS are influenced by hormonal dysregulation. This might be because elevated LH levels may be responsible for increased stromal vascularization by influencing neoangiogenesis, catecholaminergic stimulation and leukocyte and cytokine activation. [13] Compared to conventional ultrasonography, CD USG provides additional diagnostic insights by

assessing vascular dynamics, potentially aiding in early diagnosis and management. These findings support the integration of Doppler parameters into routine PCOS assessment to enhance diagnostic accuracy and tailor therapeutic strategies.

The strength of this study is that it is a comprehensive evaluation combining clinical, hormonal, and Doppler data, however it is limited in terms of a small sample size and the study design was only observational and lack a comparative aspect.

Conclusion

A useful non-invasive method for assessing hemodynamic alterations in PCOS is CD-USG. The results of the study indicate that uterine and ovarian hormonal imbalances are correlated with arterial Doppler indices, which may be useful for PCOS monitoring and early identification. Larger sample numbers and long-term follow-ups are required for additional study to provide standardized Doppler criteria for prediction and diagnosis of PCOS.

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