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Color Doppler as diagnostic criteria in polycystic ovarian syndrome (PCOS)

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Abstract

Objective: To study the role of color Doppler as diagnostic criteria in PCOS.

Material & Method: The present study was a 6 month prospective randomized open parallel group comparative study in which efficacy of color Doppler as a diagnostic criterion in PCOS was evaluated. The present study was conducted in the Department of Obstetrics and gynaecology, Govt. Medical college, Rajindra Hospital, Patiala on 50 PCOS and 20 Non PCOS patients attending the OPD. PCOS patients were assessed for BMI, FBS, FSH values and LH values. Ultrasonography machine Philips En Visor was used for color Doppler in post menstrual phase of menstrual cycle through transabdominal route. PI and RI was calculated electronically by ultrasonography machine.

Results: The mean age of presentation was 22.94 ± 2.91 and 24.45 ± 2.06 in PCOS and NON PCOS groups respectively. 100% patients presented with menstrual irregularity in PCOS group and 15% in NON PCOS group. In PCOS group 64%, 96% and 3% patients presented with hirsutism, polycystic ovaries on usg and infertility respectively while 10% had hirsutism and none had polycystic ovaries on usg and infertility in NON PCOS group. In both groups difference between clinical presentation was significant. Mean BMI of PCOS group was 26.00 ± 3.55 and in NON PCOS group mean BMI was 23.24 ± 2.24 and the difference was significant. Mean value of FSH, LH and LH/FSH was 7.71 ± 2.49 , 19.78 ± 8.61 and 2.67 ± 1.04 respectively in PCOS group. Mean RI of uterine artery in PCOS group and NON PCOS group was 0.86 ± 0.092 and 0.73 ± 0.097 respectively. The difference was highly significant. Mean PI of ovarian artery in PCOS group and NON PCOS group was 1.29 ± 0.84 and 1.46 ± 0.51 respectively. The difference was significant. Mean RI of ovarian artery in PCOS group and NON PCOS group was 0.75 ± 0.24 and 0.78 ± 0.26 respectively. The difference was significant.

Conclusion: The color Doppler ultrasonography can be used as a diagnostic criteria in suspected cases of PCOS.

Keywords: PCOS, Color Doppler

Introduction

Polycystic ovarian disease is a very common endocrinopathy seen in females of reproductive age group, that is marked especially by amenorrhoea, hirsutism, obesity, infertility and ovarian enlargement. Polycystic ovary syndrome is a functional disorder due to hyperandrogenic anovulation represented by a collection of signs and symptoms^[1].

The earliest published description of a person with what is now recognized as PCOS was in 1721 in Italy^[2]. The condition was first described in 1935 by American gynecologists Irving F. Stein, Sr. and Michael L. Leventhal, from whom its original name of Stein–Leventhal syndrome is taken^[3,4].

NIH, ESHRE/ASRM (Rotterdam) and AE-PCOS have put forward three separate and distinct diagnostic criteria for PCOS^[6-9].

1. NIH: In 1990 a consensus workshop sponsored by the NIH/NICHD suggested that a female has PCOS if she has all of the following^[5]

1. Hyperandrogenism/hyperandrogenemia
2. Menstrual dysfunction
3. Exclusion of other known disorders that can result in menstrual irregularity and hyperandrogenism

2. Rotterdam: In 2003 a consensus workshop sponsored by ESHRE/ASRM in Rotterdam indicated PCOS to be present if any 2 out of 3 major criteria are met.

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1. Oligoovulation and/or Anovulation
2. Clinical or biochemical signs of hyperandrogenism
3. Polycystic ovaries (as identified by ultrasonography), excluding other androgen excess disorders.

3. AE-PCOS: In 2006 task force appointed by AE-PCOS concluded that diagnosis of PCOS requires:

1. Hyperandrogenism (hirsutism and/or hyperandrogenemia)
2. Ovarian dysfunction (oligo/anovulation and /or polycystic ovaries)
3. Exclusion of other androgen excess or related disorders.

According to the Rotterdam criteria, 12 or more small follicles measuring 2-9mm in diameter should be seen in an ovary on ultrasound examination. The follicles may be oriented in the periphery, giving the appearance of a 'string of pearls'.

The overall prevalence of PCOS among different populations is quite similar and is approx. 7%. The overall prevalence of PCOS among different populations is quite similar and is approx. 7%.

Polycystic ovaries develop when the ovaries are stimulated to produce excessive amounts of androgenic hormones, in particular testosterone, by either one or a combination of the following (almost certainly combined with genetic susceptibility):¹⁰

- the release of excessive luteinizing hormone (LH) by the anterior pituitary gland
- through high levels of insulin in the blood (hyperinsulinaemia) in women whose ovaries are sensitive to this stimulus^[5]

The introduction of transvaginal Doppler sonography has contributed markedly to the refinement of ultrasound diagnosis. It has also provided much new morphological and pathophysiological information on blood flow dynamics within the female pelvis^[11-15]

The vessels most often analyzed in reproductive endocrinology are the uterine and ovarian arteries. Color flow images of the ascending branches of the uterine arteries lateral to the cervix in a longitudinal plane can be obtained both transvaginally and transabdominally. The ovarian arteries can be evaluated at the level of the ovarian hilum^[11, 16-22]

Elevated LH levels may be responsible for increased stromal vascularization through different mechanisms that may act individually or in a cumulative way: neoangiogenesis; catecholaminergic stimulation; leukocyte and cytokine activation^[23-25]. Increased resistance in the uterine arteries and subsequent reduction in uterine perfusion was thought to be the cause of failure of the blastocyst to implant and the increased miscarriage rate in PCOS patients.

As the number of ovarian microcysts increases, ovarian volume enlarges and Doppler indices worsen. Colour Doppler is more sensitive to slow flow and therefore allows the detection of blood flow velocimetry of uterine and ovarian vessels by calculating electronically Resistance index (RI) and pulsatility index (PI) according to the formula: $PI = (S - D)/\text{mean}$, $RI = (S -$

$D)/S$, where S is the peak shifted Doppler frequency, D is the minimum Doppler shifted frequency and 'mean' is the mean maximum Doppler shifted frequency.

In uterine artery: PI and RI is higher in PCOS patients as comparison to non PCOS patients

In Ovarian artery: PI and RI is lower in PCOS patients in comparison to non PCOS patients.

Observation

The present study was conducted in the Department of Obstetrics and gynaecology, Govt. Medical college, Rajindra Hospital, Patiala on 50 PCOS and 20 Non PCOS patients attending the OPD. After informed written consent a detailed history, physical and gynaecological examination was done (P/V was not done in unmarried PCOS girls) and recorded on performa. Aim of the study was to observe Changes in blood flow pattern in PCOS women at the onset of study and after six months and to compare it with non PCOS women. Ultrasonography machine Philips En Visor was used for color Doppler in post menstrual phase of menstrual cycle through transabdominal route. PI and RI was calculated electronically by ultrasonography machine at the onset of study and after six months of treatment in PCOS and NON PCOS women. Observations were than statistically analyzed and results were tabulated.

Results

The mean age of PCOS group was 22.94 ± 2.91 and mean age of NON PCOS group was 24.45 ± 2.06 and the difference between two groups was not significant. 100% patients presented with menstrual irregularity in pcos group and 15% in non pcos group. 54% patients were overweight and 4% patients were obese in pcos group while in non pcos group 20% were overweight and none were obese. In pcos group 64% and 96% patients presented with hirsutism and polycystic ovaries on usg respectively while none had hirsutism and polycystic ovaries on usg in non pcos group

mean BMI of PCOS group was 26.00 ± 3.55 and in NON PCOS group mean BMI was 23.24 ± 2.24 and the difference was significant (P value 0.006) the mean PI of uterine artery in PCOS group and NON PCOS group was 3.10 ± 1.39 and 2.61 ± 0.77 respectively. The difference between PI of uterine artery in PCOS group and NON PCOS group was not significant the mean RI of uterine artery in PCOS group and NON PCOS group was 0.86 ± 0.092 and 0.73 ± 0.097 respectively. The difference between RI of uterine artery in PCOS group and NON PCOS group was highly significant (p value 0.005) the mean PI of ovarian artery in PCOS group and NON PCOS group was 1.29 ± 0.84 and 1.46 ± 0.51 respectively. The difference between mean PI of ovarian artery in PCOS group and NON PCOS group was significant the mean RI of ovarian artery in PCOS group and NON PCOS group was 0.75 ± 0.24 and 0.78 ± 0.26 respectively. The difference between mean RI of ovarian artery in PCOS group and NON PCOS group was significant.

Table 1: Shows in Utrine artery and P value

	Pcos	Nonpcos	P Value
AGE	22.94 ± 2.91	24.45 ± 2.06	0.075(NS)
BMI(Mean \pm SD)	26.00 ± 3.55	23.24 ± 2.24	0.006(HS)
PI Uterine Artery(Mean \pm SD)	3.10 ± 1.39	2.61 ± 0.77	0.159 (NS)
RI Uterine Artery(Mean \pm SD)	0.86 ± 0.092	0.73 ± 0.097	0.005 (HS)
PI Ovarian ARTERY(MEAN \pm SD)	1.29 ± 0.84	1.46 ± 0.51	0.038 (S)
RI Ovarian Artery(MEAN \pm SD)	0.75 ± 0.24	0.78 ± 0.26	0.033 (S)

Discussion

In present study the mean age of patients in PCOS and NON PCOS groups was 22.94 ± 2.91 and 24.45 ± 2.06 respectively and the difference between the mean age in both groups was not significant. Similarly Dolz et al 1999 [26], Bostanci et al 2013 [27], Farshchian et al. 2015 [28] conducted the studies in which the mean age in PCOS and NON PCOS group was 24.80 ± 3.79 and 28.12 ± 6.37 , 25.65 ± 3.133 and 26.11 ± 3.428 , 23.2 ± 5.43 and 23.2 ± 5.59 respectively and difference between the mean age in both groups in all the above studies was not significant

In present study the mean BMI of patients in PCOS and NON PCOS GROUPS was 26.00 ± 3.55 and 23.24 ± 2.24 respectively and the difference between the BMI of above groups was highly significant. Similarly the study conducted by Bostanci et al 2013 [27] and Farshchian et al. 2015 [28] had significant difference in mean BMI of PCOS and NON PCOS groups

In present study 100% pcos patients had menstrual irregularity and 15% patients in non pcos group had menstrual irregularity and difference between the two above groups was significant. Bostanci et al. 2013 [27] and Farshchian et al. 2015 [28] study had 100% and 10% patients with menstrual irregularity in PCOS group and in NON PCOS groups respectively, the difference between both groups was significant in both studies.

In present study 96% patients had polycystic ovaries on ultrasonography and 4% patients had normal ultrasound and the difference between two groups was significant, Similarly in

Farshchian et al. 2015 [28] study 85% and 15% patients had polycystic ovaries on ultrasonography and normal ultrasound respectively and difference between two groups was significant

In present study 64% patients had hirsutism in PCOS group and the difference between two groups was significant, Similarly in Dolz et al. 1999 [26] and Farshchian et al 2015 [28] study 86.2% and 95% patients had hirsutism respectively and difference between two groups in both studies was significant

In present study the mean RI of uterine artery was 0.86 ± 0.092 and 0.73 ± 0.097 in PCOS and NON PCOS groups respectively and the difference between two groups was highly significant. In Bostanci et al. 2013 [27] and N. Farshchian et al. 2015 [28] study the difference between the mean PI of uterine artery in above mentioned groups was significant

In present study the mean PI of ovarian artery was 1.29 ± 0.84 and 1.46 ± 0.51 in PCOS and NON PCOS groups respectively and the difference between two groups was significant. Similarly, in Bostanci et al. 2013 [27] study the difference between the mean PI of ovarian artery in above mentioned groups was significant.

In present study the mean RI of ovarian artery was 0.75 ± 0.24 and 0.78 ± 0.26 in PCOS and NON PCOS groups respectively and the difference between two groups was significant. Similarly, IN Bostanci et al. 2013 [27] AND N. Farshchian et al 2015 [28] study the difference between the mean RI of ovarian artery in above mentioned groups was significant.

Abbreviations

NIH	National Institutes of Health
NICHHD	National Institute of Child Health and Human Development
ESHRE	European Society of Human Reproduction and Embrology
ASRM	American Society for Reproductive Medicine
AE-PCOS	Androgen Excess and Polycystic Ovarian Syndrome
PCOS	Polycystic Ovarian Syndrome
FSH	Follicle Stimulating Hormone
LH	Lutenizing Hormone
PRL	Prolactin
TSH	Thyroid Stimulating Hormone
RI	Resistance Index
PI	Pulsatility Index
CC	Clomiphene Citrate
hCG	human chorionic gonadotropin
USG	Ultrasonography
mm	Milimeters
NO.	Number
%	Percentage
BMI	Body Mass Index
i.e,	That is
SD	Standard Deviation

Conclusion

It is thus concluded that in present study the colour Doppler can be used as a diagnostic criteria in suspected cases of PCOS and to further evaluate the role of colour Doppler in diagnosing PCOS more studies are needed in large number of patients and for longer duration.

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