DOI: https://doi.org/10.53350/pjmhs22169439

ORIGINAL ARTICLE

Sensitivity of Pulsatility index of Uterine Artery on Doppler Ultrasound in Diagnosis of Polycystic Ovarian Syndrome

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ABSTRACT

Objective: This study was planned to explore the sensitivity of uterine artery PI and RI.

Method: This descriptive Observational study was carried out in Department of Radiology, Combined Military Hospital, Lahore, within six months after the approval of synopsis. Calculated sample size was of 120 females. The collected data was entered and analyzed by using software SPSS version 25.0. Man and standard deviation was calculated for PI and RI. Frequency and percentage was calculated for sensitivity of Pulsatility Index of uterine artery on 3D Doppler for polycystic ovarian syndrome diagnosis.

Results: The accurate diagnosis of PCOs among patients was 80.83%. The results revealed that mean pulstility index of right uterine artery was 2.83±0.99 and for Left uterine artery, it was 1.37±0.69 whereas the combine mean was 2.1±0.84. Similarly, mean value of Resistive Index for right uterine artery was .83±.75 and for Left uterine artery, it was .59±.21 whereas the combine mean was 0.71±0.48.

Conclusion: The accuracy of polycystic ovarian syndrome diagnosis is quite high with pelvic color Doppler which supports the usage of color Doppler for the diagnosis of polycystic syndrome in females.

Keywords: Polycystic Ovarian Syndrome, Pulsatility Index, Resistive Index

INTRODUCTION

Among endocrine disorders, a commonly prevailing disorder is Polycystic ovarian syndrome which affects the working of female's ovarian cycle during her reproductive years. Its prevalence is about 22% among females.[1] As per the new definition of polycystic ovarian syndrome based on the consensus of ASRM/ESHRE (American Society of Reproductive Medicine/European Society of Human Reproduction & Embryology, 2003), morphology of polycystic ovaries is included. Two conditions out of three are needed to fall under the diagnosis of polycystic ovarian syndrome includes Oligomenorrhea/anovulation, hyperandrogenism, or/and Polycystic ovaries, with the exclusion of other etiologies. Morphological changes during polycystic ovarian syndrome includes ovary containing 12 or more than 12 follicles with a size between 2-9mm or/and amplified volume of ovaries greater than 10cm^3.[2] Being highly sensitive to the low flow, Power Doppler ultrasound is quite beneficial as it is not angle dependent and covers the aliasing of standard color Doppler. In diagnosis of polycystic ovarian syndrome, existing literature have shown higher level of stromal vascularity.[4] Follicular phase is the most suitable time for diagnosis of polycystic ovarian syndrome.[5] Existing literature revealed that among women diagnosed with polycystic ovarian syndrome, ovarian artery Pulsatility index, Resistance index and S/D ratio were lower.[6]

For diagnosis of polycystic ovarian syndrome, transvaginal ultrasound is now the gold standard. A study reported that 20% of young females were diagnosed with polycystic ovarian syndrome with the help of transvaginal ultrasound. It was found that about 5% to 10% females were having the classical symptomology of polycystic ovarian syndrome, for instance, amenorrhea, obesity and infertility.[7] More clear findings were reported in terms of 3D power Doppler indices among females with polycystic ovarian as compared to 2D color Doppler indices, along with hormonal as well as clinical parameters.[8] As per the uterine and ovarian arteries blood flow analysis uncovered interesting alterations in blood profile among females with amenorrhea. Greater alteration was observed in peak systolic velocity and end-diastolic velocity among females diagnosed with amenorrhea. The reported peak systolic velocity and end-diastolic velocity in uterine as well as ovarian arteries was low as compared to control group.[9]

The findings reported in existing literature have discrimination in terms of average resistance index(RI) and Pulsatility index (PI) values of uterine artery for Polycystic ovarian syndrome diagnosis. One related study reported the raised values of RI and PI in uterine artery during Polycystic ovarian syndrome.[10] Contrary to these findings, a similar study reported the decrease in average PI and RI values of uterine artery in Polycystic ovarian syndrome.[11] Another study reported the raised PI value of uterine artery only among girls diagnosed with polycystic ovary syndrome.[12] This discrimination is the based to have a study which can add more concrete knowledge in the existing literature which will be helpful in accurate diagnosis of polycystic ovarian syndrome. So, this study was planned to explore the sensitivity of uterine artery PI because if the results will be reliable with 3D Doppler ultrasound, so the need of having hormonal check will not remain useful for polycystic ovaries diagnosis. Only one study is available in literature "Two and Three dimensional sonographic and colour doppler techniques for diagnosis of polycystic ovary syndrome" which shows 83% sensitivity of PI.[13] Determination of average PI and RI in females diagnosed with polycystic ovary syndrome was also explored.

MATERIAL AND METHODS

This descriptive Observational study was carried out in Department of Radiology, Combined Military Hospital, Lahore, within six months after the approval of synopsis. Calculated sample size was of 120 females by taking 95% confidence level, 7% margin of error and taking expected percentage of sensitivity of PI of uterine artery on Doppler in diagnosis of PCOS i.e. 83%. Data was collected using purposive sampling technique.

Inclusion criteria: PCOS diagnosis was made according to criteria determined during the Rotterdam ESHRE-ASRM-sponsored PCOS Consensus Workshop Group (2004). According to which two conditions out of three are needed to fall under the diagnosis of polycystic ovarian syndrome includes Oligomenorrhea/anovulation, hyperandrogenism, or/and Polycystic ovaries, with the exclusion of other etiologies. Oligomenorrhea (<6 menstrual periods in preceding year) and/or anovulation: clinical/biochemical signs of hyperandrogenism. Morphological changes during polycystic ovarian syndrome includes ovary containing 12 or more than 12 follicles with a size between 2-9mm or/and amplified volume of ovaries greater than 10cm^3.[2]

Exclusion criteria: Female who is on oral contraceptive pills, have any history of hyperprolactinemia, congenital adrenal hyperplasia or thyroid disease and/or having Polycystic ovarian syndrome with no hyperandrogenism or ovulation disorder.

Data Collection: Females who met the inclusion criteria were 120, came in OPD of Department of Obstetrics and Gynecology, Combined Military Hospital, Lahore. All the patients were given the brief introduction of study as well as the purpose and procedure of study was explained. From all the participants of study, written informed consent was taken. Every female had Pelvic duplex as well as color Doppler sonography with probe of 6MHz. Data of diagnosis was taken on the data sheet based on the diagnosis criteria for polycystic ovarian syndrome. Three reading were taken for every measurement to take the mean value. Lateral visualization of uterine artery to cervix was observed at the level of internal OS in a longitudinal plane. Placement of pulsed Doppler sample volume was done through the vessel with 0degree angle between the vessel and the ultrasound beam. Waveforms of flow velocity were recorded. For calculating PI and RI, respective formulas were used, PI=(S-D)/mean and RI=(S-D)/S, whereas S is the peak systolic frequency Doppler frequency shift, D is minimum Doppler frequency shift and mean is the time averaged maximum Doppler frequency shift over 1 cardiac cycle. Four waveforms reading were recorded to calculate the mean.

Data Analysis: The collected data was entered and analyzed by using software SPSS version 25.0. Man and standard deviation was calculated for PI and RI. Frequency and percentage was calculated for sensitivity of Pulsatility Index of uterine artery on 3D Doppler for polycystic ovarian syndrome diagnosis.

RESULTS

Age was taken as demographic variable and divided in to groups, i-e., 20 to years and 31 to 40 years. Patients between ages of 20 to 30 years were 65% of the entire data whereas between ages of 31-4-years were 35%.

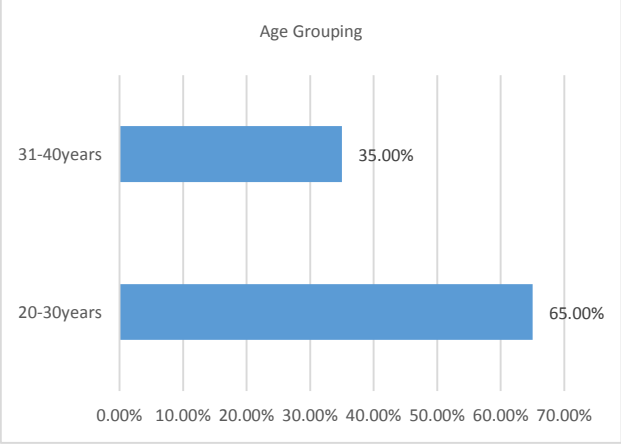

Figure 1: Age groups

The accurate diagnosis of PCOs among patients was 80.83%

Table 1: Sensitivity of Pulsatility Index of Uterine Artery

PCOS Diagnosis	Yes	No
	97(80.83%)	23(19.167%)

The results revealed that mean pulstility index of right uterine artery was 2.83±0.99 and for Left uterine artery, it was 1.37±0.69 whereas the combine mean was 2.1±0.84. Similarly, mean value of RI for right uterine artery was .83±.75 and for Left uterine artery, it was .59±.21 whereas the combine mean was 0.71±0.48.

Table 2: Pulsatilty Index and Resistive Index

	Right uterine artery	Left uterine artery	Mean(r+l)
Pulstility index	2.83±0.99	1.37±0.69	2.1±0.84
Resistive index	0.83±0.75	0.59±0.21	0.71±0.48

DISCUSSION

Current study explored the usefulness of color Doppler ultrasound as a diagnostic measure for polycystic ovarian syndrome as a noninvasive way of blood flow evaluation. Various investigations has reported conflicting results in terms of average uterine artery pulsatility index and resistance index in polycystic ovarian syndrome diagnosis.

A study reported the elevation of pulsatility index and resistance index of uterine artery among patients diagnosed with polycystic ovarian syndrome,[12] which is not in line with the findings of current study. On the other hand, a similar study reported the decrease in values of pulsatility index and resistance index of uterine artery among patients diagnosed with polycystic ovarian syndrome,[13] which is in line with the findings of current study. Elevation of pulsatility index value only was also reported among young girls diagnosed with polycystic ovarian syndrome in a similar study.[14]

Several research studies based on exploring the usefulness of Color Doppler for taking blood flow measurements of uterine and ovarian vessels have reported a low resistance index in the stroma of polycystic ovaries and correlations with endocrine changes.[15]

Occurrence of accurately diagnosed patients was 80.83%) in current research is in line with the findings of an investigation according to which 83% accurate diagnosis of polycystic ovarian syndrome was assessed by power Doppler scan.[16] Their cut off value for PI and RI values was > 1.20 for polycystic ovarian syndrome diagnosis as used in the current study. Suitability of power Doppler scan has been proved by both studies as an accurate instrument for the diagnosis of polycystic ovarian syndrome as it showed high accuracy level in both studies.

The findings of current study reported that the average PI was elevated (2.1±0.84) and average RI value was on lower side, 0.71±0.48. A comparable investigation was conducted to explore the difference in average values of PI and RI.[17] The findings of the study was elevated Pulsatility Index in polycystic ovarian syndrome patients, 3.56±.93 and for Resistive Index, it was .94±.06.

Elevated values of Pulsatility Index and Resistive Index in polycystic ovarian syndrome patients, was first reported by Goswamy and Steptoe.[18] It was revealed that Resistive Index is inversely associated with Resistive Index of intraovarian flow in females with polycystic ovarian syndrome. These outcomes revealed that with the increase in uterine artery impedance, intraovarian flow also elevated.

Additionally, an inverse association is revealed among the ratio of Luteinizing Hormone or Follicle Stimulating Hormone as well as the indices of Doppler sonography among females diagnosed with polycystic ovarian syndrome. The findings of current study in terms of changed blood flow in ovaries among females with polycystic ovarian syndrome were similar to the findings of other studies. It is found that the ovarian stroma values for Resistive Index and Pulsatility Index are in line as for corpora lutea among females with polycystic ovaries. The studies based on Doppler sonography usage for the diagnosis of polycystic ovarian syndrome reported that higher vessels count is found in polycystic ovaries as compared to the normal ovaries within initial folliculogenesis duration.

It is to conclude that the accuracy of polycystic ovarian syndrome diagnosis is quite high with pelvic color Doppler which supports the usage of color Doppler for the diagnosis of polycystic syndrome in females.

REFERENCES

1. Hart R.Definition, prevalence & symptoms of polycystic ovaries & polycystic ovarian syndrome. In Allahbadia G,Agrawal R,editors.Polycystic ovarian syndrome.1st ed.UK:Anshan Limited ;2007, 15-26.
2. Balen A H.What is new in polycystic ovarian syndrome.In:Bonnar J,DunlopW,editors.Recent advances in obstetrics and gynecology.2nd ed.UK:Royal society of Medicine Press ;2005.P.147-

58.
3. Loverro G, Vicino M, Lorusso F, Vimercati A, Greco P, Selvaggi L. Polycystic ovary syndrome: relationship between insulin sensitivity, sex hormone levels and ovarian stromal blood flow.Gynecol Endocrinol, 2001 ;15(2):142-9.
4. Pan HA,wu Meng, Cheng YU, Hsien CH and Chang FM. Quantification of Doppler signal in polycystic ovary syndrome using three-dimensional power Doppler ultrasonography: a possible new marker for diagnosis Oxford Journals Human Reproduction , 2001 Volume17, (Issue1)Pp. 201-206 .
5. Maslovitz S, Jaffa A. Ultrasound appearance of polycystic ovaries & ovarian hyperstimulation syndrome. In Allahbadia G,Agrawal R,editors.Polycystic ovarian syndrome.1st ed. UK: Anshan Ltd;2007.P57-67.
6. Özkan S, Vural B, Çalışkan E, Bodur H, Türköz E, Vural F. Color doppler sonographic analysis of uterine and ovarian artery blood flow in women with polycystic ovary syndrome; J Clin Ultrasound. 2007 Jul-Aug;35(6):305-13.
7. Lakhani K,Seifalian A M ,Atiomo W U ,Hardiman P.Polycystic ovaries.Br J Radiology,2002;75:9-16.
8. Yedla M. Mala Sharda B. GhoshReva TripathiThree-dimensional power Doppler imaging in the diagnosis of polycystic ovary syndrome International Journal of Gynecology Volume 105, Issue 1 , Pages 36-38, April 2009; Volume 105, (Issue 1 , Pages 36-38.
9. P. Pellizzari1, C. Esposito, F. Siliotti, S. Marchiori and M. Gangemi Colour Doppler analysis of ovarian and uterine arteries in women with hypoestrogenic amenorrhoea Oxford Journals Human Reproduction Volume17, Issue12Pp. 3208-3212 August 13, 2002.
10. Mala YM, Ghosh SB, Tripathi R. Three-dimensional power Doppler imaging in the diagnosis of polycystic ovary syndrome Int .J Gynaecol Obstet, 2009;105(1):36-8. Epub 2009 Feb 7.
11. Maciołek-Blewniewska G, Kozarzewski M, Szpakowski M, Pertyński T, Nowak M.Ginekol Pol. The evaluation of blood flow in uterine arteries in girls with polycystic ovary syndrome by Transvaginal colour doppler ultrasonography,1999;70(5):412-7.
12. Battaglia C, Battaglia B, Morotti E, Paradisi R, Zanetti I, Meriggiola MC, Venturoli S. Two- and three-dimensional sonographic and color Doppler techniques for diagnosis of polycystic ovary syndrome. The stromal/ovarian volume ratio as a new diagnostic criterion. J Ultrasound Med,2012; 31(7):1015-24.
13. Mala YM, Ghosh SB, Tripathi R. Three-dimensional power Doppler imaging in the diagnosis of polycystic ovary syndrome Int .J Gynaecol Obstet, 2009;105:36 -38.
14. Loverro G, Vicino M, Lorusso F, Vimercati A. Polycystic ovary syndrome: relationship between insulin sensitivity, sex hormone levels and ovarian stromal blood flow.Gynecol Endocrinol 2001;15:142-49.
15. Maciołek-Blewniewska G, Kozarzewski M, Szpakowski M. The evaluation of blood flow in uterine arteries in girls with polycystic ovary syndrome by Transvaginal colour doppler ultrasonography,1999;70:412-17.
16. Balen AH, Laven JSE, Tan SL, Dewailly D. Ultrasound assessment of the polycystic ovary: international consensus definitions. Human Reproduction Update. 2003;9505-14.
17. Battaglia C, Battaglia B, Morotti E, Paradisi R. Two- and three-dimensional sonographic and color Doppler techniques for diagnosis of polycystic ovary syndrome. The stromal/ovarian volume ratio as a new diagnostic criterion. J Ultrasound Med,2012; 31:1015-24
18. Goswamy RK and Steptoe PC: Doppler ultrasound studies of the uterine artery in spontaneous ovarian cycles. Hum Reprod 3:721, 198