An Investigation On The Uterine And Ovarian Artery Flow Velocity Indices In Women With Ovulatory Cycles

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Abstract : Ovulatory dysfunction being one of the commonest cause of infertility requires further evaluation to understand the relation between failure to conceive and a successful reproductive outcome. In this study comparison is done between the flow velocitiy indices in the uterine and ovarian artery during the luteal phase in both ovulatory and anovulatory cycles. It has been tried to ascertain if there is any correlation of the serum progesterone value along with the Doppler flow velocity indices. Very minimal number of studies so far has included all the above comparison and correlations in their study. Women with impaired perfusion can be supplemented with vascular enhancer drugs to improve the ovulatory rate.

Keywords: ovulatory and anovulatory cycles, Ovulatory dysfunction, Doppler flow velocity.

1. INTRODUCTION

Infertility is defined as a failure or inability to achieve clinical pregnancy after 12 months of regular unprotected sexual intercourse (1). Infertility implies apparent failure of couple to conceive while sterility indicates absolute inability to conceive (2). Infertility generates disability, and access to health care falls under the convention on rights of persons with disability. The major causes of infertility includes ovulatory dysfunction (20-40%), Tubal and peritoneal pathology (30-40%), Male factors (30-40%), uterine pathologies - relatively uncommon cause remaining reasons remain Unexplained (10%).

Ovulatory Dysfunction account for approximately 20% of the problems identified in infertile couples. Ovulatory dysfunction can be severe enough to prevent conception (anovulation) or only a contributing factor (Oligoovulation) (3,4). Mechanism of ovulation involves the dominant follicle reaching the surface of that particular ovary just prior to ovulation. The ovum with the surrounding cells Corona Radiata floats freely in the liquor folliculi since the cumulus become detached from the wall. With extrusion of first polar body which is pushed into perivitelline space, the oocytes completes first meiotic division. The follicular wall near ovarian surface becomes thinner. It then develops as a conical projection which penetrates the outer surface layer of the ovary and persists as a thin membrane for a while (5).

The cumulus oozes out of the follicle by a process taking about 2 minutes along with some amount of follicular fluid. The stigma then closes by plasma plug. After ovulation, follicle changes to corpus luteum. The ovum picked by the fallopian tube undergoes either

degeneration or further maturation. Ovulation is not only physical extrusion of the ovum but also it is associated with change in the hormonal mileu.

There is progressive rise in serum progesterone levels which is secreted from Corpus Luteum upto day 21 after which the Corpus Luteum regresses resulting in progressive decrease in circulating progesterone levels resulting in withdrawal menstrual bleeding if not fertilised. Hence, the current study designed to comparison between the flow velocity indices in the uterine and ovarian arteries during the luteal phase in women with Ovulatory and Anovulatory cycles. Correlation between serum progesterone value in the mid luteal phase and the Doppler flow velocity in the uterine and ovarian arteries (6).

2. MATERIALS AND METHODS

2.1. Source of data
60 Patients attending OBG OPD at Vinayaka Mission Medical College, Karaikal sent to Radiology OPD for US evaluation. The study participants has been divided into two groups Group A: Ovulatory Infertility Group, Group B: Anovulatory Infertility Group.

2.2. Period of study
All cases from 1 year (March 2018- April 2019)

2.3. The inclusionary criteria
All married females had unprotected regular intercourse for atleast 1 year with the age group: 20-40 years are categorized under women with infertility.

2.4. The exclusionary criteria
Patients treated with vasodilator drugs, women who received hormonal therapy or ovarian stimulation during the cycle of the study, women who underwent surgeries over uterus and fallopian tubes, tumors which can interfere with uterine and ovarian blood flow, women with Primary Amennorrhoea., women treated with NSAIDS during the cycle of study were excluded from the study.

2.5. Methods of statistical analysis
The Statistical analysis was performed by STATA 11.2 (College Station TX USA). Shapiro Wilk test were used to find the normality. Students t-test or Mann Whitney test were used to find the significance difference between the age, duration of infertility, Serum Progrestone levels, endometrial thickness, Doppler finding of uterine artery and ovarian artery with groups (Ovulatory and Anovulatory) and its expressed as mean and standard deviation. Chi square test for goodness of fit were used measure the association between the age distribution, duration of infertility, menstrual cycle regularity, number of Dominant follicles, Serum Progesterone levels with groups and it is expressed as frequency and percentage. $P < 0.05$ considered as statistically significant.

3. RESULTS

In this study, 60 primary infertility patients were selected which were divided into 2 groups with 30 patients in the Ovulatory infertility group and another 30 patients in the Anovulatory infertility group. We primarily compared the doppler indices of the 2 groups: While doing the study, secondary objectives like correlation of serum progesterone level with the doppler indices, endometrial thickness correlation with uterine artery velocity indices were also found. This study was conducted in the department of Obstetrics and Gynaecology, Vinayaka Missions medical college, Karaikal from March 2018 to April 2019.

The age and duration of infertility among the 2 groups was statistically insignificant. The regularity of menstrual cycle was compared among the 2 groups. The difference was statistically significant. In the Ovulatory infertility group 93% had regular cycles whereas in

the Anovulatory infertility group 70% had irregular cycles. The mean progesterone value and endometrial thickness was compared between the 2 groups and the difference was statistically significant. A correlation was drawn between the endometrial thickness and the serum progesterone levels. Increased endometrial thickness was seen with increased progesterone levels in both the groups.

Peak Systolic Velocity, End Diastolic Velocity, Resistivity Index and Pulsatility Index in Ovarian Artery was compared in the 2 groups. There was no statistically significant difference in the values. The Pulsatility Index, peak systolic velocity, end diastolic velocity of the ovarian artery was higher among Anovulatory group patients but the difference among the two groups is not statistically significant. Similarly the 4 parameters, namely Peak Systolic Velocity, End Diastolic Velocity, Resistivity Index and Pulsatility Index in the Uterine Artery was compared among the 2 groups. The difference in Resistivity Index values was statistically significant (P Value <0.05).Whereas the Peak Systolic Velocity, End Diastolic Velocity and the Pulsatility Index did not show any statistically significant difference. In this study, a correlation was drawn between the Doppler indices of the 2 arteries and the serum progesterone levels, in ovarian artery, Resistivity Index in the Ovulatory group and Anovulatory group did not bear any relationship to the serum progesterone level but in the Ovulatory group, with increase in progesterone values, the Pulsatility Index decreased. In the uterine artery, with increasing Progesterone value, in anovulatory group, the Pulsatility Index reduced.

Table 1 - Age wise distribution of patients

AGE	Ovulatory Infertility		Anovulatory Infertility		Total	P-Value
	N	%	N	%		
<= 25	5	17%	17	57%	17	
26-30	22	73%	9	30%	31	0.005
31-35	3	10%	3	10%	6	
36-40	0	0%	1	3%	1	
Total	30		30		60	

In the Ovulatory group 17% were in the 20-25yrs age group, 73% were in 26-30yrs age group and 10% belonged to 31-35yrs age group. Whereas 57% from Anovulatory group belonged to 20-25yrs age group, 30% belonged to 26-30yrs age group, 10% belonged to 31-35 yrs age group and 3% belonged to 36-40yrs age group. P-value > 0.05 suggested that the age difference between the 2 groups is not statistically significant.
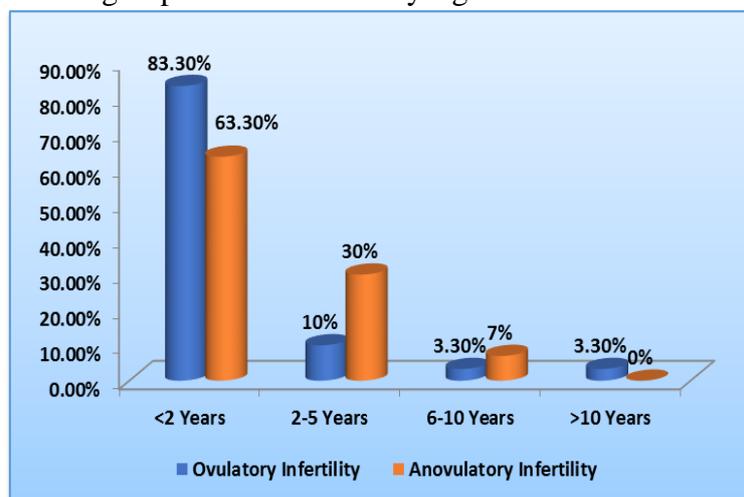

Fig.1. Duration of infertility

In the Ovulatory group, 83.3% patients had infertility for <2 yrs, 10% had infertility for 2-5 yrs, 3.3% had infertility for 6-10 yrs, 3.3% had for > 10 yrs. Whereas in the Anovulatory group, 63.3% had infertility for <2 yrs, 30% had for 2-5 yrs , 7% had for 5-10 yrs and none had infertility for >10 yrs.
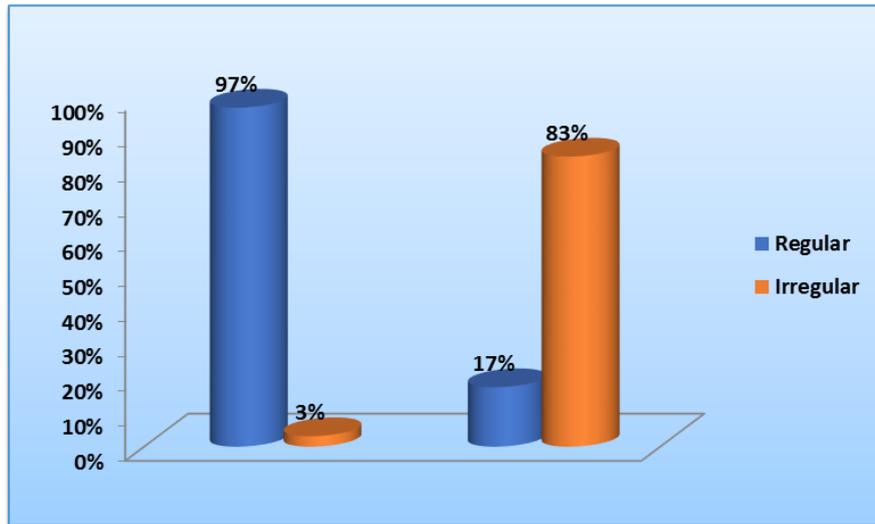

Fig.2. Regularity of menstrual cycle

In the Ovulatory group, 93% had regular menstrual cycle and 7% had irregular menstrual cycles. Whereas in the Anovulatory group, 30% had nearly regular menstrual cycles (35 days cycle) and 70% had irregular menstrual cycles. P- value was statistically significant.
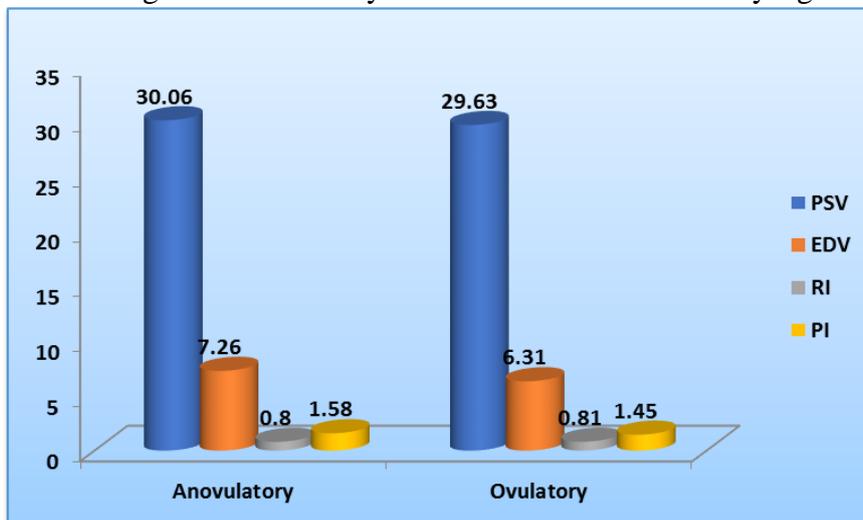

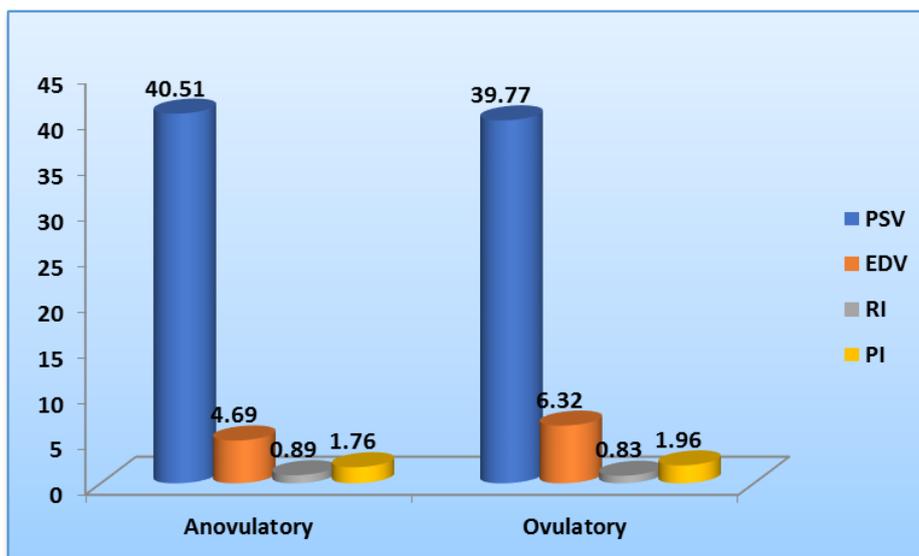Fig.3. Ovarian artery Doppler indices

Fig.4. Uterine artery Doppler indices

Similarly the 4 parameters, namely Peak Systolic Velocity, End Diastolic Velocity, Resistivity Index and Pulsatility Index in the Uterine Artery is compared among the 2 groups. The difference in Resistivity Index and End Diastolic Velocity value is statistically significant. Whereas Peak Systolic Velocity and the Pulsatility Index did not show any statistically significant difference.

Table 2 - Correlation between Serum Progesterone values and Doppler indices

S. Progesterone Values (ng/ml)	RI		PI	
	Anovulatory	Ovulatory	Anovulatory	Ovulatory
≤5	0.78 ± 0.16		1.59 ± 0.62	
5-10	0.82 ± 0.11	0.80	1.58 ± 0.11	1.56
11-20	1.40	0.81 ± 0.08	1.82	1.48 ± 0.12
>20		0.80 ± 0.14		1.30 ± 0.31

4. DISCUSSION

Various methods has been used to assess the probable cause of Ovulation and Anovulation. Due to the uncertainty of the explicit evidence of ovulation, various methods has been used for the diagnosis of ovulation. Among the modalities of diagnosis there are interventional and non-interventional methods. For obvious reasons, non-interventional methods of diagnosis are preferred. This has been an effort to assess the non-interventional method of diagnosis of ovulation by Doppler studies of the uterine and ovarian blood flow. Attempt has been made to correlate the serum progesterone values in ovulatory and anovulatory cycles (7). In this attempt, a probable cause of successful ovulation and its relationship with Doppler and progesterone level values has been tried. Transvaginal Colour Doppler ultrasonography is a non-invasive and efficient method for visualizing small vessels and study of blood flow changes. It has been demonstrated previously that impedance of uterine and spiral arteries blood flow change periodically during the normal ovulatory menstrual cycle. The lowest impedance at spiral artery blood flow has been detected at the mid-luteal phase, during which endometrium has been transformed from proliferative phase to secretory phase. At this specific time, blood supply of uterus is rich and implantation is most likely to occur. PI was

the most important parameter, and uterine and arcuate arteries blood flow can be measured by transvaginal Colour Doppler ultrasonography before HCG stimulation in IVF treatment for evaluating the procedure success rate (8, 9, 10).

According to this study, the Pulsatility Index, peak systolic velocity, end diastolic velocity of the ovarian artery was higher amonga group patients but the difference among the two groups is not statistically significant. The mean resistivity index in the anovulatory group was 0.89 ± 0.06 whereas in the ovulatory group it was 0.83 ± 0.07.   The difference in resistivity index values in the uterine artery among the 2 groups was statistically significant (11, 12).

5. CONCLUSION

Since there was statistically significant difference in the Doppler indices of uterine artery (R.I) among the Ovulatory and Anovulatory group, so it suggests that blood flow is a contributing factor. Doppler indices like Pulsatility Index, Peak Systolic Velocity, and End Diastolic Velocity of the ovarian artery was higher among anovulatory group patients. But the difference was not statistically significant. If R.I is less, chances of Ovulation is more. In cases of R.I being high we find that progesterone level is low and it indicates Anovulation. So vascular perfusion enhancer drugs may be tried to improve ovulation rates among patients with Anovulation. Further studies are required to know whether vascular perfusion enhancer drugs can be implicated in improve fertility outcome of patients with anovulation.

Conflict Of Interest

Authors do not have any conflict of interest

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