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Original Research Article

Evaluation of ovarian volume, stromal blood flow and antral follicular count in case of infertility by spectral color doppler and transvaginal 3D ultrasonography

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ABSTRACT

Background: Fertility is a complex equation of continuous hormonal changes. The present study was evaluation of ovarian volume, stromal blood flow and antral follicular count in case of infertility by spectral color doppler and transvaginal 3D ultrasonography. The present study was conducted to assess ovarian volume, stromal blood flow and antral follicular count in case of infertility by spectral color doppler and transvaginal 3d ultrasonography.

Materials & Methods: Patients between the ages of 20 and 40 years were included in both infertility (50) and pregnancy control groups (50). Basal ovarian volume and AFC are measured intravaginally. USG. Relevant clinical data and hormonal tests will be recorded for each patient. The machines used in this study are GE Voluson S8 USG-machine, Logiq p9 USG.

Results: Based on the criterion of >11 antral follicular count which gave sensitivity and specificity of 20% and 56% respectively that 43 subjects in the infertile group and 34 subjects in the control group had antral follicular count of less than 11 while seven (07) subjects in the infertile group and 34 subjects in the control group had antral follicular count of equal to or more than 11. The difference in between infertile and control group was found to be statistically significant (p = 0.03). Ovarian volume less than 11.75 cc was seen in 45 (90%) patients in infertile group and 33 (66%) patients in the control group. Ovarian volume (in cc) of more than or equal to 11.75 was seen in 05 (10%) of patients in the infertile group while 17 (34%) patients in the control group. The difference between the two group was found to be statistically significant (p = 0.004). The cut -off for ovarian volume at 11.75 cc was decided based on sensitivity and specificity of 12% and 66% respectively. PSV of less than 13 cm/sec was seen among 37 patients from infertile group while PSV of ≥13 cm/sec was seen among 13 patients from infertile group. In control group, 28 patients had PSV of <13 cm/sec while 22 patients had PSV of ≥13 cm/sec. However, the difference was not found to be statistically significant (p=0.05). The distribution was uniform across the infertile and control group and difference was not found to be statistically significant (p = 1).

Conclusion: AFC, ovarian volume, stromal blood flow (in terms of PSV and RI) can be used as predictors for determining infertility state among females of reproductive age group and further can be used in determining further management for the same. Although our study also

showed that in fertile group, there was no positive correlation between AFC and ovarian volume, PSV. The mean AFC in our study population was different from that noted in other studies from different parts of the world and it could be due to racial, socio-economic and geographical factors. A cut-off value of 11 for AFC may be used as one of the factor in females undergoing infertility assessment. Other factors such as Ovarian volume, Stromal blood flow (in terms of PSV and RI) can also be used during assessment along with AFC for management of infertility among Indian women.

Key words: Fertility, Ovary, Hormone

1. INTRODUCTION

Fertility is a complex equation of continuous hormonal changes. Infertility in women is defined as the inability to conceive after one year of unprotected sexual intercourse in women under 35 and 6 months of unprotected intercourse in women older than 35.[1]
Reproductive aging is considered to be the consequence of a decrease in the quantity and quality of the ovarian follicle pool.[2] Human ovarian autopsy investigations reveal that the number of follicles rapidly declines with age in females, beginning in foetal life and continuing until after menopause. However, the quantitative ovarian reserve can differ significantly among women of the same chronological age.[3]
Ultrasound is an important tool for predicting when to ovulate more accurately than basal body temperature, and faster and cheaper than hormonal profiles. Ultrasound plays a role in egg retrieval and embryo replacement. Ovulation detection is very important in fertility treatment.[4]
The number of antral follicles and the total ovarian volume as determined by transvaginal USG have been noted in the literature to indicate decreased fertility associated with reproductive aging.[5]
Color Doppler has emerged as an effective new diagnostic imaging modality in recent years in the field of medicine, especially in areas related to infertility.[6] Uterine Abnormalities Intrauterine Lesions, Tubal Patency, Polycystic Ovary, Follicle Monitoring, Endometrial Receptivity, Failed or Ectopic Pregnancy, Male Infertility, Uterine, Endometrial, and Ovarian Vascularity. In our evaluation, color Doppler is high -throughput sophisticated video technology.[7] The present study was evaluation of ovarian volume, stromal blood flow and antral follicular count in case of infertility by spectral color doppler and transvaginal 3d ultrasonography.

2. MATERIALS & METHODS

The present study comprised of 100 subjects. All gave their written consent for the participation in the study.
Data such as name, age, gender etc. was recorded. Patients between the ages of 20 and 40 years were included in both infertility (50) and pregnancy control groups (50). Basal ovarian volume and AFC are measured intravaginally. USG. Relevant clinical data and hormonal tests will be recorded for each patient. The machines used in this study are GE Voluson S8 USG-machine, Logiq p9 USG. Correlations were determined by Pearson ranked correlation coefficient. Chi-square test was used for non-parametric variables. For all statistical analyses, $P < 0.05$ was considered as significant.

3. RESULTS

Table I Comparison of ROC Curves

	AUC	SE	95% CI
Age	0.374	0.06	0.26 to 0.48
AFC	0.201	0.05	0.10 to 0.29
Ovarian Volume	0.132	0.04	0.05 to 0.21
PSV	0.281	0.05	0.17 to 0.38
RI	0.370	0.06	0.25 to 0.48

Table I shows that age is the significant variable to determine infertility with p value of 0.03.

Table II Association between Age and Infertility

Age (in years)	Group		Total n (%)
	Infertile (%)	Control (%)	
21 - 33	46 (92)	48 (96)	94 (94)
34 - 39	04 (08)	02 (04)	06 (06)
Total	50 (100)	50 (100)	100 (100)
p value	0.67		

Table II shows that based on the criterion of >33 years which gave sensitivity and specificity of 12% and 92% respectively that 46 subjects in the infertile group and 48 subjects in the control group in the age group of 21-33 years while four (04) subjects in the infertile group and two (02) subjects in the control group belonged to the age group of 34-39 years.

Table III Association between Antral follicular count and infertility

Antral follicular count (AFC)	Group		Total n (%)
	Infertile (%)	Control (%)	
<11	43 (86)	34 (68)	77 (77)
≥11	07 (14)	16 (32)	23 (23)
Total	50 (100)	50 (100)	100 (100)
p value	**0.03**		

Table III shows that based on the criterion of >11 antral follicular count which gave sensitivity and specificity of 20% and 56% respectively that 43 subjects in the infertile group and 34 subjects in the control group had antral follicular count of less than 11 while seven (07) subjects in the infertile group and 34 subjects in the control group had antral follicular

count of equal to or more than 11. The difference in between infertile and control group was found to be statistically significant (p = 0.03).

Table IV Association between Ovarian volume (in cc) and infertility

Ovarian Volume (in cc)	Group		Total (%)
	Infertile (%)	Control (%)	
<11.75	45 (90)	33 (66)	78 (78)
≥11.75	05 (10)	17 (34)	22 (22)
Total	50 (100)	50 (100)	100 (100)
p value	**0.004**		

Table IV shows that ovarian volume less than 11.75 cc was seen in 45 (90%) patients in infertile group and 33 (66%) patients in the control group. Ovarian volume (in cc) of more than or equal to 11.75 was seen in 05 (10%) of patients in the infertile group while 17 (34%) patients in the control group. The difference between the two group was found to be statistically significant (p = 0.004). The cut -off for ovarian volume at 11.75 cc was decided based on sensitivity and specificity of 12% and 66% respectively.

Table V Association between PSV (in cm/sec) and infertility

PSV (incm/sec)	Group		Total (%)
	Infertile (%)	Control (%)	
<13	37 (90)	28 (66)	65 (65)
≥13	13 (10)	22 (34)	35 (35)
Total	50 (100)	50 (100)	100 (100)
p value	0.05		

Table V shows that PSV of less than 13 cm/sec was seen among 37 patients from infertile group while PSV of ≥13 cm/sec was seen among 13 patients from infertile group. In control group, 28 patients had PSV of <13 cm/sec while 22 patients had PSV of ≥13 cm/sec. However, the difference was not found to be statistically significant (p=0.05).

Table VI Association between Resistive Index and infertility

Ovarian volume (in cc)	Group		Total (%)
	Infertile (%)	Control (%)	
<0.75	35 (70)	35 (70)	70 (70)
≥0.75	15 (30)	15 (30)	30 (30)
Total	50 (100)	50 (100)	100 (100)
p value	1		

Table VI shows that the distribution was uniform across the infertile and control group and difference was not found to be statistically significant (p = 1).

4. DISCUSSION

In our study, total 100 participants were included out of which, 50 were healthy women with proven fertility who acted as control and 50 were women with infertility of 20 to 40 years age group.

We found that age is the significant variable to determine infertility with p value of 0.03. We found that based on the criterion of >33 years which gave sensitivity and specificity of 12% and 92% respectively that 46 subjects in the infertile group and 48 subjects in the control group in the age group of 21-33 years while four (04) subjects in the infertile group and two (02) subjects in the control group belonged to the age group of 34-39 years. Ribeiro SC et al[8], found mean total ovarian volume to be 10.86 in the infertile group (cases) while it was 11.36 in the healthy group (controls) and the difference between the two groups was not statistically significant (p = 0.41).

We found that based on the criterion of >11 antral follicular count which gave sensitivity and specificity of 20% and 56% respectively that 43 subjects in the infertile group and 34 subjects in the control group had antral follicular count of less than 11 while seven (07) subjects in the infertile group and 34 subjects in the control group had antral follicular count of equal to or more than 11. The difference in between infertile and control group was found to be statistically significant (p = 0.03). Ng EH et al[9] in which they studied effects of age on hormonal and ultrasound markers of ovarian reserve in Chinese women with proven fertility and found that mean peak systolic velocity (PSV) was different in different age groups – in ≤20 years, it was 10.35 cm/sec, in 21-30 years, 10.10 cm/s, in 31-40 years, 12.10 cm/s and 41-50 years, 11.45 cm/s respectively.

We found that ovarian volume less than 11.75 cc was seen in 45 (90%) patients in infertile group and 33 (66%) patients in the control group. Ovarian volume (in cc) of more than or equal to 11.75 was seen in 05 (10%) of patients in the infertile group while 17 (34%) patients in the control group. The difference between the two group was found to be statistically significant (p = 0.004). The cut -off for ovarian volume at 11.75 cc was decided based on sensitivity and specificity of 12% and 66% respectively.

PSV of less than 13 cm/sec was seen among 37 patients from infertile group while PSV of ≥13 cm/sec was seen among 13 patients from infertile group. In control group, 28 patients

had PSV of <13 cm/sec while 22 patients had PSV of ≥13 cm/sec. However, the difference was not found to be statistically significant (p=0.05). In the study by Agarwal et al[10], mean AFC count was 9.60 in the infertile group and 12.53 in the control group and the difference between them was found to be statistically significant (p = 0.002).
We found that the distribution was uniform across the infertile and control group and difference was not found to be statistically significant (p = 1). Arora A et al[11] found that resistive index (RI) was significantly correlated with age (p = 0.02).

5. CONCLUSION

Authors found that AFC, ovarian volume, stromal blood flow (in terms of PSV and RI) can be used as predictors for determining infertility state among females of reproductive age group and further can be used in determining further management for the same. Although our study also showed that in fertile group, there was no positive correlation between AFC and ovarian volume, PSV. The mean AFC in our study population was different from that noted in other studies from different parts of the world and it could be due to racial, socio-economic and geographical factors. A cut-off value of 11 for AFC may be used as one of the factor in females undergoing infertility assessment. Other factors such as Ovarian volume, Stromal blood flow (in terms of PSV and RI) can also be used during assessment along with AFC for management of infertility among Indian women.

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