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Role of Trans-Vaginal Ultrasonography for Comparative Analysis of Ovarian Volume and Antral Follicle Count for Predicting the Retrieved Oocyte Number, In IVF Patients

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ABSTRACT

Aims and Objectives
a To compare the role of pre-induction ovarian volume and antral follicle count in predicting the retrieved oocyte numbers in in-vitro fertilization patients (IVF).
b To study the co-relation of ovarian volume with antral follicle count.

Methods and Materials: 53 infertile patients were randomly taken in the study. On 2nd day of cycle, Transvaginal-ultrasound was done and pre-induction total ovarian volume (TOV) and total antral follicle count (TAFC) were calculated. Ovarian volume was calculated using ellipsoid formula and total volume was considered by adding volume of both the ovaries. Ovulation was induced using clomiphene citrate from day 3 to 7 of cycle. Post induction oocyte retrieval was done on mid cycle by the IVF team and total oocyte count (TOC) was considered.

Results: Mean age was 30.11±3.6, Mean TAFC was 11.98±5.69, mean TOV was 8.27±2.19cm^3 and mean TOC was 9.38 ±4.5. Correlation coefficient for TAFC and TOC was 0.959 with p value of <0.0001. Correlation coefficient for TOV and TOC was 0.726 with p value of <0.0001. Correlation coefficient for TAFC and TOV was 0.796 with p value of <0.0001.

Conclusion: TAFC and TOV both are significant predictors of retrieved TOC. TAFC is a better predictor with high coefficient of determination of 94.5% and a low standard error of 0.55 as compared to TOV. Also TAFC and TOV are significantly correlated. As AFC increases TOV also increases.

Keywords: TVS, IVF, Antral Follicle Count, Ovarian Volume, Oocyte Count

INTRODUCTION

Assisted reproduction technology (ART) procedures are time consuming, expensive and require efforts from both clinician and patients. The ability of the ovary to respond to exogenous gonadotropin stimulation and to develop several dominant follicles is crucial for successful In Vitro Fertilization (IVF). Failure of the ovary to respond adequately to stimulation, often with cancellation of the treatment cycle as a consequence, is a common problem. Knowing the high risk of a poor outcome of the (IVF) treatment may help doctors as well as patients to decide when to withdraw from IVF treatment and search for alternatives, such as adoption or oocyte donation.

Ovarian volume measurement and antral follicle count by Transvaginal Ultrasound is quick, cost effective and minimally invasive. Therefore it can be used to predict easily for counselling couples regarding potential success to be expected by pursuing ovulation induction procedures. This study was done with the intention of assessing the role of antral follicle count (AFC) and ovarian volume (OV) measurement as a predictor of ovarian response to ovulation induction. Also the co-relation of ovarian volume with antral follicle count was studied.

MATERIAL & METHODS

In this prospective randomized study, 53 infertile patients from Infertility centre, Geetanjali Medical College and hospital, Udaipur were randomly taken. Inclusion criteria were a) Patients presenting with Primary or Secondary infertility, b) Patients undergoing cycle of ovulation induction, c) Patients having both ovaries well visualised on Trans Vaginal Sonography (TVS) and d) Patients with polycystic ovaries. Patients who were excluded were a) Patients with history of partial or complete resection of one or both the ovaries, b) Patients with ovarian cysts, c) Patients with active pelvic infections.

Thorough history and examination was done in every case. Investigations which were done were complete blood count, viral markers, hysterosalpingography / laproscopic chromopertubation for tubal patency (if required) and 2D trans-vaginal ultrasonography (TVS). On $2^{nd}/3^{rd}$ day of menstrual cycle, TVS evaluation was done in Radiology Department, Geetanjali Medical College under all aseptic conditions with 5-7.5 MHz curvilinear intra-vaginal transducer. Ovarian Volume and Antral Follicle Count was calculated as follows:

Ovarian Volume was calculated using ellipsoid formula i.e. OV = 0.523 × D1× D2 × D3 where D1 = Maximum transverse diameter (cm), D2 = Maximum antero-posterior diameter (cm), D3 = Maximum longitudinal diameter (cm), OV = Ovarian Volume (cm^3). Total ovarian volume i.e. sum of volume of both the ovaries was taken into consideration.

Antral Follicle Count was calculated by counting all ovarian follicles measuring 2mm to 10mm in both the ovaries. Total follicle count per patient was taken into consideration.

Ovulation was induced using gonadotrophins (rFSH/HMG) from 2^{nd} day of cycle & antagonist (cetrotide 0.25µgm) subcutaneously was given daily till mid-cycle. When dominant follicle becomes >14mm, oocyte retrieval was done on mid cycle by the IVF team, Geetanjali Medical College and Hospital under aseptic conditions. Total number of oocytes retrieved was noted and considered.

Statistical Analysis:

Categorical variables were presented in number and percentage (%) and continuous variables were presented as mean ± SD and median. Normality of data was tested by Kolmogorov-Smirnov test. If the normality was rejected then non parametric test was used. Spearsman correlation coefficient was used to correlate oocyte count, AFC and Ovarian Volume. Univariate linear regression was used to assess the best predictor of Oocyte Count. A p value of <0.05 was considered statistically significant. The data was entered in MS EXCEL spreadsheet and analysis was done using Statistical Package for Social Sciences (SPSS) version 21.0.

RESULTS

53 infertile females were taken into this study of which 4 had polycystic ovaries. 60.38% of patients (n=32) were ≤30 years, while only 11.32% (n=6) were >35 years. Mean age was 30.11±3.6 years (Table 1). Mean total antral follicle count was 11.98±5.69 with median of 11. Mean total ovarian volume was 8.27±2.19cm^3 and Mean total oocyte count was 9.38±4.5 (Table 2). Results showed that antral follicle count and ovarian volume both are significant predictors (p value <0.0001) of retrieved oocyte count (Fig1,2).

Table1. Age Distribution

AGE(yrs)	Frequency	Percentage
1) <=30	32	60.38%
2) 31-35	15	28.30%
3) >35	6	11.32%
Total	53	100.00%

Table2. Demographics

Parameters	Mean (Range)
Ovarian Volume(cm^3)	
Right	4.15 (2.2 – 8.5)
Left	4.11 (2.3 – 8.3)
Total	8.2 (4.5 – 14.7)

Antral Follicle Count Right Left Total	 5.9 (1 – 15) 6 (1 – 14) 11.9 (3 – 28)
Oocyte Count Right Left Total	 4.6 (1 – 12) 4.7 (0 – 11) 9.3 (2 – 22)

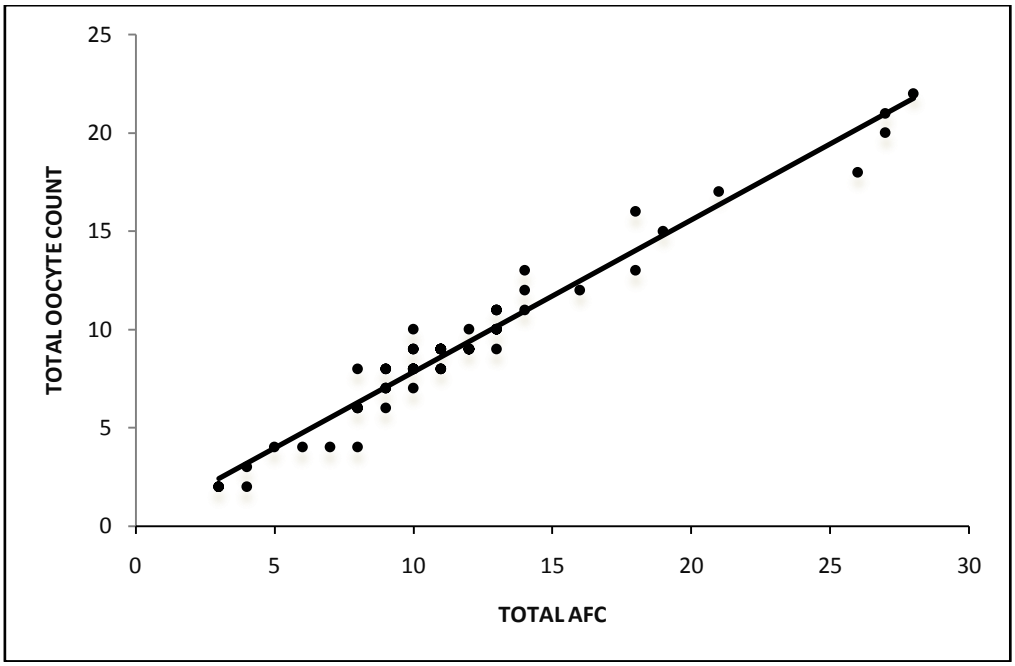

Figure1. Correlation between Total AFC & Total Oocyte Count

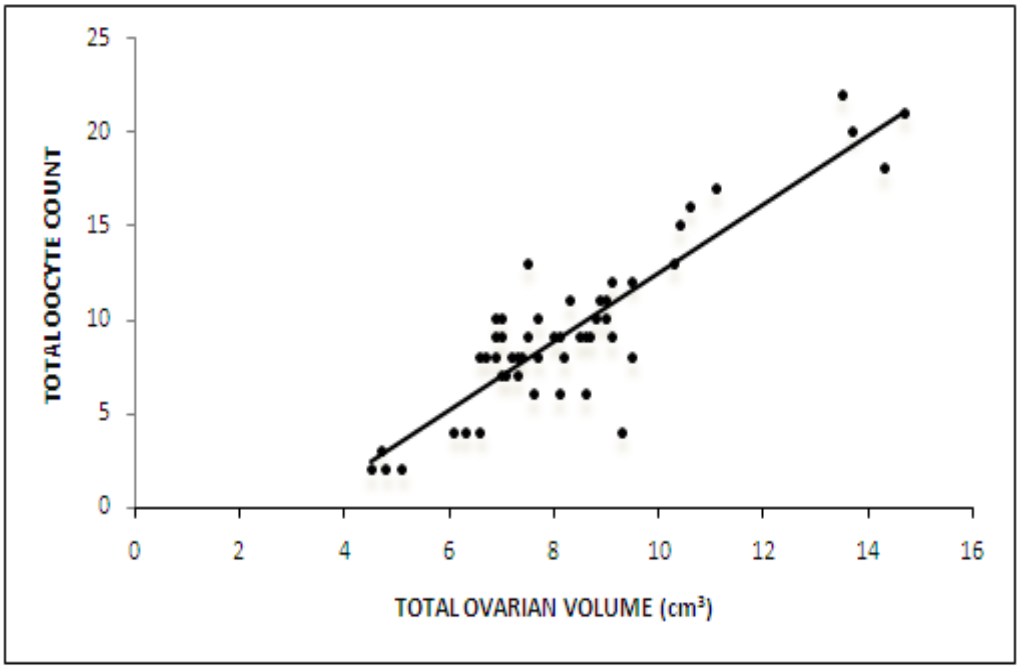

Figure2. Correlation between Total Ovarian volume & Total Oocyte Count

But antral follicle count was found to be a better predictor of retrieved oocyte count with high coefficient of determination of 94.5% and low Standard error of .05588 as compared to ovarian volume (Table 3). Correlation coefficient for total antral follicle count and total ovarian volume was 0.796 with p value of <0.0001(Fig3). It was also found that as age increases both antral follicle count and ovarian volume decreased significantly.

Table3. Linear Regression taking log oocyte as dependent

	Unstandardized Coefficients		P value	95.0% Confidence Interval for B		R Square	Std. Error of the Estimate
	B	Std. Error		Lower Bound	Upper Bound		
log AFC	1.088	.037	<.0001	1.014	1.162	.945	.05588
Log OVARIAN VOLUME	1.826	.160	<.0001	1.504	2.148	.718	.12637

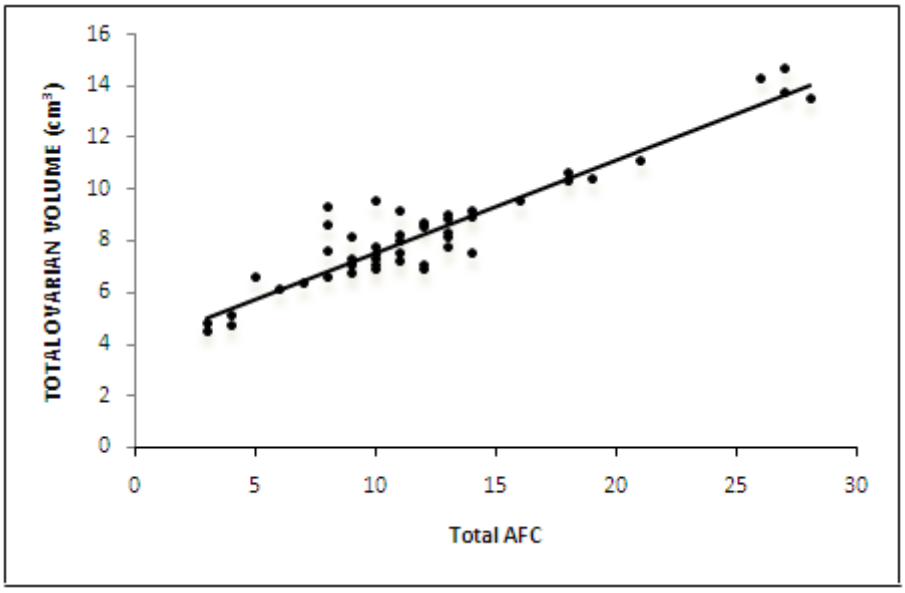

Figure 3. Correlation between Total AFC & Total Ovarian Volume

DISCUSSION

A variety of hormonal markers have been used to predict poor ovarian reserve in infertile women. Cycle day 3 FSH, E2, and inhibin B, as well as challenge tests, have been studied for their predictive value. However, despite their increasing acceptance in clinical practice, these tests are far from perfect in predicting ovarian response, cancellation rates, and ultimately, who will or will not get pregnant. It would be clinically and economically helpful if there were easy methods for prior assessment of likelihood of an adequate ovarian response.[1] Ultrasound examination of ovaries becomes an integral part of most assisted reproduction treatment programmes in assessing patients prior to stimulation and monitoring the ovarian response during stimulation. The recent introduction of measuring ovarian volume and counting the antral follicle number during scanning may further refine or improve the prediction of ovarian responsiveness.

Our results indicated that both antral follicle count and pre-induction ovarian volume are good predictors of retrieved oocyte count, but antral follicle count was a better predictor with high coefficient of determination and low a standard of error. Predictiveness of AFC was supported by Hendricks et al (2007) in their 10 studies on ovarian volume and 17 studies on AFC, by which they concluded that predictive performance of ovarian volume toward poor response was clearly inferior as compared with that of antral follicle count and stated that antral follicle count may be considered as the test of first choice when estimating quantitative ovarian reserve before in vitro fertilization.[1]

Ernest et al (2000) in their study on 128 women concluded that total antral follicle number was more sensitive parameter than total ovarian volume for predicting the ovarian response.[2] Our results were also supported by Tomas et

al (1997), who in 166 women undergoing IVF treatment concluded that the number of antral follicles present before ovarian stimulation was a better predictor of ovarian response than the ovarian volume or age alone. They revealed that the number of antral follicles was correlated more strongly with the number of recovered oocytes while the ovarian volume was correlated with the number of antral follicles before the stimulation but not with the number of oocytes.[3] In our study, ovarian volume was found to be correlating with the number of antral follicles. Kanchan and Latha (2014) in their study of 50 infertile patients concluded that ovarian volume correlates well with number of follicles.[4]

CONCLUSION

Total antral follicle count and total ovarian volume both are significant predictors of retrieved oocyte count. AFC is a better predictor with high coefficient of determination of 94.5% and a low standard error of 0.55 as compared to TOV. Also AFC and OV are significantly correlated. As OV increases AFC also increases.

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