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Full Length Research Paper

Transvaginal ultrasound measurement of ovarian volume in Port Harcourt

N. C. Nwankwo* and C. O. Maduforo

Department of Radiology, University of Port Harcourt Teaching Hospital, Nigeria.

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Transvaginal ultrasonography has been found to be very useful in gynaecological practice especially for its image clarity in assessing the ovaries and other pelvic organs. Its superiority to transabdominal sonography in assessing ovaries and monitoring follicles in *invitro*-fertilization (IVF) is not in doubt. The aim of this study is to establish normal values for ovarian volume in this environment using transvaginal technique. This was a prospective study carried out from June 2009 to February 2010. The volumes of right and left ovaries of 50 non pregnant female patients between the ages of 18 and 43 years who had transvaginal scan at the center were documented. None of the patients was on ovarian induction. And anyone with ovarian pathology was not recruited in the study. Results of this study suggest that mean ovarian volume in this environment is 9.7 and 10.2 cm^3 for the right and left ovaries, respectively with combined mean of 9.8 cm^3. Transvaginal examination of the ovaries remains the better option in assessing the ovaries and monitoring ovarian size because of its better image quality and resolution.

Keywords: Transvaginal sonography, ovarian volume, fertility.

INTRODUCTION

A precise baseline of normal measurements of organs is necessary to define disease processes. Transvaginal sonography has been shown to be useful in the evaluation of pelvic structures like the ovaries. This technique is useful in oocyte harvesting for *invitro* fertilization (Cohen et al., 1990, Mendelson et al., 1988). There is also a relationship between the ovarian volume and chances of the ovaries to respond to exogeneously applied stimuli. Ovarian volume has also been found to be useful in follow up of ovarian follicular maturation and to guide induction with human menopausal gonadotrophin (Lass et al., 1997). There is paucity of data on ultrasonic transvaginal assessment of ovarian in this environment. With recent increase in demand for assisted fertilization in our locality, there is the need to determine normal ovarian volume in our population with this preliminary report.

The sizes of ovaries could also be used as grading tools in ovarian hyper-stimulating syndrome and to evaluate the presence of polycystic ovary syndrome (PCOS) (Lobo and Camina, 2000). The size of the ovary has been found to be helpful in the diagnosis of ovarian torsion because the size and volume increases and often exceeds 4 cm in diameter (Dewbury et al., 1993).

The ovarian size is appropriately evaluated as volume because it varies in shape and configuration (Ivarson et al., 1983). The ovaries are usually oval organs measuring approximately 4x2x1 cm. They vary in size and morphology with age and physiological status of the female (Dewbury et al., 1993).

The ovarian volume is estimated by using the approximate formular for an ellipsoid which is length x breath x width x 0.523. The normal range of the ovarian volume is from 12 cm^3 at or soon after puberty and then decreases progressively to about 2.5 cm^3 at menopause and 0.5 cm^3 by 10 years after menopause. No lower limit has been suggested but non identification of the ovary does not invariably imply agenesis or dysgenesis (Ivarson et al., 1983; Orsni and Salardi, 1984). The ovarian volume varies in certain diseases of the ovary; therefore, we decided to carry out the present study in this locality because published data have been an Caucasian population. The aim of this study is to establish normal values of ovarian volumes in this

*Corresponding author. E-mail: emmynwankwo@yahoo.com

Table 1. Range of maximum and minimum age distribution

	N Statistic	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Deviation Statistic
Age	50	18.00	43.00	29.0200	6.24170
Valid No (list wise)	50				

environment using transvaginal approach

MATERIALS AND METHODS

This study was carried out at Pix centre, a private radiological diagnostic centre located in Port Harcourt between June 2009 to February 2010. A sample size of 50 subjects made up of normal non pregnant females from the age range of 18 years to 43 years was chosen. All cases with clinical indications of ovarian pathology and menstrual disorders were excluded from the study. The subjects who had no indication of ovarian disease or pelvic abnormalities, but who during the scanning procedure revealed pathology were excluded based on the ultrasonographic findings. All of the subjects were not on any oral contraceptives or any other drugs that affect ovarian size.

The equipment used for this study was a HDI 3500 Philips machine equipped with a Transvaginal probe of 7.5 MHz frequency, and a curvilinear probe of 3.5 MHz frequency.

Transvaginal technique was performed with the patient in the supine position and the knees slightly flexed. With the transducer in the vaginal vault, it was possible to angle the probe anteriorly or posteriorly and to the right or left as needed to demonstrate the uterus and ovaries. Multiple sections through the ovaries in coronal and sagittal planes were taken. The technique used is similar to that described by Schwimer and Leboric (1984). Measurements of the greatest length, transverse diameter (width) and antero-posterior (thickness) were obtained (Figure 1). The greatest length and the AP dimension were taken in the longitudinal plane while the width was obtained in the transverse plane. The age and parity of all the subjects were recorded. The ovaries were classified as right or left and the mean value of the measured ovaries (right and left) was also obtained. The T-test was employed to evaluate the mean difference between the right and left ovaries while Pearson correlation was used to assess the relationship between the age, parity and mean (right and left ovarian) volume. SPSS 16.0 software was used to analyze the data. $P.<0.01$ was considered statistically significant .

RESULTS

The results of this study are expressed in tables and figures.

Table 2. Distribution of age interval against right and left ovarian volumes

Age (Binned)		Right vol.	Left vol.
18.00 - 20.00	Mean	11.1050	10.2100
	N	2	2
	Std. Deviation	.26163	1.13137
	Minimum	10.92	9.41
	Maximum	11.29	11.01
	Kurtosis	.	.
	Skewness	.	.
21.00 - 23.00	Mean	10.3289	10.2111
	N	9	9
	Std. Deviation	1.30416	1.21938
	Minimum	8.36	8.12
	Maximum	12.70	11.57
	Kurtosis	.462	-.478
	Skewness	.652	-.919
24.00 - 26.00	Mean	8.3233	10.9300
	N	9	9
	Std. Deviation	3.16595	3.66044
	Minimum	.49	8.28
	Maximum	11.77	20.36
	Kurtosis	5.881	7.352
	Skewness	-2.181	2.623
27.00 - 29.00	Mean	9.9843	10.6000
	N	7	7
	Std. Deviation	1.44254	1.27870
	Minimum	7.99	8.80
	Maximum	11.86	12.55
	Kurtosis	-1.186	-.557
	Skewness	.088	.092
30.00 - 32.00	Mean	9.5389	10.2167
	N	9	9
	Std. Deviation	1.73117	1.08426
	Minimum	5.77	7.96
	Maximum	11.01	11.86
	Kurtosis	2.051	1.981
	Skewness	-1.500	-.848

Table 2. continues

33.00 - 35.00	Mean	10.8567	10.4633
	N	6	6
	Std. Deviation	1.90466	.92731
	Maximum	14.00	12.14
	Kurtosis	1.507	1.978
	Skewness	.538	1.386
36.00 - 38.00	Mean	8.2350	9.5525
	N	4	4
	Std. Deviation	1.74716	1.16010
	Minimum	5.77	7.96
	Maximum	9.72	10.73
	Kurtosis	1.720	1.896
	Skewness	-1.361	-1.012
39.00 - 41.00	Mean	11.4250	11.4800
	N	2	2
	Std. Deviation	.20506	.26870
	Minimum	11.28	11.29
	Maximum	11.57	11.67
	Kurtosis	.	.
	Skewness	.	.
42.00+	Mean	9.0200	8.4600
	N	2	2
	Std. Deviation	2.24860	1.00409
	Minimum	7.43	7.75
	Maximum	10.61	9.17
	Kurtosis	.	.
	Skewness	.	.
Total	Mean	9.6958	10.3542
	N	50	50
	Std. Deviation	2.07791	1.83589
	Minimum	.49	7.75
	Maximum	14.00	20.36
	Kurtosis	7.069	17.636
	Skewness	-1.819	3.242

Table 3. Range of maximum and minimum right and left ovarian volumes

	N	Minimum	Maximum	Mean	Std. Deviation
Right vol.	50	.49	14.00	9.6958	2.07791
Left vol.	50	7.75	12.55	10.1598	1.13597
Valid N (listwise)	50				

Table 4. Pearson correlation of patient's age with right and left ovarian volumes

		Age	Right vol.	Left vol.
Age	Pearson Correlation	1	-.040	-.066
	Sig. (2-tailed)		.783	.647
	N	50	50	50
Right vol.	Pearson Correlation	-.040	1	.404**
	Sig. (2-tailed)	.783		.004
	N	50	50	50
Left vol.	Pearson Correlation	-.066	.404**	1
	Sig. (2-tailed)	.647	.004	
	N	50	50	50

** Correlation is significant at the level of 0.01(2-tailed).

Table 5. Pearson correlation between the right and left ovarian volumes

		Right vol.	Left vol.
Right vol.	Pearson Correlation	1	.404**
	Sig. (2-tailed)		.004
	N	50	50
Left vol.	Pearson Correlation	.404**	1
	Sig. (2-tailed)	.004	
	N	50	50

** Correlation is significant at the level of 0.01(2-tailed).

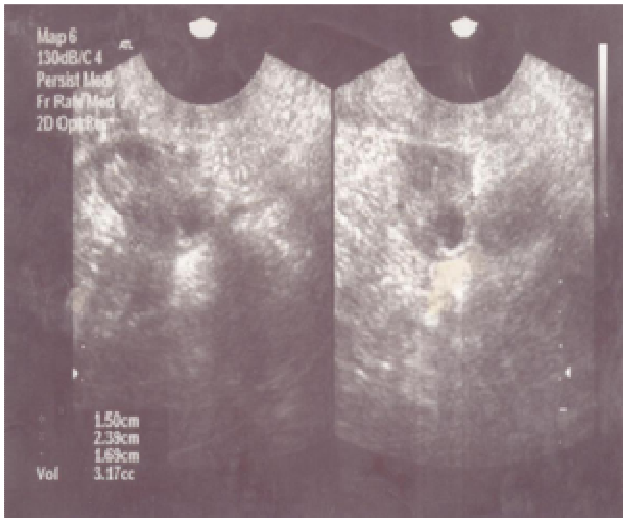

Figure 1. Transvaginal ultrasound image of the ovaries. The cursors define the points of measurements of the ovarian dimensions.

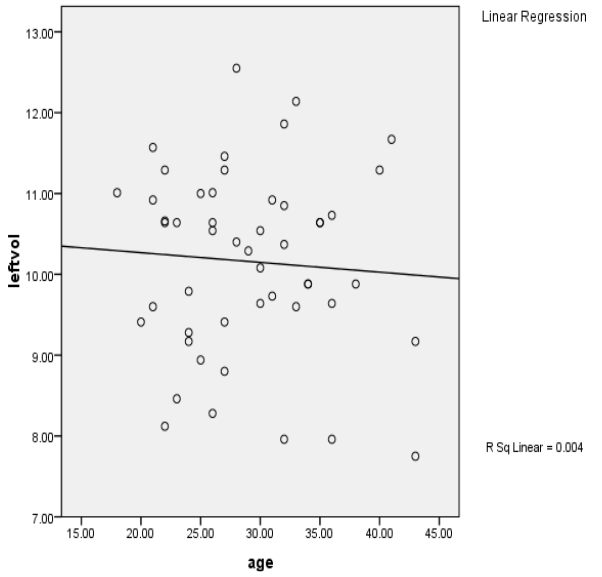

Figure 2. Scatter plot of left ovarian volumes against ages of patients

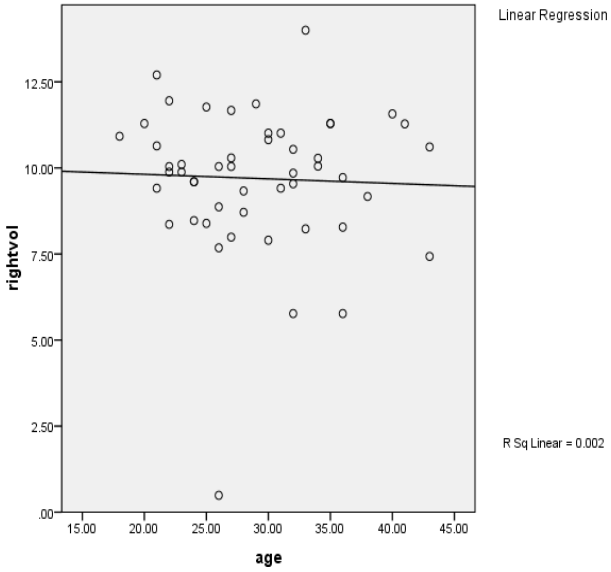

Figure 3. Scatter plot of right ovarian volumes against ages of patients

DISCUSSION

Literature is replete with the usefulness of transvaginal sonography in gynaecologic imaging, citing improved or excellent tissue characterization of the ovaries and the uterus due to proximity of the transducer to the organs, thereby mitigating the limitations of gas filled bowels, adhesions or obesity.

The results of the present study suggest that the mean ovarian volume is this: locality is 9.7 and 10.2 cm^3 for the right and left ovaries respectively with a combined mean of 9.8 cm^3. This is similar to that of Cohen et al. (1990) whose study was done on North Americans. The values in the present study are also in agreement with that of Ugwu et al. (2009), who reported a mean ovarian volume of 9.9 cm^3; whose study was on a Nigerian population in the south east geopolitical zone. These investigators used transabdominal approach for the study. In the present study, transvaginal approach was employed.

Sample et al. (1977) described the ovarian volumes in 25 normal women as 4 cm^3 while Morley et al. (1985), Athey (1989) and Parsons et al. (1989) reported values of 6 cm^3. Granberg and Wikland (1987) reported volumes in normal Swedish female subjects of 4.4 cm3(n-28) in 1987 and 4.1 cm^3(n-115) in 1988. While Munn et al. (1986) documented mean volume to be 6.5 cm^3 with a range of 2.5-13.8 cm^3 among 28 measurements on 15 normal young women, Sauerbrei et al. (1987) claimed normal volume of 9 cm^3 with a range of 5.7-18 cm^3 but did not supply any reference. Hall (1983) described normal measurements of 2.5-5.0 cm in length 1.5-3.0 cm in width and 0.6-1.5 cm in thickness. These dimensions would suggest a range of 1.2-11.8 cm^3. These dimensions by Hall (1983) are comparable to the classic ovarian measurements of 3x2x1 cm.

The normal range ovarian volume in this locality from this study is 5.9-11.7 cm^3; this range is in agreement with a study of van-Nagell et al. (1995) that recommended that ovarian volume greater than or equal to 20 cm^3 to be considered abnormal. Findings from this study are similar to those of Charles et al. (1986) and Griffin et al. (1995). Similarity with these studies suggests that there is no significant racial or geographical bias and that the values obtained by transvaginal approach are similar to those obtained by trans abdominal approach. Mendelson et al. (1988) compared trans abdominal and trans vaginal sonography in 200 female subjects in the United States of America and reported that trans vaginal image quality was better in 79-87%, and trans abdominal image quality was better in 3-5% and that images of both techniques were equally good in 10-15% of scans. The techniques provided equivalent diagnostic information in 60-84% of cases. In this study, transvaginal route was employed. Previous study on ovarian volume in a Nigerian population employed transabdominal approach; the values of ovarian volume from this studies were similar with $p>0.01$ suggesting that the approach was not statistically significant.

In the present study, the mean volume of the right and left ovaries correlated negatively ($r=-0.78$ for the right and $r=-0.65$ for the left) with age. The volume peaked on the 2nd-3rd decades and declined over the subsequent 4th and 5th decades. This trend was reported by Cohen et al. (1990) who worked on American population. This may well be due to increased hormonal stimulation in the 3rd

decade since greater percentage of reproductive age falls in this age group. There was significant difference between the left and right ovarian volumes ($p<0.01$). This is at variance with various authors where there was no statistical difference between the right and left ovarian volume. Our finding may well be due to limited sample size (n=50) used in the present study.

CONCLUSION

We have presented a data on normal ranges of values of ovarian volume in this locality using transvaginal approach. These values will be useful in evaluation of lesions that affect ovarian sizes. It will also be useful in predicting response of the ovaries ovulation induction before *invitro* fertilization (IVF) treatment.

RECOMMENDATION

There is need for further extension of this study with increased number of subjects for appropriate population study. The authors are already doing it.

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