Sonographic Quantification of Ovarian Volume in Adults Attending General Health Checkup and General Out Patient Department in Tribhuvan University Teaching Hospital

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ABSTRACT

Background

Ultrasonography is the easily available, cheap and reliable method for evaluation of ovaries. Ovarian volume is the major factor in the diagnosis of various ovarian pathologies and confusing discrepancies are found in the literature.

Objective

To determine the ovarian volume among individuals attending outpatient department in tertiary level hospital.

Method

Descriptive cross sectional study design was used; 305 patients of 16-60 years attending general outpatient department in the Tribhuvan University Teaching Hospital, Kathmandu, Nepal were included. Ovarian volume was calculated by using transabdominal ultrasonography. Data was collected in the predesigned proforma and analyzed using statistical package for the social sciences software.

Result

The study showed mean total ovarian volume 5.95 ± 2.44 cc (centimeter cube) with mean right ovarian volume 5.94 ± 2.70 cc and mean left ovarian volume 6.05 ± 2.79 cc. Significant decrease in ovarian volume with age was observed. Height and weight did not show significant correlation with ovarian volumes and no significant variation seen in the volumes of right and left ovaries. Periovulatory ovaries show significantly higher volumes on right side than luteal phase. Similarly, significantly higher volume of left ovary seen in mixed ethnic group than mongoloid group.

Conclusion

Measurement of ovarian volume is important for evaluation and management of ovarian disorders. Ultrasonography which is readily available, simple and cost effective is better suited for our environment than other imaging modality. Values of ovarian volume from this study may provide a baseline of normal ovarian volume in our community.

KEY WORDS

Ovary, Ultrasonography, Volume

INTRODUCTION

Transabdominal and transvaginalsonography are important in evaluation of ovaries and their pathologies.It has been demonstrated that, there was good correlation between ovarian volume as determined by ultrasound and by direct measurement at the time of laparotomy.[1]

The importance of ovarian size and morphology as critical diagnostic parameters in certain disease conditions affecting the ovary is not controversial and confusing discrepancies are found in the literature regarding cutoff values for ovarian volumes.[2-7] The ovarian size and volume are also affected by diseases, drugs, ovulation and age. Different studies have showed different correlation of volumes to height, weight and menstrual phases.[8-22]

There is no study till date known to establish the nomogram of the ovarian volume in the Nepalese population. Thus, this study was carried out to find out the normal ovarian volume in female attending general OPD (outpatient department), to correlate these volumes with height, weight, age, menstrual cycle and ethnic groups and to access the variation between right and left ovary. Ethnic variation of ovarian volume is a novel topic. Nepal's 2001 census enumerated 102 castes and ethnic groups. There are three main ethnic groups: Khas, Mongoloid and mixed. Khas consists of: Bahun, Chhetri, Damai, Kami etc. Mongoloid consists of Tamang, Gurung, Magar, Sherpa, Thakali and Kirat (e.g. Rai, Limbu, Sunuwar) and Mixed solely consists of Newar people.

METHODS

This was a quantitative descriptive study, carried out at ultrasound section of department of radiodiagnosis and imaging, Tribhuvan University Teaching Hospital, Maharajgunj, Kathmandu, Nepal, from September 2016 to September 2017. A total of 305 female attending general health check up and general outpatient department were participated in the study. Participants were scanned transabdominally by using C5-1 (1-5 MHZ) curvilinear probe of Philips I U 22, in supine position on fullbladder, after taking informed consent. Both the ovarian volume were measured in greatest length, transverse diameter and anteroposterior (AP) thickness. The greater length and AP thickness was taken in longitudinal plane and width in transverse plane. The volume was then calculated by approximate formula for ellipsoid i.e. length x breadth x width x 0.523. The data was entered in predesigned proforma and data was entered only for visualized ovaries. Ethical clearance was taken from the Institution Review Board, Institute of Medicine. Non-pregnant females between 16 - 60 years, sent for ultrasonography of the abdomen and pelvis for the problems other than the gynecological problems were included. All cases with clinical indication of ovarian pathology and menstrual disorder, participants on contraceptive measures and taking medicines that influence the ovarian volume, cases with previous history of any gynecological surgery and patients suffering from type II diabetes mellitus were excluded from the study. Data was analyzed by using statistical package for the social sciences software. For comparing the mean ovarian volume with age groups, height range and weight range, Pearson's correlation test was used. One way ANOVA with Post Hoc test was used to compare the ovarian volumes within different menstrual phases and ethnic groups. Volumes of right and left ovaries were compared with the help of Student t test.[11]

RESULTS

Among 305 patients, adequate visualization of three dimensions measurements of both the ovaries was possible in 71.8% of the patients examined (79.01% on the left and 92.78% of the on the right). Mean age of the patient in this study was 30.19±10.05 years with more than half (58.7%) of the patients belonged to the age group 16 to 30 years. Mean weight of the patients in this study was 54.74±8.56 Kg (Mean ± SD) with majority (39.0%) being in the range 51-60 kg. Mean height of the patients in this study was 154.25±7.20 cm (Mean ± SD) with 60.0% being in the range 151-160 cm. Most of the menstruating participants were in the luteal phase of their cycle followed by follicular and periovulatory phase. Among the ethnic groups most of the participants were from the Khas followed by Mongoloid and Mixed.

Table 1. Ovarian Volume of the Patients

Variables	Minimum (cm³)	Maximum (cm³)	Mean (cm³)	Std. Deviation
Volume of Right ovary	1.06	16.45	5.94	2.70
Volume of Left ovary	0.80	14.69	6.05	2.79
Total Volume (both Right and Left ovary)	1.19	14.13	5.95	2.44

Mean volume of right, left ovaries and total volume (mean of both right and left) were found to be 5.94 ± 2.7 cm³, 6.05 ± 2.79 cm³ and 5.95 ± 2.44 cm³ respectively (Table 1). There was no significant difference in volumes noted between right and left ovaries (p value 0.223). Decrease in volume was seen with age of the participants, maximum being at the age group 15-30 years, signifying negative correlation. However, there was no significant difference observed with height and weight of the participants (Table 2 and 3).

Mean ovarian volumes (right, left and total) in different ethnic groups and menstrual phases is shown in table 4 and 5 respectively. Analysis with one way ANOVA indicated a statistically significant difference on the left ovary amongst the ethnic groups (p value = 0.004) with Post hoc test showing higher volume on Mixed group than in Mongoloid (p value = 0.007). Similarly, one way ANOVA test showed

Table 2. Ovarian Volumes in Different Age, Height and Weight

Variables	Volume of left ovary (cm³) Mean (SD)	Volume of right ovary (cm³) Mean (SD)	Total volume right and left (cm³) Mean (SD)
Age (Years)			
16-30	6.76(2.98)	6.53(2.83)	6.65(2.61)
31-40	5.57(1.91)	5.46(2.11)	5.47 (1.65)
41-50	4.38(.84)	5.07(1.14)	4.76(1.03)
51-60	3.25(1.64)	2.81(1.29)	3.03(1.43)
Height (cm)			
131-140	9.03(4.64)	7.56(3.57)	7.94(3.85)
141-150	5.44(2.30)	5.63(3.41)	5.60(2.46)
151-160	5.93(2.69)	5.96 (2.59)	5.91(2.30)
161-170	6.20(2.24)	5.58(2.02)	5.82(2.09)
Weight (kg)			
31-40	7.86(4.31)	7.98(4.32)	7.42 (4.03)
41- 50	6.36(2.75)	5.87(2.14)	6.07(2.07)
51-60	5.40(2.43)	5.90 (2.81)	5.70(2.50)
61-70	5.96(2.72)	5.93(2.66)	5.64(2.23)
71-80	7.33(2.19)	8.49(2.45)	7.91(2.11)

Table 3. Correlation of Ovarian Volume with Different Variables

Variables	Right ovarian volume		Left ovarian volume		Total volume (Rt. and Lt.)	
	Pearson's coefficient	p-value	Pearson's coefficient	p-value	Pearson's coefficient	p-value
Age	-0.358	0.000*	-0.394	000*	-0.407	0.000*
Height	-0.109	0.068	-0.10	0.123	-0.10	0.08
Weight	-0.027	0.652	-0.091	0.216	-0.055	0.339

Table 4. Ovarian Volumes in Different Racial Group

Variables	Left ovary (cm³) $\bar{x}$(SD)	Right ovary (cm³) $\bar{x}$(SD)	Total volume (cm³) $\bar{x}$(SD)
Racial groups			
Aryan	6.30 (2.60)	5.86 (2.80)	5.93 (2.45)
Mongoloid	5.27 (3.06)	5.88 (2.39)	5.65 (2.39)
Mixed	6.99 (2.46)	6.47 (3.07)	6.65 (2.42)

Table 5. Ovarian Volumes in Different Menstrual Phase

Variables	Left ovary (cm³) $\bar{x}$(SD)	Right ovary (cm³) $\bar{x}$(SD)	Total volume (cm³) $\bar{x}$(SD)
Menstrual Phases			
Follicular	6.14 (2.64)		
Periovulatory	6.21 (2.96)		
Luteal	6.41 (2.72)		

existence of difference within the menstrual phases on the right ovary (P value= 0.038) which on Post Hoc test showed higher volume in periovulatory phase than in luteal phase.

DISCUSSION

Ultrasonography is a cheap, easily available, quick and reliable method for evaluation of the ovaries. Transabdominal imaging furnishes a global survey of anatomy, whereas transvaginal imaging provides improved texture determination and characterization of internal architecture of the ovary, vascular anatomy and adnexal area.[23] For the evaluation of the normal pelvis both the modality have same accuracy.[24] In our set up transabdominal sonography is used more commonly than transvaginal sonography as it is more cost effective and less time consuming.

Ovarian volumes from this study are similar to that reported by most of the other workers. However, lower mean ovarian volumes were seen in the study by Pavlik et al. in United States and Hung et al. in China measuring 4.0 cc and 3.90 cc respectively.[8,25] Joseph et al. in South east Nigeria, Nowanko et al. in South Nigeria, Danjeem et al. in Plateau state Nigeria and Operrman et al. in Brazil showed higher ovarian volumes in comparison to this study.[9,12-14] This variations in ovarian volume may be explained by geographic and racial differences.

Statically significant decrease in ovarian volume with age in this study indicates the peak age of reproduction is at the second and third decades of life. This may well be due to increased hormonal stimulation in the 3rd decade since greater percentage of reproductive age falls in this age group. This findings were similar to most of the studies except for Joseph et al. showing positive correlation and Christensen et al. as well as Merz et al. showing no correlation.[9,15,18] No significant difference in size of right and left ovaries in this study is not consistent with the studies by Nwanko et al. and Danjem et al. which showed higher volume on left.[12,13]

No correlation of ovarian volume to height and weight of the participants in this study was against the findings by Joseph et al. Mohamed et al. and Oppermann et al. which showed positive correlation to weight.[9,11,14] This could possibly be due to increase in the layers of fat around the meso-ovarian with increasing weight. The ovarian volume invariably measured could be a composite mass of the true ovary and the surrounding fat.[9] In this study right ovary showed higher volume in periovulatory period than in luteal phase which may be due to progressive increase in size of the follicle reaching maximum at the periovulatory period. This correlation was also seen in few studies in literature.[9,11] However, studies showing no correlation are also found in literature similar to findings of left and total ovarian volume in this study.[8,10,14]

The study of ovarian volumes in relation to different ethnic groups in Nepal is a novel topic. Left ovary showed higher volume in Mixed ethnic groups in comparision to Mongoloid which is also supported by lower volumes in

studies done by Pognastha et al. and Hung et al. in mongoloid population.[16,25] However, no such difference found for right and total ovarian volume.

Relatively small sample size, single observer and heterogenous distribution of variables in this study may affect the result. However, no study till date for estimation of ovarian volume is done in Nepal and ovarian volume is proved to be important parameter in the evaluation of ovarian disease. This may trigger the further study in this field in Nepal.

CONCLUSION

Ultrasound is simple, cost effective, reliable and readily available imaging modality for evaluation of ovaries in developing countries like Nepal and measurement of ovarian volume is important for evaluation and management of ovarian pathologies. Since ovarian volume varies in different study population done in different part of the world, the values of ovarian volume from this study may provide a baseline normal ovarian volume in our community. Morever, further studies required for the evaluation of ethnic differences as in this study.

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