

Original Article

A postmortem study - age related change of ovarian volume in Bangladeshi female

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ABSTRACT

Background : Ovarian diseases and infertility are the very common health problems among the female population. Alteration in the volume of the ovary occurs throughout the reproductive life which may predispose to ovarian diseases such as cyst, polycystic ovary and ovarian carcinoma. Moreover, the reduction in ovarian volume leading to decrease the fertility of a women also. So the present study is designed to assess the volume of the ovary in Bangladeshi women in different age groups which will provide a complete and standarize the data in Bangladeshi population and also compare the data with other countries. It will provide resourcefull information which may further determine the ovarian reserve and reproductive age of female for improving the accurate diagnosis and management of ovarian diseases as well as infertility problems.

Study design: Cross sectional and analytical type of study.

Materials: The present study was performed on 65 cadaveric ovaries of both side in Bangladeshi female age ranging from 5 years to 65 years.

Methods: The samples were divided into four different age groups. They were group A or prepubertal group (5-12years), group B or reproductive group (13-45 years), group C or perimenopausal group (46-51years) and group D or postmenopausal group (52-65years).

Results: The mean (\pm SD) volumes were 2.84 ± 0.22 milliliter and 2.83 ± 0.24 milliliter in group A, 8.64 ± 0.89 milliliter and 8.61 ± 0.89 milliliter in group B, 6.85 ± 0.79 milliliter and 6.84 ± 0.76 milliliter in group C and 2.62 ± 0.52 milliliter and 2.61 ± 0.50 milliliter in group D in the right & left ovaries respectively. The highest mean volume was observed in group B and lowest mean volume was in group D in both ovaries. Statistically highly significant difference ($P < 0.001$) were found when group A was compared with group B & C, group B was compared with group C & D and group C was compared with group D. But when group A was compared with group D, it was not significant ($P < 0.50$). The mean difference in volumes of right and left ovary between group A, group B, group C and group D were statistically not significant.

Conclusion: In this study, volume of the ovary does not vary in between right and left ovary in any age group.

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INTRODUCTION

Ovary undergoes various changes under the influence of hormones which starts from prepubertal period and continues up to post menopausal period¹. In the young adult, they are almond shape, solid and white in colour, approximately 3cm long, 1.5cm wide and about 1cm thick. The average volume of the ovary is 9.4cm³ with peak volume being recorded during the third decade of life². Ovary is essential for periodic release of oocytes and the production of steroid hormones- estrogen and progesterone. These hormones control the development of secondary sexual characteristics at the time of puberty. These activities are integrated into cyclic repetitive process of follicular maturation, ovulation with formation and regression of corpus luteum under the control of the hypothalamo-hypophyseal system³.

There is a significant correlation between length, breadth & thickness of the ovary with ovarian volume which may further determine the ovarian reserve and reproductive age of female⁴. The fertility decline in women after the age of 30 years and striking decrease is observed after 35 years of age and completely lost by 45 years of age. This age related decline in fertility results from several factors that contribute to overall reproductive failure including inadequate thickness of endometrium and poor oocyte quality⁵. By applying the accurate and efficient methods for estimating the volume of the ovaries, ovarian aging process can be assessed⁶. The repetitive growth and regression of intra ovarian structures appears to predispose this major organ to development of multiple abnormalities of structure and functions⁷, that frequently cause menstrual and fertility problems⁸. The most common group of ovarian tumour is ovarian cancer (90%)⁹. Ovarian cancer is the second most common and lethal female genitourinary cancer. In 2008, a total of 26,700 new cases of ovarian cancer were reported in United States, two thirds of which were in advanced stages of the disease. In Bangladesh, data collected from Dhaka Medical College & Hospital in the year 2010, among 400 operated gynaecological cases about 17 were ovarian cancer, 22 were ovarian cyst and 121 were other

types of ovarian tumour. In Sir Salimullah Medical College & Mitford Hospital in 2010, among 200 operated gynaecological cases about 9 were ovarian cancer, 33 were ovarian cyst, 96 were different types of ovarian tumour. In 2009, ovarian cysts were 36, other form of ovarian tumours were 19 and ovarian cancers were 3 in number among the total 125 operated gynaecological cases. In Dhaka Medical College & Hospital and Sir Salimullah Medical College & Mitford Hospital in 2010, high prevalence or incidence rate of ovarian cancer were found in elderly women between 50 to 60 yrs of age¹⁰.

Infertility rate is gradually increasing day by day in all over the world and one of the main causes of it is abnormalities of the ovarian functions as well as the ovarian diseases¹¹. Follicular depletion and reduction in ovarian volume leading to decrease the fertility of a women. The decreased fertility with increasing female age appears to diminish the quality of existing oocytes and the diameter of growing follicles. By Assisted reproductive technology (ART), an infertile couple is used to help to conceive by artificial or partially artificial means and manage the infertility problem. It works by removing eggs from a woman's body, which are then mixed with sperm to be fertilized into embryos. These embryos are then put back in the womb for pregnancy¹².

Materials & methods

The present study was performed on 65(sixty five) pairs of postmortem human ovaries. Samples were collected from unclaimed dead bodies within 12 to 36 hours of death which were autopsied on different dates in the morgue of the Department of Forensic Medicine of Sir Salimullah Medical College (SSMC) and Dhaka Medical College (DMC), Dhaka. Approximate age & sex were noted down from the morgues record book at the time of collection of samples. Then the samples were brought to the Department of Anatomy, Sir Salimullah Medical College. Samples were distributed into four groups¹³

Table 1: Age distribution of single group. Study group distribution in different age groups

Study groups	Age range (in years)	No. of samples (n = 65x2=130)
Group A (prepubertal)	05-12	07x2
Group B (reproductive)	13-45	30x2
Group C (perimenopausal)	46-51	15x2
Group D (postmenopausal)	52-65	13x2

Ovaries were collected from the cadavers by the standard postmortem techniques. After removal from the dead body, the ovaries were brought to the Anatomy department of SSMC and washed gently and thoroughly with running tap water to remove blood and blood clots as far as possible. Each sample was tagged properly bearing an identification number with the age of the cadaver. The samples were preserved in 10% formal saline solution for fixation.

Volume of each ovary was measured by applying the ellipsoid formula¹⁴ which requires the measurement of the three dimensions-length, breadth and thickness of the ovary. The length, breadth and thickness were measured by using digital vernier calipers in millimeter. The length of the ovary were measured from its one pole to another pole [fig.1(A)], breadth of the ovary were measured at the region of the highest transverse diameter [fig.1(B)] and thickness were measured at the region of maximum antero-posterior diameter [fig.1(C)] All measurements were done three times and the mean values were taken and then each mean values were converted into centimeters.

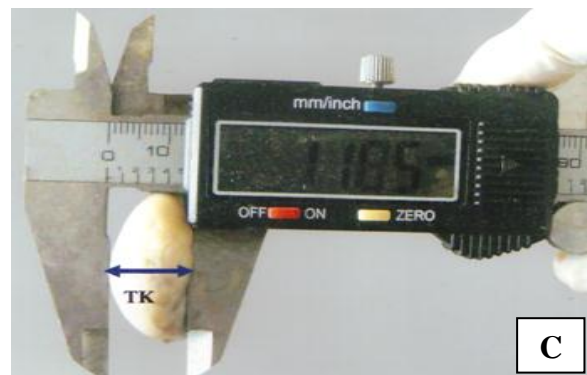


Figure. 1: Photograph showing the method of measurement of the length (LT) [A], breadth (BD) [B] & thickness (TK) [C] of the ovary by digital vernier calipers .

After getting the length, breadth and thickness of the ovary, volume was determined from the following ellipsoid formula:

Volume= length x breadth x thickness x 0.5214 ml.

RESULTS

In the current study, the mean (\pm SD) volumes of right & left ovaries were 2.84 ± 0.22 milliliter and 2.83 ± 0.24 milliliter in group A, 8.64 ± 0.89 milliliter and 8.61 ± 0.89 milliliter in group B, 6.85 ± 0.79 milliliter and 6.84 ± 0.76 milliliter in group C and 2.62 ± 0.52 milliliter and 2.61 ± 0.50 milliliter in group D respectively. The highest mean (\pm SD) volumes of ovaries were observed in group B and lowest were in group D in both ovary. The differences of mean (\pm SD) volumes were highly significant ($P < 0.001$) between group A & B, group A & C, group B & C, group B & D and group C & D but not significant ($P > 0.50$) between group A & D. The mean difference in volumes of right and left ovary between group A, group B, group C and group D were statistically not significant ($P > 0.10$). The results are shown in Fig 2 and Table 2.

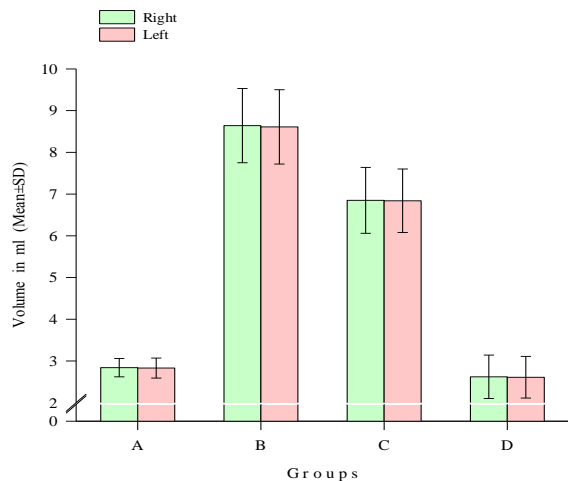


Fig. 2 Mean (\pm SD) volume of the right and left ovaries in different age groups

- Group A : Age 5-12 years
- Group B : Age 13-45 years
- Group C : Age 46-51 years
- Group D : Age 52-65 years

Table 2. Mean (\pm SD) volume of the right and left ovaries in different age groups

Age Group	Volume (ml)		Level of Significance	P value
	Right Mean±SD	Left Mean±SD		
A (n=7)	2.84±0.22 (2.50-3.00)	2.83±0.24 (2.40-3.32)	>0.10 ^{ns}	0.356
B (n=30)	8.64±0.89 (7.20-10.00)	8.61±0.89 (7.30-11.00)	>0.05 ^{ns}	0.071
C (n=15)	6.85±0.79 (6.10-9.50)	6.84±0.76 (6.20-9.40)	>0.50 ^{ns}	0.751
D (n=13)	2.62±0.52 (1.98-3.25)	2.61±0.50 (1.80-3.21)	>0.10 ^{ns}	0.436

	P value	P value
A vs B	<0.001 ^{***}	<0.001 ^{***}
A vs C	<0.001 ^{***}	<0.001 ^{***}
A vs D	>0.50 ^{ns}	>0.50 ^{ns}
B vs C	<0.001 ^{***}	<0.001 ^{***}
B vs D	<0.001 ^{***}	<0.001 ^{***}
C vs D	<0.001 ^{***}	<0.001 ^{***}

Figures in parentheses indicate range. Comparison between right and left side done by paired Student's 't' test and comparison between age groups done by One-way ANOVA (PostHoc), ns = not significant, *** = significant.

DISCUSSION

In the present study, the highest mean (\pm SD) volume were observed in reproductive age (group B) and the lowest volume were in postmenopausal age (group D) when compared among the age groups. The values were non significant ($P > 0.50$) when compared between right and left ovaries. The volume of the ovary increased from prepubertal age (group A) and reaches its maximum up to reproductive age (group B). After that they gradually begins to decline from perimenopause (group C) and become static at postmenopause (group D).

Pavlik et al¹⁵ conducted study on human ovary at the University of Kentucky over 58673 women between 25 to 91 years of age. The mean ovarian volume was 6.6ml in women <30 years of age, 6.1ml in women 30-39years, 4.8ml in those aged 40-49 years, 2.6ml in 50-59 years old and 2.1ml in women aged 60-69 years. Overall, the mean ovarian volume was 4.9ml in

perimenopausal women and 2.2ml in post menopausal women.

Saksouk and Johnson¹⁶ studied on 66 healthy female and measured the normal mean ovarian volume with ultrasonography (US) in a large series was 3.0 mL (95% confidence interval, 0.2–9.1 mL) before menarche, 9.8 mL (95% confidence interval, 2.5–21.9 mL) in menstruating women and 5.8 mL (95% confidence interval, 1.2–14.1 mL) in postmenopausal women

Scheffer et al¹⁷ studied on 162 female with ultrasonography and found the volume of the ovary was 7.4ml in 25-34years of age, 7ml in 35-40 years and 5.2ml in 41-46 years of age. However, in most of the previous studies, the ovaries were scanned through ultrasonography from living bodies and then the volume was recorded.

This research was carried out to investigate the volume of ovary of Bangladeshi female population, in order to improve the anatomical knowledge of volume of ovary, especially in relation to age. This values regarding volume ovary will also provide an essential data in our country and also will be a pre-requisite for compare the data with other countries. So the study will provide a more complete data and standarize the data in Bangladeshi female population. It will make available resourcefull information for improving the accurate diagnosis and management of ovarian diseases as well as infertility problems with assisted reproductive technologies (ART).

Conclusion: In this study, volume of the ovary does not vary in between right and left ovary in any age group. Volume of the ovary also does not vary significantly between in prepubertal age group and postmenopausal age group.

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