

Ultrasonographic Ovarian volume measurement in normal (Reproductive age group / Post-Menopausal) and infertile women

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Summary : Ovarian diameters were measured in three dimensions in 105 women; reproductive age group (normal) - 30, infertile - 60; postmenopausal - 15, by transabdominal ultrasonography of pelvis. The mean ovarian volumes were determined from these diameters by a simplified formula for prolate ellipsoid.

Ovarian volumes

| | | |
|-----------|---------------------------------|-------------------|
| Group I | Normal women | 6.02 ± 2.119 cc |
| Group II | Infertile (natural cycle) | 5.699 ± 1.504 cc |
| Group III | Infertile (Stimulated cycle) | 6.705 ± 2.0995 cc |
| Group IV | Postmenopausal | 1.857 ± 0.6386 cc |

The differences in ovarian volume in Group I, II & III were insignificant. The ovarian volume in postmenopausal women (Group IV) was significantly smaller ($P < 0.001$) than the other three groups.

Introduction

Ultrasonography has become a valuable diagnostic tool in gynaecology because the relevant structures consist almost entirely of soft tissues & often cannot be studied by other modalities. Ultrasound has now replaced invasive procedures like pneumo-gynaecography for assessment of ovarian size and reduced the need for diagnostic laparoscopy/laparotomy.

Ultrasound examination of the ovaries is a more reliable method for examining the ovary than gynecological palpation (Granberg & Wikland 1987). An accurate baseline of normal measurement is essential to diagnose disease. Ovarian size corresponds to women's endocrinologic status. Normal measurement of ovarian volume in relation to menstrual status (Premenarchal, menstruating, postmenopausal) are available in literature. We carried out this study to document baseline of normal measurement in menstruating women and menopausal women in our Indian population.

Material and Methods

Hundred and five women attending the Gynaecology out

patients department of AIIMS hospital were enrolled for the study and divided into four groups.

Group I: Normal women - 30

Women between age 18-40 yrs. with proven fertility, regular menstrual cycles, normal pelvic findings on examination and absence of hirsutism/virilism.

Group II: Infertile women (Natural cycles) - 30

Infertile women in natural menstrual cycle between age 18-40 yrs, no history of ovarian stimulation or intake of hormones in past 3 months.

Group III : Infertile women (Stimulated cycles) - 30

Infertile women between age 18-40 yrs in whom cycles were stimulated with clomiphene citrate and / or gonadotropins for invitro fertilization or artificial insemination of husband.

Group IV: Post-menopausal women - 15

Women between age 40-70 yrs with natural menopause for more than 1 year, without hormone replacement therapy.

Patients were also excluded from the study if their his-

Table I
Mean Ovarian Volumes (IN cc)

| | Group I Normal Women (n=30) | Group II Infertile (natural) (n=30) | Group III Infertile (stimulated) (n=30) | Group IV Postmenopausal (n=15) |
|------------------------------------|--------------------------------------|--|--|--------------------------------------|
| Right Ovary vol. | 5.91±2.21 | 5.59 ± 1.94 | 6.50 ± 2.58 | 1.69 ± 0.51 |
| Range | 2.85 - 14.25 | 2.70 - 11.70 | 3.15-12.69 | 0.60-2.60 |
| Left ovary vol. | 6.13±2.43 | 5.77±1.84 | 6.15±2.24 | 2.03±0.90 |
| Range | 3.09-13.52 | 2.1-9.3 | 1.75-12.82 | 0.62-4.41 |
| Mean of Right & Left ovary vol. | 6.02±2.12 | 5.70±1.50 | 6.40±2.01 | 1.85±0.64 |
| Range | 3.30-13.88 | 2.4-8.9 | 2.48-12.59 | 0.61-3.30 |

tory suggested pelvic inflammatory disease, polycystic ovarian disease, ovarian surgery or use of infertility drugs (except group III).

The women were subjected to ultrasonography of pelvis by transabdominal route by the full bladder technique using a grayscale realtime ultrasound machine (Aloka SSD 256). The women in reproductive age groups were scanned within the first 6 days of menstrual cycle. The ovaries on either side were scanned in longitudinal and transverse scans and diameters measured in three dimensions (length, breadth, thickness) using onscreen electronic callipers.

The volume of each ovary was calculated by the simplified formula for prolate ellipsoid (Morely & Barnett, 1985).

Volume = $1/2 \times \text{length} \times \text{width} \times \text{height}$

According to the results, we established a nomogram for menstruating and postmenopausal women.

Results :

The ovaries were identified as ovoid structures on either side of the uterus. The presence of follicles facilitate localization of the ovaries. Additionally, the ovaries can be frequently visualized adjacent to the internal iliac vessels. One or more small graffian follicles, less than 10mm

in diameter, were seen as round echofree areas within the ovarian substance in Groups I, II and III. The ovarian volumes in the four groups are given in Table I. Eventhough the mean ovarian volumes were larger in group III (infertile stimulated cycles) than Groups I & II, the difference was statistically insignificant.

The difference between ovarian volume of right & left ovaries in each group was also statistically insignificant. There was no significant correlation between age and ovarian volume. In group IV the duration since menopause also did not bear a significant correlation to ovarian volume.

Discussion:

The ovaries are usually identified against the side walls of the pelvis at the level of uterine fundus in both longitudinal and transverse scans, but as they are attached to pliable ligaments (the infundibulopelvic and ovarian ligaments), they may be found in variable cephalocaudal locations, especially in multiparous women. The ultrasonic picture may sometimes be misleading and the ovary may be confused with various other structures in the pelvis like the bowel, iliac vessels, hydrosalpinx and subserous fibroids of uterus. Thus an adequately distended urinary bladder is a prerequisite for proper identification and accurate measurement of the ovaries when abdominal probe is used. Hacheloer (1980) found that visualiza-

tion of ovarian vessels and tracing their entry into the ovary helped in differentiating the ovary from adjacent structures.

The knowledge of ovarian volumes is useful in the diagnosis of ovarian tumours, cysts, polycystic ovarian disease, endometriosis and ovarian failure. Moreover, ovarian volume estimation can be useful in follow up of patients after ovarian cystectomy, wedge resection and debulking surgery for malignant disease. Ovarian measurement also forms an integral part of staging and follow up of gestational trophoblastic disease and ovarian hyperstimulation syndrome. Small ovaries are associated with poor response in ovulation induction with human menopausal gonadotrophin for in-vitro fertilization (Lass et al; 1997). Greater baseline ovarian volume prior to stimulation predict ovarian hyperstimulation syndrome (Danninger et al, 1996).

Various workers have studied ovaries by ultrasound and reported volumes between 1.8 and 13.84 cc for women in reproductive age group (Swanson 1981, Munn 1986, Granberg and Wikland 1987). The present study reports mean ovarian volumes in the range of 5.7 - 6.3 cc. Even though volume of ovaries was slightly larger in stimulated cycles, the difference was statistically insignificant.

Ovarian volume in postmenopausal women has been shown to be in the range of 2-5 cc by various other workers (Rodriguez et al 1988, Campbell et al 1982, Goswamy et al 1983). Rodriguez et al (1988) reported 1.8cc (.78-4.7) as upper limit of normal. While the present study shows a mean of 1.35 ± 0.6400 & a range of 0.61 - 3.3 cc. (6-8).

Several studies (Merz et al 1996, Tepper et al 1995) have shown that there is progressive decrease in ovarian volume after the first year of menopause. Ovaian volume progressively decreased from 8.6 ± 2.3 cc in the first

menopausal year to 2.2 ± 1.4 cc after more than 15 years (Tepper et al 1995). However our study does not show any significant correlation of ovarian volume to age or duration since menopause. This could be because of a smaller number of postmenopausal women in our study.

Awareness of normal range of ovarian volume is important to diagnose disease state. A study of ovarian volume in women with pelvic inflammatory disease, PCO and ovarian malignancy will be more useful in making diagnosis on ultrasound.

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