

Uterine Length and Ovarian Volume in Healthy girls of 1-13 years of age

HAFIZA SAIMA NASEEM, AZHAR MAHMOOD JAVED, IRUM ASLAM, MARIA ZAHOOR, SADIA SADIQ

ABSTRACT

Aim: To study uterine length and ovarian volume in healthy girls of age group 1-13 years.

Study design: a cross sectional study

Place and duration of study: Department of Radiology Children Hospital & Institute of Child Health, Multan. Six months from April 2014-September 2014.

Methods: Five hundred girls of the age group from 1-13 years were selected randomly with no history suggestive of any uterine or ovarian problem and their uterine length and ovarian volume were taken and correlated with age and puberty. As regard to pubertal stage they were classified according to Tanner classification of breast into Prepubertal: Tanner stage 1 and Pubertal: from 2-5 Tanner stage.

Conclusion: uterine length and ovarian volume correlate positively with chronological age and puberty. Ovaries are mostly homogenous or microcystic in prepuberty girls and multifollicular pattern is more common in girls with puberty changes.

Keywords: ovarian volume, uterine length, puberty, BMI, chronological age.

INTRODUCTION

The knowledge of developmental changes that take place in the female reproductive organs is essential in the investigation of pelvic conditions in children and teenagers. Imaging methods can facilitate the achievement of a correct diagnosis¹. Ultrasonography (US) remains the most useful modality used in pediatric and adolescent gynecology and often the only one necessary prior to therapeutic intervention². The principle of ultrasound involves the use of high-frequency (5-8MHz) sound waves to detect the interface of two tissues with different densities. Energy beam reflected is based on the density of the tissue and converted into two- or three-dimensional images. The transabdominal probe is most widely used in pediatric gynecology and suffices for most indications. Abdominal sonographic imaging requires an adequately distended urinary bladder which allows transmissions of sound into deeper structures of the pelvis and displace gas-filled bowel loops out of the pelvis allowing easier identification of the uterus and ovaries³.

Ovarian and uterine growth patterns during childhood and puberty are not completely understood. Also, no consensus exists about the normal measures and morphologic appearance of the ovaries. This may be attributed to the methodological limitations of most studies, such as small sample size, inclusion of both pubertal and prepubertal girls

Department of Radiology, Children Hospital and Institute Of Child Health, Multan

Correspondence to Dr. Hafiza Saima Naseem Email: drcymatariq@gmail.com

in the same analysis, lack of statistical analyses, and use of formulae associated with logarithmic transformation the application of which is not practical⁴. Main indications for pelvic ultrasonography in children and teenagers are the following: either early or late puberty, pelvic pain or tumor, ambiguous genitalia, vaginal bleeding in children, and primary amenorrhea.

The prepubertal uterus is thin, with the uterine body similar in size to the cervix. Because of the hormone stimulation that takes place in the puberty, the uterus grows and the uterine body becomes prominent. In addition, although cystic ovarian structures are also commonly observed on sonography, the classification of these structures is confusing and nonuniform.

The aim of our study was to correlate ovarian volume and uterine length as observed on sonography with chronological age and breast pubertal status according to tanner stage.

METHODOLOGY

It was a prospective study in which apparently healthy girls of 1 to 13 years of age were selected randomly. Their detailed history was taken and complete examination was carried out to rule out any chronic medical disease or genetic factors which can interfere with normal growth and puberty. Proper permission was taken from institutional ethical committee to conduct the study. Informed consent was taken from each patient describing them procedures of the study ensuring confidentiality and fact that there was no risk involved to the patient while taking part in this study. All girls were subjected

to history taking, general physical examination and pubertal assessment. There anthropometric assessment was done in the form of BMI calculation. Presence of thelarche was taken as the criterion to classify girls into pre-pubertal and pubertal group according to tanner staging.

Tanner staging for breast development

Stage 1: Pre-adolescent elevation of papilla only

Stage 2: Breast bud –elevation of breast and papilla as small mound; enlargement areolar diameter.

Stage 3: Further enlargement without separation of contours.

Stage 4: Projection of areola and papilla to form a secondary mound above the level of breast.

Stage 5: Mature areola recessed to general contour of breast.

Transabdominal ultrasound using convex and linear probe of high frequency , was carried out with full bladder to assess uterine and ovarian dimensions.X8 Doppler ultrasound machine was used. ProlateEllipse formula $AXBXCX0.52$ was used to calculate ovarian volume. Since volume of right and left ovary were not significantly different so mean of both volumes was considered as the final volume. Uterine length was calculated as it is considered a more reproducible measurement ⁷. Uterine length was measured from base of cervix to uterine fundus. The morphological assessment of uterus and ovaries was also carried out. Regarding puberty assessment they were classified according to tanner classification into prepubertal (Tanner stage 1) and pubertal (Tanner stage 2-5) groups. All information collected

was recorded on a specifically designed proforma prepared for the study. The data were entered and analyzed using computer programme SPSS version 19. Mean, median and standard deviation of all studied parameters were calculated separately. Partial correlations were used to exclude the effect of age. P-value of less than 0.05 was considered as significant.

RESULTS

This study was conducted on 500 apparently healthy girls of 1-13 years of age.Uterus and ovaries were visualized in all patients. Uterine length in centimeter and ovarian volume in cm^3 was calculated . As volume of right and left ovary were not significantly different so there mean volume was taken. Table .1 shows uterine length and ovarian volume in reference to chronological age. There was a significant progressive increase noted in mean ovarian volume at the age of 8yrs and same trend continued till 13years of age. Uterine length also showed a positive correlation with chronological age. Uterine length was taken as it is considered a more reproducible marker then uterinevolume .Girls were classified according to tanner stage ofthelarche as shown in table 2.Both uterine length and mean ovarian volume were found to be higher in girls with thelarche. Mean ovarian volume and uterine length correlated positively with chronological age, and breast development.

Table 1:

Age	n	Uterine length (cm)		Ovarian volume(cm^3)	
		Mean (SD)	Median	Mean (SD)	Median
1year	25	2.60(0.61)	2.50	0.27(0.20)	0.16
2year	30	2.56(0.44)	2.45	0.29(0.22)	0.26
3year	38	2.70(0.63)	2.65	0.30(0.26)	0.20
4year	37	2.75(0.32)	2.70	0.40(0.30)	0.35
5year	48	2.85(0.30)	2.85	0.50(0.25)	0.50
6years	29	2.95(0.45)	2.90	0.53(0.23)	0.51
7year	51	3.05(0.28)	3.00	0.60(0.47)	0.50
8year	52	3.30(0.37)	3.25	1.15(0.45)	1.00
9year	47	3.70(0.65)	3.40	1.25(0.65)	1.20
10year	34	4.05(0.65)	3.90	1.45(0.55)	1.40
11year	40	4.70(1.13)	4.50	1.70(1.25)	1.65
12year	36	5.2(1.50)	5.00	2.80(1.86)	2.73
13year	33	6.0(1.25)	5.55	3.55(1.50)	3.05

Table 2

Tanner breast stage	n	Average age of that group	Uterine length(cm)		Ovarian volume(cm^3)	
			Mean (SD)	Median	Mean (SD)	Median
1	230	6yr	3.01(0.63)	2.95	0.58(0.35)	0.43
2	200	9yr	3.58(0.70)	3.50	1.62(0.48)	1.34
3	50	12yr	4.70(0.95)	4.50	2.15(1.45)	1.98
4	20	13yr	5.83(1.23)	5.45	3.53(1.73)	3.43

DISCUSSION

Puberty is associated with marked physiological and psychological changes. Ethnicity, genetic influences, environmental conditions and geographical locations appear to have a role for timing and progression of puberty⁵. Although timing and rate of occurrence of these changes is highly variable, puberty usually occurs between 10 and 14 years of age⁶. Health professionals need a reference data for uterine and ovarian measurements because of the importance of these values in relation to puberty and to differentiate normal from abnormal.

In our study a positive correlation was observed of ovarian volume and uterine length with chronological age, and breast development. Mean ovarian volume was found to be significantly associated with chronological age and breast development while chronological age, BMI, and breast development were important predictors of uterine length. In our study significant increase in ovarian volume was noted at the age of 8 yrs. However, with breast development, mean ovarian volume and uterine length also increases. There was also increased follicular activity observed in girls having puberty changes. Our results are in accordance with other studies.

Khadiilkar et al (2006) concluded that growth of female reproductive organs in Indian girls from birth to 18 years of age correlates with age in terms of uterine and ovarian volume⁷. Razzaghy et al (2011) in Iran suggested that there is a progressive increase in uterine and ovarian measurements in relation to age, height, weight, and puberty. They found that uterine volume carries the best correlation with age and stage of puberty⁸. These findings are in agreement with our study results.

Similarly, a study carried out by Badouraki et al, 2008 in Brazil in 99 girls of age range 1-12 years showed that there was a gradual increase in uterine and ovarian volume in relation to age, length, weight, and puberty⁹.

Atilla et al (2012) carried out a study in Turkish population and concluded that in prepubertal girls only age correlated with ovarian volume while in pubertal girls age had a considerable correlation which was observed in both uterine and ovarian volumes¹⁰. Liat et al. 2006 observed that increase in uterine and ovarian measurement may be an early sign of precocious puberty¹¹.

Ersen et al showed increase in growth of pelvic organs with age. He suggested that a cut off of 2.57 cm³ for uterine volume and 1.58 cm³ for ovarian volume were the best predictors of entering puberty¹².

Interestingly, Cohen et al observed that the mean ovarian volume in girls less than 6 years of age is less than or equal to 1 cm³. The increase in ovarian volume begins after 6 years. In prepubertal girls (6–10 years old), ovarian volumes range from 1.2 to 2.3 cm³. In premenarchal girls (11–12 years old), ovarian volumes range from 2 to 4 cm³¹³. The stated difference might be due to the fact that above study was conducted on a Caucasian population which is a different population in many aspects from an Asian population. Puberty is influenced by many factors including genetic, geographical, nutritional and environmental factors¹⁷.

De Vries et al studied the role of ultrasound in assessment of uterine and ovarian volumes and their relation to puberty and suggested that increased uterine and ovarian measurements may be an early sign of precocious puberty¹⁶. Confusing discrepancies are found in the literature regarding the terminology for ovarian echostucture (solid, microcystic, paucicystic, multicystic, macrocystic, major isolated cyst) the following simplified classification was used:

- Type 1 or homogeneous: absence of visible cysts or follicles;
- Type 2 or paucicystic: <6 follicles with a diameter of <10 mm;
- Type 3 or multicystic: ≥6 follicles with a diameter of <10 mm;
- Type 4 or macrocystic: ≥1 follicle with a diameter ≥10 mm¹⁴.

Ovaries are considered as a dynamic organ with stromal and follicular component. In infants microcysts were frequently observed owing to raised FSH level through mothers who are lactating. So presence of microcysts appears a physiological phenomenon in children due to either anovulation or through FSH stimulation.

In our study we also found that either paucicystic or homogeneous ovaries were more common in girls without puberty while increased follicular activity was observed in girls having puberty changes. Uterine anatomy also changes during childhood. The uterus develops a tubular configuration (anteroposterior cervix equal to anteroposterior fundus) or sometimes a spade shape (anteroposterior cervix larger than anteroposterior fundus).

Similarly, Herter et al also suggested that in prepuberty girls ovaries were generally homogeneous or microcystic as follicular activity continues even in the prepubertal period. However multicystic ovaries were seen in girls with puberty¹⁵. The presence of ovarian follicles (<1 cm) is routinely detected in 84% of neonates up to the second year of life, and in 68% of children between two and six years of age¹⁶.

CONCLUSION

Uterine length and ovarian volume correlate positively with chronological age and puberty process. With ultrasound assessment being an easily available and cost effective test, it definitely has role in preliminary assessment of female children puberty disorders and expected changes with age.

REFERENCES

- Ziereisen F, Guissard G, Damry N, et al. Sonographic imaging of the paediatric female pelvis. *EurRadiol.* 2005;15:1296–309.
- Carmen Asăvoaie¹, Otilia Fufezan², Mihaela Coșarcă³ Ovarian and uterine ultrasonography in pediatric patients *MedUltrason* 2014.Vol. 16,no.2,160-167.
- Garel L, Dubois J, Grignon A, et al: US of the pediatric female pelvis: a clinical perspective. *Radiographics* 2001;21:1393– 1407.
- Ivarsson, A.S., K.O. Nilsson and P.H. Persson, 2003. Ultrasonography of the pelvic organs in prepubertal and postpubertal girls. *Arch Dis Child.*, 58: 352-354.
- Motlagh,ab Ali Rabbani, ad Roya Kelishadi, Parisa Mirmoghtadaee, e.g., Safiyehshahryari, h Gelayol Ardalon, h Hassan Ziaodini, I Nima Parvaneh, ad ShannazKhodaei, ad Parinaz, Poursafe j and Aria sotoudehad,2011. Timing of puberty in Iranian girls according to their living area; a national study. *J Res Med Sci*, 16(3):276-281.
- Henshaw, A., 2012. Changes in Girls during Puberty, <http://www.symptomfind.com/health/changes-in-girls-during-puberty>
- Khadilkar, V., A. Khadilkar, A. Kinare, H. Tapasvi, S. Deshpande and G. Maskati, 2006. Ovarian and Uterine Ultrasonography in Healthy Girls between Birth to 18 Years.In: *Indian Pediatr.* 2006 Jul 7;43 (7):625-630 .
- Razzaghy-Azar, M., F. Ghasemi, F. Hallaji, A. Ghasemi and M. Ghasemi, 2011. Sonographic measurement of uterus and ovaries in premenarcheal healthy girls between 6 and 13 years old: correlation with age and pubertal status.In: *J Clin Ultrasound.*, 39(2): 64-73.
- Badouraki, M., A. Christoforidis And I. Economou, 2008. Sonographic assessment of uterine and ovarian development in normal girls aged 1 to 12 years: *Journal of Clinical Ultrasound.*, 36(9): 539-544.
- Atilla, E., O. Hasan, Y. Düzgün and A. Erdal, 2012. Ovarian and uterine ultrasonography and relation to puberty in healthy girls between 6 and 16 years in the Turkish population: a cross-sectional study. In: *Journal of Pediatric Endocrinology and Metabolism*, 0(0): 1-5.
- Liat de Vries, Gadi Horev, Michael Schwartz and Moshe Phillip, 2006. Ultrasonographic and clinical parameters for early differentiation between precocious puberty and premature thelarche. *European Journal of Endocrinology*, 154: 891-898.
- Ersen,A.,h. Onal D.Y and E.Adal ,2012.ovarian and uterine ultrasonography and relation to puberty in healthy girls between 6-16 years in Turkish population. A cross sectional study .*J.PediatrEndocrinol Metab*, 25(5-6).447-51.
- Cohen HL, Eisenberg P, Mandel F, Haller JO. Ovarian cysts are common in premenarchal girls: a sonographic study of 101 children 2–12 years old. *AJR Am J Roentgenol* 1992; 159:89–91.
- M .Badouraki, A. Christoforidis, I. economou, A.S. Dimitriadis and G.Katzos. Evaluation of pelvic ultrasonography in the diagnosis and differentiation of various forms of sexual precocity in girls. *Utrasound Obstet Gynaecol* 2008;32:819-827.
- Herter LD, Goldenziner E, Flores JA, Becker E Jr, Spritzer PM. Ovarian and uterine sonography in healthy girls between 1 and 13 years old: correlation of findings with age and pubertal status. *AJR Am J Roentgenol* 2002; 178:1531–1536.
- DeVaries, L., G.Horev ,M.Schwartz and M.Phillip ,2006. Ultrasonography and clinical parameters for early differentiation between precocious puberty and premature thelarche. *European Journal of Endocrinology*,154:891-898.
- Wit, J.M and C.Camacho-Hubner 2011.Endocrine regulation of longitudinal bone growth. *Endocr Dev.*21:30-41.
- Diana F.Obstetrics and Gynaecology, an evidence based text for MRCOG, second edition2010;48:529-532.