

Effects of Age on Linear Measurements, Weight and Volume of Uteri of Normal Adult Pakistani Females - An Ultra-sonographic Study

Zahid A. Khan, T. H. Zubairi, Y. Malik, N. Aziz*, M. Farooq, Z.A. Mian
Main Radiology Department, Services Hospital, Lahore.

SUMMARY

Uteri of one thousand normal adult Pakistani females were examined ultrasonographically. Linear measurements were made and weight and volume were calculated. Maximum dimensions were recorded in the age 40-49 years and they were 8.89x3.97x5.40 cm. Maximum weight and volume were also recorded in same age group and they were 117.99 gms and 181.03 cm³. Minimum values were recorded in 60 year age group and were 6.43x2.56x3.88 cm, 58.23 gms and 74.56 cm³, respectively.

INTRODUCTION

Most of the Pakistani females attending out-patient departments of hospital suffer from gynaecological problems. Previously, bimanual examination used to be the easiest approach to assess uterine anatomy. In the present era, ultrasound technique has revolutionized the gynaecological examination.

Size of uterus varies with age, parity, stage of menstrual cycle and hormonal status¹⁻⁵. Cervical shortening during pregnancy is associated with premature labour^{6,7}. Manual vaginal examination to determine cervical shortening is a subjective measurement, in which total length of cervix cannot be measured if the cervix is closed.

To determine precise uterine size in cases of uterine enlargement is very important¹⁰. Clinical examination usually fails to give accurate estimates of uterine dimensions⁸. Ultrasound being non-invasive technique gives more accurate and detailed dimensions of uterus. Uterine size has been measured in different stages of menstrual cycle in females with confirmed ovulatory cycle¹. Size and weight of uterus have been measured using bimanual examination, uterine sounding and ultrasound and comparison made⁹. Reference curves for growth of uterus in pre-pubertal and post pubertal girls have been established⁴. Reference

growth values for uterine weight and volume have been recorded in the recent past⁵. Ultrasonography is the method of choice to provide objective estimates of length of cervix¹¹. Very little literature is however available on weight and volume of uterus determined on ultrasonography. Much if not most of the data is from autopsy material and bimanual examination. As ultrasound examination is much more accurate than bimanual examination and uterine sounding⁹, present study was designed to determine the effects of age on linear measurements, weight and volume of uterus in normal adult Pakistani females using ultrasound technique. This will provide a baseline for Pakistani population and will help sonologists and gynaecologists to diagnose and manage uterine diseases.

MATERIAL AND METHODS

One thousand Pakistani females with ages ranging from 10-60+ yrs. were selected at random from the out-patient department of Services Hospital, Lahore from 1995 to 1997. They were examined in Main Radiology Department of Services Hospital. Detailed history including age, height, weight, menstrual history, duration of marriage, gravidity and parity of each subject was recorded. Females with even minor uterine

pathology were not included in this study. Abdominal ultrasolographic examination was preferred¹² and performed on each individual with full urinary bladder in supine position with 3.75 and 4.0 MHz transducers. Uterine body length, antero-posterior and transverse diameters were measured in centimetres. Cervical length was included in body length. Body length was measured from external os to dome of fundus. The antero-posterior diameter was measured perpendicular to the long axis of uterus¹³. The transverse diameter was measured in transverse section obtained roughly in upper third¹³. Volume of uterus was calculated assuming it to be an ellipse rotated on its long axis using formula $\text{volume (cm)}^3 = \frac{4}{3} \pi (\frac{1}{2} \text{ body length})^2 (\frac{1}{2} \text{ Ap-dia})$ and weight was calculated using formula $\text{weight (gms)} = 0.561 \text{ volume} + 16.4^9$. Subjects were divided in age groups each of 10 years. Data was analysed statistically with the help of computer. Maximum, minimum and average values for each age group were calculated for each linear measurement, weight and volume.

OBSERVATIONS

Effects of age on linear measurements, weight and volume of uteri of Pakistan females are shown clearly in Tables (1 and 2), along with standard deviation of each parameter.

Table 1: Weight and volume of uterus (n=1000)

Age (years)	Max.	Mini.	Average (St. Dev.)
Weight (gms)			
10-19 (n=131)	120.35	23.92	62.64 (19.34)
20-29 (n=334)	204.85	28.90	84.64 (30.91)
30-39 (n=335)	328.28	30.11	114.08 (43.06)
40-49 (n=146)	417.99	30.50	117.99 (59.09)
50-59 (n=22)	201.44	31.51	82.75 (54.71)
60+ (n=12)	159.42	23.17	58.23 (46.98)
Volume cm³			
10-19 (n=131)	185.29	13.41	82.42 (34.48)
20-29 (n=334)	335.91	22.28	121.68 (55.11)
30-39 (n=335)	555.93	24.44	174.74 (76.76)
40-49 (n=146)	715.84	25.14	181.03 (105.33)
50-59 (n=22)	329.83	26.94	118.26 (97.52)
60+ (n=12)	254.94	12.07	74.56 (83.74)

Total body length and antero-posterior diameter start increasing from age 10 years on wards attaining maximum average values of 8.89 and 3.97 cms respectively in 40-49 yrs age group. Transverse diameter also starts showing upwards trend from 10 years onwards, but attains maximum average value in 30-39 years age group and maintains itself during next decade. All the three linear measurements start decreasing in 50-59 years age group and this trend continues in the next decade. Average values recorded in 60+ age group are 6.43, 2.56 and 3.88 cms respectively (Table 2).

Table 2: Effects of age on linear measurements of uteri of pakistani females (n=1000).

Age (years)	Max.	Mini.	Average (St. Dev.)
Body length (cms)			
10-19 (n=131)	10.2	4.0	7.03 (1.06)
20-29 (n=334)	4.4	4.3	7.93 (1.24)
30-39 (n=335)	13.5	5.4	8.97 (1.45)
40-49 (n=146)	15.1	4.0	8.89 (1.88)
50-59 (n=22)	11.7	4.9	7.68 (1.95)
60+ (n=12)	11.6	3.6	6.43 (2.44)
Ap. Dia (cms)			
10-19 (n=131)	4.4	1.6	3.02 (0.56)
20-29 (n=334)	5.7	2.0	3.49 (0.67)
30-39 (n=335)	6.1	1.6	3.94 (0.73)
40-49 (n=146)	6.5	1.6	3.97 (0.90)
50-59 (n=22)	5.8	1.7	3.23 (1.05)
60+ (n=12)	4.5	1.0	2.56 (0.85)
Trans. Dia. (cms)			
10-19 (n=131)	6.1	2.4	4.21 (0.76)
20-29 (n=334)	7.8	2.5	4.8 (0.92)
30-39 (n=335)	8.5	2.7	5.4 (0.99)
40-49 (n=146)	7.9	1.5	5.4 (1.08)
50-59 (n=22)	7.4	2.6	4.51 (1.19)
60+ (n=12)	5.3	2.1	3.88 (0.90)

Weight of uterus shows maximum average value of 117.99 gms in 40-49 years age group and minimum average value of 58.23 gms in 6th. decade. Volume of uterus shows maximum average value of 181.03 (cm)³ in 40-49 years age group and shows a minimum value of 74.56 cm³ in 60+ age group (Table 1).

On average, linear measurements during 2nd and 3rd decade increase at a rate of 13% maintaining themselves in next decade and decrease at a rate of 15% during 5th and 6th. decades. Uterine weight increase at a rate of 34.5% upto 4th decade and reduces at a rate of 30% during next two decades. For uterine volume, these figures are 45% and 36% respectively.

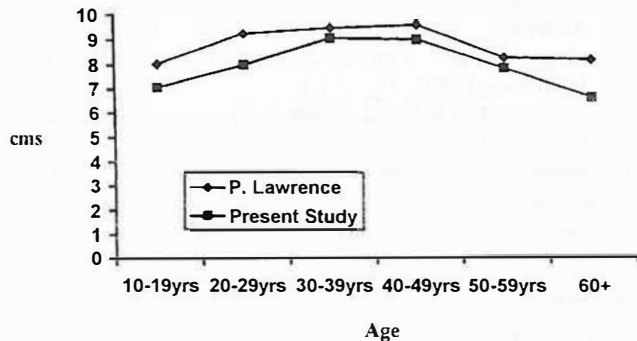


Fig. 1: Comparison of average uterine body length.

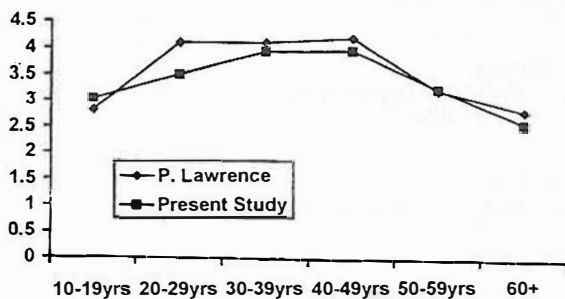


Fig. 2: Comparison of average uterine antero-posterior diameter.

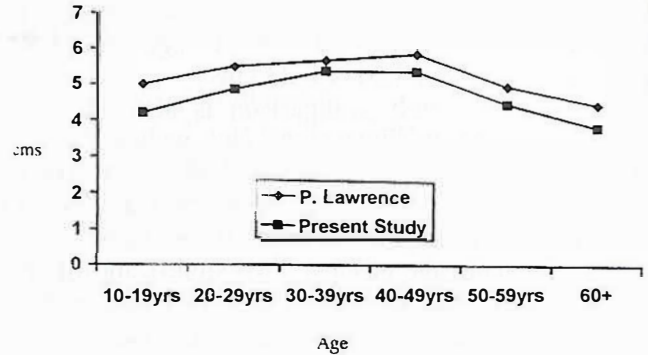


Fig. 3: Comparison of average uterine transverse diameter.

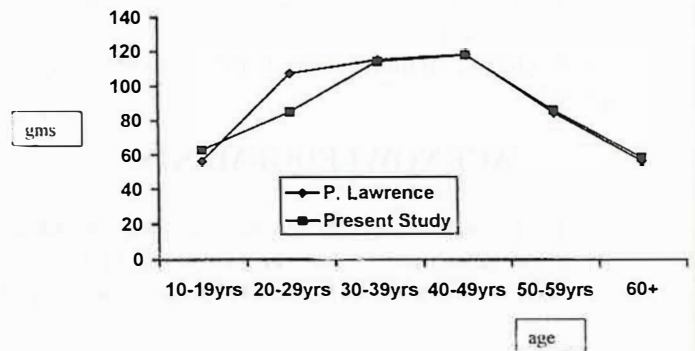


Fig. 4: Comparison of average uterine weight.

DISCUSSION

In a recent ultrasound study⁹, 18 uteri (13 premenopausal and 5 postmenopausal) at the average age of 44 years were studied. According to it, premenopausal uterine weight averaged 100 ± 6 gms, which is less as compared to same age group of Pakistani females where it is 117.99 gms. The uterine dimensions studied for length, width and antero-posterior diameter were $8.9 \pm 0.4 \times 5.6 \pm 0.2 \times$

4.01±0.2 cm respectively (mean±SEM). They can be compared with same age group of Pakistani females where they are 8.89 x 5.4 x 3.97 cm. In the same study post menopausal weight and dimensions were 96±14 gm and 8.4±0.3 x 4.07±3.01 x 301±0.3 cm respectively. In our study these parameters were (in 50 - 59 yrs age group) 82.75 gms and 7.68 x 4.51 x 3.23 cms.

In this study comparison is also being made between linear dimensions and weight of normal uteri of Pakistani females and those of American origin (Figs. 1-4)¹⁴. This shows that in general the uteri of Pakistani females show same changes among same age groups. Two significant difference are noted. One, the size of uteri of Pakistani females remain at a slightly lower level and two, they decrease at a much faster rate among old age groups. Probably genetic and racial factors, nutritional status, body size, marital status, parity etc all play their role. Pakistani females compared to their American counterparts give birth to more children which put their body resources in compromised position and they belong to much lower socio-economic group. Their uteri atrophy at a much faster rate. As the values recorded are different for different populations, it is desired that instead of referring to growth charts of other population groups, each group should have its own growth charts, which should be consulted when required.

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REFERENCES

1. Pirronen O, Kaihala HL. Uterine size measured by ultrasound during menstrual cycle. *Acta Obstet Gynae* 1975; 54: 247-250.
2. Miller EL, Thomas RH, lines P. The atrophic post menopausal uterus. *J Clin Ultrasound* 1977; 4: 261-263
3. Sample WF, Lippe BM, Gyepes MT, Grey scale Ultrasonography of normal female pelvis. *Radiology* 1977; 125: 477-483.
4. Ivarsson SA, Nilsson KO, Persson PH. Ultrasonography of the pelvic organs in prepubertal and post pubertal girls. *Arch Dis Childhood* 1983; 58: 352-354.
5. Orsini LF, Salardi S, Pilu G et al. Pelvic organs in pre menarcheal girls Real time Ultrasonography. *Radiology* 1984; 153: 113-116.
6. Stubbs TM, Van Dorsten P, Miller MC The preterm cervix and preterm labour. Relative risks, predictive values and changes over time. *Am J Obstet Gynecol* 1986; 68: 855-858.
7. Papiernik E, Bouyer J, Collins D, et al, Precocious cervical ripening and preterm Labour. *Obstet Gynecol* 1986; 67: 238-242.
8. Saxton DW, Farquhar CM, Rae T, et al. Accuracy of Ultrasound measurements of female pelvic organs *Br J Obs and Gynae* 1990; 97: 695-699.
9. Flickinger L, D'Ablaring G, Mishell DR. Size and weight determination of non-gravid enlarged uterus. *Obs Gynaecol* 1986; 68: 855-858.
10. Plat JF, Bree RL and Davidson D. Ultrasound of the normal and non-gravid uterus-Correlation with gross and histopathology *J Clin Ultrasound* 1990; 18: 15-19.
11. Anderson HF. Transvaginal and transabdominal ultrasonography of uterine cervix during pregnancy. *J Clin Ultra sound* 1991; 19: 77-83.
12. Obstetrical ultrasound Chudleigh P. Pearce Malcolm J. Churchill Livingstone 2nd edition 27.
13. Obstetrical ultrasound by Philippe Jeanty and Robert Romero 1987; 22-23.
14. The Size of the Normal Uterus P. Lawrence Langlois, M.D. *J Reprod Med* 1970; 4: 31.

The Authors:

Zahid A. Khan,
Main Radiology Department,
Services Hospital,
Lahore.

T. H. Zubairi,
Main Radiology Department,
Services Hospital,
Lahore.

Y. Malik,
Main Radiology Department,
Services Hospital,
Lahore.

N. Aziz,
Professor
Department of Anatomy
PMC, Faisalabad.

M. Farooq,
Main Radiology Department,
Services Hospital,
Lahore.

Z.A. Mian
Main Radiology Department,
Services Hospital,
Lahore.

Address for Correspondence:

Dr. Yahya Malik
Main Radiology Department,
Services Hospital,
Lahore.