Uterine roundness index: model formulation and nomogram for a Nigerian population

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ABSTRACT: This study was aimed to establish a nomogram for uterine roundness index (UTRI) for a Nigerian population. Seven hundred Nigerian girls and women in the premenarche, nulliparous, multiparous and postmenopausal groups with normal uteri were evaluated by pelvic ultrasound. The length, anteroposterior and transverse diameters of the uterus were measured and the UTRI calculated as the ratio of anteroposterior diameter to the length. The age, height, and parity of the subject were recorded. The mean UTRI $\pm$SD were 0.44457$\pm$0.0629 for premenarche, 0.5880$\pm$0.1118 for nulliparous, 0.6005$\pm$0.1046 for multiparous and 0.5269$\pm$0.1037 for postmenopausal. Pearson's correlation analysis showed significant correlation between UTRI and age, height and weight in premenarche group and weight in the nulliparous, multiparous and postmenopausal groups ($p< 0.05$). Significant negative correlation between UTRI and age occurred only in the postmenopausal group ($p< 0.05$). The study has established a nomogram for UTRI in a Nigeria population which will be of gynaecological importance to sonographers and referring clinicians in assessing the normality of uterine shapes and contour.

KEY WORDS: Uterine roundness index; Uterus; Ultrasound; Nigerian women; Nomogram

INTRODUCTION

The uterus is a very important organ in the female reproductive system and is subject to investigation for size, shape and position in cases of infertility. Normal uterine dimensions are well established for the Caucasian population[1-4]. A nomogram of uterine sizes, shapes and positions has also been established for the Nigerian population[5,6]. In the nomogram established for the Nigerian population, uterine shapes identified are pear-shape, tubular and globular[5]. These shapes were subjectively described as they appeared sonographically. No quantitative values were attached to them. The shape of a similarly shaped organ, the gallbladder has been described in quantitative terms by the roundness index[7,8] and spherical index[9].

To the best of our knowledge there has not been any study or documentation on uterine roundness index in any population. The aim of this study was formulate such a model for the Nigerian population and relate it to the anthropometric variables that may affect it. This novel work would provide the baseline data for assessing the normality of uterine shape.

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MATERIAL AND METHOD

Study Design: A cross sectional design was adopted for the study. The subjects consisted of referrals to the ultrasound section of Radiology Department of Federal Medical CentreMakurdi, Benue State, Nigeria between April 2005 and September 2007. Informed consent was obtained from each subject before enrolment in the study. Ethical clearance for this study was given by Human Research and Ethics Committee of Federal Medical Centre, Makurdi.

Sample Size: The minimum sample size is given by:

$$n = Z^2 P(1-P) / d^2$$ ---for a finite population[10]

Where *n* is sample size, *Z* is 1.96 at 95% confidence interval, P is estimated population proportion. Since this proportion is not known for the target population, a value of 50% (0.5) is assigned to obtain the maximum value for p, and d is the absolute precision required on either side of the proportion = 5% (0.05).

$$n = (1.96)^2 x 0.5(1-0.5) / (0.05)^2 = 384$$

From the foregoing a sample size of 700 subjects was chosen for this study which is about twice greater than the calculated minimum sample size of 384 to increase the validity of the study.

The number of subjects scanned for the pelvis during the period of the study was 1,237 but only those who met the inclusion criteria were included in the study. The subjects included were only Nigerian girls and women from 9 years and above who were not pregnant at the time of the study or had delivered babies in the past 12 weeks prior to being scanned. Those who have had hysterectomy or have uterine or adenexal masses visualized on scan were excluded. Subjects with suspected uterine malformation were also excluded. The 700 subjects who met the inclusion criteria consisted of 100 subjects each for premenarche and postmenopausal groups and 250 subjects each for nulliparous and multiparous groups.

Data Collection: On arriving at the department an informed consent was sought and obtained from each subject before enlistment into the study. The height and weight of the subjects were measured using a meter tape and weighing scale. The age, parity, premenarchal and postmenopausal statuses were obtained by direct questioning.

Pelvic sonography was carried out on each subject using *Toshiba SSA 250* ultrasound equipment with 3.75MHz curvilinear electronic transducer in the presence of chaperon. A full urinary bladder without over distension was achieved by ingesting water to each subject prior to each scan. The length and anteropoterior diameter of uterus were obtained on the same longitudinal scan. A transverse scan of the uterus was used to obtain the transverse diameter. The measurement of the uterine dimensions was taken in three planes described by **Chudleigh** and **Pearce**[11] as shown in **figure 1**.

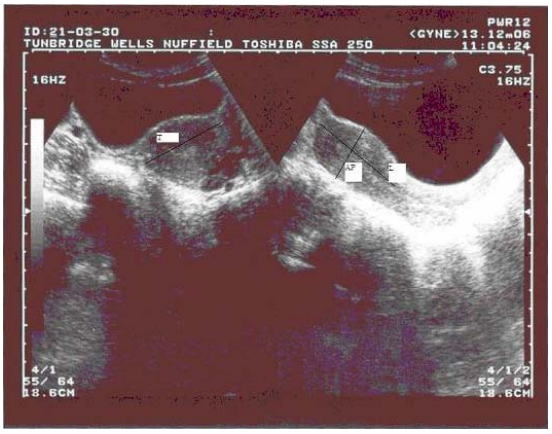

Figure 1: Sonogram showing the measurement of uterine dimensions

Data Analysis: The data were categorized into four groups namely; premenarche, nulliparous, multiparous and postmenopausal and analysed on computer using SPSS version 11.0 statistical software. Values were expressed as mean ± standard deviation. Statistical tests were two-tailed with $p<0.05$ indicating statistical significance.

RESULTS

The anthropometric characteristics of the subjects are shown in the **table 1**. The mean uterine roundness indices UTRI±SD are 0.4457± 0.0629 for premenarche, 0.5880 ± 0.1118 for nulliparous, 0.6005 ± 0.1046 for multiparous, 0.5269 ± 0.1037 for postmenopausal as shown in **table 1**.

Table 1: The UTRI and anthropometric characteristics of the subjects

	UTRI ±SD	Age (yrs) ±SD	Height (cm) ±SD	Weight (kg) ±SD	Parity ±SD
Premenarche	0.4457 ±0.0629	11.17 ±1.4499	143.70 ±7.1823	39.840 ±7.5555	--
Nulliparous	0.5880 ±0.1118	22.528 ±4.5418	158.86 ±12.197	61.440 ±10.822	--
Multiparous	0.6005 ±0.1046	30.324 ±7.3787	160.57 ±8.8006	68.156 ±12.135	3.6320 ±2.2443
Postmenopausal	0.5269 ±0.1037	59.910 ±7.8214	155.75 ±5.9022	55.660 ±8.0894	--

There was significant correlation between UTRI and age, height and weight in the premenarche group, and weight in the nulliparous, multiparous and postmenopausal groups as shown in the **table 2** ($p< 0.05$). There was significant negative correlation between UTRI and age in the postmenopausal group ($p< 0.05$). The correlation between UTRI and, age and height was not significant in the nulliparous and multiparous groups ($p> 0.05$). The correlation of UTRI with height was not significant in the postmenopausal group ($p> 0.05$).

Table 2: Pearson's correlation values between UTRI and anthropometric variables

	UTRI ±SD	Correlation with age	Correlation with height	Correlation with weight	Correlation with parity
Premenarche	0.4457 ±0.0629	0.255 (p=0.010)*	0.361 (p = 0.000)*	0.320 (p = 0.001)*	--
Nulliparous	0.5880 ±0.1118	0.110 (p = 0.820)	0.065 (p = 0.302)	0.136 (p = 0.031)*	--
Multiparous	0.6005 ±0.1046	0.083 (p = 0.192)	0.102 (p = 0.107)	0.218 (p = 0.001)*	-0.001 (p = 0.986)
Postmenopausal	0.5269 ±0.1037	-0.402 (p=0.000)*	0.149 (p = 0.140)	0.456 (p = 0.000)*	--

* Statistically significant value

DISCUSSION

Determination of uterine shape is an important aspect of the evaluation of uterus in case of infertility. Uterine shape determination had up till now been done subjectively by observing the contours of the uterus sonographically. Uterine roundness index (UTRI) is a novel idea and had not been previously documented to the best of our knowledge. UTRI is an objective method of assessing the normality of uterine shape.

Our results showed that the UTRI$\pm$SD observed are 0.4457 $\pm$ 0.0629 for premenarchal subjects, 0.5880 $\pm$ 0.1118 for nulliparous subjects, 0.6005 $\pm$ 0.0104 for multiparous subjects and 0.5269 $\pm$ 0.1037 for postmenopausal subjects. There was a general upward trend from premenarchal value to multiparous value and then a decline to a value comparable to the nulliparous value in the postmenopausal subjects. This trend we think represents the pattern of changes associated with uterine size and shape at these different phases of reproductive life. UTRI being the ratio of anteroposterior diameter to length would always remain relatively constant in the four categories of subjects. It can however be altered when one of the dimensions is increased by the presence of a mass as a change in shape may be an indication of congenital malformation or presence of a mass. **Ohagwu et al**[5] noted that in leiomyoma uteri the uterus sometimes becomes large and changes contour which affects both size and the normal pear-shape. They noted that uterine malformations are only suspected at ultrasound when uterine shape and size are abnormal. Thus, knowledge of UTRI would be invaluable in making diagnosis of uterine masses and congenital uterine malformations.

The results of our study showed significant correlation between UTRI in premenarche and anthropometric variables (age, height, and weight). In the postmenopausal subjects significant correlation between UTRI and subject age and weight were observed. In the nulliparous and multiparous subjects, significant correlation between UTRI and subject body weight was observed. This observed correlation between UTRI and body weight in nulliparous and multiparous subjects indicate that changes associated with puberty and childbearing affect the shape of the uterus.

Our study has formulated a model for UTRI and established a nomogram. Further studies in health and in disease in different clinical and demographic environments would further validate its clinical value.

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