Sonographic Assessment of Endometrial Thickness in Different Menstrual Stages in Sudanese Normal Women in Khartoum State

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Abstract: ***Purpose of this study was to determine the endometrial thickness and layering in Sudanese normal women in Khartoum state in all stages of menstrual cycle. Design used is a descriptive non-interventional analytical study using ultrasound investigation trans-abdominally [TAS] to scan the pelvis in 102 normal menstruating Sudanese women between [14 – 45 years]. The data was collected by designed clinical data collection sheet. Findings of this study resulted in endometrial thickness = [2.1_ 4.3] mm in menses stage, [3.3 _ 7.5] mm in early proliferative stage, [5.9_ 11.5] mm in the late proliferative stage and [8.1 _ 11.9] mm in secretary stage.***

Keywords: Endometrium, Thickness, Menstrual stages, Khartoum.

1. Introduction

The field of medical imaging is advancing at a rapid pace. Imaging modalities like x-ray radiography, x-ray computed tomography [CT] and magnetic resonance imaging [MRI] have been used in biology and medicine to visualize anatomical structures. [1] Ultrasound is considered the most cost-effective among them. It is used routinely in hospitals and clinics for diagnosing a variety of diseases. It is the tool of choice in obstetrics and cardiology because it is safe and capable of providing imaging in real time. Also Doppler ultrasound is used as a technique for making non-invasive velocity measurements of blood flow. New applications in small-animal imaging and cellular imaging are being explored. [1]

Ultrasound machines are better than ever before. To obtain a good image, the operator has to know how to use all of the setting of ultrasound machine and there are many of the concepts that form the basis for adjusting the various settings. Ultrasound machine should be chosen based on its ability to see a certain structure as well as resolving images and based on its penetrating power.[2]

The endometrium is the lining of the uterus. This lining grows and thickens every month to prepare the uterus for pregnancy. If pregnancy does not occur, the lining is shed during the menstrual period. [3] Endometrial abnormalities are common diagnostic challenges facing the radiologist and referring gynecologist. Ultrasound is the primary imaging modality in this setting. [3] The endometrium demonstrates a wide spectrum of normal and pathologic appearance through menarche as well as during pre-pubertal and postmenopausal years and the first trimester of pregnancy. [4]

It is important to understand that the appearance of the endoetrium is related to multiple factors including the patient's age, stage in the menstrual cycle and pregnancy status and whether she has undergone hormonal replacement therapy or tamoxifen therapy. So, these factors should be taken into account in addition to clinical history and physical examination findings. [4]

1.1Endometrial thickness

Is defined as the maximal distance between the two echogenic interfaces of the myometrium and endometrium measured through the central longitudinal axis of the uterine body. It is important when measuring endometrial thickness that the entire length of the uterus is imaged to avoid taking an oblique section of the uterus, which would make the measurement inaccurate. The measurement is performed just below the fundus and incorporates any tissue but should exclude any intra-cavity fluid. [5]

1.2 Physiology of the endometrium

Menstruation is a very important indicator of the function and condition of the female reproductive organs. Menstruation occurs due to the unique lining [mucus membrane] that covers or line the cavity inside the womb. The length of a menstrual cycle is calculated from the day it starts until it stops. It is usually 24 to 32 days with an average of 28 days. The bleeding lasts for 3-7 days. The color depends on the rate the bleeding occurs. Slow bleeding causes the color to become darker, even black. A slow rate causes the blood to take longer to reach the outside and old blood becomes darker. The womb forms substances that prevent clot formation and a normal menstruation is clot free. a fast rate prevent these anti clotting substances to be effective and clots form.[6] The female hormones estrogen and progesterone control the changes in the uterine lining.[3]

1.3 Sonography of the endometrium

Modern diagnostic ultrasound imaging equipment consists of mainly digital real-time [RT] scanners which produce two-dimensional [2D]. High-end ultrasound imagers offer the capability of three-dimensional [3D] image display. The addition of various Doppler technologies provides an excellent adjunctive tool for sonographic diagnosis in many patients. Doppler technologies in common clinical use include color Doppler [CD], power Doppler [PD], and spectral Doppler [SD]. The newest Doppler technology in clinical use is PD combined with 3-D imaging, which is

referred to as 3-D power Doppler [3-DPD]. The added information obtained with 3-D power Doppler improves diagnostic confidence for findings obtained with conventional 2-D imaging and power Doppler. [7]

In clinical practice the greatest diagnostic benefit is likely to occur in cases in which complex anatomic problems of the fetal circulation are already suspected. Doppler can provide useful vascular information that can narrow the differential diagnosis. [7]

There are several scanning techniques for evaluating the endometrium:

- Transabdominal Sonography [TAS]
- Endovaginal Sonography [EVS]
- Sonohysterography [SHS]
- Transrectal Sonography [TRS]

The two commonly applied techniques are TAS and EVS. [7]

Sonographic appearance:

- The uterus lies between the urinary bladder anteriorly and rectosigmoid colon posteriorly. It is usually anteverted and anteflexed.
- The size of the normal uterus is related to age. [8]
- The uterine myometrium should appear smooth and medium-level echoes with even texture.
- The endometrial cavity is a thin echogenic line that varies in intensity and thickness depending on the menstrual phase and patient age.
- The vaginal walls have medium level echoes and the vaginal canal is hyperechoic.
- The ovaries have medium- level echoes .The follicles are seen round or oval anechoic structures along the ovarian periphery.
- The urinary bladder appears anechoic if it is full and collapsed if it is empty with smooth and thin echogenic walls.
- The fallopian tubes are not normally seen.
- The cul-de-sac is posterior to the uterus that is seen when it contains fluid or blood.
- Normal variants:
  - Retrovetred uterus: the entire uterus is tilted posteriorly.
  - Retroflexed uterus: only the uterine fundus and body are tilted posteriorly.
  - Didelphia uterus: two uterine bodies, two cervices, and two vaginas.
  - Bicornuate uterus: two uterine bodies with one vagina and one or two cervix. [9]

2. Results and Discussion

Table 1: Distribution of thickness in menses stage

Statistical Descriptive	Value
Mean	3.2 mm
Median	2.9 mm
Mode	2.4 mm
Std. Deviation	1.14 mm
Minimum	2 mm
Maximum	6 mm

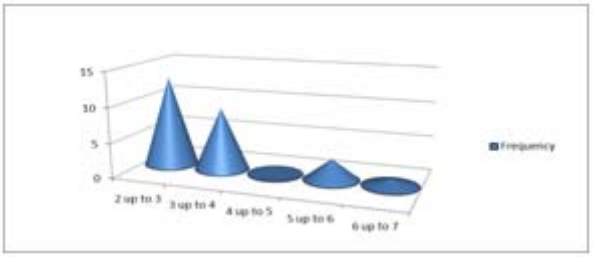

Figure 1: Thickness of menses distribution

In the menses stage, the mean of thickness was about 3.2 mm with standard deviation of 1.1 mm, which means the thickness ranged between 2.1 and 4.3 mm.

Table 2: Distribution of thickness in early proliferative stage

Statistical Descriptive	Value
Mean	5.4 mm
Median	4.9 mm
Mode	5 mm
Std. Deviation	2.14 mm
Minimum	2 mm
Maximum	10.7 mm

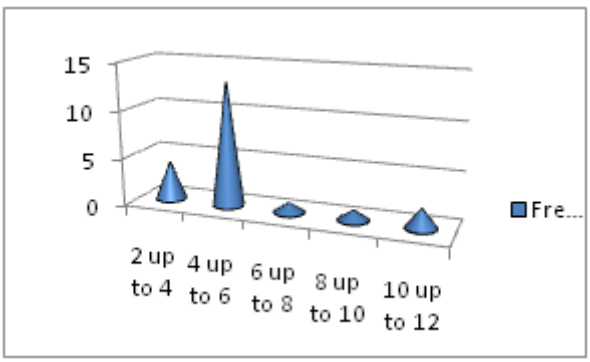

Figure 2: thickness in early proliferative stage distribution.

In the early proliferative stage, the mean of thickness was about 5.4 mm with standard deviation of 2.1 mm, which means the thickness ranged between 3.3 and 7.5 mm.

Table 3: Distribution of thickness in late proliferative stage

Statistical Descriptive	Value
Mean	8.7 mm
Median	8.3 mm
Mode	9 mm
Std. Deviation	2.80 mm
Minimum	4.9 mm
Maximum	17 mm

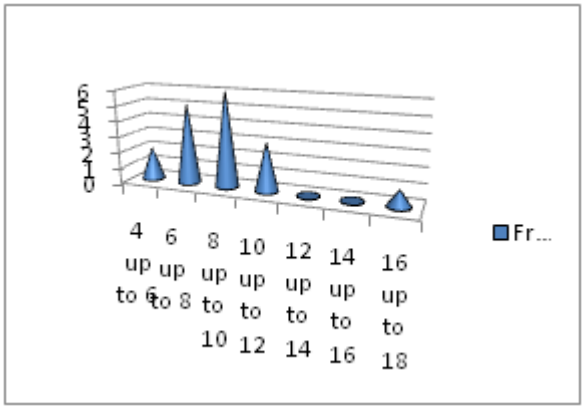

Figure 3: Thickness in late proliferative stage distribution

In the late proliferative stage, the mean of thickness is about 8.7 mm with standard deviation of 2.8 mm that means the thickness ranged between 5.9 and 11.5 mm.

Table 4: Distribution of thickness in secretory stage

Statistical Descriptive	Value
Mean	10 mm
Median	9.5 mm
Mode	9 mm
Std. Deviation	1.93 mm
Minimum	6.9 mm
Maximum	14.6 mm

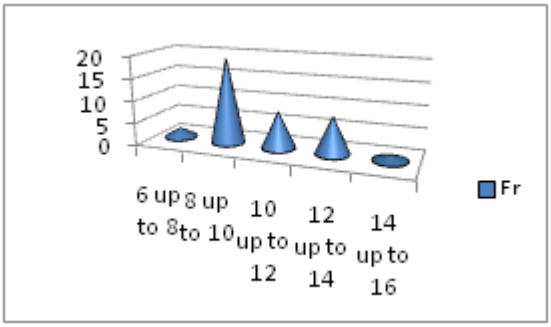

Figure 4: Thickness in secretory stage distribution

In the secretory stage, the mean of thickness was about 10 mm with standard deviation of 1.9 mm that means the thickness ranged between 8.1 and 11.9 mm.

3. Conclusion

In normal Sudanese menstruating women in Khartoum state, the endometrial thickness is 3.2 ± 1.1 mm in menses, 5.4 ± 2.1 mm in early proliferative stage, 8.7 ± 2.8 mm in late proliferative stage and 10 ± 1.9 mm in secretory stage.

4. Recommendations

This topic needs further studies with bigger sample size that may explain more precise measurements. For married women, the measurement of endometrial thickness is better to be done with trans-vaginal ultrasound [TVS] because it gives accurate measurements. For single women, TAS should be applied with full urinary bladder to give accurate measurements.

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