CERVICAL LENGTH ASSESSMENT DURING PREGNANCY USING ULTRASOUND MEASURES IN DUHOK CITY

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ABSTRACT

Preterm birth has been regarded as a major cause of perinatal morbidity and mortality with an incidence ranging from 5-18 % worldwide. Early screening of pregnant women at risk of preterm delivery and managing it correctly are essential aids to reduce the predictable complications associated with prematurity

Objective: The main aim of the study was to assess the true and acuurate cervical measuremants that predict the clear definition and cut values of the cervical incompetence in second trimester pregnant women by using transabdominal and transvaginal Ultrasound .

More specofc aim of the study was looking for the accuracy of transabdominal ultrasound in measuring the cervical length for prediction of preterm birth when compared with transvaginal ultrasound, assessment of the mean cervical lengthin the second trimester pregnancy , the correlation between both of these modalities in each case , finding the clear cut off value of transabdominal Ultrasound measurement to be further assessed by transvaginal Ultrasound .

Materials: A cross sectional prospective study done on ninety-three pregnant women between 12-22 weeks of gestation who were referred between March to November of 2018in thisprospective study ,their cervical lengths were assessed by using transabdominal Ultrasound , using Transvaginal Ultrasound as the reference, both methods were correlated forvariance.

Results: The mean transabdominal cervical length measurements was seen to range $(34.3 \pm 5.8$ mm) while the mean transabdominal cervical length measurements was seen to range $(35.9 \pm 4.4$ mm). The mean transabdominal cervical length   was shorter than the mean transvaginal cervical length by an average of 1.6 mm. The 10th percentile of transabdominal and transvaginal cervical length was 27 mm and29.4 mm, respectively. The two groups that showed significant difference between the two scanning methods were the 25th-50th centile group (TACL) of 33-37 mm) with p = 0.019, and the 50th-75th centile group (TACL) of 37-40 mm) with p =0.001 , the clear cut value of 27 mm was the value considered to revert fron TAUS to TVUS for CL assessment

Conclusion:TAUS was found to be an initial CL screening method in the second trimester pregnant women generally while from 12- 14 weeks GA specifically the   TVUS is preferred for this measurement ,a cut-off value of 27 mm is used to revert to TVUS for CL assessment instead of TAUS.

INTRODUCTION

Preterm birth has been regarded as a major cause of perinatal morbidity and mortality with an incidence ranging from 5-18 % worldwide. Early screening of pregnant women at risk of preterm delivery and managing it correctly are essential aids to reduce the predictable complications associated with prematurity. There is an association between short cervical length and the development of preterm birth. The cervix can be assessed by either transvaginal or transabdominal ultrasound , figure 1 showing the   detailed assessment of cervical length by using transabdominal US (Blencowe, *et al*., 2012, Rumack , et al .,2011).

Preterm birth, defined as delivery of fetus prior to 37 weeks of gestation, ithas become an important issue and subject in current literature because of its high incidence despite of recent advances in the obstetric care with the incidence being substantially higher in the developing

countries (Blencowe, *et al*., 2012). Previous preterm birth, recurrent second trimester abortions, previous caesarian section and/or myomectomy, previous surgical interventions of the cervix and multiple gestations are risk factors for preterm delivery(Rumack , et al .,2011)

There is sufficient data demonstrating an association between preterm birth and a short cervical length (Hassan , *et al*.,2000),(Moroz *, et al.,* 2012),(Romero , *et al*., 2012)Cervical incompetence (CI) can be assessed accurately during mid pregnancy by ultrasound (US) examinationas shown in figure 2,3, Funneling (V shaped cervical configuration) as shown in figure 2 can be accurately assessed by both transabdominal (TA) and transvaginal (TV) US . TVUS is regarded as the reference standard method because of the close proximity of the transducer to the cervix and hence better resolution. Although the TA US is quick, more readily available and more convenient for the patient, has limited practical use due to onfounding factors such as maternal habitus and the state of urinary bladder conducted as in the study done in India (Roh , et , al .,2014), which assessed the factors that influence TA US measurement of cervical length. They concluded that TA US fails to visualize the cervix in a high proportion of cases and that successful visualization requires a full bladder which falsely increases the cervical length. Conversely, later studies showed that TA US measurements of the cervix are closely correlated with TV measurements and that cervical length could be obtained by TA approach in the majority of

pregnant women with no known risk factors of preterm birth (Stone , et ., al 2010),(Peng , et , al .,2015).

In the early 1980s several studies were carried out using TAUS which drew attention to the association between a short cervical length and the occurrence of preterm delivery (Bowie, Andreotti and Rosenberg, 1983, Ayers*et al*., 1988, Podobnik *et al*., 1988). In 1991, Frank Andersen from Michigan was the first to draw attention to the superiority of TVUS and provided a risk for preterm delivery based on sonographic measurement of cervical length. Later (Iams *et al..* in 1996) and the Nicolaides group in London in 2012 confirmed that ultrasound screening will predict a large percentage of women who will go into preterm labor. The Nicolaides group were able to identify 50% of women who delivered prior to 33 weeks of gestation using a cut-off cervical length of 15 mm (Heath *et al*., 1998), This study aim to assess the efficacy of TAUS in measuring the cervical length when compared with measurements obtained by TV US in different maternal conditions , parities , gestaional ages , helping to find which one of them is better for assessing the cervical length in the early pregnancy, finding the relationship between cervical length and both maternal and fetal demographics , finding the cut off value in millemeters in which the examiner should revert from TAUS to TVUS to avoid missing cases at risk of miscarriage or spontaneous pretermdelivery.
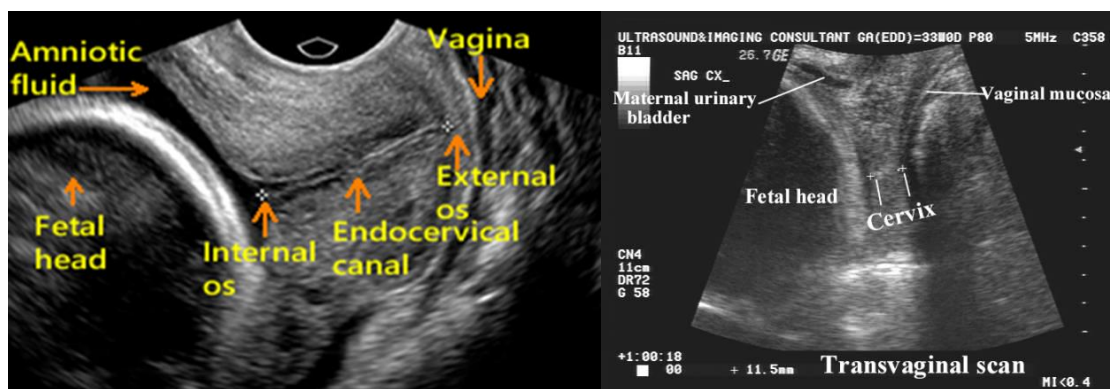

Fig.(1):- Two uktasound images showing brief description of cervical length assessment , by using transabdominal US on the right and intravaginal US on the left **.**

METHODS

data collection

The author developed a questionnaire form according to the evidence-based documents of the current literature to obtain general information of each patient who are collected from Azadi teaching hospital and Maternity hospital both in Duhok city , all patients were referred from these hospitals after complete clinical examination by specialized gynecologists in charge . All of the ultrasound scans, both TA and TV, were performed by the researcher under supervision of a specializedsenior radiologist.

Inclusion criteria:

Pregnant women between 12-22 weeks of gestation of any age, parity, andrace , those who are not complaining of any obstetric or relevantproblems .

Exclusion criteria:

Recurrent abortions, Congenital anomalies, Previous or current cervical cerclage in situ, vaginal bleeding, low lying placenta or placenta previa, women who refused to undergo TV scan.

Ethical considerations

The study was approved by the local Health Ethics Committee in Duhok-Iraq. The current study did not have any harmful effects on the patients. A written informed consent form was obtained from each woman prior to the study.

MATERIALS AND METHODS

One hundred and twenty one pregnant women between 12-22 weeks of gestation who attended Azadi General Hospital for routine obstetrical ultrasound scan were enrolled in this study. Ninety three women who met the inclusion and exclusion criteria underwent both TA and TV ultrasound scans of the cervix.

All of the examinations were performed using Philips HD11 XE ultrasound machine which was manufactured in 2017. The TA scans were performed using a transducer with a frequency of 2-5 MHz and the TV scans were performed using an endocavity transducer with a frequency of 7 MHz.

STATISTICAL ANALYSIS

The collected data were entered into an Excel 2010 workbook and then converted into SPSS version 24 (IBM Corp., 2016) for analysis. A paired test was used to examine the significant association between TA length and TV length measurement and to detect the significance of the difference between them. A p value of ≤0.05 was consideredsignificant.

RESULTS

As shown in Table 1, the mean maternal age was 26.9 ±4.9 years (17-40 years) and the mean gestational age was 16.5 ±3.1 weeks. The mean gravidity was 4 ±2 and the mean parity was 2 ±1.6. The mean number of first trimester abortion was 1 ±0.9.

Table(1): -Characteristics of women involved in the study (n = 93)

Characteristic	Minimum	Maximum	Mean	Standard Deviation
Age of the mother (years)	17	40	26.9	4.9
Gestational age (weeks)	12	22	16.5	3.1
Gravida	1	9	4	2.0
Parity	0	7	2	1.6
First trimester abortion	0	4	1	0.9

The mean TA cervical length measurement was 34.3 ± 5.8 mm and the mean TV cervical length measurement was 35.9 ±4.4 mm. Table 2 shows that the mean TA cervical length was on average shorter than the TV cervical length when measured in the same woman. The mean difference between the two methods of measurement was 1.6 mm.

Table(2): -Transabdominal and transvaginal cervical length measurements by centiles, mean and standard deviation (SD)

	Minimum	1st	5th	25th	Median*	Mean	SD	75th	95th	99th	Maximum
TA (mm)	22.4	22.4	24.4	31.4	33.8	34.3	5.8	3.72	45.3	55.6	55.6
TV (mm)	22.6	22.6	28.5	33.4	36.4	35.9	4.4	3.84	42.4	49.5	49.5
TA–TV	-15.2	-15.2	-10.6	-4.5	-2.2	-1.6	5.1	0.10	6.8	14.1	14.1

* Median = 50th centile.

Relationship between cervical lengths and the fetal demographics As shown in table 3, in early fetal age (12-14 weeks), the TA ultrasound measurement was significantly shorter than the TV measurement by an average of 1.9 mm (p = 0.023). In fetuses whose presentation was cephalic at the time of examination, the TA measurement was significantly shorter than the TV measurement by an average of 1.7 mm (p =0.009).

Table(3):- Difference in cervical length based on TA and TV measurements, by gestational age

Gestational age (weeks)		No.	Mean	SD	Median	nimum	ximum	TA-TV	P*
12-14	**TA (mm)**	34	34.0	5.5	34.3	22.8	47.0	- 1.9	**0.023**
	TV (mm)		35.9	4.4	35.8	27.3	49.5		
15-18	**TA (mm)**	36	34.3	6.1	33.8	22.4	55.6	- 1.7	0.074
	TV (mm)		36.0	4.2	37.0	25.5	42.9		
19-22	**TA (mm)**	23	34.7	6.0	33.0	24.0	52.1	- 1.0	0.375
	TV (mm)		35.7	5.0	36.2	22.6	48.7		
Overall (12 – 22)	**TA (mm)**	93	34.3	5.8	33.8	22.4	55.6	- 1.6	**0.003**
	TV (mm)		35.9	4.4	36.4	22.6	49.5		

* Based on paired t-test; significant difference is printed in bold.

Relationship between cervical lengths and the maternal demographics

Table 4 shows the relationship between the TA-TV discrepancy and the maternal demographics. In women up to the third decade of age, the TA ultrasound measurement was significantly shorter than the TV measurement by an average of1.95 mm (*p* = 0.020). Similarly, the TA measurement was shorter than the TV measurement in primigravidae and multiparous women by an average of 2.1 mm (*p* =0.49 and 0.008, respectively). Furthermore, in women with a previous first trimester abortion, the TA measurement was significantly shorter than the TV measurement by an average of 2.7 mm (p = 0.014)

Table(4):- Mean cervical lengths and discrepancy between TA and TVcervical length according to maternal and fetal conditions

			No.	TV (cm) Mean	SD	TA (cm) Mean	SD	P*	TA – TV (cm) Mean	SD	P**
	1 7	- 24	33	34.4	4.4	32.2	4.6	**0.034**	-2.2	5.7	0.448
Age (years)	2 5	- 32	44	36.2	3.6	34.6	4.8	**0.012**	-0.17	4.2	
	3 3	- 40	16	38.1	5.5	37.9	8.4	0.893	-0.2	6.2	
Gestational	1 2	- 14	34	35.9	4.4	34.0	5.5	**0.023**	-1.9	4.7	0.811
age (weeks)	1 5	- 18	36	36.0	4.2	34.3	6.1	0.074	-1.7	5.4	
	1 9	- 22.5	23	35.7	5.0	34.7	6.0	0375	-1.0	5.5	
	1		15	34.6	4.0	32.5	3.8	**0.049**	-2.1	3.7	0.410
Gravidity	2 - 4		48	35.9	4.8	33.8	5.6	**0.008**	-2.1	5.3	
	5 - 9		30	36.6	4.0	36.0	6.6	0.579	-0.6	5.5	
	0		44	36.1	5.0	34.9	5.3	0.107	-1.1	4.6	0.395
Abortions	1		29	35.9	3.5	33.3	5.6	**0.014**	-2.7	5.5	
	2 - 4		20	35.5	4.5	34.4	7.2	0.417	-1.1	5.8	
Presentation	Cephalic		63	36.0	4.3	34.2	5.6	**0.009**	-1.7	0.52	0.693
of fetus	Breech		30	35.8	4.6	34.5	6.2	0.179	-1.3	5.2	
Total			93	35.9	4.4	34.3	5.8	**0.003**	-1.6	5.1	

Note : the gestational age in case of fetal presentation was collected during the gestational age (19 – 22)

* Based on paired t-test; significant difference is printed in bold.

** Based on one-way analysis of variance, except presentation of fetus on unpaired t-test

To determine a threshold for TA ultrasound scan, the 10th centile (published centile for TA threshold) along with its confidence interval was analyzed as shown in table 5. As listed, a cervical length of 27 mm on TA scan is the established threshold.
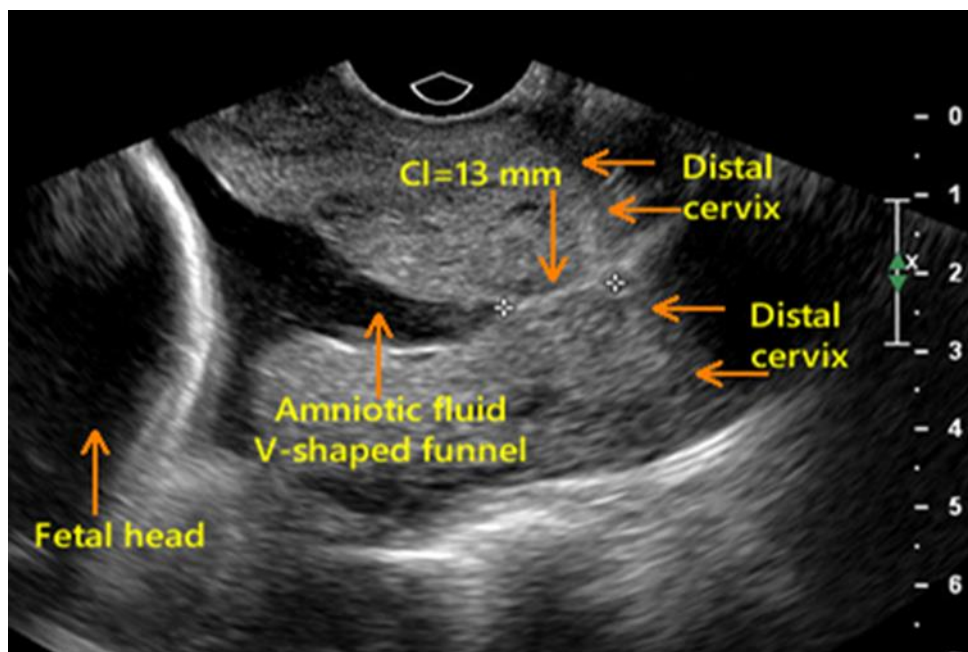
Fig.(2) : -cervical incompetence in second trimester pregnant woman showing funneling .
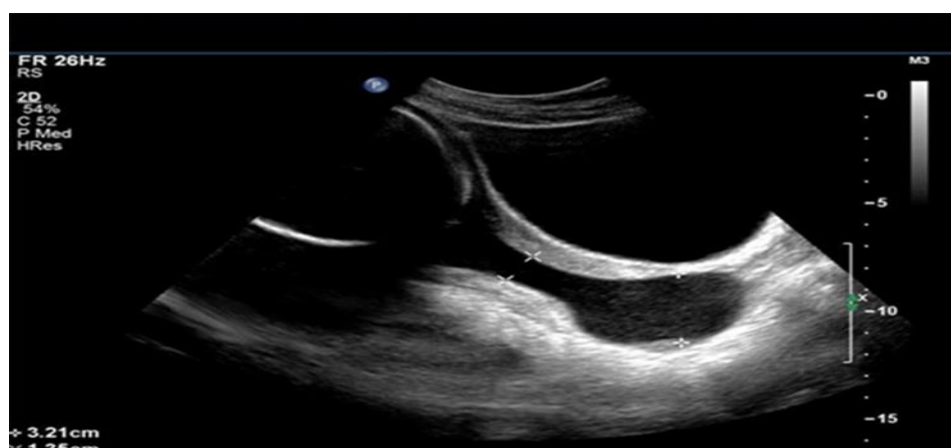

Fig.(3) :- Incompetent cervix in second trimester pregnant women showing increament in both cervical length and width**.**

Table(5): -The tenth centile of TA and TV with its confidence intervals

Variable	TA (mm)	TV (mm)
No. of women	93	93
10th Centile 95% Conf. Interval	27.0 24.2 – 29.5	29.4 27.9 – 32.4

DISCUSSION

The risk of preterm birth is increased in women with a short cervix during pregnancy; a cervical length of 25 mm is said to be predictive of preterm delivery , TV scan is inconvenient and many patients decline this scan, (Nambiar *et al.*, 2017)**.**

In the current study, only two (2.1%) patients had a TVCL of <25 mm and the TA overestimated the cervical length by an average of 8 mm in these cases, as shown in table 1 . In

agreement with the current study, Hernandez-Andrade *et al.*, who conducted a similar study in 2012 on 220 pregnant women, also found that TA ultrasound gave an overestimate of the cervical length by an average of 8 mm in women with TVCL <25 mm. In their study, 21 (9.3%) out of 220 women had a TV CL<25 mm.

Although TA ultrasound measurements overestimated the cervical lengths of the small number of women with short cervices in the current study, the overall mean TACL was consistently shorter than that of TV measurement by an average of 1.6 mm. Similarly, (Peng *et al.* 2015) ,(Stone *et al.* 2010)and (Roh *et al.*, 2014)also found that the mean TACL was similar to or shorter than the mean TV CL by an average of 1.6 mm, 2.6 mm and 0.05 mm, respectively.

Furthermore, in the current study as shown in table 2 and in agreement with Stone *et al.***,**all women with TACL<25 mm had longer TVCL (average = 9 mm), and in such cases TA did not overestimate the cervical length. Therefore, when assessing low-risk pregnant women, even when the TACL is less than 25 mm, there is only a very small chance that the TVCL would be less than 25 mm. This observation suggests that TA ultrasound can be effectively used for initial assessment of cervical length.

Several previous studies have found difficulties in visualizing the cervix transabdominally at advanced gestational ages. In the current study, the internal os was easily visualized in women with later gestational ages and there was no significant difference between the two scanning methods in these cases but a significant discrepancy was found in women with earlier gestational ages between 12-14 weeks ($p = 0.023$) as shown in table 3 . mabyin the first trimester it is often difficult to distinguish between the lower segment of the uterus and the internal margin of the cervical isthmus (Kurjak and Chervenak, 2003)**.**

In disagreement with the current study, (Roh *et al.,* 2014)observed that it was difficult to perform TA ultrasound in women with advanced GA because of the inconspicuousness of the internal os. May be this disagreement could be due to that their study group consisted of women with higher GA(20-29 weeks) as compared with this study group.

This study ,in agreement with (Roh *et al.*,2014)found an inverse relationship between maternal age and parity and the CL . The younger the age of the pregnant women and the less number of parity, the more significant difference was found between the two methodsdue to that the TACL and TVCL in these groups of women was on average shorter.

In addition, the current study as in the study by(Roh*et al.,* 2014)observed the relationship between the presentation of the fetus and the cervical length at time of examination , as shown in table 4 . It was noted that those with cephalic presentation had a greater discrepancy between TA ultrasound measurements when compared with those of TV measurements with a p value of 0.009. While on the contrary, (Roh *et al.,* 2014) found no significant difference between TA and TV measurements in either cephalic or breech cases. No definite reason could be found behind this finding but the author believes that the weight of the fetal head, which is the heaviest part of fetal body, could press on the internal os of the cervix and hence compress it making the cervix appear shorter in cephalic cases.

There has been recommendations made by other similar studies that there is a need to establish a "cut-off" value for TACL to suggest when to revert to TV for accurate measurements (O'Hara, Zelesco and Sun, 2013). The 10th percentile TA value is the most widely published percentile used to determine this cut-off point. In this study, the 10th percentile TA measurement value was 27 mm with 95% confidence interval of 24.2-29.5 mm as shown in table 5 . This means when the TACL is 27 mm or less, further evaluation by TV ultrasound is advised. Similar to the present study, in the study by (Iams*et al.*,1996), the 10th percentile TA value was 25 mm and that by Stone *et al.*,*2010* was 27 mm.

CONCLUSION

TA ultrasound assessment could be used initially for cervical length screening in low- risk pregnant women, especially after 14 weeks of gestation. In early pregnancy (12- 14 weeks), it is better to assess the cervical length by TV ultrasound. A TA cut-off value of 27 mm or less can be used to revert to TV ultrasound to verify the accuracy of TA value and to avoid missing cases at risk of spontaneous miscarriage or spontaneous preterm delivery. This step by step approach may be more convenient for both the patients and the radiologists for cervical length screening.

Conflicts of interest

All authors declare that they have no conflict of interest .

Disclosure Statement

No author has any potential conflict of interest.

Appendix : showing the formula of informations that has been took from each patient

0 APPENDIX
1
2 Questionnaire Form
3
4 Name of patient: ……………………………………………………. Age of patient: ………..... years
5 Parity: ……………
6 Gestational age: ………… weeks ……………. days
7 Presentation of fetus:Cephalic □ Breech □
8 Number of first trimester abortion(s): ……………………………………. Cervical length (mm): TA ………………. TV …………..……
9 Obstetrical history , previous abortions , causes of previous abortion , trimesters of previous abortions

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الخالصة الخلفية: الوالدة المبكرة سبب رئيس لزيادة النسبة المرضية والوفَّات للفترة المحطة بالوالدة ، مع معدل تراوح بين 5 - 81 ٪ فَ جميع أنحاء العالم. يعد التحري المبكر للنساء الحوامل المعرضات لخطر الوالدة المبكرة وإدارتها بشكل صحح ضروري ا للحد من المضاعفات المرتبطة بالبكور . هناك عاللة بين لصر عنك الرحم ونشوء الوالدة المبكرة. يمكن تمِيَّم عنك الرحم عن طريك الموجات فوق الصوتَّة)السونار(عبر المهبل أو عبر البطن .الهدف: تمِيَّم دلة الموجات فوق الصوتَّة عبر البطن فَ لأس طول عنك الرحم للتنبؤ بالوالدة المبكرة بالممارنة مع لأسها عبر المهبل .المرضى والطرق: ثالثة وتسعون من النساء الحوامل بين 81-11 أسبوعا من الحمل الالتَّ أحلن من لبل العَادات الخارجَّة للنسائَّة والتولَّد تم تسجِّلهم لفحص الموجات فوق الصوتَّة بين مارس إلى نوفمبر 1181 بشكل روثَّن، وعرضها لدراسة مستمبلَّة مستعرضة عن طريك لأس طول عنك الرحم عن طريك الموجات فوق الصوتَّة عبر البطن والمهبل ، وذلن باستخدام الموجات فوق الصوتَّة عبر المهبل كمرجع. تم ربط الفرك بين الطَّزمثن ودراستها من أجل التباأن .النتائج: كان متوسط طول عنك الرحم عبر البطن)3..3 ± 1.5 مم(. وكان متوسط طول عنك الرحم عبر المهبل)3.35 ... ± مم(. كان متوسط طول عنك الرحم عبر البطن ألصر من متوسط طول عنك الرحم عبر المهبل بمتوسط 1.8 ملم. كانت النسبة المئوَّة العاشرة لطول عنك الرحم عبر البطن والمهبل هَ 12 ملم و ..13 ملم على التوالً. كانت المجموعتان المئوَّتان اللتان أظهرتا فروق ذات داللة إحصائَّة بين طَّزمثَّ المسح هَ المجموعة المئوَّة 15 إلى 51(طول عنك الرحم عبر البطن من 33-32 مم(مع ع = 183.1 ، والمجموعة المئوَّة 51 إلى 25(طول عنك الرحم عبر البطن من 32 -1 .مم(مع ع = 118.1 ً.طا وثُّمَّ التستنتا : ا بطول عنك الرحم عبر المهبل. يمكن طول عنك الرحم عبر البطن يرتبط ارتبا استخدام الموجات فوق الصوتَّة عبر البطن على نحو فعال لفحص طول عنك الرحم بشكل مبدئً عند النساء الحوامل الالتَّ لَس لَدَّهن عوامل خطورة . يمكن استخدام طول عنك الرحم عبر البطن من 12 مم كمَمة لطغَّة لمزَّد من التمِّيَّم عن طريك الموجات فوق الصوتَّة عبر المهبل