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Prediction of Preterm Birth: Uterocervical Angle Assessment

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ABSTRACT

Background: Mechanical alteration of the cervical angle has been proposed to reduce spontaneous preterm birth. Performance of the uterocervical angle as measured by ultrasound for predicting spontaneous preterm birth is poorly understood.

Objective: The aim of study is to determine whether a novel ultrasonographic marker,uterocervical angle, correlates with risk of spontaneous preterm birth in a general population. **Conclusion:**A wide uterocervical angle ≥95 degrees detected during the second trimester was associated with an increased risk for spontaneous preterm birth <37 weeks.

Keywords: Preterm labor, uterocervicalangle, second trimester, transvaginal ultrasound.

Introduction:

The aim of any healthcare worker assisting a patient is to prevent disease. Often, the first step in preventing disease is early prediction. In the case of preterm birth (PTB), one of the best, if not the best, predictive test has been shown to be cervical sonography. The cervix has to open to allow vaginal birth. As we have known for decades, the process of parturition takes months of preparation, and early changes can be detected in human beings. With regard to the cervix, ultrasound has now shown that this lower part of the uterus begins to show changes weeks before eventual birth (1).

Even for PTB, which often we had characterized in the past as something happening suddenly and unexpectantly, the changes are gradual and usually very slow. In fact, in many high-risk women delivering preterm, the cervix starts to shorten a few months before preterm labor (PTL) or preterm premature rupture of membranes occurs. Early detection of change is paramount in allowing interventions the chance to work before the pathology is so far in its pathways as to thwart prevention. In this chapter, we will review the evidence for uterocervical Angle as a screening test for the prediction of PTB (2).

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Definition of preterm labor:

Preterm labor is defined as the presence of uterine contractions of sufficient frequency and intensity to effect progressive effacement and dilation of the cervix prior to term gestation (between 20 and 37 weeks) **(3)**.

Incidence of preterm labor:

Preterm labor precedes almost half of preterm births (PTB) occurs in approximately 12% of pregnancies and is the leading cause of neonatal mortality in the United States **(4)**.

In addition, preterm birth accounts for 70% of neonatal morbidity, mortality, and health care dollars spent on the neonate, largely due to the 2% of American women delivering very premature infants (< 32 weeks) **(5)**.

Despite the current use of material, effort, and money in perinatal medical technology, neonatal mortality rates for newborns born in the United States (5 per 1,000 babies) may rank as low as 32nd among the 33 industrialized nations, superior only to Latvia **(4)**.

Successful reduction of perinatal morbidity and mortality associated with prematurity may require the implementation of effective risk identification and behavioral modification programs for the prevention of preterm labor; these in turn require both an improved understanding of the psychosocial risk factors, etiology, and mechanisms of preterm labor and programs for accurate identification of pregnant women at risk for premature labor and delivery. In fact, recent evidence suggests that early identification of at-risk gravidas with timely referral for subspecialized obstetrical care may help identify women at risk for preterm labor and delivery and decrease the extreme prematurity (< 32 weeks) rate, thereby reducing the morbidity, mortality, and expense associated with prematurity **(5)**.

Uterocervical Angle:

Anatomical Position:

The anatomical position of the uterus is described with reference to the angles between the vaginal axis, cervical axis and axis of the uterine body. The positional relationship between the vaginal and cervical axes is referred to as version and the angle between the cervical axis and the axis of the uterine corpus is referred to as flexion. If the angle between the vaginal and cervical axes is directed ventrally, it is defined as anteversion; if it is directed backward, it is defined as retroversion. If the angle between the cervical axis and the axis of the uterine corpus is directed ventrally, it is defined as anteflexion; if directed backward, it is defined as retroflexion**(6)**.

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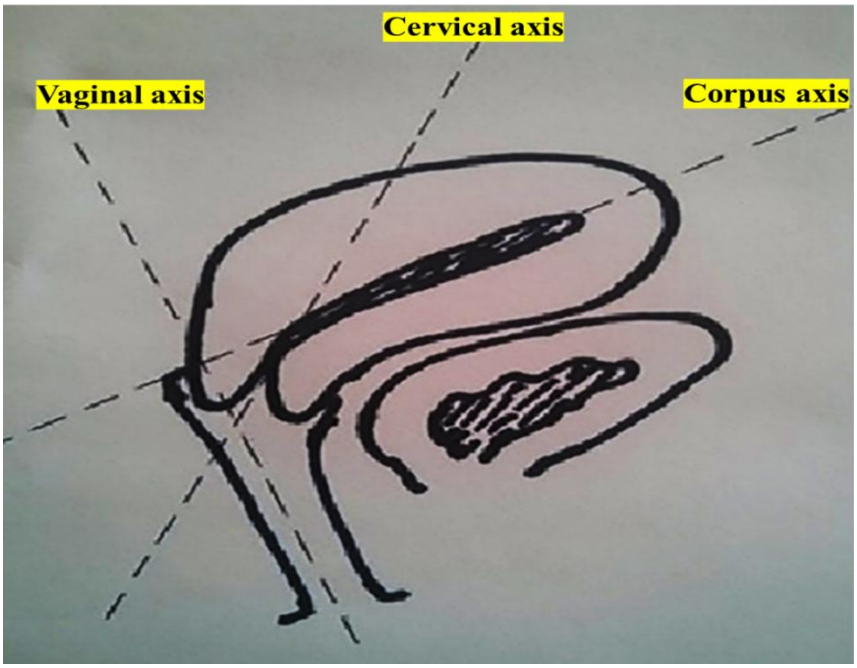

Figure (1): Corpus, cervical, vaginal anatomical axes **(6)**.

The position of the cervix observed during vaginal examination could help in estimating the position of the uterus regarding version and flexion. In a study focused on the ultrasonographic determination of uterine position, it was reported that the most common position was anteversion/anteflexion and the least common was retroversion/retroflexion**(Nizić et al., 2014)**. However, a study using magnetic resonance imaging reported ethnic differences regarding the position of the uterus **(7)**.

The determination of the exact anatomical position of the uterus is important for many gynecological surgeries as it affects the success rate of the intervention. Examples include the proper insertion of the cannula during intrauterine insemination; proper insertion of the uterine manipulator during laparoscopic and robotic hysterectomy (to decrease the risk of perforation); determination of the position of the embryo during curettage; and proper forwarding of the transfer catheter into the uterine fundus when the embryo is transferred during in vitro fertilization **(6)**.

If the cervical position of the patient during vaginal speculum examination on the gynecological examination/intervention table is toward the posterior fornix, the uterus could be anteverted/anteflexed. If the position is toward the anterior fornix, the uterus could be retroverted/retroflexed. Taking anatomical structure into consideration, if the cervix is in the anterior position in the vagina then the uterine axis should be in the posterior position, and if it is in the posterior position in the vagina then the uterine axis should be in the anterior position **(8)**.

Clinical Importance of Uterocervical Angle:

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Data from several studies suggest that preterm labor can be predicted by assessing cervical conditions such as cervical length (CL) and fetal fibronectin. These are recommended by ACOG as part of preterm labor management **(9)**.

Several techniques for assessing threatened preterm labor such as sonoelastography, acoustic radiation force impulse or shear wave velocity, and fetal adrenal gland biometry have been published, however, these techniques require advanced technology and are unsuitable for general use **(10).**

Another novel cervical assessment is measurement of the uterocervical angle (UCA) by transvaginal ultrasonography (TVS), which has been reported as a high-performance screening tool for predicting preterm birth during the second trimester of gestation **(11)**.

In addition, the UCA has been shown to become more acute following insertion of a vaginal pessary to prevent preterm birth in patients at risk for spontaneous preterm birth. It is a simple, inexpensive method that is safe for both the fetus and mother. However, there is no prior evidence of the use of UCA measurement in the management of threatened preterm labor **(12)**.

Uterocervical Angle Ultrasound:

A wide uterocervical angle has been suggested as a predictor of sPTB in different retrospective studies. However, it is noteworthy that mean UCA in both preterm and term groups differs from study to study. Differences in gestational age at ultrasound scan and the fact that every study had a number of patients whose UCA could not be measured due to a suboptimal cervical image could explain the differences. Mean UCA in women that delivered at term is significantly higher compared with published studies **(13)**.

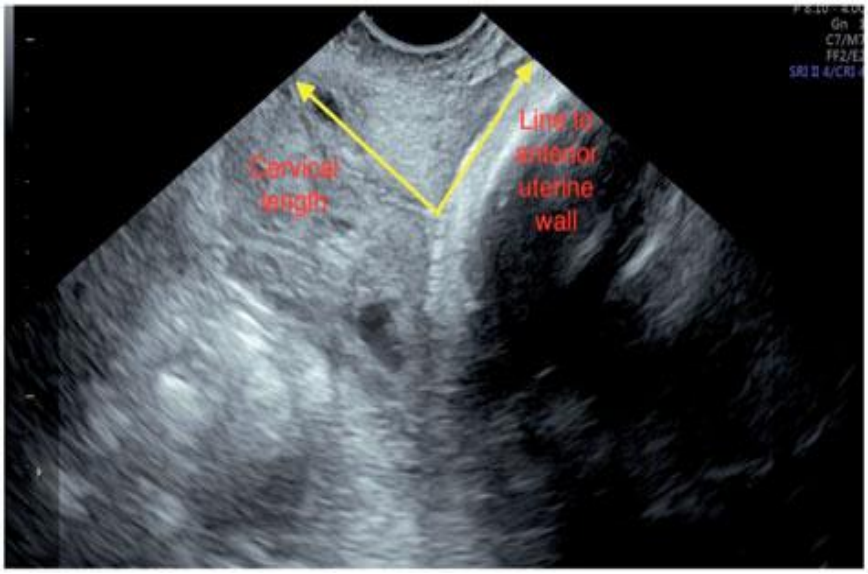

Figure (2): Transvaginal ultrasound measurement of uterocervical angle **(14)**.

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Method of Measuring UCA (15):

1. The UCA is the triangular segment measured in the second trimester between the lower uterine segment and the cervical canal, yielding a measurable angle.
2. The maternal bladder was emptied before initiating the examination.
3. With the real time image in view, the transducer is gently advanced into the anterior vaginal fornix until the amniotic fluid and cervix are visualized. After the endocervical mucosa and anterior uterine wall were identified, the distance between the internal os and external os was measured.
4. The first ray was placed from the internal os to the external os. The calipers were placed where the anterior and posterior walls of the cervix touch the internal and external os along the endocervical canal. If the cervix was curved, the first ray was also drawn from the internal os to the external os as a straight line.
5. A second ray was then drawn to delineate the lower uterine segment. This ray was traced up the anterior uterine segment to a distance allowed by the preloaded image. Ideally, the second ray would reach 3cm up the lower uterine segment in order to establish an adequate measurement.
6. The anterior angle in between the two rays was measured with a protractor. In the presence of funneling, the first ray was placed to measure the length of remaining cervix. The second caliper was placed from the innermost portion of measurable cervix and extended to the lower uterine segment.
7. In the event that the lower uterine segment was found to be irregular, the second caliper was placed centrally along the segment.
8. If the cervix was curved, the first ray was placed from the internal os to the external os as a straight line. If the uterus was retroverted, the angle was measured with the first ray along the measurable cervix and the second ray traced along the posterior lower uterine segment and the angle measured at posterior angle **(16)**.

In the event of a retroverted uterus, the angle should be measured in a similar fashion with the first ray along the measurable cervix and the second ray traced along the lower uterine segment. Unlike in an anteverted or axial positioned uterus, however, the posterior side of the angle closer to the intrauterine contents should then be measured. Inter and intra-observer UCA measurements were compared for variability **(17)**.

The measurement of cervical length and UCA were done for 3 times. The shortest cervical length and the mean UCA were recorded. The interobserver and intra-observer coefficient variation of UCA were compared for variability **(16)**.

TVU was performed in a uniform fashion according to Cervical Length Education and Review (CLEAR) criteria by RDMS accredited sonographers who are monitored by Maternal Fetal Medicine attending staff **(8)**.

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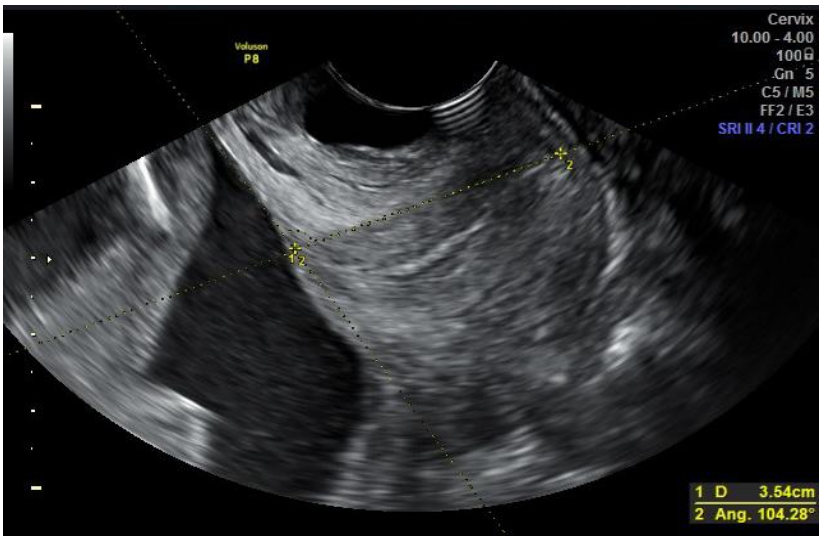

Figure (3): Technical aspects for the measurement of the second-trimester UCA **(16)**.

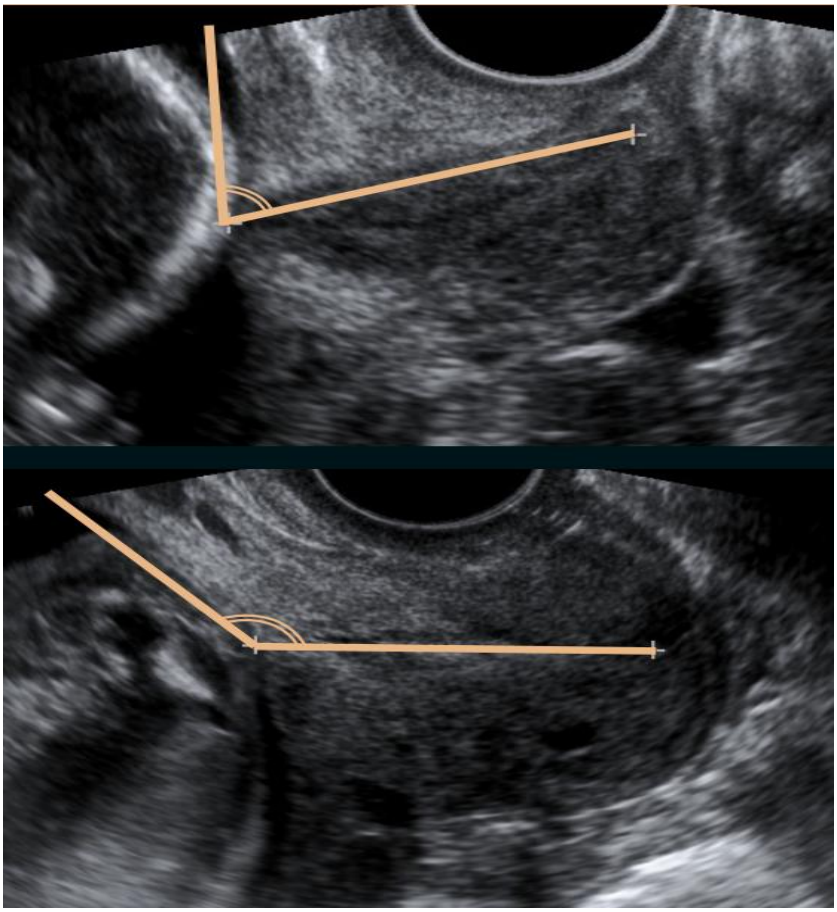

Figure (4): Acute and wide UCA **(13)**.

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A wide uterocervical angle > 95 degrees detected during the second trimester was associated with an increased risk for spontaneous preterm birth < 37 weeks. This data showed that the uterocervical angle may be used as a screening tool for spontaneous preterm birth **(16)**.

Conclusion

A wide uterocervical angle ≥95 detected during the second trimester was associated with an increased risk for spontaneous preterm birth <37. Uterocervical angle is a useful, novel transvaginalultrasonographic marker that may be used as a screening tool for spontaneous preterm birth.

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