ASSESSMENT OF CERVICAL LENGTH IN SECOND TRIMESTER TO PREDICT PRETERM LABOUR

DISSERTATION SUBMITTED IN FULFILLMENT OF THE

REGULATIONS FOR THE AWARD OF

M.D.OBSTETRICS AND GYNAECOLOGY

DEPARTMENT OF OBSTETRICS AND GYNAECOLOGY

PSG INSTITUTE OF MEDICAL SCIENCES & RESEARCH

THE TAMILNADU DR.M.G.R.MEDICAL UNIVERSITY

GUINDY,CHENNAI, TAMIL NADU,INDIA

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DEEPA CHRISTY.

INTRODUCTION

1. INTRODUCTION

Preterm labour is an important problem associated with high perinatal mortality and morbidity. It is defined as the onset of labour in patients before 37 weeks. Strategies for reducing the incidence of preterm labour and delivery have focused on educating both physicians and patients about the risks for preterm labour and methods of predicting and predicting preterm labour.

Early detection of pregnant women who will deliver before term has been sought as an avenue to reduce the occurrence of prematurity-related perinatal morbidity. Preterm birth is associated with 75% of perinatal morbidity and mortality for infants born without congenital anomalies. The rates of preterm birth have actually increased in recent years despite widespread efforts to address the problem. About 40% of preterm birth occur due to preterm labour and 35% result from preterm pre labour rupture of membranes. The remaining 25% are due to medical or obstetric conditions such as hypertension, antenatal hemorrhage or IUGR.

The incidence of preterm labour varies between 8 to 10%. The major causes of preterm labour are placenta previa, abruptio placenta, chorioamnionitis, immunological, cervical incompetence (16%), uterine anomalies, maternal illness, trauma, fetal anomalies and for reasons unknown. Despite advances in medicine, the accurate prediction, prophylaxis and management of preterm labour has remained a challenge for every obstetrician. Preterm birth is a leading cause of perinatal mortality in India. Though survival has improved with sophisticated neonatal care, the cost of therapy may not be affordable. In addition, survivors of extreme prematurity still face considerable long term morbidity in later life.

Diagnosing early preterm labour is difficult and has a high false positive

rate. False diagnosis of preterm labour have resulted in unnecessary and potentially hazardous treatment for thousands of women. Improved methods of early diagnosis would be a significant advance in the treatment of women at risk for preterm labour.

The Cervix in Pregnancy

Throughout the pregnancy, the cervix is closed and non compliant and acts to maintain the concepts within the uterine cavity. With the onset of cervical ripening, it is converted into a compliant and easily dilating structure that allows the uterine contractions to effect the transport of the fetus through the birth canal without the cervix undergoing inversible changes that may compromise its function in any future pregnancy.

The present management of preterm labour relies on the administration of tocolytics while ignoring the associated cervical changes. These tocolytic agents are currently effective in achieving a limited delay before delivery. Perhaps treatment aimed at halting premature cervical repining will result in significant prolongation in pregnancy, thereby reducing the perinatal morbidity and mortality associated with preterm delivery.

Most of the data pertaining to the prediction of preterm labour have focused on myometrial contractility. It has been suggested that more emphasis should be placed on the role of the cervix in preterm birth with increased knowledge of these mechanisms and the pathology that triggers them, the more likely we are to develop etiologically based prevention and treatment strategies.

Signs and Symptoms

In addition to painful or painless uterine contractions, symptoms such as pelvic pressure, menstrual like cramps, watery or bloody vaginal discharge and pain in the low back are being associated with impending preterm birth.

The importance of these signs and symptoms has been emphasized by some investigators (Iams & ass.1990). In a follow up of their study they found that these signs and symptoms signaling preterm labour appeared within 24hrs of onset of preterm labour. Thus, these are late warning signs of preterm labour.

Predictors of Preterm Birth

1. USG Examination of the Cervix

There is fair evidence that transvaginal ultrasound assessment of the cervical length will improve the identification of those women at increased risk of preterm birth.

It has been recently shown that transvaginal sonography is an objective, reproducible and reliable method to assess the cervix and predict the risk of preterm delivery in high and low risk pregnancies. Assessment of the cervix includes cervical length measurement (CLM) and presence or absence of funneling in a dynamic functional examination. There is an increased correlation between cervical length and the pregnancy of preterm delivery. The high negative predictive value avoids unnecessary interventions such as tocolysis or cerclage. From large observational studies in low risk populations we know that the 50th percentile of cervical length is 35mm at 24 weeks of gestation.

Advantages of CLM as a screening test include the fact that sonographical assessment of the cervix is a widely accepted and well standardized method, which requires only a relatively short period of training.

Disadvantages of screening are two factors, the first being the low sensitivity of the test and the low prevalence of preterm deliveries in a low-risk population. Secondly screening is worthwhile if an effective preventive therapy is available.

2. Oncofetal Fibronectin Identification in Cervico-Vaginal Secretions

Fibronectin is a glycoprotein concentrated in the amniotic fluid and the extra-villous tropho-decidual interface. The substance is expressed in cervico-vaginal secretions during the first 20 weeks of pregnancy, disappears from the secretions after this period and does not normally reappear until spontaneous rupture of membranes at term. Lock wood (1991) and co-workers reported that the presence of fetal fibronectin as a predictor for preterm delivery before 37 weeks had a sensitivity of 92.6% and a specificity of 51.7%,a positive predictive value of 46.3% and a negative predictive value of 93.9%.

Why do we need to predict preterm birth?

-Use of predictors does not reduce preterm birth

-Use of predictors allows appropriate triage of woman at clinical risk

- Avoid potentially harmful treatment if unnecessary

- Concentrate resources on those at true risk

Fetal fibronectin or cervical length?

-Approximate equal positive predictive value, equal and excellent negative predictive value

-Suggestive that combined they increased predictive value.

3. Screening for Abnormal Genital Tract Colonization:

There is now undeniable evidence that infection is a cause for preterm labour. In this way it would seen appropriate to investigate whether the presence of bacterial vaginosis in early pregnancy is a useful indicator of subsequent preterm labour and delivery.

4. Biochemical Markers

Biochemical markers in maternal blood have been evaluated for the prediction of preterm labour. These include serum collagenase, plasma corticotrophin releasing hormone, serum tissue inhibitor of metallo – proteinases and serum relaxin. Other biochemical markers have been evaluated in maternal saliva, the value of increased salivary estriol to progesterone ratio as a possible predictor for preterm labour.

This study analyses the correlation between the cervical length in the second trimester and preterm deliveries in low risk patients. Transvaginal ultrasonography has recently been shown to be an objective, reproducible and reliable method to assess the cervix in high and low risk pregnancies.

The application of transvaginal ultrasonography cervical sonography has recently merged from a recommendation by the American College of Radiology that the cervix and lower uterine segment be imaged as part of every obstetric examination in the second trimester. The American College of Radiology used 30mm as the threshold for reassurance. When a cervical length of <25mm or less is obtained, it may be appropriate to obtain a foetal fibronectin. Despite the poor sensitivity of both tests alone, the positive predictive value for preterm labour <35 weeks was 50% when asymptomatic low risk women had a positive fibronectin and a cervical length of <25mm.

In the absence of data about how to manage these patients, education about the signs and symptoms of preterm labour, more frequent visits and consideration of antenatal steroids seems reasonable.

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

Morphology of the Uterine Cervix

The cervix is the cylindrical portion of the uterus, which enters the vagina and lies at right angles to it. It measures between 2 to 4 cm long. Its point of juncture with the uterus is marked by a constriction of the lumen called the isthmus. The cervical canal extends from the internal os, where its joins the uterine cavity to the external os which projects into the vaginal vault. The isthmus is taken up into the uterine body to form the lower uterine segment in late pregnancy.

Many of these anatomic features are seen on transvaginal ultrasound. In the pregnant state, the internal os is identified with the amniotic membrane or presenting part first superior to it. The cervical canal is surrounded by a hyperechoic or hypoechoic area after 31 weeks of gestation gradually. Its lack of detection, which is associated with cervical opening may be another marker for preterm labour sonographically.

Sonography of the Cervix in Pregnancy

Sonographic evaluation of the uterine cervix began in the 1970's and development of the transvaginal probe a decade later improved its accuracy and diagnostic value. This resulted in widespread illustration of the procedure.

The diagnosis of preterm labour is based on findings of cervical dilatation or effacement by digital examination. However, obstetricians may be reluctant to rely solely on the digital examination. Studies report a high inter- observer variability in digital assessment of cervical effacement and dilatation. The main

drawback of the examining finger is its inability to evaluate the supra-vaginal region. The subtle early changes are difficult to detect on digital examination and may be perceived as only “softness” even to an experienced examiner.

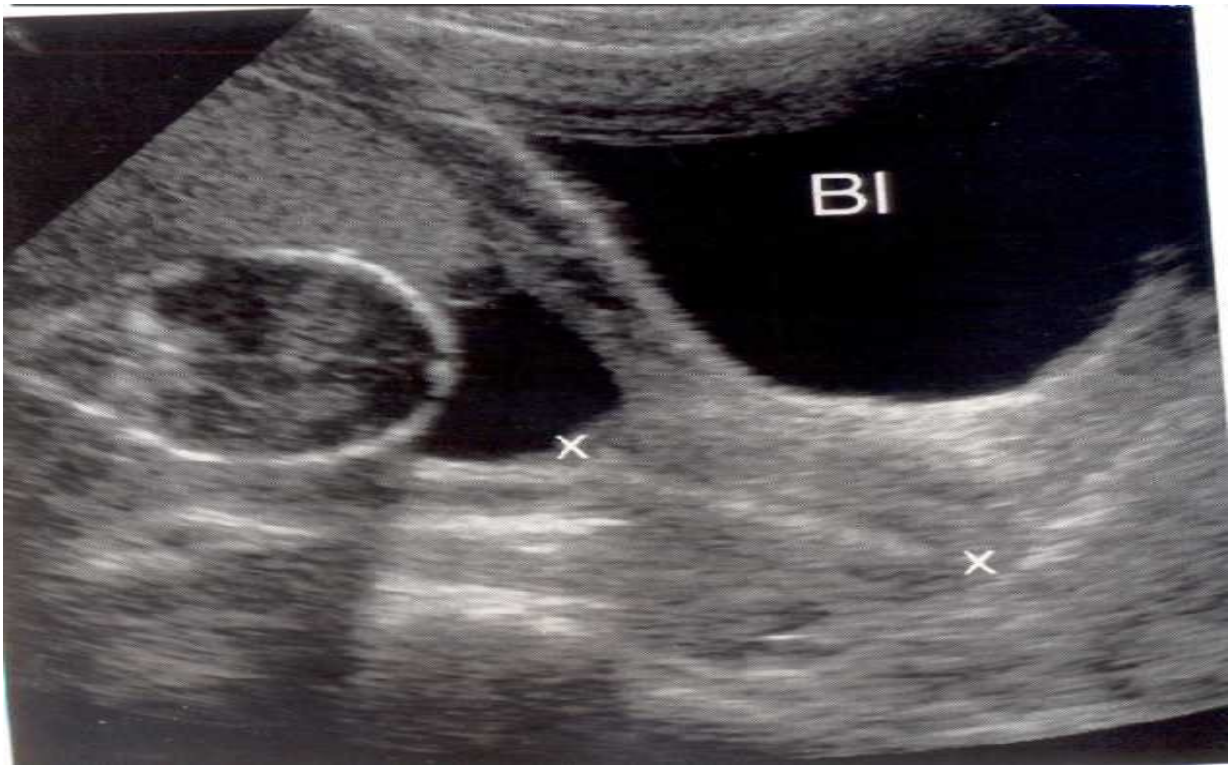
The limitations of these subjective evaluations led to the use of sonography as potentially more objective for examination of the cervix. Several investigators showed that cervical measurements obtained by sonography are longer by 10 to 21mm compared with digital examination. Mahony *et al* noted that 1.5cm cervix measured by translabial sonography is equivalent to 50% effacement and a 1cm long cervix is approximately 75% effaced. In general, decreasing cervical length corresponds to increasing effacement. (by %)

Cervical length is the between the internal os and the external os measured with electronic calipers. Cervical length varies by modalities used, cervical length is longest if obtained transabdominally and is directly related by to bladder fullness.

Several studies described cervical length by transabdominal ultrasonography (mean 3.2 to 5.3cm), transvaginal sonography (mean 3.2 to 4.8cm) and transperineal sonography (mean 2.9 to 3.5cm).

Difference Between the 3 Techniques

- Trans abdominal sonography
- Trans vaginal sonography
- Translabial sonography (transperineal)



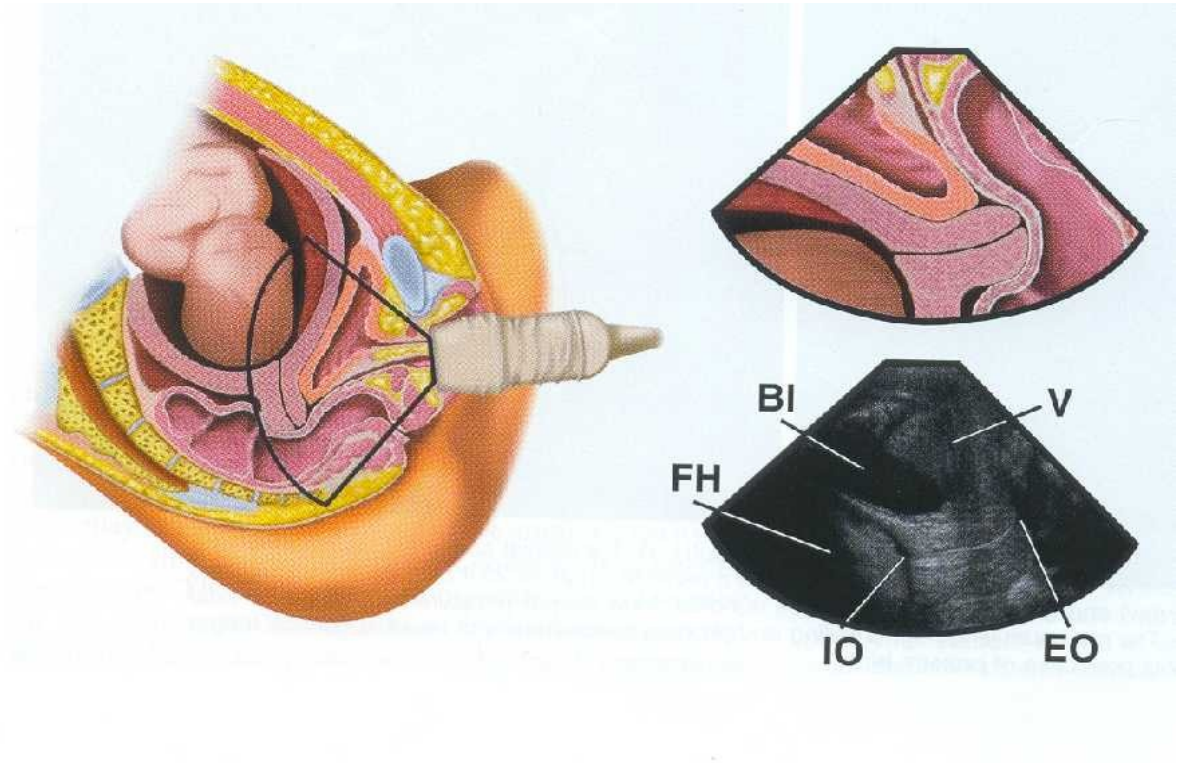
Uterine cervix as seen by transabdominal sonography. A full bladder assists in visualization of the cervix. Caliper measurement indicates cervical length (Bl, Bladder).

1. Transabdominal Sonography

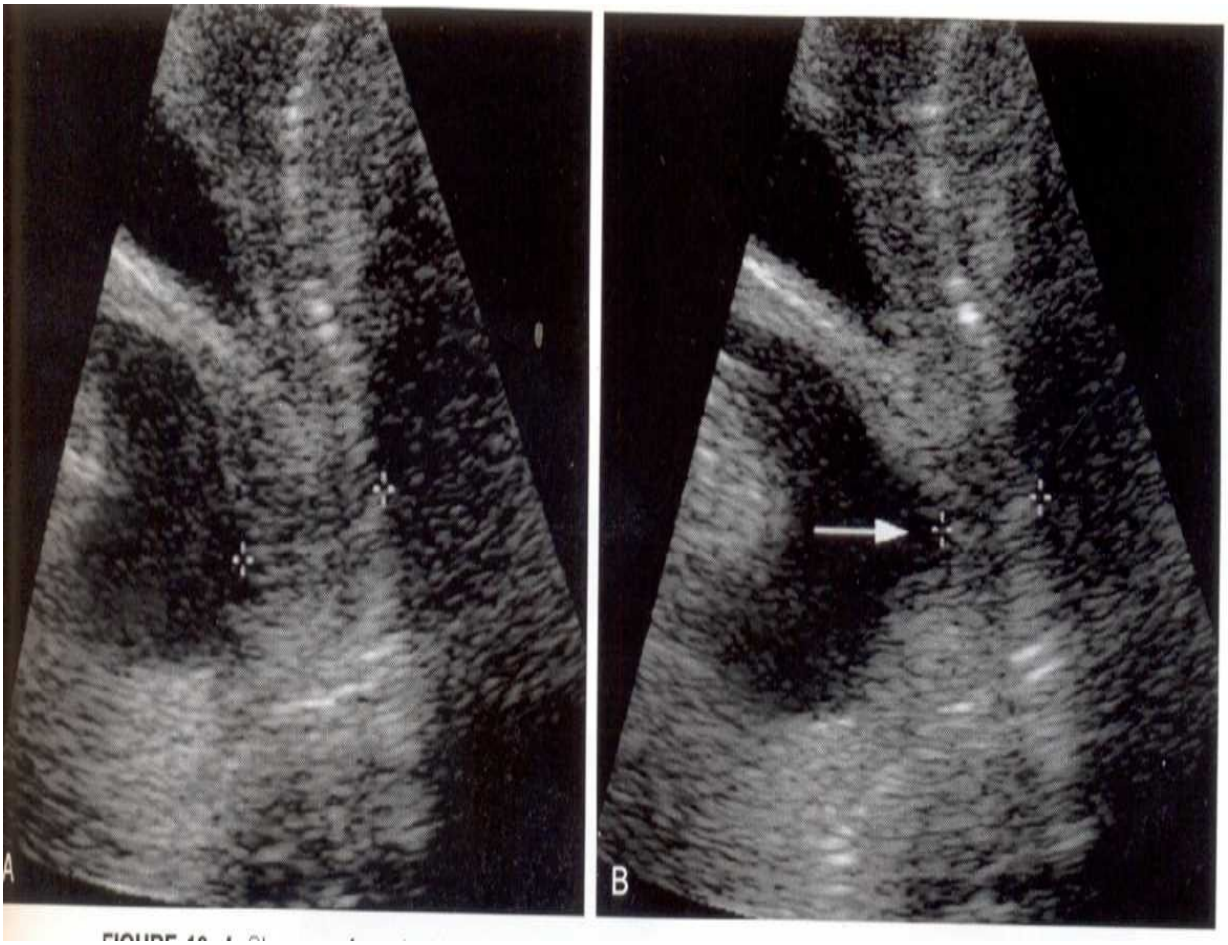
With transvaginal ultrasonography, the uterine cervix is best visualised when the bladder is full because this provides an acoustic window. Visualization is achieved in 86% of patients with a full bladder and is reduced to 46% with partial bladder fullness. Although full bladder is needed for adequate visualisation of cervix, an over distended bladder falsely increases cervical length by compressing the lower segment. In addition, this over distended bladder may create false funneling.

Pitfalls with TAS

1. Position of cervix
2. Maternal habitis
3. Overdistention of maternal bladder
4. Foetal presenting part all of which obscure visualisation of cervix.



Diagrams and translabial sonogram of the female pelvis showing the transducer placed at the vaginal introitus and oriented in the direction of the vaginal (Bl, bladder; FH, fetal head; V, vagina; IO, internal os; EO, external os). (illustration by James A. Cooper, M.D., San Diego, CA).



Changes of cervical length during sonography. A – Translabial sonogram demonstrating a slightly shortened cervix with a caliper measurement with a cervical length of 26.4mm.

Translabial Sonography

Translabial approach is well tolerated by the patient. Partial bladder fullness assists visualisation of the cervix. Kirtzman *et al* showed a good correlation between cervical length measurements obtained using transvaginal & transperineal methods. However, they also observed that transperineal sonography was technically more challenging.

Rectal gas, which obscures the region of the external os, may cause a falsely short measurement of cervical length. This can be overcome by elevation of hips, better application of transducer on the perineum, or changes in the orientation of the probe. When these maneuvers fail transvaginal ultrasonography is the next alternative.

Nevertheless, compared with a nearly 100% visualisation using transvaginal sonography, the cervix is adequately visualised in 90 to 95% of cases.

Pitfalls of Translabial Ultrasound

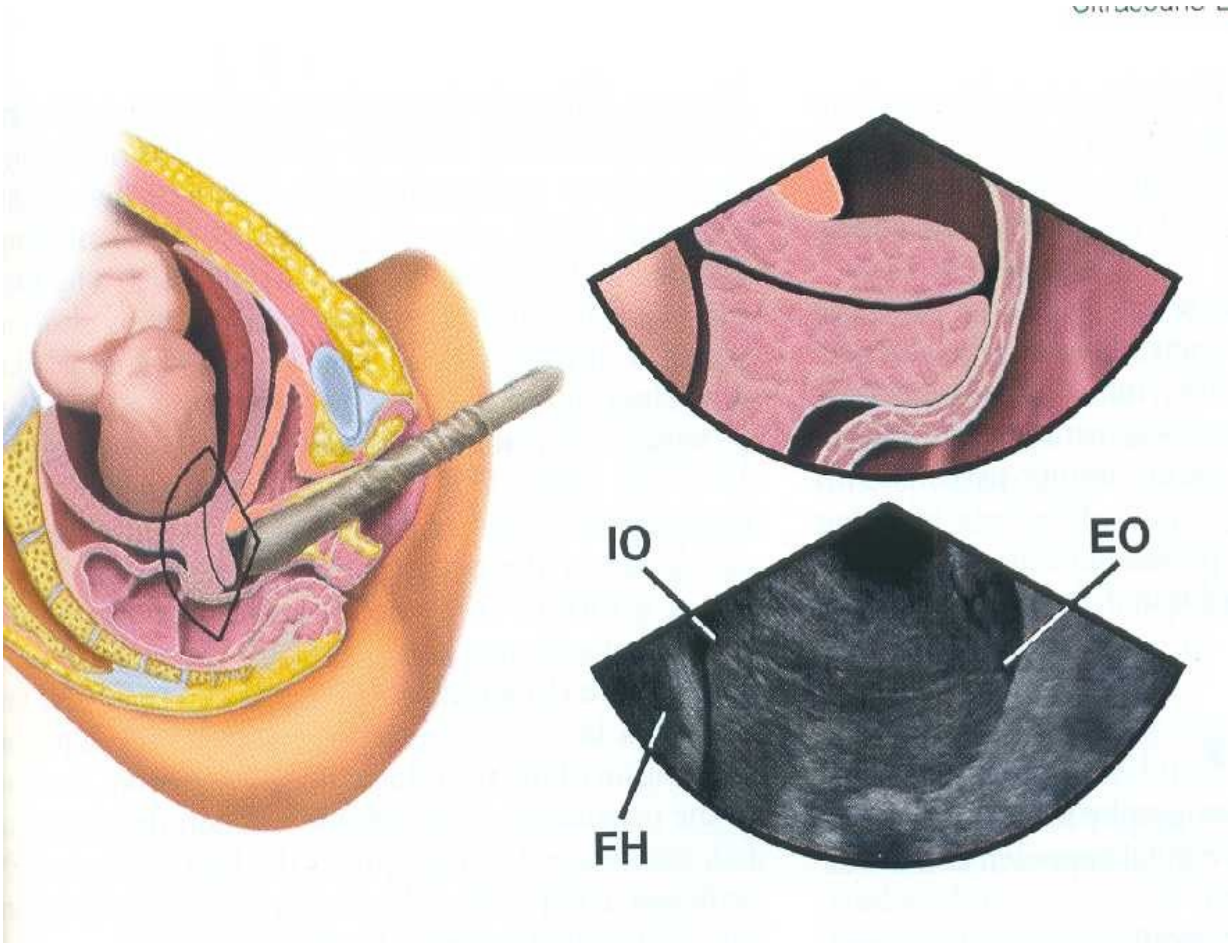
- technical factors
- full bladder and fluid in the vaginal vault mistaken for the cervix
- poor penetration or too small field of view
- scan angle
- bowel gas, cervical cysts, perivervical veins

Transvaginal Sonography

Transvaginal sonography provides a very clear picture of the cervix in nearly all cases. The acceptability rates among patients is high, more than 90% report either none or only mild discomfort or embarrassment during the

procedure. It is an objective, reproducible and reliable method to assess & predict the risk of preterm delivery.

Endovaginal cervical length measurement in routine anatomic surveys allows us to more clearly visualize foetal intra-cranial anatomy and lumbosacral spine and diagnose placenta previa more accurately.



Diagrams and sonogram of the female pelvis demonstrating placement of the transvaginal transducer in the vagina (IO, internal os; EO, external os; FH, fetal head). (Illustration by James A. Cooper, M.D., San Diego, CA) B. Uterine cervix as seen by transvaginal sonography.

Limitations of TVS

-A poorly developed lower uterine segment

-Polyps fibroids obscuring the internal

-Excessive pressure on the vaginal probe

-Failure to empty the maternal bladder are associated with false measurements.

Guidelines for TVS Cervical Length Measurements

> 35mm - normal

< 30mm - at risk for preterm labour os

< 20mm - high risk

To reduce the inter-observer variability and improve reproduceability of cervical length measurements using transvaginal ultrasound, the following conditions are suggested.

1. The internal os is often visualised as a flat dimple or an isosceles triangle.
2. The whole length of the cervix is visualised.
3. The external os appears symmetric
4. The distance from the surface of the posterior lip to the cervical canal is equal to the distance from the surface of the anterior lip to the cervical canal.

These conditions, when met, ensure visualisation of the entire cervix and placement of only minimal pressure on the cervix by the transducer (which may falsely increase cervical length and create false funneling using these guidelines, the inter observer variability decreased from 3.04 to 1.24.

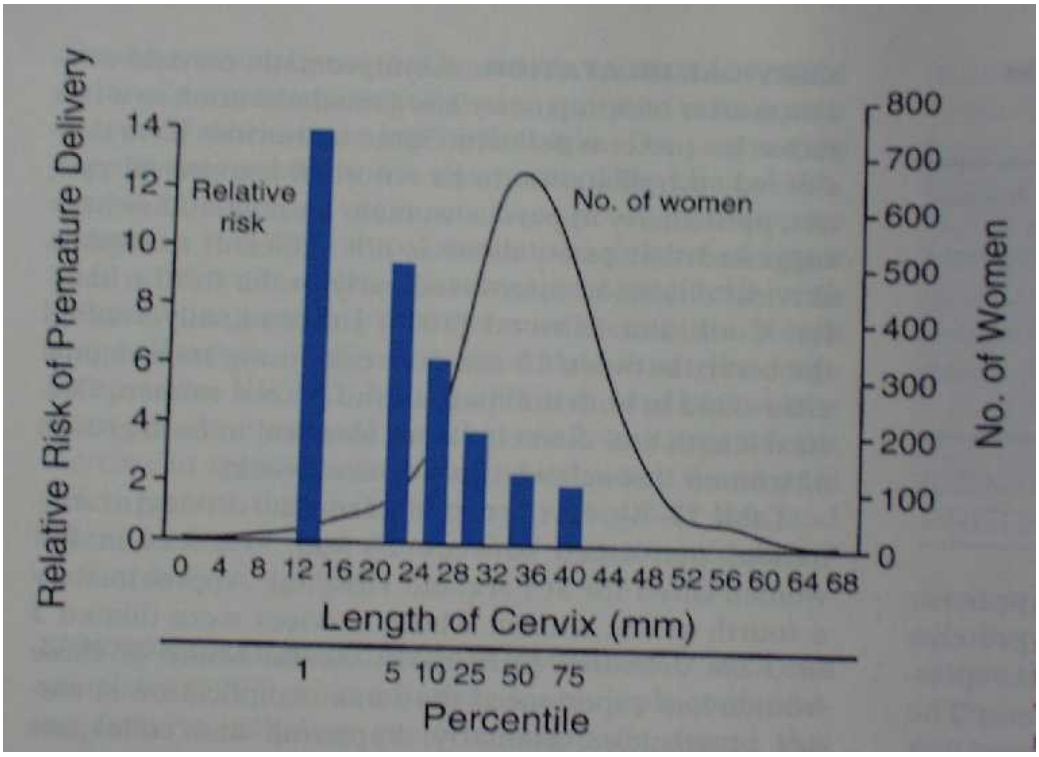
Iams et al (1990) used vaginal ultrasonography to measure the length of the cervix and also documented the incidence of spontaneous delivery before 35 weeks gestation. They examined 2915 women at approximately 24 weeks of

gestation.

They examined 2915 women at approximately 24 weeks of gestation and 2531 of these women again at approximately 28 weeks. Spontaneous preterm delivery (at less than 35 weeks) occurred in 126 of the women (4.3 percent) examined at 24 weeks. The length of the cervix was normally distributed at 24 and 28 weeks (mean [+/- SD], 35.2 +/- 8.3 mm and 33.7 +/- mm, respectively).

The relative risk of preterm delivery increased as the length of the cervix decreased. When women with shorter cervixes at 24 weeks were compared with women with values above the 75th percentile, the relative risks of preterm delivery among the women with shorter cervixes were as follows: 1.98 for cervical lengths at or below the 75th percentile (40mm), 2.35 for lengths at or below the 50th percentile (35mm), 3.79 for lengths at or below the 25th percentile (30mm), 6.19 for lengths at or below the 10th percentile (26mm), 9.49 for lengths at or below the 5th percentile (22mm), and 13.99 for lengths at or below the 1st percentile (13mm) ($P<0.001$ for values at or below the 50th percentile). The risk of spontaneous preterm delivery is increased in women who are found to have a short cervix by vaginal ultrasonography during pregnancy.

Shows the distribution of subjects among the different percentiles and relative risk for spontaneous preterm birth.



Distribution of subjects among percentiles for cervical length measured by transvaginal ultrasonography at 24 weeks' gestation (solid line) and relative risk of spontaneous preterm delivery before 35 weeks gestation according to percentiles for cervical length (bars). The length of the cervix and risk of spontaneous preterm delivery. *N Engl J Med 196; 334: 567-72*.

An inverse relationship between cervical length measurement and relative risk of preterm birth was demonstrated. Using receiver operator curves, three potential thresholds values for clinical use were identified. 30mm, 25mm and 20mm.

Variable	**≤ 20mm**	**< 25mm**	**< 30mm**
Sensitivity	23%	37.2%	54%
Specificity	97%	92.2%	76%
Positive predictive value	25.7%	17.8%	93%
Negative predictive value	96.5%	97%	97.4%

The rate of spontaneous delivery before 35weeks was 4.3% among female examined at 24wks. The tenth percentile cervical length measurement at 24weeks was found to be 25mm and this increased the risk for preterm delivery six fold. Although a cervical length measurement of 25mm had only an 18% positive predictive value, this measurement has subsequently been used as a benchmark of short cervical length in second trimester in many studies.

Why is the Cervix Short?

The length of the cervical canal measured by USG in the second and early third trimester ranges from 10 to 50mm, the median length is 35mm, the length percentile is 25mm and the 90th percentile is 45mm. the risk of spontaneous preterm birth increases as the length of the cervix decreases across the entire range of cervical length. A cervix length of <25mm at 22-24 weeks is associated with a six fold increase in preterm birth before 35 weeks relative to women whose cervical length is above the 75th percentile.

Some of the range of cervical length is thought to be simply biologic. In other cases, women may experience early effacement as a result of inflammation due to hemorrhage, infections, or less commonly due to biophysical effects of uterine distention or subclinical contractions.

1. Physical Factors

A. Biological variation

1) Absolute versus relative insufficiency
2) Cervical function insufficient to carry a singleton pregnancy to 32 weeks but not to term

a) Cervical function insufficient to carry a singleton pregnancy to 32 weeks but not to term
b) Cervical function insufficient to carry a singleton pregnancy to 24 weeks, that is the lower most end of a bell curve of cervical performance.

B. Uterine Volume:

a) Multiple gestation, especially higher order

C. Cervical Injury

a) Obstetric laceration
b) Gynaecological conditions: conisation, laser or LEEP

D. Contractions

2. Biochemical Factors

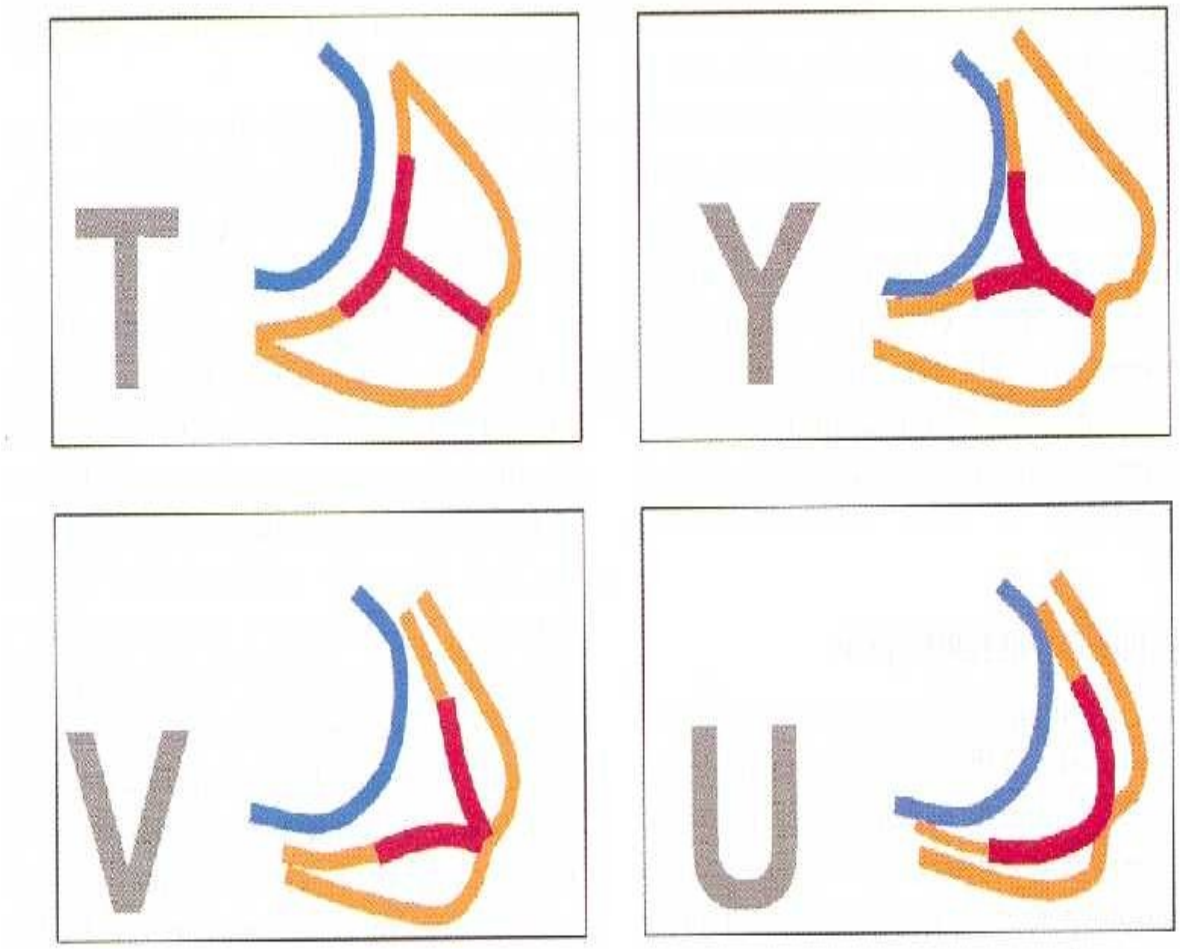
a) Infection

b) Decidual hemorrhage

c) Role of genetic polymorphisms

In a low-risk population endovaginal cervical ultrasonography helps rule out a preterm delivery if cervical length is long enough. It can also detect cervical incompetence. In a high-risk population, women whose cervix is longer than 30 millimeters can be identified. These women have over 80% chance to deliver on or after 36 weeks of pregnancy.

Preliminary studies suggest that performing an endovaginal ultrasonography could decrease the number of false positive clinical diagnosis of modified cervix and thus, save long, expensive and inefficient hospital stays.



Schemata to display the process of cervical as it proceeds from the internal os, caudad toward the external os, as seen on transvaginal sonography. The letters T, Y, V and U depict the relationship between the lower uterine segment and the cervical canal. *(Zillianti M, Azuaga A, Calderon F, et al. J Ultrasound Med 19.*

Heath VC *et al (1998)*: stated that cervical length at 23 weeks is <or =15min in <2% of the populations; this group contains about 90% and 60% of the women delivering at <or =28 and <or 32 weeks, respectively. Measurement of cervical length provides accurate prediction of risk for early preterm delivery.

Transvaginal ultrasound measurement of the cervix is increasingly used for the prediction of preterm labour. In comparison to clinical vaginal examination, it has the advantages of being highly reproducible, with a low inter-

observer variability, and of offering an evaluation of the entire cervical canal, including the internal os. The sensitivity and specificity of transvaginal ultrasound have been validated by several studies in women with symptoms of preterm labour, however its clinical applications and its limits have yet to be fully determined.

Hertzberg *et al., (1995)* assessed the spontaneously changing gravid cervix its clinical implications and prognostic features. Sonograms in 27 pregnant patient with a spontaneously changing cervix were studied prospectively. The length and width of cervical funneling and the length of intact cervix caudal to the funneling were measured when the cervical dimensions were most normal and most abnormal.

Sonographic measurements were correlated with clinical and delivery data. Twenty patients delivered preterm, although only six delivered within a week of the ultrasound examination. Wider funneling of the internal os and a shorter segment of intact cervix caudal to the funneling both correlated with an increased likelihood of preterm delivery.

Most patients with a spontaneously changing cervix deliver preterm. Measurements obtained when the cervix appears most abnormal are most predictive of early delivery.

Is a study done by Watson *et al., (1999)* There was a positive association between a short cervix and increased risk of preterm birth ($F=13.3$, $P<.0001$). The variable with the highest predictive value for preterm birth was the cervical length at 24 weeks gestation. Changes over time did not substantially improve the predictive accuracy for spontaneous preterm birth.

We conclude that a short cervix as determined by endovaginal sonography has a significant association with preterm birth in a high-risk obstetric population. Measurements taken at 24 weeks gestation are most

accurate in assessing this risk, and serial observations of the cervix over time have less accuracy for predicting preterm birth.

Taipale *et al., (1998)* stated that despite much research, little progress has been made in timely identification of the mothers at risk. He examined the uterine cervix with ultrasonography to discover whether such a procedure would be helpful in determining which women will deliver prematurely.

He performed transvaginal ultrasound examinations in addition to routine transabdominal ultrasonography at 18 to 22 weeks gestation in 3694 consecutive pregnant women with live singleton fetuses. He measured the length of the uterine cervix and evaluated the dilatation, if any, of the internal os. The results of cervical ultrasonography were not available to the clinicians. Spontaneous delivery occurred before 37 completed weeks in 88 women (2.4%) and before 35 weeks in 31 (0.8%). The relative risk of delivery risk of delivery before 35 weeks was 8 (95% confidence interval 12,67).

Transvaginal ultrasonography performed as an addition to routine transabdominal ultrasonography at 18 to 22 weeks helps to identify many patients at significant risk for prematurity; however, low sensitivity and low positive predictive value limit its usefulness in screening low-risk obstetric populations.

Fukami *et al., (2003)* Numerous reports have examined the relationship between sonographically determined cervical length and spontaneous preterm birth. Moreover, large screening studies have consistently demonstrated that the shorter the cervical length, the higher the rate of spontaneous preterm delivery. However, the sensitivity and positive predictive value of the cervical length for detecting preterm birth were low. Subsequently, developed a new sonographic cervical findings (shortened cervical length or absence of cervical glandular area) at 16-19 weeks gestation could predict spontaneous preterm birth. The absence of CGA as compared to the shortened cervical length showed a higher

sensitivity (75.0% vs. 50.0%) and a significantly elevated positive predictive value (54.5% vs 8.3%) for preterm birth before 32 weeks gestation. It was concluded that the absence of CGA was a novel and useful sonographic parameter for predicting early spontaneous preterm birth.

In addition to primary predictors of preterm birth which are used to estimate the baseline risk of preterm birth, secondary predictors (based on examinations done during the current pregnancy) allow a more accurate assessment of the risk of preterm birth in individual women. Screening for early signs of spontaneous preterm labour has always been an important topic in obstetric care. During the last two decades, the detection of fetal fibronectin (FFN) from cervicovaginal secretions and cervical shortening diagnosed by transvaginal ultrasonography have emerged as the major secondary predictors of preterm birth.

Both markers have been extensively studied and consistently shown to be strong short term predictors of preterm birth across a wide range of gestational ages. Other secondary predictors that confirm the role of intrauterine infection in the pathogenesis of preterm birth are bacterial vaginosis (BV) and elevated levels of interleukin (IL)-6, IL-8, ferritin and granulocyte colony-stimulating factor. Apart from bacterial vaginosis, inflammatory markers are still not routinely used.

The sensitivity of single markers in predicting preterm birth is only moderate and serial examinations of markers, combinations of different markers and multiple marker tests have been studied, with limited results. Studies of interventions in order to prevent preterm birth have also yielded mixed benefits, as a consequence of which the use of these markers to screen low risk pregnancies is generally not recommended.

Several investigators have attempted to used cervical length in asymptomatic women to predict preterm delivery. Conoscenti *et al.,* (2003) prospectively followed 2469 women and found that cervical length at 13 to 15

weeks gestation was not different in women who delivered term and preterm.

Carvalho *et al., (2003)* conducted a prospective study involving 529 pregnant women attending for routine antenatal care who underwent transvaginal scan at 11 to 14 weeks and 22-24 weeks for evaluation of cervical length. The mean cervical length was calculated at both steps of gestation and lengths were compared between groups which delivered at term and prematurely. (<37weeks).

The mean cervical lengths were 42.4mm and 38.6mm at 11 to 14 weeks. Cervical length at 11 to 14weeks was not significantly different between the groups who delivered at term (42+mm) and preterm (40.6mm). However, at 22-24weeks evaluation, cervical length was significantly shorter in the group which had a preterm delivery (26.7mm) and term (39.3mm). So he concluded that there is a spontaneous shortening of the pregnant cervix from the first to the second trimester of pregnancy.

Many studies have evaluated second trimester assessment of cervical length as a predictor of preterm delivery. Goldenberg *et al* conducted Preterm Prediction Study With The Maternal Fetal Medicine from 1993 to 1996.

They assessed about 3000 women for risk factors, biophysical characteristics and biochemical tests that might be predictive of preterm delivery. Using a cervical length of 25mm as the definition of short cervix (24 to 30wks), positive fetal fibronectin was the strongest predictor of preterm birth followed by short cervix.

Among non-gravid women Jackson *et al* reported that transvaginal and transabdominal ultrasound measurements of the cervix agreed closely with anatomic measurements, whereas digital examination underestimated the cervical length by an average of 13.6mm.

Screening for preterm birth risk using cervix measurement

STUDY	N	CL	GA	S	SP	PPV	NPV
Anderson *et al.* 1990	178	≤ 34	30	47	84	34.8	89.9
Tongsong *et al.* 1995	71	≤ 35	28.30	65.9	62.4	-	-
Iams *et al.* 1996	2915	≤ 20 ≤ 25 ≤ 20	24	23 3 .3 54.0	97 92.2 76.3	25.7 17.8 9.3	96.5 97 97.4
	2531	≤ 20 ≤ 25 ≤ 30	28	31.3 49.4 69.9	94.7 86.8 68.5	16.7 11.3 7.0	97.6 98.0 98.5
Toipale and thilesmaa 1998	3694	< 29	18-22	19	97	6	

N = Number of patients

CL = Cervical length (mm)
GA = Gestational age (weeks)
S = Sensitivity
Sp = Specificity
PPV = Positive predictive value
NPV = Negative predictive value

Honest *et al., (2003)* conducted studies where they undertook antenatal transvaginal sonographic cervical assessment among a population of pregnant women with known gestational age of delivery. There were 46 primary articles, which included a total of 31,577 women, consisting of 33 studies in asymptomatic and 13 studied in symptomatic women. Data were extracted for the studies characteristics and quality. Accuracy data were used to form 2 x 2 contingency tables for various cervical length measurements with birth before 32, 34 and 37 weeks gestation as the reference standards.

Our review showed that transvaginal cervical sonography identifies women who are at higher risk of spontaneous preterm birth, although there was a wide variation amongst studies with respect to gestational age at testing, definition of threshold of abnormality and definition of reference standard. The most commonly reported sub-group was testing of asymptomatic women at <20 weeks gestation using a threshold cervical length of 25mm with spontaneous preterm birth before 34 weeks gestation as the reference standard.

Both cervical length measurement and funneling, whether alone or in combination, appear to be useful (depending on the threshold chosen to define the abnormality) in predicting spontaneous preterm birth in asymptomatic women. For symptomatic women there was a paucity of data, although the degree of funneling appeared to be predictive of spontaneous preterm birth.

Rozenberg *et al., (1998)* Neither risk scores nor systematic digital vaginal examinations at prenatal consultations have helped to diminish the incidence of prematurity. Because an indispensable prerequisite to reducing this incidence is better identification of the patients at risk, new approaches toward this end have been proposed in recent years. Various studies have shown that fetal fibronectin in cervico-vaginal secretions between 23 and 36 weeks gestation can be used to identify, among patients with uterine contractions and clinically observable

modifications of the cervix, a subgroup of women at very high risk of preterm delivery. Systematic assays for fetal fibronectin among low-risk women are not, however, valuable, because of both the low prevalence of preterm delivery in such a population and the poor positive predictive value.

Transvaginal ultrasound of the cervix furnishes an objective and noninvasive method for ascertaining cervical status. Various studies have shown that, among patients presenting signs of preterm labour, the risk of preterm birth is higher when the cervical length, measured with ultrasound, is less than a given cut-off point (the good predictive values of which have been ascertained). Transvaginal ultrasound is also useful among the general population. Measurement of cervical length ought to be incorporated into the routine ultrasound performed in this population.

Risk of spontaneous preterm births at various GA with various risk factors in Nulliparas

Risk factor	N	<32 wks	< 35wks	< 37wks
All –ve	1033	0.6	1.7	6.0
FFN	52	3.9	5.8	11.5
CL ≤ 25mm	109	3.7	9.2	18.4
FFN + CL	17	35.3	58.8	64.7

N - No. of patients

FFN - Fetal fibronectin

CL - Cervical length

From Goldenberg RC, Iams JD, Mercer BM *et al.,* The preterm prediction study: the value of new vs standard risk factors in predicting early of all spontaneous preterm births *(Am J Public Health 88: 233, 1998).* In symptomatic women with suspected preterm labour a cervical length of <20mm is not necessarily predictive of preterm birth, but a length of >30mm can reliably exclude preterm birth.

Hasegawa *et al* conducted a study in 729 pregnant women with no risk factors between 15 and 34 weeks gestation in Japan. Cervical parameters, including cervical length, internal os dilatation and funneling depth, more measured by transvaginal ultrasound. The predictive values of these measurements for preterm delivery was investigated in a prospective fashion.

Among various parameters, cervical length (mm) showed the best correlation with pregnancy outcome. The group with a shortened cervix (mean cervix length – 1SD as cut off value) showed a significantly high preterm delivery rate exclusively in primigravidae (odds ratio: 4.86, 95%). Internal os

dilation, in contrast, was a useful predictor in multiparouns women (odds ratio 6, 98%). It was concluded that TVS cervical assessment, especially the measurement of cervical length, was effective for the prediction of preterm delivery in the primigravidae.

The accurate predictor, prophylaxis and management of preterm labour is a challenge for every obstetrician. This study conducted in a multi-disciplinary tertiary institute correlates cervical length by TVS with the occurrence of preterm labour.

Several published studies have demonstrated inverse relationship between cervix length and frequency of preterm delivery. The group with a shortened cervix showed a significantly higher preterm delivery rate exclusive in the primigravid population. In contrast, internal os dilation was a more useful predictor in multiparous women. The authors concluded that the length of the cervix was possibly an indirect indicator of cervical competence.

Although the predictive value of ultrasonography was low in this low risk population it is postulated that the predictive value will rise as the risk of prematurity in the study population increases.

Cervical effacement in pregnancy has been demonstrated by USG to begin at approximately 32 weeks for term births and as early as 16-24weeks for preterm birth. The process of change of the internal os often is well established before recognition of external os changes. Cervical effacement may occur slowly and often precedes clinically evident preterm labour.

AIM OF STUDY

3. AIM OF STUDY

1. To determine the cervical length by transvaginal sonography at 20 to 24 weeks in singleton pregnancies.
2. To follow them up until delivery and assess the correlation between the cervical length measurement and preterm labour.

Transvaginal ultrsonographic cervical measurement of less than 26 to 30mm has been shown to be atleast equivalent to bishop scores in predicting term vaginal delivery. It seems logical that transvaginal USG cervical length may also be useful as a predictor for preterm labour.

Transvaginal ultrasound has been shown to produce clear, reproducible visualization of cervix with a high degree of standardization of measurements of cervical length.

This study was conducted in a multi- disciplinary tertiary institute correlates cervical length by transvaginal ultrasonography with the occurrence of preterm labour.

MATERIALS AND METHODS

4. MATERIALS AND METHODS

1. A prospective ongoing study to determine correlation between cervical length with period of gestation at delivery, over a period of 2 yrs.
2. Study group – 131 women were included in this group

Inclusion Criteria

Primigravid women, low risk and with good dates.

Exclusion Criteria

Patients with PIH, GDM, anemia, other maternal illness, foetal anomalies, unknown CMP.

Techniques

Aloka real time 2D USG unit with a transvaginal probe. (3.5MHZ)

Time of sonography – gestation age between 20-24wks.

Position -Dorsal position

Pre requisities -empty bladder

All these patients were routinely followed up in our antenatal clinic until delivery.

Procedure

The patient should be instructed to empty her bladder before examination. She should then be placed in dorsal position.

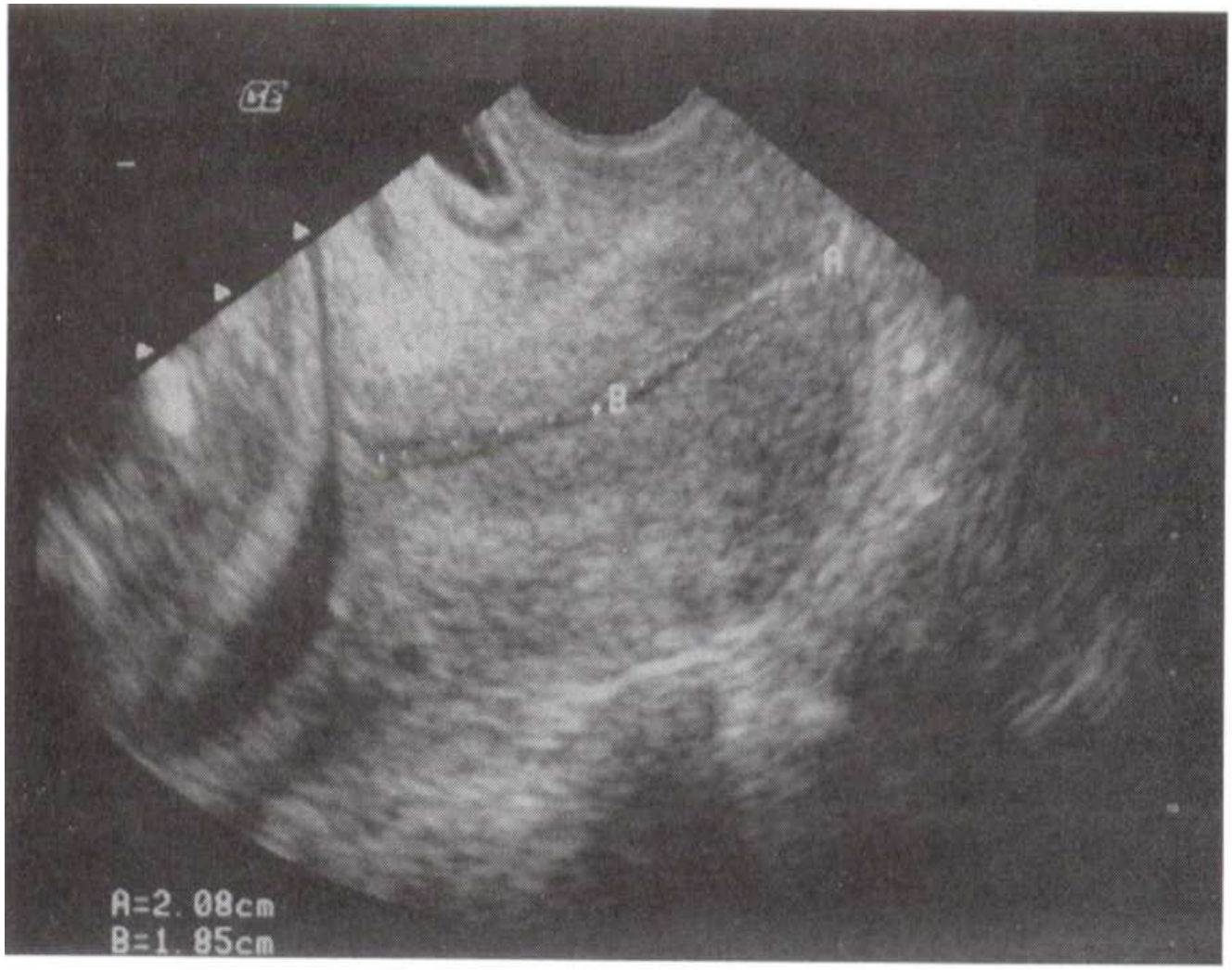
The endovaginal probe protected by a lubricated sterile transducer cover should be used. Ideally the area in view should include at least a 120° field of view, allowing the operator to visualize the required landmarks without excessive probe manipulation.

Identification of the bladder, amniotic fluid and presenting part should be done first. The operator should look in the midline sagittal plane of the cervix and identify 3 landmarks.

1. Internal os

2. Endocervical canal
3. The external os

The internal os usually appears as a small notch or triangle at the interface between the amniotic cavity and the endocervical canal. Cervical stroma above the cervical canal should appear similar to that below the canal. The length of the cervix is measured between the internal and external os.



Transvaginal ultrasound image of the cervix obtained from a woman during routine screening at 24weeks. The cervical length is 38mm.

RESULTS

5. RESULTS

Total no of patients enrolled in the study – 131

Pre–requisites – low risk primigravidas with singleton pregnancies. USG done at 20 to 24 weeks by transvaginal probe

Exclusion criteria – patients who develop any complications

-PIH, anemia , GDM, epileptics abruption, UTI any other medical disorders wrong dates

No. of patients who completed the study – 119

No. of patients who were excluded due to complications – 14

Final list of patients - 105

Total no. of patients who delivered preterm – 5

Incidence of preterm in low risk primigravida – 4.7%

Number of preterm babies who required neonatal admission-4 out of 5 babies

Number of babies born at term who required neonatal admission-5 out of 100

Number of patients with cervical length <2.5cm who required tocolytic therapy -3.

Table 1. The total study group, the varying cervical length, number of patients excluded and the final outcome

Cervix Length	No. of Patients	Preterm	Term	Complications	Preterm	Term
<2.5mm	4	3	1	-	3	1
2.5to3cm	7	3	4	GDM-1 PPROM-1	2	3

3 to 3.5	38	2	36	PIH -3 PROM-1 GDM – 1 Anemia – 1	32	32
3.5 to 4	42	1	42	PIH -2 GDM-1 Anemia-1 Epilepsy-1 UTI-1	36	36
4 to 4.5	13	-	13	-	13	13
4.5 to 5	13	-	13	-	13	13
7.5	2	-	2	-	2	2

Fig 1. Agewise distribution of preterm labours among the study group

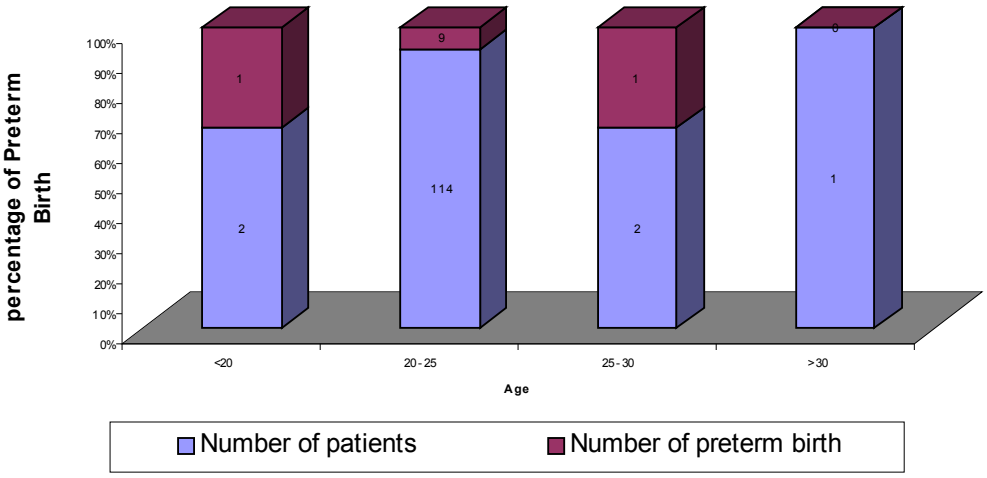
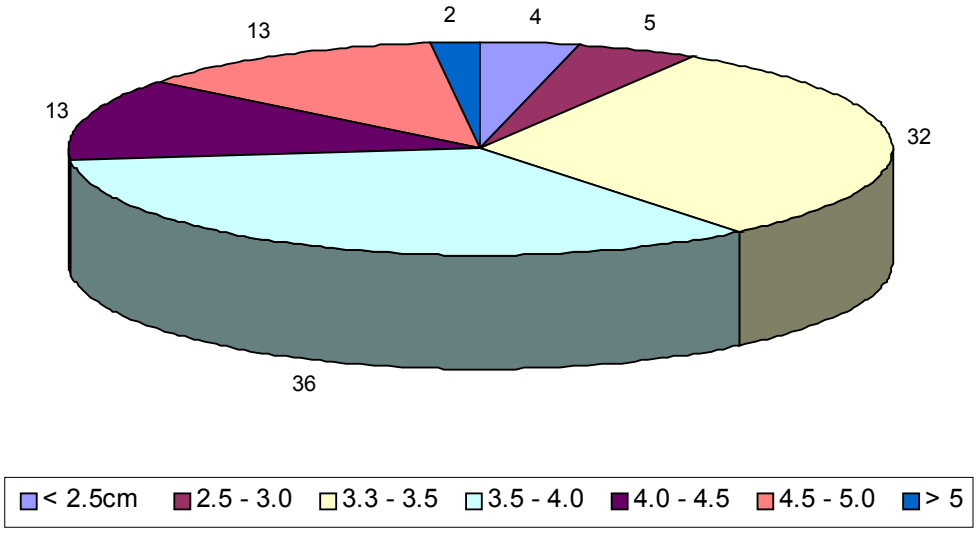


Table 2. Number of Patients based on their occupation and the Number of preterm births in the original study group

S.No	Occupation	No. of Patients	No. of preterm birth
1	House wife	101	9
2	Working Women	-	-
3	Nurse	2	-
4	Teacher	2	-
5	Technician	2	-
6	Coolie	3	2
7	Officers	3	-
8	Engineers	2	-
9	Attenders	2	-
10	Agriculturist	2	-
Total		**119**	**11**

Fig 2. : Cervical length Measurements of the study population by Transvaginal ultrasound



DATA ANALYSIS

Cervical length	Peterm	Term	Total
<_2.5	3	1	4
< 2.5	2	99	101
	5	100	105

Sensitivity = 3/5 = 60%

Specificity = 99/100 = 99%

Positive predictive value = ¾ = 75%

Negative predictive value = 99/101 = 98%

Chi square test

X^2 = 30.56

Hence P < 0.001, which is significant

Fig 3.: Relationship between the cervical length and preterm delivery

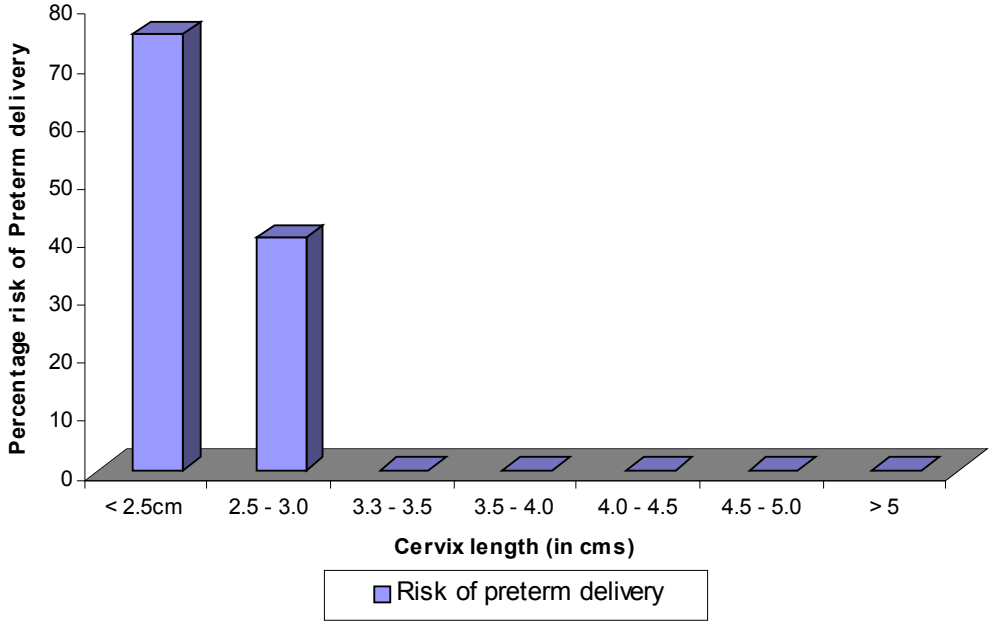


Fig 4.Gestational age at delivery in the study population

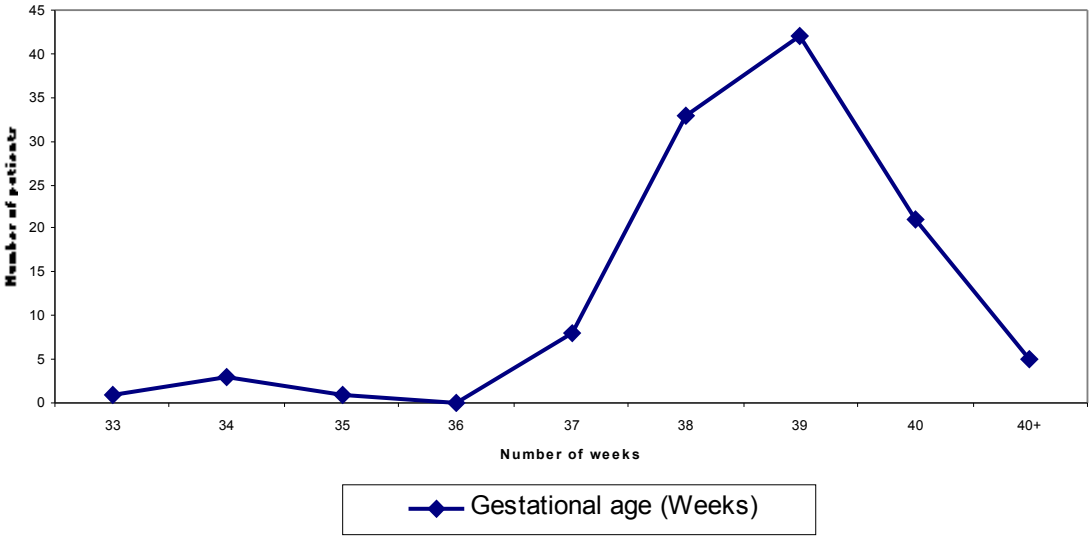


Fig 5. Preterm and term delivery of the study population

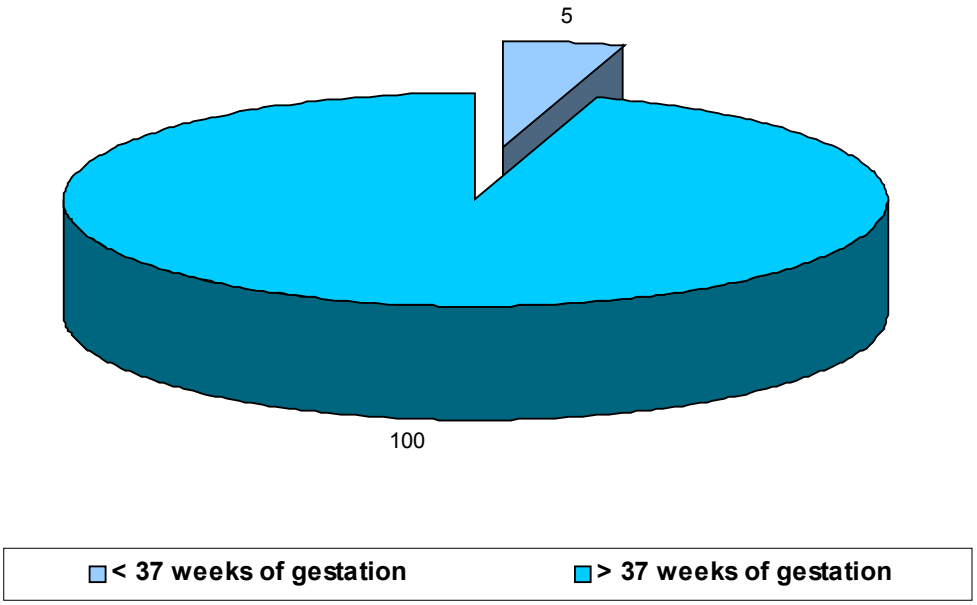
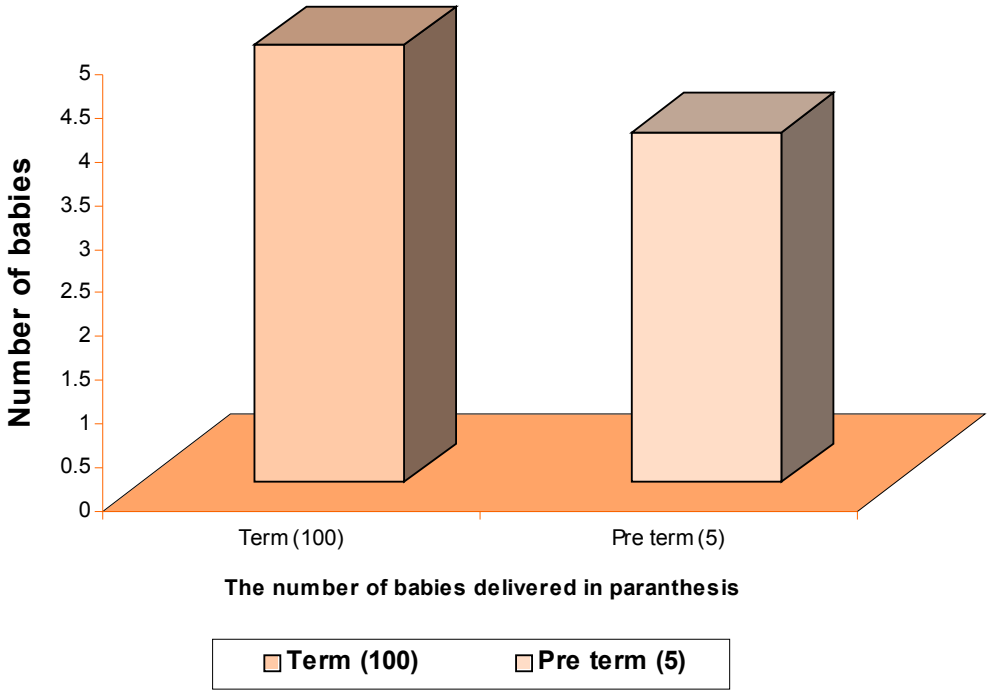


Fig 6. Number of Term and Preterm Babies Requiring NICU Admissions



DISCUSSION

6. DISCUSSION

In this prospective observational study we found that selected low risk primigravidas with short cervical lengths on endovaginal ultrasound at 20 to 24 weeks gestation were at a significantly higher risk for early delivery.

As the threshold value for cervical length increases, the sensitivity increases but the positive predictive value decreases. Negative predictive values are consistently very high.

Transvaginal sonography can be used as a reliable and cost effective screening procedure in both low and high risk asymptomatic patients at 20 to 24 weeks. A number of studies have proved in the role of cervical assessment by sonography in prediction of preterm labour. Though various authors have used different cut- off values of cervical length and period of gestation at which it is done, <25mm at 24 weeks(Iams *et al*) is a more accepted practice with good sensitivity and confirms these findings.

Why 20 to 24 Weeks?

All patients registered in our hospital regularly had an anomaly scan done at 20 to 24 weeks.

This procedure was coupled with the anomaly scan, evidence that the cervical length starts to shorten sometime after 15 weeks gestation in women who subsequent delivery preterm (mean –18weeks).

Cervical length to predict preterm birth was first noted by Anderson *et al* who found that in an unselected population of 113 gravidas, a cervix of less than 39mm before 30 weeks gestation was a significant risk factor. Tongsong *et al* studied 730 unselected women at 28 to 30 weeks gestation and found that cervix <35mm was associated with preterm delivery.

Cervix length <26mm measured at 24 to 28 weeks gestation was shown by Iams *et al* sensitivity and specificity of cervix length measurement at 24

weeks were 37% and 92% respectively. Only and 18% PPV was achieved with a spontaneous preterm delivery rate of 4.3% (<35 weeks).

Cervical length measured in the study population is depicted in Fig. 3. Majority of women in had a cervical length between 35mm and 40mm. Majority of women delivered at 39 weeks of gestation (Fig. 4).

4.7% of the patients delivered preterm (37weeks) according to my data 60% of these women who delivered preterm had a cervical length <25mm and 40% had a cervical length between 25 to 30mm. In the group of women whose cervical length was >30mm none of them delivered preterm (Fig. 3).

In this study the sensitivity of cervical length measured by transvaginal ultrasonography (20-24weeks) in predicting preterm labour in asymptomatic women with a cut off <25mm is 60% and specificity is 99%. The positive predictive value is 75%, but the negative predictive value is 98.01% which is very reassuring. A woman with a cervical length <25mm at 20-24 weeks with no other complications has a probability of 75% to deliver preterm. On doing the chi-square test, the P value obtained is <0.001 which is significant.

It was also found in the study that 80% of babies low prematurely required neonatal intensive care unit admissions for various reasons like low birth weight, asphyxia, respiratory distress, poor feeding and weight gain (Fig.6). Whereas only 4% of babies born at term required neonatal admissions.

The incidence of preterm labour was 4.7% in the low risk population. In the whole study group the causes of preterm labour were short cervix (45.5%), medical and obstetric complications (54.5%) and no case of preterm premature rupture of membranes was reported.

In addition to cervical shortening, other abnormal ultrasound findings independently associated with an increased risk of preterm delivery include the following: dilation of the internal os, wedging, funneling (protrusion of amniotic membranes into the cervix), dynamic changes in the degree of dilation of the

cervical canal (opening of the internal os or protrusion of membranes) observed, either spontaneously during contractions or after pressure on the fundus. Because fibronectin assays and cervical ultrasound allow patients at risk of true preterm labour to be identified earlier and more accurately, they should improve the chances that tocolytic treatment will succeed. They also ought to reduce the iatrogenic disorders related to prevention of preterm birth (excessive tocolysis and extended hospitalizations) without raising the incidence of such births.

Preterm labour has primary and secondary predictors. In this study the main aim was to study the correlation and predictive value of one of the major secondary predictors “transvaginal ultrasound detected cervical shortening” and preterm labour. There was a strong correlation between short cervical length diagnosed in second trimester and preterm labour. In addition some of the primary predictors of preterm labour like age and occupation were also observed. However there was no correlation of the age, occupation of theses patients and preterm labour. (Fig.1 & Table 2)

Our findings confirm these of the previous studies that have found an increase relationship between the length of the cervix and preterm delivery. Vaginal ultrasound produced good images in our study and was accepted by all patients. Although the predictive value was low in the low risk population, it will increase with the risk of permaturity in the population studies. This method can be used to select patients for prospective interventional trials with the rationale that early intervention might be more effective. Transvaginal ultrasonography can also be used in combination with other markers for preterm delivery such as fetal fibronectin, serum alpha feto protein, serum alkaline phosphatase, in developing treatment strategies.

CONCLUSION

7.CONCLUSION

Ultrasonographic assessment of the cervix has a promising role to offer in the prediction of the risk of developing preterm labour. Considering the magnitude of preterm labour, cost of management of preterm babies and morbidity and mortality associated with it, the use of sonographic assessment of cervix at 20 to 24 weeks as a routine screening method is cost effective and should be offered to all pregnant women.

Preventing preterm delivery remains a major challenge for the 21st century. The cervix plays a fundamental role in supporting a pregnancy and preventing ascending infection from the lower genital tract. Infection is associated with early preterm delivery in about half of cases. Whatever the aetiology of preterm delivery, dilation of the cervix is a common endpoint, and transvaginal scanning of the cervix now provides a good predictor of early preterm delivery in both high and low-risk women. Changes in the cervix are related to the detection of fetal fibronectin in the vagina, which is also an accurate predictor of delivery. The advantages of cervical measurement by transvaginal ultrasonography over fetal fibronectin estimation in the vaginal secretions is the ease of performance, cost and availability.

However, the role of intervention in at-risk women is unclear. Elective cerclage is only effective in a minority of women, and the evidence to support its use is limited. It is currently being evaluated whether indicated cerclage, dictated by ultrasound findings, is beneficial.

Although the use of predictors does not reduce the incidence of preterm birth it definitely helps to identify people at risk and helps us opt for better

treatment strategies. It also helps us avoid over diagnosing preterm labour and administering overzealous treatment.

ANNEXURE

9. ANNEXURE

PROFORMA

Name: IP No: OP No:

Age: Sex:

Occupation:

History:

LMP: EDD:
OBS score : Primi Gravida
Menstrual history :
Martial history :
H/O Previous Surgeries :
Antenatal Complications :
Investigations :
HB :
Urine R/E :
Dating USG :
Anomaly Scan :
TAS: FI -
BPD -
FH -
Amniotic fluid -
Placenta -

TVS: Cervical length -
Labour outcome :
Onset of labour :
Gestational age :
Mode of delivery :
Complications :
APGAR :

NICU Admission :

8. BIBLIOGRAPHY

Iams J D,Johnson FF,Sonek J *et al*: cervical competence as a continuum: a study of usg cervical length in obstetric performance.(Am J Obs and Gyn 1995;172:1097-1106)

Albert H F,Davis N: Cervical length between 14-24 weeks and risk of preterm birth(Am J Obs and Gyn-1996)174:413

Anderson H F.Nugent C E.Wanty S D,Hayashi R H – Prediction of preterm delivery by ultrasound measurement of cervical length (Am J Obs and Gyn 1990 163:859-867)

Gomez R,Galasso M,Romero R *et al*: USG examination of the uterine cervix is better than cervical digital examination as a predictor of the likelihood of premature delivery in patients with preterm labour and intact membranes. (Am J Obs and Gyn-1994;171:956-964)

Iams J,Goldenberg R,Meis *et al*: The length of the cervix and the risk of spontaneous preterm delivery (N Engl J Med 1996; 334:567-572)

Zilianti M, Azuaga A,Calderson F *et al*: Monitoring the new effacement of the uterine cervix by transperineal ultrasound: a perspective – J of USG Med 1995:14 :719-724

Zemyln S: The length of the uterine cervix and its significance (J Clin USG 1981:9: 267-269)

Bomei D, Andreotti RF,Rosenberg ER: sonographic appearance of the uterine cervix in pregnancy : the vertical cervix (Am J Radiology 1983: 140 :737-740)

Kushnir O, Vigil D A, Ixqueirdo *et al*: vaginal ultrasound assessment of the cervix and changes during normal pregnancy (Am J Obs and Gyn 1990: 162: 991-993).

Taipale and Hiilesmaa.V –sonographic measurement of the uterine cervix at 18-22 weeks gestation and the risk of preterm labour (Obs and Gyn 1998:902 -907)

The preterm prediction study: can low risk females destined for spontaneous preterm birth be identified? (Am J Obs and Gyn 2001 march 184 (4): 652-5)

Hibbard *et al*: cervical length between 16-22 weeks in and Gyn asymptomatic gravidas and the risk of preterm labour (Obs 2000 96:972 -978)

Anderson H F:TVS and TAS of the uterine cervix during pregnancy (J Clin USG 19: 77 1991)

Hertzberg B S,Kleimer M A,Farrwell T A *et al*: spontaneously changing gravid cervix:(clinical implications and prognostic features Radiology 196:721,1995)

Okitsu O,Mirmura T,Nakayama T *et al*:early detection of preterm delivery by TVS (Ultrasound Obs and Gyn 2:402,1992)

Honnest H, Bachmann LM,Coomarasamy A,Gupta JK, Kleijnen J, Khan KS :Accuracy of cervical transvaginal sonography in predicting preterm birth:a systematic review :ultrasound obstet gynaecol.2003 sep;22(3):305-22

Rozenberg P. :New markers of the risk of preterm delivery :bull acad natl med.1998;182(7):1455-68

Leitich H. *et al*: secondary predictors of preterm labour :BJOG 2005 Mar112 suppl 1:48-50

Watson W J,Stevens D,Welter S,Day D: Observations on the sonographic measurement of cervical length and the risk of premature birth :J Matern Fetal Med 1999 Jan – Feb;8(1):17-9

Shennan A, Jones B: The cervix and prematurity: Med.2004 aetiology,prediction and prevention :Semin Fetal Neonatal Dec;9(6):471-9

Fukami T,Ishihara K,Sekiya T,Araki T: is transvaginal ultrasonography at mid trimester useful for predictingearly

spontaneous preterm birth? :J Nippon Med S ch.2003 Apr;70(2):135-40.

Danti L, Palai N, Ravelli V, *et al*: ultrasonography of the uterine cervix in pregnancy. Curve of normality in a longitudinal and cross sectional study: Minerva Ginecol 1998 Oct; 50 (10): 397-404.

Bergella V, Tolosa J E,Kuhlman K, *et al*: cervical predictor of ultrasonography compared with manual examination as a preterm delivery.: Am J Obstet Gynecol .1997 Oct;177(4);723-30.

Conoscenti G,Meir Y J,*et al*: Does cervical length at 13-15 weeks gestation predict preterm delivery in an unselected population? : Ultrasound obstet & gynecol 2003 feb.21(2):128-34

Kayem G,Cabrol D,: Current implications of transvaginal ultrasound measurement of the cervix during pregnancy : J Gynecol Obstet Biol Reprod (Paris).2002 feb;31 :2s48-55

(Williams Obstetrics 21 st edition) .chapter 27:Preterm labour (697-704).

Preterm labour – Murdo G.Elder,Roberto Romero,Ronald F.Lamont. Ultrasound evaluation of the cervix and the value of cervical cerclage. (section 3 pg.165-185).

Ultrasound in Obstetrics and Gynecology : 4th edition by Peter

W, Callen MD: Chapter on ultrasound evaluation of the cervix ;pg: 577 – 597.

Textbook on Transvaginal ultrasounography - David A, Nyberg Lyndon M.Hill -1998 (chapter 9 pg: 169-187).

J. of Clinical Obstetrics and Gynecology volume.47,number. 4, 775-783 (2004): Cervical length measurement and cervical cerclage to prevent preterm birth Marvin Williams,D O and Jay D.Iams.