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Ultrasonographic Cervical Length Assessment in Predicting Preterm Birth in Singleton Pregnancies

This clinical practice guideline has been prepared by the Diagnostic Imaging Committee, reviewed by the Family Physicians Advisory Committee and the Maternal Fetal Medicine Committee, and approved by the Executive and Council of the Society of Obstetricians and Gynaecologists of Canada.

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Key Words: Preterm birth, prediction, ultrasonography, transvaginal, cervical cerclage

Abstract

Objectives: To review (1) the use of ultrasonographic-derived cervical length measurement in predicting preterm birth and (2) interventions associated with a short cervical length.

Outcomes: Reduction in rates of prematurity and/or better identification of those at risk, as well as possible prevention of unnecessary interventions.

Evidence: Published literature was retrieved through searches of PubMed and The Cochrane Library up to December 2009, using appropriate controlled vocabulary and key words (preterm

labour, ultrasound, cervix, incompetent cervix, transvaginal, transperineal, cervical length, fibronectin). Results were restricted to general and systematic reviews, randomized controlled trials/controlled clinical trials, and observational studies. There were no date or language restrictions. Grey (unpublished) literature was identified through searching the websites of health technology assessment and health technology assessment-related agencies, clinical practice guideline collections, clinical trial registries, and national and international medical specialty societies.

Values: The evidence and this guideline were reviewed by the Diagnostic Imaging Committee and the Maternal Fetal Medicine Committee of the Society of Obstetricians and Gynaecologists of Canada, and the recommendations were made according to the guidelines developed by The Canadian Task Force on Preventive Health Care (Table 1).

Benefits, harms, and costs: Preterm birth is a leading cause of perinatal morbidity and mortality. Use of the ultrasonographic technique reviewed in this guideline may help identify women at risk of preterm birth and, in some circumstances, lead to interventions that may reduce the rate of preterm birth.

Sponsors: The Society of Obstetricians and Gynaecologists of Canada

Summary Statements

1. Cervical length in the general obstetrical population is relatively stable over the first 2 trimesters. The natural history of cervical length change may be useful in identifying women at increased risk of spontaneous preterm birth. Because there may be different patterns or a delay in cervical length shortening, repeat assessment of cervical length may be useful. (II-2)
2. There is no consensus on the optimal timing or frequency of serial evaluations of cervical length. If repeat measurements are performed, they should be done at suitable intervals to minimize the likelihood of observation error. (II-2)
3. Transvaginal sonography can be used to assess the risk of preterm birth in women with a history of spontaneous preterm birth and to differentiate those at higher and lower risk of preterm delivery. The gestational age of a prior preterm birth affects the cervical length in a future pregnancy. (II–2)
4. Cervical length measurement can be used to identify increased risk of preterm birth in asymptomatic women at < 24 weeks who have other risk factors for preterm birth (previous excisional treatment for cervical dysplasia, uterine anomaly, or prior multiple dilatation and evacuation procedures beyond 13 weeks' gestation). However, there is insufficient evidence to recommend specific management strategies, such as cerclage, in these women. (II-2)
5. No specific randomized trials have evaluated any interventions in asymptomatic women at > 24 weeks' gestation who are at increased risk of preterm birth (e.g., those who have a history of prior spontaneous preterm birth, previous excisional treatment for cervical dysplasia, uterine anomaly, or prior multiple dilatation and evacuation procedures beyond 13 weeks' gestation) and who have a short cervical length. This information may help with empiric management of these women, including reduction of activity level, work, or travel, relocation, increased surveillance, and administration of corticosteroids. (III)
6. Transvaginal ultrasound appears to be safe in preterm premature rupture of membranes, but its clinical predictive value is uncertain in this context. (II-2)
7. It is unclear whether ultrasonographic cervical length assessment has significant advantages over clinical examination alone after elective or emergency cervical cerclage placement, although some signs, such as funnelling to the stitch, are associated with a high risk of preterm premature rupture of membranes. There is no consensus on the frequency or timing of ultrasonographic cervical length assessment post cerclage. (II-2)
8. It is unclear whether a policy of cervical length surveillance is equivalent to clinical assessment of the need for elective cerclage in those at risk of preterm delivery. (I)
9. Ultrasonographic cervical length assessment and fetal fibronectin appear to be similar in predictive ability, and the combination of both in a high-risk population may be of value. However, further research is needed in this area. (II-2)

Recommendations

1. Transabdominal ultrasonography should not be used for cervical length assessment to predict preterm birth. (II-2D)
2. Transvaginal ultrasonography is the preferred route for cervical assessment to identify women at increased risk of spontaneous preterm birth and may be offered to women at increased risk of preterm birth. (II-2B)
3. Transperineal ultrasonography may be offered to women at increased risk of preterm birth if transvaginal ultrasonography is either unacceptable or unavailable. (II-2B)
4. Because of poor positive predictive values and sensitivities and lack of proven effective interventions, routine transvaginal cervical length assessment is not recommended in women at low risk. (II-2E)
5. In women presenting with suspected preterm labour, transvaginal sonographic assessment of cervical length may be used to help in determining who is at high risk of preterm delivery and may be helpful in preventing unnecessary intervention. It is unclear whether this information results in a reduced risk of preterm birth. (II-2B)
6. In asymptomatic women with a history of spontaneous preterm birth and an ultrasonographically diagnosed short cervical length (< 25 mm) prior to 24 weeks of gestation, cervical cerclage should be considered to reduce the risk of preterm birth. (I-B)
7. In all asymptomatic women who present with membranes at or protruding past the external cervical os, an emergency cerclage should be considered to reduce the risk of preterm delivery. (I-B)

ABBREVIATIONS

LEEP loop electrical excision procedure

TP transperineal

TV transvaginal

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INTRODUCTION

Preterm birth is the leading cause of perinatal morbidity and mortality.[1–5] Despite advances in perinatal care, the incidence of preterm birth continues to rise, primarily because of the increased multiple pregnancies resulting from assisted reproduction.[6–9] Tocolytics prolong pregnancy minimally once preterm labour has begun, and they can be associated with significant undesirable maternal, fetal,

Table 1. Key to evidence statements and grading of recommendations, using the ranking of the Canadian Task Force on Preventive Health Care

Quality of evidence assessment*	Classification of recommendations†
I: Evidence obtained from at least one properly randomized controlled trial	A. There is good evidence to recommend the clinical preventive action
II-1: Evidence from well-designed controlled trials without randomization	B. There is fair evidence to recommend the clinical preventive action
II-2: Evidence from well–designed cohort (prospective or retrospective) or case–control studies, preferably from more than one centre or research group	C. The existing evidence is conflicting and does not allow to make a recommendation for or against use of the clinical preventive action; however, other factors may influence decision-making
II-3: Evidence obtained from comparisons between times or places with or without the intervention. Dramatic results in uncontrolled experiments (such as the results of treatment with penicillin in the 1940s) could also be included in this category	D. There is fair evidence to recommend against the clinical preventive action
	E. There is good evidence to recommend against the clinical preventive action
III: Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees	L. There is insufficient evidence (in quantity or quality) to make a recommendation; however, other factors may influence decision-making

* The quality of evidence reported in these guidelines has been adapted from The Evaluation of Evidence criteria described in the Canadian Task Force on Preventive Health Care.[141]

† Recommendations included in these guidelines have been adapted from the Classification of Recommendations criteria described in the The Canadian Task Force on Preventive Health Care.[141]

and neonatal consequences.[10–19] In order to address the prematurity problem, it is important to identify those at increased risk.

The following are risk factors for spontaneous preterm birth:

- Reproductive history (previous spontaneous preterm birth and use of assisted reproductive technologies)[8,20–22]
- Antepartum bleeding, rupture of membranes, cervical/uterine factors (cervical insufficiency, uterine anomalies,[22] fibroids, and excisional cervical treatment for cervical intraepithelial neoplasia)[23–25]
- Fetal/intrauterine factors (multifetal gestation, fetal anomaly, and polyhydramnios)
- Infection (chorioamnionitis, bacteruria, periodontal disease,[26] current bacterial vaginosis with a prior preterm birth[27])
- Demographic factors (low socioeconomic status, single marital status, low level of education, First Nations ethnicity, or maternal age < 18 years or > 35 years)
- Lifestyle issues (cigarette smoking, illicit drug use, stress, physical abuse[28])
- Inadequate prenatal care, low pre-pregnancy weight and poor weight gain in pregnancy.[29]

However, many women who deliver preterm do not have any known risk factors.[8,22]

Research has focused on combined risk scoring systems that use multiple serum markers, ultrasound, and maternal demographic factors, but these have not been fully validated in large scale studies.[30–42] Other screening strategies that have been suggested include measuring biochemical markers such as fetal fibronectin and screening for infections.[27,43–46]

In the 1980s, an objective, ultrasound-based measurement was developed to identify women at increased risk of preterm birth. The risk of preterm birth was inversely correlated to the length of the cervix as measured by ultrasound. This observation has been confirmed in multiple studies using different techniques; however, the most widely accepted and used technique is transvaginal ultrasound.[34,47–57] A number of interventions based on this observation have been studied in randomized trials. A recent meta-analysis[58] has looked at its efficacy in preventing preterm birth. Since the publication of the 2001 SOGC guideline,[36] there have been numerous studies on imaging, natural history, and use of transvaginal ultrasound in common clinical scenarios, as well as a number of randomized trials looking at interventions for a short cervix. This updated guideline provides a comprehensive review of studies of shortened cervical length diagnosed on transvaginal ultrasound and is broader in scope than the 2001 guideline.[36]

ULTRASONOGRAPHY COMPARED WITH DIGITAL ASSESSMENT OF CERVICAL LENGTH

Digital assessment of the cervix has been commonly used to diagnose premature labour or to evaluate women perceived to be at increased risk of preterm labour. Digital assessment of cervical length is subjective, varies between

examiners, and underestimates true anatomic length. In one study, digital examinations before hysterectomy underestimated cervical length by approximately 14 mm, whereas ultrasonography measured length accurately.[59] Investigations using transvaginal ultrasound measurement as the standard confirmed that digital examination underestimates cervical length.[57,60] This underestimation may result from an inability to assess the cervix length digitally beyond the vaginal fornices unless there is 2 cm or more of dilatation and the entire intracervical canal is examined. The majority of studies have found that ultrasound assessment of cervical length is superior to clinical examination for the prediction of preterm birth.[61–64] Therefore, ultrasound assessment of cervical length is more reliable and more clinically predictive of preterm birth than manual examination of the cervix.

COMPARISON OF TRANSVAGINAL, TRANSABDOMINAL, AND TRANSPERINEAL ULTRASONOGRAPHIC CERVICAL LENGTH ASSESSMENT

Ultrasound assessment of the cervix was initially performed transabdominally, but specific disadvantages led to a preference for transvaginal ultrasound assessment. Both TP and TV cervical assessments have been studied, with most studies evaluating TV assessment.[65,66]

The patient's bladder must be full for transabdominal ultrasonography to assess the cervix adequately, but this may spuriously lengthen the cervix by opposing the anterior and posterior lower uterine segments[65] and concealing cervical shortening or funnelling. In contrast, TV ultrasound is performed with the bladder empty.[66] Transabdominal ultrasound is significantly less likely than the other 2 methods to provide adequate imaging and measurements.[67] Visualization of the cervix by transabdominal ultrasonography is hampered significantly by maternal obesity, shadowing from fetal parts, and the need for lower frequency transducers.

Recommendations

1. Transabdominal ultrasonography should not be used for cervical length assessment to predict preterm birth. (II-2D)

TP ultrasonography has been found to be as accurate as transabdominal ultrasound for examining the cervix, and one study found it was more acceptable to women than TV scanning.[55,67] Other studies, however, have found both TV and TP techniques acceptable to women.[55,68–70] TP assessment is more accurate than digital examination for predicting preterm birth, and, when adequate images can be obtained, TP ultrasonography can predict preterm birth as accurately as TV ultrasonography.[56,63] However, most authors suggest that adequate images can be obtained more frequently with TV than with TP technique,[55,67,71,72] that TV assessment is easier to obtain and more reproducible, and that TV correlates better with true cervical length than TP assessment.[69,71,72] Since the TV technique is more studied and more likely to be obtainable, TP ultrasonography should be reserved for women at increased risk of preterm birth for whom vaginal assessment is unavailable or unacceptably invasive or uncomfortable.

Recommendations

2. Transvaginal ultrasonography is the preferred route for cervical assessment to identify women at increased risk of spontaneous preterm birth and may be offered to women at increased risk of preterm birth. (II-2B)
3. Transperineal ultrasonography may be offered to women at increased risk of preterm birth if transvaginal ultrasonography is either unacceptable or unavailable. (II-2B)

NORMAL CERVICAL LENGTH

Cervical length is normally distributed and remains relatively constant in pregnancy until the third trimester.[73–75] If there is any statistically significant reduction in length, it is not clinically significant (< 0.5 mm /week).[73–77] Heath et al.[52] found a mean length of 38 mm at 23 weeks. Iams et al.[34] found a mean length of 35 mm at 24 weeks and of 34 mm at 28 weeks. If funnelling is present, measurement should exclude the funnel and be taken from the funnel tip to the external os.[47]

CERVICAL CHANGE IN WOMEN WHO DELIVER PRETERM

In women who deliver preterm or require cerclage, the rate of cervical length change may be predictive of preterm birth. The rate of cervical shortening is faster in women who deliver preterm than in those who deliver at term; however, the difference can be quite small.[76–80] The range of cervical length decline in those who go on to preterm delivery, preterm labour, or pregnancy intervention varies from 0.5 mm/week to 8 mm/week.[76–80] In a cross-sectional, longitudinal study, Yoshizato et al.[81] examined cervical change in women whose cervix became short (< 25 mm) in either the early (< 26 weeks) or the late preterm period (26 to 30 weeks). They found that "rapid CL shortening occurred between 16–20 and 21–25 weeks in the early group and between 21–25 and 26–30 weeks in the late group"[81] Intervention in terms of tocolytics or cerclage was

used in 19 of 20 in the early group, and 10 of 19 in the late group. More interesting was that the longitudinal cervical length change (mm/week) in the late group was statistically the same as in controls between 16 and 25 weeks, and then accelerated 3-fold in the next observation period. This study suggests that cervical length may be stable for a period of time and then undergo a phase of rapid decline prior to the onset of symptoms.[81] Hence, repeat evaluation of the cervical length may be reasonable to screen for those who may be at increased risk of late preterm delivery.

Summary Statement

1. Cervical length in the general obstetrical population is relatively stable over the first 2 trimesters. The natural history of cervical length change may be useful in identifying women at increased risk of spontaneous preterm birth. Because there may be different patterns or a delay in cervical length shortening, repeat assessment of cervical length may be useful. (II-2)

FREQUENCY OF CERVICAL LENGTH MEASUREMENT

The natural history of cervical shortening in women who will deliver preterm may be used to determine when serial measurements should be performed. These studies may make it possible to time reassessment and perhaps stratify follow-up according to length of measurement and the desired target threshold for intervention. Studies report thresholds for intervention ranging from 15 mm to 25 mm.[82–87] Thus depending on the initial cervical length, the chosen threshold for intervention, and knowledge of natural history, it is possible to estimate when the next measurement should be performed. For example, if the measured cervical length is 36 mm and the threshold for intervention is 20 mm, then it is reasonable to wait 2 weeks to reassess cervical length, assuming the greatest velocity of cervical decline (8 mm/week). Using a mid-range estimate of cervical decline (5 mm/week), it would be reasonable to wait at least 3 weeks between ultrasound assessments. If the initial cervical length is greater than that, the interval between assessments could be longer.

Minimum Interval of Time Between Cervical Assessments

Since the published rates of cervical decline in those destined to deliver preterm are quite small (1 to 8 mm/week)[76–80] and fall within the 95% CI of interobserver and intraobserver variability (intraobserver repeatability coefficient of approximately ± 6 mm and the interobserver limits of agreement of approximately ± 10 mm),[88] the interval should be at least 1 week, and perhaps even 2, to avoid observation error. The shorter the interval of time between measurements, the higher the rate of observation error: either not enough time has elapsed between assessments to detect change in the cervical length, or a small observed change is really observational error. The current evidence and the regional differences in resources, access, and practice across the country do not allow the development of a national consensus surveillance protocol.

Summary Statement

2. There is no consensus on the optimal timing or frequency of serial evaluations of cervical length. If repeat measurements are performed, they should be done at suitable intervals to minimize the likelihood of observation error. (II-2)

TRANSVAGINAL SONOGRAPHIC CERVICAL LENGTH ASSESSMENT IN ASYMPTOMATIC WOMEN AT LOW RISK

Cervical length is inversely related to the risk of preterm birth in asymptomatic women.[34,47–49,52,54,57] The largest study of this relationship[34] noted that when compared with women who had values above the 75th percentile of cervical length, those with a shorter cervix at 24 weeks had the following relative risks: approximately 4 if length was < 30 mm (25th percentile), 6 if < 26 mm (10th percentile), 9 if < 22 mm (5th percentile), and 14 if < 13 mm (1st percentile). However, the positive predictive values (6 to 44%) and sensitivities (47%) were poor in this low-risk population. Davies et al.,[89] in a Canadian, prospective, blinded observational trial of 964 women (general obstetrical population), found a sensitivity of 57% and a specificity of 82% for preterm birth, using a 30 mm cut-off at 24 to 28 weeks. The positive predictive value for preterm birth (< 35 weeks) was only 4.5%, because preterm birth was infrequent. The authors concluded that using TV ultrasonographic cervical length to screen for preterm birth in a general obstetrical population was unwarranted. Also, no studies have shown that cervical cerclage is beneficial in women at low risk who have a short cervix.[87,89,90] Because of the low incidence of preterm birth in this low-risk population[34] routine screening of cervical length as a predictor of preterm birth in this population is not recommended.[35]

Recommendation

4. Because of poor positive predictive values and sensitivities and lack of proven effective interventions, routine transvaginal cervical length assessment is not recommended in women at low risk. (II-2E)

TRANSVAGINAL SONOGRAPHIC CERVICAL LENGTH ASSESSMENT IN ASYMPTOMATIC WOMEN WITH A HISTORY OF SPONTANEOUS PRETERM BIRTH

Cervical length is a better predictor of preterm birth in women at increased risk, such as those with a history of spontaneous preterm birth, than in asymptomatic women at low risk.[35,49,87,91–95] In studies of women with a history of preterm birth, using a cervical length cut-off of 25 to 30 mm to predict preterm birth < 37 weeks of gestation, sensitivity is 60% to 80%, positive predictive value is 55% to 70%, and negative predictive value is 89% to 94%. Thus, a long cervix (at least 25 to 30 mm) is reassuring and can help to reduce unnecessary and costly interventions, such as activity restriction, maternal transfer, steroids, and tocolytics.

A study published in 2009 found that the gestational age at which the prior preterm delivery occurred affects the frequency and rate of cervical shortening in the current pregnancy. A prior spontaneous early preterm birth (< 24 weeks) puts women at a higher risk of cervical shortening. Women in this group also have a higher rate of cervical decline that begins at an earlier gestational age than women with a history of a later preterm birth (24 to 32 weeks).[96]

Summary Statement

3. Transvaginal sonography can be used to assess the risk of preterm birth in women with a history of spontaneous preterm birth and to differentiate those at higher and lower risk of preterm delivery. The gestational age of a prior preterm birth affects the cervical length in a future pregnancy. (II–2)

TRANSVAGINAL SONOGRAPHIC CERVICAL LENGTH ASSESSMENT IN OTHER ASYMPTOMATIC WOMEN AT HIGH RISK

Transvaginal cervical length assessment has been found to be effective in predicting preterm birth in asymptomatic high-risk groups, including those with uterine anomalies,[97] excisional cervical treatment for cervical intraepithelial neoplasia (LEEP and cone biopsy),[23,98] and prior multiple dilatation and evacuation procedures (beyond 13 weeks of gestation).[23,51,92,97–100] There is no evidence that cervical cerclage placement is beneficial in these women if they are found to have a short cervix on transvaginal ultrasound.

Summary Statement

4. Cervical length measurement can be used to identify increased risk of preterm birth in asymptomatic women at < 24 weeks who have other risk factors for preterm birth (previous excisional treatment for cervical dysplasia, uterine anomaly, or prior multiple dilatation and evacuation procedures beyond 13 weeks' gestation). However, there is insufficient evidence to recommend specific management strategies, such as cerclage, in these women. (II-2)

DIAGNOSIS OF SHORT CERVIX BEYOND 24 WEEKS' GESTATION IN ASYMPTOMATIC WOMEN AT HIGH RISK

The finding of a short cervix in asymptomatic women at increased risk of preterm birth can be divided into 2 categories according to when the diagnosis is made: < 24 weeks of gestation and ≥ 24 weeks of gestation. No randomized trials have evaluated specific management strategies for women at > 24 weeks with a short cervix; however, having this information may help with empiric management of these women. This may include altering activity level, work, and travel, increased surveillance, relocation close to a tertiary care centre, and administration of corticosteroids.

Summary Statement

5. No specific randomized trials have evaluated any interventions in asymptomatic women at > 24 weeks' gestation who are at increased risk of preterm birth (e.g., those who have a history of prior spontaneous preterm birth, previous excisional treatment for cervical dysplasia, uterine anomaly, or prior multiple dilatation and evacuation procedures beyond 13 weeks' gestation) and who have a short cervical length. This information may help with empiric management of these women, including reduction of activity level, work, or travel, relocation, increased surveillance, and administration of corticosteroids. (III)

ULTRASONOGRAPHIC CERVICAL LENGTH ASSESSMENT IN CLINICAL MANAGEMENT

Ultrasonographic Cervical Assessment in Women Suspected of Being in Preterm Labour

The use of cervical length measurement has been studied in women presenting with suspected preterm labour. The goal of these studies was to attempt to differentiate between women who were likely to deliver preterm and those who were not. This information may help women avoid unnecessary interventions of limited or unproven value, such as tocolysis, hospitalization, and activity restriction. Spontaneous preterm birth is unlikely if the cervical length is ≥ 30 mm.[39,101–103]

Fuchs et al.[104] showed that a cervical length of < 15 mm in a population presenting with painful contractions (< 32

weeks) had a 5.5-fold increased risk (44%) of delivery within a week, and those with a cervical length of ≥15 mm had a 2% risk.[104] In other studies, delivery occurred within 7 days of presentation in 37% of 43 women with cervical length <15 mm,[102] and a cervical length of <20 mm had a 93.7% and 87.5% positive predictive value for preterm birth in primiparous and multiparous women respectively.[105] In all these studies, the cervical length was an independent predictor of preterm delivery.[102–105] In 2010, Sotiriadis et al.[106] published a meta-analysis on the use of cervical length measurements in patients presenting with symptoms of preterm labour. They included prospective cohort and/or case–control studies that evaluated transvaginal ultrasonographic assessment of cervical length for the prediction of preterm birth in women with a singleton pregnancy and intact membranes (studies with <20% premature rupture of membranes and multiples were included, however). Studies involving the use of tocolytics and/or prophylactic steroid administration were also included. They used a weighted analysis to determine test performance. The cumulative data suggest that the cervical length measurement in symptomatic women can be used to discriminate between those at higher and those at lower risk of preterm delivery, which may help to rationalize their management; however, there was considerable heterogeneity across the studies. Table 2 presents data from the study by Sotiriadis et al.[106]

On the basis of the weighted estimates, and using a pooled prevalence of 11.1% for birth within 1 week of presentation, Sotiriadis et al.[106] calculated that the negative predictive values of 15 mm, 20 mm, and 25 mm would be 94.8%, 96.3%, and 95.8%, respectively.

Use of Transvaginal Ultrasound to Stratify Women Presenting With Preterm Labour

In a prospective cohort study among several hospitals using different protocols for threatened preterm labour, the use of ultrasound assessment of cervical length appeared to shorten hospital stay without compromising patient care.[107] In a small (N = 41) trial,[108] women with threatened preterm labour were randomized to a control group, who received tocolytics and steroids in keeping with the hospital's protocol, or to an assessment group who had cervical length measured by transvaginal ultrasound. Women in the assessment group who were found to have a cervical length of <15 mm were given tocolytics and steroids. Those with cervical length of ≥15 mm were not given tocolytics and steroids. No babies in the group considered to be at low risk of preterm birth were born prematurely without a full course of antenatal corticosteroid therapy, and babies in this group had significantly lower rates of exposure to steroids and tocolytics.

The results suggest that it may be safe to use ultrasonographic cervical length assessment to prevent unnecessary use of tocolytics and steroids.[108] However, the small sample size of this study does not provide adequate power to assess uncommon outcomes such as preterm birth at <34 weeks and to determine whether this approach could cause harm.

A meta-analysis by Berghella et al.[58] evaluated the efficacy of cervical length measurements to prevent preterm birth by asking whether the knowledge of ultrasonographic cervical length affected the rate of preterm birth.[58] This was studied in 2 groups: those that presented in preterm labour and those with preterm rupture of membranes. Knowledge of TV ultrasonographic cervical length results was associated with a non-significant decrease in preterm birth at <37 weeks (22.3% and 34.7%, respectively; RR 0.59; 95% CI 0.26 to 1.32). Delivery occurred at a later gestational age in the knowledge than in the no-knowledge group (mean difference 0.64 weeks; 95% CI 0.03 to 1.25). The authors concluded that there was insufficient evidence to recommend routine screening of asymptomatic or symptomatic pregnant women with transvaginal ultrasound. However, it should be noted that the total number of women in the study was small (total N = 290 in preterm labour, n = 92 in premature preterm rupture of membranes). Also, the study did not determine whether progesterone or cerclage was used, and it included clinical presentations in which neither of those interventions would likely be used.

In summary, it appears that TV ultrasonography can be used to stratify risk in women presenting with preterm labour, and there is some evidence that suggests this can be done safely and with some benefit.

Recommendation

5. In women presenting with suspected preterm labour, transvaginal sonographic assessment of cervical length may be used to help in determining who is at high risk of preterm delivery and may be helpful in preventing unnecessary intervention. It is unclear whether this information results in a reduced risk of preterm birth. (II-2B)

Ultrasonographic Cervical Assessment in Women With Suspected Preterm Premature Rupture of Membranes

Preterm premature rupture of membranes conveys an increased risk of chorioamnionitis and preterm birth.[27,28] In such circumstances, uterine contractions causing cervical change are difficult to assess because the digital cervical examination is associated with an increased risk

Table 2. Meta-analysis of the use of cervical length measurements (Sotiriadis et al.[106])

Performance based on a 15 mm threshold									
Outcome	Studies	n	Prevalence	Sens	Spec	LR+	LR−	PPV	NPV
< 48 hours	3	1266	7.1	71.1	86.6	5.92	0.35	28.8*	97.5*
< 7 days	6	1781	11.1	59.9	90.5	5.71	0.51	44.03*	94.7*
< 34 wks	4	429	18.18	46.2	93.7	4.31	0.63	62.2*	88.7*
Performance based on a 20 mm threshold									
Outcome	Studies	n	Prevalence	Sens	Spec	LR+	LR−	PPV	NPV
< 7 days	4	1263	9.3	75.4	79.6	3.74	0.33	27.6*	96.9*
< 34 wks	2	385	20.5	49.4	93.1	n/a	n/a	65*	88.5*
Performance based on a 25 mm threshold									
Outcome	Studies	n	Prevalence	Sens	Spec	LR+	LR−	PPV	NPV
< 7 days	4	856	9.7	78.3	70.8	2.81	0.36	22.3*	96.8*
< 34 wks	5	735	11.40	64.3	68.4	n/a	n/a	20.8*	93.7*

* Extrapolations based on unweighted data presented for each horizontal category

Sens: sensitivity; Spec: specificity; LR: likelihood ratio; PPV: positive predictive value; NPV: negative predictive value.

of infection and should be postponed until labour is established. Several cohort studies have shown that the cervical length measured by TV predicts latency to delivery in preterm premature rupture of membranes.[109,110] In a much smaller study, cervical length measurements by TP ultrasound did not correlate with latency duration to delivery.[111] Transvaginal cervical length measurement in a randomized trial was not found to increase the risk of infection in patients with preterm premature rupture of membranes. This study did not find that cervical length had predictive value for latency. This is not consistent with the findings of another study.[112]

Summary Statement

6. Transvaginal ultrasound appears to be safe in preterm premature rupture of membranes, but its clinical predictive value is uncertain in this context. (II-2)

The Use of Progesterone in Women With a Short Cervical Length by Ultrasonographic Assessment

Recent studies have evaluated the use of progesterone in patients with a short cervix to prevent preterm delivery. In a study by Fonseca et al.,[83] 250 women (24 to 34 weeks' gestation) who were determined to have a cervical length of < 15 mm were randomized to either vaginal progesterone (200 mg each night) or placebo. The primary outcome was spontaneous delivery before 34 weeks. Delivery before 34 weeks of gestation was less frequent in the progesterone group than in the placebo group (19.2% vs. 34.4%; RR 0.56; 95% CI 0.36 to 0.86). However, there was no statistically significant reduction in neonatal morbidity (8.1% vs. 13.8%; RR 0.59; 95% CI 0.26 to 1.25; $P=0.17$). There were no serious adverse events associated with the use of progesterone.[83] In a secondary analysis of a randomized, double-blind, placebo-controlled trial of progesterone to prevent preterm birth in patients with a history of preterm birth,[113] the use of progesterone when cervical length was < 28 mm was associated with a reduction in preterm birth prior to 32 weeks (0% vs. 29.6%, $P=0.014$), fewer NICU admissions (15.8% vs. 51.9%, $P=0.016$), and shorter NICU stays (1.1 vs. 16.5 days, $P=0.013$). A recent randomized trial compared cerclage and 17 α-hydroxyprogesterone for short cervix (< 25 mm) in a high-risk population and showed no difference in rates of preterm birth; however, this study was small (N = 79) and underpowered, because recruitment was halted at the midpoint of the study. In a sub-analysis of that data set, it was shown that cerclage may be better if the cervix is < 15 mm.[114] In 2009, the United States Food and Drug Administration declined approval of this use of progesterone, because of concerns about possible adverse effects, but in February 2011, intramuscular progesterone was approved for the prevention of preterm birth.[115] Although progesterone supplementation in women with a previous preterm birth and a short cervix appears promising, more data are needed to better demonstrate benefit and a number of studies are in progress.[116] A committee consensus could not be reached to recommend its use in this population.

Ultrasonographic Cervical Length Assessment and Cervical Cerclage

Several studies have evaluated the value of cervical cerclage in women with ultrasonographically diagnosed short cervix. A prospective cohort study was the first to show benefits in those who had a cerclage versus those who had usual care, with significantly lower rates of prematurity and no fetal losses.[84] Subsequently, 3 randomized trials had disparate findings, although their patient populations were different.[87,90,117] A meta-analysis of patient level data of

those 3 studies showed that in women with a history of spontaneous preterm birth and a cervical length < 25 mm before 24 weeks' gestation, placement of a cervical cerclage was associated with a significant decrease in preterm birth < 35 weeks of gestation (from 39% to 23%).[86] A recent National Institutes of Health-sponsored multicentre trial confirmed these findings, noting a significant reduction in preterm birth < 35 weeks and/or previable delivery in women with a prior spontaneous preterm birth and mid-trimester transvaginal cervical length < 25 mm, with findings most pronounced when cervical length was < 15mm.[118]

In patients with membrane prolapse at or beyond the external os of the cervix, there may be benefit to emergency cerclage compared with conservative management. Several retrospective studies[119–122] suggest that pregnancy outcomes are better with emergency cerclage, and a small randomized trial[82] also showed significant prolongation of pregnancy and reduced preterm delivery rates.

Recommendations

6. In asymptomatic women with a history of spontaneous preterm birth and an ultrasonographically diagnosed short cervical length (< 25 mm) prior to 24 weeks of gestation, cervical cerclage should be considered to reduce the risk of preterm birth. (I-B)
7. In all asymptomatic women who present with membranes at or protruding past the external cervical os, an emergency cerclage should be considered to reduce the risk of preterm delivery. (I-B)

Ultrasonographic Cervical Length Assessment After Cervical Cerclage Placement

There is limited information on the use of ultrasonographic cervical length assessment after cervical cerclage placement. Studies involve a combination of both elective and emergency cerclage, which can confuse the results. It is unclear whether ultrasound assessment is superior to clinical examination in determining the need for cerclage.[123] Cervical length significantly increases post cerclage,[124–126] but the overall length post cerclage does not seem to predict preterm birth.[124,126] There is some evidence that absent or short cervical length above the cerclage[123,125] or the appearance of funnelling to the level of the cerclage[123,126] (at 24 to 28 weeks) increases the risk of preterm delivery. In particular, 2 studies have shown that funnelling down to the cerclage has a 50% risk of preterm premature rupture of membranes.[123,126] Progressive shortening may also indicate an increased risk of preterm birth, but the difference between women who deliver preterm and those who deliver at term, is slight.[123–126] There is considerable disagreement about when to initiate, how frequently to reassess, and when to stop performing transvaginal cervical length assessments after cerclage, and its value is therefore in doubt.[123,124] O'Brien et al.[126] empirically suggest every 2 to 4 weeks post cerclage placement until 28 weeks of gestation, whereas other authors suggest that cervical length shortening after 28 weeks is most diagnostic of preterm delivery.[123,124] Although the assessment of the cervix may help identify those at increased risk of preterm birth, it cannot predict when it will occur.

Summary Statement

7. It is unclear whether ultrasonographic cervical length assessment has significant advantages over clinical examination alone after elective or emergency cervical cerclage placement, although some signs, such as funnelling to the stitch, are associated with a high risk of preterm premature rupture of membranes. There is no consensus on the frequency or timing of ultrasonographic cervical length assessment post cerclage. (II-2)

Serial Ultrasonographic Cervical Length Assessment Compared With Clinical Assessment of Need for Elective Cerclage Placement

Several authors have noted that if a policy of surveillance is used in women at high risk, with urgent or emergency cerclage for those who develop a short cervix, approximately 60% of those patients would not have required cerclage. In small studies, this approach of using cervical cerclage in only women with a short cervix had perinatal outcomes equivalent to those in women who had elective cerclage.[117,127] The CIRCLE trial[128] was a randomized trial of either serial TV ultrasound measurements with cerclage when cervical length was < 20 mm or clinician-based assessment of need for elective cerclage. Its findings, published in 2009, were not consistent with those of earlier studies: the TV ultrasound group was found to have significantly more interventions, including cerclage, hospitalization, and progesterone use with no difference in outcomes.[128]

Summary Statement

8. It is unclear whether a policy of cervical length surveillance is equivalent to clinical assessment of the need for elective cerclage in those at risk of preterm delivery. (I)

ULTRASONOGRAPHIC CERVICAL LENGTH COMBINED WITH FETAL FIBRONECTIN IN THE PREDICTION OF PRETERM BIRTH

Multiple studies have considered association between ultrasonographic assessment of cervical length and the presence of fetal fibronectin. It appears they are independently associated with an increased risk of preterm birth although there is some overlap.[42,50,129–132] Direct comparison of these tests can be difficult. Depending

on the threshold of cervical length or fetal fibronectin concentration used, the sensitivities and specificities will vary. The definitions of preterm birth and/or the outcome of interest (delivery within a certain interval of time) differ from study to study. These tests have a low sensitivity in a low-risk population and should be used in women at high risk rather than for general screening.[133] Study findings vary, so it is unclear whether one is more predictive than the other.[129,134,135] The combination of both (sequentially or in tandem) may be more effective than using one alone, but again conflicting results have been found.[31,50,129,133–137] Whether these screening strategies result in reduced interventions and use of resources remains uncertain.[138–140]

Summary Statement

9. Ultrasonographic cervical length assessment and fetal fibronectin appear to be similar in predictive ability, and the combination of both in a high-risk population may be of value. However, further research is needed in this area. (II-2)

CONCLUSION

Ultrasonographic cervical measurement is a safe and effective technique to predict increased risk of preterm delivery in selected women. The transvaginal route appears to be the most well studied and is acceptable to women; however, the transperineal route can also be used if the patient declines the transvaginal route. It can also be used to prevent unnecessary interventions in women at increased risk of preterm delivery if the result is reassuring. In contrast, routine prenatal transvaginal ultrasound screening of cervical length in low-risk populations is not supported by available evidence. Evidence from randomized trials supports the recommendation of cerclage in patients with a prior preterm birth and a short cervix. The thresholds proposed vary from 15 mm to 28 mm. The use of progesterone in patients with a short cervix appears promising, but consensus recommendation awaits further evidence and/or analysis. Further evidence is also needed with respect to the utility of measuring fetal fibronectin in conjunction with measurements of cervical length.

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