

Ultrasound measurement of cervical length in the second trimester of pregnancy for prediction of preterm delivery

Akademisk avhandling

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Avhandlingen baseras på följande delarbeten

- I. **Kuusela P, Jacobsson B, Söderlund M, Bejlum C, Almström E, Ladfors L, Hagberg H, Wennerholm U-B.** Transvaginal sonographic evaluation of cervical lengths in the second trimester of asymptomatic singleton pregnancies, and the risk of preterm delivery. *Acta Obstetrica et Gynecologica Scandinavica* 2015;94:598-607.
- II. **Kuusela P, Jacobsson B, Fadl H, Wesström J, Lindgren P, Hagberg H, Wennerholm U-B*, Valentin L*.** Second-trimester ultrasound measurement of cervical length for prediction of preterm delivery: a Swedish population-based multicentre observational study. *equal contribution. *In Manuscript*.
- III. **Kuusela P, Wennerholm U-B, Fadl H, Wesström J, Lindgren P, Hagberg H, Jacobsson B, Valentin L.** Inter-and intra-observer agreement and reliability of second-trimester cervical length measurements with transvaginal ultrasound. *Submitted*.

Ultrasound measurement of cervical length in the second trimester of pregnancy for prediction of preterm delivery

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Abstract

Background: Short cervical length is a risk factor for preterm delivery (PTD) and screening of cervical length using transvaginal ultrasound in the second trimester is a proposed method to find women at risk

Aims: To examine the potential value of routine measurement of cervical length in a Swedish population of women with singleton pregnancies in the prediction of PTD. To estimate inter- and intra-observer agreement and reliability of cervical length measurements.

Methods: Women at routine fetal scan examinations in the second trimester were recruited to a study measuring cervical length with transvaginal ultrasound. Assessments were performed by certified midwives. Women were recruited at two Swedish centers in the PILOT study (Paper I) and at seven Swedish centers in the CERVIX study (Paper II). In the PILOT study the results of the measurements were not blinded but in the CERVIX study they were. The cervix was measured once in the PILOT study and twice, at least two weeks apart, in the CERVIX study. The isthmus was measured separately in the CERVIX study. The REPRODUCIBILITY study (Paper III) forms part of the CERVIX study and consists of two studies: the LIVE study and the CLIPS study. In the LIVE study, seven pairs of midwives assessed cervical length in between 24 and 30 women each. In the CLIPS study, 16 trained examiners (raters) measured cervical length twice at least two months apart on 93 video clips. The midwives were blinded to each other's results and in the CLIPS study also to their own previous results.

Results: Paper I: In the PILOT study, cervical length was measured in 2122 women. Median cervical length at 16-23 gestational weeks (GW) was 39.0 mm and the prevalence of a short cervix (≤ 25 mm) was 0.5%. There was a significant association between cervical length and spontaneous PTD < 34 GW.

Paper II: The CERVIX study included 11 456 women. The prevalence of endocervical length ≤ 25 mm was 4.0% at 18-20 GW (Cx1) and 4.4% at 21-23 GW (Cx2). Isthmus was present in 23% at Cx1 and in 9% at Cx2. The discriminative ability of endocervical length was better in women with no isthmus than in women with isthmus and better at Cx2 than at Cx1. At Cx1, to predict spontaneous PTD at < 33 GW the best cut-off point for endocervical length was ≤ 29 mm, which had a sensitivity of 43%, Area Under receiver operating characteristic Curve (AUC) of 0.68. The corresponding figure at Cx2 was ≤ 27 mm with AUC 0.76. Using the 27 mm cut-off at Cx2 identified 54% of spontaneous PTD before 33 gestational weeks with 35 false positive test results per one true positive and 449 women were screened to correctly identify one woman as being at risk. **Paper III:** For the best examiner pair in the LIVE study the mean difference between the two examiners' measurements of endocervical length was 0.33 mm, the limits of agreement -4.06 to 4.72 mm, for the poorest examiner pair it was 0.73 mm and -11.7 to 13.2 mm, respectively. In the CLIPS study, the repeatability for the best rater was 3.9 mm and that of the poorest 9.6 mm (median 5.9 mm).

Conclusions: In the second trimester short cervical length is a risk factor for spontaneous PTD - the shorter the cervix the higher the risk. At this point cervical length has a moderate ability to identify women at risk, the discriminative ability being higher to predict early PTD (< 33 GW) than PTD 34-37 GW. Inter-observer agreement and reliability of second trimester cervical length measurements differed substantially between examiner pairs in the LIVE study and so did intra-observer measurement error, repeatability and reliability between the examiners in the CLIPS study.

Key words: Cervical length measurement, preterm delivery, second trimester of pregnancy, prospective study, cohort study, observational study, mass screening, reproducibility of results, inter-observer variation, intra-observer variation, data accuracy, quality control