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Title and subtitle

Three – dimensional ultrasound studies of the cervix during pregnancy

Abstract

The aim of this thesis was to evaluate cervical physiological changes by three-dimensional (3D) ultrasound during pregnancy and to investigate the ability of 3D power Doppler to predict time to spontaneous and induced delivery in prolonged pregnancy.

The thesis is based on five studies: reproducibility of cervical measurements by 3D power Doppler ultrasound (study I), reference data representative normal findings of the cervix assessed by 3D ultrasound during pregnancy (studies II, III) and the ability of 3D power Doppler to predict time to spontaneous and induced delivery in prolonged pregnancy.
(Study IV and V). 935 women from 17 to 42 gestational weeks (gws) were examined by 2D and 3D ultrasound.
Reference values for cervical length, anterior-posterior (AP) diameter and width, cervical volume and cervical funneling length, AP diameter and width, and for cervical blood flow indices VI (vascularization index), FI (flow index) and VFI (vascularization flow index) as assessed by 3D ultrasound at 17 to 41 gws were established. There was excellent agreement between 2D and 3D ultrasound results. The cervix shortens from 33 gws. Cervical diameter and width increases from 31 gws. Cervical funneling and an opening of the cervical canal become more common with advancing gestation. Separate values for cervical length for nullipara and multipara should be used from 33 gws. Cervical volume and blood flow indices do not change from 17 to 40 gws but cervical volume is smaller at 41 gws than at 17 to 40 gws. Multipara have larger cervix than nullipara and their cervix is more vascularized at 17 to 30 gws. Our reference data lay the basis for studies of pathological conditions in the cervix during pregnancy.

Univariate regression analyses showed that Bishop score, cervical length and parity are related with time to spontaneous onset of labor and time to delivery. VI is related to time to spontaneous delivery. Multivariate logistic regression showed that Bishop score and vascular indices did not enter any model to predict onset of labor, only cervical length, width and parity did. Model including cervical length, VI and VFI predict delivery > 48h. Cervical length and Bishop score were both independent predictors of delivery > 60h. The areas under the ROC curves did not differ significantly between the diagnostic tests. Changes in VI give some credibility to assumption that vascular changes in the cervix occur when it ripens.
In women with prolonged pregnancy undergoing labor induction with prostaglandin suppositories ultrasonographic cervical length, Bishop score and parity were related to the success of labor induction, but 3D power Doppler indices were not. Nonetheless, VI and VFI were slightly higher in women who were in labor <12h after start of induction.
Our study to determine the reproducibility of 3D ultrasound examination of the cervix showed high inter-CC and intra-CC values for cervical volume and blood flow indices, but wide limits of agreement. This means that it is probably not possible to detect anything but large differences or changes in cervical volume and blood flow indices using current 3D ultrasound technique.