Fetal breech presentation: impact on perinatal posture and locomotion

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Summary

Fetal posture and behaviour are the result of an interaction between fetal (neuromotor) development and intra-uterine environmental restraints. Changes in intrauterine environment have been found to influence fetal and later postnatal behaviour. By using ultrasound observations, information can be obtained about fetal neuromotor development by observation of the posture and movements of the fetus in its own intrauterine environment. As breech presentation is the most commonly occurring fetal malpresentation in term pregnancy, it is an ideal model to study influences of this physiological change in intra-uterine environment on fetal and postnatal development.
The aetiology of breech presentation remains unknown for the greater proportion of healthy breech fetuses. Increasing attention is being focussed on the neuromotor development of babies born in breech presentation. It has been suggested that factors intrinsic to the fetus may be responsible for both the breech presentation and any subsequent neurological morbidity, as opposed to the mode of delivery being the only cause for neurological abnormality in these babies.

For this thesis different aspects of perinatal posture were studied in a group of healthy breech fetuses and compared to findings in a group of healthy cephalic fetuses. Starting from 33 weeks gestational age until birth weekly ultrasound examinations were performed in which fetal head-, arm and leg posture were observed. Postnatal examination of leg posture during general movements was done at 2, 4, 6, 12 and 18 weeks postnatal age to assess the influence of prenatal fetal presentation on postnatal development. Furthermore, we studied walking performance for both groups at the age of 2.5 years to investigate long-term effects of the prenatal presentation.

In **chapter 1** a general introduction is given about fetal breech presentation and its consequences for postnatal development. An overview is presented of reports on possible prenatal and early postnatal differences in (neurological) development between breech and cephalic fetuses. Furthermore, an outline of this thesis is provided.

In **chapter 2** the results of our observations on the influence of breech presentation on prenatal head-position preference are presented. The development of a lateralised head-position preference was clearly less outspoken in the breech fetuses when compared to the cephalic group. Our data show an association between the orientation of the fetal vertebral column and head-position predominance in the group of cephalic fetuses only, which complies with Previc's left-otolithic dominance theory. No association could be detected between changes in fetal head shape (that normally occurs in breech fetuses) and head-position preference. These findings support the idea that environmental influence (i.e. intra-uterine environment) may play an important role in the development of fetal lateralised behaviour. However, other factors such as possible differences in the development of the vestibular system should be considered too.

Chapter 3 deals with the effect of breech presentation on fetal arm posture development. No differences were found between breech and cephalic fetuses in elbow and finger posture in the final trimester of pregnancy. However, breech fetuses exhibited significantly less wrist flexion after 36 weeks gestational age than the cephalic controls. We believe that environmental restrictions led the cephalic fetuses to adopt a wrist posture that is more flexed than that of the breech fetuses. Especially since the fetuses in both groups preferentially held their hands in the vicinity of the fetal head, which means that the breech fetuses had their hands positioned in the upper part of the uterus, whereas the cephalic fetuses' hands were in the lower part of the uterus most of the time. And the fact that this difference in flexion was found very late in pregnancy supports this hypothesis.

In **chapter 4** the extensive influence of intra-uterine environment on fetal leg posture is described. In the group of breech fetuses a clear preference was found for a leg posture with extended knees when compared to the cephalic fetuses. The cephalic fetuses on the other hand showed significantly more crossing of the lower part of the legs than the breech fetuses. For both findings, no significant change over time could be observed in either group. A leg position with crossing of the lower legs over each other, as we

observed in the cephalic fetuses, is thought to lead to a more abducted hip position in utero than when the legs are uncrossed. As abduction of the hip joint facilitates normal development of the femoral head and the acetabulum, the observed preference leg position of our breech fetuses with extended knees and uncrossed lower legs could be one of the reasons why breech fetuses show a significant risk of abnormal development of the hip joint.

In **chapter 5** the results of our study of postnatal leg posture during general movements in both groups are reported. The breech infants showed significantly more hip flexion in the first 4 to 6 weeks after birth than the cephalic infants. Between 2 and 4 weeks postnatal age a significant decrease in hip flexion together with an increase in hip extension for the breech fetuses could be observed. The striking prenatal difference between both groups with significantly more knee extension for the breech fetuses had already disappeared within two weeks after birth. The observed differences between the breech and the cephalic babies were transient, as from 12 weeks on no significant differences were seen anymore between both groups, which is in accordance with earlier reports.
Changing from supine to a vertical position had more impact on hip posture in the breech (significantly more hip extension) than in the cephalic group (no significant change in hip posture). Differences in hip posture between the groups were also less outspoken in vertical position than in supine. Together, this implies that the impact of gravity exceeds that of the prenatal hip movement restriction in the breech infants.

In **chapter 6** the possible role of prenatal breech presentation, and thus prenatal environmental constraints, on qualitative aspects of locomotion was investigated. No significant differences between the breech and the cephalic group in functional hip dynamics during walking were found at 2.5 years of age. Moreover, when the children were challenged to cross a gap during walking, no differences in achieved maximum gap width were found between both groups, meaning that the breech-born children performed equally well in this task as the control children. However, nearly half of the breech-born children used significantly less extra hip flexion to achieve the

same gap width in comparison with the control group. Given the finding that there was no significant difference between these two groups in the total amount of extra hip motion involved in maximum gap crossing, it seems that this subgroup of breech children must apply extra hip extension in the trail leg, (although not significantly more than the control group), to compensates for the smaller amount of extra flexion in the leading leg.
Our findings illustrate once more the transient, age-dependent nature of the effects of prenatal breech presentation when considering hip function in a functional task. Nonetheless, subtle differences remain between the groups in the execution of the instructed task.

In **chapter 7** findings are reported about three fetuses that spontaneously turned from breech to cephalic presentation during the study period. After their change to cephalic presentation, these fetuses showed resemblance with the cephalic fetuses in head preference posture. For leg posture, in the period before spontaneous version these fetuses exhibited less preference for knee-extension and possibly more leg crossing than the fetuses that remained in breech. After version a clear preference for knee flexion was observed, in accordance to the behaviour in the group of cephalic fetuses. When considering arm posture, the data for wrist flexion after spontaneous version show a decrease, which is more in resemblance with the behaviour of the breech fetuses. So for two of three studied aspects of prenatal posture the spontaneously verted fetuses seem to show adaptation to the prenatal change in intra-uterine environment. This group of fetuses could be interesting to observe possible determinants for spontaneous cephalic version and for aetiology of persistent breech presentation for that matter.

Chapter 8 comprises an epilogue with thoughts on the backgrounds behind our findings. The observed differences between healthy breech and cephalic fetuses and infants are demonstration of the fact that intra-uterine environment is an important determinant of both pre- and postnatal development. The ways in which the healthy fetus and infant are able to adapt to changes in (intra-and extra-uterine) environment are remarkable. With the increasing demand for optimal counselling of parents on health and

development of their (unborn) child, knowledge of neuromotor development of fetuses and infants is gaining importance. Further postnatal research on the development of head posture, arm posture and movements, behavioural asymmetries and general movements is necessary. The importance of multidisciplinary efforts in this respect is stressed.