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The influence of prenatal breech presentation on neonatal leg posture

Bianca F. Fong [a,b,*], Geert J.P. Savelsbergh [a,c], Maaike R. Leijsen [a], Johanna I.P. de Vries [a,b]

[a] Research Institute MOVE, Faculty of Human Movement Sciences, VU University, Amsterdam, The Netherlands
[b] Department of Obstetrics & Gynaecology, VU University Medical Centre, Amsterdam, The Netherlands
[c] Institute for Biomedical Research into Human Movement, Manchester Metropolitan University, UK

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ABSTRACT

The aim of our study was to examine the effect of prenatal breech presentation on postnatal leg posture. Twelve infants were born after breech presentation and nine infants after cephalic presentation participated. At 2, 4, 6, 12 and 18 weeks postnatal age leg posture was examined during general movements in supine and vertical position.

Results: Transient differences in hip posture between the groups were observed during the first 6 weeks postnatal age, with significantly more hip flexion and less hip extension in the breech group. For knee extension, differences between the groups were not statistically significant.

Changing from supine to vertical position, the breech group demonstrated a significant increase in hip extension, with no significant changes in hip posture for the cephalic group. For both groups the vertical condition resulted in a significant increase in knee extension. Continuity from pre- to postnatal life was found for hip posture in both groups and for knee extension only in the breech group.

Conclusions: Significant differences between breech and cephalic-born infants were found during the first 6 weeks after birth and mainly concerned hip posture and not knee posture. An increase in gravitational force has more impact on leg posture in the breech than in the cephalic group. The observed differences in hip posture between the studied groups were found to be transient, however, in the long term subtle differences still remain between the groups.

1. Introduction

Movement restriction in the human foetus can cause abnormal development of bones and joints. Persistent and most severe forms are caused by congenital disorders like the foetal hypokinesia–akinesia disorder sequence [1]. In pregnancies complicated by oligohydramnios transient effects have been found on the quality of foetal and neonatal movements until 5 weeks after birth [2]. Even in physiological circumstances, like in uncomplicated foetal breech presentation, movement restriction of the foetal hips seems to have an influence, demonstrated by the known association between breech presentation and congenital hip dysplasia [3,4].

Also, Sival et al. [5] have demonstrated long term effects of foetal breech presentation on postnatal motor functions of the lower limbs, namely leg posture, reflexes and posture while walking until the age of 12–18 months. In a comparison between breech-born and cephalic-born infants Bartlett et al. [6] found minor transient differences; more open popliteal angles at birth (Dubowitz assessment) and significantly lower motor scores at 6 weeks (Alberta Infant Motor Scale) in the breech infants. Both studies lack extensive longitudinal and repeated foetal postural assessment to relate to the postnatal data.

The aim of our study was to examine the effect of prenatal breech presentation on postnatal movements of the lower limbs in children of whom we know that they have been in breech presentation for at least 6 weeks before birth. In weekly observations of prenatal posture from 33 weeks gestational age onwards, we demonstrated significantly more knee extension in the breech foetuses and significantly less crossing of the lower part of the legs in this group when compared to cephalic foetuses in the same gestational age period [7]. We studied leg crossing prenatally as a means of getting an indirect impression of foetal hip motility, as with 2-D ultrasound it is impossible to get a direct view of the hip joint. For the same study groups, we reported earlier on the influence of breech presentation on foetal arm posture and head position preference [8,9]. Now we are able to correlate foetal postural aspects with postnatal development of the lower extremities up to 18 weeks. In this paper we will focus on three aspects. Firstly, what is the development of leg posture during general movements in the first 18 weeks after birth in children born after breech and cephalic presentation and is there a difference in this development between these groups? With our prenatal data in mind, we would expect more knee extension and less hip extension in the breech group, especially in the first weeks after birth. Secondly, what is the influence of a change in gravity on the leg posture development in both groups? By

* Corresponding author. Department of Obstetrics & Gynaecology, VU University Medical Centre, Amsterdam, The Netherlands. Tel.: +31 20 4443258; fax: +31 20 4441485.
E-mail address: b.f.fong@mca.nl (B.F. Fong).

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Table 1
Clinical data for the breech and the cephalic groups

	Breech (n = 12)	Cephalic (n = 9)
	Mean (range)	Mean (range)
Maternal age	33 (30–42)	35 (27–37)
Parity: P0/P1	8/4	9/0
Sex: F/M	8/4	3/5
GA at birth (weeks)	38 (36–39)	39 (37–42)
Birth weight (g)*	3271 (2800–3810)	3682 (3070–4400)
1 min AS	9 (6–10)	9 (5–10)
5-min AS	10 (8–10)	9 (6–10)
UapH	7.25 (7.07–7.32)	7.19 (7.09–7.33)

F = female; M = male; P0 = nulliparous; P1 = primiparous; GA = gestational age; AS = Apgar score; UapH = umbilical arterial pH; *p < 0.05.

positioning the children first in supine and thereafter in vertical position we studied the influence of a physiological change in postnatal environment, namely an increase in gravitational forces. Our hypothesis here is that severity of prenatal movement restriction would be inversely related to the impact of an increase in gravitational forces. And finally, can continuity in leg posture be found when going from prenatal to postnatal life for both groups? Our expectation is that for the breech babies postnatal leg posture would show more continuity with prenatal findings because of the prenatal movement restriction experienced by this group.

2. Methods

Twelve children after uncomplicated breech presentation and nine children after cephalic presentation participated in the present study. The study was approved by the Medical Ethics Committee of the VU University Medical Centre and all parents of the participating infants gave their informed consent.

This study is part of a longitudinal follow-up study on the influences of breech presentation on pre- and postnatal development of posture and motility, in both groups of children.

At the postnatal ages of 2, 4, 6, 12 and 18 weeks leg posture was observed during general movements. The children were first laid down and securely fastened on a horizontal platform which supported them up to their buttocks. The legs were not supported, so they had complete freedom of movement in all directions. Four small Light Emitting Diodes (LEDs)were attached to the lateral side of each leg: at the hip joint, the knee, the ankle and the foot. A fifth LED was attached to the torso of the child, in a horizontal line (with the child in supine), approximately 10 cm from the hip joint-LED. With the Optotrak (Northern Digital Inc. Canada) exact 3-D coordinates of the different leg joints were registered during spontaneous movements in one-minute trials. The Optotrak device sampled with a frequency of 100 Hz, so for each one-minute trial 6000 measuring points of leg posture were obtained. After recording 3–4 trials per child in supine position, the children were held in vertical position – only supported under their arm pits by one of the parents – to register spontaneous leg movements in vertical position. Per child, 1–3 one-minute-trials were recorded in vertical position. The recordings were made with the children awake and active (behavioural state 4 [10]). The recordings were stopped if the child was crying (behavioural state 5). In this paper data on hip joints and knee joints will be discussed. In analogy to Sival et al. [5], the position of the hip joint was categorized into: 1. flexion: hip joint angle (the angle between the torso and the upper leg) <90°, 2. semi-flexion: hip joint angle between 90 and 135°, 3. extension: hip joint angle>135°.

The categorization of the knee-angle (the angle between the upper and the lower leg) was made in accordance with our report on the prenatal leg position [11]: 1. flexion: knee-angle<135°, 2. extension: knee-angle>135°.

We tested the continuity of foetal leg position and postnatal hip joint posture by comparing the last prenatal data on leg crossing to the first postnatal data on hip extension for the groups. Transition from prenatal to postnatal environment for the knee joint is studied by combining the last prenatal data on knee-extension with the first postnatal data for the same joint.

Data are presented in percentages of the observation time that the children had their joints in one of the specified angle-categories.

Statistical analysis was performed using SPSS 15.0. Values of both legs were accounted as independent values. A Wilcoxon sign ranks test was performed to determine changes in time. Unpaired t-tests were performed to determine differences between the study group and the control group in this aspect. Paired t-tests were performed to determine the difference between the horizontal and the vertical study condition within the groups. Effects of the transition from pre- to postnatal environment were analysed by using a Wilcoxon sign ranks test.

3. Results

Table 1 shows the clinical data for both groups. All babies in both groups had birth weights > 10th centile according to Kloosterman [12]. However, the birth weights in the breech group were significantly lower than those in the cephalic group (mean 3271 g vs. 3682 g; p = 0.031). This is probably because the breech infants were born earlier than the cephalic infants (mean 38 weeks vs. 39 weeks). The amount of amniotic fluid was within the normal ranges with the exception of one breech foetus, having an Amniotic-Fluid-Index below the 5th centile at all registrations. This foetus did not show outliers in the results. No twin pregnancies were included in our study group. No uterine anomalies were known before participation in the study and none detected during or after delivery.

Nine infants in the breech group were born in frank breech position (with both knees extended) and 3 showed complete breech (with both knees flexed) at birth. Our prenatal data (Table 2) show a great consistency in the type of breech position from 33 weeks onwards. Since only 3 foetuses were in complete breech we chose not to compare differences between the different groups of breech foetuses. When excluding the three complete breech foetuses from the analyses, the observed differences between the two groups become even more pronounced, especially in the data on hip flexion and hip extension (results not shown).

All children were neurologically examined in the first week after birth and at one year of age with the method described by Prechtl [13] with special attention for active and passive muscle tones [14]. They were all found to be neurologically normal. None of the children in our study group showed signs of congenital hip dysplasia at ultrasound examination of the hips at about 3 months of age.

Table 2
Breech group: type of breech presentation during prenatal ultrasound and presentation at birth

GA (weeks)	33	34	35	36	37	38	39	Presentation at birth
1	F	F	F	F	F	F		F
2	C	C	C	C				C
3	I	C	F	C	I	C		C
4	C	I	C	C	C	C	C	C
5	F	F	F	F	F	F		F
6	I	F	–	F	F	I		F
7	F	F	F	F	F	F	F	F
8	–	F	F	F	F	F	F	F
9	I	F	F	F	F	F		F
10	–	F	F	F	F			F
11	F	F	F	F	F	F		F
12	F	F	F	F	F	F		F

F = frank breech; C = complete breech; I = incomplete breech (one leg flexed and the other leg extended); GA = gestational age; – = no data available.