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Clinical Course of Asymmetric Motor Performance and Deformational Plagiocephaly in Very Preterm Infants

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Objectives To describe the clinical courses of positional preference and deformational plagiocephaly up to 6 months corrected age (CA) in infants born at gestational age <30 weeks or birth weight <1000 g, and to explore predictive factors for the persistence of these phenomena.

Study design A total of 120 infants were examined 3 times each. The presence of deformational plagiocephaly and a score of 0-6 on an asymmetry performance scale served as outcome measures at 6 months CA. Predictive factors were determined using regression analysis.

Results The prevalence of a positional preference of the head was 65.8% (79 of 120) at term-equivalent age (TEA) and 36.7% (44 of 120) at 3 months CA and that of deformational plagiocephaly was 30% (36 of 120) at TEA and 50% (60 of 120) at 3 months CA. At 6 months CA, 15.8% of the infants (19 of 120) scored ≥2 of a possible 6 on the asymmetry performance scale and 23.3% (28 of 120) had deformational plagiocephaly. Sleeping in the supine position was predictive of an asymmetric motor performance at 6 months CA. Chronic lung disease and/or slow gross motor maturation at 3 months CA predicted the persistence of deformational plagiocephaly.

Conclusion Infants born very preterm may develop deformational plagiocephaly. A positional preference of the head at TEA seems to be a normal aspect of these infants' motor repertoire, with limited ability to predict persistence of an asymmetric motor performance. The decreased prevalence of deformational plagiocephaly between 3 and 6 months CA indicates an optimistic course. Infants with a history of chronic lung disease and/or slow gross motor maturation merit timely intervention. *(J Pediatr 2013;163:658-65)*.

A high prevalence (13%-22%) of asymmetric posture and/or head shape is widely reported in term-born infants.[1-4] The emergence of a positional preference of the head and a deformational plagiocephaly are phenomena which influence or aggravate each other.[5,6] In many studies, environmental factors, including positioning and parental care practices, have been considered risk factors for deformational plagiocephaly.[4,7-10] Mild prematurity also has been identified as a risk factor.[7] In our preliminary retrospective study of 192 infants born at gestational age (GA) ≤32 weeks, a high prevalence of positional preference of the head (n = 86; 44.8%) at term-equivalent age (TEA) was reported during neonatal follow-up. Deformational plagiocephaly was observed in 10.4% of the infants (20 of 192) at TEA and in 13% (25 of 192) at 6 months corrected age (CA). Positional preference, multiple birth, and male sex were found to predict the persistence of deformational plagiocephaly.[11]

These findings were inconclusive regarding the role of motor performance, particularly the development of postural control. In fact, the infant factors contributing to the persistence of asymmetric motor performance beyond age 3 months remain unknown. Very preterm-born infants are at high risk for developmental sequelae.[12] Among the factors that apparently play a role in the motor behavior of these young infants are the neonatal intensive care environment, a relatively immature stage of development, a different course of motor development in the early months of life,[13,14] and an elongated, laterally flattened head shape.[15] At present, whether asymmetry in posture and performance in these infants can be considered a benign transient phenomenon in their developmental trajectory is unclear. The present study aimed to describe the clinical course of positional preference and deformational plagiocephaly in infants born very preterm for up to 6 months CA, and to explore predictive

AIMS	Alberta Infant Motor Scale
BW	Birth weight
CA	Corrected age
GA	Gestational age
T1	Time 1
T2	Time 2
T3	Time 3
TEA	Term-equivalent age
TIMP	Test of Infant Motor Performance
TIMPSI	TIMP Screening Instrument

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factors (in demographics, medical history, social environment, and motor development) for the persistence of asymmetry in motor performance and deformational plagiocephaly.

Methods

All participants (GA <30 weeks) underwent 3 assessments within a 6-month period beginning in April 2009. The infants were examined in the neonatal follow-up clinic at TEA (time 1 [T1]) and 6 months CA (time 3 [T3]) by 2 pediatric physical therapists (M.E. and I.v.H.). At 3 months CA (time 2 [T2]), all infants were examined at home by J.N. The therapists had extensive experience with the assessment of preterm infants. Parents provided informed consent before enrollment in the study, which was approved by the Institutional Review Board of the University Medical Center Utrecht.

Eligible infants were born in or referred to the level III neonatal intensive care unit within 1 week of birth between January 2009 and October 2010. Infants born at GA <30 weeks or with a birth weight (BW) <1000 g who visited the neonatal follow-up clinic at TEA were included. Infants diagnosed with a disease or dysfunction that could possibly lead to a symptomatic asymmetry, such as a central nervous system disorder or congenital malformation, were excluded.[16,17]

In the first year of life, a neonatologist and a pediatric physical therapist simultaneously examined the infants at TEA and at 6 months CA during a 20-minute session in the neonatal follow-up clinic. The same team examined these infants at both visits. At 3 months CA, a 30-minute assessment was performed for all infants in the home setting. The examiner at T2 was blinded to the findings from T1, and the examiners at T3 were blinded to the findings from T2.

Positional preference of the head was defined as the infant's head persistently turned to one side for approximately 75% of the assessment time while in a supine position, along with restricted active movement to the other side and inability to maintain passive rotation. Deformational plagiocephaly was defined as a unilateral occipital flattening of the skull and/or homolateral anterior ear displacement. The skull was observed from both the cranial and posterior views. The degree of deformity was evaluated using the clinical classification scheme of Argenta, with Argenta grade I the mildest form involving one-sided posterior flattening only, grade II also with forward ear displacement, and grades III and IV with additional involvement of the frontal skull and the face.[18] We considered a grade I deformational plagiocephaly at 6 months clinically irrelevant, because this grade of deformation is cosmetically minimal and a further increase in deformation is not expected. For this reason, we chose deformational plagiocephaly ≥grade II as an outcome measure.

The positional preference observed at a younger age usually resolves by age 6 months.[11,19] In our clinical experience, older infants may show asymmetric motor performance in postural control of the head or trunk in a vertical position or in rolling, which might be related to the earlier positional preference or deformational plagiocephaly. To our knowledge, none of the instruments currently used to measure motor development in young infants is designed to specifically measure this kind of asymmetry in motor performance. Consequently, we have developed an asymmetry clinical scale (**Appendix**; available at www.jpeds.com) to standardize the observation and define the persistence of asymmetric motor performance measured at T3. The scale includes head and trunk control, arm movements (eg, grasping), leg movements (eg, kicking), and asymmetry in range of motion (>10°) of the cervical spine or hips and in bidirectional skills (eg, rolling, pivoting). A score of ≥2 (out of a possible 6) on the scale is defined as an asymmetric motor performance. The items of the composite score and cutoff point for asymmetry were reviewed extensively with 3 pediatric physical therapy experts in the field. The items included in the scale were chosen because asymmetry in these items seen in clinical practice is often indicative of the need for an intervention, such as physical therapy.

Predictive Factors

Demographic data (ie, sex and ethnicity), perinatal data (ie, GA, BW, mode of delivery, single or multiple birth, and 5-minute Apgar score), and medical history (ie, duration of admission, mechanical ventilation and continuous positive airway pressure, chronic lung disease, necrotizing enterocolitis, sepsis, and cranial ultrasonography findings at admission, including intraventricular hemorrhage grade I-IV and periventricular leukomalacia grade I-III[20,21]) were recorded. Chronic lung disease grade I was defined as the need for oxygen for >1 month after birth, and grade II was defined as oxygen dependency at 36 weeks postmenstrual age.[22] These factors are believed to impact the variability of positioning and movement patterns.[23,24] Information on the social environment (eg, parental age and educational level, family composition, use of day care), including child-rearing practices (eg, sleep positioning over the last 3 months, actual time in prone and side-lying positions when awake, average time an infant seat is used per day) was elicited via a digital questionnaire sent by e-mail to parents 1 week before T2.

Motor Performance Tests

We applied 3 tests to examine different aspects of motor performance at this early age. General movements were assessed at T1 and T2. This assessment reflects central nervous system integrity by observing endogenously generated whole-body movements with the infant supine. The assessment can be performed up to 6 months CA.[25] General movements are classified as normal, subnormal, mildly abnormal, or definitely abnormal based on fluency, complexity, and variability.[26] We expected to find an association between the quality of the general movements and the variability in postures.

The Test of Infant Motor Performance (TIMP) is commonly used to assess the postural and selective motor control needed for functional performance in daily life in infants from 34 weeks postmenstrual age to 17 weeks post-term. By measuring postural control, we investigated the