Development of posture in prone and supine positions during the prenatal period in low risk preterm infants

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Abstract

The development of posture in the prone and supine positions was studied longitudinally in 10 low risk preterm infants between 31 and 39 weeks' postmenstrual age whose subsequent neurological development at 18 months old was normal. The infants were observed from one week after birth until the expected date of delivery. All postures were analysed according to the procedures described by Prechtl *et al.*

There were large intraindividual and interindividual differences in posture in terms of the duration and incidence of the two positions. There was no age specific preferred posture found in either position. The posture duration in the prone position was longer than that in the supine position, but overall flexed and abducted posture were observed more often in the former. Turning of the head to the right side was also observed more often in the prone than in the supine position.

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The resting posture is used in the neurological assessment of neonates.^{1,2} Saint-Anne Dargassies reported that in preterm infants of 28-37 weeks' postmenstrual age, age specific preferred postures were related to postmenstrual age because of the gradual acquisition of flexor tone in the caudocephalic direction.³ This preference posture is used as an indicator of maturation in the prenatal period.⁴⁻⁶ Some workers, however, have reported that there are no age specific postures in the prenatal period.^{7,8} This study investigated whether preterm infants showed a posture of preference and whether the preferred posture changed with age.

The physiological effects of positioning have been studied to determine whether the recommendation of one position over others is justified,⁹⁻¹¹ but few studies have been conducted on the effects of body position on postural behaviour and motor activity.^{12,13} Another objective of our study was to evaluate the effects of positioning on postural behaviour such as postural change, duration, and incidence.

Some workers have reported that full term infants have a marked tendency to lie with their heads turned to the right in the supine position.¹⁴⁻¹⁶ Gardner *et al*¹⁷ and Prechtl *et al*⁷ found a similar predominant asymmetry towards the right side in preterm infants.

Although many workers have studied the asymmetrical head turning of full term and preterm infants in the supine position,^{7,14-17} there have been few reports on the asymmetrical head turning of preterm infants in the prone position.¹⁸ The final objective of this study was to determine whether preterm infants show similar predominant asymmetry towards the right side in the supine and prone positions during the prenatal period.

Patients and methods

PATIENTS

To exclude the association of preterm birth with other perinatal factors, the following selection criteria were used: reliably known last menstrual date; gestational age <36 completed weeks; birth weight >25th and <90th centile; uneventful pregnancy and delivery; normal Apgar score (>7 at five minutes); no neurological abnormality detected in the first days of life; no complications, including cardiopulmonary, infectious, neurological, metabolic, or haematological complications; normal findings on extensive neurological examination at 38-40 weeks' postmenstrual age; and no sign of abnormality detected by ultrasonography.

From 12 preterm infants selected on the basis of prenatal and immediate postnatal conditions, 10 preterm infants (four boys and six girls) met all postnatal criteria and were included in the study; the other two were excluded because later complications developed 18 months after the expected date of delivery. Gestational ages ranged from 29 to 35 weeks and birth weights from 1080 to 2328 g. They were systematically checked until discharge from the neonatal intensive care unit and neurological examinations during their stay in hospital did not detect any abnormalities. The neurodevelopmental outcome of all infants at 3, 9, 12, and 18 months after the expected date of delivery was normal.

METHODS

Beginning one or two weeks after birth, 10 infants were observed longitudinally until the expected date of delivery. During this period they were filmed two or more times; each video recording included one hour in the supine and one hour in the prone position. Five infants were supine and after one hour their position was changed to prone. The other five infants were changed from prone to supine. There was no standard nursing position. During the

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Figure 1 Preferred posture (most frequently observed posture for each individual infant) in 10 preterm infants at postmenstrual ages of 31 to 39 weeks.

observation period the infants were naked and free to move. Older infants (already in a cot) were placed in an incubator or a warmer place at a neutral temperature during the recording period. At the beginning of the observation the experimenter held the head at the temple between the thumb and forefinger until no resistance was felt; the head was then released. The observation was made in the afternoon, one hour after feeding. The video camera was positioned about 1 m from the incubator. Posture was assessed when the infant had remained still for at least 10 seconds and a sketch was made every time a new posture was assumed. The time spent in each posture was determined by the interval between onset minus the time spent in interim movement.

To process the postural data, each posture was described by a 10 digit number using the technique developed by Cioni *et al.*¹⁹ The first digit indicates the head position (1, 2, or 3, indicating right, left, or centred respectively),

the second the trunk position (1, 2, 3, or 4, indicating supine, right side, left side, or prone), and the last eight digits the postures of the right and left shoulder, elbow, hip, and knee respectively. For these joints, postures were coded from the sketches with the aid of a transparent compass card showing eight sections at 45° each, the sections being numbered from 1 to 8.

All postures observed during the recording period were analysed according to the procedure described by Prechtl *et al.*⁷

Comparison of the data for the two positions was performed using the Wilcoxon test for matched pairs. Separate data were obtained for each of three age groups: 31–33, 34–36, and 37–39 weeks. Comparison between two different age groups was performed using the Mann-Whitney U test.

In this study the preferred posture was defined as the position of the head, trunk, and limbs assumed by the infant for the largest percentage of the observation time. This percentage was obtained by calculating the percentage of total time without movement for each posture.

The preferred head position was defined as that (right or left) assumed during more than 55% of the entire posture time. The preferred head position in the two positions during the prenatal period was compared using the χ^2 test.

Results

There were large intraindividual and inter-individual differences in preferred posture and no clearly dominant pattern of posture in either the supine or prone position was observed. Furthermore, no specific developmental trend was noted with increasing postmenstrual age (fig 1).

There was no difference between the two position or among the three age groups in the number of times each change in posture

Figure 2 Duration of postures at various postmenstrual ages.

Lacey *et al* longitudinally studied the prone and supine resting postures of the pelvis and legs of 106 preterm infants between 30 and 38 weeks' postmenstrual age.¹³ They assessed the posture in relation to the angle of elevation of the pelvis and the weightbearing surface of the knee in the prone position, and in relation to the angle of rotation of the leg in the supine position. They found that the postures of preterm infants could be graded according to position on the resting surface and that each of the three behaviours studied was shown to have a sequence of development. They concluded that the development of antigravity resting postures of the lower limb is apparently age specific, and thus appropriate for longitudinal assessment of the development of preterm infants. Grenier observed that prolonged lying in the prone position resulted in a flattened posture which he termed 'frog lying'.²¹ He proposed that prolonged, excessive hip flexion resulted in shortening of the iliopsoas and adductor brevis muscles leading to 'scissoring'. Downs *et al* found that infants positioned with specific hip support during intensive care displayed significantly fewer features of this flattened posture at the age equivalent to term.²² In our study the flattened posture with the lower limbs abducted and externally rotated and the hips flexed to greater than 90° was noted in both positions. The percentage of the postures described by Downs *et al* is greater in the prone position, however.²² These findings suggest that preterm infants have a postural control system and change their postures according to their position. No age related tendency in the incidence of these postures was observed in either position. Prechtl *et al* reported that there was a clearcut dominant head position to the right side from the age of 28 weeks onward in the supine position.⁷ Our study showed the same phenomenon in this position from the postmenstrual age of 33 weeks onwards. We found no right side dominance for head turning in the prone position, however. Konishi *et al* reported that, when preterm infants are consistently placed in the prone position throughout their neonatal period, they turn their heads in both directions and have a symmetrical skull shape one month after the expected date of delivery.¹⁸ The cause of these phenomena are obscure. About half of the preterm infants in our study turned their head to the left side when they were placed in the prone position, even though they turned their head to the right side in the supine position in the prenatal period. During feeding in the prone position in the incubator, nursing staff turned the infant's head to the left side to observe the infant's face. They turned the infant's head to the right side in the supine position for the same reason.

Among preterm infants, several causes for asymmetrical head turning have been postulated – for example, developmental defect,²³ asymmetrical brain injury,²⁴ and the head turning practices in individual neonatal nurseries.^{18, 25} Our findings suggest that the latter is the cause of the asymmetrical head turning observed in preterm infants.

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