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VI. Early responsivity and speech-language development in preterm infants

Responsivity during early mother-infant communication is generally considered as important for the subsequent speech- and language development of children. This link between early communicative behavior and later development is especially relevant for preterm infants, as differences from the fullterm pattern have been frequently reported in both domains.

In an earlier study (Van Beek, Hopkins & Hoeksma, 1994) we examined infant and maternal responsivity in a fullterm group and three groups of preterm infant-mother pairs at 6, 12 and 18 weeks, corrected age. All four groups consisted of 6 mother-infant pairs. Responsivity (or predictability) was quantified by means of loglinear analyses and information statistics. That is, for both mother and infant it was determined whether the likelihood of the ongoing behavior was influenced by the previous behavior of the partner, while accounting for auto-correlational effects.

No differences were found between the groups in maternal responsivity. A lack of maternal response was uncommon and nearly always co-occurred with a lack of infant response. Infant responsivity, however, did differ between the groups, particularly at the age of 12 weeks. A lack of response was most frequent in preterm infants who were not only born too soon, but also too small for gestational age (4 out of 6). Only a few infants from the two preterm groups with appropriate birthweights (1 of the infants born before 32 weeks and 2 of the infants born after 32-34 weeks of pregnancy) were not responsive to their mother's behavior. All fullterm infants responded to their mothers.

Firstly, the present study will further analyze the specific behavioral patterns of the non-responsive infants at 12 weeks of age. We already noted (Van Beek et al., 1994), that the lack of infant response was mainly due to a lower variability in the infants' behavior, i.e., one behavior was shown for most of the time. Some of the infants still looked at their mother's face for most of the time (they did not yet look at their own extremities like the fullterm infants), while hardly emitting any positive facial or vocal expressions. In other infants 'looking away from the mother' was the most prominent behavior. Now we will try to find more exact boundaries that can identify non-responsive infants from responsive ones on the basis of their behavioral pattern(s) only. This way we attempt to find a method that can be used in a clinical setting.

Secondly, the predictive value of these behavioral patterns will be examined for the subsequent speech and language performance at 18, 22 and 30 months of age in a group of preterm infants (N=25).

Methods

Subjects

- 25 healthy preterm infants (and their mothers): pregnancy <35 weeks and no inborn errors or additional medical complications (severe IVH, IRDS or asphyxia). Eight were small-for-gestational age (SGA=birthweight < p10) and 17 appropriate-for-gestational age (AGA=birthweights ≥ p25), of which 7 were born after 28-31 and 10 after 32-34 weeks of pregnancy.
- 15 healthy fullterm infants (and their mothers).

Procedures

- Micro-analysis of 6 minutes of video-recordings of mother-infant play in a standardized lab situation at 12 weeks of corrected age.
- Dutch version of the Preschool Language Scale (PLS)[1] at 18, 22 and 30 months of corrected age, consisting of a scale for auditory comprehension and one for verbal expression. Quotients are expressed as (test age/norm age) x 100. A quotient of <85, which is equivalent to a delay of about 3 months, is considered less optimal.
- Active vocabulary at 18, 22 and 30 months corrected age: all spoken words the parents could indicate. Five categories were distinguished: 1 (no words), 2 (1-10 words), 3 (11-30 words), 4 (31-50 words) and 5 (>51 words).

[1] The main reason for selecting this instrument instead of the Reynell-test lies in its minimal use of items requiring motor skills. This makes the test more suitable for infants at risk for (mild) motor impairments.

Results

Behavioral patterns of non-responsive infants at 12 weeks post-term

Seven of the 18 preterm infants from our previous study were termed non-responsive on the basis of the loglinear analyses. Two of them spent most of the time (62.6% and 65% respectively) not looking at the face of the mother. Four others did not yet look at their own hands. They mainly looked at mother's face while only showing few positive facial and/or vocal expressions. The seventh infant was an exception, as she and her mother were extremely positive for the majority of time. This should be considered as an artifact of the analyses due to the lumping of all positive behaviors in one category.[2]

Thus, two patterns are seen in non-responsive infants. The first is characterized by a lack of attention for the face of the mother, here defined as 'looking away from the mother for 60% or more'. The second pattern involves the absence of looking at the own extremities in combination with a low expressivity. The distribution of the frequencies of positive expressions in the sample of 25 preterm infants indicated three clusters: from 1-4.5 (N=9), from 6-10 (N=7) and above 11.5 per minute (N=9). A frequency of less than 5 per minute was taken as a cut-off point indicating low expressivity. In doing so, 2 of the 11 infants originally termed 'responsive' on the basis of the loglinear analyses did also comply with

[2] Infant and mother were highly responsive to each other's positive behaviors (e.g., many imitations). The same 'artifact' was found in one of the fullterm infant-mother pairs.

Table 1. Specificity, sensitivity and predictive values for the Comprehension (Comp.) and Expression (Expr.) tasks of the Preschool Language Scales (PLS) and for the active vocabulary (AV of non-responsive versus responsive infants).

	PL 18 months		PLS 22 months		PLS 30 months		AV 22 months
	Comp.	*Expr.*	*Comp.*	*Expr.*	*Comp.*	*Expr.*	
Specificity	0.83	0.73	0.75	0.79	0.69	0.83	0.91
Sensitivity	0.80	0.86	1.00	0.86	0.67	0.70	0.82
Predict. values							
non-responsive	0.80	0.60	0.56	0.67	0.44	0.78	0.90
responsive	0.83	0.92	1.00	0.92	0.85	0.77	0.83

At 18 and 22 months scores <85 on the PLS are regarded as less optimal. At 30 months only 4 infants had quotients <85. Therefore a score <100 is reflected.
For the AV a distinction is made between being in category 5 or not (all but 3 of the fullterm infants were in this category).
The distinctions reflect a relatively slower development, not a disorder. Also 4 fullterm infants had one or both quotients < 85 at 18 months and < 100 at 30 months. At 30 months the quotients were generally higher than at 18 and 22 months in all groups of infants. At all three ages the non-responsive preterm infants scored significantly lower than both the responsive preterm infants and the fullterm group.

these criterion.[3] Only one of the 15 fullterm infants complied with the criteria, indicating that these behavioral patterns are typical for the preterm population.[4]

Responsivity and language performance

Interactions of 25 preterm babies (including 16 from the previous study) were screened for the existence of one of the two 'non-responsive' behavioral patterns described above. This resulted in 11 non-responsive (4 pattern 1 and 7 pattern 2) and 14 responsive infants.
Table 1 shows the specificity, sensitivity and predictive values of this distinction for language comprehension and expression at 18, 22 and 30 months of corrected age. As the active vocabulary at 18 and 30 months hardly showed variability (most infants in category 3 and 5 respectively), only the results at 22 months are displayed.

Conclusions and discussion

The data indicate a considerable relationship between early infant responsivity and later speech and language development.[5]
For comprehension the predictive value for the non-responsive infants becomes

[3] In the following analyses they are regarded as non-responsive.

[4] This infant had scores < 85 at 18 months for both comprehension and expression.

[5] This relationship is considerably higher than the one between language performance and indices of the medical background like the distinction on the basis of birthweight status (SGA versus AGA) or pregnancy duration (<32 versus 32-34 weeks).

less strong with age. This indicates that part of these infants eventually reached a level of comprehension that is comparable with the responsive infants. The relationship between responsiveness and expressive abilities (including AV) shows a more stable pattern.

These preliminary findings indicate that in preterm infants it is not so much maternal responsivity (as expected by 'classical' attachment theory), but rather infant responsivity that bears a relationship with later speech and language development.This link suggests a continuity in the infants' communicative abilites that should be further examined in arger groups. However, we should bear in mind that this link does not necessarily point to a causal relationship; a third factor (e.g.,mild neurological differences) may underlie sub-optimal performance in both domains.

Reference

Van Beek, Y., Hopkins, B. & Hoeksma, J.B. (1994). The development of communication in preterm infant-mother dyads. *Behaviour*, *129*, 35-61.