Early Human Development 90 (2014) 649–656

Contents lists available at ScienceDirect

Early Human Development

journal homepage: www.elsevier.com/locate/earlhumdev

Language development of low risk preterm infants up to the age of 30 months

Miguel Pérez-Pereira [a,*], Pilar Fernández [a], María Luisa Gómez-Taibo [b], Mariela Resches [a]

[a] University of Santiago de Compostela, Spain
[b] University of A Coruña, Spain

ARTICLE INFO

Article history:
Received 23 March 2014
Received in revised form 8 August 2014
Accepted 12 August 2014

Keywords:
Preterm children
Language development
Vocabulary development
Grammatical development
Determinant factors
Environmental factors
Biomedical factors
CDI

ABSTRACT

Purpose: To compare the lexical and grammatical development of a group of low risk preterm children with a group of full-term children at 10, 22, and 30 months of corrected age. In addition, the effect of possible determinant factors on linguistic development was investigated.
Method: An initial group of 150 low-risk PR children (mean GA: 32.62) and 49 FT children (mean GA: 39.70) recruited at birth were assessed at 10, 22, and 30 months of age. Communicative and linguistic abilities were measured at these three points in time through the CDI. Cognitive development and quality of family environment of the children, among other variables, were also assessed at 22 months of age. Hierarchical regression analyses were performed in order to test those factors which may contribute to prediction of language outcomes.
Results: There was no significant delay in communicative, lexical or grammatical development of PR children. Even when comparisons were performed between fullterm and very preterm children, differences were not significant.
Regression analyses indicate that gestures and early word comprehension predict very early word production development, but their effect disappears with time. The most important factors which predict language development at 30 months of age are previous cognitive scores and word production at 22 months of age. The results coming from group comparisons and from hierarchical regression analyses indicate that GA does not significantly affect language development from 10 to 30 months of age.
Conclusions: Low risk preterm toddlers do not seem to be delayed in their linguistic development.

1. Introduction

In recent years the study of first language acquisition by preterm (PR) children has received increasing attention. This interest is twofold: practical and theoretical. From a practical point of view, preterm (PR) children are a group that has a higher risk of suffering developmental problems due to their immaturity. Therefore the study of this population is an area of great concern for researchers and practitioners in order to promote efficient intervention. From a theoretical perspective, scholars' interests have been focused on discovering if PR children show atypical trajectories in their development [1] and on discovering those factors which may predict their linguistic development.

However, PR children are not a homogeneous group, and therefore not at equal risk of developmental delays [2]. Usually, PR children are classified according to gestational age (GA) into: late preterm (GA 34–36 weeks), moderately preterm (GA 32–33 weeks), very preterm (VPR) (GA between 28 and 31 weeks), and extremely preterm children (EPR) (GA below 28 weeks). Different studies have shown that not only gestational age (GA) and birth weight (BW) (which are usually correlated: the shorter the GA the lower the BW) are factors that predict later linguistic outcomes, but also medical complications, such as bronchopulmonary dysplasia or periventricular leukomalacia, along with environmental factors are important determining factors. The risk of medical complications increases as GA and BW are lower [3]. Extremely and very preterm children have a greater probability of being affected by them than late preterm children. Therefore it would be expected that PR children with different GAs or BWs, with a different incidence of medical complications, and coming from different family environments, should have different linguistic (developmental) outcomes.

Previous studies tended to confirm that PR children show language delays in relation to FT children as measured through vocabulary production or grammar scores [4–11]. Differences were greater when comparisons were performed between the extreme groups of very preterm or very low birth weight (VLBW) children and FT children, indicating that GA and BW affect language development [6,12]. A few studies found differences only after a given point in time (around age 18 months), although not earlier [13–15]. In contrast, other studies

* Corresponding author at: Department of Developmental Psychology, Faculty of Psychology, University of Santiago de Compostela, 15782 Santiago de Compostela, Spain.
E-mail address: miguel.perez.pereira@usc.es (M. Pérez-Pereira).

http://dx.doi.org/10.1016/j.earlhumdev.2014.08.004
0378-3782/

did not find significant differences between PR and FT children's language development [16–21]. Most of these later studies were carried out with a wider range of PR children without health problems.

Discrepant results among previous studies may be due to different reasons:

1) Differences in the characteristics of the samples studied in terms of their GAs.
2) Exclusion criteria are not always carefully described and controlled a reason why the role played by medical problems is difficult to ascertain. This circumstance is a menace to internal validity, and may lead to confounding the effects of GA with those of medical problems.
3) Age of assessment varies among studies, and this could also have affected the results obtained.
4) Finally, the use of different instruments to assess language development may also have resulted in apparent differences between studies.

Several factors were found to affect language outcomes in preterm children. A few studies found that biomedical factors seem to have an effect on later language scores. Among those factors are Apgar score at birth [16,20–23], length of stay in Neonatal Intensive Care Unit (NICU) [21,24,25], gestational age [5,6,11], gender [10,11,13,17], and medical complications such as bronchopulmonary dysplasia, intraventricular hemorrhage higher than grade II, or periventricular leukomalacia [2, 22,26–30]. Other studies found an influence of environmental factors such as mothers' education [16,18,30,31] or quality of family environment [26,32,33]. Finally, there were other studies which found that previous cognitive development [9,18,30], or previous communicative (use of gestures) or linguistic (word comprehension and production) development [9–11,34] are good predictors of later linguistic development. Connected with this, a number of studies indicate that PR children obtain significantly lower results in cognitive scales than FT children [4, 9,10,27,29,35]. Approximately 18% of EPR children with cognitive delay also show language delay, although another 14% of EPR children show specific language delay without associated cognitive delay [10].

Most studies on language development of PR children were carried out with very or extremely preterm (VPR or EPR) children, or with samples of PR children in which medical complications and environmental circumstances were not carefully controlled. It is important to note that EPR or VPR children constitute around 20% of the entire population of PR children [3]. Therefore it is of extreme relevance to carry out studies with PR children with characteristics more representative of the entire PR population. The present study investigates language development up to 30 months of age in a sample of PR children with a relatively wide variety of GA, and without associated medical problems. Given the characteristics of the sample, this sample could be defined as a low risk sample. The PR children's development will be compared to a control group of FT children of similar characteristics. Since this is a longitudinal study, it is possible to observe whether differences between PR and FT children appear at a given point in time or not. The second aim of this research is to identify factors that may predict language development. The effect of most of the former biomedical, contextual and personal factors on language outcomes at different ages will be also investigated in this study.

Our hypotheses are 1) that low risk PR children will not show significantly lower results than those of the PR children, 2) that therefore GA will not have any predictive role on children's language development, which will mostly depend on previous language abilities. The first hypothesis is based on the idea that PR children are not a homogeneous group [2] as well as on the findings obtained in previous studies carried out with low risk PR children [16,17,19–21], who obtained similar results to those of FT children. The second hypothesis is based on those studies which found significant differences in language development between PR children with associated medical complications and FT children, but not between PR children without medical complications and FT children [28,29], and on those investigations which indicated that early language abilities are the main predictor of later language abilities [10,30].

2. Method

2.1. Participants

A group of 150 PR children, and another group of 49 FT children were recruited for a longitudinal project just after birth from 4 different hospitals in Galicia (Spain). Parents' consent, and approval by the Galician Ethics Committee of Clinical Research were obtained before the beginning of the research.

PR children with further serious complications were excluded from the study. Among the exclusion criteria were babies suffering from cerebral palsy (as diagnosed up until 9 months of age), periventricular leukomalacia (PVL), intraventricular hemorrhage (IVH) greater than grade II, hydrocephalus, encephalopathy, genetic malformations, chromosomal syndromes, metabolic syndromes associated to mental retardation, or important motor or sensorial impairments. Newborn children with Apgar scores below 6 at 5 min were also excluded.

The initial sample was recruited at birth, and there were 150 PR children and 49 FT children. When the children were 10 months of age they were assessed on language and communicative development for the first time. The sample at this time comprised 142 PR children, and 49 FT children. The next assessment occasion took place when the children were 22 months of age. At this moment, there were 138 PR children, and 43 FT children. At 30 months the children were assessed again. At this time, the PR sample consisted of 115 children, and the FT sample of 37 children.

Descriptive data of the children who initially entered in the study are the following: The group of PR children had a mean GA of 32.60 (SD = 2.43; range 26–36), and the FT group had a mean GA of 39.84 (SD = 1.44, range 37–42). The mean Apgar scores (1 min) of the PR and FT children were similar ($t(197) = -.909$, $p = .365$): PR mean = 7.87 SD = 1.43, and FT mean = 8.08, SD = 1.25. Both groups were similar in terms of distribution by gender ($X^2(1) = .000$, $p = .997$), and mothers' education ($X^2(6) = 8.66$, $p = .194$).

The 138 PR children participating on the next assessment occasion (22 months of age) had a mean GA (and SD) of 32.62 (2.41), a mean BW of 1721.70 (435.36), and a mean Apgar score (first minute) of 7.94 (1.30). As for the 43 FT children, they had a mean GA of 39.70 (1.48), a mean BW of 3373.83 (433.09), and a mean Apgar score (1 min) of 8.13 (1.20).

At 30 months of age, the characteristics of the 115 PR and the 37 FT children were very similar to those of the sample at the beginning of the study. The mean GA (and SD) of the PR children was 32.56 (2.49), the mean BW was 1712 g (428), and the mean Apgar score was 7.94 (1.27). For the FT group, the mean GA (and SD) was 39.76 (1.49), the mean BW was 3377 g (443), and the mean Apgar score was 8.16 (1.25).

The former data indicate that the children who still continued in the project at 30 months of age had similar characteristics to the original sample. Thus there was no selective mortality.

The sample of PR children may be considered as a low risk sample if we consider the Apgar mean score, the inexistence of children with serious medical complications, and the characteristics of their families (mother's education).

2.2. Instruments

From the battery of instruments used to assess the children, the following instruments were taken into consideration for the present study.

Inventario do Desenvolvemento de Habilidades Comunicativas (IDHC) [36,37], which is the Galician version of the MacArthur–Bates Communicative Development Inventories (CDI) [38]. The form for children between 8 and 15 months (*Palabras e Xestos* '*Words and Gestures*') of this