Neuropsychological assessment and perinatal risk: A study amongst very premature born 4- and 5-year old children

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A R T I C L E   I N F O

A B S T R A C T

Background: Prematurity and its consequences are serious problems that can result in numerous neurosensory disabilities and cerebral cognitive dysfunctions. The Perinatal Risk Index (PERI) might provide a predictive measure of these problems.

Aim: This study compared the cognitive development of prematurely born children at 4 and 5 years of age with age-matched peers born at term. The secondary objective was to determine whether a correlation exists between perinatal risk and performance on neuropsychological tests among premature children.

Methods: A total of 54 children between four and five years of age were evaluated; 27 were born very premature (premature group; PG), and 27 were born at term (term group; TG). Executive function, attention, memory, language, visual perception, and spatial structuring were evaluated. Subtests from the Kaufman Assessment Battery for Children, the Rey Complex Figure Test, the McCarthy Scales of Children's Abilities, the Peabody Picture Vocabulary Test, Test A, Trails A and B, the spatial structuring questionnaire from the Child Neuropsychological Maturity Questionnaire, and the Wechsler Intelligence Scale for Children were used. A PERI score was also obtained for the PG.

Results: The PG showed significantly lower scores than the TG in all the studied cognitive domains. Visual-perceptive scores were significantly and negatively correlated with the PERI scores of the PG.

Conclusions: The PG showed neurocognitive deficits compared with the TG. The PERI can be used to predict the development of visual-perceptive abilities in children between four and five years of age.

1. Introduction

Prematurity, i.e., birth prior to gestational week 37, affects between 8 and 10% of all births (Bermudez et al., 2012). Spanish incidence of prematurity has increased by 36% over the last two decades, with a lower prevalence compared with the Europe mean

(6.41% vs. 10%) (Instituto Nacional de Estadistica, 2013), and it is the cause of 75% of all cases of perinatal mortality and 50% of all cases of disability in infancy (Bermudez et al., 2012; Glass et al., 2015).

A child is considered very premature when his or her birth weight is less than or equal to 1500 g, when the birth occurs on or before gestational week 32 (Aylward, 2005), or both; thus, weight and gestational age are risk factors for postnatal alterations (Rellan Rodríguez et al., 2008).

Prematurity is associated with complications such as intracranial haemorrhage, seizure, hydrocephaly, dysmorphic facial features, various central nervous system dysfunctions, and ophthalmic retinopathy of prematurity (Fernández-Carrocera, Guevara-Fuentes, & Salinas-Ramírez, 2011). Likewise, it is related to a higher incidence of neurosensory lesions such as periventricular leukomalacia and periventricular-intraventricular haemorrhage (Aylward, 2005).

Although the prevalence of serious disorders such as cerebral palsy has not increased over recent decades, the prevalence of neuropsychological problems has increased (Aylward, 2002), including of those related to executive function, verbal fluency, working memory, cognitive flexibility, visual-spatial and visual-motor processing, and attention and verbal memory performance (Bermudez et al., 2012; Burnett et al., 2015; Glass et al., 2015; Mulder, Pitchford, Hagger, & Marlow, 2009; Roldán-Tapia, Ramos-Lizana, Cánovas, & Bembibre-Serrano, 2013).

Nevertheless, the risk factors to which a premature child is exposed are not predictors of subsequent development *per se*. Rather, the major determinant is the presence of certain factors combined with certain characteristics in the premature infant such that risk increases with the number of environmental and biological risk factors (Chen et al., 2004; Torres Valdivieso et al., 2008).

One tool for evaluating biological risk is the Perinatal Risk Inventory (PERI), which consists of a scale that measures 18 of these neonatal risk factors prior to discharge from the hospital. The PERI is used for its predictive value regarding pathologies and developmental anomalies (Pérez López, García Martínez, Sánchez Caravaca, García-Martínez, & Sánchez-Caravaca, 2009; Zaramella et al., 2008).

The current study sought to compare the cognitive development of prematurely born children born at four and five years of age with age-matched peers born at term. The secondary objective was to determine whether a correlation exists between perinatal risk and the neuropsychological test performance of premature children.

2. Methods

2.1. Design

A comparative study was performed between January 2005 and December 2006 to examine children between four and five years of age (chronological age) who were born prematurely or at term. Within the very premature group (PG), a correlational study was performed between the scores obtained on neuropsychological tests and the PERI.

2.2. Participants

2.2.1. Premature group (PG)

The PG included children born in the Torrecárdenas Hospital Complex of Almería (Spain) between 2000 and 2001. The inclusion criteria for the premature group were (i) born before gestational week 32, weight less than 1500 g at birth, or both; and (ii) aged between four and five years old at the time of evaluation.

Likewise, participants who met any of the following criteria were excluded: (i) those with the presence of severe sensorimotor or mental deficits, thus do not excluded participants with a mild sensorimotor deficits and cerebral palsy, according to medical criterial, and if this status do not interference in the assessment (ii) those not consenting to participate, or (iii) those attending only one evaluation session.

Sample selection was completed through a list of random numbers, which was used to select case pairs.

2.2.2. Neonates born at term group (TG)

The TG was composed of children born between 2000 and 2001 who attended various public schools in Almería. The inclusion criteria were (i) born after gestational week 37, (ii) birth weight of greater than 1500 g, and (iii) aged between four and five years at the time of evaluation.

The exclusion criteria were the same as those described above for the PG group.

The TG sample was obtained through intentional sampling with the goal of matching with the premature group with regard to child age, sex, and education level as well as the socioeducation level of the parents.

2.3. Variables and data collection tools

2.3.1. Sociodemographic variables

The sociodemographic variables obtained included sex, age (months), birth weight (g), gestational age, child's level of education (pre-school stage), and parental level of education (years of formal education).

2.3.2. Cognitive variables

The neuropsychological evaluation consisted of tests with recognised diagnostic value, usability, and scoring across the following