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One-year neurodevelopmental outcome of very and late preterm infants: Risk factors and correlation with maternal stress

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ABSTRACT

Although "late preterm" (LP) newborns (33–36 weeks of gestational age) represent more than 70% of all preterm labors, little is known about the relation between certain risk factors and developmental outcomes in LP compared to "very preterm" (≤32 weeks) children (VP).

This study investigates: (1) LP and VP infants' development at 12 months of corrected age (CA) using the Bayley Scales of Infant Development – 3rd Edition (BSID-III); (2) correlation between BSID-III performances and maternal stress (using Parenting Stress Index-Short Form, PSI-SF) among LP and VP at 12 months CA; and (3) the link between known neonatal and demographic risk factors and developmental outcomes of LP and VP infants.

For both LP and VP infants the Mean Cognitive (LP: 102.69 ± 7.68; VP: 103.63 ± 10.68), Language (LP: 96.23 ± 10.08; VP: 99.10 ± 10.37) and Motor (LP: 91.11 ± 10.33; VP: 93.85 ± 10.17) composite scores were in the normal range, without significant differences between the groups. Correlations between PSI-SF and BSID-III showed that in the VP group (but not LP), Language score was negatively related to the PSI-SF 'Difficult Child' scale ($r = -.34$, $p < .05$). Regression models revealed that cognitive performance was significantly predicted by physical therapy in LP and by cesarean section in VP infants. For VP only maternal education and length of stay predicted Language score, whereas physical therapy predicted Motor score.

Results of the study underline the importance of considering cognitive, language and motor developments separately when assessing a preterm child's development. Prediction models of developmental performance confirm the influence of some known neonatal risk factors and indicate the need for further research on the role of sociodemographic risk factors.

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1. Introduction

It has been well documented that preterm birth (<37 weeks of gestational age) is associated with poor cognitive and neurological outcomes, but much of the literature has focused on those born 'very preterm' (VP ≤ 32 weeks of gestational age). However, little is known about early and late outcome in preterms born between 33 and 36 weeks' of gestation, usually referred to as 'late-preterm' infants (LP) (Peacock, Henderson, Odd, & Emond, 2012). The LP represent more than 70% of all preterm labors with an important increment from 1990 until now (Davidoff et al., 2006; Dong & Yu, 2011). In clinical practice LP are usually managed like term neonates and habitually excluded from neurodevelopmental follow-up programs, despite being at higher risk of hospital intensive care and having a greater chance of re-admission (Shapiro-Mendoza et al., 2006).

Over recent years, there has been growing interest in the neurological, cognitive and behavior outcome in LP infants who show less advanced cognitive functioning, poor school outcome and higher prevalence of behavioral problems compared to full term (FT) peers (Chyi, Lee, Hintz, Gould, & Sutcliffe, 2008; Talge et al., 2010). Previous investigations found that at 1–4 years of age, LP have an increased risk of presenting developmental delay (Nepomnyaschy, Hegyi, Ostfeld, & Reichman, 2012; Voigt, Pietz, Pauen, Kliegel, & Reuner, 2012; Woythaler, McCormick, & Smith, 2011). Some of them analyzed the infant perinatal course and socio-demographic data to be included as possible independent risk factors for developmental outcome, especially in case of studying middle-long term cognitive and language development (Freeman Duncan et al., 2012; Greene, Patra, Nelson, & Silvestri, 2012; Morag et al., 2013). However, findings on LP's developmental outcome are still contradictory (McGowan et al., 2012; Romeo et al., 2012).

In addition, it is known that parenting a child born preterm is more challenging than parenting an infant born at term. Many studies have highlighted that mothers of VP infants report significantly higher levels of anxiety and stress, probably due to persistent concern about the infant's health, and their view of the child as being constantly vulnerable even after discharge from the neonatal intensive care unit (Zanardo, Freato, & Zacchello, 2003). Anxiety and psychological distress in VP's mothers have been shown to correlate negatively with early lactation (Zanardo et al., 2011), to have a negative impact on the mother–child interaction (Forcada-Guex, Borghini, Pierrehumbert, Ansermet, & Muller-Nix, 2011; Muller-Nix et al., 2004), and on the child's development and behavior (Benzies, Harrison, & Magill-Evans, 2004; Forcada-Guex et al., 2011; Miceli et al., 2000; Montirosso, Provenzi, Calciolari, Borgatti, NEO-ACQUA Study Group, 2012; Singer et al., 2003; Voigt et al., 2013) but few studies described mother distress persisting one year or more after delivery (Brummelte, Grunau, Synnes, Whitfield, & Petrie-Thomas, 2011; Garel, Dardennes, & Blondel, 2006). While there is a wealth of published studies exploring mental health in mothers of VP, few have focused on maternal well-being and LP. Recently some authors have described that mothers of LP infants experienced significantly greater emotional distress at least one month after delivery and have greater symptoms of depression and anxiety than mothers of term infants (Brandon et al., 2011; Voegtline, Stifter, & Family Life Project Investigators, 2010). Mothers of LP are also more likely to perceive their child as being too demanding and more frequently have breastfeeding difficulties such as failed first attempts at breastfeeding and the need to consult a lactation professional (McDonald et al., 2013; Voegtline et al., 2010). Greater understanding of maternal mental health in cases of late preterm delivery is needed to validate existing observations.

The aims of the present study were to: (1) describe the developmental profile of LP infants and compare the cognitive, language and motor development in LP and VP infants at 12 months of corrected age; (2) explore the relationship between measures of developmental outcomes and maternal stress in the two subgroups; (3) analyze the influence of neonatal risk factors and maternal socio-demographic characteristics on measures of developmental outcomes.

2. Methods

2.1. Participants and procedures

As part of a multidisciplinary longitudinal study on neurodevelopment of preterm infants and maternal stress, 79 children, 39 born LP (33–$36^{0/6}$ weeks gestation; $M = 11.59$ months of CA; SD = 1.59) and 40 born VP (≤$32^{0/6}$ weeks gestation; $M = 12.34$ months of CA; SD = 1.32), were seen at 12 months of corrected age (CA). CA was calculated by 'subtracting the number of weeks born before 40 weeks of gestation from the chronological age' (American Academy of Pediatrics, 2004). All infants were born between February 2010 and June 2012 and were recruited from the Neonatal Intensive Care Unit (NICU) at the Bambino Gesù Children's Hospital, which is the major tertiary neonatal unit for the province of Rome, Italy. Since this hospital does not have a maternity ward, the infants admitted to NICU frequently have at least one relevant medical complication. Infants with a genetic syndrome, a major congenital anomaly, or severe neurosensory and/or motor disability (e.g., blindness, cerebral palsy) were excluded, so this study addressed parenting stress in relatively healthy children born late preterm and very preterm. Written parental consent was given for participation in the study participation.

The Bayley Scales of Infant Development 3rd Ed. (BSID-III) were administered to children and their mothers were asked to complete the Parenting Stress Index-Short Form (PSI-SF) during their child's assessment session. Parents who did not speak Italian did not complete PSI-SF and were excluded from the study.