The Impact of Prematurity on Social and Emotional Development

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INTRODUCTION

Advances in neonatal intensive care in the past 2 decades have led to an increase in survival rates of premature infants. Reports on long-term follow-up cohorts of children, adolescents, and young adults born prematurely, in particular very low birth weight infants (VLBW infants <1500 g), provide critical information about the prevalence of chronic conditions, functional outcomes, and quality of life in this population. Among these chronic conditions, the high prevalence of behavioral and emotional problems, specifically deficits in attention, autism spectrum disorder (ASD), anxiety, and depression, have been a focus of concern due to their impact on family life, social interaction, and school performance. In 2013, based on a study population of 96,677 children living in the United States aged 2 to 17 years old, Singh and colleagues found 28.7% prevalence of parent-reported mental health problems among VLBW infants compared with 15% in children born full-term. Multiple studies have supported these findings, even after correcting for socioeconomic factors, severe developmental impairment, and other chronic

KEYWORDS

• Social and emotional development • Preterm birth • Screening and treatment

KEY POINTS

• High incidence of behavioral and emotional problems in children born prematurely have an impact on quality of life.
• Supporting social and emotional development in this high-risk population, with an emphasis on promoting protective factors and minimizing the factors that are known to be deleterious requires a multifaceted approach, and collaborative efforts among academic institutions, the private sector, and governmental programs.
• Lack of correlation between brain lesions and behavioral problems might indicate that premature birth affects social and emotional development through different mechanisms than brain injury, and that children affected by encephalopathy of prematurity may have impaired capabilities to adapt, respond, and overcome negative experiences, making them less resilient to the effects of psychosocial adversity.
conditions. Johnson and colleagues conducted an 11-year follow-up cohort study of 219 children born at less than 26 weeks’ gestation compared with 153 term controls and found that premature infants were 3 times more likely to have a psychiatric disorder, had a significantly increased risk of attention-deficit/hyperactivity disorder (ADHD) (11.5% vs 2.9%; odds ratio [OR] 10.5; confidence interval [CI] 1.4–81.8); autism (8% vs 0%, \( P < .000 \)), and other emotional disorders (9% vs 2.1%; OR 4.6; CI 1.3–15.9). Along with advances in neuroimaging and neurobiology have led to a better understanding of the extent of brain injury beyond intraventricular hemorrhage and periventricular leukomalacia (PVL) in premature infants. After the initial axonal injury hypomyelination or PVL, caused by the effects of hypoxemia, free radicals, and inflammatory mediators, a secondary insult to the developing brain, mediated by impaired cell-to-cell interactions, results in the arrest of neuronal and axonal proliferation in other areas of the brain and translates to the decreased volumes of cerebral cortex, thalamus, and basal ganglia seen in VLBW infants. This widespread brain involvement or encephalopathy of prematurity has been postulated as an explanation for the high prevalence of sensory, cognitive, and behavioral deficits even in the absence of major motor impairment. However, unlike the patterns associated with motor outcomes and academic deficits, brain abnormalities on MRI are not predictors of behavioral outcomes. Lack of correlation between brain lesions and behavioral problems might indicate that premature birth affects social and emotional development through different mechanisms than brain injury, and also that children affected by encephalopathy of prematurity may have impaired capabilities to adapt, respond, and overcome negative experiences, making them less resilient to the effects of psychosocial adversity.

EMOTIONAL-SOCIAL DEVELOPMENT AND PREMATURE BIRTH

To elucidate the different mechanisms by which premature birth affects behavior, it is important to start with the description of what it is known about normal early emotional and social development. According to the bio-behavioral synchrony model, coordinated, predictable, and repetitive exchanges between mother-infant and father-infant establishes the framework for future stress reactions, emotional regulation, and socialization. These exchanges, mostly mediated by the epigenetic effects of oxytocin and cortisol on central nervous system (CNS) maturation and function, further enhances the ability of the infant and the parents to sense, process, and respond in a synchronous manner to each other. Oxytocin not only plays a crucial role in reorganizing neuronal networks, but also affects stress, immune, and inflammatory responses. According to this model, the potential for reorganization of neuronal networks, or neuronal plasticity, makes reparation possible during the first years of life. In the event of premature birth, the need for intensive care support limits the opportunities for synchronous interactions. Following the bio-behavioral synchrony model, it is postulated that mother-infant separation and lack of synchronous interactions or “maternal deprivation” not only impairs an infant’s ability to process information and to modulate responses, but also affects maternal responsiveness to the infant’s cues. To support this theory, multiple studies of infant-maternal dyads, participating in kangaroo care programs in neonatal intensive care units (NICUs) have shown positive effects on infant and maternal responsiveness in addition to decreasing maternal anxiety when compared with the standard of care. Long-term protective effects of kangaroo care have been reported, including a lower incidence of problems with in attention, impulsivity, and antisocial behavior. Even though literature tends to focus on the negative effects of premature birth on
bonding, there are reports of higher-quality mother-infant interactions among preterm dyads when compared with full-term counterparts, particularly in favorable social and supportive environments. Furthermore, investigators have reported how premature infants are not only more sensitive to poor-quality mother-father-infant interactions, but more responsive to high-quality interactions than full-term infants, which highlights the potential for long-term protective effects from these strategies. Breastfeeding is one of the most representative examples of synchronic interaction and it is affected by multiple factors associated with preterm birth, including infant-mother separation, delay in the attainment of mature feeding pattern, and need for fortification to promote growth. It is estimated that only 40% to 60% of VLBW infants are breastfed and are discharged from the NICU with a predominantly human milk diet. The role of human milk in social and emotional development may be mediated by its direct effect on neurogenesis, but also by the hormonal effect on CNS maturation and function, during infant-mother synchronic interactions. Some reports have shown a lower incidence of ADHD and other behavioral problems in children who received a human milk diet, suggesting the role of breastfeeding as a protective factor. Additionally, longer length of stay in the NICU has been associated with an increased risk for behavioral and emotional problems even after correcting for prematurity, chronic conditions such as bronchopulmonary dysplasia, and social factors.

Fig. 1. Early stages of emotional-social development and premature birth. Repetitive and synchronic maternal-infant interactions establish the framework for emotional regulation and socialization mediated by oxytocin CNS maturation. Premature birth and NICU stay, affect both maternal and infant responsiveness resulting in dysregulation and impaired infant social interaction.
OTHER DETERMINANTS OF SOCIAL AND EMOTIONAL DEVELOPMENT AFTER PREMATURE BIRTH

The psychosocial environment, in particular maternal mental health and parental styles, are important determinants of behavioral outcomes of children born prematurely. Maternal mental health has been described as one of the most influential factors in on the emotional and social well-being of children. Maternal birth increases the risk for maternal depression, anxiety, and post-traumatic stress disorder (PTSD). Maternal depression and anxiety have also been associated with attachment disorders and poor behavioral outcomes in children born prematurely. In addition to the impact of maternal depression on children’s mental health, the use of antidepressants during pregnancy, in particular selective serotonin reuptake inhibitors, has been a source of controversy due to reports that suggest an increased risk for ASD in children with prenatal exposure to these drugs. Maternal substance abuse frequently coexists with other mental pathologies and has been associated with poor behavioral outcomes, most likely the result of a combination of in utero exposure, neurotoxicity, and adverse social environment.

In addition to surveillance systems for maternal depression, anxiety, PTSD, and addiction, there is no question about the need for robust programs that support diagnosis and treatment of maternal mental health problems starting in pregnancy and continuing in the NICU and after discharge. Furthermore, there is a need for mental health professionals with experience in addressing issues related to attachment problems and with training in behavioral therapy. It is important to mention that high-quality developmental NICU practices, including family-centered approaches and home-visiting programs, have shown positive effects in decreasing parental symptoms of depression and anxiety.

The role of parenting has been described as one of the most important determinants of social and emotional development. In particular, parental styles characterized by hostility, negativity, intrusiveness, and lack of structure have been associated with impaired child self-regulation and poor behavioral outcomes. This highlights the importance of parent education regarding positive parenting practices starting from the NICU, as well as access to evidence-based behavioral interventions.

CURRENT CHALLENGES IN THE SCREENING AND TREATMENT OF EMOTIONAL AND BEHAVIORAL PROBLEMS

Although there is a significant body of evidence that supports the importance of early detection and treatment of emotional and behavioral problems to improve functional outcomes, in the United States, it is estimated that primary care providers identify only half of children with serious behavioral and emotional problems, and when diagnosed only 1 of 8 children receive specialized treatment. When analyzing obstacles that prevent pediatric patients from receiving mental health care services, the high cost, type of insurance, local governmental policies and limited availability of pediatric mental health providers are among the most critical factors. Medicaid covers only half of all costs of treatment for mental health conditions in children age 5 to 17 years, with an estimated per-child cost of $2000 per year. Variation of coverage between states is affected by unfavorable local governmental policies, including the lack of adoption of Medicaid expansion, low rates for reimbursement of mental health care services, and no acceptance of developmentally specific diagnosis in children aged 0 to 5 years as reimbursable conditions in addition to the limited availability of pediatric mental health providers. The situation is maybe more critical for patients living in rural areas and for children younger than 5 years. Given the challenges of providing mental
health services to children, models of collaborative efforts between mental health and primary care providers have been proposed to improve early detection and increase the probability of receiving treatment. Critical points to consider when developing these types of programs included identification of local mental health providers, the establishment of routine screening, tracking referrals, and obtaining psychiatric consultation.36,37

Similar models should be adopted at high-risk developmental follow-up clinics with an emphasis on early screening, in-house counseling when possible, and a surveillance system for referrals. Close contact with mental health providers in the community may help to improve the chances of getting adequate treatment. At the Developmental Progress Clinic at Emory University, as a result of the challenges in early diagnosis and treatment of behavioral and emotional problems in our population, a multidisciplinary focus group was created to evaluate the problem and to develop strategies to better support patients and families affected by these conditions. The adoption of a surveillance system for referrals, with follow-up calls and redirection of care, if needed, and the identification of reliable mental health resources that fit our population’s needs and characteristics, increased the percentage of patients receiving treatment from 25% in 2015 to 60% and 65% in 2016 (Angela Leon Hernandez, 2016, unpublished data). Even though there is an improvement in the percentage of patients who are receiving therapies, insurance coverage and parental acceptance of need for behavioral intervention continues to be a challenge.

Developing models to support healthier behavioral and emotional development from NICU to school age in children born prematurely with an emphasis on the application of strategies that have proven to be protective, is a priority. High-risk follow-up clinics with the support of mental health providers can play a distinctive role in coordination and implementation of these strategies.

Given the complexity of the factors involved in social and emotional development, not a single strategy but a combination of actions starting from pregnancy and continuing in the NICU and after discharge at least for the first 5 years of life requires collaboration of academic institutions, the private sector, and governmental programs (Fig. 2).

Based on the current literature, implementation of various strategies is recommended:

- Promotion of early infant-mother, infant-father interactions and intervention when risks for attachment disorders are identified, systematic evaluation and treatment of maternal mental health problems during pregnancy, and continued evaluation at NICU and after discharge.
- Implementation of developmentally oriented strategies at NICU supporting human interaction through kangaroo care, and other positive experiences for premature infants, including family-centered care with involvement of both parents.
- Support and promote human milk–based diet and breastfeeding.
- Parental education about early social and emotional development, brain development, and positive parenting styles. Family support by social services for transportation, housing, and coordination of care and other social needs.
- After discharge, continue family education and support through home-visiting programs, parenting groups, and school readiness programs.
- Standardized screening for behavioral and emotional problems at specialized developmental clinics with surveillance systems for referrals with an option for consultation with mental health providers to guarantee early diagnosis and treatment.
Establish collaborative efforts among academic institutions, the private sector, governmental programs, and community programs to guarantee access to high-quality and evidence-based preventive and therapeutic strategies, with special attention to children with history of prematurity and social adversity.

SUMMARY

Given the high incidence of behavioral and emotional problems in children born prematurely and their impact on quality of life, supporting social and emotional development in this high-risk population, with an emphasis on promoting protective factors and minimizing the factors that are known to be deleterious, requires a multifaceted approach and collaborative efforts among academic institutions, the private sector, and governmental programs.

REFERENCES


