What do we know about long-term cognitive and behavioral outcomes of school-aged children who were born moderate to late preterm?

Eun Sun Kim, MD, PhD
Department of Pediatrics, Kangwon National University School of Medicine, Chuncheon, Korea

Corresponding author:
Eun Sun Kim, MD, PhD
Department of Pediatrics, Kangwon National University School of Medicine,
1, Kangwondaehak-gil, Chuncheon-si, Gangwon-do, 200-701, Korea
Tel: +82-33-258-9020
Fax: +82-33-258-2418
E-mail: naivesun1@hanmail.net
With improvement of neonatal intensive care unit (NICU) care, major neurologic disabilities such as cerebral palsy, mental retardation, blindness, or deafness seem to have been decreased.\textsuperscript{1-3)} However, cognitive/behavioral outcomes of school-aged children who were born preterm are known to be worse than children who were born term. Meta-analysis of school-aged children born preterm showed that mean cognitive scores were significantly lower (weighted mean difference, 10.9; 95% confidence interval, 9.2-12.5) compared with children born term.\textsuperscript{4)} It is notable that intelligence quotient (IQ) scores show gestational age-related gradient especially in children born before 33 weeks.\textsuperscript{5)} In addition, most studies show an increased risk of attention problem such as attention-deficit/hyperactivity disorder (ADHD).\textsuperscript{4,5)} Some studies include executive function and academic achievement in school-aged children who were born preterm, showing their deficits which lags behind term-born peers.\textsuperscript{6)}

Those studies focus on very preterm (< 32 weeks’ gestation) or very low birth weight (< 1,500 g) infants. Meanwhile, long-term cognitive and behavioral outcomes of moderate (32-33 weeks’ gestation) and late (34-36 weeks’ gestation) preterm infants are relatively not known even though they account for 88-89% of preterm births in Korea. In this issue of Korean Journal of Pediatrics, Jin et al.\textsuperscript{7)} reported a single center long-term neurodevelopmental outcomes of children born moderate to late preterm and this is the first Korean report of wide range of neurodevelopmental outcomes including cognition, executive function, and behavioral problems of school-aged former moderate to late preterm infants. The study found that about a quarter of the children had cognitive problems (IQ 70-84) and more than half of the children had abnormal scores at ADHD screening tests. In addition, they found about a quarter of the children had borderline scores in executive function tests possibly suggesting deficits in academic achievement.\textsuperscript{8)} Because this large population of moderate to late preterm infants are sometimes underestimated or neglected during follow-up
evaluation, the study suggests the importance of long-term follow-up of those infants.

The follow-up rate of the long-term outcome study is important because highly followed up data represent the group characteristics better. Jin et al.’s study\(^7\) described relatively low follow-up rate and they explained practical reasons of including such a small number of children at methods section with a flow chart. In addition, authors analyzed clinical characteristics between follow-up and not-follow-up population, showing no difference, and this partially resolves the selection bias.

Preterm longitudinal studies typically need term control groups. The most ideal control group is term siblings who have an impact of controlling postnatal environmental factors. Classmate controls matched for age and sex can be also used as a control group. Control group should be evaluated at the same time point because the result of the study group can be either developmental problem or cohort-specific problem.\(^5\) Besides, IQ scores tend to drift upward over time and obsolete tests can underestimate if there is no contemporary control group.\(^5\) As Jin et al.’s study\(^7\) mentioned as a limitation, they could not include a term control group. Instead, they supplemented data from term-born population in cognitive and executive function tests at discussion section.

One interesting point is that there was no significant association with perinatal/socioeconomic factors and neurocognitive results in this study. Because severe neurologic deficit cases were excluded and no children in the study group had severe brain injury, other perinatal factors may not show any significant impact on long-term outcomes. Postnatal environmental factors such as parenting, education, or economic status are possible influential factors of neurocognitive outcomes in preterm infants. Intervention in parenting was suggested as one of methods for better neurocognitive outcomes in preterm infants at school-age.\(^9\) Jin et al.’s study\(^7\) did not analyze parenting, however, they uncovered disadvantages in cognitive, executive, and behavioral outcomes in former moderate to late
preterm children regardless of perinatal, economic, and maternal educational factors.  

Jin et al.’s study\(^7\) cohort did not show severe cognitive deficit (IQ <70) and it can be comparable with children born very preterm. However, high prevalent (about a quarter) and low severity (borderline) cognitive problems should be emphasized. Even though abnormal scores in ADHD screening tests are not concluded as ADHD diagnosis, attention problems were highly prevalent in the cohort. Children with borderline IQ or attention problems may show overlapping deficits in executive functions. Because borderline or subtle neurodevelopmental problems are more responsive to early intervention, developmental trajectory of moderate preterm and NICU admitted late preterm infants should be closely followed up, not limited to school-age but extended to adolescents or adults.\(^10\)

In conclusion, moderate to late preterm infants are at risk of developing problems in cognition, behavior, and executive function with high prevalence at school-age. Periodic follow-up and assessment of the population is important. Further studies with high follow-up rate and any appropriate term control group are required to conclude long-term outcomes in moderate to late preterm infants.

**Conflicts of Interest**

No potential conflict of interest relevant to this article was reported.
References


