

CURRENT TOPICS

Psychological development of prematurely born children

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Improvements in antenatal care and advances in neonatal medicine have resulted in increased survival of infants, in particular those of very low birthweight (VLBW) (< 1500 g) and extremely low birthweight (ELBW) (< 1000 g). If simple gain in life years is taken as a standard, then neonatal care is the most successful discipline in medicine today.¹ The psychological development and quality of life of VLBW and ELBW children has become an increasing focus of recent research.²

Domains of psychological development

The psychological development of the preterm child has been considered in four main domains: (a) cognitive development (for example, intelligence, memory, language); (b) behavioural and emotional status ranging from individual differences such as temperament to behavioural problems such as hyperactivity, phobias, or enuresis; (c) social functioning—that is, the ability to form and maintain social relationships with adults and peers and to reflect on these relationships (for example, self concept); and (d) school adaptation and failure.

Follow up research methods

To provide reliable, valid, and generalisable information on the psychological developmental outcome of VLBW infants the ideal study should: (a) be prospective; (b) be based on large populations (geographical, epidemiological, or multicentre studies); (c) have few infants lost to follow up or good documentation of the dropouts; (d) include full term control groups for cohort specific comparisons; (e) be long term (that is, into school age to assess the full spectrum of abilities and behaviours); (f) include differential reports of subpopulations (for example, according to social class, small for gestational age *v* appropriate for gestational age, single *v* multiple birth, ELBW *v* VLBW); and (g) be conducted by independent (group blinded) psychology researchers not involved in the neonatal care of the infants under investigation. Unfortunately, most reports to date are single centre studies (mostly regional or university centres of excellence), have inadequate descriptions of study populations and those lost to follow up, most included no same aged comparison children, ended in the preschool years, and were often conducted by those also involved in the neonatal care of the

children.³ These limitations have serious effects on the conclusions reached and usually result in underestimation of the true rate and prevalence of developmental deficits.⁴⁻⁶ Particular emphasis should be placed on findings from controlled investigations.

Cognitive development

Uncontrolled studies have reported that VLBW children have intelligence quotients (IQs) in the normal range but up to 0.5 SD (approximately 7 points) lower than the norms for same aged children.⁷ Studies comparing same aged controls usually found poorer performances with average IQs 0.5 to 1 SD (7-15 points) lower for all VLBW children and 7-10 points for those VLBW children without major neurological impairment.⁴⁻⁸⁻⁹ Ten to 25% of VLBW children have been found to have severe cognitive impairments (< -2 SD) compared with the expected 2.3% in the normal population. The cognitive ability is correlated with the degree of fetal growth retardation, and infants born too early and too small are at an even higher risk for cognitive deficits than appropriate for gestational age infants.¹⁰ Low birthweight (< 2500 g) children with a weight above 1500 g also show some IQ differences to full term controls, but these are usually small. The relation between birth weight and IQ is usually linear in LBW groups—that is, the smaller the newborn the lower the IQ.¹⁰

Parents of VLBW infants expect cognitive developmental delays in the early years of life but anticipate that VLBW infants will catch up by school age.¹¹⁻¹² In contrast with parents' beliefs, mean differences in IQ have not been found to reduce over the years compared with peers.⁹⁻¹³⁻¹⁴ Multiple problems often become apparent at school age because of the larger demands on differential abilities (for example, spatial, verbal, phonological processing). Children with persistent IQ deficits from infancy (who often also have neurological and neuro-sensory problems) most often have multiple cognitive deficits including language, speech, reading, or difficulties with mathematics.¹⁵ Although it has been suggested,¹⁶ there is insufficient or little evidence that VLBW children have more frequently specific learning disorders (for example, isolated reading difficulties) than controls.⁹ There is increasing evidence that VLBW children are more likely to

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have a central deficit in processing different stimuli at the same time, such as is required in visual motor integration or logical reasoning.^{17 18}

Despite increasing proportions of smaller infants surviving, no deterioration in IQ scores in successive cohorts from the same neonatal units have been reported.^{19 20} The findings are inconclusive, however, as they did not correct for secular trends in IQ test results by including cohort specific control groups.⁴

Behavioural development

No, or little, difference in predispositions for expressing behaviour (temperament) have been found between preterm and full term children.²¹ There is some evidence, however, that very preterm infants (VPIs) (< 32 weeks gestation at birth) more often suffer colic and feeding problems in infancy. Contrary to anecdotal reports, VPIs have not been found to have more sleeping problems in the preschool years.²²

Problems within the hyperactivity spectrum, such as difficulty concentrating, have been found most consistently in follow up studies of VLBW children.^{9 23 24} These findings in primary schoolchildren have led to worry about long term behavioural outcome. General child population studies have indicated that 30–50% of those diagnosed as hyperactive also have, or develop, conduct disorder.²⁵ Increasing evidence suggests that VLBW children are more likely to suffer a “pure” form of attention deficit disorder, often without hyperactivity, which is not associated with the development of conduct disorder or oppositional behaviour.^{9 26} These, and recent, findings that parenchymal lesions/ventricular enlargements in the neonatal period predict attention deficit hyperactivity,²⁷ strongly suggest a central nervous system origin rather than a social origin of attention regulation problems in VPIs. Although attention deficit problems are most salient, VLBW children, according to recent controlled studies, also experience internalising problems more often such as withdrawn, depressive, and anxiety symptoms, and tic disorders.^{14 18 23 28}

Unfortunately, differential analysis for subgroups of VLBW children has rarely been reported. There is some suggestion that behavioural problems are more frequent in those born small for gestational age.²⁹ Others showed that differences between VLBW children and controls are reduced when they are controlled for by IQ.²³ This suggests that VLBW children may have more behaviour problems because lowered intellectual functioning may restrict their abilities to choose or to execute appropriate behaviours. Low performance IQ and attention deficit disorder appear to be most clearly related to very premature birth.

Social relationships and quality of life

The relationship of preterm infants and VPIs with their mothers has been predominantly investigated in the first two years of life. Mothers of preterm infants have been reported to be either more passive in interaction or overstimu-

Key messages

- Approximately a quarter of VLBW children have severe or multiple psychological problems and a further quarter have moderate to mild problems
- Lowered IQ, attention deficit, and schooling problems are the most prevalent psychological difficulties of VLBW children
- Larger preterm infants (LBW) are only at a slightly increased risk for long term psychological deficits
- Postdischarge environment can often reduce or compensate for neonatal risk in LBW children. Evidence for compensatory processes in VLBW infants after discharge from a neonatal intensive care unit are much more limited and disappointing

lating as if to compensate for lost time.³⁰ The dyadic interaction has often been described as less socially engaging, less harmonic, and less sensitive.³¹ Most deviating interactions have been reported for small for gestational age, very preterm infant–mother dyads³² and in dyads with previously severely ill infants.³³ More dysfunctional interaction patterns are usually predictive of more insecure attachment relationships between child and mother. However, the majority of studies have not found a larger proportion of insecure attachment of LBW children to their mothers compared with full term children and their mothers.³⁴ In contrast, a higher percentage of insecure attachment relationships of VLBW infants with their mothers may be found.³⁵ There is still little known about the long term relationships between VLBW children and their parents. Recent evidence indicates that mothers of VPIs remain more controlling in interaction until their child’s ninth year of life.³⁶ However, the differences between VPIs and controls in their behaviour were found to be larger than the differences among the mothers. Furthermore, after controlling for a child’s IQ all differences disappeared. It seems that mothers of VLBW children adopt a more active and controlling strategy as a result of their children’s developmental delay rather than because they differ from mothers of full term children.

VLBW children themselves have been found to describe their relationships to same aged peers as more problematic.^{14 28 37} Similarly, parents have reported that children who were VPIs have more social difficulties.³⁷ Again, those with multiple cognitive and behavioural problems appear to be at the greatest risk. Adolescents who were ELBW infants still suffer from a greater burden of morbidity and rate their health related quality of life as significantly lower than control teenagers,³⁸ but are more positive than objective tests would suggest. Self concept and quality of life estimates of preterm infants only show poor to moderate correspondence with actual cognitive performance and motor function measures.³⁹ Parents and

teachers of preterm or full term children rate their children's social, cognitive, and motor performances poorer than the children rate themselves.³⁷ Children are usually more positive in their outlook of life than their parents. Whether this optimism also shown by premature children continues throughout the school years and transition into adulthood is unknown.

Schooling problems

Progress in school provides a "real life" measure of the adaptation of VLBW children in society. School problems have been defined as the need for special schooling, education below age level (class repeated or late school entry), special support in regular school, or poor performance in comparison with pupils in the same class. The percentage of VLBW children with significant school problems in 13 different studies has varied from as little as 12% to as much as 51.5%. Two large epidemiological studies in Holland and Germany, which used the same definitions of school failure produced nearly identical figures of schooling problems^{15 40}: 19–22% of VLBW children were in special education at 8 to 9 years of age, a further 22–26% were educated below their age level, and 11–15% received special help in regular school. Fewer than half of all VLBW children (40–45%) were in the age appropriate class in regular primary school. Children in special schools attended mainly special classes for learning disabled, followed by behavioural, neurosensory, and language disabled classes. VLBW children without major handicaps—IQs in the (lower) normal range and attending regular school—are still at higher risk for school achievement problems compared with same aged peers.^{14 41 42}

Early predictors for later schooling problems in preterm children include persistent cognitive deficits, language delay, and neurosensory and behavioural problems assessed before school entry.^{40 42 43}

Developmental mechanisms and intervention

Long term prenatal and perinatal cohort studies before the introduction of neonatal intensive care concluded that social factors and the quality of the home environment can compensate for perinatal and neonatal disadvantage.⁴⁴ Recent evidence shows that favourable social and environmental factors are predictive of catch up in cognitive and behavioural development in larger LBW and preterm infants.⁴⁵ After approximately 2 years of age, IQ scores in low to moderate risk premature children are better explained by caretaking environment than their initial neonatal morbidity.¹⁵ These findings indicate that in the vast majority of larger LBW children no persistent central nervous system insult is present. Larger preterm infants benefit from educational stimulation and home interventions.^{46 47}

In contrast, although social factors are important for predicting psychological outcome in VLBW infants,⁹ biological factors have been found to be by far the best predictors of

cognitive and behavioural outcome into school age in VPIs.^{13 14 27 48 49} Intensive intervention programmes that implemented improvements of educational stimulation and home environment have been disappointing, resulting in no long term benefits for VLBW children.⁵⁰ Taken together, this evidence suggests that VLBW children have been subject to various degrees of central nervous system insult that reduce the ability to take advantage of environmental offers. The pathogenic pathways are not fully understood but injuries to the white matter (subcortical ischaemic/infarctive brain lesions) with subsequent implications for late migration, brain organisation, and myelination are a likely cause.^{27 48}

Critical reflections

Changes in neonatal care occur continuously. It has been suggested that since the introduction of surfactant treatment or improved neonatal nutrition, psychological outcome may have improved rendering previous (that is, here reviewed) findings obsolete. There is, however, little or no empirical evidence to show that trends in neonatal care have led to changes in psychological disability rates.^{19 51 52} In fact, the variability of care approaches and neonatal outcomes between units is usually larger than their commonalities, making it difficult to exactly pinpoint current trends.^{2 53 54} Furthermore, considering that there are—for example, 50 to 60 times more ELBW children surviving now compared with the early 1960s, small changes in the rates of disability are virtually immaterial to time trends in the prevalence of psychological deficits (the number of ELBW children with problems in the community).⁵⁵ This is not an indictment of neonatal intensive care, as for every VPIs with severe deficits several well functioning children are also added to the population. Rather, the full range of long term psychological consequences of being born very premature are only emerging. Premature birth remains one of the most challenging and costly public health problems,^{2 56} and repeated cohort studies are needed for evidence-based health planning and family care.⁵⁷ Understanding the underlying mechanisms (nature, nurture, and medical treatment), which control the psychological development of VPIs will be the key for devising successful preventive strategies for the smallest of infants.

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