Markers of minor brain damage are associated with developmental performance in preschool children

Gosselin J, Amiel-Tison C, Infante-Rivard C, Fournon C, Fournon JC. *Minor neurological signs and developmental performances in high risk children at preschool age*. *Developmental Medicine and Child Neurology* 2002 May; **44**: 323–8.

QUESTION: Is there a relationship between minor neurological signs and later developmental performance in high risk preschool children?

Design

Cohort study.

Setting

One hospital in Montreal, Canada; January 1991 to June 1998.

Participants

72 preschool children at risk of poor development due to maternal placental insufficiency (documented with an abnormal umbilical artery Doppler velocity waveform). Mean age 4 years (range 2–5 years); 53% female. Exclusion criteria were gestational age under 29 weeks at birth; families that did not speak French at home; location outside metropolitan area; chromosome disorders; congenital malformations; consanguinity, and evidence of socio-familial problems such as mental illness, drug addiction, receipt of welfare or physical abuse.

Assessment of risk factors

A short neurological examination was used to assess neurological status. Participants were categorised as 1) minimal cerebral palsy with independent walking before 2 years; 2) Amiel-Tison triad (ATT) with imbalance of passive axial tone, phasic stretch reflex in triceps surae and cranial signs; 3) intermediate with 1 or 2 of the three ATT signs, or 4) no neurological signs.

Main outcome measures

Developmental performance was measured using French language subscales of the Griffiths Mental Developmental Scales for locomotion, hand-eye co-ordination, language, performance, practical reasoning and interpersonal skills.

Main results

Neurological status predicted developmental performance in co-ordination, language and practical reasoning (all $p < 0.05$; table). Confounders such as socio-economic factors were controlled for using multiple linear regression.

Conclusions

Minor neurological signs assessed using the Amiel-Tison triad may be linked to later developmental difficulties.

website extra

Additional information appears on the Evidence-Based Mental Health website www.ebmentalhealth.com

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Relationship between neurological status and mean score on Griffiths Development Scales

Development domain (mean score)	Minimal cerebral palsy	ATT	Intermediate	No signs
Locomotion	92	91	96	97
Eye-hand co-ordination*	89	95	97	100
Performance	100	103	104	109
Language*	89	95	100	104
Practical reasoning*	80	81	89	95
Interpersonal / social	94	98	99	104
Independent walking (months)* #	14	14	13	12

* $p < 0.05$. Age of independent walking was not assessed using Griffiths Scales

COMMENTARY

Predicting abnormal later development from minor neurological signs in infancy is controversial. Children at risk of poor development because of perinatal medical complications frequently have transient dystonia.¹ Furthermore, experts define 'soft' neurological signs differently and almost never report inter rater measurement reliability. Previously Gosselin *et al* found that having at least 2 signs related to passive postural tone abnormalities or abnormal cranial suture development (the Amiel-Tison triad or ATT) was correlated with neuropsychological outcome at 4 years.² This study extends the investigation to children at risk of poor development due to maternal placental insufficiency. Neuropsychological development at 2–5 years of age was related to ATT. The authors suggest that the ATT can be used in clinical practice to identify 2 year olds at risk of learning disabilities at school age, thus making better use of intervention resources. They do not describe how the clinician should use this information to make clinical decisions or provide information on inter rater reliability of the ATT.

There was a relationship between ATT and coordination, reasoning and language disabilities, but it is unclear how to apply the results to an individual child. For individual decision making, it is important to know the diagnostic validity of the screening tool, that is, the sensitivity, specificity and positive and negative predictive values. Sensitivity statistics tell us how many children with poor development will be captured by the presence of ATT, while the positive predictive value indicates what resources will be spent following children who may or may not turn out to have a developmental disability. The relationship found in this group with perinatal complications might not hold in a cohort of children with varying degrees of risk, including healthy children born after full-term pregnancy. Future research should study these relationships longitudinally, use a larger cohort of children with varying degrees of risk and report rater reliability and diagnostic validity statistics.

- 1 Drillien CM. Abnormal neurologic signs in the first year of life in low-birthweight infants: possible prognostic significance. *Developmental Medicine and Child Neurology* 1972; **14**: 575–84.
- 2 Amiel-Tison C, Njokiktjen C, Vaivre-Douret L *et al*. Relation of early neuromotor and cranial signs with neuropsychological outcome at 4 years. *Brain and Development* 1996; **18**: 280–6.

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