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


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 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 socioeconomic 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.

Relationship between neurological status and mean score on Griffiths Development Scales

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

*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. 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. 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.


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Aetiology