Neuromotor Examinations for Infants and Young Children less than Five Years Old

By: Michele Boucher and Joanne Kabaniuk
Physical therapists, occupational therapists, physicians, pediatric nurses, and other health care providers who have had appropriate training can administer the HINT.”

(McCoy, S. W., et al., 2009)
Assessments of Neuromotor Functioning

- Infant Motor Profile (IMP)
- Harrison Infant Neuromotor Test (HINT)
- Alberta Infant Motor Scale (AIMS)
- Hammersmith Infant Neurological Examination (HINE)
- Bayley Scales of Infant Development II (BSID)
- Peabody Developmental Motor Scales (PDMS)
Infant Motor Profile (IMP)

- Video-based assessment
- For infants aged 3 to 18 months (may be used for children older than 18 months with a moderate/severe development motor disorder)
- Consists of 80 items
- Organized into 5 subtests
  - Variability (size of repertoire)
  - Variability (ability to select)
  - Symmetry
  - Fluency
  - Performance

- 80 infants (40 full term, 40 premature)
- Assessed at 4, 6, 10, 12, and 18 months.
- Administered the IMP and the AIMS
- Objective: to test reliability and congruent validity of the IMP and AIMS
- Results: high correlation between IMP and AIMS scores.
  - Implies both are reliable to test a child’s motor behavior
- AIMS scores increased with age
  - Suggests a strong correlation between age and AIM test performance.
- IMP Results: pre-term infants scored much lower than full term infants

Harris Infant Neuromotor Test (HINT)

**Test**
- Assesses for possible motor and/or cognitive development disorders
- Used for infants 2.5 – 12.5 months of age
- Four general areas:
  1. General background information
  2. Caregiver’s concerns
  3. 21-item testing section
  4. Overall clinician impression
- 15 to 30 minutes to administer and score

**Case Study**
- 67 US infants (ranging from 2.5 – 12.5 months of age)
- 64 Canadian infants
- Compared US infants to Canadian infants to test validity of the HINT
- Results: no difference in scores between those of US infants and Canadian infants
  - Canadian norms can be applied to US infants
- Compared HINT scores to the Ages and Stages Questionnaire
- Results: parents’ responses on the ASQ are slower than results from the HINT

(McCoy, S. W., et al., 2009)
## Harris Infant Neuromotor Test (HINT) Items

<table>
<thead>
<tr>
<th>Test Method</th>
<th>Cognitive or Behavioral Development Items</th>
<th>Motor Development Items</th>
</tr>
</thead>
</table>
| Observation (infant is observed when placed in or allowed to move independently into supine, prone, sitting, and standing positions) | • Behavior and cooperation  
• Presence of stereotypical behaviors | • Mobility, supine  
• Neck retraction, supine  
• Eye muscle control  
• Head position, prone  
• Upper-extremity position, prone  
• Head position, sitting  
• Trunk position, sitting  
• Locomotion and transition skills  
• Posture of hands  
• Posture of feet  
• Frequency and variety of movements |
| Testing (infant is provided stimulation or is handled by the examiner to determine scores) | • Head circumference | • Visual following  
• Asymmetrical tonic neck reflex  
• Reaching from supine position  
• Passive range of motion in supine position  
• Head righting in transition from supine to prone to supine positions  
• Trunk mobility in transition from supine to prone to supine positions  
• Passive range of motion in prone position |

(McCoy, S. W., et al., 2009)
Alberta Infant Motor Scale (AIMS)

- Infant developmental test
- Used to test motor performance from birth-walking
- 58 items in 4 positions (supine, prone, sitting, and standing) are administered
- Each of the 58 items have 3 movement components:
  - Weight-bearing
  - Postural ailments
  - Antigravity movement

- 100 Dutch infants
- Children were observed individually for 20-30 minutes
- Scores were compared to a Canadian reference group
- Dutch infants scored lower as compared to the Canadian reference group
- Canadian norm values not relevant to Dutch population
- Further studies needed to achieve new norms for the AIMS

(Fleuren, K. M. W., Smit, L. S., Stijnen, T. & Hartman, A., 2007)
Hammersmith Infant Neurological Examination (HINE)

• For infants 2 to 24 months
• Developed by Dubowitz et al.
• 3 sections:
  1) Neurological Exam – postures, cranial nerve function, reflexes, tone, movements
  2) Development of Motor Function – head control, sitting, walking, crawling, rolling, grasping
  3) State of Behavior – consciousness, social orientation, emotional state

• 70 infants with CP
• Evaluated at 3, 6, 9, 12 months
• Findings:
  • Progressive motor development until about 9 months
  • Similar scoring between infants with diplegia and quadriplegia
  • Scores consistent with GMFCS (test of gross motor skills) at 2 years

(Rameo et al., 2007)
### Hammersmith Infant Neurological Examination (HINE)

#### Table 3 – Items of Hammersmith Infant Neurological Examination in the total population

<table>
<thead>
<tr>
<th></th>
<th>Cranial nerve</th>
<th>Posture</th>
<th>Movements</th>
<th>Tone</th>
<th>Reflexes</th>
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<tbody>
<tr>
<td></td>
<td>Median (range)</td>
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<td>Median (range)</td>
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<tr>
<td>3 months</td>
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<tr>
<td>Diplegia</td>
<td>11 (7–15)ns</td>
<td>10 (5–14)a</td>
<td>1 (0–2)ns</td>
<td>12.5 (6–18)a</td>
<td>3 (1–7)ns</td>
</tr>
<tr>
<td>Quadriplegia</td>
<td>10 (7–13)c</td>
<td>9 (3–11)c</td>
<td>0 (0–1)c</td>
<td>9 (3–13)c</td>
<td>2.5 (1–5)c</td>
</tr>
<tr>
<td>Hemiplegia</td>
<td>13 (11–15)b</td>
<td>14 (11–16)b</td>
<td>4 (2–5)b</td>
<td>16 (13–22)b</td>
<td>7 (4–9)b</td>
</tr>
<tr>
<td>6 months</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diplegia</td>
<td>12 (8–15)ns</td>
<td>11 (8–16)a</td>
<td>1 (0–2)ns</td>
<td>13 (7–20)a</td>
<td>4 (1–7)ns</td>
</tr>
<tr>
<td>Quadriplegia</td>
<td>11 (7–14)c</td>
<td>9 (4.5–12)c</td>
<td>0 (0–1)c</td>
<td>9.5 (3.5–15)c</td>
<td>3 (1–5)c</td>
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<td>18 (13–22)b</td>
<td>7 (4–9)b</td>
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<tr>
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<tr>
<td>12 months</td>
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<tr>
<td>Diplegia</td>
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<tr>
<td>Hemiplegia</td>
<td>15 (13–15)b</td>
<td>16 (15–18)b</td>
<td>4 (3–5) b</td>
<td>21 (17–23)b</td>
<td>8 (5–11) b</td>
</tr>
</tbody>
</table>

*ns = no statistical significance on difference between diplegia and quadriplegia.

a Diplegia vs quadriplegia (p < 0.001).
b Diplegia vs hemiplegia (p < 0.001).
c Quadriplegia vs hemiplegia (p < 0.0001).

(Rameo et al., 2007)
### Bayley Scales of Infant Development II (BSID)

#### Test
- For infants 1 to 42 months
- 45 to 60 minutes to administer
- Measures development of 3 components:
  - Cognitive
  - Motor
  - Behavioral

#### Case Study
- 1,730 extremely low birth weight infants between 18 and 30 months tested
- Test stability of neuromotor and functional results for infants
- Results: Most were stable between 18 and 30 months
  - Normal tone predicts normal neuromotor exam
  - Abnormal tone may not

(McCoy, S. W., et al., 2009) and (Peralta-Carcelen M. et al., 2009)
Peabody Developmental Motor Scales-2 (PDMS)

Test

- Birth to 5 years
- Evaluates emerging or present gross and fine motor abilities
- 3 composite standard scores
  1.) Gross Motor Quotient
  2.) Fine Motor Quotient
  3.) Total Quotient
- 25 to 30 minutes to administer at 1 year

Case Study

- 100 premature infants
- Compared 3 assessments that predict motor outcome at 12 months
- PDMS-2 and AIMS results coincided
  - Predicted by time on ventilation and intraventricular hemorrhage (IVH)
- Poor functional outcomes may be due to motor difficulties

(Snider et al., 2009)
Summary

• Currently, very few neuromotor assessments available for children under age 5
• Generally administered by PT, OT, Pediatric Nurses, Physicians, etc.
• Further research is needed
References


