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“Can Initial Assessment Findings Predict Future Mobility in Children with Spina Bifida?”

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• No financial relationships to disclose
Can Initial Assessment Findings Predict Future Mobility in Children with Spina Bifida?

Suzie Taylor, Rachal Quinlan, Antoinette Botman, Michael Paulka, Ryan Harris, Verity Pacey
Background

• Mobility changes
  • Obesity  *(Simsek et al., 2015)*
  • Orthopaedic complications  *(Danielsson et al., 2008 and Dicianno et al., 2015)*
  • Neurological complications  *(Dicianno et al., 2015)*

• Assessment of a child suggests
  • Predictive variables  *(Pauly & Cremer, 2012 and Seitzberg et al, 2008)*
    - Lesion Level
    - Fracture History
    - Knee extension strength
Aim

“To determine if the initial physical examination of the child within the first three months of life can predict peak mobility”
Method

Children presenting to CHW
2005-2015
Aged 0-12 months

**Included**
- Diagnosis of SB
- Lesion level L1 and below

**Excluded**
- Additional diagnosis or diagnosis other than SB
- Lesion >L1
- No initial data in first 3/12 of life
- No peak mobility data

**Data collection**
- Sociodemographic data
- Physical examination
  - Hydrocephalus +/- VP shunt
  - Hoffer Ambulation Scale
  - Walking aides

**Statistical analysis**
Stepwise multiple regression analysis
Hoffer Functional Ambulation Scale

<table>
<thead>
<tr>
<th>Original</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1: Community ambulators</td>
</tr>
<tr>
<td>Level 2: Household ambulators</td>
</tr>
<tr>
<td>Level 3: Non-functional ambulators</td>
</tr>
<tr>
<td>Level 4: Non-ambulators</td>
</tr>
</tbody>
</table>

Hoffer et.al., 1973
### Hoffer Functional Ambulation Scale

<table>
<thead>
<tr>
<th>Original</th>
<th>Modified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1: Community ambulators</td>
<td>Level 1: Community ambulators</td>
</tr>
<tr>
<td>Level 2: Household ambulators</td>
<td>Level 2: Community ambulators with equipment</td>
</tr>
<tr>
<td>Level 3: Non-functional ambulators</td>
<td>Level 3: Household ambulators</td>
</tr>
<tr>
<td>Level 4: Non-ambulators</td>
<td>Level 4: Non-functional ambulators</td>
</tr>
<tr>
<td></td>
<td>Level 5: Non-ambulators</td>
</tr>
</tbody>
</table>
## Results

<table>
<thead>
<tr>
<th>Lesion Type</th>
<th>Lesion level</th>
<th>Presence VP shunt</th>
<th>Congenital MSK</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Myelomeningocele</strong> (n=41)</td>
<td>L1-2 = 16</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>L3-4 = 5</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>L5 below = 20</td>
<td>13 (Total= 31)</td>
<td>13 (Total=31)</td>
</tr>
<tr>
<td><strong>Meningocele</strong> (n=6)</td>
<td>L1-2 = 0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>L3-4 = 0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>L5 below = 6</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Lipomyelomeningocele</strong> (n=24)</td>
<td>L1-2 = 1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>L3-4 = 6</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>L5 below = 17</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>
## Hoffer Functional Ambulation Scale

<table>
<thead>
<tr>
<th></th>
<th>Original</th>
<th>Modified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1: Community ambulators</td>
<td>79%</td>
<td>Level 1: Community ambulators</td>
</tr>
<tr>
<td>Level 2: Household ambulators</td>
<td>12%</td>
<td>Level 2: Community ambulators with equipment</td>
</tr>
<tr>
<td>Level 3: Non-functional ambulators</td>
<td>9%</td>
<td>Level 3: Household ambulators</td>
</tr>
<tr>
<td>Level 4: Non-ambulators</td>
<td>0%</td>
<td>Level 4: Non-functional ambulators</td>
</tr>
<tr>
<td>Level 5: Non-ambulators</td>
<td></td>
<td>Level 5: Non-ambulators</td>
</tr>
</tbody>
</table>
Results

Hoffer Level (original) = 2.34 – (0.38 x knee extension MMT) + (0.36 x level of lesion) – (0.32 x hip flexion MMT)

82% variance F= 72.7, p< 0.001

Hoffer Level (modified) = 3.2 – (0.61 x Ankle dorsiflexion MMT) – (0.42 x Knee extension MMT) + (0.41 x V-P shunt)

81% variance F= 66.9, p< 0.001

**MMT (Manual Muscle Test):**
0= No movement, 1= Weak movement, 2= Strong movement

**Level of lesion:**
0= L5 and below , 1= L3-L4, 2= L1-L2

**V-P Shunt:**
0= Absence 1= Presence
Results: L5 and below Level Lesion

Hoffer Level (original) = 2.34 – (0.38 \times \text{knee extension MMT}) + 
(0.36 \times \text{level of lesion}) – (0.32 \times \text{hip flexion MMT})

Knee extension = 2 Level of lesion = 0 Hip Flexion = 2

Hoffer Level (original) = 2.34 - (0.38 \times 2) + (0.36 \times 0) - (0.32 \times 2)
Results: L5 and below Level Lesion

Hoffer Level (original) = 2.34 – (0.38 × knee extension MMT) + (0.36 × level of lesion) – (0.32 × hip flexion MMT)

Knee extension = 2 Level of lesion = 0 Hip Flexion = 2

Hoffer Level (original) = 2.34 - (0.38 × 2) + (0.36 × 0) - (0.32 × 2)

Hoffer Level = 1= Community Ambulator
Results: L1-2 Level Lesion

Hoffer Level (original) = 2.34 – (0.38 x knee extension MMT) + (0.36 x level of lesion) – (0.32 x hip flexion MMT)

Knee extension = 1 Level of lesion = 2 Hip Flexion = 2

Hoffer Level (original) = 2.34 - (0.38 x 1) + (0.36 x 2) - (0.32 x 2)
Results: L1-2 Level Lesion

Hoffer Level (original) = 2.34 – (0.38 \times \text{knee extension MMT}) + (0.36 \times \text{level of lesion}) – (0.32 \times \text{hip flexion MMT})

Hoffer Level (original) = 2.34 - (0.38 \times 1) + (0.36 \times 2) - (0.32 \times 2)

Hoffer Level (original) = 2 = \text{Household Ambulator}
Results: L5 and below lesion

Hoffer Level (modified) = 3.2 – (0.61 x Ankle dorsiflexion MMT) – (0.42 x Knee extension MMT) + (0.41 x V-P shunt)

Ankle Df=1, Knee extension=2, V-P shunt=1

Hoffer Level (modified) = 3.2 - (0.61 x 1) - (0.42 x 2) + (0.41 x 1)
Results: L5 and below Lesion

Hoffer Level (modified) = 3.2 - (0.61 x Ankle dorsiflexion MMT) - (0.42 x Knee extension MMT) + (0.41 x V-P shunt)

Ankle Df=1, Knee extension=2, V-P shunt=1

Hoffer Level (modified) = 3.2 - (0.61 x 1) - (0.42 x 2) + (0.41 x 1)

Hoffer Level (modified) = 2 = Community Ambulator with equipment
Results: L1-2 Level Lesion

Hoffer Level (modified) = 3.2 – (0.61 x Ankle dorsiflexion MMT) – (0.42 x Knee extension MMT) + (0.41 x V-P shunt)

Ankle Df = 0, Knee extension = 1, V-P shunt = 1

Hoffer Level (modified) = 3.2 - (0.61 x 0) - (0.42 x 1) + (0.41 x 1)
Results: L1-2 Level Lesion

Hoffer Level (modified) = 3.2 - (0.61 \times \text{Ankle dorsiflexion MMT}) - (0.42 \times \text{Knee extension MMT}) + (0.41 \times \text{V-P shunt})

Ankle Df = 0, Knee extension = 1, V-P shunt = 1

Hoffer Level (modified) = 3.2 - (0.61 \times 0) - (0.42 \times 1) + (0.41 \times 1)

Hoffer level (modified) = 3 = Household Ambulator
Discussion

- Able to predict over 80% variance at initial assessment
- Able to predict mobility at all lumbar lesion levels
- First to assess and predict within the first 3 months of life
Clinical Implications

- Ability to predict peak mobility
- Modified Hoffer is more descriptive and provides accurate information for parents
- Easily transferable to clinical practice
Limitations

• Retrospective chart audit
• Small sample size from one hospital
• May be less applicable to milder forms of SB
• Only applicable to SB without additional diagnosis
• Does not consider future variables
Future Research

• Prospective

• Bigger sample sizes

• Development of standardised assessment and new ambulation scale
References


Şimşek TT, Türküçüoğlu B, Tezcan S. Examination of the relationship between body mass index (BMI) and functional independence level in children with spina bifida. Developmental Neurorehabilitation. 2015;18(3):149-54.