Group 6: Pediatric Case

Kaylea Kirven, Kailee Karst, Laurin Sunshine, Rob Oldham, and Greg Banks
Pt is a 7 month old female, born at 27 weeks gestation. Pt was transferred from NICU→PICU, and presents with health-related issues secondary to premature birth.

**Corrected Age:** 3.75 months old
Social History:

- Born to first-time parents
- Parents live in an urban development
- 2-story home, 4-5 steps to front door
Evaluation:

**Behavior:**
- Smiles
- Interacts w/ others
- Tracks objects
- Kicks feet reciprocally
- Generally happy

**Head Shape:**
- Scaphocephalic

**ROM:**
- WFL (UEs, LEs, Trunk, Neck)

**MMT:**
- WFL (UEs, LEs, Trunk, Neck)

**Tone:**
- WNL
Evaluation - Activity:

**Supine:**
- Maintains head in midline
- Rotates in/out of midline
- Hands to midline
- Tracks people
- Reciprocally kicks feet
- Explores toys when presented to hands
- Attempts to put pacifier in mouth
- Reaches & grasps toys bimanually

**Prone:**
- Holds head up 45° w/ towel roll
- Weight-bears on hands w/ facilitation at shoulders
- Accepts weight on hands *briefly*
- Doesn’t tolerate prone well
Evaluation - Activity:

**Supported Sitting:**
- Good head control
- Poor ⇒ fair trunk control w/ support to pelvis
- Demonstrates retracted shoulders & forward lean *in attempt* to perform weight-bearing on hands

**Side-Lying:**
- Grasps toys
- Kicks legs
- Demonstrates good postural control
- Maintains position while playing w/ toys
Evaluation - Activity:

Transitions:

- Sidelying ⇦ Supine
- Supine ⇦ Sidelying
- Propels herself w/ her feet while in supine to reach toys
- Pivots w/ her legs while in prone to move around crib & to pursue desired toy
Health Condition:

- Congenital hemangioma
- Laryngomalacia
- Subglottic stenosis
- Chronic lung disease
- Pulmonary hypertension
- Bilateral sensorineural hearing loss
- Encephalomalacia

- Tracheostomy
- Nissen fundoplication
- G-J tube
Body Function & Structure Impairments:

❖ **Decreased:**
  ➢ Postural control
  ➢ Muscular endurance
  ➢ Cardiovascular endurance
  ➢ Cervical spinal extension

❖ **Difficulty:**
  ➢ Hearing
  ➢ With verbal communication
Activity Limitations:

❖ Unable to sit or roll independently
❖ **Decreased:**
  ➢ Ability to perform weight-bearing on hands
  ➢ Tolerance for prone positioning & prone play
  ➢ Early mobility
Participation Restrictions

Decreased movement variability has led to decreased environmental exposure, impacting child’s ...

- Ability to play and interact with parents/children her age
- Ability to fully and independently explore her environment
Parent/Patient Goals:

“For my daughter to be able to play”
Prognostic Question: Can the AIMS accurately predict risk of delayed motor development in a child born preterm?
Study Design: Prospective Longitudinal Study

Purpose of Study:

- To assess the concurrent validity and diagnostic agreement between the TIMP and AIMS when used at 3 months corrected age (CA) for infants <1000 g, or <30 weeks GA
- To determine the ability of the TIMP and AIMS to predict the level of gross motor maturation and independent walking around 15 months CA
- To explore predictors associated with the age of independent walking
Methodology:

- N=95 (started with 158), Mean GA: 28+/- 1.6 weeks
- Data collected at 3-, 6-, 15- months
- TIMP scores taken at 3 months in order to compare TIMP vs. AIMS values

Results:

- TIMP and AIMS scores were correlated at 3 months (p< .001)
- AIMS scores at 6 months were significantly associated with AIMS scores at 15 months (p<.001)
- TIMP and AIMS scores at 3 months were not found to be statistically significant in predicting age of onset of independent walking or correlated with AIMS scores at 15 months.
Discussion:

- Although the concurrent validity between the TIMP and AIMS at 3 months CA is statistically significant, neither can reliably predict gross motor maturation of walking skills at 15 months CA.
- The age of 3 months might be too early to assess infants if the goal is to give any valid prediction of later gross motor outcome.
- Infants born at <30 weeks of gestation started walking independently about three months later than term born infants, even with full correction for prematurity.

Limitations of Study:

- Did not include patients with sensory system disorders, congenital malformations or lesions, and with known medical conditions that would delay gross motor development.
- Parental report of walking age might be influenced by recall bias.
- The average age of the last collection was actually 16 months instead of 15 due to cancellations and a busy schedule at the follow up clinic.

Patient Relevance:

- Patient is relatively healthy, but may still be at risk for motor delay and could benefit from use of the AIMS.
Study Design: Prospective Longitudinal Study of a Very Preterm Infant Cohort

Purpose of Study: To evaluate the accuracy of serial assessments using the Alberta Infant Motor Scale (AIMS) and Neuro-Sensory Motor Developmental Assessment (NSMDA) for preterm children over the first year of life for predicting motor impairment at 4 years of age.

Methodology:
- 82 children born <30 weeks gestation were prospectively recruited
- At 4, 8, and 12 months corrected age the children were assessed using the AIMS and the NSMDA
- At 4 years corrected age the children were assessed for CP and/or motor impairment using the Movement Assessment Battery for Children 2nd edition (MABC-2). CP was further classified using the GMFCS
- MABC ≤ 15th percentile were classified as at risk for motor delay at 4 years
- MABC ≤ 5th percentile were classified as having a significant motor delay at 4 years
Accuracy of Two Motor Assessments during the First Year of Life in Preterm Infants for Predicting Motor Outcome at Preschool Age
Alicia J. Spittle, Katherine J. Lee, Megan Spencer-Smith, Lucy E. Lorefice, Peter J. Anderson, Lex W. Doyle

<table>
<thead>
<tr>
<th>4 Year Motor Outcome</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
<th>+ Predictive Validity (%)</th>
<th>- Predictive Validity (%)</th>
<th>LR+</th>
<th>LR-</th>
<th>Accuracy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MABC&lt; 15th (At risk for Motor delay)</td>
<td>52</td>
<td>89</td>
<td>61</td>
<td>84</td>
<td>4.6</td>
<td>0.5</td>
<td>79*</td>
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<tr>
<td>MABC ≤ 5th (Significant motor Delay)</td>
<td>61</td>
<td>89</td>
<td>61</td>
<td>89</td>
<td>5.6</td>
<td>0.4</td>
<td>83*</td>
</tr>
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</table>

Psychometric Properties of the NSMDA at Administered at 4 months as a Predictor of Motor Delay

<table>
<thead>
<tr>
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<th>LR-</th>
<th>Accuracy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MABC≤ 15th</td>
<td>38</td>
<td>85</td>
<td>47</td>
<td>80</td>
<td>2.6</td>
<td>0.7</td>
<td>73</td>
</tr>
<tr>
<td>MABC ≤ 5th</td>
<td>44</td>
<td>86</td>
<td>47</td>
<td>85</td>
<td>3.2</td>
<td>0.6</td>
<td>77</td>
</tr>
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### Psychometric Properties of the AIMS Serially Noted Delay at 4, 8, and 12 months

<table>
<thead>
<tr>
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<th>- Predictive Validity (%)</th>
<th>LR+</th>
<th>LR-</th>
<th>Accuracy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MABC ≤ 15th</td>
<td>43</td>
<td>95</td>
<td>75</td>
<td>83</td>
<td>8.7</td>
<td>0.6</td>
<td>82*</td>
</tr>
<tr>
<td>MABC ≤ 5th</td>
<td>44</td>
<td>95</td>
<td>73</td>
<td>86</td>
<td>9.5</td>
<td>0.5</td>
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### Psychometric Properties of the NSMDA Serially Noted Delay at 4, 8, and 12 months

<table>
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<tr>
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<th>+ Predictive Validity (%)</th>
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<th>LR+</th>
<th>LR-</th>
<th>Accuracy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MABC ≤ 15th</td>
<td>24</td>
<td>95</td>
<td>63</td>
<td>78</td>
<td>4.8</td>
<td>0.8</td>
<td>77</td>
</tr>
<tr>
<td>MABC ≤ 5th</td>
<td>26</td>
<td>95</td>
<td>63</td>
<td>82</td>
<td>5.9</td>
<td>0.8</td>
<td>80</td>
</tr>
</tbody>
</table>
Limitations of Study:

- 5 children were unable to complete the MABC-2 at 4 years, which may have resulted in underestimation of motor impairment
- Long-term motor outcome was assessed at 4 years as it is approaching school age, however the validity of assessments at this age has been questioned
- As preterm children grow older, motor assessments tend to identify more problems, which is likely due to the complexity of assessment tasks as age increases
- The study excluded infants with congenital abnormalities

Discussion & Patient Relevance:

- For a single method of assessment the AIMS at 4 months was a more accurate predictor both of risk of motor delay and significant motor delay at 4 years of age (Our child is ~ 3.75 months of age)
- Average gestational age of infants: 27.3 weeks
- The highest accuracy for a single test with serially noted delay was the AIMS with three delayed assessments
- Accuracy of motor delay prediction at 4 years increased with serial delays as well as with combining AIMS and NSMDA scores due to the high false positive rate in each test, but it should be noted that the predictive validity of the NSMDA on motor delay has not been as extensively studied as the AIMS
Criteria for Delayed Motor Development:
- 4 months: <10th percentile
- 8 and 12 months: < 5th percentile

Application of the AIMS to our Patient:

Subscale Scores
- Prone: 3
- Supine: 6
- Sitting: 2
- Standing: 2
- TOTAL: 13

Percentile Rank:
- ~7th percentile; delayed motor development
- According to Spittle et al. this score may predict with 79-83% accuracy that this child will be at risk for motor delay or have a significant motor delay at 4 years of age as measured by the MABC-2
In a child born at 27 weeks gestational age, can increased prone play have a positive effect on motor development as demonstrated through AIMS score?
Study Design: Retrospective Study of a Preterm Infant Cohort

Purpose of Study:

1) To determine the relationship between total duration of equipment use and the duration of use of different pieces of infant equipment and motor development overall and position-specific
2) Investigate the relationship between infant’s predominant play positions and variations in motor development
Methodology:
● N=60 preterm children at 8 months corrected age
● Avg gestational age at birth= 28.7 weeks
● At-Risk: Birth weight < 1500 g or complicated neonatal course with clinical findings placing them at high risk for developmental sequelae.
● Parents participated in verbal interviews
● Assessed using AIMS

Interview Questions:
● “What equipment, if any, has your baby used in your home while awake over the past month?”
  ○ “What is the average time per day that your baby used the equipment?”
● “What is your baby’s favorite/least favorite play position?”
  ○ “How long will your child play in this position at one time”
Results:

- In regard to equipment use, saw statistically significant correlation between:
  - Time in swing and prone, sit, and total AIMS scores
  - Time carried and sit AIMS subscale
  - Total equipment and sit, stand AIMS subscale

<table>
<thead>
<tr>
<th>Reported Favorite Position</th>
<th>AIMS Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standing (n = 9)</td>
<td>44.3</td>
</tr>
<tr>
<td>Prone (n = 9)</td>
<td>34.9</td>
</tr>
<tr>
<td>None (n = 4)</td>
<td>32.8</td>
</tr>
<tr>
<td>Sitting (n = 23)</td>
<td>31.7</td>
</tr>
<tr>
<td>Supine (n = 15)</td>
<td>25.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Least Favorite Position</th>
<th>AIMS Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supine (n = 15)</td>
<td>41.4</td>
</tr>
<tr>
<td>Sitting (n = 8)</td>
<td>36.6</td>
</tr>
<tr>
<td>None (n = 10)</td>
<td>30.5</td>
</tr>
<tr>
<td>Prone (n = 24)</td>
<td>26.8</td>
</tr>
</tbody>
</table>
**Discussion:**
- Encourage parents early on in “prone to play” to facilitate a variety of play positions during awake time.
- During intervention, encourage motor acquisition first in favorite position, then progress to less popular positions.
- Long term, preventive methods by teaching parents handling techniques and caregiving practice that expose postural challenges.
- Limit time spent playing in assistive equipment if possible.

**Limitations:**
- Based on parent perception of average time spent using equipment and in favorite position.
- Could be improved using log book.
- Focused on play positions opposed to specific play activities.

**Patient Relevance:**
- Encourage prone positioning through positioning and handling techniques to facilitate motor development.
Motor Development and sleep, play, and feeding positions in very-low-birthweight infants with and without white matter disease
Linda Fetters and Hsiang-han Huang

Study Design:
- Retrospective Cohort Study

Purpose of Study:
- To determine the effects of typical sleep and awake positions on achieving motor milestones in preterm infants with white matter disease compared to preterm healthy infants and term healthy infants
Motor Development and sleep, play, and feeding positions in very-low-birthweight infants with and without white matter disease
Linda Fetters and Hsiang-han Huang

Methodology:
- **68 infants**
  - 30 preterm with documented white matter disease
  - 21 healthy preterm
  - 17 healthy term
- Data collection at corrected ages of 1 month, 5 months, and 9 months
- Motor milestones assessed by 2 testers using the AIMS
- Parents interviewed at each assessment about infants’ preferred positioning

Interview Questions:
- “Does your son/daughter have a preferred position for sleeping/feeding/playing?”
  - Options included: supine, prone, sitting (supported or unsupported), and side-lying
  - Parents allowed to give more than one option for each question
Results:

- Sleeping in prone had a positive association with AIMS scores in all three groups at all three ages.
- At 5 months playing prone had a positive association with AIMS scores in all three groups.
- At 9 months preterm prone sleeping infants had significantly higher AIMS scores than preterm prone sleeping infants with white matter disease (the difference was not significant at 1 and 5 months).
- At 9 months predominantly sitting for play was negatively associated with AIMS scores.

Discussion:

- Spending time in prone position can positively affect achievement of motor milestones regardless of being born preterm or full-term.
- Would not recommend infants be put to sleep in prone due to risk of SIDS.
- Would recommend infants spend time playing in prone; especially infants more vulnerable to complications.
- No evidence that sleeping supine negatively affected motor milestone achievement.
Motor Development and sleep, play, and feeding positions in very-low-birthweight infants with and without white matter disease
Linda Fetters and Hsiang-han Huang

Study Limitations:
- Small sample size
- Did not separate supported sitting and unsupported sitting for positioning categories
- Relied heavily on parent report which can be skewed

Patient Relevance:
- Our child was born premature
- Our child does not tolerate prone position well and spends very little time in this position
Intervention:
Based on Bartlett and Fanning, our suggested dosage will be at least 45 minute of prone play time per day.
Our PT plan of care will be divided into PT sessions and parent education. Parent education will allow the infant to get more consistent “prone play” time.
Plan of Care

Class Activity
PT Goals: Prone

In 3 weeks, infant will be able to tolerate prone positioning for 20 minutes with 2 rest breaks while on a RES-Q Wedge in order to increase tolerance in prone.

In 4 weeks, infant will be able to hold her head up 80-90 degrees while in prone while PT/caregiver provides stimulation at eye level in order to promote increased exploration of her environment.

LTG: In 6 weeks, infant will be able to tolerate prone positioning for at least 45 minutes with rest breaks, 80% of the time, 5 days per week, with minimal assistance and stimulation from the PT/caregiver and toys in order to facilitate comfort, play, and pivoting in prone.
PT Goals: Sitting

In 2 weeks, patient will be able to sit for 3 minutes with good trunk control and with minimal external support provided by PT/caregiver in order to begin reaching outside of her base of support without loss of balance.

In 3 weeks, patient will tripod sit independently in order to ensure she can weight-bear on her hands for future transitions in and out of sitting.

**LTG:** In 6 weeks, patient will be able to perform unimanual reaching with minimal loss of balance in unsupported sitting with minimal assistance from PT/caregiver in order to demonstrate dynamic trunk control, which is a prerequisite for standing.
PT Goals: Rolling

In 2-3 weeks, infant will transition from supine to prone with minimal assistance, 100% percent of the time, in order to develop independence with position variability.

In 2-3 weeks, infant will transition from prone to sidelying with minimal affordances, on \( \frac{3}{4} \) successive attempts, in order to facilitate initiation of independent rolling.

**LTG:** In 6 weeks, patient will be able to successfully roll from prone to supine independently by using a righting reaction and lateral trunk flexion in order to experience self-directed tactile stimulation on her back and abdomen.
Plan of Care:

❖ **Frequency:** 5 x per week, for 6 weeks (or until medically stable to return home)
❖ **Duration:** ~ 1 hour
❖ **Barriers:**
  ➢ Bilateral SNHL
  ➢ Tracheostomy
  ➢ G-J Tube
  ➢ Bosentan Side-Effects
    ■ Dizziness, stomach pain, unusual weakness, nausea/vomiting
    ■ Must monitor hemoglobin levels & liver transaminase in EMR
Plan of Care: Prone

To Achieve Tolerance in Prone:
- Utilize RES-Q Wedge ⇒ Boppy Pillow
- Place child on mom’s chest in prone
- Cradle/carry child in prone
- Lie child prone across parent’s thighs while supporting head if needed
- Prone on therapy ball (exercise ball) or large pillow

To Achieve 80°-90° Head Position in Prone:
- Place hand on bottom to shift child’s weight posterior
- Lie with child face-to-face
- Place mirror and colorful toys in front of child while lying prone
- Stroke plush toys or washcloths on child’s forehead
Plan of Care: Prone

What to Monitor:
❖ Oxygenation: Pulse Oximeter
   ➢ Simple and non-invasive technique that could illustrate hypoxic attacks

Positioning Considerations:
❖ Abdomen should hang between 2 pillows or supports
❖ Head placed towards ventilation tubes

Added Benefits of Prone Positioning on Ventilation:
❖ Increase in oxygen saturation: Average increase of 2%
❖ Lungs can inflate at lower pressures
❖ Increased functional residual capacity
Plan of Care: Sitting

To Achieve Trunk Control & Dynamic Trunk Control in Sitting:

Place child’s hands on floor and gently place hands over top
  ➢  Progression: Shift child’s weight anteriorly over hands

Place child in sitting position on floor with parent positioned behind to provide support to pelvis (if needed)
  ➢  Place toys/ familiar objects in front to encourage propping forward on hands

Encourage side-to-side balance
  ➢  Shift child off balance to one side while in sitting position so child extends ipsilateral arm to maintain sitting balance
  ➢  Progression: Have child reach for toy of interest on each side in sitting position

Place child in sitting position on exercise ball
  ➢  Initially hold higher up on chest
  ➢  Progression: Hold at pelvis
Plan of Care: Rolling

To Achieve Rolling from Supine ⇐⇒ Prone:

❖ Ensure child is comfortable playing in supine, side-lying, and prone
❖ Catch infant’s attention with toy in supine & then guide across midline
  ➢ Once infant is side-lying continue pulling toy away so infant must reach farther
❖ Use wedge to have gravity assist with rolling
  ➢ Once proficient move to flat surface
**Parent Education:**
- Importance of prone play
- Importance of exploration
- Typical development

<table>
<thead>
<tr>
<th>Behavior</th>
<th>3 months</th>
<th>4 months</th>
<th>5 months</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Expected</strong></td>
<td>Lift head 45° in prone</td>
<td>Lift head 90° in prone</td>
<td>Hold head steady when held upright</td>
</tr>
<tr>
<td></td>
<td>Track objects in short arc</td>
<td>Track objects side-to-side</td>
<td>Roll (1 way)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Complete head control in prone</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sit w/o support (av. 5.4 mo)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Reach for objects</td>
</tr>
<tr>
<td><strong>Likely</strong></td>
<td>Lift head 90° in prone</td>
<td>Hold head steady when upright</td>
<td>Bear wt. on legs when held upright</td>
</tr>
<tr>
<td></td>
<td>Bring hands to midline</td>
<td>Roll (1 way)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Raise chest in prone</td>
<td></td>
</tr>
</tbody>
</table>
Plan of Care:

Recommendations after Hospitalization:
❖ Outpatient frequency: weekly or bi-monthly
❖ Continue to encourage play position variability: Prone, supine, sitting, and standing

Will allow child to:
● Develop adaptable postural control strategies
● Attain different perspectives of the environment which would influence cognitive and motor development
● Acquire an array of functional skills
● Participate in self-discovery

❖ Motivate child with toys
❖ Maintain a log of milestone accomplishments


Questions?