Developmental and Motor Testing in the NICU: Is it of value?

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Objectives

• Relate the rationale for standardized testing of motor behavior in infants born pre-term ('at-risk') or with known developmental risk.
• Understand core constructs associated with 'standardized' tests and test score interpretation.
• Compare and contrast select standardized tests designed to evaluate motor behavior in pre-mature or 'at-risk' infants (Test of Infant Motor Performance, General Movement Assessment, Hammersmith Infant Neurological Examination).
• Recognize the strengths and limitations of above standardized tests when used for evaluation of motor behavior in infants prior to three months adjusted age.

True or False:

• Approximately fifty percent of infants born before 28 weeks gestation are diagnosed with some type of developmental disability.
• Developmental testing at term adjusted age predicts developmental outcomes at six and twelve months of age.
• Movement disorders like cerebral palsy cannot be detected with clinical assessments before twelve months adjusted age.
• During infancy, motor difficulties or delays are unrelated to and distinct from cognitive and/or language delays.

Prematurity and Neurodevelopmental Outcomes (Blencowe, 2013; Pascal, 2018)

• 2018 data (pooled prevalence)
  • 16.9% cognitive
  • 20.6% motor
  • 6.8% CP
• When can we detect?
• What can we detect?

Why focus on motor?

• Cognitive and communication skills are motor-dependent
  • Orientation of eyes or head in response to auditory/visual cues.
  • Allocation of attention.
  • Eyes, hands, mouth work together to gather information.
• Pre-term infants demonstrate decreased exploratory motor behaviors and motor learning capacity as early as 1.5 months adjusted age.
• Motor behaviors reflect neurological integrity and can be measured, both qualitatively and quantitatively!

Earlier detection, earlier intervention and family support (prediction)…..

“Before age 12 to 24 months was historically regarded as the latent or silent period where cerebral palsy could not be identified accurately. Experts now consider the silent period as outdated because cerebral palsy or ‘high risk of cerebral palsy’ can be accurately predicted before age 6 months’ corrected age.” (Novak, et. al. 2017)
Immediate goals of testing (discriminative and/or evaluative):

Long-term goal: predictive!

Standardized developmental testing is:

- Administered in a specific way
- Psychometrically sound
  - Valid
  - Reliable
  - Discriminative
  - Predictive
- Criterion or norm-referenced
  - ‘mean’
  - Z or cut-off score

Besides psychometric properties, consider:

- Theoretical perspective
- Clinical Utility:
  - Training requirements (time and cost)
  - Cost and availability of testing materials
  - Administration and interpretation time (assessor burden)
  - Handling requirements (infant burden)

Noble and Boyd (2012)

Current Guidelines for Early Detection of CP (NINDS and Novak, et. al., 2017)

In infants ‘at-risk’ for adverse neurological outcomes, the following tests of neuromotor integrity are recommended before 5 months adjusted age:

- General Movement Assessment (GMA)
- Test of Infant Motor Performance (TIMP)
- Hammersmith Infant Neurological Examination (HINE)

Test of Infant Motor Performance (TIMP) (Campbell, Kolobe, Osten, Lenke, and Girolami, 1995)

Purpose:

- Identify motor delays between 34 weeks and 4 months AA.
- Assist in planning intervention programs when appropriate.
- Document change over time or in response to intervention.
- Educate parents about infant development.
TIMP constructs:
Functional motor assessment of movement/postural control demands placed upon an infant during naturalistic, caregiving interactions or routines.

20 "elicited items" (scored)
13 observed items (present/absent)

Psychometric Properties
- Ecologic Validity: ½ of all caregiving demands TIMP related
- Discriminative Validity:
  - detects differences in gestational age and medical complexity
  - Detects changes related to intervention
  - correlates with MRI: white matter integrity
- Inter and intra-rater reliability (trained testers): .89 - .95
- Sensitivity (.72); Specificity (.91)
- Negative predictive validity (.91)

But is the TIMP predictive?
- TIMP at 90 days is the best predictor
  - Low Average (> .5 SD below the mean): 75% demonstrated poor motor performance at 1 and 5 years of age
  - Average TIMP: 91% demonstrated typical motor performance at 1 and 5 years of age
  - Peyton (2018): TIMP z-scores at 10 to 15 weeks adjusted age significantly associated with all three subscales of Bayley-III at 2 years
  - With cutoff of 0.5: specificity high for cognitive, language, and motor (87-89%) outcomes, sensitivity low (cognitive 41%, language 49%, motor 57%).

General Movement Assessment (GMA):
Prechtl (1990, 1995)
- Qualitative assessment of spontaneous, endogenously-generated infant movements.
- Believed to reflect integrity of developing central nervous system.
- Appear to have a developmental trajectory attributed to CNS maturation.

General Movement Assessment: videotaped

Purpose: ‘global, gestalt’ identification of infants demonstrating atypical movement characteristics (discriminate); those who would benefit from early intervention (predictive)
- Normal
  - Variability, complexity, fluency
  - Onset/offset; accelerations/decelerations
- Abnormal (pre/post 9-13 weeks adjusted age)
  - Cramped, synchronous, absent fidgety: CP
  - Atypical fidgety (chaotic or poor repertoire): other neurological conditions
Examples of GM’s

Normal

Abnormal

Psychometric Properties of GMA

- Correlates with MRI indices of white matter abnormality at 1 and 3 months adjusted age (discriminative)
- High inter/intra rater reliability among trained observers (.84 -.95)
- Specificity (.96); Sensitivity (.95 - .98)
- 100% prediction of spastic CP with absence of fidgety; cramped synchronous as early as 9 weeks adjusted age
- Predictive of:
  - intelligence, working memory, attention, and hyperactivity at 10 years of age

Hammersmith Infant Neurological Examination (HINE)

Purpose: assessment of neurological status 2 – 24 months adjusted age
- Cranial nerve function
- Posture, movement, tone, reflexes
- Developmental motor function
- State/behavior
Global score (0 – 78)

Can a single ‘standardized’ motor test at or before term equivalent age predict neurodevelopmental outcomes?

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Select References:


