Implementation of Prechtl’s General Movements Assessment to Diagnose Cerebral Palsy

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Objectives

• Determine the best practice pathway based on the international guidelines for the early diagnosis and treatment of cerebral palsy

• Describe and discuss Prechtl's GMA, a new-to-BC assessment of at-risk infants for the earlier identification of cerebral palsy through sample videos

• Determine how service delivery of the GMA could look in a practice setting and medical community through the innovative use of secure technology
Disclosures

• Nothing to disclose
Term-Age / Moderate-Risk Infants
Morgan, Fahey, Roy, & Novak, 2018

• Referral for intervention is often delayed until 2yo unless child is NICU graduate

• 57% of children with CP are born at term-age
  • Majority have no immediately identifiable risk factors for CP

• Ambulant children were latest to be diagnosed, particularly those with bilateral spastic CP (mean 23.9 months old)

• Late access to EI is detrimental, resulting in lost opportunities during the critical window for neuroplasticity
SIGNS PROMPTING REFERRAL FOR SPECIALIST EVALUATION FOR CP

• Persistent fisting of the hands > 4 months old
• Persistent head lag > 4 months
• Delayed sitting without support > 9 months
• Stiffness or tightness in the legs between 6 and 12 months
• Early handedness before 12 months
• Any asymmetry in posture or movements

From a parent’s perspective, may look like:
• Delayed acquisition of skill(s)
• Involuntary movements or coordination impairments
• Regression of skill(s)
• Strength, coordination and endurance issues

Boychuck et al 2017

Nortiz et al 2013
Hammersmith Infant Neurological Examination (HINE)

• Consists of 26 items that assess different aspects of neurological function
  o Cranial nerve function
  o Movements
  o Reflexes and protective reactions
  o Behaviour
  o Age-dependent items that reflect the development of gross and fine motor function

• Age range for exam between 3 – 24 months of age
HINE

• Scores can also be used to assist in the early detection, diagnosis and prognosis of infants at risk for developing cerebral palsy
HISTORY OF GENERAL MOVEMENTS

• Developed by Heinz Prechtl in Austria after many years of observing infants’ movement patterns
  • High risk infants moved differently than typical term infants

• He developed Prechtl’s method of *General Movements Assessment* in the 1990’s

• Over the past 25 years, General Movements (GMs) have been studied and validated with a high predictive value for cerebral palsy as they are a “window” into the developing brain
General Movements Assessment

• Typical and distinct spontaneous “general movements” from 9 weeks post-menstrual age to 20 weeks post term

• Infants whose GMs are absent or abnormal at higher risk of neurological conditions, in particular cerebral palsy

• Currently validated in high-risk infants only

• Most predictive when used longitudinally (*Einspieler et al 2005*)

• Knowing the difference between normal and abnormal GMs allows a practitioner to follow and predict a child’s developmental trajectory
DEVELOPMENTAL COURSE OF GMs

WRITHING PERIOD: birth until 6-9 weeks post-term

FIDGETY PERIOD: Begins 6-9 weeks post-term until 16-20 weeks old

Voluntary Movements: 15 weeks, foot to foot, hands to midline, etc.
TRAJECTORIES OF GMs
PrechtI et al, 1997

- All babies with Normal Writhing
  - Normal Fidgety
  - Normal Outcome

- ~2/3 with Poor Repertoire
  - Normal Fidgety
  - Normal Outcome

- ~1/3 with Poor Repertoire
  - Absent Fidgety
  - CP

- Cramped Synchronous Writhing
  - Absent Fidgety (majority)
  - Abnormal Fidgety (some)
  - All Dx with CP
ESTIMATES OF SENSITIVITY AND SPECIFICITY
Bosanquet et al., 2013

<table>
<thead>
<tr>
<th>Method</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>GMA (General Movement Assessment)</td>
<td>98%</td>
<td>91%</td>
</tr>
<tr>
<td>Cranial ultrasound</td>
<td>74%</td>
<td>92%</td>
</tr>
<tr>
<td>Neurological examination</td>
<td>88%</td>
<td>87%</td>
</tr>
<tr>
<td>MRI performed at term corrected age</td>
<td>86 to 100%</td>
<td>89 to 97%</td>
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• GMA has the best predictive accuracy for CP diagnosis at 2 years old
• MRI at term corrected age has good predictive value
• Cranial ultrasound can be as specific as MRI, readily available at the bedside
LEARNING TO OBSERVE GMS:
PRECHTL’S ASSESSMENT OF GMs

- Observe babies and watch for GMs that should be present without handling and/or disturbing them too much
- “Gestalt” Perception/Approach
- Detailed Approach
GENERAL MOVEMENTS: WRITHING MOVEMENTS

• Involve the whole body in a variable sequence of arm, leg, neck and trunk movements (unpredictable);

• Characteristic features of good writhing movement:
  • Fluency and elegance
  • Variability of speed, amplitude, intensity
  • Complexity of movements

• Visually, the writhing movement may look dissimilar at different gestational ages, but the above components are present when analyzed carefully
NORMAL WRITHING MOVEMENTS

• Videos
ABNORMAL WRITHING MOVEMENTS

• Reduced fluency, complexity and variability
• Lesion is causing poor modulation of the movements

Subcategories of Abnormal WMs:
• Poor Repertoire (PR)
• Cramped-Synchronous (CS)
• Chaotic (Ch)
• Hypokinetic (H)
ABNORMAL WRITHING:
POOR-REPERTOIRE

• Video
ABNORMAL WRITHING:
CRAMPED-SYNCHRONOUS

• Video
General Movements:

FIDGETY MOVEMENTS (FM)

• Continuous in the awake infant
• Fidgety movements are very strong biomarkers of sensorimotor and corticospinal development
• Circular GMs (tiny displacements)
  • Small amplitude
  • Moderate speed at each joint
  • Variable acceleration of neck, trunk and limbs in all directions
• Occurring in infants 6-9 weeks old until 16-20 weeks old post-term
NORMAL FIDGETY MOVEMENTS

• Videos
ATYPICAL FIDGETY MOVEMENTS

• Absent (F-)
• Sporadic (same as Absent)
• Abnormal (FA)= Exaggerated
ATYPICAL FIDGETY MOVEMENTS:
   ABSENT OR SPORADIC

• Videos
ATYPICAL FIDGETY MOVEMENTS: ABNORMAL

• Abnormal FMs (FA) look like normal FMs, but amplitude, speed and jerkiness are moderately or greatly exaggerated
• Looks like a “puppet on a string” or a “bad conductor”
• Rare classification of fidgety movements
• 1/3 develop normally, 1/3 develop CP, 1/3 delayed motor movement but not CP
ABNORMAL FIDGETY MOVEMENTS

• Video
IMPLEMENTATION:
In our Setting
STEP 1: TRAINING AND COLLABORATION

• 4 PTs trained in basic course in 2016 and advanced course in 2018
• 1 additional trained in basic course in 2018

• Victoria General Hospital, Level 3 NICU
• Early Intervention Program at Queen Alexandra Centre for Children’s Health
• Neonatal Follow Up Clinic at Victoria General Hospital
STEP 2: EARLY IMPLEMENTATION

- Collaboration with NICU, EIP and Neonatology group
- Protocol Developed for Pilot Project
  - Decision to video
  - Consent Form
  - Parent handout
  - One video taken in NICU at writhing age
  - One late writhing video taken at home by EIP PT
  - Moved Neonatal Follow Up clinic appointment earlier to 3 months corrected age and took fidgety age video at clinic
STEP 3:
TECHNICAL REFINEMENT

• Consideration of the BabyMoves App (Spittle et al. 2016)
• Discovery of the Accellion KiteworksTM program
• Approval to store videos on shared drive
• VLC Software to manipulate/view videos
STEP 4: PROCESS REFINEMENT

• Decision to take 2+ writhing age videos in NICU, and one fidgety age video

• Family to take fidgety age video ~11 weeks (corrected age) with therapist reminder

• Therapist facilitates upload of videos securely through Kiteworks

• Neonatal Follow Up clinic appointment moved back to 4 months corrected age, results delivered at 4 month visit.
IMPLEMENTATION:

CHALLENGES

• Finding the ideal timing for writhing and fidgety age assessments
• Agreement from institution about process for video storage
• Technology support – secure upload and software to view videos
• Discussion with medical team about the best way to use this assessment for the Neonatal Follow Up Clinic
IMPLEMENTATION:
STRATEGIES THAT IMPROVED OUR PROCESS

• Parent Education
• Parent Participation
• Community Partners
EARLY FEEDBACK FROM NEONATAL FOLLOW-UP CLINIC

• iPad survey done at NICU follow-up clinic for short window in the first half of 2019 with 10 families
  • 7 families completed GMA process
  • 100% found the GMA experience valuable
  • No specific comments related to the GMA in the open-ended portion of the survey
PARENT PERSPECTIVES on Early Diagnosis of CP

Guttman et al, 2018

• Survey of 463 parents of children with CP, overall parents perceived that physicians underestimate functional outcomes and diagnose CP late

• Although 67% of children were diagnosed with CP before age 2 years, 40% of parents (162 of 401) indicated that diagnosis was “a little too late” or “very delayed”

• Parents reported that their children received more services after diagnosis of CP compared with before diagnosis

• The literature also suggests that mothers may feel a sense of relief once a formal diagnosis of CP is made
PARENT PERSPECTIVES on Early Diagnosis of CP:

One parents thoughts on early screening at Nationwide Hospital In Columbus, OH

“We knew leaving the NICU that Owen was at very high risk for cerebral palsy. Armed with that knowledge we were able to jump right in, starting physical therapy at 5 weeks old and researching every treatment and therapy in our area that might be a good fit for his recovery. Dr. Maitre helped guide us and also told us about clinical trials Owen may be eligible for as he got older. We received the formal diagnosis of cerebral palsy at just 6 months and were enrolled in an amazing trial called APPLES the very same day. Knowing to expect that Owen may have cerebral palsy at 3 days old, and getting the formal diagnosis so early, has given us the incredible gift of time. We’ve been able to get out ahead of potential issues, and in some ways anticipate where he may need extra support or where there may be delays in his development.”

“Owen’s differences have never been a mystery – we didn’t have to fight for a diagnosis or wring our hands as he missed milestones and we didn’t know why. With the Early Detection Initiative we were guided from the very beginning to give Owen the best chance to take advantage of the neuroplasticity and the amazing resilience of his baby brain (turns out that wasn’t something they just made up). Early Detection let us know that although his trajectory may be different, he will hit milestones in his own time and in his own way, and we can continue to work to find the best tools to support him.”

OUR HIGH RISK PATIENTS

• Gestational age <= 29 weeks
• Birth Weight <1250 g
• Intraventricular Hemorrhage Grade III or IV
• Perinatal Asphyxia (HIE)
• Other at-risk babies

• 93 babies
• 238 videos
RESULTS

GMA Videos
Total = 239

- Writhing Age Videos: 119 + 35 = 154
- Fidgety Age: 8 + 76 = 84

- Normal Video
- Atypical Video
RESULTS

Patient Outcomes
n = 93

- Normal Outcome: 76
- Atypical Outcome: 7
- Multipe Normal WA: 5
- No FA Video, Normal Dev't Scores: 2
- Technical Issues: 1
- Lost to Follow-up: 1
- Death: 1
HAVE WE IDENTIFIED CHILDREN WITH CP: SENSITIVITY

• Of 6 Atypical FA results:
  
  • 5 absent fidgety
    • 2 confirmed with CP diagnosis
    • 1 probable CP diagnosis at 18 months
    • 2 under 8 months, likely CP diagnosis
  
  • 1 abnormal fidgety
    • No CP diagnosis, significant delays and hypotonia, peripheral vision loss
    • Bayley scores at 18 m: FM 10, GM 3, Composite 79
DO ANY CHILDREN WITH NORMAL FIDGETY VIDEOS HAVE CP: SPECIFICITY

• 3 patients with normal fidgety assessments have reached 3 years old
  • Average Motor Composite Score: 101
    • Fine Motor Average 10.4; Gross Motor Average 10
  • No concern of CP

• 22 patients with normal fidgety assessed at NICU follow up at 18 months
  • Average Motor Composite Score: 97.7
    • Fine motor average 11; Gross Motor average 8
IMPLEMENTATION:
GAPS

• Consistent next steps for children identified at high-risk for cerebral palsy
• Varying levels of awareness of GMA
• Varying levels of support to use the assessment
• Change is hard!
• Limited awareness of the interpretation of results
The 5 “E” Words in Early Intervention

As EARLY as possible

Active EXPLORATION by infants in a stimulating ENVIRONMENT

Coaching parents/caregivers to integrate activities into EVERYDAY routines

Supported by EVIDENCE

- Dianne Daminano

Implementation of Early Detection and Intervention for Cerebral Palsy, April 2019
CONSIDERATIONS FOR EARLIER DIAGNOSIS

• Plasticity
  • Cognition
  • Sensory
  • Motor

• Parent voice
  • Want earlier diagnosis
  • Don’t want information withheld – value honest & accurate information
  • Research driven diagnosis and treatment

• Eligibility for funding
  • With earlier ability to classify a child’s level of function and needs it may be possible to access funding earlier
“Many things we need can wait.  
**The child cannot.**  
Now is the time her bones are being formed, 
her mind developed.  
To her we cannot say tomorrow,  
**her name is today.**”

Adapted from Gabriella Mistral

“**Lives are being CHANGED,  
futures are being REWRITTEN, and we can be A PART OF IT.**”

- Nationwide Children’s Hospital
Thank you!

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