IMPLEMENTATION OF THE
GENERAL MOVEMENTS
ASSESSMENT (GMA) TO
OPTIMIZE NEONATAL
OUTCOMES

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OBJECTIVES
- Understand the purpose and method for administration of the General Movements Assessment (GMA)
- Recognize the importance for early identification of neurologic impairments
- Compare the psychometric properties of different neurologic assessments used in early infancy
- Identify clinical practice changes with implementation of the GMA at Cleveland Clinic Children’s Hospital for Rehabilitation (CCCHR)
- Describe how knowledge translation and knowledge brokering can be used to optimize implementation of the GMA

IDENTIFYING A NEED
- In the US, the incidence of preterm birth is 1 out of 10 infants
  - Prevalence of survival for very pre-term birth, <32 weeks post-menstrual age (PMA) has increased to >85%2
  - Despite advances in perinatal care, 50% of these infants experience neurobehavioral impairments2
- Neurological impairments are often missed, or diagnosis is delayed due to poor predictive validity of traditional neurological examination and brain imaging techniques3,4
Heinz Prechtl
Developmental neurologist
1970’s – Working on developing a standardized method for a neonatal neurological examination
- Recognition of patterned fetal motor behavior
- Observed high-risk infants moved differently when compared to typically developing infants
1990’s – Development of General Movements Assessment
- A new approach to assessing the young nervous system using spontaneous movements

“Spontaneous motility, as the expression of spontaneous neural activity, is an excellent marker of neural dysfunction caused by brain impairment”

A window into the brain!

Prechtl’s General Movement Assessment (GMA)
- An qualitative method of assessing the integrity of the developing nervous system, through the categorization of endogenously generated movement patterns in infants aged 26 weeks PMA to ~20 weeks post-term age (PTA)
- Utilizes a trained observer’s Gestalt perception to assess and identify infants at risk for cerebral palsy and other developmental disabilities
- ADHD, Autism Spectrum disorders, Rett syndrome
HOW IS YOUR GESTALT?

DEFINING A GENERAL MOVEMENT
- Squeezes
- General movements
- Hiccups
- Normal arm movements
- Normal leg movements
- Breathing movements
- Morbidity
- Excessive hand movement of the head
- Intermittent and movement of the head
- Face twitching
  - Rapid face contact
  - Opening and closing of the fingers
  - Stiff
  - Veins
  - Isolated finger movements
  - Tongue protrusion
  - Subtle and twitching
  - Minor arm movements
- Rapid or involuntary
- Wild movements

ANALYZING AT DIFFERENT AGES

Visual and Atypical GM
Normal GM
Postmature Age, wk
Term, wk
0 7 14 21 28 35 42 49 56 63 70
Preterm Age, wk

[Diagram showing different stages and ages]
CASE EXAMPLE AT 2 WEEKS PTA

Normal Writhing GMs  Cramped Synchronized GMs

CASE EXAMPLE AT 16 WEEKS PTA

Normal Fidgety GMs  Absent Fidgety GMs

Utilizing A Developmental Trajectory

<table>
<thead>
<tr>
<th>Weeks</th>
<th>FMs Pos;erm</th>
<th>Writhing Movements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>++ or +</td>
<td>Normal Writhing</td>
</tr>
<tr>
<td>2</td>
<td>+ or +/-</td>
<td>Cramped Synchronized</td>
</tr>
<tr>
<td>3</td>
<td>++ or +</td>
<td>Normal Fidgety</td>
</tr>
<tr>
<td>4</td>
<td>+ or +/-</td>
<td>Absent Fidgety</td>
</tr>
</tbody>
</table>

4/14/16
Effecting Change

24 weeks post-conception 40 weeks post-conception

What About Pruning?

Tract-ing Changes
Babies with amblyopia will fail to develop full acuity with depth perception if the problem is not corrected.

- Using a patch minimizes competition of space for developing neural pathways from the good eye.
- Without intervention, the neural pathways associated with the good eye continue to strengthen and begin to displace weaker pathways connecting the weak eye, making that eye weaker.

<table>
<thead>
<tr>
<th>Assessment Tool</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Movement Assessment</td>
<td>93-100</td>
<td>82-100</td>
</tr>
<tr>
<td>Magnetic Resonance Imaging</td>
<td>60-100</td>
<td>89-99</td>
</tr>
<tr>
<td>Cranial Ultrasound</td>
<td>74-80</td>
<td>83-97</td>
</tr>
<tr>
<td>Standard Neurological Examination</td>
<td>57-86 (Preterm)</td>
<td>45-83 (Preterm)</td>
</tr>
<tr>
<td></td>
<td>68-96 (Term age)</td>
<td>52-97 (Term age)</td>
</tr>
</tbody>
</table>

Comparing GMA to other examination techniques: 7,10,17-19
**SHIFTING AWAY FROM TRADITIONAL NEUROLOGICAL EXAM**

- Sherrington’s work demonstrated that decerebrated animals respond reflexively to external stimulation.

- If reflexive movement can be elicited in decerebrated animals, why rely on these reactions to tell us about the integrity of cortical functioning?

- Spontaneous activity is more sensitive an indicator of brain dysfunction than reactivity to sensory stimuli in reflex testing.

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**CONSIDERATIONS FOR THE PRACTICING PT**

<table>
<thead>
<tr>
<th></th>
<th>GMA</th>
<th>TIMP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age Range</strong></td>
<td>26 weeks – 5 months</td>
<td>32 weeks – 4 months</td>
</tr>
<tr>
<td><strong>Stated Purpose</strong></td>
<td>Documents spontaneous movements to identify early CNS dysfunction</td>
<td>Evaluates motor control and organization of posture and movement for functional activities</td>
</tr>
<tr>
<td><strong>Components Tested</strong></td>
<td>Spontaneous Movements</td>
<td>Both spontaneous behaviors (15 items) and elicited behaviors (29 items)</td>
</tr>
<tr>
<td><strong>Psychometric Properties</strong></td>
<td>93-100% (sensitivity) 82-100 (specificity)</td>
<td>Norm referenced 62.5% (sensitivity) 77.4% (specificity)</td>
</tr>
</tbody>
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**ADMINISTERING THE GMA**

- Non-invasive, global-visual Gestalt perspective minimizes the need for handling.

- One of the only assessments to categorize the quality of movement patterns observed.

The GMA stands out as one of the most cost-effective and sensitive tools available for prediction of long-term neurobehavioral impairments that allows for early implementation of targeted interventions.
CASE EXAMPLE AT 2 ½ YEARS OF AGE

- Discharged from NICU after 39 days
- Term writing video taken at 2 weeks PTA with subsequent referral to outpatient PT and Early Intervention Services
- Fidgety video taken at 16 weeks PTA (as part of outpatient PT visit) with subsequent referral to OT
- Current medical team includes: Neurology, Pediatric Physiatry, OT, PT and Early Intervention Providers
- Current medical management includes:
  - Oral baclofen
  - Botox injections
  - Equipment
  - Microcurrent
- Current functional abilities:
  - Began walking at 29 months
  - Still limited in play, self-care and dressing skills
- Expected to participate in a structured Constraint Induced Movement Therapy program this summer

HOW DID WE GET HERE? USING A KNOWLEDGE-TO-ACTION FRAMEWORK

- Identification of a clinical problem
- Obtaining administrative support
- Having ready access to knowledge materials
- Ongoing engagement with a knowledge broker
- Providing multi-faceted educational strategies
IDENTIFYING A TWO-PART PROBLEM

PROBLEM PART 1: DECIDING WHEN THE GMA IS NECESSARY
- Review of medical history
- Therapist observation of atypical movement patterns during routine care
  - OT and PT receive automatic referrals for high-risk infants or infants < 34 weeks PMA

PROBLEM PART 2: GETTING BUY IN
- Introducing the GMA to NICU leadership:
  - Presentation of evidence to the Medical Director of Neonatology
  - Presentation to the entire Neonatology Enterprise
    - 3 NICUs in the Cleveland Clinic Health System
  - Organization of regional presentation by Colleen Peyton PT, DPT, PCS University of Chicago Medicine, Comer Children’s Hospital
- Over 50 therapists, physicians, nurse practitioners and nurses attended this event
**Obtaining Administrative Support**

- Review of protocol
- Identifying logistical barriers
  - Video consent
  - Documentation templates
  - Billing procedures

**Acknowledging Differences in Different Settings**

<table>
<thead>
<tr>
<th>NICU</th>
<th>Outpatient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Videos taken prior to discharge during the pre-term writhing and/or the writhing phase</td>
<td>Videos taken in the term writhing and fidgety phase</td>
</tr>
<tr>
<td>Observation of movements help guide discharge planning</td>
<td>Small part of overall assessment in terms of time spent during patient encounter</td>
</tr>
<tr>
<td>Education is provided to the health care team, including the family</td>
<td>Education provided to family with referrals made to other health care professionals as appropriate</td>
</tr>
</tbody>
</table>

**Preparing for Implementation**

- Equipment
  - Video camera and tripod
  - Memory card reader
- Storage
  - Physical and digital
**Ensuring accurate result**

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Age</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preferred Behavioral State</td>
<td>Any age</td>
<td>• No crying, no NNS</td>
</tr>
<tr>
<td></td>
<td>&lt; 36 weeks PMA</td>
<td>• Quiet alert state*</td>
</tr>
<tr>
<td></td>
<td>&gt; 36 weeks PMA</td>
<td>• Quiet alert state</td>
</tr>
<tr>
<td>Position</td>
<td>Any age</td>
<td>• Supine on flat surface</td>
</tr>
<tr>
<td>Clothing</td>
<td>Any age</td>
<td>• No clothes with small diaper</td>
</tr>
<tr>
<td>Environment</td>
<td>Any age</td>
<td>• Neutral temperature, sound, lighting.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Avoid engaging with baby during recording</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Use a tripod</td>
</tr>
</tbody>
</table>

**Having ready access to knowledge materials**

- Knowledge Translation defined:
  - A dynamic process by which relevant research information is made available and accessible to optimize practice.
- Strategies to transfer knowledge:
  - Distributing educational materials/conference presentations
  - Building a community of practice
  - Integrating content into academic curriculum

**Creating a new, Evidence-Based Clinical Standard of Practice**

- If abnormal GMs are observed during NICU stay, infant is referred to NICU Transition Clinic
- Order written for OT/PT while in NICU
  - Families leave NICU with appointment in hand → improved compliance with keeping appointments
- First appointment in NICU Transition Clinic prior to 6 weeks PTA for term writhing video vs. NICU follow-up clinic at ~4 months corrected age
ARRANGING THE OUTPATIENT VISIT

- Patient Services Representative follows-up with family prior to first appointment
- Evaluating therapist is scheduled on a rotating basis
  - If infant has discipline specific needs, appointment is schedule accordingly
- NICU Transition Clinic held in outpatient therapy satellite
  - Helps with compliance if ongoing outpatient therapy is recommended
  - Many referrals for ongoing outpatient services are made after 13-15 weeks PTA (fidgety stage)

CHECKING IN WITH A KNOWLEDGE BROKER: ASSESSING IF IT IS MAKING A DIFFERENCE24,26

- Knowledge Broker defined:
  - A person who fills a role to make research and practice more accessible to each other
- Changes of clinical practices began with an individual → organization → structure

MONTHLY NICU ADMISSION RATES AND NUMBER OF GMA VISITS

- NICU GMA
- Outpatient GMA
- NICU Admissions

Sep 2013-Aug 2014
Sep 2014-Aug 2015
Sep 2015-Feb 2016

0 5 10 15 20 25 30 35 40 45 50 55
PROVIDING MULTI-FACETED EDUCATION

Getting Trained

General Movements Trust
- Course runs ~3.5 day
  - Basic Certification
  - Registration: ~$895
  - Advanced Certification
  - Registration: ~$850

For more information:
http://general-movements-trust.info/dates

Hadders-Algra
- Course runs ~2 days
  - General Movements Assessment Certification
  - Registration: ~$700
  - Infant Motor Profile Course
  - Registration: ~$425

For more information:
www.developmentalneurology.com

DEVELOPING A PROGRAM FOR NICU GRADUATES

- GMA Certification for outpatient therapists
- Development of clinical skills specific to treating NICU graduates:
  - Targeted continuing education, mentoring, collaboration with NICU therapists
- NICU Family Support Group: Highest risk infants being followed in NICU Transition Clinic or Outpatient Therapy
Building a Community of Practice

- When possible, have more than one person on your team trained
- Find out who in your region is certified
  - GMA Pow-Wows to maximize reliability post-certification
- Seek out advanced training once you have some practice\(^6\,^{,22}\)
- Provide opportunities to engage professional students and develop a mutually beneficially educational-clinical relationship

Educating Students

- Doctor of Physical Therapy programs are tasked with educating students as generalists\(^7\)
- Providing detailed content regarding specialty areas (including practice in the NICU) is often limited
- As part of a didactic evidence-based curriculum, Cleveland State University Doctor of Physical Therapy students are educated on the GMA

Maximizing Educational Potential\(^{28}\)
GETTING INVOLVED!

Personal Accomplishments:
- Assisted in creation of IRB
- Created videotaping protocol documents
- Obtained basic certification through GM Trust
- Knowledge translation
  - In-service during clinical affiliation
  - Involvement in local and national conferences
- Professional development

Other Available Opportunities:
- Review current literature and update annotated bibliography
- Input data into research registry
- Organize and attend GMA Pow.Wows for local practicing clinicians
- Establish protocol for tracking sheet
- More knowledge translation!

IN SUMMARY:

- The GMA is a cost-effective, objective assessment tool that can accurately identify neonates at risk for neurobehavioral sequelae
- Translation of knowledge surrounding the benefits of using the GMA helps streamline implementation of the GMA as a clinical standard of care
- The babies you see will thank you, as initiating early-targeted interventions can maximize long-term function and minimize disability

QUESTIONS?
REFERENCES


REFERENCES—CONTINUED


