

Implementation of the General Movements Assessment

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When CP gets recognized later in life, children often face significant and unnecessary challenges.

Cerebral Palsy Foundation/Nationwide Children's Conference 2019

ASSOCIATED CONDITIONS AND EVIDENCE-BASED TREATMENT					
CP is often associated with a number of associated conditions and these can be challenging to the physical condition.					
PAIN 3 in 4	INTELLECTUAL DISABILITY 1 in 2	VISION IMPAIRMENT 1 in 3	HEPATOCHOLELITHIASIS 1 in 3	WOUND HEALING 1 in 4	EPILEPSY 1 in 4
Treat to prevent sleep & behavioural issues	Refer to speech & language, occupational therapists	Independent living at 20 years of age	6-12 monthly top-ups of the bile salts	Augment diet with protein	Seizure risk reduction
BEHAVIOURAL DIFFICULTY 1 in 4	BLINDNESS 1 in 4	SLEEP PROBLEMS 1 in 5	ASTHMA 1 in 10	WOUND HEALING 1 in 15	DEAFNESS 1 in 25
Treat early & ensure pain is managed	Conduct investigations & after more time	Conduct investigations & ensure pain is managed	Avoid early & accommodate	Assess medical safety & monitor growth	Assess early & accommodate

World CP Day; McIntyre et al. 2011, Novak 2014

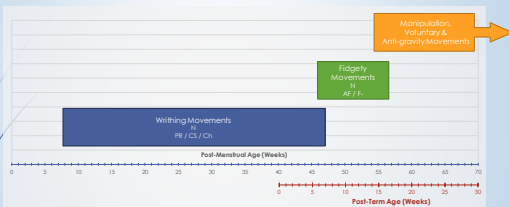
WHAT IS THE GENERAL MOVEMENTS ASSESSMENT (GMA)?

- 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

GMA

- Infants have typical and distinct spontaneous "general movements" from 9 weeks post-menstrual age to 20 weeks post term.
 - "Brain Beats" – the body's expression of brain function
- Infants whose general movements are absent or abnormal are 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

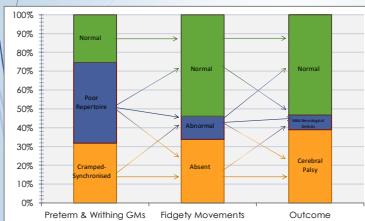
DEVELOPMENTAL COURSE OF GMs



- WRITHING PERIOD:** birth until 8-12 weeks post-term
- FIDGETY PERIOD:** Begins 6-9 weeks post-term - 16-20 weeks old
- Voluntary Movements: 15 weeks, foot to foot, hands to midline, etc.

TRAJECTORIES OF GMs

Prechill et al 1997



- All babies with normal WM → normal FM → normal outcome
- ~2/3 with PR → normal FM → normal outcome
- ~1/3 with PR → F → spastic CP
- Babies with CS WM → majority F- but some develop AF → still develop spastic CP

LEARNING TO OBSERVE GMS: PRECHTL'S ASSESSMENT OF GMS

- We can observe babies and watch for GMS that should be present without handling and/or disturbing them too much (this is especially important when they are in the NICU)
- "Gestalt" Perception/Approach = fixing your gaze around the sternum and allowing your peripheral vision to see how much space their limbs are using, if there is variability & complexity of movement
- Detailed Approach: look for the individual/isolated movements

GMS: 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



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



ABNORMAL WRITHING: CRAMPED-SYNCHRONOUS



FIDGETY MOVEMENTS (FM)

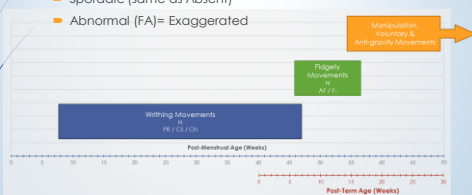
- Continuous in the awake infant
- If present – Neuro system is intact
- Circular GMs (tiny displacements)
 - Small amplitude
 - Moderate speed at each joint
 - Variable acceleration of neck, trunk and limbs in all directions
- Occurring in infants 6-9 weeks old until 16-20 weeks old post-term

NORMAL FIDGETY MOVEMENTS



FIDGETY MOVEMENTS: CLASSIFICATION

- Normal
- Absent (F-)
- Sporadic (same as Absent)
- Abnormal (FA)= Exaggerated



FIDGETY MOVEMENTS: ABSENT/SPORADIC

- Fidgety movements are very strong biomarkers of the sensorimotor and corticospinal development
- Absence of fidgety movements shows us abnormality in neuro system
- Usually movement is uniplanar, and may be very sporadic → still classified as "absent fidgety"
- About 1/3 of children with PR have absent fidgety movements → develop CP
- Babies who have CS movements, may move a lot, but never develop normal FM → develop CP

ABSENT/SPORADIC FIDGETY



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



ESTIMATES OF SENSITIVITY AND SPECIFICITY

Bosquet et al 2013

	SENSITIVITY	SPECIFICITY
GMA (General Movement Assessment)	98%	91%
Cranial ultrasound	74%	92%
Neurological examination	88%	87%
MRI performed at term corrected age	86 to 100%	89 to 97%

- 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

PROJECT OBJECTIVES

- To identify children at risk of cerebral palsy earlier through implementation of the GMA
- To use limited resources during critical periods of development
- Tailor intervention and positively modify the natural history

OUR HIGH-RISK PATIENTS

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

■ 64 babies
■ 142 videos



**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 and Neonatology group
 - Presentations to Neonatal Follow Up Clinic team in fall 2016 & early 2017
- EIP presentations in 2016 to EIP staff
- 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: REFINEMENT

- Consideration of the BabyMoves App (Spittle et al. 2016)
- Discovery of the Accellion Kiteworks™ program
- Approval to store videos on shared drive
- VLC Software to manipulate/view videos

- Decision to take 2+ writhing age videos in NICU, and one fidgety age video
- Therapist reminds family to take fidgety age video ~11 weeks
- Therapist facilitates upload of videos securely through Kiteworks
- Neonatal Follow Up clinic appointment moved back to 4 months corrected age

SCORING AND REPORTING

- Monthly meetings to review videos
- Videos reviewed by more than one therapist
- NICU PT provided writhing age results to families, documented in chart
- Fidgety age results delivered by PT at Neonatal Follow Up clinic visit and in written report
- Rare circumstances:
 - If the child is not followed by the Neonatal Follow Up clinic, the EIP PT provides letters to the GP and Pediatrician. The GMA PT also meets with the family and their EIP team to discuss the results.
 - If the child lives outside of the South Island and is not part of NICU Follow Up, the NICU PT follows up with the family & team about the results

DATA COLLECTION AND MANAGEMENT

- Spreadsheet on secure shared drive between VGH and EIP PTs with GMA training
 - When each video was taken (corrected age)
 - Results of assessment (normal, abnormal)
 - Medical history
 - Date the outcome was shared with parents
 - If a formal diagnosis has been made by a Physician

CONSIDERATIONS - BABY

- Timing/state of baby
 - Avoid thermal dysregulation (warm blanket)
 - Avoid if too fussy/hungry/hiccups/pacifier (inhibits movements)
- Finding ideal age for writhing and fidgety assessments
 - Avoid early post-injury (not within first week)
 - Writhing age: pre-term and early post-term is ideal
 - Fidgety age: around **11-12 weeks is ideal**

CONSIDERATIONS – VIDEO

- Orientation of video (vertical is best)
- Keep limbs in the frame
- Diaper only is best
- Avoid distraction
- Best taken on a bed/mattress to allow for slight "nesting" of body

CHALLENGES – KNOWLEDGE TRANSLATION

- Varying levels of awareness of GMA
- Varying levels of support to use the assessment
- Change is hard!
- Limited awareness of the interpretation of results
 - Phone calls or letters to therapists , physicians, pediatricians

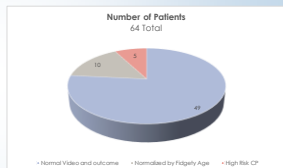
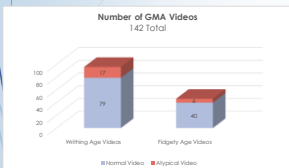
CHALLENGES – PROJECT LOGISTICS

- 3 different work sites
 - Multiple storage locations initially
 - Limited data accessibility for confidentiality
- Timely scoring of videos
- Fitting extra work into existing caseloads

CHALLENGES – TECHNICAL ISSUES

- Storage Consideration: different devices have drastically different file sizes
- Accellion Kifeworks™ application – secure upload
- Viewing programs (VLC software)

OUR RESULTS



HIGH-RISK FOR CP

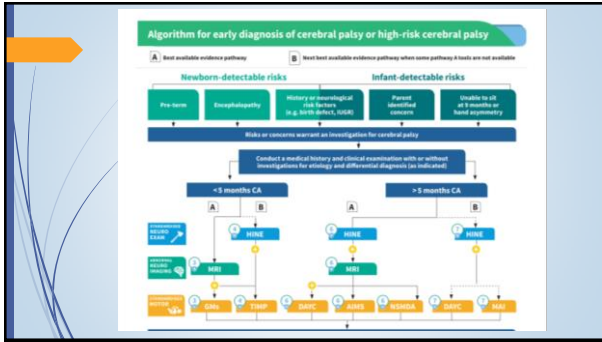
- Five Atypical results at Fidgety Age
 - 4 "Absent" Fidgety
 - Two CP diagnosis
 - Two awaiting diagnosis
 - One "Abnormal" Fidgety
 - Undiagnosed, low HINE scores, peripheral vision loss
- One child with abnormal GMs in the NICU recruited to Neonatal Follow Up clinic who otherwise did not meet standard criteria.
- More specific and prompt referral to Early Intervention

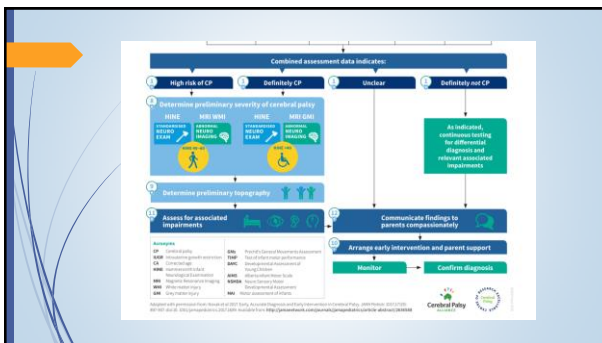
OUTCOMES

- Increased therapist confidence – correlation with other assessments
- Refinement of our GMA project to take videos at ideal times
- Increased professional awareness of assessment and its interpretation
- Increased professional support for using the GMA
- Poster Presentation April 2019 in Columbus Ohio: Early Detection conference
- Presentation for local pediatricians/neonatologists

SO WHAT?

- Plasticity
 - Cognition
 - Sensory
 - Motor
 - Parent voice
 - Want earlier diagnosis
 - Don't want information withheld
 - Research driven diagnosis and treatment
 - Eligibility for funding
- Baird et al 2000, Novak et al 2017





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

Boychuck et al 2017

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

Nortz et al 2013

FUTURE CONSIDERATIONS FOR INTERVENTION

- If we can predict type of CP earlier, we can tailor interventions based on best evidence available



- **Hemiplegia:** Constraint-induced movement therapy (better hand function if started <6 months)
- **Bilateral:** Hip surveillance, high-intensity physical therapy
- **Any Type:** Early, intense, enriched, task-specific, training-based therapy (best outcomes when interventions occur at home with parent involvement)

Novak et al 2017; CP Alliance

NEXT STEPS

- Communicate the early results of our screening program to other professionals
- Develop a standardized process to obtain MRI and neurologist referral
- Explore best practice for frequency and intensity of early intervention
- Modify our process for communicating results and confirming diagnosis
 - Using tools from recent early detection conference
 - SWOT (Strengths, Weaknesses, Opportunities, Threats)
 - SIPOC (Supplier, Input, Process, Output, Customer)
- Possible collaboration with other centres

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

QUESTIONS? FEEDBACK?

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