Guideline

Women and Babies: General Movements Assessments (GMA) and other assessment modalities for prediction of cerebral palsy and adverse early neurodevelopment in high-risk infants.

Document No: RPAH
Functional Sub-Group: Clinical Governance

Summary: General Movements Assessments accurately predict cerebral palsy in high risk populations. This motor assessment tool should be used in this context, in conjunction with clinical assessment, examination and imaging modalities to provide families with prognostic information and the opportunity for tailored early intervention to meet individual patient needs.

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Approved by: Must be tier 2 position nominee (state specific title) and / or relevant committee

Publication (Issue) Date: September 2016
Next Review Date: October 2019

Replaces Existing Policy: New

Previous Review Dates: N/A

Note: Sydney Local Health District (LHD) and South Western Sydney LHD were established on 1 July 2011, with the dissolution of the former Sydney South West Area Health Service (SSWAHS) in January 2011. The former SSWAHS was established on 1 January 2005 with the amalgamation of the former Central Sydney Area Health Service (CSAHS) and the former South Western Sydney Area Health Service (SWSAHS).

In the interim period between 1 January 2011 and the release of specific LHN policies (dated after 1 January 2011) and SLHD (dated after July 2011), the former SSWAHS, CSAHS and SWSAHS policies are applicable to the LHDs as follows:

Where there is a relevant SSWAHS policy, that policy will apply

Where there is no relevant SSWAHS policy, relevant CSAHS policies will apply to Sydney LHD; and relevant SWSAHS policies will apply to South Western Sydney LHD.
Womens and Babies: General Movements Assessments (GMA) and other assessment modalities for prediction of cerebral palsy and adverse early neurodevelopment in high-risk infants.

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1. Introduction

The risks addressed by this policy:

Potential morbidity associated with delayed intervention for infants at high risk of cerebral palsy.

The aims / expected outcome of this policy

Those infants at high risk of adverse neurodevelopmental outcome will undergo General Movements Assessments in conjunction with routine clinical assessment, examination and imaging to provide families with prognostic information and allow for tailored early intervention to meet individual patient needs.

2. Policy Statement

RPA Newborn Care will provide routine General Movements Assessments for high risk infants.
General Movements Assessment Flowchart

Babies in Newborn Care meeting any of the following criteria:
- Prematurity (≤29+6 weeks)
- Hyponatremia and Encephalopathy
- Other neurological concerns as per neonatologist

Writing Phase (birth to 8 weeks postmenstrual age) in Newborn Care:
- Usual neuroimaging and clinical assessments
- Parental information discussed and consent gained by trained staff (parent information & consent form - see guideline website link)
- Baby is filmed for 5 minutes ideally off respiratory support and in settled state (filming instructions - see guideline website link)
- The video is reviewed by GM certified staff (at least 2) and scored as per the following categories:

- Normal
- Poor Repertoire (not predictive)
- Chaotic (rare & not predictive)
- Cramped Synchronised (Predictive if persistent)

Result Communication by GMA certified staff:
- Neonatologist on duty
- Parents
- Medical record
- Electronic Medical Record

Film baby again in the Fidgety period (9-16 weeks corrected age) as an outpatient

Repeat video in 1-2 weeks. Filming may be repeated more than once if abnormal movements persist

Normal
- Abnormal Fidgety (rare)
- Absent Fidgety

Reassure low risk for Cerebral Palsy
- ongoing developmental follow-up

Possible increased risk of neurological condition
- physiotherapy & developmental follow-up
- consider CPA referral

High risk for Cerebral Palsy
- physiotherapy & developmental follow-up
- consider CPA referral

Compliance with this Guideline is recommended
3. Cerebral Palsy

Cerebral palsy (CP) is characterised by motor impairment, ranging in severity from mild to severe; associated with a static brain injury occurring in early human development. The clinical picture is diverse and is further characterised by motor impairment type (e.g., spasticity, dyskinesis and ataxia), anatomical distribution, functional impairment and associated co-morbidities.

3.1 Incidence

According to the Australian Cerebral Palsy Register, there were 3135 individuals with cerebral palsy born between 1993 and 2006, a prevalence of 2.1/1000 live births (95% CI 2.0-2.2).

RPA Newborn Care cerebral palsy and other adverse neurodevelopmental outcome rates

Of babies born <30 weeks gestation between 2000-2008 inclusively who received long-term developmental follow-up, the rate of cerebral palsy, diagnosed by 5 years of age was 5.4%.

3.2 Aetiology & risk factors for cerebral palsy

Of the 3135 cases included in the Australian CP register, 95% were deemed to have been caused by brain injury occurring during the prenatal and perinatal period of infant development. The remainder occurred more than 28 days after birth. The predominant cause for this later group was a cerebrovascular accident (34.2%) being spontaneous, associated with surgery or with complications of cardiac defects.

For the prenatal/ perinatal group, the following factors were associated with CP:

- 41.3% were born premature
- 41.7% were born with a low birth weight
- 11.9% were part of a multiple birth compared with 3.3% of births in the general Australian population.
- There was an excess of males; 57.3% were male compared to 51% of births in Australia.
- Spasticity was the predominant motor type of cerebral palsy (86.6%). Of individuals with a spastic motor type, 38.8% had unilateral spasticity (hemiplegia/monoplegia) and 61.2% had bilateral spasticity (diplegia, triplegia and quadriplegia).
- Associated impairments occurred frequently in children with cerebral palsy. At the age of five: 30% had epilepsy; >50% had intellectual impairment; 60% had speech impairment; 40% had visual impairment and 10% had hearing impairment.
- Other aetiological factors include: birth asphyxia, genetic predisposition and maternal disease.

3.3 Diagnosing Cerebral Palsy

Due to the evolving nature of early human motor development, accurate diagnosis of CP in infancy and early childhood is challenging. Misdiagnoses of CP most commonly occur in the first 2 years. False-positives may include transient conditions such neurologic signs of infancy (dystonia and hypotonia) or other neurodevelopmental conditions such a global developmental delay.
What is Cerebral Palsy?

Cerebral palsy is a physical disability that affects movement and posture.

It is the most common physical disability in childhood.

**MOTOR TYPES**

**SPASTIC: 70-80%**
Most common form. Muscles appear stiff and tight. Arises from Motor Cortex damage.

**DYSKINETIC: 6%**
Characterized by incoordinate movements. Arises from Basal Ganglia damage.

**ATAXIC: 6%**
Characterized by shaky movements. Affects balance and sense of positioning in space. Arises from Cerebellum damage.

**MIXED TYPES:** Combination damage.

**PARTS OF THE BODY**

Cerebral palsy can affect different parts of the body.

**QUADRIPLEGIA/BILATERAL:** Both arms and legs are affected. The muscles of the hands, face and mouth are often also affected.

**DIPLEGIA/BILATERAL:** Both legs are affected. The arms may be affected to a lesser extent.

**HEMIPLEGIA/UNILATERAL:** One side of the body is affected, arm and one leg.

**GROSS MOTOR SKILLS**

The gross motor skills (e.g., sitting and walking) of children and young people with cerebral palsy can be categorised into five different levels using a tool called the Gross Motor Function Classification System (GMFCS) developed by CanChild in Canada.

**MANUAL ABILITY**

At least two thirds of children with cerebral palsy will have movement difficulties affecting one or both arms. Almost every daily activity can be impacted.

**ASSOCIATED IMPAIRMENTS**

Children with cerebral palsy may also have a range of physical and cognitive impairments.

- 1 in 3 is unable to walk
- 1 in 4 is unable to talk
- 3 in 4 experience pain
- 1 in 4 has epilepsy
- 1 in 4 has a behaviour disorder
- 1 in 2 has an intellectual impairment
- 1 in 10 has a sensory impairment
- 1 in 10 has bladder control problems
- 1 in 5 has speech problems
- 1 in 5 has saliva control problems

World Cerebral Palsy Day worldcpday.org

Proudly supported by The Allergens Foundation
Cerebral Palsy

DIAGNOSIS AND TREATMENT

Cerebral palsy is a physical disability that affects movement and posture.

**Diagnosis**

- **Infant has risks for cerebral palsy?**
  - No
  - Yes
- **Infant has abnormal motor development?**
  - No
  - Yes
- **Infant has abnormal neuroimaging?**
  - No
  - Yes

**Guidelines**

- **Risk Factor**
  - Maternal Risk (pre-eclampsia, birth injury, IUGR, placental abnormalities, multiple births)
- **CP Risk**
  - Born Premature
  - <28 weeks
  - 28-31 weeks
  - 31-37 weeks
- **Term Born**
  - Healthy, known risks

**Assessing Risk Development**

- **Age:** 6-12 months
- **Developmental Assessment:**
  - 55% predictive
  - CPG Prevalence

**Neuroimaging**

- **Abnormal Neuroimaging**
  - White matter injury
  - Cerebral atrophy
  - CV
  - Grey matter injury
  - Ventriculomegaly
  - Infarction
  - Non-specific
  - Normal

**Prognosis**

Cerebral palsy can affect different parts of the body:

- **2 million**
  - Most children with cerebral palsy will walk
  - 60% are independent ambulators
  - 40% walk with an aid
  - 30% use a wheelchair

**Associated Conditions and Evidence-Based Treatment**

CP is almost always accompanied by a number of associated conditions and these can be as disabling as the physical condition.

**Pain**

- 3 in 4
  - Treat to prevent sleep and behavioural disorders

**Intelectual Disability**

- 1 in 2
  - Room for improvement in academic and social contexts

**Non-ambulant**

- 1 in 3
  - Independent sitting at 24 months

**Hip Displacement**

- 1 in 3
  - 6-12 monthly hip surveillance using 3-D

**Non-verbal**

- 1 in 4
  - Augment speech early

**Epilepsy**

- 1 in 4
  - Seizures well controlled

**Behaviours**

- 1 in 4
  - Treat early & ensure pain is managed

**Bladder Incontinence**

- 1 in 5
  - Conduct investigations & allow more time

**Sleep Disorder**

- 1 in 10
  - Assess early & accommodate

**Blindness**

- 1 in 15
  - Assess swallow safety & monitor growth

**Non-oral feeding**

- 1 in 25
  - Assess early & accommodate

World Cerebral Palsy Day worldcprday.org

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This content for this infographic was drawn from:


Compliance with this Guideline is recommended
3.4 Investigations and assessment modalities to predict CP risk

There are numerous investigative and assessment modalities that may assist in accurate diagnosis of CP. These include motor assessment tools, radiological imaging (cranial ultrasound and MRI) and standardised neurological examination systems which include: Dubowitz, HINE, Lacey, Denver, Bayley, Griffiths, Amiel-Tison.

Used since the late 1970s to detect structural changes in the neonatal brain, cranial ultrasound has the advantages of being minimally invasive, well tolerated, often readily available at the bedside and relatively inexpensive. MRI brain, a more advanced neuroimaging technique, provides high-resolution scans of the newborn brain that, in addition to T1 and T2 weighted images, includes techniques such as diffusion-weighted imaging, spectroscopy and angiographic sequences. Disadvantage include expense, lack of portability and often limited accessibility.

3.4.1 General Movement Assessment

Prechtl’s General Movement Assessment (GMA) has been used since the 1990s to qualitatively assess spontaneous general movements of infants from pre-term age up to approximately 5 months post term age.\textsuperscript{12,13} Spontaneous movements of infants are rated in two distinct periods of time in which certain movements should occur normally; the writhing period (birth-8 weeks post-term) and fidgety period (8-20 weeks post-term). Possible GMA results are summarised in table 1.

The assessment is carried out through observation, usually retrospectively, of video recordings of infants in a quiet alert state by certified staff. The GM assessment process has the advantages of being non-invasive, non-disruptive to infants and relatively inexpensive. Certification requires attendance of GM-Trust approved 4 day course and high performance in a summative assessment concluding the course as determined by the course organisers.

<table>
<thead>
<tr>
<th>Screening Period</th>
<th>Possible Result</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Writhing</strong></td>
<td></td>
</tr>
<tr>
<td>(Birth- 8 weeks post term)</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Poor Repertoire</td>
</tr>
<tr>
<td></td>
<td>Cramped Synchronised</td>
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<tr>
<td></td>
<td>Chaotic</td>
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<tr>
<td><strong>Fidgety</strong></td>
<td></td>
</tr>
<tr>
<td>(8-20 weeks post term)</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Absent</td>
</tr>
<tr>
<td></td>
<td>Abnormal</td>
</tr>
</tbody>
</table>

3.4.2 Which diagnostic tools to use?

The evidence.

A recent systematic review by Bosanquet\textsuperscript{14} comparing tests to predict CP in a predominantly preterm population of young children, found that on meta-analysis, compared to cranial ultrasound and neurological examination, GMA had the highest levels of sensitivity and specificity: 98% and 91%, cranial US 74% and 92% and neurological examination 88% and 87% respectively. MRI at term corrected in preterm infants showed encouraging results in a small study but this data was not suitable for pooling for meta-analysis.\textsuperscript{15}

The negative predictive value for the General Movement Assessment at any age was high: 95-100%.\textsuperscript{16,17} Additionally, the negative predictive value for cramped synchronised movements alone was shown to be very high at 100% and positive predictive value ranging 87-100% for later spastic CP.\textsuperscript{18}
The data is summarised below:

Table 2 CP predictive accuracy of diagnostic modalities according to Bosanquet systematic review

<table>
<thead>
<tr>
<th>Test</th>
<th>No of studies</th>
<th>N</th>
<th>CP rate %</th>
<th>CUS</th>
<th>MRI &lt;sup&gt;14&lt;/sup&gt;</th>
<th>Sensitivity % (95% CI)</th>
<th>Specificity % (95% CI)</th>
<th>DOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>GMA</td>
<td>4</td>
<td>326</td>
<td>29</td>
<td>Y</td>
<td></td>
<td>98 (73-100)</td>
<td>91 (83-95)</td>
<td>453</td>
</tr>
<tr>
<td>CUS</td>
<td>6</td>
<td>2404</td>
<td>9.4</td>
<td>Y</td>
<td></td>
<td>74 (63-83)</td>
<td>92 (81-96)</td>
<td>31</td>
</tr>
<tr>
<td>NEx</td>
<td>2</td>
<td>142</td>
<td>41</td>
<td>Y</td>
<td></td>
<td>88 (59-97)</td>
<td>87 (57-97)</td>
<td>49</td>
</tr>
<tr>
<td>MRI</td>
<td>1</td>
<td>61</td>
<td>11.4</td>
<td>N</td>
<td>(23-46)</td>
<td>86</td>
<td>89</td>
<td>-</td>
</tr>
</tbody>
</table>

DOR diagnostic odd ratio (+LR/-LR)
CUS cranial ultrasound
NEx standardised neurological examination

An earlier systematic review<sup>19</sup> to assess the predictive validity of GMA for a broad range of neurodevelopmental outcomes at 12 and 24 months compared to traditional neurological assessment and neuroimaging techniques found GMA performed best in the majority of the studies at 8-20 weeks post menstrual age (PMA): sensitivity ≥92%; specificity ≥82%. Studies were not suitable for meta-analysis. The majority of the study participants (90%) were preterm. In the same review, neurological examination assessments in the same PMA period had sensitivity and specificity values ranging from 89-100% and 43-87% respectively. A similar cranial ultrasound was reviewed and had sensitivity in the 60-89% range and specificity 82-87%.

**Evolution of GMA**

Early writhing movements (particularly in early preterm babies) may be influenced by the immaturity of the preterm brain, as well as by perinatal morbidities<sup>20</sup>. A single GMA recording at or prior to term age is non-predictive as the only screening assessment. Abnormal (cramped-synchronised) GMA may be transient, or present for several weeks, which would be a strong predictor for spastic cerebral palsy. Repeated assessment throughout both the writhing and fidgety stages of general movements assists in long-term prediction of neurodevelopmental outcomes.<sup>22</sup>
3.5 Early intervention - the evidence

Despite the logical expectation, given the prolonged period of human neurodevelopment and knowledge of neuroplasticity, convincing evidence that early interventional therapy benefits infants with brain damage has been lacking. This in part has been attributed to the diversity of trialled therapeutic interventions and measured outcomes. Additionally, ethically, achieving true comparison between intervention and no treatment has been challenging particularly in high-risk groups.\textsuperscript{23}

However, a recent Cochrane review by Spittal et al\textsuperscript{24} which compared the effectiveness of early developmental intervention programmes post-discharge in preterm infants versus standard medical follow-up encouragingly showed significant benefits in cognitive outcomes up to school age and in motor outcomes during infancy. There was no effect noted on cerebral palsy rates. All 25 studies were either randomised (12) or quasi randomised-controlled trials. There was again however heterogeneity between interventions utilised and participant gestational age. Thus, the need remains for large scale, high-quality studies in high-risk infants, possibly with abnormal GMAs, to establish the most effective interventions for improvement in long-term neurodevelopment.

3.6 General Movement Assessment Process at RPA Newborn Care

All families of high-risk infants will be provided with a parent information sheet, video-recording instructions (for the 12 week video) and will be counselled regarding the purpose and possible results of the general movements assessment by a certified GMA professional. Consent will be obtained, documented and recorded in the patient’s medical record.

**Timing of Assessment:**

Infants who meet the criteria for silver-star follow up (<30 weeks or <3\textsuperscript{rd} percentile and preterm or with neurological concerns including any baby who received therapeutic hypothermia) will have a GMA performed in the nursery after consent is obtained. The initial assessment will occur around 34-36 weeks, and at a time suited to ongoing developmental cares. If there is evidence of cramped-synchronised movements, a further GM assessment will be conducted within the following 2 weeks.

At 12 weeks PMA a GMA in the fidgety stage will be undertaken. Parents will be asked to video their infants at home, and to send in a copy for review prior to their 4 month outpatient appointment.

**Results of screening**

GMA videos will be reviewed on a weekly basis by a team of multidisciplinary clinicians trained and certified in Prechtl’s Method of Qualitative Assessment of General Movements.

Results of inpatient videos will be conveyed to the on call neonatologist, admitting neonatologist, and documented in the paper and electronic medical record. The results of the assessment will be discussed with the parents by a member of the GMA team. Results of outpatient videos will be conveyed to the patient’s neonatologist. Parents will be informed of the results at their follow-up developmental appointment, or via phone if not attending for follow-up at RPA - in which case the relevant paediatrician managing the infant will also be informed.

**Intervention and follow-up**

Those babies identified at high-risk of neurodevelopmental impairment, will generally be seen through the high
risk ‘silver star’ follow up program within the Department of Newborn Care. This will include ongoing review, assessments and allied health therapy.

An abnormal GMA at 3 months, combined with clinical assessment warrants consideration of referral to the Cerebral Palsy Alliance for enrolment in their early intervention program.

1. Key Points

<table>
<thead>
<tr>
<th>Key point</th>
<th>Level of Evidence &amp; Recommendation (NHMRC)</th>
</tr>
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<tbody>
<tr>
<td>General Movement Assessment are predictive of cerebral palsy in high-risk populations</td>
<td>Level of evidence: A (Systematic review with meta-analysis)</td>
</tr>
<tr>
<td></td>
<td>Strength of recommendation: A</td>
</tr>
<tr>
<td>General Movement Assessment are predictive of adverse neurodevelopment in high-risk populations</td>
<td>Level of evidence: B (SR no MA)</td>
</tr>
<tr>
<td></td>
<td>Strength of recommendation: B</td>
</tr>
<tr>
<td>Early intervention improves early neurodevelopmental outcome in preterm babies</td>
<td>Level of evidence: A (Cochrane SR)</td>
</tr>
<tr>
<td></td>
<td>Strength of recommendation : A</td>
</tr>
</tbody>
</table>

2. References


19. Burger, M., A. Frieig, and Q.A. Louw, General movements as a predictive tool of the neurological outcome in very low and extremely low...