CEREBRAL FUNCTION MONITORING (aEEG). NEONATAL CLINICAL GUIDELINE

1. Aim/Purpose of this Guideline

1.1. To provide guidance on the operation and interpretation of Cerebral Function Monitoring (CFM) in neonates.

All involved will benefit from the improvement in service and timing.

2. The Guidance

2.1 The Olympus 6000 Monitor

Cerebral Function Monitoring (CFM) is a minimally invasive tool to detect/confirm the presence of seizure activity in neonates. The Olympic 6000 records a single channel of EEG from 2 electrodes placed on either side of the baby’s head. A third electrode acts as a ground placed anteriorly to the anterior fontanelle. The signal is filtered to reduce interference from ECG monitoring and movement and the amplitude of the remaining signal in microvolts is displayed on screen.

The upper screen displays the CFM. 6cms display is equivalent to 1 hour of recording the entire screen width shows approximately 3 hours recording. The lower screen contains the stored EEG and using the touch screen facility can display the EEG at any given point on the upper screen. The lower screen displays approximately 2-3 seconds of EEG.

2.2 Attaching electrodes

Requirements: Three different coloured electrodes (for attachment identification)
1x pack of Steristrips, Sterets, Sterile scissors, 30cm length of tubegauze
2.3 Method.
Give sucrose analgesia as appropriate. Part the hair and clean scalp with an alcohol wipe. Ensure anterior needle is away from the fontanelle. Posterior needles need to be 7.5cms away from each other. Insert needle subcutaneously to hub and wrap ½ steristrip around and another over hub to secure. Place hat on baby and feed electrodes through a length of tubegauze to avoid pulling electrodes out.

2.4 n Olympus 6000 Operating Instructions

- Connect mains, connect amplifier
- Ensure scalp electrodes attached
- Turn on switch at back of monitor
- Insert electrodes to appropriate slots in amplifier
- Press RECORD
- Once in record mode press PATIENT and enter baby’s details (touch screen to navigate)
- To display EEG press EEG and touch upper screen where interpretation required (red line)
- To enter a record of events (seizures, cares, anticonvulsants) onto upper screen press MARK and touch screen where record is required (green line)
- Data needs to be collected for at least 30 minutes for any interpretation to be made
- To playback press scroll control ‘ » ’ to display data
- If a restart is required a text box will ask if record is to be appended. Press YES if this occurs to keep patient record intact
- If electrode becomes detached, monitor will alarm and display ‘impedance’
2.5 Natus Cerebral Function Monitoring
Using the supplied measure guide behind the ear tragus the goal is to identify the electrode position by sliding the positioning aid back and forth over the head until the letter at the ear tragus matches the letter at the sagittal suture.

Fig1. neonatal measuring aid with Purple indicator arrow indicating electrode placement sites on each side of the tape

1. Align the Letters A-H marks at the ear tragus and the sagittal suture using the measuring aid until a letter is matched (the measuring strip placed behind tragus to measure, as displayed) Either side of the purple arrow on the strip is then marked where the electrodes are to be placed using technique shown below

2. When the same letter is displayed at the sagittal suture and behind ear tragus mark skin with marker pen for needle sitting positions at arrow sites
3. Insert needle just beneath the skin, secure with a steristrip and cover the needle side with small piece of Comfeel. Place a small gauze square under lead to avoid the needle lifting through the skin (note: the needles should not point towards each other as this can cause interference)

4. Cut mefix tape to wrap around lead and fix in place. Repeat for the other 3 electrodes

5. The adhesive ground lead can be placed on the forehead or shoulder. Using abrasive gel can aid fixing

6. Apply a cut CPAP hat to support fixings and thread leads through tubegauze to avoid dislodgement

7. Connect electrodes to Data Acquisition Box in appropriate receptacles. Eg. Left anterior C3, Left posterior P3. The ground lead inserts to GREEN Common receptacle

8. Check signal quality via this button to check impedance. Poor contact will be shown in red with the problem electrode highlighted. Enter Patient Information on the touch screen then NEXT choose 5 lead START RECORDING
2.6 Interpretation of the CFM

Two features of the CFM trace should be assessed:
1. **The Amplitude**
2. The presence of seizure activity.

**Amplitude** - Normal, Moderately abnormal, Severely abnormal

Amplitude is assessed by measuring the upper and lower margins of the trace against the monitor’s scale. **The upper margin should be over 10 microvolts and the lower margin greater than 5 microvolts.**

In well term babies the trace alters in width according to activity – wider during sleep and narrower when awake (sleep/wake cycling) in **normal** traces the band width varies from 10-40 microvolts.

**Moderately abnormal trace** occurs when the upper margin is over 10 microvolts and the lower margin is less than 5 microvolts. This wide trace can occur with moderate Hypoxic Ischaemic Encephalopathy or as a result of anticonvulsants or sedative treatment.

NB. This trace can also be seen normally in preterm infants.
Severely abnormal trace when upper margin is less than 10 microvolts. The lower trace is usually less than 5 microvolts (lower margin can have ECG or other artefact interference when baby severely suppressed). This pattern can be accompanied by brief bursts of higher voltage spikes above the background activity (burst suppression) as a severely abnormal trace is often accompanied by seizures.

Sample 5: Moderately abnormal CFM.

Sample 12: CFM amplitude varying between moderately and severely abnormal trace. EEG shows burst suppression pattern.
The Presence of Seizure Activity

Seizure activity is seen as ‘notches’ in the band as bursts of higher voltage interfere with the trace. EEG activity can confirm the abnormality by touching the upper screen where the ‘notch’ occurred (EEG from red line in example below).

Sample 14: Irregular CFM amplitude with frequent bursts. EEG shows seizures. CFM amplitude severely abnormal following midazolam.
2.6 Points to note.
- The CFM does not give information about EEG frequency. It only displays the amplitude of the EEG.
- EEG activity less than 2 Hz or greater than 12 HZ is not recorded by the CFM trace.

Sample 15: Normal CFM amplitude but seizures are present and confirmed on EEG.

Sample 27: Frequent seizures. CFM amplitude cannot be determined because of frequency of seizures.
• Focal abnormalities in the EEG may not be identified because the signal is obtained from a single channel.
• If the CFM trace looks ‘odd’ or is not consistent with the infant’s clinical picture use the EEG display facility on the CFM 6000 to check for artefacts.
• Movement artefacts associated with head bobbing due to breathing difficulty may show up as a wide trace on CFM. Changing the position of the head or supporting the head with a roll may lesson the artefact.
• Artefact from the ECG may falsely elevate the lower margin of the trace or even the whole CFM trace. Confirm by displaying the EEG.
• Pulse artefact may be difficult to distinguish from seizure on the EEG. The pulse artefact is regular with the pulse whilst a seizure discharge frequency usually varies. Re-siting the electrodes further away from the fontanelle may help.
3. Monitoring compliance and effectiveness

<table>
<thead>
<tr>
<th>Element to be monitored</th>
<th>Key changes in practice recommended by guidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tool</td>
<td>Audit To be included in Neonatal Clinical Audit programme Findings reported to the Directorate Audit meeting / Governance Meeting</td>
</tr>
<tr>
<td>Frequency</td>
<td>As dictated by audit findings</td>
</tr>
<tr>
<td>Reporting arrangements</td>
<td>Child Health Directorate Audit and Clinical Guidelines Meetings</td>
</tr>
<tr>
<td>Acting on recommendations and Lead(s)</td>
<td>Paul Munyard. Consultant Paediatrician and Neonatologist Andrew Collinson. Consultant Paediatrician and Neonatologist</td>
</tr>
<tr>
<td>Change in practice and lessons to be shared</td>
<td>Required changes to practice will be identified and actioned within 3 months of audit. A lead member of the team will be identified to take each change forward where appropriate. Lessons will be shared with all of the relevant shareholders</td>
</tr>
</tbody>
</table>

4. Equality and Diversity

4.1 This document complies with the Royal Cornwall Hospitals NHS Trust service Equality and Diversity statement which can be found in the 'Equality, Diversity & Human Rights Policy' or the Equality and Diversity website.

4.2 Equality Impact Assessment
The Initial Equality Impact Assessment Screening Form is at Appendix 2.
# Appendix 1. Governance Information

<table>
<thead>
<tr>
<th>Document Title</th>
<th>Cerebral Function Monitoring (aEEG) Neonatal Clinical Guideline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date Issued/Approved:</td>
<td>October 2015</td>
</tr>
<tr>
<td>Date Valid From:</td>
<td>November 2015</td>
</tr>
<tr>
<td>Date Valid To:</td>
<td>November 2018</td>
</tr>
</tbody>
</table>
| Directorate / Department responsible (author/owner): | Judith Clegg. Advance Neonatal Nurse Practitioner
Paul Munyard. Consultant Paediatrician and Neonatologist.
Neonate. Women’s and Child Health Directorate |
| Contact details:                | (01872) 253293
(01872) 252667                                                  |
| Brief summary of contents       | This guideline is designed to ensure the implementation of a standardised approach to neonatal CFM and interpretation of CFM traces. |
| Suggested Keywords:             | Cerebral Function Monitoring. CFM. Neonatal. aEEG.             |
| Target Audience                 | RCHT PCH CFT KCCG                                             |
| Executive Director responsible for Policy: | Executive Director                                      |
| Date revised:                   | November 2014                                                 |
| This document replaces (exact title of previous version): | Neonatal guideline for CFM Monitoring (aEEG) |
| Approval route (names of committees)/consultation: | Paediatric Consultants
Child Health Audit and Guidelines meetings |
| Divisional Manager confirming approval processes | Sheena Wallace |
| Name and Post Title of additional signatories | Not Required |
| Signature of Executive Director giving approval | {Original Copy Signed}
Helen Ross McGill |
| Publication Location (refer to Policy on Policies – Approvals and Ratification): | Internet & Intranet ✓ Intranet Only |
Links to key external standards

- 1. Olympus 6000 manual.
- 2. [www.npeu.ox.ac/toby](http://www.npeu.ox.ac/toby)
- 3. CFM handbook
- 4. CFM Quiz for trace interpretation
- 5. [www.OlympicMedical.com](http://www.OlympicMedical.com)
- 6. Natus CFM operator manual

Training Need Identified?

Yes. Further training on CFM trace interpretation is advisable

### Version Control Table

<table>
<thead>
<tr>
<th>Date</th>
<th>Version No</th>
<th>Summary of Changes</th>
<th>Changes Made by (Name and Job Title)</th>
</tr>
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<tbody>
<tr>
<td>November 2007</td>
<td>V1.0</td>
<td>Initial Issue</td>
<td>Paul Munyard. Consultant Paediatrician and Neonatologist</td>
</tr>
<tr>
<td>October 2015</td>
<td>V3</td>
<td>Approved at Consultant led Neonatal Guidelines Meeting</td>
<td></td>
</tr>
</tbody>
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**All or part of this document can be released under the Freedom of Information Act 2000**

This document is to be retained for 10 years from the date of expiry.

This document is only valid on the day of printing

**Controlled Document**

This document has been created following the Royal Cornwall Hospitals NHS Trust Policy on Document Production. It should not be altered in any way without the express permission of the author or their Line Manager.
Appendix 2. Initial Equality Impact Assessment Form

<table>
<thead>
<tr>
<th>Clinical Guideline for neonatal Cerebral Function Monitoring (aEEG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directorate and service area: Neonatal. Women and Child Health Directorate.</td>
</tr>
<tr>
<td>Name of individual completing assessment: Paul Munyard</td>
</tr>
<tr>
<td>Telephone: (01872) 252393</td>
</tr>
</tbody>
</table>

1. Policy Aim*
   Who is the strategy / policy / proposal / service function aimed at?
   To provide guidance on the implementation of CFM monitoring and the interpretation of the results generated as a result of this monitoring. This guideline is aimed at hospital based medical staff responsible for the care of infants with suspected cerebral insult.

2. Policy Objectives*
   As above

3. Policy – intended Outcomes*
   Evidence based and standardised practice

4. *How will you measure the outcome?
   Audit

5. Who is intended to benefit from the policy?
   Neonatal Medical and Nursing staff
   Neonatal patients

6a) Is consultation required with the workforce, equality groups, local interest groups etc. around this policy?

   b) If yes, have these *groups been consulted?
   N/A

   C). Please list any groups who have been consulted about this procedure.
   N/A

7. The Impact. Please complete the following table.

<table>
<thead>
<tr>
<th>Equality Strands:</th>
<th>Yes</th>
<th>No</th>
<th>Rationale for Assessment / Existing Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex (male, female transgender/gender reassignment)</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cerebral Function Monitoring (aEEG). Neonatal Clinical Guideline
### Race / Ethnic communities /groups
- X

### Disability -
- Learning disability, physical disability, sensory impairment and mental health problems
- X

### Religion / other beliefs
- X

### Marriage and civil partnership
- X

### Pregnancy and maternity
- X

### Sexual Orientation, Bisexual, Gay, heterosexual, Lesbian
- X

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You will need to continue to a full Equality Impact Assessment if the following have been highlighted:

- You have ticked “Yes” in any column above and
- No consultation or evidence of there being consultation - this **excludes** any policies which have been identified as not requiring consultation. **or**
- Major service redesign or development

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8. Please indicate if a full equality analysis is recommended. | No
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9. If you are not recommending a Full Impact assessment please explain why.

No area indicated

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Signature of policy developer / lead manager / director | Date of completion and submission
Paul Munyard | 09:11:2015

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Keep one copy and send a copy to the Human Rights, Equality and Inclusion Lead, c/o Royal Cornwall Hospitals NHS Trust, Human Resources Department, Knowledge Spa, Truro, Cornwall, TR1 3HD. A summary of the results will be published on the Trust’s website.

Signed ________ Kim Smith________

Date ________12:11:2015________