NEONATAL TOTAL BODY COOLING for HYPOXIC ISCHAEMIC ENCEPHALOPATHY (HIE) - CLINICAL GUIDELINE

1. Aim/Purpose of this Guideline

1.1. This guideline applies to medical and nursing staff working on the Neonatal Unit at RCH. Initial measures also apply to staff working on Delivery Suite and Community Midwives. The purpose of the guidance is to recognize babies who meet cooling criteria, take prompt action to induce cooling measures and to utilize evidence based practice for supportive measures for babies during the cooling period. This guideline complies with guidance from our tertiary unit in Bristol

2. The Guidance

2.1. Total Body Cooling should be considered for any babies meeting A, and B inclusion criteria:

A: Infants ≥ 36 completed week’s gestation with at least ONE of the following:
1. Apgar Score of ≤ 5 at 10 minutes after birth
2. Continued need for resuscitation, including ETT or mask ventilation at 10 minutes after birth
3. Acidosis within 60 minutes of birth (defined as any occurrence of umbilical cord, arterial or capillary pH < 7.00)
4. Base Deficit ≥ 16mmols/L in umbilical cord or any blood sample (arterial, venous or capillary) within 60 minutes of birth

B: Moderate to severe encephalopathy, consisting of altered state of consciousness (lethargy, stupor or coma) plus at least ONE of the following:
1. Abnormal tone (focal or general hypotonia, or flaccid) and
2. Abnormal primitive reflexes (weak or absent suck or Moro response)
3. Clinical seizure

Infants who meet criteria A and B should be evaluated for on-going treatment with cooling. CFM trace monitoring is not essential prior to cooling but useful for management and monitoring of baby’s status therefore apply as soon as possible for criteria C:

C: Abnormal background aEEG activity or seizures defined as:
1. Normal background voltage with electrical seizure activity
2. Moderately abnormal activity (Upper margin of trace >10µV and lower trace <5µV
3. Suppressed activity (upper margin trace <10µV and lower margin <5µV)
4. Continuous seizure activity

[refer to RCH CFM guideline for further graph interpretation information if needed]

PRINT OUT APPENDIX 4 GUIDELINE REMINDERS CHECKLIST ON ADMISSION
2.2 When to start cooling:
Active cooling should commence as soon as possible and within an hour of decision to cool for eligible infants. If a baby >36 weeks is still requiring resuscitation at 10 minutes of age with altered consciousness and tone stop actively warming the baby by switching off the overhead heater (not clock) Request cord gases and request placental weight, swab and histology.

Phone ahead to NNU to request open cot, aEEG monitoring and to prepare cooling mattress (see Appendix 1)
On arrival to NNU give no supportive heat measures, continuously monitor rectal temperature and apply CFM monitoring (Appendices 2 and 3) Inform senior clinician of baby’s admission. Assess the trace after 30 minutes and record findings in notes. If unsure re. Criteria C provide active cooling for the baby at 33-34°C for 72hours

2.3 Management
Do not delay active cooling to insert (double lumen UVC) central lines, CFM monitoring, bloods as below. Current evidence suggests infants are unlikely to benefit from cooling if target core temperature is not reached beyond 6 – 8 hours after birth. Earlier cooling is associated with a better outcome.

Aim for target temperature of 34°C pre decision to actively cool to avoid overcooling the baby. If criteria C is clearly not met and baby clinically improving allow passive rewarming of the baby over 6hrs (0.3°per hour) to 36°C – continue CFM, if baby deteriorates then provide active cooling for full period

Cooling should be continued for 72 hours with the aim of reducing the core temperature to 33-34 Centigrade. Record in the medical notes when baby’s RECTAL temperature first reaches target range. The TOBY cooling paperwork is now incorporated into the Badger daily data entry under NEUROLOGY/NAS. Please ensure it is filled out daily and record on checklist.

Temperature should not exceed 36.5°C for 24 hours after cooling completed

If a cooling mattress is unavailable the baby should have no active warming. Use gloves filled with cold water along the side and head to keep baby cool until transfer. DO NOT use ice packs at any time. Monitor rectal temperature via Philips monitor rectal probe

COOLING DURATION = 72 HOURS + AT LEAST 7 HRS REWARMING

2.4 NURSING/ PRACTICAL GUIDANCE

Preparing the cot space:
- As soon as an admission for hypothermic treatment is expected, prepare the equipment so that cooling can start as soon as possible

- Set up ventilator for a rate limited, eg. SIMV mode with a back up rate. Avoid triggered ventilation modes which may cause low C02 levels; targeted volume can still be used
- Prepare an open, unheated cot with a single cotton sheet between baby and cooling mattress with a ‘cooling pillow’ (check for ‘ready made’ in cooling consumables box) The pillow is important to insulate the head and scalp. It is made out of 6 layers of bubble wrap covered with cotton and formed with a roll along one side which should be placed under the infant’s neck (see Fig.1) to allow free flow of air around the head.

Fig1. Cooling pillow

- Prepare the cooling machine and mattress with skin and rectal temperature probes (Set up see Appendix 1)

- Cerebral Function Monitor (CFM) will also be required (Set up see Appendix 2,3)

2.5 Preparing the baby:

**Monitoring**: Attach all the usual intensive care monitoring equipment and site the surface and rectal temperature probes. The rectal temperature probe should be inserted to 6cm (mark the 7cm line on the probe with tape so that it is obvious if the probe slips out) Attach Comfeel to the infant’s inner thigh and then stick the rectal probe to the Comfeel using sticky tape

Monitor core temperature continuously until criteria met. Aim for 34°C initially, avoid overcooling **Record rectal temperature hourly for 84 hours**

**CFM monitoring** – Insert needles according to CFM monitor type (see Appendix 2 and 3) using the fixation technique shown to minimize likelihood of needlestick injury and damage to scalp/hair

**Fixing technique for CFM needles**:

**NATUS monitor 2 channel EEG**: 4 needles plus 1 ‘ground’ adhesive lead for (can use an ECG lead as the adhesive lead, placed on forehead or shoulder after abrasive gel skin prep) see **Appendix 2 for detail of how to measure needle positions**

**Olympic 6000 single channel EEG**: 2 needles plus 1 ‘ground’ lead 2 placed in line with the ears either side of head 7.5cm apart, posterior position preferred see **Appendix 3**

A CPAP hat, split at the front can be used to reduce dislodging the needles
Procedure:

- Part the hair/trim as necessary, clean the scalp with an alcohol wipe, then insert the probe in measured position and secure using steristrips
- Cover inserted probe with Comfeel to prevent needle stick injury
- Place a piece of gauze under the lead to keep the probe at a slight angle to the scalp, so that the tip will not protrude through the scalp
- Feed wires through tubinet gauze and apply a split CPAP hat to avoid dislodgment, ensure the correct wires are connected to the correct data box receptacle ports

![Image](image_url)

**Fig. 2** Cover the comfeel and needle with mefix dressing to reduce needle dislodging

**Ongoing care**

Actively promote reduced noise around baby and minimally handle

Calculate fluid balance 6-8 hourly

Perform and record urinalysis at each change, may need a urinary catheter

No enteral nutrition recommended until 12 hours post normothermia then preferably start with breast milk

**Parents** Give parents BLISS booklet on HIE and cooling to accompany verbal information AND RECORD in notes timing of both senior consultation and that written information has been given

**Positioning** Keep baby’s head (nose) IN ALIGNMENT WITH SPINE/MIDLINE at all times as turning the head only could impair venous drainage from the head. Vary the baby’s position 6hrly –flat, slight up-tilted, supine, right or left side. Check pressure areas 3 hourly as risk of subcutaneous fat necrosis.
3. **SYSTEMS SUPPORT/ MEDICAL GUIDANCE**

In addition to routine sepsis screen and admission bloods request LDH (as this peaks earlier, 3-6 hours after initial insult), AST and ALT as these may give an indication of the timing of the insult ie. at or preceding the time of birth.

Send blood to save for Toxoplasma/viral screen and metabolic screen for any baby with unexpected collapse after birth (ref RCPCH guideline on “Sudden unexpected collapse in the first week of life”)

3.1 **Respiratory/ blood gases:**

Support ventilation as clinically indicated, adjust settings noting increased risk of hyperventilation in triggered modes. Rate limited SIMV preferable mode than PTV for these babies. Volume targeting modes can still be used. Elective ventilation may be needed for any overstressed baby who is requiring increasing levels of sedation/pain relief risking impaired respiratory drive.

**Aim for a PaCO₂ 6-7.5kPa** [gas machine default at 37°C analysis the true value is 0.83kPa lower if cooled] **Aim for PaO₂ 8-12 kPa**

More frequent suction may be needed from 24hours onwards as secretions tend to be more ‘sticky’ when cold. Risk of increased viscous secretions after the first 24 hours of cooling. **Maintain oxygen saturations as per guideline** Avoid bicarbonate to correct acidosis. Arterial lactate is not affected by cooling. Important to monitor for prognosis

3.2 **CVS/ Fluids:**

Site central lines with double lumen UVC and arterial access. Consider urinary catheter. Maintain an accurate input/output record

Fluid restrict to 40ml/kg/day initially 10% Dextrose BUT note some hypothermic infants displace fluid to tissue and become hypovolaemic

**Blood pressure:** Aim for a minimum mean BP 45mmHg

**Inotropes:** Assess cardiac function clinically, optimally with ECHO to choose volume or inotropes to support BP. No data to support that cooling affects inotropic function

**Heart rate** is reduced 12 beats per minute per 1° C reduction in temperature. At 33.5°C average rate is 90/min if higher can indicate stress and less effective neuroprotection (as 3.3)

**ELECTROLYTES:**

**SODIUM** - Hyponatraemia risk, monitor 8 hrly minimum. Keep sodium at lower level towards end of cooling period as fluid displacement to tissues can lead to raised sodium levels

**MAGNESIUM** – Keep levels above 1.0mmol/L, low levels increase energy expenditure and shivering and evidence suggests higher levels may increase neuroprotection

**COAGULATION** : 3.5°C reduction results in only moderate effect on coagulation and
function so should remain normal. However, a sick or asphyxiated baby is at risk so needs to be monitored. May need FFP to correct

3.3 CNS

Note that a “normal” heart rate may indicate stress. High levels of stress will significantly reduce neuroprotection. Sedation/pain relief should be given early with ongoing monitoring for stress. Load with 50mcg/kg morphine and maintain initially at 20mcg/kg/hour, adjust according to examination and heart rate. After 48 hours either stop (risk of accumulation) or consider continuing at 5mcg/kg/hr even if not ventilated

Seizures: Treat clinical seizures or electrical seizures lasting over 10mins in any 1hr period according to seizure guideline. NOTE high risk of cumulative effects of anticonvulsant drugs.

AVOID IV Lignocaine if Phenytoin previously administered. (Risk of toxicity if infused over 6 hours at 6mg/kg/hr or >12 hours at lower doses) Continue aEEG for the duration of treatment and rewarming period.

Infant can develop severe bradycardia or ventricular tachycardia following Phenytoin or Lignocaine administration DISCONTINUE if above occur

Paralysis: Bolus preferred due to accumulation risk. Pancuronium 100 microgram/kg

Cranial Ultrasound: Scan at 24-48hrs including Resistance Index (RI)

RI= peak systolic velocity- end diastolic velocity
peak systolic velocity
<0.55 is a marker of poor outcome but is less reliable in hypothermic babies

Note any echodensity, basal ganglia lesions, midline shift

aEEG: Monitor throughout cooling and re-warming period. Interpret data in notes daily. Print out/download data. Normalizing of sleep wake cycling is a good indicator of recovery

3.4 Rewarming

After 72hrs cooling rewarm the baby at 0.3°C/hour. If seizure activity recurs stop warming and re-cool until baby is stable again. Rewarm after 2hrs at 0.2°C/ hour. A 36.5°C core temperature is adequate for the next 24 hours as hyperthermia is a risk. Rectal temperature monitoring is needed for 12hrs post normothermia reached.

Note peripheral vasodilation can occur during rewarming with significant drops in blood pressure or cardiac output due to reduced central volume. Baby will, therefore need close monitoring during this time

MRI: Organize MRI for day10 and neuro-developmental follow up plan.

Note: Badger discharge summary for any HIE baby should be copied to Community Paediatricians together with an email.

3.5 Any baby meeting cooling criteria should be discussed with on-call Consultant and NICU Consultant in Plymouth as per Peninsula agreed care pathway below
Peninsula agreed care pathway for cooling

- Baby fulfills cooling criteria (36 wks, evidence of perinatal hypoxia & encephalopathy)
- Admit to the NNU
- Institute passive cooling measures

- Active cooling can be provided locally?
  - Yes: Institute cooling in accordance with TOBY guidance
  - No: Continue passive cooling. Contact PNTS and arrange transfer to cooling centre

- Baby in a network NICU?
  - Yes: Continue with care in accordance with TOBY guidelines
  - No: If not already aware – inform lead centre for network

- Evidence of multisystem instability?
  - No
  - Yes: Consider transfer to network NICU

Ensure the following apply
- Cooling equipment available
  - Cot on the ICU available
  - Staffing suitable for level of care

Neonatal Total Body Cooling for Hypoxic Ischaemic Encephalopathy (HIE) Clinical Guideline
Page 7 of 18
4. Monitoring compliance and effectiveness

<table>
<thead>
<tr>
<th>Element to be monitored</th>
<th>Use of Total Body Cooling and compliance with guideline plus neonatal outcome for babies when they are over 2 years old</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead</td>
<td>Neonatal audit lead</td>
</tr>
<tr>
<td>Tool</td>
<td>National audit tool for monitoring babies receiving cooling as per Oxford perinatal trial unit TOBY guidance</td>
</tr>
<tr>
<td></td>
<td>All cooled babies should reach target temperature within 6 hours</td>
</tr>
<tr>
<td></td>
<td>All cooled babies should have documented discussion with consultant within 6 hours of admission to NNU</td>
</tr>
<tr>
<td></td>
<td>All actively cooled babies should have continual rectal temperature monitoring for duration of treatment and 12 hours after</td>
</tr>
<tr>
<td></td>
<td>All actively cooled babies should have adequate sedation with morphine infusion</td>
</tr>
<tr>
<td></td>
<td>All actively cooled babies should have cranial ultrasound with resistance index within 48hours</td>
</tr>
<tr>
<td></td>
<td>All surviving cooled babies should have an MRI scan at 10 days</td>
</tr>
<tr>
<td></td>
<td>All survivors should have neuro-developmental follow up and Community Paediatrician referral</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frequency</th>
<th>5 year audit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reporting arrangements</td>
<td>Outcomes will be shared with the neonatal Network</td>
</tr>
<tr>
<td></td>
<td>Local arrangement to report to Paediatric Governance and audit meeting to identify and deficiencies and actions required</td>
</tr>
<tr>
<td>Acting on recommendations and Lead(s)</td>
<td>Child Health Governance Committee, Neonatal Lead</td>
</tr>
<tr>
<td>Change in practice and lessons to be shared</td>
<td>Required changes to practice will be identified and actioned within one month of audit. A lead member of the team will be identified to take each change forward where appropriate. Lessons will be shared with all the relevant stakeholders</td>
</tr>
</tbody>
</table>

5. Equality and Diversity

5.1 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.

5.2 Equality Impact Assessment
The Initial Equality Impact Assessment Screening Form is at Appendix 4.
### Appendix 1. Governance Information

<table>
<thead>
<tr>
<th>Document Title</th>
<th>Neonatal Total Body Cooling for Hypoxic Ischaemic Encephalopathy (HIE) – Clinical Guideline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date Issued/Approved:</td>
<td>November 2014</td>
</tr>
<tr>
<td>Date Valid From:</td>
<td>November 2014</td>
</tr>
<tr>
<td>Date for Review:</td>
<td>November 2017</td>
</tr>
<tr>
<td>Directorate / Department responsible (author/owner):</td>
<td>Judith Clegg, ANNP, Child Health Directorate. Neonatal Unit</td>
</tr>
<tr>
<td>Contact details:</td>
<td>(01872) 252667</td>
</tr>
<tr>
<td>Brief summary of contents</td>
<td>Criteria for Total body Cooling for neonates after HIE. Application of CFM monitoring. Guidance for medical and nursing care of cooled baby</td>
</tr>
<tr>
<td>Suggested Keywords:</td>
<td>Neonate. Neonatal. Cooling. HIE. CFM. Seizures. TOBY. encephalopathy.</td>
</tr>
<tr>
<td>Target Audience</td>
<td>RCHT</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Executive Director responsible for Policy:</td>
<td>Frances Keane</td>
</tr>
<tr>
<td>Date revised:</td>
<td>26/2/2014</td>
</tr>
<tr>
<td>This document replaces (exact title of previous version):</td>
<td>New document</td>
</tr>
<tr>
<td>Approval route (names of committees)/consultation:</td>
<td>Neonatal Guidelines Group approval Lead, Dr Paul Munyard, Plus liaison with all Consultant Paediatricians</td>
</tr>
<tr>
<td>Divisional Manager confirming approval processes</td>
<td>Sheena Wallace</td>
</tr>
<tr>
<td>Name and Post Title of additional signatories</td>
<td>None required</td>
</tr>
<tr>
<td>Signature of Executive Director giving approval</td>
<td>{Original Copy Signed}</td>
</tr>
<tr>
<td>Publication Location (refer to Policy on Policies – Approvals and Ratification):</td>
<td>Internet &amp; Intranet</td>
</tr>
<tr>
<td>Document Library Folder/Sub Folder</td>
<td>Child Health/Clinical/Neonatal Guidelines CNS</td>
</tr>
<tr>
<td>Links to key external standards</td>
<td>None</td>
</tr>
</tbody>
</table>
Related Documents:

5. RCPCH (2011) Sudden Unexpected collapse in the first week of life guidelines. British Paediatric Surveillance Unit www.rcph.ac.uk

Training Need Identified? no

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>
</thead>
<tbody>
<tr>
<td>November 2014</td>
<td>V1.0</td>
<td>Initial Issue for document library</td>
<td>Judith Clegg, ANNP Neonatal Unit</td>
</tr>
<tr>
<td>November 2014</td>
<td>V1.0</td>
<td>Reviewed and Formatted</td>
<td>Reviewed by: Dr Paul Munyard. Consultant Paediatrician and Neonatologist. Formatted by: Kim Smith. Staff Nurse</td>
</tr>
</tbody>
</table>
Appendix 2. Initial Equality Impact Assessment Form

<table>
<thead>
<tr>
<th>Name of the strategy / policy / proposal / service function to be assessed:</th>
<th>Neonatal Total Body Cooling for Hypoxic Ischaemic Encephalopathy (HIE) Clinical Guideline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directorate and service area:</td>
<td>Child Health Directorate. Neonatal Unit</td>
</tr>
<tr>
<td>Is this a new or existing Policy?</td>
<td>New policy</td>
</tr>
<tr>
<td>Name of individual completing assessment:</td>
<td>Judith Clegg</td>
</tr>
<tr>
<td>Telephone:</td>
<td>(01872) 252667</td>
</tr>
</tbody>
</table>

1. Policy Aim*
Who is the strategy / policy / proposal / service function aimed at?
To provide guidance on the criteria for Total body Cooling for neonates after Hypoxic Ischaemic Encephalopathy; Application of CFM monitoring; Guidance for medical and nursing care of a cooled baby

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?

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

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>
### Table of Key Areas

<table>
<thead>
<tr>
<th>Race / Ethnic communities /groups</th>
<th>x</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disability - learning disability, physical disability, sensory impairment and mental health problems</td>
<td>x</td>
</tr>
<tr>
<td>Religion / other beliefs</td>
<td>x</td>
</tr>
<tr>
<td>Marriage and civil partnership</td>
<td>x</td>
</tr>
<tr>
<td>Pregnancy and maternity</td>
<td>x</td>
</tr>
<tr>
<td>Sexual Orientation, Bisexual, Gay, heterosexual, Lesbian</td>
<td>x</td>
</tr>
</tbody>
</table>

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

8. Please indicate if a full equality analysis is recommended. No

9. If you are not recommending a Full Impact assessment please explain why.

No area indicated

**Signature of policy developer / lead manager / director**

Paul Munyard

Date of completion and submission 12 November 2014

Names and signatures of members carrying out the Screening Assessment

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 web site.

Signed: ………………Kim Smith………………

Date: ………………12:11:2014…………………….
APPENDIX 3.

Setting up the TECOTHERM NEO cooling mattress

1. **Pre fill mattress**, minimum volume in mattress is 250ml
2. Connect male mattress connectors to female connectors of fill bottle
3. Turn over bottle and hold 0.5m higher than mattress and allow gravity fill of mattress until plump

Prime machine with TECOmed fluid

4. Ensure mattress hoses are disconnected from front ports (lower)
5. Fill TECOmed bottle to 450ml
6. Connect fill up set to upper refill ports *the green connector always fits right hand port*
7. **Turn on machine**, select ‘CONSTANT’ mode
8. Invert bottle to allow fluid to enter the system until fluid stops being taken
9. QUIT treatment mode
10. Attach the mattress to the hoses and connect to lower device ports
11. Connect the **GREEN** connector of the fill up bottle to the right refill port – DO NOT attach the left hand male connector
12. Select CONSTANT and fill Tecotherm with another 100ml fluid
13. Disconnect fill up set and check no air bubbles in mattress

TREATMENT MODES

14. In main menu select: Servo Mode, Complete Treatment Mode or Constant Mode
   Note: **Servo Mode** will not start until rectal probe connected
15. Scroll down and select any parameter changes
16. Press START

DURING TREATMENT TEMPERATURE DISPLAY DETAILS:

In SERVO MODE: **GREEN** display temperature number indicates temperature within range +/- 0.5°C  **RED** display = outside range  **NOTE: please make note of time baby achieves optimal range temperature in medical notes**

In Constant Mode: **BLUE** display = within temperature range  **BLACK** = outside range

**DETAILS** button = all parameters seen. At any time parameters can be changed via the ‘change settings’ button and select parameter to change.

Top up of fluid as above can be done without stopping treatment as needed.
APPENDIX 4

Set up for 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.

1. Align the Letters A-H marks at the ear tragus and the sagittal suture using the measuring aid until a letter is matched at both sites (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. Repeat on other side.

3. Insert needle just beneath the skin, secure with a steristrip and cover the needle side with a 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
APPENDIX 5

Set up for Olympic CFM 6000 Monitor

One channel EEG is provided with the Olympic model. The 3 probes should be positioned in line with the ears on either side of the head. The reference probe can be positioned anywhere on the scalp avoiding the fontanelle. The probes should be positioned 7.5cm away from each other. Patient details have to be put into the monitor before recording can start. This monitor has a print facility.
## HIE CHECKLIST FOR BABY NOTES

### APPENDIX 6

<table>
<thead>
<tr>
<th>Action</th>
<th>Time and Date</th>
<th>Result</th>
<th>Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criteria A and B met? Cord gases, APGARs, encephalopathy level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Requested placenta weight, swab and examination</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Criteria C met and recorded? aEEG trace Findings recorded</td>
<td></td>
<td>Record findings/printout in daily notes</td>
<td></td>
</tr>
<tr>
<td>Double lumen UVC inserted</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Record time rectal temp. 34 °C reached</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sepsis screen PLUS: LDH AST Lactate, Magnesium Coagulation + clotted tube save micro</td>
<td></td>
<td>Record routine bloods in Lab results sheet</td>
<td></td>
</tr>
<tr>
<td>Level 3 unit Contacted</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parents updated and recorded in notes &amp; Badger</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HIE Bliss booklet given</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cranial USS and Resistance Index recorded</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily clinical exam score</td>
<td>Day 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Badger updated on Ward Round</td>
<td>Day 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 10 MRI booked</td>
<td>Day 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community Paed Badger sent.</td>
<td>Day 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr Jo Lewis informed</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>