### HYPOXIC ISCHAEMIC ENCEPHALOPATHY MANAGEMENT FORM

#### Supportive Management

<table>
<thead>
<tr>
<th><strong>Ventilation</strong></th>
<th>Support breathing when necessary</th>
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<tbody>
<tr>
<td></td>
<td>Avoid hypocarbia (decreases cerebral blood flow) ➔ keep PaCO₂ 40-55mmHg</td>
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<td></td>
<td>Avoid hyperoxia ➔ keep PaO₂ 50-100mmHg</td>
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<td></td>
<td>Monitor for PPHN (see protocol)</td>
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<table>
<thead>
<tr>
<th><strong>Circulation</strong></th>
<th>Maintain mean BP 40-60mmHg to maintain adequate cerebral perfusion</th>
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<tbody>
<tr>
<td></td>
<td>If clinical PPHN ➔ start appropriate management (see protocol) and request cardiac sonar</td>
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<tr>
<td></td>
<td>If hypotensive ➔ do cardiac sonar to determine RV and LV function</td>
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<td>Hypovolaemic ➔ fluid bolus (only if normal cardiac fx) ➔ start with 10ml/kg, followed by an inotrope if necessary (dopamine is 1st-line)</td>
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<td></td>
<td>Normovolaemic ➔ dopamine is 1st-line, dobutamine 2nd-line</td>
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<td></td>
<td>Myocardial dysfx ➔ avoid fluid bolus ➔ dobutamine is 1st-line, dopamine 2nd-line</td>
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<td></td>
<td>3rd-line management ➔ consider hydrocortisone (sepsis), or adrenaline infusion (sepsis and myocardial dysfx)</td>
</tr>
</tbody>
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<thead>
<tr>
<th><strong>Fluid &amp; Nutrition</strong></th>
<th>Start fluid volume at 60ml/kg/day (including enteral feeds)</th>
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<tbody>
<tr>
<td></td>
<td>Decrease total volume if poor urine output (&lt;1ml/kg/hr). Only increase daily fluid volume if urine output adequate (≥1ml/kg/hr)</td>
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<td></td>
<td>Start trophic feeds (20ml/kg/d) on day of birth and continue low volume until after re-warming (72 hours)</td>
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<td>Give enteral feeds via NGT until sucking and swallowing assessed</td>
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<td></td>
<td>TPN must be prescribed until on full enteral feeds</td>
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<td></td>
<td>Aminophylline (dose: 8mg/kg ivi stat) within 1st hour of birth to prevent AKI</td>
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<td>Place urine catheter to monitor fluid balance</td>
</tr>
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<td></td>
<td>If positive fluid balance and urine output &lt;1ml/kg/h ➔ suspect intrinsic renal</td>
</tr>
<tr>
<td></td>
<td>Diuretic trial (lasix 1mg/kg ivi stat)</td>
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<td></td>
<td>If positive fluid balance and urine output &lt;1ml/kg/h ➔ suspect pre-renal (hypovolemia)</td>
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<tr>
<td></td>
<td>Fluid bolus (10ml/kg saline)</td>
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<td></td>
<td>If no response to above measures ➔ restrict fluid to urine output plus insensible losses (20-25ml/kg/d)</td>
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<td></td>
<td>If oliguric / anuric ➔ avoid potassium-containing fluid</td>
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<td></td>
<td>If hyperkalaemic (K⁺ &gt; 7mmol/L) ➔ treat (see protocol)</td>
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<tr>
<td></td>
<td>Monitor for SIADH (decreased UO, serum Na &lt; 130mmol/L, urine SG &gt;1020 (increased osmolarity)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Renal</strong></th>
<th>Clinical examination documenting modified sarnat and Thompson score</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Attach EEG ➔ interpret voltage and background patterns (see next page)</td>
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<tr>
<td></td>
<td>Monitor for seizures (see protocol to diagnose &amp; treat seizures)</td>
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<tr>
<td></td>
<td>Routine phenobarbitone prophylaxis to prevent seizures is NOT recommended</td>
</tr>
<tr>
<td></td>
<td>NB: seizures soon after delivery (1 to 6 hours of life) and those starting after 24 hours of life are NOT consistent with an acute intrapartum event</td>
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<tr>
<td></td>
<td>Exclude meningitis in ALL patients</td>
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<tr>
<td></td>
<td>There is NO evidence for steroid use to prevent / treat cerebral oedema in patients with HIE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Cerebral</strong></th>
<th>Monitor hgt ➔ prevent hypoglycemia</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Monitor electrolytes</td>
</tr>
<tr>
<td></td>
<td>Cord arterial gas or infant arterial blood gas within 1 hour of birth</td>
</tr>
<tr>
<td></td>
<td>Do NOT use NaHCO₃ infusion to correct metabolic acidosis</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Metabolic</strong></th>
<th>Avoid hyperthermia</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Determine eligibility for cooling (see next page)</td>
</tr>
<tr>
<td></td>
<td>If eligible, start as soon as stabilised (improved neurological outcome when cooling started within 3 hours of birth)</td>
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<td></td>
<td>Core temperature target: 33.5-34.5°C for 72 hours</td>
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<tr>
<td></td>
<td>Use whole body cooling method (criticool), but if not available use gel pack method if sufficient staffing available</td>
</tr>
<tr>
<td></td>
<td>Provide sedation if agitated / shivering while receiving cooling (valeron drops)</td>
</tr>
<tr>
<td></td>
<td>Once completed 72 hours of cooling ➔ Rewarm at 0.5 °C per hour</td>
</tr>
</tbody>
</table>

**REFERENCES:**
## ELIGIBILITY CRITERIA FOR THERAPEUTIC HYPOTHERMIA

<table>
<thead>
<tr>
<th>CRITERIA (A), (B) AND (C) MUST BE PRESENT</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age and gestation (A)</td>
<td>AND</td>
<td></td>
</tr>
<tr>
<td>36 weeks gestational age</td>
<td></td>
<td></td>
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<tr>
<td>≤ 6 hours of life</td>
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<tr>
<td>Evidence of intrapartum asphyxia / hypoxia (B)</td>
<td>OR</td>
<td></td>
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<tr>
<td>pH ≤ 7 OR BE ≥ -16</td>
<td></td>
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<tr>
<td>(Arterial cord blood or neonate arterial specimen within 60 minutes of birth)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 and 10 minute Apgar ≤ 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ongoing resuscitation from birth to 10 minutes</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Clinical Examination (defined by the presence of one or more signs in at least 3 of the 6 categories of the Modified Sarnat Score)</td>
<td>Moderate or severe encephalopathy (Please circle the criteria defining encephalopathy in the table below) OR clinical seizures</td>
<td></td>
</tr>
<tr>
<td>Seizures</td>
<td>Abrupt rise in both upper and lower margins</td>
<td></td>
</tr>
<tr>
<td>Discontinuous (Moderately abnormal): Upper band &gt;10, lower band &lt;5</td>
<td></td>
<td></td>
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<tr>
<td>Continuous low voltage (Suppressed): Upper band &lt;10, lower band &lt;5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isoelectric / flat (Suppressed): Upper band &lt;5, Lower band &lt;5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Burst suppression</td>
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</table>

### REFERENCES:

### Modified Sarnat Staging

<table>
<thead>
<tr>
<th>Category</th>
<th>Moderate encephalopathy</th>
<th>Severe encephalopathy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 Level of consciousness</strong></td>
<td>Lethargic</td>
<td>Stupor or coma</td>
</tr>
<tr>
<td><strong>2 Spontaneous activity</strong></td>
<td>Decreased activity</td>
<td>No activity</td>
</tr>
<tr>
<td><strong>3 Posture</strong></td>
<td>Distal flexion, complete extension</td>
<td>Decerebrate</td>
</tr>
<tr>
<td><strong>4 Tone</strong></td>
<td>Hypotonia (focal or general)</td>
<td>Flaccid</td>
</tr>
<tr>
<td><strong>5 Primitive reflexes</strong></td>
<td>Suck</td>
<td>Absent</td>
</tr>
<tr>
<td></td>
<td>Weak</td>
<td>Absent</td>
</tr>
<tr>
<td></td>
<td>Moro</td>
<td>Absent</td>
</tr>
<tr>
<td></td>
<td>Incomplete</td>
<td>Absent</td>
</tr>
<tr>
<td><strong>6 Autonomic system</strong></td>
<td>Pupils</td>
<td>Deviated, dilated, or non-reactive to light</td>
</tr>
<tr>
<td></td>
<td>Constricted</td>
<td>Deviated, dilated, or non-reactive to light</td>
</tr>
<tr>
<td></td>
<td>Heart rate</td>
<td>Bradycardia</td>
</tr>
<tr>
<td></td>
<td>Variable</td>
<td>Variable</td>
</tr>
<tr>
<td></td>
<td>Respiration</td>
<td>Periodic breathing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Apnoea</td>
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</tbody>
</table>

### REFERENCES:
### Special investigations

<table>
<thead>
<tr>
<th></th>
<th>D 1</th>
<th>D 2</th>
<th>D 7-10</th>
<th>NOTES:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exclude other pathology</strong></td>
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<td></td>
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<tr>
<td>Request placental pathology</td>
<td>X</td>
<td></td>
<td></td>
<td>Document appearance and weight. Identify adverse growth events and/or infections as alternate etiologies of NE</td>
</tr>
<tr>
<td>Blood culture</td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td>Lumbar puncture</td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td>Craniial Sonar</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Markers of cerebral oedema: sparkly echo reflectance of parenchyma, obscured sulcal markings, and closure of fissures. Appears approximately 24 hours after a hypoxic event and resolves in 3-5 days. Slit-like ventricles are a NORMAL sonographic finding in term infants</td>
</tr>
</tbody>
</table>

| **Evidence of Multi-organ involvement (Record all results in separate flow sheet)** |     |     |        |                                                                                           |
| FBC, diff, platelets | X   | X   |        | Maintain plts > 50 x10⁹/L                                                                 |
| Urine dipsitx      |     | X   |        | Document hematuria                                                                        |
| UKE               |     | X   |        | AKI: Serum creatinine rises > 27μmol/L within 48hours, OR rise ≥ 1.5x baseline, OR ≥ 221μmol/L (Modified KDIGO classification) |
| INR / PTT          | X   |     |        | Transfuse FFP if INR > 2                                                                 |
| AST / ALT          |     | X   |        |                                                                                           |
| CMP               |     | X   |        | Correct hypocalcemia and hypomagnesemia                                                     |
| Troponin T         |     | X   |        | ≥100 ng/L indicates myocardial injury. If present, request cardiac sonar                    |
| MRI brain          | X   |     |        | Two characteristic patterns of injury: 1) BG, thalami, and peri-rolandic cortex; 2) parasagittal watershed distribution |
| aEEG              |     | X   |        | See previous page for description of aEEG background patterns                              |
| EEG               |     |     | X       | Repeat if abnormal                                                                        |

**Evoked potentials**
- Hearing screening (ABR): Book as outpatient
- Vision screening (VEP): Book as outpatient

**REFERENCES:**
## PROGNOSTICATION (LONG-TERM)

<table>
<thead>
<tr>
<th>Score</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limb tone</td>
<td>Generally hypertonic</td>
<td>Generally hypotonic</td>
<td>Flaccid</td>
</tr>
<tr>
<td>LOC</td>
<td>Hyperalert, hyper-reactive or staring</td>
<td>Lethargic / Obtunded</td>
<td>Comatose / Stuporose</td>
</tr>
<tr>
<td>Visible fits</td>
<td>Infrequent (&lt; 3/day)</td>
<td>Frequent (&gt;2/day)</td>
<td></td>
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<tr>
<td>Posture</td>
<td>Fisting and/or cycling</td>
<td>Strong distal flexion</td>
<td>Decerebrate</td>
</tr>
<tr>
<td>Moro</td>
<td>Partial</td>
<td>Absent</td>
<td></td>
</tr>
<tr>
<td>Grasp</td>
<td>Poor</td>
<td>Absent</td>
<td></td>
</tr>
<tr>
<td>Suck</td>
<td>Poor</td>
<td>Absent and/or bites</td>
<td></td>
</tr>
<tr>
<td>Resp effort</td>
<td>Hyperventilation</td>
<td>Brief apnoea</td>
<td>Apnoea (IPPV)</td>
</tr>
<tr>
<td>Fontanelle</td>
<td>Full, not tense</td>
<td>Tense</td>
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</table>


### Day 1

<table>
<thead>
<tr>
<th>Day</th>
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<th>3</th>
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<td>Posture</td>
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### Interpretation of Thompson score

<table>
<thead>
<tr>
<th>Interpretation of Thompson score</th>
<th>PPV (%) (Abnormal outcome)</th>
<th>NPV (%) (Normal outcome)</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seizures</td>
<td>57</td>
<td>92</td>
<td>94</td>
<td>48</td>
</tr>
<tr>
<td>Subcortical leukomalacia</td>
<td>100</td>
<td>74</td>
<td>53</td>
<td>100</td>
</tr>
<tr>
<td>Max score &gt;10</td>
<td>65</td>
<td>100</td>
<td>100</td>
<td>61</td>
</tr>
<tr>
<td>Score D3 &gt;10</td>
<td>73</td>
<td>94</td>
<td>94</td>
<td>74</td>
</tr>
<tr>
<td>Score D4 &gt;10</td>
<td>75</td>
<td>90</td>
<td>88</td>
<td>78</td>
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<tr>
<td>Max score &gt;15</td>
<td>92</td>
<td>82</td>
<td>71</td>
<td>96</td>
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<tr>
<td>Score D3 &gt;15</td>
<td>89</td>
<td>71</td>
<td>47</td>
<td>96</td>
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<tr>
<td>Score D4 &gt;15</td>
<td>90</td>
<td>73</td>
<td>53</td>
<td>96</td>
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<tr>
<td>AbN score D7</td>
<td>63</td>
<td>100</td>
<td>100</td>
<td>57</td>
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*NOTE: These predictors were determined in the pre-cooling era*