وزارة الصحة
Ministry of Health

CLINICAL PRACTICE GUIDELINE FOR THE DIAGNOSIS AND TREATMENT OF NEONATAL HYPOXIC ISCHEMIC ENCEPHALOPATHY

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N.B. Staff should be discouraged from printing this document.
This is to avoid the risk of out-of-date printed versions of the document.
The Intranet should be referred to for the current version of the document.

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1. Statement of Purpose

To outline the protocol for diagnosis, initiation and maintenance of therapeutic hypothermia and rewarming of infants who meet criteria.
To monitor patients for potential adverse effects related to therapeutic hypothermia and hypoxic ischemic encephalopathy.

Abbreviations

CI	Confidence Interval
CPAP	Continuous Positive Airway Pressure
CPG	Clinical Practice Guideline
EBM	Evidence-Based Medicine
GIN	Guidelines International Network
HIE	Hypoxic Ischemic Encephalopathy
MEF	Minimal Enteral Feeds
NICU	Neonatal Intensive Care Unit
PPV	Positive Pressure Ventilation
PPHN	Persistent Pulmonary Hypertension of the Newborn

2. Introduction

- The guidelines set out the standards required of the hospital to ensure that a high standard of neonatal care at all levels continues to be provided in its Neonatal Intensive Care Units (NICU).
- Neonates are a specialized cohort of patients requiring an individualized approach in nursing care.
- Goals of care include minimizing stress, conserving energy, enhancing recovery, promotion of growth and well-being and protecting sleep pattern.
- All sick neonatal with encephalopathy can be an unpredictable outcome, and could happen anywhere particularly if appropriate resources are not available should under assessment of this guidelines protocol.

3. Applicability

3.1. This policy applies tall Health Care Facilities and staff regulated by the Ministry of Health (MOH).

3.2. All MOH hospital who care for newborn at delivery with different level

4. Definitions

4.1 **Newborn** is a A newborn infant, or ne onate, is a child under 28 days of age.
4.2 **Premature** refers to any baby delivered alive below 37 weeks gestational age.
4.3 **Neonatal Hypoxic-ischemic encephalopathy (HIE)** is a type of neonatal encephalopathy caused by oxygen deprivation to the brain in which clinical findings and test results indicate an acute peripartum (most common) or intrapartum event is a likely contributor

5. Policy

Guideline Objective(s)

This CPG aims to provide evidence-based recommendations for the early diagnosis and treatment of neonates with HIE in order to decrease the sequelae of multi-organ complications that occur in asphyxiated newborn babies.

Health / Clinical Question (PIPOH)

P: Patient (Target Population):

Newborn infants at risk of or diagnosed with HIE

I: Interventions and Practices Considered / CPG Category:

Early diagnosis and treatment)

P: Professionals (Intended / Target Users or Stakeholders) :

Healthcare professionals in primary, secondary, and tertiary care of neonatal and maternity services including physicians, nurses, pharmacists, laboratory technicians

Clinical Specialties

Physicians (pediatricians, neonatologists, pediatric infectious diseases, microbiologists, and obstetricians), clinical pharmacists, nurses, laboratory technicians, and midwives. These identified target users will use this CPG to inform their clinical decision-making and standards of care.

O: Major Outcomes Considered:

1. Decrease death (Mortality)
2. Decrease major neurodevelopmental disability in surviving babies (Morbidity)

H: Healthcare Settings:

Primary, secondary, and tertiary neonatal healthcare services are mainly nurseries, NICUs, and outpatient clinics in Saudi Arabia.

Recommendations

Definitions of Quality of Evidence (QoE) and Strength of Recommendations (SoR)

Key Recommendations

Management:

Clinical Management of infants who suffer from HIE is essentially supportive. Therapeutic Hypothermia (TH) is considered to be the standard of care based on several high quality large RCTs. (Level of evidence 1a)

- **Resuscitation:**
  - HIE infants usually require respiratory support at birth (CPAP or PPV)
  - Some infants need cardiac compressions and/or IV Epinephrine
  - Aim for normothermia until the infant meets the inclusion criteria for therapeutic hypothermia
  - Monitor temperature to avoid hyperthermia
- **Inclusion Criteria for TH:**
  - Term and near-term infants **≥36 weeks GA and ≥1.8kg** Body weight with **HIE** who are **≤6 hours** old and who meet **either** treatment criteria **A+C** or treatment criteria **B+C**
    - **A.** Cord pH ≤7.0 or base deficit ≥−16, OR
    - **B.** pH 7.01 to 7.15 or base deficit −10 to −15.9 on cord gas or blood gas within 1 h AND any one of the following:
      1- History of acute perinatal event (such as but not limited to cord prolapse, placental abruption or uterine rupture) OR
      2- Apgar score ≤5 at 10 minutes or at least 10 minutes of positive-pressure ventilation
    - **C.** Evidence of moderate-to-severe encephalopathy, demonstrated by the presence of seizures OR at least three of the six categories shown in Table 1.

Note: Some tertiary NICUs may decide to cool infants below 36 weeks based on individualized infant conditions and expert involvement, but not less than 35 weeks.

Table 1. Criteria for defining Moderate and Severe Encephalopathy (Modified Sarnat Criteria):

Category	Moderate Encephalopathy	Severe Encephalopathy
Level of consciousness	Lethargy	Coma
Spontaneous activity	Decreased Activity	No Activity
Posture	Distal flexion, full extension	Decerebrate (arms extended and internally rotated, legs extended with feet in forced plantar flexion)
Tone	Hypotonia (focal, general)	Flaccid
Primitive Reflexes **-Suck** **-Moro**	Weak Incomplete	 Absent Absent
Autonomic System **-Pupils** **-Heart Rate** **-Breathing**	 Constricted Bradycardia Periodic Breathing	 Skew deviation/dilated/nonreactive to light Variable Heart Rate Apnea

- **Exclusion Criteria for TH:**
  - **Critically** ill infants including but not limited to the following examples:
    - Severe refractory clinical PPHN (manifest as differential cyanosis between pre- and post-ductal saturations of ≥10% that's not responding to treatment)
    - Refractory hypoxemia
    - Severe bradycardia requiring inotropes
  - **Major** congenital or genetic abnormalities who are not normally candidates for life support therapy in the absence of HIE (e.g. Trisomy 13 or 18.)
  - **Clinically significant** coagulopathy (manifest as significant active bleeding.)
  - Evidence of severe head trauma or severe intracranial bleeding

If the baby does not qualify for TH in the first hour, we recommend to reevaluate hourly for the first 6 hours for inclusion criteria.

The decision to exclude an infant is always made at the discretion of the most responsible neonatologist .

- **Fluid, Glucose and Electrolyte Management during TH:**

  - Recommended TFI in the first day of life is **50 mL/kg/day** using an electrolyte-free solution of Dextrose Water 10% (**D10W**)
  - If the infant develops hypoglycemia, use higher dextrose concentrations rather than higher TFI to increase GIR.

- **Laboratory monitoring during TH**

Investigations	Tests
Routine investigations	• Blood gases, electrolytes, glucose and lactate (all obtainable from blood gas sample) as needed. • Complete Blood Count (CBC) once daily. • PT, aPTT, and INR STAT • Liver and renal function: day 1–2 • Septic work-up • The above may need to be repeated (e.g. daily or more often) if abnormal or if there is ongoing moderate or severe encephalopathy or signs of dysfunction of other organs (e.g. oliguria)
Specific investigations (if needed)	• Lumbar puncture (LP). • Blood for chromosome analysis, ammonia, and amino acids. • Urine for amino and organic acids, ketones, and reducing substances. • Early newborn screening if metabolic/genetic disorders suspected.

- **Feeding:**
  - Early MEF (10 to 20 mL/kg/day) during hypothermia, initiated a few hours after stabilization, is safe and feasible for newborns with HIE
  - Minimal feeds is generally safe despite the fact that gut perfusion may be decreased during cooling
  - Expressed Breast Milk (EBM) is preferred if available. Regular Infant Formula can be given if EBM is not available

- **Antiepileptics:**
  - Neonatal seizures are common in HIE and are suspected to be an independent cause of brain injury
  - If the infant develops abnormal movements, treatment in this setting using antiepileptic(s) is **strongly recommended**
  - Follow the local anti-seizure protocol in your unit if you have one. If you don't have one, follow the following protocol:
  - Phenobarbitone loading dose (20 mg/ Kg) slow IV infusion is the first drug of choice.
  - Repeated phenobarbitone half loading dose (10 mg/ Kg) slow IV infusion can be given if seizure recur.
  - Phenobarbitone maintenance dose (5 mg/ Kg/ day) after 24 hours from the loading dose if seizure recur.
  - Obtain serum levels of antiepileptics, particularly in the first 72 hours if redosing is needed

- **Sedation:**

  - TH may cause discomfort or shivering to the infant
  - **Morphine** is preferred over other narcotics as it offers the combined effect of sedation and analgesia, as well as being easier to wean later
  - TH reduces Morphine metabolism; hence a smaller infusion rate is sufficient to achieve the required effect
  - MOH recommends to start Morphine infusion **at 5-10 micrograms/kg/day** during the period of TH

- **Adjuvant Therapies:**

  - Adjuvant therapies that are currently under research include: EPO, Xenon, $MgSO_4$
  - There is insufficient evidence to recommend their use at this time

- **Target Temp in TH:**

  - **Whole body cooling** is recommended preferentially, targeting a rectal temperature of **33-34°C**
  - **MOH strongly recommends making cooling devices available in all level III NICUs across KSA**
  - **Passive cooling** is to be used by the referring hospital only before and until transport if cooling device not available
  - Since infants are transported inside incubators, active cooling during transport should be provided using a portable cooling aid like **ice gel packs** (see figure below), with frequent monitoring of rectal temperature (every 15 minutes)
  - Use axillary temperature whenever rectal temperature is not feasible (e.g. an infant with imperforate anus)
  - Add 0.5°C to the reading if axillary temperature is used

Frozen Ice Gel Packs

Equipments:

• 4 cold packs in fridge temperature at 10°C

• Disposable rectal probe and cable

• Cotton cover the cold packs





- **Duration of TH:**
  - 72 hours

- **Rewarming:**
  - At the end of TH, rewarm over 6 to 12 hours (0.5°C every 1 to 2 hours approximately)

- **Brain Imaging after TH:**
  - Obtain an MRI Brain between days 10 and 14
  - If resources permit, consider an early MRI between days 5-7 of life for prognostic purposes.
  - If MRI is not available can do Head Ultrasound (HUS) instead, however those offer much less positive predictive value for neurodevelopmental outcomes (Class I & Class II evidence)

- **Follow Up:**
  - All infants who received TH should have high risk follow up clinic visits and if not available then can be referred where available.
  - Follow up recommended to a minimum of **2 years** by a Neonatologist/Pediatrician, with referral(s) to Pediatric Neurology, Neurophysiology, Audiology & OT/PT whenever indicated.

Patient values and preferences

It was not feasible to recruit a patient representative to participate in the GAG or in the ERG but the patient values and preferences were considered during the formulation of the adapted recommendations and in the 'Parent discussion points' (Implementation tool).

Implementation Strategies and Tools

Several implementation frameworks and manuals have recommended the following strategies or interventions:

1. Leadership commitment, engagement, and support.
2. Local clinical and quality champions.
3. Dissemination (printed and electronic).
4. Regular training and education.
5. Regular audit and feedback (along with regular review and update promotes the concept of the 'living CPGs'.
6. Networking with relevant existing projects
7. Parents or carers as champions for changes

Implementation Tools

The CPG adaptation group decided to adopt all of the CPG implementation tools proposed by the QMN CPG.

1. Checklist for therapeutic hypothermia (cooling)

If baby has a perinatal event and/or acidosis and meets the criteria below, therapeutic hypothermia may be indicated.

Call a Tertiary Referral Centre immediately to discuss the need for transfer and therapeutic hypothermia with a neonatologist.

- **Evidence of moderate-to-severe encephalopathy,** demonstrated by the presence of seizures OR at least one sign in three or more of the six categories shown in Table 1.

- **AND EITHER OF A OR B:**
  A - Cord pH ≤7.0 or base deficit ≥−16
  B - pH 7.01 to 7.15 or base deficit −10 to −15.9 on cord gas or blood gas within 1 h AND

    1- History of acute perinatal event (such as but not limited to cord prolapse, placental abruption or uterine rupture) OR
    2- Apgar score ≤5 at 10 minutes or at least 10 minutes of positive-pressure ventilation

  - **AND** No absolute contraindications to therapeutic hypothermia:

- Uncontrolled critical bleeding
- Uncontrolled hypoxia due to persistent pulmonary hypertension
- Imminent withdrawal of life support planned

  - **AND** Meets the following criteria:

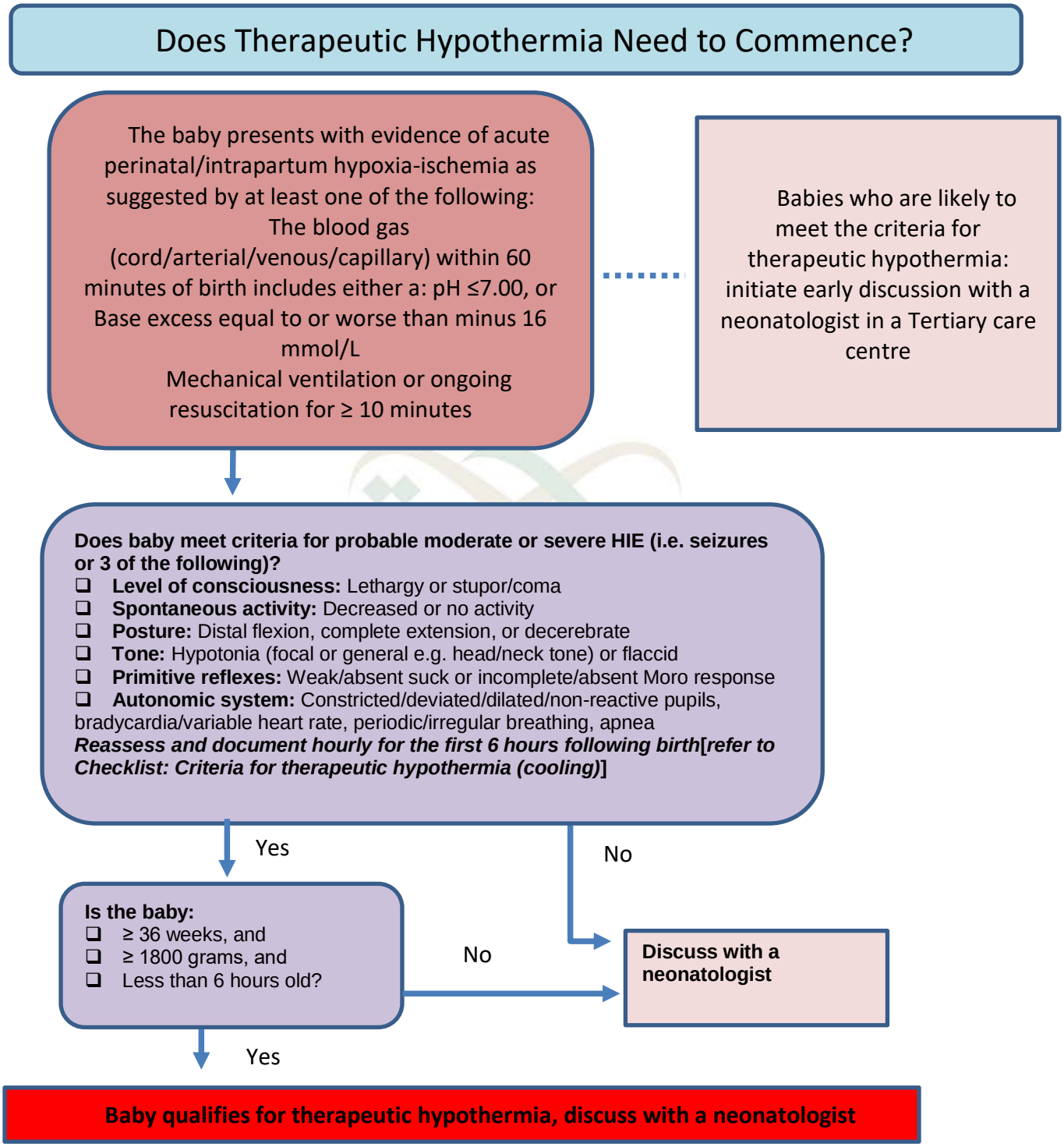
- ≥ 36 weeks

- Birth weight ≥ 1800 grams
- Able to begin cooling before 6 hours of age
- Assessment of relative contraindications (e.g. uncontrolled pulmonary hypertension, critical bleeding or coagulopathy, major congenital abnormalities
- Not moribund and with plans for full care

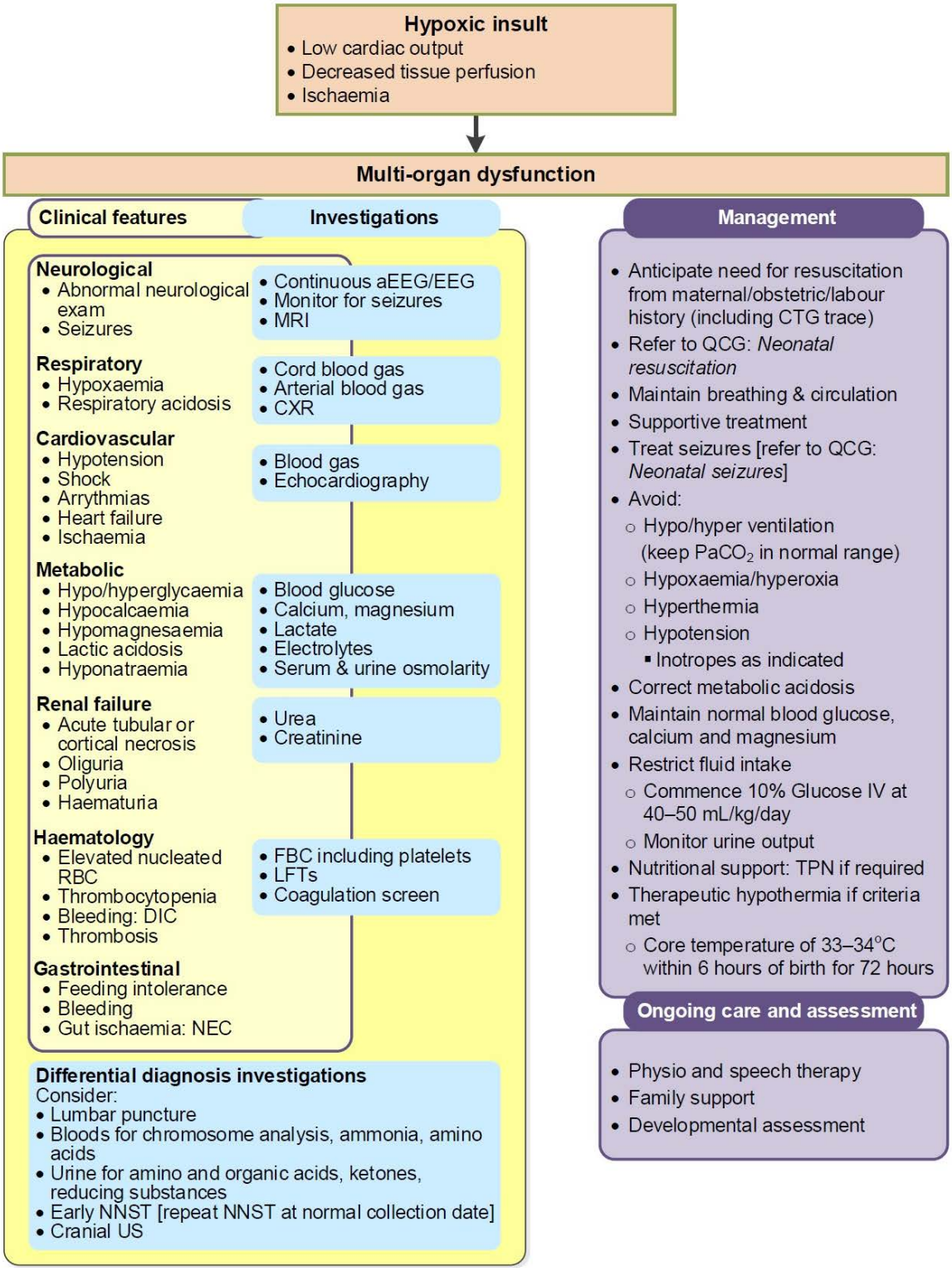
2. Assessment of encephalopathy severity

Category	Moderate Encephalopathy	Severe Encephalopathy
Level of consciousness	Lethargy	Coma
Spontaneous activity	Decreased Activity	No Activity
Posture	Distal flexion, full extension	Decerebrate (arms extended and internally rotated, legs extended with feet in forced plantar flexion)
Tone	Hypotonia (focal, general)	Flaccid
Primitive Reflexes -Suck -Moro	 Weak Incomplete	 Absent Absent
Autonomic System -Pupils -Heart Rate -Breathing	 Constricted Bradycardia Periodic Breathing	 Skew deviation/dilated/nonreactive to light Variable Heart Rate Apnea

3. Flowchart/ algorithm: Criteria for therapeutic hypothermia (cooling).



3- Flowchart: HIE clinical features, investigations and management



4. Parental discussion points

Aspect	Suggested Advice To Parents
Resuscitation	- Your baby needed significant resuscitation at birth to help him/her breathe. He/she appears to have suffered from the effects of lack of oxygen and blood supply to the brain
Incidence	- About 1–4 in 1000 newborn babies suffer from the effects of reduced blood flow or oxygen supply to their brain around the time of birth
Consequences	- This can result in brain damage from direct injury and also from subsequent secondary changes within the brain - These secondary changes are known to increase the amount of brain injury that occurs. Within 6 hours from injury there is a chance to lessen the secondary changes
Prognosis	- Babies with mild brain injury often have a normal outcome - Approximately 30 to 60% of those babies who survive after more severe damage to their brain may develop long-term disabilities. These disabilities include cerebral palsy and severe learning difficulties
Treatment	- Your baby will be assessed to see if cooling can be used as a treatment - Research has shown that cooling babies with moderate or severe brain injury may reduce the brain injury, increase the chance of survival and reduce the severity of possible long-term disability if started within 6 hours of birth
Cooling	- Your baby will continue to receive standard intensive care support - Your baby's temperature will be slowly lowered and kept between 33 and34 °C for 72 hours. Cooling will be achieved by exposing your baby to the ambient air temperature and with the use of cool gel packs if required - Your baby's temperature and other vital signs will be closely monitored throughout the process. If your baby shows any signs of discomfort during cooling he/she will be prescribed medication to reduce this - After 72 hours of cooling your baby will be gradually rewarmed to a temperature of 37 °C
Research	- Research is ongoing on the best ways to prevent, treat and care for newborn babies with brain injuries - You may be asked to consider participating in research trials that are happening at this time

5. Sarnat and Sarnat staging system

	Stage 1	Stage 2	Stage 3
Level of consciousness	Hyperalert	Lethargic or obtund	Stuporous
Neuromuscular control			
Muscle tone	Normal	Mild hypotonia	Flaccid
Posture	Mild distal flexion	Strong distal flexion	Intermittent decerebration
Stretch reflexes	Overactive	Overactive	Decreased or absent
Segmental myoclonus	Present	Present	Absent
Complex reflexes			
Suck	Weak	Weak or absent	Absent
Moro	Strong, low threshold	Weak, incomplete, high threshold	Absent
Oculo vestibular	Normal	Overactive	Weak or absent
Tonic neck	Slight	Strong	Absent
Autonomic function	Generalised sympathetic	Generalised parasympathetic	Both systems depressed
Pupils	Mydriasis	Miosis	Variable, often unequal, poor light reflex
Heart rate	Tachycardia	Bradycardia	Variable
Bronchial and salivary secretions	Sparse	Profuse	Variable
Gastrointestinal motility	Normal or decreased	Increased, diarrhoea	Variable
Other			
Seizures	None	Common, focal or multifocal	Uncommon (excluding decerebration)
Electroencephalo-gram findings	Normal (awake)	**Early:** low-voltage continuous delta and theta **Later:** periodic pattern (awake) **Seizures:** focal 1-to 1½-Hz spike-and-wave	**Early:** periodic pattern with isopotential phases **Later:** totally isopotential
Duration	Less than 24 hours	2–14 days	Hours to weeks

6. Therapeutic hypothermia: cooling and rewarming

Cooling	
Aspect	**Consideration**
Clinical Standard	- Commence cooling within 6 hours of birth before secondary reperfusion injury begins - Cooling is continued for 72 hours - Achieve core temperature between 33.0 and 34.0 °C24, 28, 49 by 2 hours from commencement
Clinical Practice	- Achieve cooling primarily by passive methods: o Nurse the baby on an open care system and turn the radiant warmer off o Nurse the baby naked with only a nappy on and no sheepskin, water bags, cloth or occlusive wraps - Active cooling: use a cooling and rewarming bed if available - If the baby is ventilated maintain the humidifier temperature at the temperature recommended by the manufacturer
Active Cooling Option 1:	- The preferred method: initiate servo-controlled cooling and rewarming mattress as programmed or as per manufacturer instructions
Active Cooling Option 2:	Apply the cool pack to the back of the neck and head, and across the torso as required • If the rectal temperature is: o Less than 34.5 °C: remove one/some/all cool packs o Less than 34.0 °C: remove all cool packs o Less than 33.0 °C: manually adjust the heater output on the radiant warmer to regain a core temperature between 33 and 34 °C • The cool pack temperature guide is 10 °C (acquire from the fridge, never the freezer) • Cover cool packs with a cotton/other appropriate cover • Observe skin in contact with cool packs every 15 minutes and document this observation o Subcutaneous fat necrosis can occur from tissue exposure to excessively cold temperatures
Stopping Cooling Before 72 hours	Indications to consider ceasing cooling prior to 72 hours include: o Life threatening coagulopathy o Uncontrolled pulmonary hypertension o A cardiac arrhythmia requiring treatment (excluding sinus bradycardia) o Deterioration in condition which leads to redirected/palliative care based on discussions with parents and the treating team

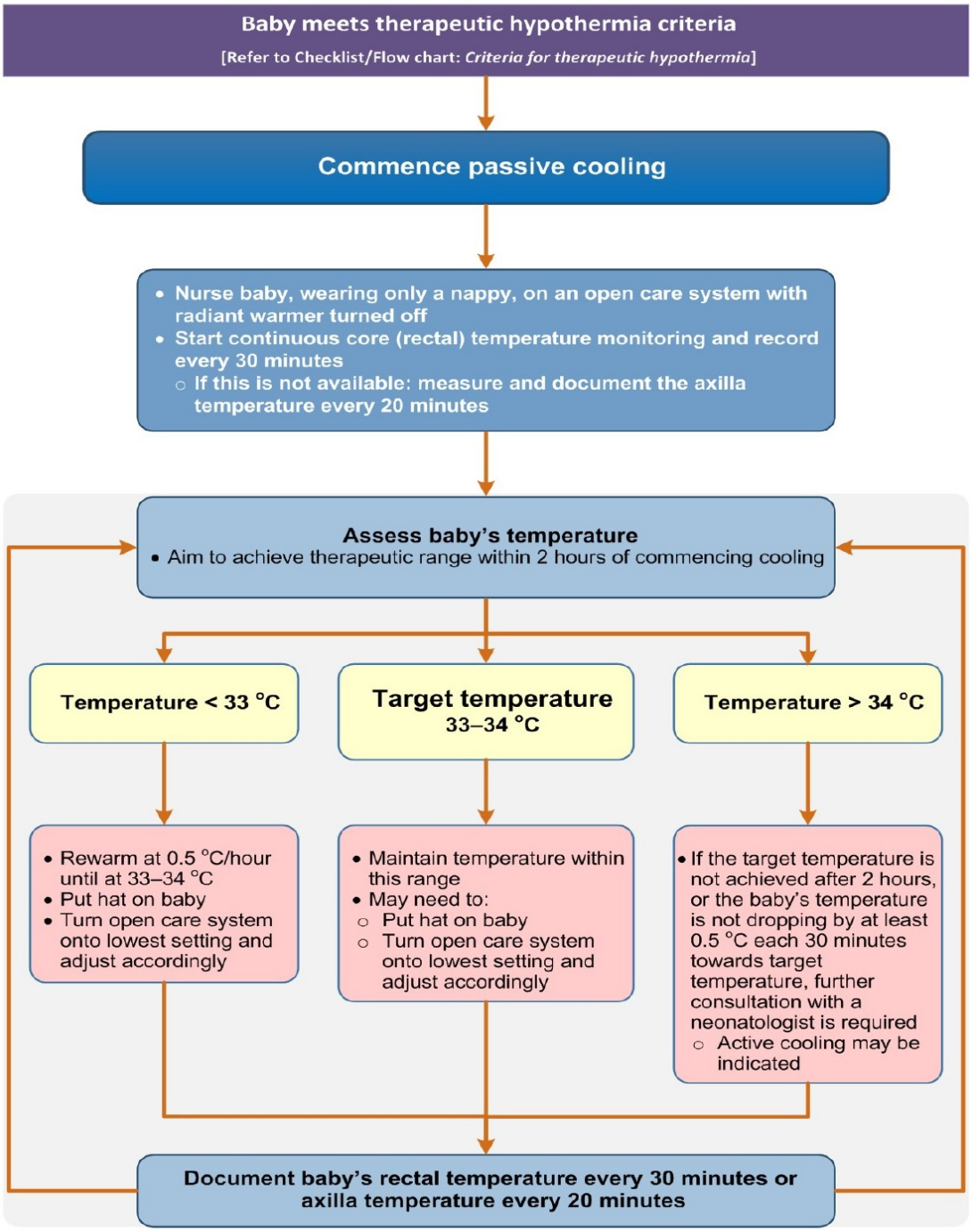
Sedation/Pain relief	If the baby shows any signs of distress or there is excessive shivering causing difficulties maintaining the desired baby temperature, consider: o Low dose morphine and/or midazolam o Paracetamol: Preferably administer per rectum The presence of the rectal thermistor sensor does not inhibit administration May also be administered intravenously • Metabolism of most drugs, including analgesics and sedatives, is altered by hypothermia and NICU-specific guidelines or consultation with a clinical pharmacist is advised
Feeding	Minimal Enteral Feeds during hypothermia, 10-20 ml/kg/day
Risks	Therapeutic hypothermia does not appear to affect the incidence or severity of most typical multi-organ system complications found in asphyxiated babies21 • Risks may include24: o Subcutaneous fat necrosis o Thrombocytopaenia o Sinus bradycardia: transient and reversible with warming • Due to the potential for accumulation and toxicity, carefully administer all pharmacological agents according to clinical need

Rewarming	
Aspect	**Consideration**
Principles of rewarming	After 72 hours of cooling, rewarm baby at a rate not exceeding 0.5 °C every 2 hours • The target rectal temperature is 37 °C • Babies will take 12–16 hours to rewarm • Rectal probe measurements may cease after the baby has maintained the target rectal temperature of 37 °C for at least 6 hours • Prevent rebound hyperthermia which is detrimental in moderate to severe HIE • Ensure aEEG is continued for total of 96 hours (or EEG, ideally accompanied by video) as the rewarming period is a high risk interval for recurrence of seizures
Rewarming	

Option 1 (Cooling and Warming Mattress)	Rewarm baby on the proprietary servo-controlled cooling and rewarming mattress as programmed or as per manufacturer instructions • Document, every 30 minutes, rewarming times, increments and temperatures • Upon reaching a rectal temperature of 37 °C: o Attach a skin temperature probe to the baby, connect to open care system and set skin Infant Servo Control (ISC) mode to desired temperature o Connect rectal temperature probe to the relevant monitoring system for ongoing continuous display

Rewarming Option 2 (Manual Rewarming)	Nurse the baby on ISC mode o The lowest setting that can be achieved on some ISC systems is 34.5 °C, therefore carefully manage manual heater increases prior to reaching 34.5 °C o Increase the desired set temperature by 0.1 °C every 20 minutes Over the two hour period, this regimen provides for five 0.1 °C increases with one 20 minute period at the end of the two hour time frame of no temperature increase before resuming further temperature increases • Document, every 20 minutes, rewarming times, increments and temperatures o A specialised observation form for this purpose is suggested

7. Flowchart: Passive cooling



8. *Educational material/ education (slides, videos)*
   a. Video link: https://vimeo.com/165095063/3711423611
   b. Slides: https://www.health.qld.gov.au/__data/assets/pdf_file/0024/140685/ed-hie.pdf
   c. knowledge assessment (Quizz): https://qcg.cvent.com/surveys/Welcome.aspx?s=dc8b2060-69b8-467f-8d2d-b9f465448c40
9. *Consumer information (2 pages)*

Hypoxic-ischaemic encephalopathy (HIE)

This information sheet aims to answer some commonly asked questions about Hypoxic-ischaemic encephalopathy (HIE).

IMPORTANT: This is general information only. It is not intended as advice for your individual circumstances. Ask your health care provider for more information.

Your baby may have been very unwell at birth and might have developed hypoxic-ischaemic encephalopathy (HIE).

What does 'hypoxic-ischaemic encephalopathy (HIE)' mean?

Hypoxic means not enough oxygen; *ischaemic* means not enough blood flow; and *encephalopathy* means brain injury.

What is hypoxic-ischaemic encephalopathy (HIE)?

HIE occurs when there has been reduced oxygen or blood flow getting to your baby's brain. The reduced blood flow and HIE can also affect your baby's other organs such as the lungs, liver, heart, and kidneys. Your baby may be hyper-alert, irritable, sleepy, floppy, and/or have abnormal movements (e.g. fitting, jittery).

The reduced oxygen or blood flow causes the baby to have a brain injury. The brain injury may be mild, moderate or severe. Some babies will not survive but most will survive. Over time, mild, moderate or severe disabilities may become noticeable. Some babies make a recovery without lasting effects – these are likely to be the babies who have had a mild brain injury. Your baby's health care team will talk with you about your baby and what may happen.

Why does your baby have HIE?

There may be many reasons why HIE has happened and it may not always be possible to know the cause. HIE might develop before, during or after birth. Your baby's doctor will talk with you about what the reasons might be.

Where will your baby be treated?

The recommended treatment for your baby will depend on the doctors classifying the HIE as mild, moderate or severe.

Babies with mild HIE are expected to improve. Your baby will be watched closely by the doctors and nurses/midwives for at least the first 6 hours after birth. Your baby may be in the Special Care Nursery (SCN) during this time and you will be able to visit. Sometimes mild HIE might progress and further treatment may need to commence within this timeframe.

Babies with moderate or severe HIE, usually need care in a newborn (neonatal) intensive care unit (NICU). If there is not a NICU at your hospital, your baby may need to be transferred to the closest NICU. Further information on transferring an unwell baby is provided in the Parent information brochure *Transferring an unwell or preterm baby* [www.health.qld.gov.au/qcg/html/consumers.asp].

What will happen in intensive care?

Your baby's heart rate, breathing patterns, blood pressure, and temperature will be monitored. Blood tests will also be taken. To help monitor, record, and assess brain function, electrodes may be placed on your baby's scalp and/or scans may be taken.

Whilst in intensive care, your baby may be fed through an intravenous (IV) line (drip). This delivers fluids, nutrients, and medicines into your baby's veins. If your baby's condition is severe enough, they may also receive a treatment which involves cooling the baby's body temperature. This is known as therapeutic hypothermia.

What is therapeutic hypothermia?

Research has shown that cooling babies a few degrees below their normal body temperature soon after birth may lessen brain damage. Your baby will be placed on a special cooling mattress. Your baby will be cooled for three days and then slowly rewarmed back to normal body temperature. Your baby will be assessed for any discomfort and medication (e.g. paracetamol) given if required. If your baby is being cooled, you will not be able to hold or cuddle your baby, as your body temperature can warm your baby up too quickly. You will be able to hold your baby when rewarming is completed. Your baby will be assessed for any discomfort and medication given if required.

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Parent educational information (Arabic)

إعتلال الدماغ بنقص الأكسجة والتروية الدموية

ما هو إعتلال الدماغ بنقص الأكسجة والتروية الدموية؟

يحدث إعتلال الدماغ بنقص الأكسجة والتروية الدموية في حال لم يتلق دماغ المولود الكمية الكافية من الأكسجين أو التروية الدموية الكافية خلال فترة الولادة. وقد تستخدم مصطلحات أخرى مثل "الإختناق" أو "الإختناق وقت الولادة". ويحدث نقص الأكسجين او التروية لدماغ المولود غالباً قبل، أو خلال وقت الولادة، ولكن قد يحدث أيضاً بعد فترة وجيزة من الولادة. ولا يقتصر تأثير نقص الأكسجين والتروية الدموية على الدماغ فقط، بل يشمل أيضاً الرئتين، والكبد، والقلب، والأمعاء، وكذلك الكليتين.

ويقسم إعتلال الدماغ بنقص الأكسجين والتروية الدموية إلى ثلاث درجات: خفيفة، ومتوسطة، وشديدة، حيث تتسبب الدرجات المتوسطة والشديدة بإعاقات مستقبلية في بعض الحالات، إضافة إلى تسبب الحالات الشديدة منها بالوفاة أحياناً.

ما هي مسببات إعتلال الدماغ بنقص الأكسجة والتروية الدموية؟

من غير الممكن معرفة سبب ذلك في كل الحالات، فقد يحدث إعتلال الدماغ بسبب بعض المضاعفات في الوقت المحيط بالولادة، مثل الحالات التالية:

- انفصال المشيمة الباكر عن جدار الرحم.
- تمزّق جدار الرحم.
- المخاض المديد (فترة الولادة أطول من المعتاد).
- في حال استعصاء الكتفين وقت الولادة.

ويفضّل سؤال الفريق الطبي المتابع لحالة طفلك للاستفسار عن سبب حدوث ذلك.

ما هي علامات إعتلال الدماغ بنقص الأكسجة والتروية؟

تختلف العلامات حسب شدّة الإصابة العصبية، وتشمل ما يلي:

- فرط الإستثارة، حيث يبدو المولود وكأنه متنّبه بشدّة، مع قلّة النوم.
- التهيّج، مع الإنزعاج من الضجّة، واللمس، والإضاءة.
- زيادة الميل للنوم.
- يبدو المولود رخواً، أو صلابة في تحريك الأطراف.
- وجود حركات غير طبيعية أو تشنجات.
- ضعف التنفّس أو توقفّه.
- إنخفاض مستوى الوعي أو الاستجابة.

وتحدّد درجة الإصابة لدى المولود طبيعة المعالجة الأفضل للحالة.

ما هي التحاليل والاستقصاءات الواجب إجراؤها للمولود؟

تتضمن بعض هذه الاستقصاءات ما يلي:

- مراقبة الوظيفة الدماغية: وهو جهاز يسجل الوظيفة الدماغية، ويظهر تأثير نقص الأكسجة على دماغ طفلك، كما يساعد في اتخاذ القرار بالبدء بالتبريد العلاجي.
- الأشعة الصوتية للدماغ: يساعد في اكتشاف الحالات مثل: النزف، الإحتشاء، أو الوذمة الدماغية.
- جهاز الرنين المغناطيسي: يعطي صورة مفصّلة ودقيقة لمناطق الدماغ، ويساعد على اكتشاف المناطق المتضررة أو المتأذية، ويُجرى عادة بعد الانتهاء من التبريد العلاجي.

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ما هي العلاجات المتاحة لإعتلالا الدماغ بنقص الأكسجين والتروية الدماغية؟

- يتعافى معظم المواليد المصابين بالدرجة البسيطة من إعتلال الدماغ بسرعة، ويُراقب المولود عادة للتأكد من استقرار حالتهم وعدم حاجتهم لعلاجات إضافيّة.
- أما في الدرجات المتوسطة والشديدة، فيوجد خطورة للوفاة أو الأذية الدماغية الدائمة.
- لتقليل هذه الخطورة، يخضع هؤلاء المواليد لمعالجة تدعى (التبريد العلاجي)، والتي يتوجب البدء بها خلال الساعات الست الأولى بعد الولادة، حيث تستخدم وسادة مخصصة للتبريد لخفض درجة حرارة المولود إلى ما بين 33 إلى 34 درجة مئوية لمدة 72 ساعة، وتملأ هذه الوسادة بسائل يمكن تبريده أو تدفئته حسب درجة حرارة حرارة المولود.
- تراقب درجة حرارة المولود بدقّة للتأكد من بقائها ضمن المجال المحدد قبل البدء بإعادة التدفئة بعد 72 ساعة، ويراقب الفريق المعالج كذلك سرعة ضربات القلب، والضغط الدموي، مع إجراء التحاليل اللازمة ومراقبة وظيفة الدماغ، وكذلك إعطاء الأدوية ومسكنات الألم عند الحاجة.
- يتسبب البدء بالعلاج بالقلق لبعض الأهل لعدم مقدرتهم على حمل طفلهم أو ملامسته عبر وضعه على صدر الأم وملامسة الجلد للجلد. يمكن لمس الطفل خلال العلاج بالتبريد، ولكن هذا يعتمد على مدى شدّة الإصابة لديه ومدى تأثره وحاجته للعديد من الأجهزة التي يوصل إليها.
- يفضل التحدث للطبيب أو الممرضة عند وجود أي سؤال أو تخوف يتعلق بالحالة الصحية للمولود.
- يمكن أن تقوم الأم خلال فترة التبريد بعصر الحليب (شفط الحليب) وكذلك التحدّث إلى الطفل وحتى القراءة له.
- أظهرت الدراسات بأن التبريد يمكن أن يفيد بعض المواليد المصابين بالدرجة المتوسطة أو الشديدة والمولودين بعد الأسبوع السادس والثلاثين، إضافة إلى تخفيض التبريد للمضاعفات والإعاقات المستقبلية لديهم.
- من المفيد دوماً الحديث مع الفريق المعالج عن فوائد التبريد العلاجي وكيفية إجرائه وأي مخاطر قد تتعلق به وأهميته في التقليل من المضاعفات المستقبلية.

ما هي المضاعفات المستقبلية لإعتلال الدماغ بنقص الأكسجة والتروية؟

بالرغم من شفاء قسم من الحالات بشكل تام دون أية مضاعفات مستقبلية، إلا أن بعض الحالات قد تعاني من صعوبات تستدعي الدعم من الطاقم الطبي، مثل العلاج الفيزيائي (العلاج الطبيعي)، أو إضطرابات اللغة والنطق.

في حال عُولج طفلك بالتبريد، سيقوم الفريق المعالج بمناقشة نتائج التصوير بالرنين المغناطيسي معكم، كما سيشرحون لكم المضاعفات المستقبلية المحتملة، مع شرح خطة العلاج والتدبير المستقبلي للطفل، مع تحديد الزيارات والمتابعات اللازمة حسب الحالة.

يجب متابعة جميع المواليد الذين تأثروا بنقص الأكسجة الدماغية ومراقبة تطورهم بدقّة، وخصوصاً خلال أول عامين من العمر.

عندما يبلغ طفلكم العمر ما بين 18 إلى 24 شهراً، سيقوم الفريق الطبي بفحص النقاط التالية المتعلّقة بتطورهم:

- الوظيفة الحركية (مقدرته على التحرّك ضمن المتوقّع نسبة لعمره، مع حمل الأشياء والإمساك بها).
- الوظيفة الحسيّة: (الرؤية، واللمس، والتذوق، والشم، والسمع).
- اللغة: (المقدرة على التواصل وفهم المفردات).
- الجانب المعرفي: (المقدرة على تعلّم التفكير وربط الأمور ببعضها).

- يمكن لهذا الفحص والتقييم أن يزوّد بفهم أفضل لتطوّر الطفل مع الإجابة عن معظم تساؤلاتكم.
- قد يتطوّر شلل دماغي لدى بعض المواليد، وهو عبارة عن حالة فيزيائية جسمية تؤثر على الحركة، الوضعية، والتسيق الحركي. وقد يصاب بعض المواليد بمشاكل بالرؤية أو السمع أو مشاكل بالتعلّم أو صعوبات سلوكيّة. وقد تتطور لدى البعض منهم نوب صرعية (تشنجات).
- قد تتسبب معرفة الأهل لإحتمالية إصابة طفلهم بمضاعفات مستقبلية بالقلق والإحباط في البداية، لذلك يجب توفر فرق لدعم الأهل ومساندتهم إضافة إلى الفريق الطبي المعالج ودوره الأساسي في ذلك.

6. Responsibilities

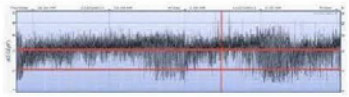
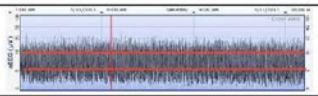
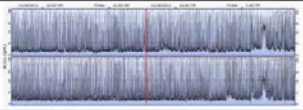
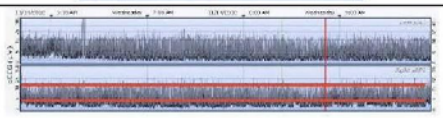
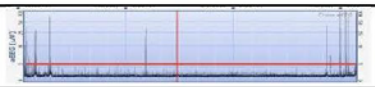
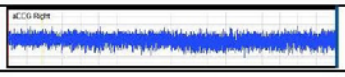
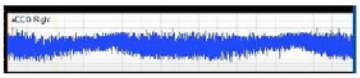
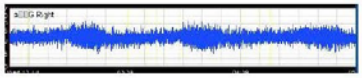
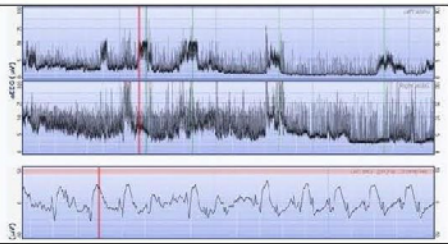
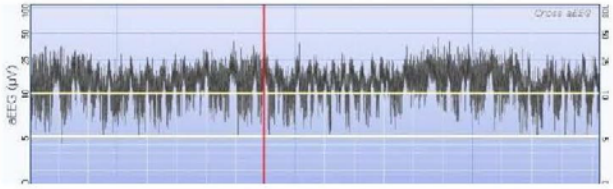
6.1 Leader's responsibility of each health care facility to ensure full implementation

7. Attachments

7.1 All appendix's names that mentioned in the policy.

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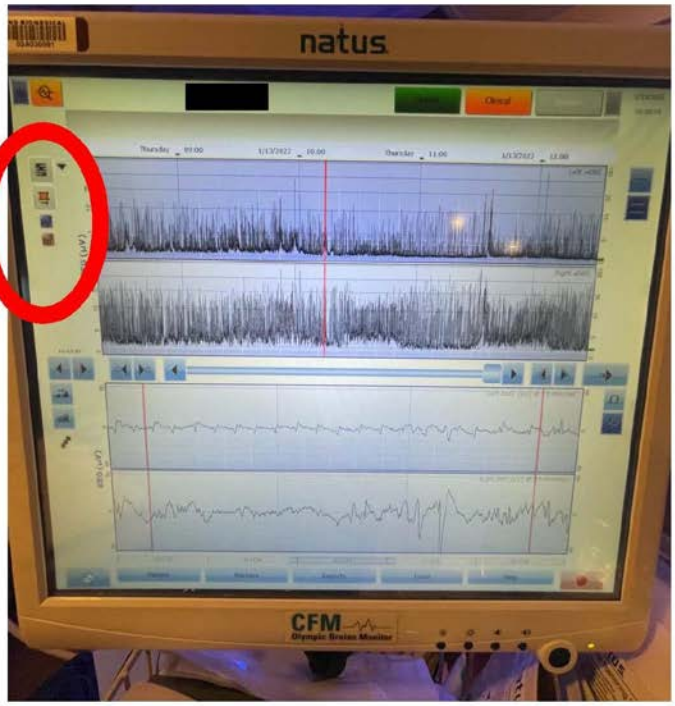
Cerebral Function Monitoring (CFM) guidelines

Background pattern		
Continuous	Continuous activity with lower margin around 5-10 µV and maximum amplitude of 10-50 µV	
Discontinuous	Discontinuous background with lower margin variable, but below 5 µV and upper margin above 10 µV	
Burst suppression	Discontinuous background with lower margin without variability at 0-2 µV and bursts with amplitude >25 µV BS+:>100 bursts/h BS-: <100 bursts/h.	
Low voltage	Continuous background pattern of very low voltage both upper and lower margin below 5 µV	
Inactive, flat	Primarily inactive background below 5 µV	
Sleep-Wake Cycling		
No SWC	No cyclic variation of the aEEG background	
Imminent/immature SWC	Some, but not fully developed, cyclic variation of the lower amplitude, but not developed as compared with normative gestational age representative data.	
Developed SWC	Clearly identifiable sinusoidal variations between discontinuous and more continuous background activity, with cycle duration >20 min	
SEIZURE		
Seizure: Repetitive pattern showing evolution in amplitude and/or frequency		
Saw Tooth appearance/ Status Epilepticus		

How to use the RecogniZe software in Olympic Brainz Monitor

This automatic detection software helps you review recorded CFM easily and alerts you about any clinically significant change that may need your attention. It does not replace your clinical acumen. So always check tracings especially raw EEG tracings before clinical intervention

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The CFM machines you are using in the unit are equipped with an automatic seizure and background detection algorithm

You have the option of either using it or not

It is always running on the background

The panel highlighted here identifies the Recognize software



Touch the screen on this button to see the detections

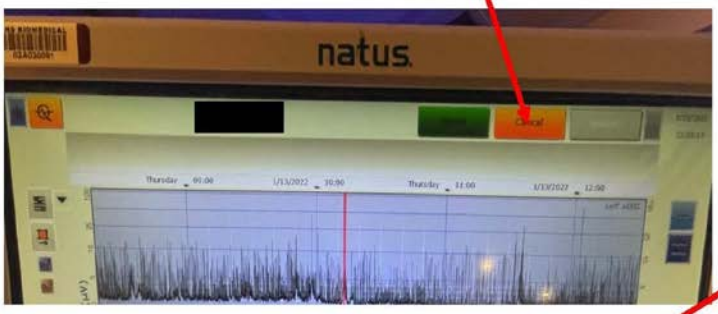
If you want to narrow the panels, touch the screen here

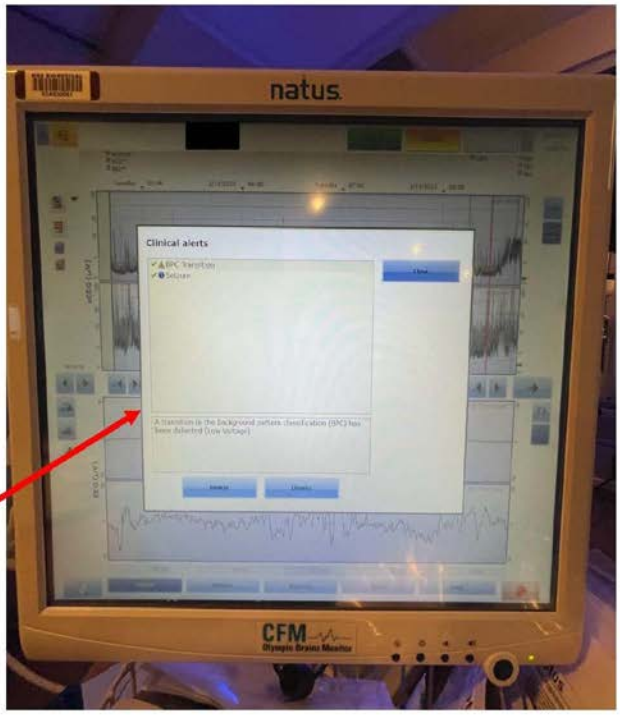
Orange line in the upper panel shows when a seizure event is recognized

The colors in this panel indicates different background patterns

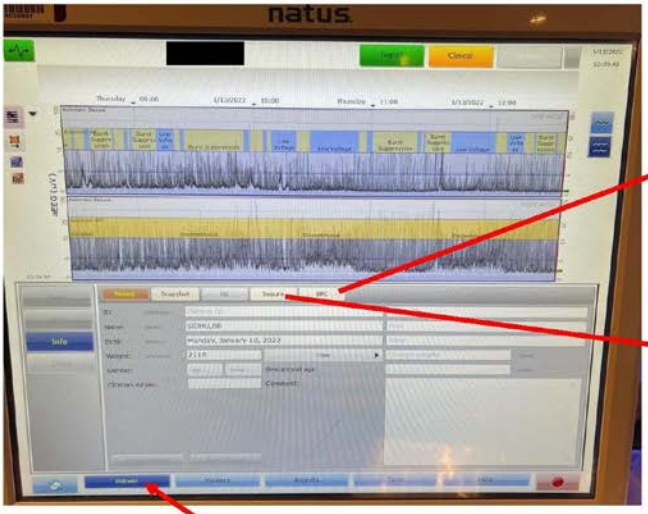
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This button blinks when there is a seizure detected or background changes suddenly

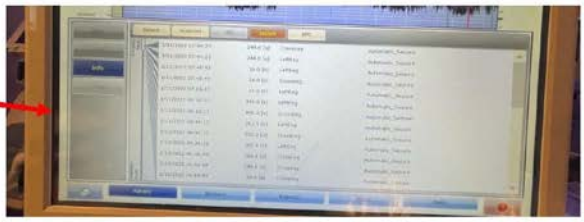




If you touch the clinical button, another window opens that defines the change detected







If you would like to review all detections in a tabular format press here

Then select Seizure or BPC to see each list

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Press this button to learn more about the patterns



Warning: Computer algorithms can not replace your clinical acumen, so always review the raw EEG and aEEG yourself before clinical interventions



This orange line indicates a seizure confirmed in the raw EEG tracing

Remember: Every orange line may not be a seizure, always look at the corresponding raw EEG by aligning the red cursor with the orange line

8. Performance measurement

8.1 The formula of the related KPI to monitor the compliance of the policy and outcome.

9. Related references

1. Bonifacio, Sonia Lomeli, and Shandee Hutson. "The Term Newborn: Evaluation for Hypoxic-Ischemic Encephalopathy." Clinics in Perinatology, vol. 48, no. 3, 2021, pp. 681–95, doi:10.1016/j.clp.2021.05.014.
2. Yieh, Leah, et al. "Neonates with Mild Hypoxic–ischaemic Encephalopathy Receiving Supportive Care Versus Therapeutic Hypothermia in California." Archives of Disease in Childhood. Fetal and Neonatal Edition, 2021, doi:10.1136/archdischild-2021-322250.
3. Thigha, Raja, et al. "Magnitude, Short-Term Outcomes and Risk Factors for Hypoxic Ischemic Encephalopathy at Abha Maternity and Children Hospital, Abha City, Saudi Arabia and Literature Review." Journal of Clinical Neonatology, vol. 9, no. 2, Wolters Kluwer India Pvt. Ltd, 2020, pp. 98–110, doi:10.4103/jcn.JCN_12_19.
4. Lemyre, Brigitte, and Vann Chau. "Hypothermia for Newborns with Hypoxic-Ischemic Encephalopathy." Paediatrics & Child Health, vol. 23, no. 4, Oxford University Press, 2018, pp. 285–91, doi:10.1093/pch/pxy028.
5. Carlton, Katherine, et al. "Quality Improvement for Reducing Utilization Drift in Hypoxic-Ischemic Encephalopathy Management." Journal of Perinatal Medicine, vol. 49, no. 3, De Gruyter, 2021, pp. 389–95, doi:10.1515/jpm-2020-0095.
6. Queensland Clinical Guidelines. Hypoxic-Ischemic Encephalopathy (HIE). Guideline No. MN16.11-V9-R21. Queensland Health. 2018. Available from: http://www.health.qld.gov.au/qcg or https://www.health.qld.gov.au/qcg/publications#neonatal [Accessed 12 October 2021].
7. Lemyre B, Chau V. Hypothermia for newborns with hypoxic-ischemic encephalopathy. Paediatrics & child health. 2018 Jun 12;23(4):285-91.
8. Amer YS, Wahabi HA, Abou Elkheir MM, et al. Adapting evidence-based clinical practice guidelines at university teaching hospitals: A model for the Eastern Mediterranean Region. J Eval Clin Pract. 2018;1–11. https://doi.org/10.1111/jep.12927
9. Amer YS, Elzalabany MM, Omar TI, Ibrahim AG, Dowidar NL. The 'Adapted ADAPTE': an approach to improve utilization of the ADAPTE guideline adaptation resource toolkit in the Alexandria Center for Evidence-Based Clinical Practice Guidelines. J Eval Clin Pract. 2015 Dec;21(6):1095-106. doi: 10.1111/jep.12479
10. Fervers B, Burgers JS, Voellinger R, Brouwers M, Browman GP, Graham ID, Harrison MB, Latreille J, Mlika-Cabane N, Paquet L, Zitzelsberger L. Guideline adaptation: an approach to enhance efficiency in guideline development and improve utilisation. BMJ quality & safety. 2011 Mar 1;20(3):228-36.
11. Johnston A, Kelly SE, Hsieh SC, Skidmore B, Wells GA. Systematic reviews of clinical practice guidelines: a methodological guide. Journal of clinical epidemiology. 2019 Apr 1;108:64-76.

12. Brouwers MC, Spithoff K, Lavis J, Kho ME, Makarski J, Florez ID. What to do with all the AGREEs? The AGREE portfolio of tools to support the guideline enterprise. Journal of Clinical Epidemiology. 2020 Sep 1;125:191.
13. Agreetrust.org. 2021. The Appraisal of Guidelines for Research and Evaluation (AGREE) Enterprise website. [online] Available at: <https://www.agreetrust.org/> [Accessed 14 September 2022].
14. Amer YS, Anabrees J, Abdelmawla M, Abdelgader A, Almazroei A, Alhifzi I, Alonazi AH, Sabr Y, Hneiny L, El-Malky A, Alshalawi A. Clinical Practice Guidelines for Neonatal Hypoxic-Ischemic Encephalopathy: A Systematic Review using the Appraisal of Guidelines for REsearch and Evaluation (AGREE) II Instrument. Frontiers in Pediatrics.;11:349. https://doi.org/10.3389/fped.2023.1092578
15. Amer YS, Anabrees J, Abdelmawla M, Abdalgader A, Almazroei A, Alhifzi I, AlOnazi AH, Sabr Y, Hneiny L, El-Malky A, Alshalawi A, Alayoubi A, Chaudhry IA, Elkhateeb O. Clinical practice guidelines for neonatal hypoxic-ischemic encephalopathy: A systematic review using the appraisal of guidelines for research and evaluation (AGREE) II instrument. Front Pediatr. 2023 Mar 22;11:1092578. https://doi.org/10.3389/fped.2023.1092578

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