NHS Resolution

Case story

Good practice: Optimising care in neonatal hypoxic ischaemic encephalopathy

Part of NHS Resolution's maternity campaign 2022/25
#ImprovingMaternityOutcomes

Advise / Resolve / Learn

Early Notification
Case story guidance

Background

In Advise, resolve and learn Our strategy to 2025, our second strategic priority is to share data and insights as a catalyst for improvement and our third is to collaborate to improve maternity outcomes. Aligned with these aims we have gathered together learning from our Early Notification Scheme and produced a number of case stories to help support learning from harm identified through claims.

These resources

Our case stories are illustrative and based on recurring themes from real life events. These experiences have been highlighted and shared with you, to help identify potential risks in your clinical area, promote learning and prevent fewer incidents like these occurring in the future.

How to use the case stories

There are various ways you may use the case stories, from individual self-directed learning to support continuous professional development to using them in a team environment. The idea is that by learning from the experience of others, maternity unit staff will be able to change their approach to care.

As you read or discuss the examples of incidents that we are sharing we ask you to consider the following:

- Could this happen in my organisation?
- What changes within my organisation or team might I consider after reading the material, including individual practice?
- What information should I share with the team?
- How can I share the learning from this case story?
- Who else needs to know?

Practical applications

1. Consider the key elements of the case story and through reflection apply the learning to influence your practice in the future.
2. Use this case study as a point of discussion at appropriate multi-disciplinary team meetings, safety huddles, and/or human factor's training.
3. Use this case study to create a multi-disciplinary simulation in the clinical area or on mandatory training.
4. Review your claims scorecard to identify whether there are any themes which relate to this case story and identify where improvements could be made.

Case story

This case story is illustrative based on a range of examples of real events. NHS Resolution is sharing the experience of those involved to help prevent a similar occurrence happening to women and people giving birth, families, and staff.

As you read about this incident, please ask yourself:

- Could this happen in my organisation?
- Who could I share this with?
- What can we learn from this?

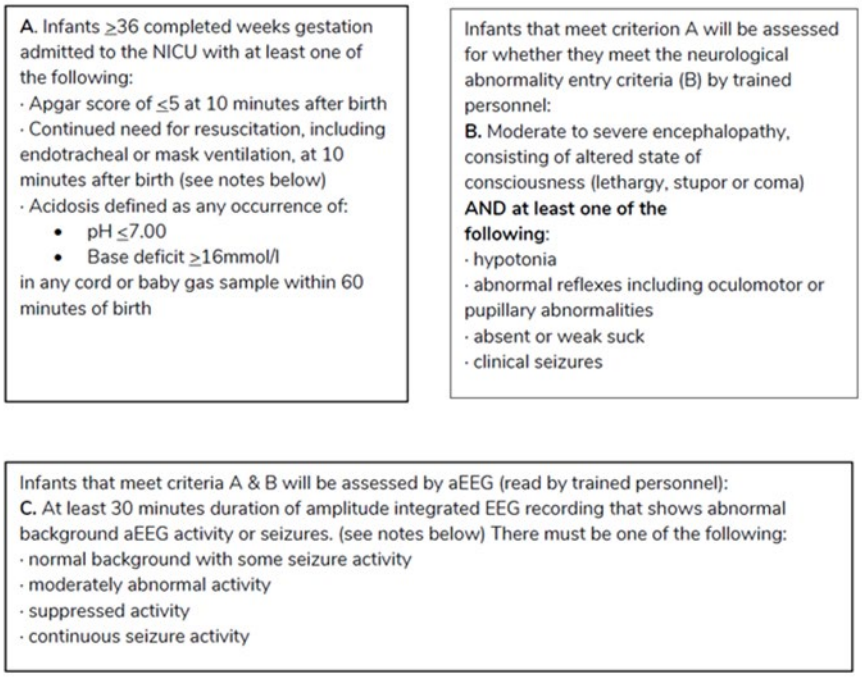
Topic: The optimisation of neonatal care for babies who have hypoxic ischaemic encephalopathy.

Key points

Therapeutic hypothermia is an effective treatment to reduce mortality and disability for babies who have had perinatal asphyxia leading to hypoxic ischaemic encephalopathy (HIE).

Criteria outlined by the TOBY study[1] should be used to identify babies who will benefit from therapeutic hypothermia. This is outlined in the British Association of Perinatal Medicine (BAPM) Framework for Practice of therapeutic hypothermia for neonatal encephalopathy[2]. Babies should meet criteria A, B and C to benefit from therapeutic hypothermia.

Figure 1: The BAPM framework for therapeutic hypothermia criteria[2] is based on the criteria in the TOBY study[1]



HIE symptoms and signs evolve over time and several neurological assessments of a baby who meets criteria A should take place in the first few hours. Signs and symptoms can progress or even improve.

The decision for therapeutic hypothermia should be discussed with parents in an honest and supportive way.

Families should be supported to stay with a baby admitted to a neonatal unit, even if they are transferred to another neonatal unit.

Therapeutic hypothermia is an intensive care treatment and babies undergoing therapeutic hypothermia must have close monitoring of their cardiovascular status, fluid management including glucose levels, and appropriate support for haematological complications.

Maternity Story

Ms X attended the maternity assessment unit at 38+4 weeks gestation in established labour. A CTG was commenced due to a history of reduced fetal movements prior to admission. A fetal bradycardia was identified, and following discussion with Ms X, a decision was made to deliver the baby by category 1 caesarean birth under a general anaesthetic.

The baby was born floppy, pale with no respiratory effort and a slow heart rate. The neonatal team followed the Newborn Life Support (NLS) algorithm[3] to provide initial resuscitation of the baby. The baby required chest compressions and ventilation breaths at a ratio of 3:1 for four minutes after which the heart rate was auscultated to be >100 beats per minute (bpm). Chest compressions were stopped, and ventilation breathes were continued and the baby was intubated at eight minutes of age.

Paired cord gases were taken and communicated to the neonatal team:

	pH	Base excess	Lactate
Arterial	< 6.72	unrecordable	unrecordable
Venous	6.86	-21.9	24

The baby was transferred to the local neonatal unit (LNU). Intravenous (IV) access was obtained, a septic screen was taken, and antibiotics and vitamin K were given within 1 hour of birth. The baby was started on volume-targeted synchronised ventilation of 4mls/kg.

The first blood gas showed a glucose level of 1.8g/dL and pCO2 of 5.6kPa. A 2.5mls/kg bolus of 10% IV dextrose was given, and IV fluids were started at 40mls/kg/day (2.77mg/kg/min of glucose).

A second blood gas 30 minutes later showed a glucose level of 1.6g/dL and a pCO2 3kPa.

The ventilation mode was changed to volume-targeted synchronised intermittent mandatory ventilation with a respiratory rate of 25 and a volume of 4mls/kg and the

dextrose concentration was increased to 12.5% and the volume increased to 60mls/kg/day (5.2mg/kg/min of glucose).

A third blood gas showed a glucose of 2.6 g/dL and pCO2 4.5 kPa.

Cerebral Function Monitoring (CFM) was started and showed moderately abnormal activity. Neurological examination found that the baby remained floppy with abnormal reflexes.

The baby had been assessed as meeting criteria A, B and C for therapeutic hypothermia[1]. The baby had cardio-respiratory stability and passive cooling was started at one hour and 30 minutes of age and a referral to the tertiary neonatal intensive unit (NICU) was made. The target cooling temperature was reached before six hours of age.

Ms X's partner had been updated about the baby's birth and was taken to the neonatal unit when the baby was transferred. The neonatal consultant met the parents and congratulated them on the birth of their baby. They explained what HIE was and explained how therapeutic hypothermia may help prevent further brain injury. They also explained likely long-term morbidity and mortality associated with perinatal brain injury.

The baby was transferred to the regional NICU and was shortly followed by Ms X who was transferred by the midwifery team. The baby received 72 hours of therapeutic hypothermia. During this time, Ms X was supported to express breast milk and both parents were supported to actively partake in the care of their baby such as changing nappies, giving breast milk for mouth care and participating in ward rounds. The parents were regularly updated by senior neonatal staff who responded to all of their questions.

An MRI brain scan on day seven showed changes consistent with hypoxic ischaemic injury, which suggest that the baby is at risk of developing cerebral palsy. They were discharged home on day 15. The baby is being followed up and has regular physiotherapy.

Learning Points

This case highlights the importance of:

- **Knowing when cord gases are indicated and how should they be communicated**

In this case, during the neonatal stabilisation, paired cord blood gases were taken. Paired cord blood gas samples are indicated if a baby is born in poor condition where they may have low tone, abnormal breathing, or heart rate[4] or where there has been an attempt at assisted vaginal birth[5]. Cord gas results are used to help determine if a baby is at risk of HIE and whether they could benefit from therapeutic hypothermia[2]. Communicating this information early to the neonatal team can help ensure the baby gets the appropriate care that they need. HIE is an evolving condition so if perinatal acidosis is demonstrated on blood gases they should have

several neurological examinations in the first six hours of life[2]. Depending on local policy, this may occur on the neonatal unit or on delivery suite/postnatal ward by a neonatal clinician.

The Scottish Cooling Group has produced a free training video on how to perform a neonatal neurological assessment to support its Neuroprotection Care Pathway[6].

Therapeutic hypothermia has only been shown to be beneficial if it is started within 6 hours of birth[2].

- **Babies who have HIE are at greater risk of hypoglycaemia than healthy term babies**

Perinatal acidosis is a risk factor for hypoglycaemia and they will require blood glucose monitoring after birth[7].

In this case, the baby had a low blood glucose level of 1.8g/dL which required an IV 2.5mls/kg 10% dextrose bolus followed by an infusion of IV 10% dextrose, and subsequently an increase in the concentration of maintenance dextrose to 12.5% as well as an increase in the infusion rate. This increased the glucose delivery rate by 2mg/kg/min. The flow charts included in the BAPM framework for practice for the identification and management of neonatal hypoglycaemia in the full term infant[7] were followed. A blood glucose level of 2.6g/dL was targeted in this case due to perinatal acidosis. This is recommended in the BAPM therapeutic hypothermia framework[2].

After birth, there is a period of physiological reduction in glucose concentration which then increases two to three hours after birth in healthy babies[7]. Intrapartum hypoxic ischaemia causing perinatal acidosis disrupts the physiological metabolic transition and is associated with lower blood levels of glucose compared to healthy babies[8]. 25% of babies with moderate to severe HIE have hypoglycaemia[9]. There is some emerging evidence that hypoglycaemia may be an independent risk factor for poorer long term neurological outcome in babies who have had HIE[10].

- **Managing a baby's pCO2 in HIE is important**

In this case, the baby required intubation and ventilation. They were started on volume guided synchronised ventilation. A blood gas showed a pCO2 of 3kPa which is low. Hypocarbia and hypercarbia should be avoided in HIE[2]. Thus, the ventilation strategy was changed to synchronised intermittent mandatory ventilation (SIMV) with a lower respiratory rate of 25 to maintain a normal pCO2.

The homeostasis of acid-base balance is an important physiology. When there is significant acidosis such as in perinatal acidosis, physiologically the baby may try to hyperventilate to correct the acid-base balance by reducing the pCO2.

The physiology of paO2 and paCO2 is dependent on the temperature of the patient and when interpreting blood gases, the temperature of the patient should be inputted into the blood gas analyser to ensure an accurate paO2 and paCO2 measurements.

There is some evidence that significant hypocarbia is associated with poorer neurological outcomes in babies with encephalopathy[11]. Avoiding hypocarbia is therefore an important aspect of neonatal intensive care in babies with HIE and ventilation strategies such as SIMV can be useful for this.

- **When to start therapeutic hypothermia**

In this case, as the baby met criteria A, B and C for therapeutic hypothermia at one hour and 30 minutes passive cooling was initiated. Therapeutic hypothermia should be initiated before six hours of age if criteria A, B and C have been met[2]. If there is no CFM available, and the baby meets criteria A and B then therapeutic hypothermia treatment should be initiated and not delayed for CFM[2].

Prior to starting therapeutic hypothermia, including passive cooling, the baby should have achieved cardio-respiratory stability and should have completed resuscitation. It is not recommended to start hypothermia treatment while the baby is undergoing active resuscitation such as chest compressions or being given resuscitation drugs. The baby should have an adequate heart rate and oxygen saturations prior to starting therapeutic hypothermia. Treatment, including passive cooling should only be started when there is continuous temperature monitoring, preferably with a rectal thermometer probe. This is to avoid over-cooling[2].

- **Communicating with the family and a culture of minimising separation of families should be achieved**

In this case, Ms X had undergone a general anesthetic for a category 1 caesarean birth. Her birth partner had been updated and attended the neonatal unit to be with the baby. Both parents were then updated by a senior member of the neonatal team as soon as possible after the baby was stabilised. Early open and honest communication with parents is an essential aspect of neonatal care[2]. All possible efforts should be taken to ensure effective communication with parents. This includes arrangements with a language interpreter if English is not the parents' preferred language[12].

In this case, Ms X was transferred as soon as possible to the same hospital as the baby. Minimal separation of families should occur in neonatal care and ensuring that parents have access to facilities and resources for them to be resident with their baby and to take an active role in caring for their baby is recommended as standard of practice[13,14].

Considerations for your hospital

- Does your trust have a clear policy of when cord gases should be taken?
- Is there a process in place for the maternity team to communicate cord gases to the neonatal team?
- Does your neonatal team have the knowledge and skills required to perform neonatal neurological examinations? Have they seen the Scottish Neuroprotection Care Pathway (NCP) for Infants with HIE[6] training videos?
- Does your trust have an HIE guideline?

- Does your trust have a pathway to facilitate interpretation services if English is not the parents' preferred language?
- Do you always use interpretation services when communicating with families when English is not their preferred language?
- How do you support safe transfer of a woman or person who has given birth to enable them to be cared for in the same hospital as their baby?
- Does your hospital follow the Bliss Baby Charter: Helping to make family-centred care, or similar guidance, a reality on your neonatal unit[15]?

What has happened as a result?

This case story is illustrative. If a similar case were to occur in real life, then it would be referred to NHS Resolution's Early Notification Scheme. NHS Resolution's in-house, specialist teams will review all available information about the care received, to decide whether there is any evidence of substandard care which could potentially result in compensation.

The expertise of NHS Resolution is used to proactively assess the legal risk and provide early support to families where liability is established.

NHS Resolution supports an open, transparent discussion between clinicians and families following adverse events[16]. The scheme is also designed to improve the experience for NHS staff by time limiting the need for protracted involvement in the legal process and rapidly share learning.

It is very important to note that no amount of money is comparable with the loss of a child or a child living with lifelong neurological injuries. Where poor outcomes occur as a result of deficiencies in care, NHS Resolution aims to resolve all such claims or cases fairly and as quickly as possible.

The current compensation cost to the NHS for a baby who has long term severe brain injury is on average £13.5 million. The human costs to the babies, families and clinical teams involved are immeasurable.

Resources:

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