

Yorkshire Neonatal Network (North) Mortality Review Group (MRG) Summary of Learning Points 2019-2020

From the five MRG meetings between February 2019 and February 2020, a number of learning points have been identified. A number of these reflect thoughts for how the patient journey could have been managed in a smoother way even though these changes would not have made a difference to outcome. Mortality review is a good opportunity for detailed study of a particular patient's journey and as such yield a lot of useful learning which is often applicable in many other types of cases. These reflections and recommendations have been summarised below and reflect the local and MRG views on what could be learnt from individual cases.

Antenatal and Perinatal issues

Lethal Conditions

In potentially lethal conditions where the pregnancy is beyond 24 weeks, antenatal counselling ideally should be completed as soon as possible in case of preterm delivery. Where there is a known lethal genetic condition, senior support from a consultant neonatologist is helpful. At times parents can find it hard to accept that treatment after birth is futile and in these cases or where there is a difference of opinion between the family and the medical team, a second opinion can be sought from another neonatal service.

Where complex anomalies are anticipated, a joint delivery plan and specific postnatal care plan which covers all eventualities should be agreed upon wherever possible, and completed as soon as possible as these babies often deliver early. Even in conditions where no active treatment can be offered and death is expected but is not imminent, palliative surgery to improve quality of life can be offered. In cases of antenatally diagnosed inoperable cardiac disease where palliative care is the most likely outcome, delivery in a cardiac centre should be considered, in order to facilitate confirmation of the diagnosis soon after birth.

Conditions treatable in-utero

In cases of fetal arrhythmia where there are no other indicators for immediate delivery, there are potentially options for treatment with maternal flecainide to try and achieve sinus rhythm in utero.

Immediate post birth considerations

Deferred cord clamping brings well documented benefits and may be overlooked in cases of urgent delivery. The need for this can form part of the WHO checklist for caesarean sections with an agreed plan for timing depending on the condition of the baby. All deliveries recorded through Badger should have time of cord clamping documented within this system.

Differential Diagnostic issues

Genetics

In babies with suspected genetic conditions, CGH array results can take longer than 5 days. If a more urgent result is needed, a specific request needs to be made using the support of a local geneticist. In some cases it is worth consideration of sending DNA on index cases to help diagnosis in future pregnancies but the parents need to be fully aware of this. Where CGH array is normal, but the baby has significant unexplained clinical features, early involvement of geneticists is helpful as they may recommend rapid exome sequencing.

In cases with extreme persistent acidosis, particularly where the cause is not clear, a specific gene diagnosis may be considered and supported by a more detailed family history.

Other postnatal diagnoses

- In the absence of other signs of HIE, other causes of severe floppiness at birth should be considered such as muscular or neurological conditions. Cervical cord injuries can also present with severe hypotonia and apnoea.
- NEC can still occur in babies fed exclusively on maternal milk and diagnosis should be actively sought if symptoms are suggestive of this.

Bereavement and Post Mortem issues

The organisational steps taken around the time of a baby's death can make a significant difference for parents. Compassionate discussion about options and benefits of post-mortem can often help with some of the "why" aspects after a baby dies. Reuniting families where twins are in separate hospitals brings organisational challenges and this is where hospice care can help in this situation. Compassionate extubation after repatriation can avoid many technical issues with ensuring twins stay together or can enable parents to be close to home and their family members.

End of life checklists are useful to ensure all families are offered equal services after their baby dies e.g. to ensure a PM is offered around the time of death etc. All families should be offered a post mortem when the cause of sudden deterioration is unclear, irrespective of religion. Discussion with a coroner may help to support this discussion. A limited post mortem has value where parents are unsure about full post mortem and can allow for later genetic and prenatal counselling.

Human Tissue Authority Considerations

There are administrative considerations for certain parts of post mortem tests. When taking skin, blood or other tissue biopsies after death, a human tissue act form needs to be completed. The HTA manager in each Trust can help navigate through the process for such post mortem samples and in some cases this may be the same as the SUDIC process. As part of guidance to clinicians, information on local HTA license status should be available.

Bereavement follow up and PMRT

Where more than one medical team has been involved in a baby's care, joint bereavement meetings can have benefit to families but need to be prepared well. It is important to seek parental views on which counselling is likely to be the most beneficial to them. Once a decision about counselling is made, it is then vital to establish who is chairing this process and arranging to invite parents for this meeting.

PMRT has challenged all units in the depth of information and the degree of MDT discussion required. After a baby has died, a full copy of the clinical notes should be retained to facilitate PMRT. The original notes will be required for post mortem, safeguarding or child death reviews which can take many months to be completed. In order to complete PMRT fully, information such as feedback on debrief after resuscitation are required. It is good practice to hold an early debrief to look at safety aspects and any immediate actions to be taken and all details of this should be fully documented in the notes.

PMRT also has the benefit of allowing reviewing staff to identify latent risks during their detailed review of the first 24 hours of a baby's life. While these may not be pertinent to cause of death, this can allow refinement of guidelines and practices that may increase risk of complications.

Documentation and communication issues

Procedures for alerting the neonatal team to attend deliveries are well established but are not always clear and understood by all members of midwifery, obstetric and neonatal nursing teams. Procedures should be reviewed as part of regular MDT discussion regularly in order to identify procedural changes that may impact the smooth communication in emergency situations. Safety huddle between neonates and midwifery are vital in ensuring opportunities for discussions are in place.

Mortality reviews identified other separate issues relating to documentation and communication

- Following category 1 LSCS, documentation of full neurological findings are helpful especially if transfer to PNW is considered a safe option.
- Consultants in SCBU/LNUs should be encouraged to use support for difficult cases and decision making from NICU consultants via Embrace, even if immediate request for transfer is not appropriate or desirable.
- Yammer and Forward are NHS approved information sharing Apps for clinical information if a remote second opinion is required. Forward uses nhs.net email and therefore it is possible to find any user with an nhs.net email address.

- All cranial USS or other imaging should be recorded and stored as access to these files may be required in the future or as part of the PMRT review. This should include neonatal unit scans as well as formal radiology departmental ones.
- For babies with long lines, daily documentation of skin integrity and line dressing check is important. This kind of documentation may not be specifically easy to record as part of a standard observations chart but some units do have more detailed neonatal specific observation records that can be adapted for local use.

Practical procedures

Vascular access

Delay in vascular access can arise from persistence by one member of staff to insert a cannula. Units should have escalation policies where multiple cannulation attempts are required and monitor that this is followed

Umbilical Venous Catheters

UVCs can provide vital early venous access but also are associated with complications especially in extremely low birth weight babies. In conditions such as hydrops, an early UVC may be the only vascular access possible and therefore are vital. However (especially in smaller babies), UVCs that track into hepatic vessels or are low lying carry additional risks of extravasation. There is helpful guidance available through BAPM. If UVCs with suboptimal positioning are not replaced quickly, as a minimum, the reason for keeping them in situ should be risk assessed and the rationale documented in the case notes.

<https://www.bapm.org/resources/10-use-of-central-venous-catheters-in-neonates-revised-2018>

Therapeutic agents

A number of issues relating to commonly used agents were identified through the mortality reviews. Whilst these were not the sole contributors to a baby's death, the complications arising made clinical decision making more difficult and, in combination, made a high risk situation even harder to manage.

Surfactant

LISA has transformed early treatment for respiratory distress syndrome but can also bring complications or delay more definitive treatment. All units should have guidelines for LISA which are monitored through audit.

If a standard first dose of a full vial of curosurf is used in all cases, it brings the risk of overdose in babies below 450g birth weight as 120mg vial can equate to around 300mg/kg.

Congenital Diaphragmatic hernia

Babies with congenital diaphragmatic hernias are usually born in specialised centres. European guidelines for management are available and management of this condition should be in line with this consensus view. The 2010 guideline and the 2015 update include information on referral for ECMO.

<https://www.karger.com/Article/FullText/444210>

<https://pubmed.ncbi.nlm.nih.gov/27077664/>

Emergency blood transfusion

In an emergency, if irradiated blood is not available, CMV negative, non-irradiated O negative blood can be used in order to avoid significant delays in treatment. The risks of subsequent complications due to non-irradiated blood are outweighed by the benefits of rapid transfusion in some cases.

Sodium Bicarbonate and risk of tissue damage

Sodium bicarbonate can be given peripherally with care if a central access is not possible (Prescribing and administering information is available through YNN website).

<file:///C:/Users/User/Downloads/Sodium%20Bicarbonate%20-%20I2%20V1.pdf>

Difficulties with pancuronium resistance

Rocuronium infusion can be an effective muscle relaxant if a baby develops resistance to pancuronium boluses. (Leeds PICU have guidance on regimes and can be contacted for advice)

Feed thickeners and risk of NEC

Thickeners should be used with caution in premature babies as they are associated with a number of complications including inspissation of solids and NEC. Jejunal feeds may be a suitable alternative where vomiting is persistent even on continuous milk feeds.

All additives to milk should be used with caution and the total rise in osmolarity considered especially in association with a transition from breast to formula milk.

Transfer of patients

Some neonatal units and labour and delivery suites are not co-located with Emergency departments and this can present difficulties when transferring a sick baby that has delivered in ED. In such units, good patient flow pathways way from L&D are essential to ensure pregnant women presenting to ED can be transferred to obstetric services as soon as possible.

Other problems can arise in transfers between neonatal services where a mother still requires inpatient treatment. It is important that the mother's medical needs are communicated to the maternity services of the receiving unit as soon as possible so that the necessary inpatient bed can be arranged. This becomes especially important where a baby is critically unwell as parents need to be able to join in decision making for their child; as well as be present should the baby's condition deteriorate.

Sepsis

Sepsis and chorioamnionitis

Sepsis is a common problem and early targeted antibiotics may improve outcomes especially in cases of chorioamnionitis. Where there is evidence of this, it is useful if the placenta is sent for full microbiological assessment to guide neonatal antimicrobial treatment. When transferring a baby between neonatal units, all information relating to the maternal health should be considered and results for microbiology in particular sought from the referring unit or forwarded to the receiving unit as part of the admission process.

Respiratory failure

Extubation failure can be due to a number of causes and sepsis should be considered as a cause especially with significant acidosis. A decision not to treat with antibiotics in such situations should be an active one.

Late onset sepsis

Sepsis is one of the most common causes of deterioration in neonatal patients and antibiotics should be started proactively. Treatment needs to remain broad and all possible causes of sepsis considered including viral. Anti-viral agents should be considered as an addition to therapy in severe cases especially late onset sepsis. Overwhelming herpes simplex sepsis is uncommon but occurs usually in babies from women with no known previous history.

Equipment issues

Resuscitation equipment

Smooth resuscitations often depend on easily available, comprehensively stocked resuscitation equipment. Whilst Labour and Delivery services are often responsible for this equipment, it can be helpful for Neonatal units to offer regular review of both content and checking procedures. There are benefits from neonatal services having responsibility for resuscitation trolleys used on L&D.

Equipment for extremely low birth weight infants should be available in the main resuscitation trolleys on L&D as not all such deliveries can be anticipated but equipment should be clearly labelled as intended for this group of babies to avoid inadvertent use of too-small ETTs in particular.

Ventilator issues

The Draeger Vn500 is used in many units and is excellent for most forms of ventilation but it cannot deliver breaths of less than 2.5mls in its volume guided mode. Where minimal ventilation is required in babies weighing less than 500g, pressure-controlled ventilation or lower rates may be required.

The ventilators display a “leak” warning if the expired volume passing up through the ETT is less than the inspired volume being delivered. Therefore, there are many reasons as well as a dislodged ETT for this alarm to appear. Other possible causes to consider are pneumothorax or insufficient cardiac output.

A check for ETCO₂ using a pedicap or similar is reliable if positive but a negative change is not a reliable indicator of a dislodged tube. The definitive test, if in doubt, is to visualise the ETT directly.

Some other specific equipment issues were identified in this year’s mortality reviews:

- Size 2.0 ETT are difficult to secure within the Neofit and therefore this equipment should be stored with easily accessible advice or pictures on additional taping for around the ETT before the Neofit strap is tightened.
- A size 3.5 UAC does not pass well down umbilical vein so size 5F and 8F are better options for resuscitation equipment.
- Servo controlled continuous temperature probes on resuscitaires allow for the most accurate thermoregulation whilst a baby is nursed on a resuscitaire but continuous monitoring with manual adjustment of heat sources can be equally effective.
- If available, a video laryngoscope should go with the difficult airway box to deliveries that are anticipated to require this. Video laryngoscopes for inexperienced intubators can increase the success rate of intubation. Funding for video laryngoscopes for training and use in practice can be bid for through the Education Research and Innovation Committee hosted by Health Education England. <https://www.yorksandhumberdeanery.nhs.uk/education/eric>
- Hypothermia is known to be associated with significantly poorer outcomes in preterm babies. Incubator humidity is a major factor in maintaining thermoregulation and should be set at 80-85% as soon as possible for some babies. All factors contributing to thermoregulation should be considered carefully and in detail.

Resuscitation and Stabilisation

Prolonged resuscitation

NLS algorithms are used both at deliveries and in resuscitation of a severely deteriorating patient on the neonatal unit. Case reports and NLS guidance recommend that attempts to resuscitate should be continued for up to 20 minutes of effective resuscitation as some of these case reports have published good outcomes up to this time. However, effective resuscitation is dependent on good teamwork and thorough appraisal of potential causes for the baby’s deterioration or failure to respond. Staff who have not under gone NLS training should receive additional support for attending resuscitations.

Stabilisation

Some diagnoses may present more difficulty, but even in situations such as the presence of severe and prolonged oligohydramnios there is merit in stabilising and attempting resuscitation as there is evidence that once initial resuscitation is successful, outcomes are improved with inhaled nitric oxide.

Timely intervention for basic ABC support in the deteriorating patient is essential. In situations such NEC in preterm babies especially where surgery for perforation is anticipated, action to intubate and ventilate early as part of the stabilisation process may prevent other complications developing.

Teamwork

Technical issues in assessing effectiveness of intervention are well recognised, for example – when ventilating with a mask, chest wall movement may be difficult to determine and all team members should be involved in whether these initial resuscitation steps are being effective.

Pneumothorax

In a situation where a baby is failing to respond to all attempted measures of resuscitation, needle thoracocentesis using a butterfly or open needle system should be considered. Cold light illumination is not effective in large term babies and false negatives are likely. Transillumination in small babies from a mid-axillary position may help determine if there is unilateral transillumination suggestive of a pneumothorax and especially in these babies positive responses are likely to be correct.



Pulmonary haemorrhage

In complex situations such as pulmonary haemorrhage, the ETT should not be removed if at all possible. ETCO₂ will often not register and correct placement of the tube may need to be confirmed by direct or video inspection. High pressures may be required in this situation to achieve oxygenation.

Documentation

Detailed documentation is essential around the time of resuscitation/stabilisation in order to determine perinatal events and facilitate bereavement counselling where this is needed. Doctors involved in resuscitation should ensure all notes are accurate and written in the immediate period after resuscitation has taken place.

Dr Alex Lu

Neonatal Grid HST ST7

Dr Joanna Preece

Consultant Neonatologist

Clinical Lead HUTH NHS Trust

Chair of Y&H Neonatal ODN Mortality Review Panel Group (North)

7th July 2020

Ratified by the Y&H Neonatal ODN Mortality Review Panel Group (North)