1. Introduction and Who Guideline applies to

This guideline is aimed at all Health care professionals involved in the care of infants within the Neonatal Service.

Aims:

To appropriately manage the resuscitation and neonatal care of infants with a risk of developing meconium aspiration syndrome

Key Points section:

- There is increasing evidence that in severe meconium aspiration syndrome, the aspiration event is antenatal, and the course of the illness is not influenced by perineal or tracheal suction after delivery (Grade A)

- Tracheal suction on the resuscitaire should not be performed in a vigorous well infant (Grade A)

- The initial attempts at ventilation should not be delayed by directly visualising the airway in a non-vigorous baby. The recommendations suggest against routine immediate direct laryngoscopy and/or suctioning after delivery with the emphasis on initiating ventilation in the first minute of life (Grade A)

- The recommendation is for observations at 1hr, 2hrs of age and subsequently 2 hourly for the first 12 hours where there is ‘significant’ meconium-stained liquor. If there is non-significant meconium-stained liquor, observations should still be recorded at 1 and 2 hours of age (Flowchart in appendix).

- Infants with severe meconium aspiration may develop persistent pulmonary hypertension of the newborn and ECMO should be considered if the Oxygenation Index (OI) is approaching 40 (Grade A)

Related UHL documents:

- Persistent Pulmonary Hypertension of the Newborn neonatal guideline
- Resuscitation of the Newborn Infant at Birth
- Guideline for transfer of babies to the neonatal unit from home or community hospital
Background:

All babies born with meconium present (whether thick or thin) should be considered at risk of meconium aspiration syndrome and this should be suspected in any term infant in whom:

- There is respiratory distress in association with meconium stained liquor
- There are Chest X Ray findings compatible with the diagnosis of meconium aspiration

Pathophysiology:

The exact pathophysiology of meconium aspiration has been the subject of much debate, but an accepted theory is below:

Fetal 'distress' and acidosis lead to both the passage of meconium in utero and fetal 'terminal gasping'. This gasping can lead to antenatal aspiration of meconium.

Meconium aspiration is predominantly seen in term babies.

Evidence criteria:

Evidence according to RCPCH

<table>
<thead>
<tr>
<th>Grade A</th>
<th>At least 1 randomised controlled trial addressing specific recommendation</th>
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<tr>
<td>Grade B</td>
<td>Well conducted clinical trials but no randomised trial on specific topic</td>
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<td>Grade C</td>
<td>Expert committee report or opinions</td>
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2. Guideline Standards and Procedures

The treatment algorithm in this guideline requires an assessment as to whether there is significant meconium.

The NICE guideline on intrapartum care recommends observations at 1 hour, 2 hours and subsequently two-hourly for the first 12 hours if there is significant meconium in the liquor [8].

We have defined significant meconium as follows:
Any grade of meconium where the baby is compromised at delivery or develops respiratory distress within the first hour of life; i.e. if one or more of the following is present:

- The baby is not vigorous at birth and requires resuscitation beyond suction and lung inflation
- The baby has signs of respiratory distress
- The baby is otherwise unwell

Meconium of any grade is NOT considered to be significant if:

- The baby is vigorous at birth
- The baby is clinically well within the first hour of life

All babies born through meconium-stained liquor should have observations taken and documented by the midwife at 1 and 2 hours of age.

While there are differences between the NICE guidance and this guideline in how to define significant meconium, the recommended UHL management algorithm has been subject to audit to ensure safe practice \[18\].

**Initial management**

We recommend following the Resuscitation Council Newborn Life Support algorithm \[9\]. Every baby born through meconium-stained liquor should be assessed at delivery by a member of the neonatal medical team (Appendix - Flowchart)

- If there is meconium in the liquor and the baby is vigorous and breathing then the airway is not obstructed- the baby should be dried and given to their mother
- The presence of thick, viscous meconium in a non-vigorous baby is the only indication for initially considering visualising the oropharynx and suctioning material, which might obstruct the airway \[10\]
- Tracheal intubation should not be routine in the presence of meconium and should only be performed for suspected tracheal obstruction \[10, 11\] (Grade A)
- If suctioning is attempted use a 12–14 FG suction catheter, or a paediatric Yankauer sucker, connected to a suction source not exceeding −150 mmHg (20kPa). \[12\] The airway should be inspected, and any meconium present should be cleared under direct vision, using a laryngoscope
- If there is meconium seen below the vocal cords, the baby should be intubated, and a meconium aspirator can be used to apply suction directly to the endotracheal tube. The neonatal resuscitation team should be called if not already in attendance
In the presence of thick meconium this process may need to be repeated with a new endotracheal tube.

Once the meconium has been cleared, resuscitation should continue with inflation breaths in the usual way as per NLS algorithm (Appendix A). Remember that although it is usual to commence resuscitation in air, it is important to increase the oxygen if the baby is still dusky/cyanosed.

The emphasis should be on initiating ventilation as soon as possible and within the first minute of life in non-breathing or ineffectively breathing infants.[10]

Subsequent management

- All babies born through meconium-stained liquor should have observations taken and documented by the midwife at 1 and 2 hours of age.[18]
- A review by the neonatal team should be requested if there are concerns about the baby’s condition.
- Babies where there has been significant meconium at delivery may require immediate admission to the neonatal unit following resuscitation.
- Where a decision is made by a neonatal clinician that a baby may be cared for on a ward other than the NNU, the baby should be observed for signs of respiratory distress and be reviewed by a member of the neonatal team at around one hour of age (or earlier if there is clinical concern from postnatal ward staff). Observations should be documented on appropriate charts (Newborn Early Warning Score Chart [NEWS]).
- Consideration should be given to the possibility of hypoxic-ischaemic encephalopathy, noting the cord gases and the infant’s neurological status. Any reviews by the neonatal team should be clearly documented, including any further management plans.

Management of Meconium Aspiration on the Neonatal Unit

The early stabilisation of a baby with meconium aspiration is similar to any other baby that needs intensive care. Specific points include:
Respiratory Care

- Hypoxia can be a significant problem- ventilatory strategies should be used to optimise the mean airway pressure. These may include increasing the inspiratory time or the peak inspiratory pressure.

- High frequency Oscillation can be considered although there is no evidence that respiratory outcomes are improved (13); care should be taken to check for pneumothoraces as the meconium can act as a ‘ball valve’ and lead to over distension of parts of the lung.

- There is evidence that surfactant administration is beneficial in reducing the severity of respiratory illness and need for ECMO. Occasionally repeated doses are needed (14). (Grade A) There is insufficient evidence to recommend surfactant lavage as a routine treatment, although it may be considered (15).

- Nitric Oxide is often used in babies with persistent pulmonary hypertension and has been shown to decrease the need for ECMO (16) (Grade A)

Cardiovascular Care

- Babies with meconium aspiration are at risk of persistent pulmonary hypertension of the newborn. Echocardiography may be useful in assessing pulmonary pressures and excluding congenital heart disease.

- Blood pressure should be ideally measured from an arterial line and should be optimised considering using volume and inotropes, as appropriate to minimise right to left shunting. If there is evidence of pulmonary hypertension or hypoxia, aim to optimise the blood pressure to improve oxygenation aim for a mean arterial blood pressure of at least 40 mm Hg.

Fluids

- Babies with meconium aspiration have often suffered an antenatal insult and renal impairment can be present. Consideration should be given to fluid restriction and electrolytes and fluid balance should be monitored.

Neurology

- Sedation is usually required, and muscle relaxation should be considered.

- Babies that have had a period of perinatal hypoxia are at risk of encephalopathy. They should be observed for seizures and cerebral function monitoring (CFM) may be useful. A neurological examination should be documented prior to muscle relaxation.

- Consider if the baby has met cooling criteria.

Extra Corporeal Membrane Oxygenation

- There is good evidence that ECMO is a beneficial treatment in meconium aspiration (7) (Grade A)

- The oxygen index is used as a guide: this should be regularly monitored in babies with meconium aspiration.
Oxygen Index (OI) = Mean Airway Pressure x FiO2 x 100 
\[\text{PaO2} \times 7.5\]
(7.5 is a factor to convert kPA to mmHg)

- ECMO can be considered if the OI is greater than 40 and early liaison with an ECMO service is advised if there is a rising OI. (Referral should only take place after discussion with the Consultant Neonatologist)

If a baby is accepted for transfer for ECMO they baby should be transferred with a maternal blood sample as two adult units of blood will be needed for establishing on the ECMO circuit

- A head ultrasound should be performed, and blood clotting should be measured and corrected as appropriate

**Prognosis**

The survival for babies that require ECMO for meconium aspiration is good (around 95%) and there is a low risk of long term disability \[^{[17]}\] (Grade A).

**5. Supporting References**

7. UK Collaborative ECMO Trial Group UK collaborative randomised trial of neonatal extracorporeal membrane oxygenation. Lancet 1996; 348:75-82


18. Two PDSA cycles on management of babies born through meconium stained liquor between 2013-2015 at University Hospitals of Leicester NHS Trust. (Audit registration number 7570_Audit of babies born through Meconium stained liquor and their neonatal outcome -Alternative to NICE guidance)

6. Key Words

Meconium aspiration, mec, newborn, neonatal, maternity, cooling, postnatal

The Trust recognises the diversity of the local community it serves. Our aim therefore is to provide a safe environment free from discrimination and treat all individuals fairly with dignity and appropriately according to their needs. As part of its development, this policy and its impact on equality have been reviewed and no detriment was identified.
### Guideline development:

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<th>Date</th>
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<td>February 2004</td>
<td>Guideline originally written by D J Field</td>
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<tr>
<td>September 2008;</td>
<td>Reviewed by J Cusack</td>
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<td>January 2011</td>
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<tr>
<td>September 2011</td>
<td>Reviewed by J Cusack and E Boyle</td>
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<td>Oct 2015</td>
<td>Reviewed by E Boyle (minor amendments one year review date)</td>
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<tr>
<td>Oct 2015</td>
<td>Neonatal Guidelines and Governance Groups</td>
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<td>March 2018</td>
<td>Neonatal Guidelines Meeting (minor amendments required)</td>
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<tr>
<td>March 2018</td>
<td>Neonatal Governance Meeting (ratification)</td>
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<tr>
<td>March 2021</td>
<td>Neonatal guideline Meeting and Governance meeting</td>
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Appendix: Flowchart for management of a baby born through meconium stained liquor

Any grade of meconium stained liquor

Assessment at delivery by a member of the neonatal team

SIGNIFICANT MECONIUM
Baby is compromised at delivery with one or more of the following:
1. Baby not vigorous at birth and needed resus more than suction and lung inflation.
2. Signs of respiratory distress
3. Otherwise unwell

Baby has depressed vital signs
Laryngoscopy and suction under direct vision by a healthcare professional trained in advance neonatal life support

Assess need for intubation and direct tracheal suction if respiratory depression and meconium below the cord. IPPV should be commenced if the process takes more than a minute

Follow Resuscitation Council Newborn Life Support algorithm

Assess need for admission to neonatal unit or observation on postnatal ward

Postnatal ward - Observations on NEWS chart at 1 hour & 2 hours and two-hourly for the first 12 hours

Admission to Neonatal Unit if any concerns

NON-SIGNIFICANT MECONIUM
Assess the baby at birth:
1. The baby is vigorous at birth
2. No signs of respiratory distress
3. Clinically well

Dry the baby and give it to mother
Admit to postnatal ward for observation

Midwifery team to document observations on NEWS chart at 1 hour and 2 hours after birth
1. General wellbeing
2. Chest movements and nasal flare
3. Skin colour (test capillary refill)
4. Feeding
5. Muscle tone
6. Temperature
7. Heart rate and respiration

Assess need for admission to neonatal unit if any concerns. Neonatal team to review

Discharge or routine care if no concerns at two hours