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1. Introduction and who this guideline applies to

This guideline is aimed at all Health care professionals involved in the care of infants within the neonatal and maternity service.

Background:

All babies born with meconium present (whether significant or non-significant) 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.

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 ^[1] or tracheal suction after delivery ^[2]
- Tracheal suction on the resuscitaire should not be performed in a vigorous well infant ^[3] ^[4]

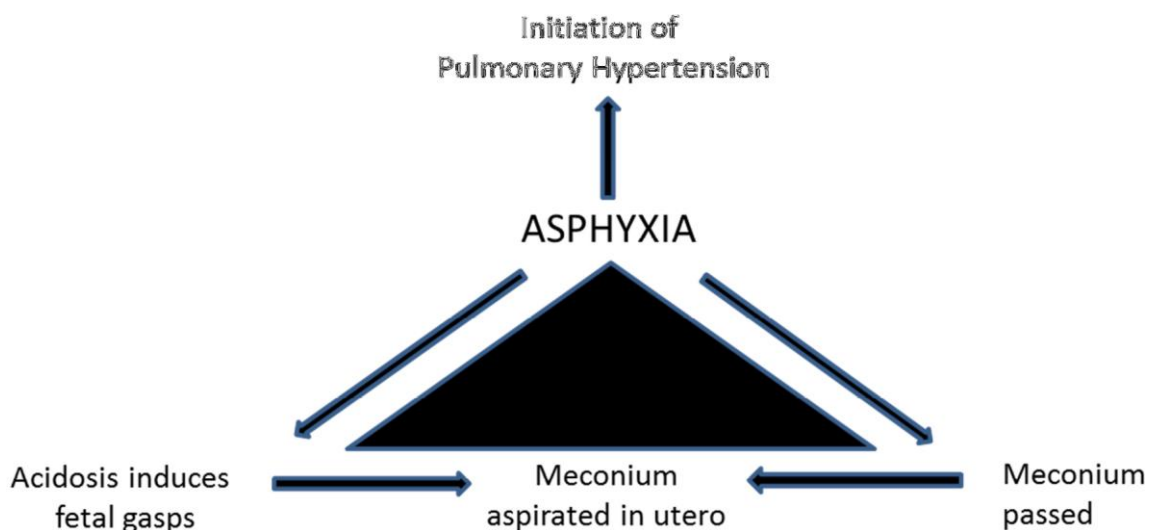
- The initial attempts at ventilation should not be delayed by directly visualising the airway in a non-vigorous baby. The recommendations suggest against routine immediate direct laryngoscopy and/or suctioning after delivery with the emphasis on initiating ventilation in the first minute of life ^[5]
- 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 ^[6] and ECMO should be considered if the Oxygenation Index (OI) is approaching 40 ^[7]

Related UHL documents:

- [Persistent Pulmonary Hypertension of the Newborn UHL Neonatal Guideline](#)
- [Resuscitation at Birth UHL Neonatal Guideline](#)
- [Transfer of Babies to Neonatal Unit from Home or Community Hospital UHL Obstetric and Neonatal Guideline](#)

2. 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.

3. Guidelines/Recommendations:

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

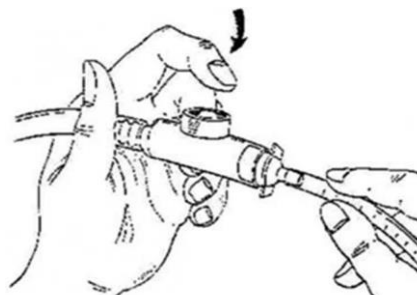
The NICE guideline on intrapartum care recommends observations at 1 hour, 2 hours and subsequently two-hourly for the first 12 hours if there is significant meconium in the liquor ^[8].

We have defined **significant meconium** as follows:
Dark green or black amniotic fluid that is thick or tenacious.

4. 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.
- Consider visualising the oropharynx and suctioning material, if chest rise is not seen even after repositioning and 5 inflation breaths. ^[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 for a potentially blocked airway use a wide bore 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 ([Resuscitation at Birth UHL Neonatal Guideline](#)). Remember that although it is usual to commence resuscitation in air, it is important to increase the oxygen if the baby failed to achieve the standard saturations targets. 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 on-going respiratory problem secondary to meconium aspiration syndrome are likely to require immediate admission to the neonatal unit. 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.

5. 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 baby meet 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.

$$\text{Oxygen Index (OI)} = \frac{\text{Mean Airway Pressure} \times \text{FiO}_2 \times 100}{\text{PaO}_2 \times 7.5}$$

(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.

6. 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](#)).

7. Education and Training

None

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9. **Key Words**

Extra Corporeal Membrane Oxygenation (ECMO), Meconium aspiration syndrome, Resuscitation, Tracheal Suction

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.

CONTACT AND REVIEW DETAILS			
Guideline Lead (Name and Title) S Mittal – Consultant Clinical Guidelines Lead		Executive Lead Chief Medical Officer	
Details of Changes made during review:			
Date	Issue Number	Reviewed By	Description Of Changes (If Any)
February 2004	1	Guideline originally written by D J Field	
September 2008	2	J Cusack	
January 2011	3	J Cusack	
September 2011	4	J Cusack and E Boyle	
April 2013	5	E Boyle	
Oct 2015	6	E Boyle	minor amendments one year review date
March 2018	7	Neonatal Guidelines Meeting Neonatal Governance Meeting	minor amendments required
March 2021	8	Neonatal Guidelines Meeting Neonatal Governance Meeting	
May 2024	9	Neonatal Guidelines Meeting Neonatal Governance Meeting	Changed terminology from thick and thin meconium to significant and non-significant

10. Evidence criteria:

Evidence according to RCPCH

Grade A	At least 1 randomised controlled trial addressing specific recommendation
Grade B	Well conducted clinical trials but no randomised trial on specific topic
Grade C	Expert committee report or opinions

Appendix: Flowchart for management of a baby born through meconium stained liquor

