



CLINICAL GUIDELINE

**Meconium Aspiration Syndrome (MAS)**

<b>Scope (Staff):</b>	Nursing and Medical Staff
<b>Scope (Area):</b>	NICU KEMH, NICU PCH, NETS WA

This document should be read in conjunction with this [DISCLAIMER](#)

## Definition

MAS is a clinical diagnosis that includes delivery through meconium stained amniotic fluid (MSAF) with respiratory distress, characteristic appearance on chest x-ray and lack of alternative diagnosis for respiratory distress.

## Background

- Meconium stained liquor occurs in 8–25% of births and, among these between 3% and 12% of infants born with MSAF develop MAS.
- Incidence of MAS increases between 38 and 42 weeks, from 0.24% to 1.42%
- Risk factors are caesarean delivery, advanced gestation, ethnicity, low Apgar score at birth, and fetal heart rate abnormalities.
- MAS often occur in the post-mature infant or in the presence of other Placental insufficiency syndromes.
- The clinical course is variable with mild respiratory distress to the most severe cases of respiratory distress with hypoxic respiratory failure and persistent pulmonary hypertension of new-born.

## Pathophysiology

The pathophysiology of MAS is complex. Meconium is comprised of gastrointestinal, hepatic and pancreatic secretion, cellular debris, swallowed amniotic fluid, lanugo, and vernix. It begins to appear in the fetal intestine by the twelfth week of gestation. However, because of good anal sphincter tone, lack of strong peristalsis, and low level of motilin, in utero passage is uncommon until term. In utero hypoxia and acidosis can cause vagal response leading to increased peristalsis and a relaxed anal sphincter resulting in meconium passage.

Intra-uterine distress (at any time in gestation) may initiate gasping in utero. This may result in amniotic fluid and particulate matter to be inhaled into the large airways. When meconium particles are aspirated it causes physical obstruction of airways, chemical pneumonitis leading to surfactant dysfunction and inflammation which further leads to parenchymal disease.

The meconium causes a ball-valve effect in the airways, resulting in complete obstruction of airways causing areas of collapse or atelectasis or areas of overexpansion due to gas trapping and air leak.

Meconium is a potent activator of inflammatory mediators, including cytokines, complement, prostaglandins and reactive oxygen species. Meconium activates two main recognition systems of innate immunity, the Toll-like receptors and the complement system, which not only leads to lung dysfunction (pneumonitis) but also causes systemic inflammatory response.

The atelectasis, hypoventilation, acidosis may lead to secondary [persistent pulmonary hypertension \(PPHN\)](#). The acidosis contributes to PPHN resulting in right to left shunting of blood causing severe hypoxemia. Hypoxemia contributes to ventricular dysfunction and complicates PPHN. Left ventricular dysfunction elevates left atrial pressure causing pulmonary venous hypertension and exacerbates hypoxemia.

### Clinical Presentation

The infant with MAS may be cyanosed, tachypneic, grunting with nasal flaring, retractions, with a hyper inflated chest (barrel shaped chest) and coarse breath sounds on auscultation. They may have marked swings in oxygen saturation due to intra and extra-pulmonary shunting. Poor perfusion may result from impaired cardiac function.

### Investigations

- Pre and post-ductal oxygen saturations to measure the degree of shunting.
- Echocardiogram is gold standard to diagnose PAH and also to exclude cyanotic heart disease.
- Chest X-ray findings include diffuse, asymmetric, patchy, or streaky infiltrates with areas of hyperinflation, consolidation, or atelectasis, pneumo-mediastinum, pleural effusions and pneumothorax.

### Management

#### In delivery room

Although the new NRP guidelines (7<sup>th</sup> edition 2016) recommend

For vigorous infant routine intubation for tracheal suction is not suggested. We have continued to recommend a senior person attend MSAF deliveries and apply tracheal toilet in non-vigorous infants with significant oropharyngeal contamination. Evidence is now emerging to suggest this may be the best approach and the ILCOR guidelines are under review.

#### Established MAS

Early stabilisation is the most important management strategy. Management should be similar to that of treating for pulmonary hypertension: *Refer to [Persistent Pulmonary Hypertension of the Newborn](#)*.

1. Treat with antibiotics until sepsis excluded.
2. Optimal temperature / glucose regulation.

3. Minimal handling: Typically the infants with MAS are very sensitive to handling. Frequency of routine cares and handling should be discussed with consultant and senior nursing staff. Ensure pressure relieving devices are utilised.
4. Oxygen Therapy- Providing adequate oxygenation therapy forms the mainstay of PPHN therapy. Some authors recommend to maintained oxygen saturation higher targets for O<sub>2</sub> saturation (94-98%) and pre-ductal PaO<sub>2</sub> (60-100 mmHg).
5. Inhaled [nitric oxide](#) (iNO) is a selective pulmonary vasodilator and hence will decrease pulmonary arterial pressure if it gets into the airways. It should be considered in infants requiring FiO<sub>2</sub> > 0.6 after optimizing ventilation.
6. Consider Surfactant: In systematic reviews it was reported that Surfactant administration was found to reduce the severity of respiratory illness, the duration of mechanical ventilation, hospital stay and requiring support with ECMO. Surfactant should be considered for any infant with MAS who is ventilated and in > 50% oxygen. Some infants may acutely deteriorate after bolus surfactant administration. Therefore; surfactant administration for MAS should always be discussed with consultant. Surfactant may need to be given in more than two aliquots because of the large volume.
7. Ventilation— for detail management strategies refer to following guidelines, [Persistent Pulmonary Hypertension of the Newborn. High Frequency Jet Ventilation, High Frequency Oscillatory Ventilation.](#)
8. [ECMO](#): With the use of inhaled nitric oxide, surfactant and high frequency ventilation need for ECMO has decreased. Consider ECMO for the infants with MAS and severe respiratory failure unresponsive to the conventional management. For the detailed indication and discussion with other consultant refer to ECMO guidelines. Involve parents in the decision making. Typically the infants more than 34 weeks gestation and more than 2000 g weight with reversible cardiac/pulmonary failure and no major neurological insult are potential candidates for ECMO.
9. The prognosis of infants with meconium aspiration syndrome is dependent on the degree of severity of the pulmonary hypertension and other end-organ involvement.

**Related CAHS internal policies, procedures and guidelines**

- [ECMO](#)
- [High Frequency Jet Ventilation](#)
- [High Frequency Oscillation Ventilation](#)
- [Nitric Oxide Therapy](#)
- [Persistent Pulmonary Hypertension of the Newborn](#)

**References and related external legislation, policies, and guidelines**

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