Meconium Aspiration Syndrome: Preventing

What is Involved in Preventing Meconium Aspiration Syndrome?

› Meconium (i.e., the first stool passed by a newborn infant) is a thick, dark-green tarry substance composed of intestinal secretions (i.e., bile), mucus, lanugo (i.e., fine soft hair covering the body of a human fetus/newborn), and solid elements of ingested amniotic fluid, and is typically expelled within 48 hours after birth. Meconium aspiration syndrome (MAS) is a potentially life-threatening respiratory disorder that occurs when meconium is expelled in utero or during labor, resulting in meconium-stained amniotic fluid (MSAF) that is then aspirated (i.e., brought below the level of the vocal cords into the lungs) by the infant. MAS can result in partial or complete airway obstruction, pneumonitis (i.e., lung tissue inflammation), persistent pulmonary hypertension of the newborn (PPHN), pneumothorax, surfactant displacement, atelectasis, respiratory failure, and death (for more information on MAS, see Quick Lesson About … Meconium Aspiration Syndrome)

• What: Strategies to prevent MAS include early identification and prevention of fetal distress; routine intrapartum suctioning (i.e., after delivery of the head but before delivery of the shoulders) of all infants born through MSAF is no longer recommended

• How: Neonatal resuscitation efforts are the same for infants born with MSAF or clear amniotic fluid

• Where: Infants with depressed respiratory effort or poor muscle tone at birth should be placed on a radiant warmer for resuscitation efforts. Infants who have good respiratory effort and muscle tone may stay with mother for routine newborn care

• Who: There should be at least one clinician present at the infant’s birth whose primary responsibility is to initiate resuscitation in the newborn, as needed; this clinician should possess expert knowledge of neonatal resuscitation guidelines (e.g., of the American Heart Association [AHA]) and be certified in Neonatal Resuscitation Program (NRP) and PALS. In general, a physician or advanced practice clinician intubates the newborn with a registered nurse (RN) assisting; in facilities where RNs intubate newborns, an RN can perform endotracheal intubation and suctioning, according to facility/unit-specific protocol. The mother and her partner can be present during resuscitation efforts

What is the Desired Outcome of Preventing Meconium Aspiration Syndrome?

› The desired outcome of preventing MAS is to prevent the complications associated with MAS (for more information, see What You Need to Know Before Preventing Meconium Aspiration Syndrome, below)

Why Is Preventing Meconium Aspiration Syndrome Important?

› Preventing MAS is important to prevent the complications associated with MAS, which include severe respiratory compromise. MAS can result in partial or complete airway obstruction, pneumonitis, PPHN, pneumothorax, surfactant displacement, atelectasis, respiratory failure, severe metabolic and respiratory acidosis, hypotension, and tachycardia; severe cases can result in death. Survivors of MAS can have long-term neurologic and developmental deficits (e.g., seizures, intellectual disability) as well as an increased risk for asthma and abnormal bronchial reactivity
**Facts and Figures**

› The American College of Obstetricians and Gynecologists (ACOG) does not advocate routine prophylactic amnioinfusion (i.e., the infusion of warm sterile normal saline into the amniotic fluid) for the dilution of meconium-stained amniotic fluid, but maintains that amnioinfusion is a reasonable treatment for repetitive variable fetal heart rate (FHR) decelerations, regardless of amniotic fluid meconium status (ACOG, 2017)

› Cochrane reviewers concluded that amnioinfusion is associated with improved perinatal outcomes, but only in clinical settings with limited perinatal surveillance (i.e., settings with limited capabilities to monitor the baby’s condition during labor); this conclusion was based on the results of 14 trials involving 4,435 women. The authors were not able to determine if the improvement in perinatal outcomes occurred as a result of dilution of meconium or relief of oligohydramnios (i.e., inadequate volume of amniotic fluid); (Hofmeyr et al., 2014)

› Cochrane reviewers also found evidence that lung lavage with dilute surfactant might be of benefit to patients with MAS, but additional clinical trials are required to confirm the treatment effect (Hahn et al., 2013)

› In a recent clinical report, the American Academy of Pediatrics (AAP) issued a recommendation that rescue surfactant (as opposed to preventive administration) be considered for infants with hypoxic respiratory failure due to MAS, pulmonary hemorrhage, or sepsis/pneumonia. The authors concluded that surfactant therapy can improve oxygenation and reduce the need for extracorporeal membrane oxygenation (ECMO; i.e., a procedure using a cardiopulmonary bypass machine that provides an artificial lung and pump to the infant) in newborns with MAS, while causing no increase in morbidity (Polin et al., 2014)

---

**What You Need to Know Before Preventing Meconium Aspiration Syndrome**

› Knowledge of risk factors, signs and symptoms, pathophysiology, and complications associated with MAS, as well as treatment options, is necessary prior to providing care for a newborn born through MSAF

› Risk factors for meconium release *in utero* (i.e., MSAF) include maternal hypertension, diabetes mellitus [DM], chronic respiratory and/or cardiovascular disease, heavy smoking, pre-eclampsia/eclampsia, maternal drug use (e.g., cocaine, tobacco), post-term pregnancy, oligohydramnios, and intrauterine growth restriction (IUGR; refers to fetal weight < 10th percentile for gestational age)

› Risk factors for MAS include heavy MSAF, nulliparity (i.e., condition of not having completed a pregnancy beyond 20 weeks; not having borne children), post-term pregnancy, abnormal fetal heart rate during labor, meconium below the vocal cords, 5-minute Apgar score ≤ 8, birth weight > 4,500 g/10 lbs, and respiratory distress after birth

› Meconium passage *in utero* is believed to occur as a result of a hypoxic event (e.g., umbilical cord compression, uteroplacental insufficiency) that causes vagal stimulation, anal sphincter relaxation, and meconium release; gasping in response to the hypoxic event causes the infant to aspirate the MSAF. Early identification and prevention of fetal distress can help in preventing meconium release *in utero*, and thereby help prevent MAS

–Not all infants who are born through MSAF will aspirate the meconium or develop MAS

–Signs and symptoms of MAS include cyanosis, pallor, tachypnea, nasal flaring, intercostal retractions, grunting, air trapping, low oxygen saturation, and rales and ronchi upon auscultation. The chest can appear barrel-shaped with an increased anterior-posterior diameter due to air trapping and hyperinflation. In addition, the skin, nails, and umbilical cord can be stained with meconium. Arterial blood gases (ABGs) will demonstrate hypoxia and acidosis (often respiratory and metabolic); the severity of hypoxia and acidosis depend on the severity of the disease

–MAS is categorized as mild, moderate, or severe, depending on the severity of symptoms and treatment required

› Complications associated with MAS include partial or complete airway obstruction, pneumonitis, PPHN, pneumothorax, surfactant displacement, atelectasis, respiratory failure, severe metabolic and respiratory acidosis, hypotension, and tachycardia; severe cases can result in death. Survivors of MAS can have long-term neurologic and developmental deficits (e.g., seizures, intellectual disability), as well as an increased risk for asthma and abnormal bronchial reactivity

› Treatment for MAS depends on severity, but typically includes supplemental oxygen and close monitoring of respiratory status; additional treatment depends on the severity of respiratory compromise, but can include intubation and mechanical ventilation, surfactant administration (by bolus into or lavage of the lungs), fluid resuscitation, administration of vasoconstrictor agents (e.g., DOPamine), inhaled nitric oxide (NO), and/or ECMO. Antibiotics are indicated only if infection is suspected; they are not administered prophylactically

–Endotracheal intubation and suctioning to prevent MAS is performed only in newborns born through MSAF who are *non-vigorous*, as demonstrated by a depressed respiratory effort, depressed muscle tone, and/or heart rate < 100 beats/minute. Endotracheal intubation and suctioning is contraindicated in newborns who have a strong respiratory effort, good muscle tone with spontaneous movement, heart rate > 100 beats/minute, even though they were born in the presence
of MSAF; only routine newborn care is indicated for vigorous infants unless subsequent assessment indicates more aggressive care is warranted.

- Intrapartum suctioning of the newborn born through MSAF is not recommended; the decision to intubate and suction is made immediately following birth based on patient assessment. Also, the consistency of the meconium (i.e., thick or thin) is no longer a consideration when determining the need for intubation and suctioning. In addition, meconium-stained newborns are no longer required to go immediately to the radiant warmer for care, but can receive routine care with the mother.

–Potential adverse effects of tracheal intubation and suctioning include:

- trauma to lips, tongue, and alveolar ridge
- laryngeal trauma
- vocal cord injury or avulsion
- airway injury or perforation
- pain
- infection
- regurgitation of gastric contents
- apnea and hypoxia
- hypotension
- bradycardia
- laryngospasm or bronchospasm
- increased intracranial pressure
- esophageal or bronchial intubation

In addition, the clinician should have knowledge and demonstrated competence in the following:

• Standard precautions and sterile technique. Intubation and suctioning is a sterile procedure that requires sterile equipment because the suction catheter can inadvertently slip into the lower airway or esophagus (for more information, see Nursing Practice & Skill ... Aseptic Technique and Infection Prevention: Applying Principles at the Bedside).

• Neonatal assessment, particularly of the respiratory and cardiovascular systems.

• NRP and PALS resuscitation protocols. Healthcare organizations also develop their own resuscitation protocols based on current guidelines published by expert organizations (e.g., the AHA). It is essential to adhere to your facility’s protocol and treating clinician orders when performing neonatal resuscitation.

Preliminary steps that should be performed before administering neonatal care at the time of birth to prevent MAS include the following:

• Review the facility/unit-specific protocol, if one is available, and consensus guidelines for newborn care, infant resuscitation, and treatment of the newborn born in the presence of MSAF.

• Review any orders written by the treating clinician (e.g., in anticipation of birth complications due to a known preexisting maternal or fetal condition), although written orders usually do not exist at the time resuscitation measures are initiated due to the emergent nature of the condition.

• Review the manufacturer's instructions for all equipment to be used and verify that the equipment is in good working order.

• Verify parental completion of facility informed consent documents for neonatal care, if indicated. Resuscitation is included in the general consent for obstetric and neonatal care, but consent for additional laboratory or diagnostic studies might be required.

Gather the necessary supplies, which typically include the following:

• Personal protective equipment (PPE; e.g., sterile gloves, gown, face mask, eye protection)

• Laryngoscope with blade (size 1 for a full-term infant)

• Bulb syringe

• 8F suction catheter attached to wall suction

• Meconium aspirator

• Positive-pressure ventilation (PPV) device

• Term- and preterm-sized masks

• Portable or wall suction

Additional equipment that should be present at the time of birth includes:

– Pediatric crash cart

– Emergency airway equipment in neonatal sizes (e.g., oral airway, laryngoscope, size 1 laryngeal mask airway [LMA], manual resuscitation bag-valve-mask device [i.e., Ambu-bag])
How to Prevent Meconium Aspiration Syndrome

› Perform hand hygiene and don PPE
› Identify the infant/mother according to facility protocol
› If appropriate to the situation, briefly introduce yourself to the mother/family and explain your clinical role; assess mother/family for knowledge deficits and for knowledge deficits and anxiety regarding newborn assessment and resuscitation, as needed. (Note that verbal interaction with the parent(s)/family will be postponed until after resuscitation measures are performed)
• Determine if the mother/family requires special considerations regarding communication (e.g., due to illiteracy, language barriers, or deafness); make arrangements to meet these needs if they are present
  – Use professional certified medical interpreters, either in person or via phone, when language barriers exist
• Explain the procedures involved in newborn assessment and resuscitation; answer any questions and provide emotional support as needed
› Assess for MSAF by observing for the presence of meconium on the infant or in the birth field
› Perform a respiratory and cardiovascular assessment; do not stimulate vigorous breathing as this can increase the likelihood of meconium aspiration. Observe for
  • a depressed respiratory effort
  • depressed muscle tone
  • heart rate < 100 beats/minute
› Warm and maintain normal temperature, dry, position, clear airway, and stimulate infant
› Remove secretions that obstruct airway by wiping nose and mouth with a cloth or by using suction device.
  • Suction mouth before nose to clear secretions
› If apneic, gasping or heart rate below 100, initiate PPV and monitor SpO2.
› Proceed with steps of neonatal resuscitation per NRP guidelines
› Update the patient’s plan of care, as appropriate, and document the neonatal resuscitation procedure and outcomes in the patient’s medical record, including the following information:
  • Date and time of birth and time resuscitation efforts were initiated
  • Newborn’s respiratory status (e.g., oxygenation, color, vigor)
  • Additional resuscitative measures (e.g., use of positive pressure ventilation, supplemental oxygen, CPR, intubation, insertion of intravenous lines, and medications given)
  • Newborn’s current physical condition (Apgar scores at 1 and 5 minutes)
  • Time of transfer to the NICU, in indicated, and name of person assuming the infant’s care
  • Emotional support and parent/family member education, including topics presented, response to education provided/discussed, plan for follow-up education, and details regarding any barriers to communication and/or techniques that promoted successful communication

Other Tests, Treatments, or Procedures That Can Be Necessary Before or After Preventing Meconium Aspiration Syndrome

› The newborn’s respiratory and cardiovascular status will be continuously monitored, and the appropriate treatment provided, following tracheal intubation and suctioning, including
  • assessing the depth and quality of respirations, monitoring respiratory and heart rate, and auscultating the newborn’s heart and lung sounds
  • monitoring oxygen saturation, blood pressure, pain, and other vital signs
  • administering supplemental oxygen and assisting with mechanical ventilation, as ordered
  • obtaining and monitoring the results of any laboratory tests (e.g., CBC with differential)
  • obtaining and monitoring ABG results
  • administering medications (e.g., Dopamine), as ordered
What to Expect After Preventing Meconium Aspiration Syndrome

› The newborn’s airway will remain patent, and the newborn will not develop any signs or symptoms of respiratory distress or MAS

Red Flags

› Cyanosis, tachycardia, bradycardia, apnea, increased respirations, decreased respiration, and poor muscle tone must be monitored closely, and resuscitation (e.g., mechanical ventilation, oxygen supplementation, warming to maintain body temperature, antibiotic administration to treat infection) must be initiated promptly, as needed, to prevent rapid respiratory decompensation (for details, see Nursing Practice & Skill ... Neonatal Resuscitation (Birth throughout Initial Hospitalization: Performing)

› Severe respiratory distress precludes immediate breastfeeding or other nutrition

What Do I Need to Tell the Patient’s Family?

› MAS is a serious condition that can be safely managed through diligent monitoring and treatment; stress the importance of adhering to all treatment recommendations

› Most infants recover from MAS, although some do have lingering respiratory or neurologic changes

› Parents should be encouraged to be at the newborn’s bedside and participate in care as much as possible to promote bonding

› Although the infant might not be able to breastfeed immediately—depending on the severity of MAS and care required—the mother should be encouraged to pump and store breast milk; refer the mother to the facility lactation consultant for education and support, as available

› Parents and other family members should be encouraged to ask questions regarding the infant’s care in order to relieve anxiety

References


