

Meconium Aspiration Syndrome

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Abstract

Meconium aspiration commonly presents in term and post-term infants, particularly in the setting of fetal stress. Affected newborns present with respiratory distress in the setting of meconium-stained amniotic fluid. Chest radiography shows pulmonary hyperinflation with patchy opacities. Treatment of meconium aspiration is supportive and includes oxygen supplementation, mechanical ventilation, and intravenous fluids.

Keywords: Newborn, Pulmonary, Airway

Clinical Summary

A term infant was born at 40 weeks, 5 days of gestation. At delivery, the amniotic fluid contained thick meconium. The patient was intubated and suctioned below the vocal cords, at which time he decompensated, requiring oscillator ventilation and exogenous surfactant.

Imaging Findings

Chest radiograph (Figure 1) shows hyperinflated lungs with patchy pulmonary opacities.

Diagnosis and Differential Diagnosis

Meconium aspiration.

The differential diagnosis for meconium aspiration syndrome includes respiratory distress syndrome, transient tachypnea of the newborn, neonatal pneumonia, persistent pulmonary hypertension of the newborn, and congenital heart disease.¹

Discussion

Meconium aspiration is a rare and potentially life-threatening respiratory disorder of newborns caused by the aspiration of meconium. It occurs with an incidence of 2.49 cases per 1000 births in the United States² and is most common in term or post-term infants.

Meconium is the earliest stool of an infant. It is a viscous, sticky material consisting of materials swallowed in utero, such as intestinal cells, lanugo, bile, and intestinal and pancreatic secretions. When meconium is passed prior to birth, the meconium-stained amniotic fluid (MSAF) may be aspirated by the fetus.

Meconium aspiration is first suspected after visualizing MSAF. The stained fluid typically occurs because of fetal distress due to hypoxia or acidosis.³ This can be caused by placental insufficiency, maternal hypertension, septicemia, fetal inflammatory response syndrome, or other external factors and can ultimately lead to meconium aspiration during the infant's first breaths, especially if gasping.

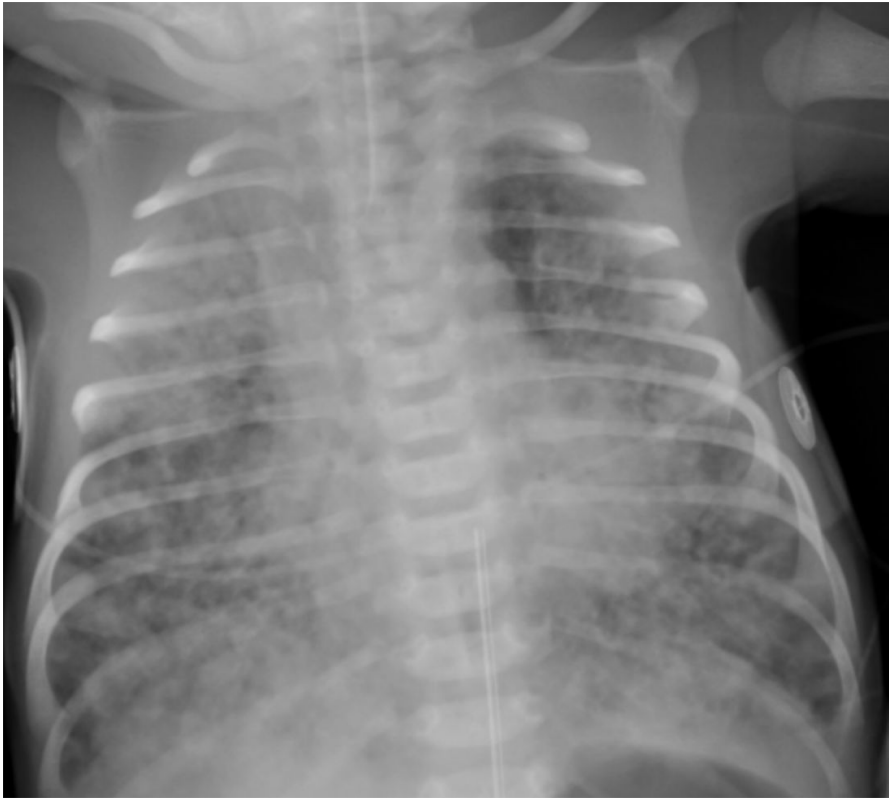
The risk of meconium aspiration increases with increasing amounts of meconium within the amniotic fluid. There are 3 grades of MSAF: grade 1, amniotic fluid that is translucent and light yellow-green; grade 2, amniotic fluid that is opalescent; and grade 3, amniotic fluid with a thick, green, and opaque appearance. Grades 2 and 3 of MSAF are correlated with an increased risk of adverse neonatal outcomes, including hypoxic-ischemic injury, respiratory distress syndrome, pneumothorax, persistent pulmonary hypertension, and infection/inflammation. It was also noted that clinical chorioamnionitis and oligohydramnios independently increase the risk of adverse outcomes in MSAF.⁴

Due to its tenacious nature, aspirated meconium can cause airway obstruction and pulmonary dysfunction. The severity of symptoms varies depending on how distal the meconium moves. When meconium is present in the proximal airways and is able to be removed after birth, patients may have minimal or no symptoms and a normal chest radiograph. However, if meconium extends to the distal bronchioles and alveoli, severe, persistent airway obstruction with marked ventilation-perfusion mismatch can occur, leading to severe respiratory distress. On chest radiograph, these neonates have asymmetric, patchy opacities with associated obstructive overinflation.

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Disclosures: The authors have no conflicts of interest to disclose. None of the authors received outside funding for the production of this original manuscript, and no part of this article has been previously published elsewhere.

Figure 1. Chest radiograph shows hyperinflated lungs with patchy pulmonary opacities.



Newborns with meconium aspiration with distal penetration most commonly present with respiratory distress, poor lung compliance, and hypoxemia.⁵ Common laboratory findings include blood gas analysis showing low pH, decreased oxygen saturation, and increased carbon dioxide. Meconium aspiration can be classified as either mild ($\text{FiO}_2 < 0.40\%$ for less than 48 hours), moderate ($\text{FiO}_2 > 0.40\%$ for more than 48 hours without air leak), or severe (mechanical ventilation for more than 48 hours and/or pulmonary hypertension plus air leak).⁶

Imaging can confirm the diagnosis and assess the severity of the disease. Chest radiography is the preferred imaging modality used in the diagnosis and follow-up of meconium aspiration. It shows pulmonary hyperinflation with patchy opacities scattered in the lungs. The

opacities represent areas of atelectasis, while the regions of hyperinflation represent air trapping due to lower airway obstruction by the viscous and sticky meconium.⁷ Lung US has recently been used in the neonatal intensive care unit. The most common findings are lung consolidations, pleural line abnormalities, pleural effusions, atelectasis, and absence of lung sliding.⁸

Meconium aspiration is a significant contributor to morbidity and mortality in developing countries, and studies conducted in Nepal have revealed a neonatal mortality rate from MA at about 5.4% to 11.3%.⁹ This is predominantly attributed to complications of meconium aspiration, particularly asphyxia and pulmonary hypertension.¹⁰ In contrast, the mortality rate of meconium aspiration in the United States is considerably lower, with a large retrospective study revealing

that of the neonates diagnosed with MAS, only 2.4% were transferred to the neonatal intensive care unit for convalescent care, and of this cohort, 1.2% died.¹¹ This difference in mortality rates is thought to be due to improved obstetric practices such as early identification of risk factors, reduced incidence of post-maturity, and improvement in perinatal care in the United States.⁷

Conclusion

Meconium aspiration commonly presents in term and post-term infants, particularly in the setting of fetal stress. Affected newborns present with respiratory distress in the setting of MSAF. Chest radiography shows pulmonary hyperinflation with patchy opacities. Treatment of meconium aspiration is supportive and includes oxygen supplementation, mechanical ventilation, and intravenous fluids.

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