Review Article

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Meconium: The "Ins" and "Outs"

Varsha Deshmukh*, Madhavi Patil, Kanan Yelikar*****

Author's Affiliation:
*Associate Professor,
**Senior Resident,
***Head, Department of Obstetrics & Gynecology, GMC Aurangabad.

Reprint Request:
Varsha Deshmukh,
Associate Professor, Department of Obstetrics & Gynecology, Government Medical College, Panchakki Road, Aurangabad, Maharashtra 431001.
E-mail: deshmukhvl@yahoo.com

Abstracts

Meconium appearing in liquor which had clear earlier in labor is perhaps the most absolute sign of fetal distress. Meconium term derived from the Greek word "Meconium arion" meaning substance that resembles poppy juice or opium which is greenish in color. It is the first intestinal discharge from the newborn. Mechanism of passage meconium ma be – (a.) Physiological due to spontaneous gastrointestinal tract motility (b.) Due to direct hypoxic bowel stimulation. (c.) Due to sporadic and repetitive cord compression causing vagal stimulation .Factors influencing meconium staining are Gestational age, Gravid and Parity, Postdatism, Oligohdramnios, Intrauterine growth restriction(IUGR), Gestational hypertension, Preclampsia. Grading of MSAF by subjective assessment . Meconium aspiration syndrome (MAS) occurs due to aspiration of meconium during delivery with the initial braths of the baby. Factors associated with MAS: neurological complications, Birth asphyxia etc. This concluds prediction of the meconium staining of amniotic fluid can be attempted which would be of invaluable help in reducing the perinatal morbidity and mortality Presence of thick meconium should be viewed seriously as it may pose a potential danger for baby.

Keywords: Meconium; Hypoxia; Gestational Age; Oligohydramnos; Pneumonia Septicemia.

Introduction

Meconium staining of the liquor amnii in labor has long been regarded by obstetricians as an adverse sign so far as the fetus is concerned; indeed, meconium appearing in liquor which had been clear earlier in labor is perhaps the most absolute sign of fetal distress .

Reed (1918),first described inutero aspiration of meconium and meconium aspiration syndrome (MAS). An explanation for the pathogenetic mechanism was based on the hypothesis that inutero anoxia could relax the anal sphincter and result in meconium passage. Other investigators maintained that asphyxia leads to meconium passage because of increased intestinal peristalsis [1].

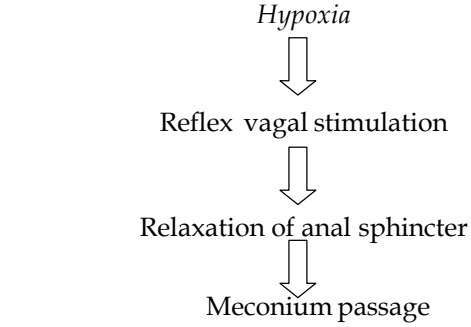
Similarly, Desmond et al (1957) considered meconium a marker for hypoxia and evidence that fetus may become dangerously hypoxic during the remainder of the birth.They stated that meconium staining of liquor amnii does not imply that the fetus is in extreme distress but rather is close to its tolerance limits [2].

Miller et al (1975) concluded that passage of meconium may be –

a. Physiological due to spontaneous gastrointestinal tract motility.

b. Due to direct hypoxic bowel stimulation.

c. Due to sporadic and repetitive cord compression causing vagal stimulation.



Pathophysiology of Hypoxia Causing Meconium Passage

They reported that presence of meconium in the amniotic fluid (AF) without sign of fetal asphyxia (late deceleration and acidosis) is not a sign of fetal distress and need not be an indication for active intervention.The combination of fetal asphyxia and meconium staining of the amniotic fluid however does enhance the potential for meconium aspiration and poor neonatal outcome [3].

Westagate et al (2002), in an experimental study ,demonstrated that meconium passage related to hypoxia is mediated by the sympathetic nervous system. They suggest that a reduction in sympathetic neural tone must be a component of meconium passage [4].

Meconium

Meconium,the fecal material that accumulates in the fetal colon throughout gestation,is a term derived from the Greek word, "Meconium arion" meaning substance that resembles poppy juice or opium,which is greenish in color. Commencing with Aristotle's observation of the association between meconium staining of the amniotic fluid and a sleepy state or neonatal depression,obstetricians have been concerned about fetal well being in the presence of meconium stained stained amniotic fluid (MSAF). Fetal hypoxic stress may stimulate colonic activity, resulting in the passage of meconium aspiration.

Definition, Composition and Formation

The first intestinal discharge from the newborn is meconium.

Meconium passage in newborn infants is a developmentally programmed event normally occurring within first 24 to 48 hours after birth [5].

Meconium is sterile, thick, black-green, odourless,viscous liquid. The fetal bowel contents consist of various product of seceretion,such as glycerophospholipids from the lungs,undigested debris from swallowed amniotic fluid, desquamated fetal cells, lanugo, scalp hair and vernix. Water is major liquid constituents which makes upto 72-80% of meconium. It also contains cholesterol and its precursors, lipids, enzymes including pancreatic phospholipase A2, mucopolysaccharides, proteins, bile acids and salts as well as drug metabolites. 80% of its dry weight is made up of polysaccharides. The dark greenish-black color is caused by pigments, especially biliverdin [6,7].

The circumferential musculature of the colon is complete by 10 weeks of gestation and innervation is complete b 12^{th} week. Meconium first appears in terminal ileum in beginning of the second trimester of fetal life (13^{th} to 17^{th} week) Abramovich et al (1982) noted that fetal defecation diminishes after 16 week and ceases by 20 weeks, concurrent with innervation of anal sphincter . At that time, the rectum appears to be filled with meconium . From approximately 20 to 34 weeeks, fetal passage of meconium was infrequent. Most newborn infants who pass meconium are mature (term). Under normal circumstances ,the passage of meconium from the fetus into the amnion is prevented by the lack of intestinal peristalsis,which is caused by several factors, including low motilin level, tonic contraction of anal sphincter , and a terminal cap of viscous meconium [6,7].

Westgate et al (2002) in their study suggested that meconium is normally passed into the amniotic fluid but cleared rapidly, probably by fetal swallowing and membrane macrophages, so that the amniotic fluid is normally not obviously meconium stained. In the presence of hypoxia , these clearance mechanism are likely to be impaired so meconium accumulates [4].

Factors Influencing Meconium Staining

Gestational Age

Incidence of meconium stained amniotic fluid increases with gestational age (GA). The incidence of meconium passage increases with gestational age and reaches upto 30% at 40 weeks and 50% at 42 weeks of gestation. The presence of meconium in amniotic fluid may reflect fetal gastrointestinal maturity. Fetal gut transit time does decrease with gestational age, and gut motility increases. Meconium passage in the preterm third trimester fetus has been reported to be a rare event, as typically it occurs near or post term.The intestinal hormone motilin has been implicated in passage of meconium inutero which causes contraction of smooth muscle in the gut wall [8].

Gravida and Parity

Nulliparity itself may lead to an increased risk of obstetric complications. The duration of labor of a nulliparous women is significantly longer than that of a multiparous woman. Prolonged duration of the second stage of labor is associated with a higher risk of the occurence of MSAF. These observations suggest that the frequency of MSAF is higher among nulliparous women than among multiparous women after the onset of labor because of a longer duration of the second stage of labor in nulliparous women.

Postdatism

Most common factor associated with MSAF. The hormone motilin is secreted in increasing quantities by the fetus as gestation advances and most meconium passages are said to occur in postdate gestation because the motilin levels are highest in postdated patients [8].

Oligohydramnios

Increased likelihood of cord occlusion with low amniotic fluid volume and vasoconstricting effect of meconium on umbilical and placental vessels may also contribute to the increased morbidity noted in this fetuses [8].

Intrauterine Growth Restriction (IUGR)

MSAF is often seen with IUGR fetuses due to fetal anoxia during intrapartum period. Stress-induced glucocorticoids mediated changes in corticotrophin releasing factor receptor subtype expression may alter colonic motility leading to meconium passage inutero [20].

Gestational Hypertension, Preeclampsia

IUGR is common in these cases so meconium staining of amniotic fluid is common.Other factors influencing the occurence of MSAF are prolonged labour, drugs and route of induction, premature rupture of membrane (PROM), anemia.

Grading of MSAF

By subjective assessment,the meconium content in AF was classified into: thin (light), moderate ,and thick (heavy). Grading of meconium and availability of continuous intrapartum fetal heat rate monitoring play an important role in the management of patients with meconium stained amniotic fluid. Apart from this, mode of delivery depends upon gravid status, dilatation of cervix at detection of meconium and uterine contractions.

Intrapartum Assessment of Fetal Wellbeing

1. Electronic fetal monitoring
2. Fetal oxygen saturation measured by pulse oximetry
3. Fetal scalp PH

Fetal heart rate (FHR): Tachycardia with more than 180/min associated with fetal distress and its warning sign for intervention.bradycardia less than 100/min FHR indicate terminal response of dying fetus.The mode of delivery is decided by individual assessment.

Meconium Aspiration and Meconium Aspiration Syndrome (MAS)

Babies born with the meconium stained amniotic fluid are more likely to be suffering from MAS.

MAS is defined as respiratory distress in an infant born through MSAF whose symptoms cannot be otherwise explained [11].

Coltart et al (1989) in his study gave strict criteria to diagnose MAS,

1. The presence of meconium-stained liquor
2. Chest X-ray consistent with MAS shows– scatteredopacities with tendency to over expansion of lungs
3. Histological confirmation of meconium in alveoli at autopsy.

Pathophsiology of MAS

Aspiration of meconium occurs during delivery with the initial breaths of the baby. This causes injury to the lungs.

Mechanism of Injuries

Meconium seems to be toxic to lungs and mechanism are

- Mechanical obstruction of airways,
- Chemical pneumonitis,
- Vasoconstriction of pulmonary vessels and
- Inactivation of surfactant

Diagnosis of MAS [12]

The classical findings in MAS are diffuse asymmetric patchy infiltrates But various radiographic findings may be present because of diverse mechanism.

Factors Associated with MAS

1. Neurological complications
2. NICU admission
3. Birth asphyxia
4. Hypoxic ischemic encephalopathy (HIE)
5. Transient tachypnea of newborn (TTN)
6. Septicemia
7. Pneumonia ,pneumothorax
8. Persistant pulmonary hypertension of newborn (PPHN)

9. Jaundice
10. Association with maternal infection

Thick meconium is associated with increased fetal heart rate abnormalities increased operative interventions, low APGAR scores, increased risk of birth asphyxia, meconium aspiration syndrome and overall increased perinatal mortality.

Conclusions

Meconium stained amniotic fluid is common fetal hazard in obstetrics. By thorough observation of the antepartum and intrapartum events prediction of the meconium staining of amniotic fluid can be attempted which would be of invaluable help in reducing the perinatal morbidity and mortality. Since all fetuses with meconium passage in labor do not have associated maternal risk factor and do not have adverse outcome, it is important to distinguish those who are destined to develop fetal distress promptly and intervene accordingly to prevent meconium aspiration syndrome and sequelae.

Presence of thick meconium should be viewed seriously as it may pose a potential danger for the baby. Repetitive bouts of asphyxia should be avoided as it leads to meconium aspiration. If neonatal complications are to be avoided, full cooperation and coordination of the obstetrician and pediatrician is required.

This Article is dedicated to Late Dr. Amol Dyanoba Pampatwar. He had done his PG Dissertation on MSAF.

"WE ALL MISS YOU AMOL !!!"

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