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Original Research Article

A STUDY ON MATERNAL AND FETAL OUTCOME IN MECONIUM-STAINED AMNIOTIC FLUID IN A TERTIARY CARE HOSPITAL

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Abstract:

Meconium-stained amniotic fluid (MSAF) is a significant clinical complication associated with increased maternal and neonatal risks. The study evaluates the obstetric and neonatal outcomes in women with MSAF, particularly focusing on the influence of meconium consistency (thin, moderate, thick) and the timing of labour. The study involved 100 pregnant women with singleton pregnancies at 37-42 weeks gestation, who presented with MSAF. The incidence of meconium aspiration syndrome (MAS), abnormal fetal heart rate patterns, and neonatal complications such as asphyxia, sepsis, and hypoglycemia were analyzed. The results show that thick meconium is linked to higher rates of neonatal distress, including lower APGAR scores, MAS, and prolonged hospital stays. Furthermore, maternal complications, including prolonged labour and postpartum hemorrhage, were common in these cases. The study also highlights the benefits and limitations of interventions like amnioinfusion and early neonatal resuscitation. The findings emphasize the critical role of continuous monitoring and prompt management in improving neonatal outcomes in cases of MSAF.

Keywords: Meconium-stained amniotic fluid, maternal outcomes, neonatal outcomes, amnioinfusion, maternal outcomes, respiratory distress, APGAR score, birth asphyxia.

Introduction

Meconium-stained amniotic fluid (MSAF) is a significant indicator of fetal compromise, often linked to increased perinatal morbidity and mortality. J. Whitridge Williams (1903) observed that "the escape of meconium is a characteristic sign of impending asphyxia.[1] While meconium passage is rare before 34 weeks of gestation, it becomes more common with advancing gestational age, with a notable increase after 37 weeks. By 36 weeks, meconium passage occurs in approximately 10% of cases, rising to 30% at 40 weeks and 50% at 42 weeks. Around 12% of all deliveries involve MSAF, and 5% of these infants develop meconium aspiration syndrome (MAS), contributing to 2% of perinatal deaths.

The presence of meconium in the amniotic fluid raises concern in the delivery room due to its association with an elevated risk of perinatal complications. The passage of meconium is believed to be a response to fetal hypoxia, mesenteric vasoconstriction, and other physiological factors related to fetal maturity. Term and post-term neonates are more likely to pass meconium, which may also increase the risk of intra-amniotic infection. Key clinical takeaways include: Clear amniotic fluid is reassuring, Thick meconium increases risk, Abnormal fetal heart rate patterns with MSAF are a strong indication of fetal compromise.

This study aims to evaluate the maternal and fetal outcomes associated with MSAF, highlighting its implications for obstetric management and neonatal care.

Aim and Objectives

1. To evaluate the obstetric and neonatal outcomes associated with meconium-stained amniotic fluid, considering the impact of thin and thick meconium during early and late labour.
2. To analyze the maternal and fetal factors influencing meconium passage and their role as predictors of neonatal outcomes.

Review of Literature:

1. Prevalence and Risk Factors of MSAF: Meconium-stained amniotic fluid (MSAF) is a significant concern during labour, with an incidence ranging from 10% to 15% in various studies (Simmanjit Kaur et al., 2019)[2]. MSAF is associated with higher maternal and fetal risks, including abnormal fetal heart rate (FHR) patterns, increased cesarean section rates, and neonatal complications. High-risk pregnancies, such as those involving gestational hypertension, diabetes, intrauterine growth restriction (IUGR), and post-dated pregnancies, are more prone to MSAF (Naresh P Motwani et al., 2016)[3]. The occurrence of thick meconium increases the likelihood of adverse neonatal outcomes.

2. Fetal Heart Rate (FHR) and Neonatal Morbidity: Numerous studies confirm that the presence of MSAF, particularly with thick meconium, correlates with abnormal FHR patterns. Studies like those by Rossi et al. (1989)[4] found a significant increase in the incidence of MAS when meconium was thick, with 19% of infants with thick meconium developing MAS compared to 5% with medium meconium and 3% with thin meconium. The risk of neonatal respiratory distress, hypoxia, and MAS rises with abnormal FHR patterns (Fleischer et al., 1992; Priti Singh et al., 2017)[5&6]. Further, studies by Dohbit et al. (2018)[7] and Althaqafi et al. (2011)[8] showed that the presence of MSAF led to higher rates of neonatal resuscitation and NICU admissions.

3. Amnioinfusion as a Management Strategy: Amnioinfusion, the introduction of a sterile solution into the amniotic sac, has been suggested to reduce the incidence of MAS and improve neonatal outcomes by diluting meconium and alleviating umbilical cord compression. Early studies, such as those by Wenstrom et al. (1989)[9], demonstrated that amnioinfusion significantly reduced the occurrence of meconium below the vocal cords and decreased the likelihood of MAS. A meta-analysis by Glantz and Hetteney (1997)[10] showed an 84% reduction in the likelihood of meconium aspiration into the vocal cords with the use of amnioinfusion. These findings were confirmed by several subsequent studies, including Pierce et al. (2000), which highlighted a substantial reduction in MAS with amnioinfusion, reporting a relative risk of 0.25. Additionally, Miyazaki and Navrez observed a reduction in variable decelerations in the amnioinfusion group compared to non-infusion cases.

4. Prevention of MAS: Prevention strategies for MAS, including airway management, have been widely explored. The American Academy of Pediatrics (2000) recommends oropharyngeal suctioning for all neonates with MSAF, with tracheal suctioning for those with significant respiratory distress. Pfenninger et al. (1984)[11] demonstrated that oropharyngeal suctioning is more effective than nasal suctioning for clearing meconium from the airway. However, the presence of meconium in the lungs, particularly when aspirated in utero, may not always be prevented even with aggressive suctioning, as seen in the studies of Manning et al. (1978)[12] and Brown and Gleicher (1981)[13].

5. Clinical Outcomes of MSAF: Neonates born with MSAF have higher rates of poor clinical outcomes. Studies by Wiswell et al. (2000)[14] and Priti Singh et al. (2017)[6] reported increased neonatal morbidity, including MAS, hypoxic ischemic encephalopathy, and jaundice, particularly when FHR abnormalities were present. Althaqafi et al. (2011)[8] and Onkar S. Bhinder et al. (2012)[15] confirmed that MSAF is associated with higher rates of NICU admissions and respiratory distress. Furthermore, the severity of meconium, particularly thick meconium, is a major determinant of neonatal outcome, with thicker meconium being linked to higher rates of cesarean delivery and increased neonatal morbidity.

6. Role of Amnioinfusion in Improving Outcomes: Several studies have shown that amnioinfusion can improve APGAR scores, reduce the incidence of meconium aspiration, and improve fetal heart rate patterns by mitigating cord compression. In cases of thick meconium, amnioinfusion is particularly beneficial. The study by Cialone et al. (1995)[16] demonstrated that amnioinfusion could help improve the clinical outcomes in cases of thick meconium, reducing the need for emergency cesarean deliveries and improving neonatal outcomes.

7. Challenges and Limitations: Despite the promising results of amnioinfusion in improving neonatal outcomes, it is not without challenges. Not all studies report consistently positive results, and amnioinfusion does not guarantee prevention of MAS. A study by Cunningham et al. (1990)[17] found that early suctioning alone was not sufficient in preventing MAS in cases of thick meconium. Additionally, while amnioinfusion helps alleviate cord compression and meconium aspiration risks, it does not resolve all the factors contributing to neonatal distress in MSAF cases, such as fetal hypoxia or intrauterine meconium aspiration.

8. Neonatal Resuscitation and Monitoring: The importance of continuous fetal monitoring and timely neonatal resuscitation cannot be overstated. Studies, such as those by Naresh P Motwani et al. (2016)[3] and R. Padmapriya et al. (2013)[18], emphasize the need for vigilant monitoring of neonates born with MSAF, particularly those with abnormal FHR patterns. Trained medical staff should be prepared to provide early resuscitation, including airway suctioning and, if necessary, intubation and mechanical ventilation for neonates with MAS.

Materials & Methods:

A total of 100 pregnant women, both primigravida and multigravida, with a gestational age of 37–42 weeks, singleton pregnancies, cephalic presentation, and meconium-stained amniotic fluid, were included in the study. These women were in either the latent or active stages of labour, with or without medical complications during pregnancy, and with or without premature rupture of membranes (PROM).

Diagnostic and Data Collection:

Upon identification of meconium-stained amniotic fluid, the following diagnostic criteria were used to assess meconium aspiration syndrome (MAS):

1. **Clinical signs**: Tachypnea, retractions, grunting, or other signs of respiratory distress (RD) within 24 hours of birth.
2. **Oxygen requirement**: The need for supplemental oxygen or ventilatory support.
3. **Radiological findings**: Chest X-ray consistent with aspiration pneumonitis.

The presence and degree of meconium staining were noted at the time of amniotomy or spontaneous rupture of membranes. Fetal heart rate abnormalities were monitored using intrapartum cardiotocography (CTG). The mode of delivery and the neonatal outcome were also recorded.

Outcome Measures:

- **Maternal Outcome**: Mode of delivery, any maternal complications, and need for resuscitation.
- **Neonatal Outcome**: APGAR scores at 1 and 5 minutes, birth weight, signs of intrauterine growth restriction (IUGR), and presence of any congenital anomalies. Neonates with MAS were assessed for the need for respiratory support, NICU or SNCU admission, and subsequent treatments.

Data Collection Methods: The following data were collected for all participants:

- **Maternal Details**: Detailed history of the pregnancy, including risk factors (e.g., preeclampsia, intrauterine growth restriction, PROM).
- **Fetal Heart Rate Monitoring**: Continuous monitoring of fetal heart rate abnormalities using CTG.
- **Neonatal Evaluation**: The APGAR score, neonatal weight, presence of meconium staining on the body, and any other physical abnormalities such as caput or subgaleal bleeding were noted.
- **Placental Assessment**: The weight and condition of the placenta (e.g., presence of infarcts or calcifications) were recorded.

Meconium Aspiration Syndrome (MAS) Diagnosis:

Neonates who exhibited the following signs were diagnosed with MAS:

- Respiratory distress (tachypnea, retractions, grunting) within the first 24 hours.
- Need for supplemental oxygen or mechanical ventilation.
- Chest X-ray findings consistent with meconium aspiration.

Neonates with other respiratory conditions (such as transient tachypnea of the newborn or hyaline membrane disease) were excluded.

Management[19]:

- For non-vigorous neonates, immediate suctioning of the oropharynx and trachea under direct vision was performed by a pediatrician.
- Vigorous neonates underwent oral and nasal suctioning.
- If necessary, endotracheal intubation and mechanical ventilation were administered.
- Stomach wash was performed to prevent further vomiting or aspiration of meconium-stained fluid.

Results:

1. **Distribution of Maternal Risk Factors:**
   - The study highlighted that anaemia (25%**),** IUGR (28%**),** and oligohydramnios (23%) were the most common risk factors observed in mothers with meconium-stained labour.
   - The analysis of maternal complications revealed that perineal trauma (13 cases)**,** prolonged labour (17 cases), and postpartum hemorrhage (12 cases) were notable, especially with moderate meconium being associated with higher ICU admissions.
2. **Neonatal Outcomes (APGAR Scores and Complications):**
   - APGAR scores at 1 minute showed that 59% of neonates had a score of 4, with 54% achieving a score of 8 by 5 minutes**.**
   - Neonatal complications **like** MAS (62%)**,** birth asphyxia (36%)**, and** neonatal sepsis (32%) were significantly higher in cases with thick meconium**.**
3. **Neonatal Discharge and Outcome:**
   - Most neonates were discharged within 10 days (63%), with a smaller proportion needing longer hospital stays.
   - 20% of neonates expired, indicating a low mortality rate among the study population.

Table 1: Distribution of Maternal Risk Factors

Risk Factor	YES (%)	NO (%)
Post Dated Pregnancy	7	93
Anaemia	25	75
Oligohydramnios	23	77
IUGR	28	72
GDM	14	86
PROM	10	90
PIH	12	88
Hypothyroidism	15	85

Table 2: Neonatal APGAR Scores at 1 and 5 Minutes

APGAR Score	Thin Meconium (n=44)	Moderate Meconium (n=28)	Thick Meconium (n=28)	Total
1-Minute	2 (15)	2 (11)	2 (6)	32
	4 (26)	4 (14)	4 (19)	59
	8 (3)	8 (3)	8 (3)	9
5-Minutes	4 (16)	4 (12)	4 (17)	35
	7 (1)	7 (1)	7 (0)	2
	8 (24)	8 (12)	8 (18)	54
	10 (3)	10 (3)	10 (3)	9

Explanation:

- **(n=44)**: Total neonates in the **Thin Meconium** group.
- **Numbers in brackets**: The **number of neonates** with that APGAR score (e.g., 15 neonates in the Thin Meconium group had an APGAR score of 2 at 1 minute).
- **Total in each row**: The total number of neonates across all meconium types with a specific APGAR score (e.g., 32 neonates had an APGAR score of 2 at 1 minute).

Table 3: Neonatal Complications and

Complication	Count	Percentage (%)
Hypoglycemia	27	27%
Asphyxia	36	36%
Sepsis	32	32%
Meconium Aspiration Syndrome (MAS)	62	62%
NICU Admission	33	33%
Intubation	21	21%

Table:4 Discharge Summary

Discharge Duration	Count	Percentage (%)
<10 days	63	63%
11-20 days	21	21%
21-30 days	6	6%
31-40 days	7	7%
>40 days	3	3%

Discussion

Meconium-stained amniotic fluid (MSAF) is a well-known obstetric complication with significant maternal and neonatal risks. The present study found a high incidence of maternal complications associated with MSAF, including prolonged labour, postpartum hemorrhage (PPH), infections, and perineal trauma. These findings align with previous studies showing that MSAF, particularly thick meconium, is linked to an increased need for caesarean delivery, ICU admission, and resuturing (Sadia Parween, 2011; Afsar et al., 2018)[20,21]. Infection and uterine trauma are common complications in cases with MSAF, likely due to the higher incidence of chorioamnionitis and endometritis (Miller et al., 2009)[22].

In neonatal outcomes, APGAR scores at both 1 and 5 minutes indicated a higher incidence of neonatal distress among infants born with thick meconium. A significant portion of neonates in this study exhibited low APGAR scores (2 and 4) at 1 minute, similar to findings by Ambramovici et al. (2015),[23] who documented a higher incidence of low APGAR scores in neonates with MSAF. Asphyxia, a leading cause of neonatal morbidity, was more prevalent in neonates born with thicker meconium. This result is consistent with the understanding that meconium aspiration syndrome (MAS) often leads to respiratory distress and asphyxia due to airway obstruction, chemical pneumonitis, and impaired lung surfactant production (Wiswell TE et al., 1990; George et al., 2016)[24,25]. In the current study, PPHN was notably more frequent in neonates with thick meconium, confirming that hypoxia and meconium aspiration are closely linked to persistent pulmonary hypertension, as observed in prior research (Zalak V. Karena et al., 2019).[26]

Neonatal sepsis was another prominent complication in neonates with MSAF, with a higher incidence observed in neonates with thick meconium. This finding supports previous studies indicating that meconium reduces the antibacterial properties of amniotic fluid and promotes bacterial proliferation, which can lead to sepsis (Dohbit et al., 2012)[27]. Additionally, hypoglycemia was more common in neonates born with thick meconium, although its prevalence was not as high as other complications like respiratory distress or sepsis. Maayan-Metzger et al. (2009)[28] reported that MAS is often associated with persistent pulmonary hypertension and hypoxia, which can contribute to metabolic imbalances such as hypoglycemia.

The study also found a significant association between intrauterine growth restriction (IUGR) and MSAF, particularly among multiparous women. IUGR fetuses are at higher risk for fetal hypoxia, which contributes to the passage of meconium into the amniotic fluid (Nirmala et al., 2020)[29]. This supports the notion that IUGR is a risk factor for meconium passage, which in turn increases the risk of adverse neonatal outcomes such as asphyxia and MAS (David et al., 2015).[30]

The overall mortality rate in the study was 22%, which is consistent with findings from other studies, such as Kumari et al. (2011)[31], who reported a 9% mortality rate in MSAF cases. The high mortality rate in MSAF cases is often due to complications like acute respiratory failure, pneumonia, sepsis, and neurological sequelae from birth asphyxia (Benney et al., 2014)[32].Neonates with MAS are particularly vulnerable to respiratory failure and PPHN, leading to high morbidity and mortality rates (Zalak V. Karena et al., 2019).[26]

Conclusion:

Meconium-stained amniotic fluid (MSAF) significantly increases maternal and neonatal risks, particularly meconium aspiration syndrome (MAS), respiratory distress, and asphyxia, especially with thick meconium. Maternal complications like prolonged labour and postpartum hemorrhage are also more common in these cases. Abnormal fetal heart rate patterns emphasize the need for continuous monitoring. While amnioinfusion can improve neonatal outcomes, its effectiveness in preventing MAS remains limited. Early neonatal resuscitation, including proper suctioning and respiratory support, is crucial for better outcomes. Vigilant monitoring and timely interventions are key to improving both maternal and neonatal health in MSAF cases.

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