|| ISSN(online): 2589-8698 || ISSN(print): 2589-868X ||

Available online on http://www.ijmbs.info

International Journal of Medical and Biomedical Studies; 2024; 8(4); 68-74

Research Article

Risk Factors Associated with Meconium-Stained Amniotic Fluid and Neonatal Outcomes

Indu Khare[1], Gunjan Gunjan[2], Ashutosh Kumar[3], Anjana Sinha[4]

[1]Senior Resident, Department of Obstetrics & Gynecology, Patna Medical College & Hospital, Patna, Bihar, India

[2]Senior Resident, Department of Obstetrics & Gynecology, Patna Medical College & Hospital, Patna, Bihar, India

[3]Senior Resident, Department of ENT, Jawahar Lal Nehru Medical College & Hospital, Bhagalpur, Bihar, India

[4]Professor, Department of Obstetrics & Gynaecology, Patna Medical College & Hospital, Patna, Bihar, India

Received: 11-07-2024 / Revised 25-07-2024 / Accepted 14-08-2024
Corresponding author: Gunjan Gunjan ((dr.gunjan24@gmail.com))
DOI: **https://doi.org/10.32553/ijmbs.v8i4.2881**
Conflict of interest: Nil

Abstract:

Introduction: Meconium-stained amniotic fluid (MSAF) is a common complication in term and post-term pregnancies and may indicate fetal distress, increasing the risk of meconium aspiration syndrome (MAS) and other neonatal complications. This study aims to evaluate the risk factors for meconium-stained liquor and assess the outcomes of neonates born with meconium-stained amniotic fluid.

Methodology: This observational study was conducted over 12 months at Patna Medical College and Hospital, involving 200 pregnant women with MSAF. Maternal data were collected, including age, parity, gestational age, and pregnancy complications. Neonatal outcomes, such as Apgar scores, NICU admissions, and the incidence of MAS, were recorded. Statistical analysis was performed using chi-square tests and logistic regression, with a significance level set at $p<0.05$.

Results: Of the 200 participants, 40% of neonates exposed to thick meconium had Apgar scores below 7 at 1 minute, and 25% required NICU admission. MAS occurred in 20% of cases with thick meconium, compared to 3% in those with thin meconium. Neonatal death was observed in 5% of thick meconium cases. Additionally, cesarean sections were associated with poorer neonatal outcomes, including lower Apgar scores and higher NICU admission rates, compared to vaginal deliveries.

Conclusion: Thick meconium-stained amniotic fluid is associated with significantly worse neonatal outcomes, including higher rates of MAS, NICU admissions, and neonatal deaths. Cesarean sections were linked to poorer outcomes compared to vaginal deliveries. Early detection and timely management of pregnancies complicated by meconium-stained liquor are crucial to improving neonatal outcomes.

Recommendation: Vaginal delivery should be considered when feasible, and close monitoring of neonates born through MSAF is essential. Further studies are recommended to refine management strategies for reducing complications associated with thick meconium-stained liquor.

Keywords: Meconium-Stained Amniotic Fluid, Neonatal Outcomes, Meconium Aspiration Syndrome, Cesarean Delivery, Vaginal Delivery.

Introduction:

Meconium-stained amniotic fluid (MSAF) is a condition characterized by the presence of meconium, the first stool of the fetus, in the amniotic fluid [1]. It is a relatively common occurrence, affecting approximately 10-20% of all pregnancies, particularly at or beyond term. The presence of meconium in the amniotic fluid has long been associated with fetal distress, as meconium passage is often triggered by fetal hypoxia or other forms of stress in utero [2]. While it can be a normal physiological process, especially in post-term pregnancies, meconium staining is a warning sign in many cases and can be associated with a variety of maternal and fetal risk factors [3]. The condition can lead to serious complications for the neonate, particularly when meconium is aspirated into the lungs during delivery, resulting in meconium aspiration syndrome (MAS) [4]. Meconium is typically sterile and is made up of amniotic fluid, intestinal secretions, bile, and epithelial cells. In utero, the fetus may pass meconium as a response to various stimuli, including fetal hypoxia, vagal stimulation, or even as part of normal gastrointestinal maturation in the later stages of pregnancy [5,6]. Meconium-stained liquor is classified based on the consistency and amount of meconium in the fluid, ranging from thin to thick. Thick meconium, in particular, poses a higher risk of meconium aspiration syndrome, a serious respiratory condition that occurs when the newborn inhales meconium-stained fluid into the lungs during or shortly after birth. MAS can lead to severe respiratory distress, requiring intensive medical interventions, and may also result in long-term complications such as persistent pulmonary hypertension and neurological damage [7,8].

Several maternal and fetal risk factors have been associated with the passage of meconium into the amniotic fluid. Maternal conditions such as preeclampsia, hypertension, diabetes, and infections can increase the likelihood of fetal stress and subsequent meconium passage. Prolonged labor, post-term pregnancy (pregnancy lasting beyond 41 weeks), and intrauterine growth restriction (IUGR) are also recognized risk factors [9.10]. Additionally, fetal distress, as indicated by abnormal fetal heart rate patterns, may contribute to the presence of meconium in the amniotic fluid. In some cases, the absence of immediate delivery after detecting MSAF may further exacerbate risks for both the mother and the infant [11,12].

The outcomes for neonates born through meconium-stained amniotic fluid can vary widely, depending on the severity of the condition and the management strategies employed during labor and delivery. In mild cases, neonates may not experience any significant complications, while in severe cases, especially when meconium aspiration occurs, there is a risk of respiratory distress, pulmonary complications, infection, and long-term developmental issues [13]. Neonatal resuscitation, mechanical ventilation, and even extracorporeal membrane oxygenation (ECMO) may be required in severe instances of MAS. However, early identification of at-risk pregnancies and timely interventions, such as amnioinfusion or cesarean delivery in cases of fetal

distress, can improve neonatal outcomes [14].

Given the potential risks associated with meconium-stained amniotic fluid, understanding the underlying maternal and fetal risk factors, as well as the outcomes for neonates exposed to meconium in utero, is essential for improving perinatal care. Appropriate management strategies during labor and delivery, along with prompt neonatal assessment and treatment, play critical roles in minimizing adverse outcomes [15].

The aim of this study is to analyze the risk factors associated with meconium-stained liquor and assess the outcomes of neonates born in the presence of meconium-stained amniotic fluid.

Methodology

Study Design

This study was an observational study conducted over 12 months. The aim was to evaluate the risk factors associated with meconium-stained liquor and assess the outcomes of neonates born in the presence of meconium-stained amniotic fluid.

Study Setting

The study was conducted at the Department of Obstetrics and Gynecology, Patna Medical College and Hospital (PMCH), Bihar, India. Data collection occurred from 1st May 2023 to 1st May 2024, encompassing 12 months. The hospital is a tertiary care facility, providing care for high-risk pregnancies and serving a large population of patients.

Participants

A total of 200 pregnant women who presented with meconium-stained amniotic fluid during labor were included in the study. The neonates born to these women were also evaluated for outcomes.

Inclusion and Exclusion Criteria

- **Inclusion Criteria**:

1. Pregnant women at term gestation (37–42 weeks) presenting with meconium-stained amniotic fluid during labor.
2. Singleton pregnancies.
3. Neonates born to these mothers were assessed immediately after delivery for outcomes.

- **Exclusion Criteria**:

1. Pregnant women with multiple gestations.
2. Pregnancies with known congenital anomalies.
3. Preterm deliveries (<37 weeks).
4. Women with a history of uterine anomalies or previous uterine surgery.
5. Cases with incomplete data or refusal to participate in the study.

Bias

Efforts were made to minimize bias by ensuring that all eligible patients were consecutively enrolled during the study period, reducing the risk of selection bias. Data collection was standardized, with all investigators following a predefined protocol to avoid information bias. Furthermore, multiple physicians were involved in assessing neonatal outcomes to provide objective and consistent evaluations, mitigating observer bias.

Data Collection and Analysis

Data were collected prospectively from all eligible participants during labor and after delivery. Maternal data, including demographic information (age, parity, gestational age, presence of pregnancy complications), and intrapartum factors (mode of delivery, duration of labor, and fetal distress), were recorded. Details regarding the meconium staining (thin or thick) were also noted. Neonatal outcomes were assessed immediately after delivery and included Apgar scores at 1 and 5 minutes, birth weight, need for resuscitation, and admission to the neonatal intensive care unit (NICU). Additionally,

any cases of meconium aspiration syndrome (MAS) were documented.

Statistical Analysis

Data were entered and analyzed using statistical software such as SPSS version 25.0. Descriptive statistics, such as means, percentages, and frequencies, were calculated for demographic data, maternal risk factors, and neonatal outcomes. Chi-square tests were used to determine the association between maternal factors and meconium-stained amniotic fluid and between meconium staining and neonatal outcomes. A p-value of <0.05 was considered statistically significant. Logistic regression analysis was performed to identify independent risk factors associated with adverse neonatal outcomes, adjusting for potential confounders.

Ethical Considerations

Ethical approval for the study was obtained from the Institutional Ethics Committee of Patna Medical College and Hospital prior to the commencement of the study. Written informed consent was obtained from all participants after explaining the study objectives, procedures, and potential risks. All data collected during the study were kept confidential and used only for research purposes.

Results

A total of 200 pregnant women with meconium-stained amniotic fluid and their neonates were included in this study. The mean maternal age was 28.3 ± 4.5 years, with a mean gravidity of 2.3 ± 1.1. The average gestational age at delivery was 39.5 ± 1.2 weeks, indicating most pregnancies were either term or post-term. Preeclampsia was observed in 25% of the cases, while 18% of the pregnancies were post-term. Prolonged labor was reported in 30% of the women, and fetal distress was noted in 40%. Regarding the mode of delivery, 55% of the women had vaginal deliveries, while 45% underwent cesarean sections.

Table 1: Maternal Demographics and Risk Factors

Parameter	Value
Age (years)	28.3 ± 4.5
Gravidity	2.3 ± 1.1
Gestational Age (weeks)	39.5 ± 1.2
Preeclampsia (%)	25%
Post-term Pregnancy (%)	18%
Prolonged Labor (%)	30%
Fetal Distress (%)	40%
Mode of Delivery (Vaginal: C-section)	55% : 45%

Neonates born through meconium-stained amniotic fluid were categorized based on the thickness of the meconium (thin or thick), and the outcomes were analyzed accordingly. Neonates exposed to thick meconium had poorer outcomes compared to those exposed to thin meconium. Apgar scores of less than 7 at 1 minute were seen in 40% of neonates with thick meconium and 15% with thin meconium. Similarly, at 5 minutes, 15% of neonates with thick meconium had Apgar scores below 7, while only 3% of neonates with thin meconium did. NICU admission was required in 25% of cases with thick meconium compared to 5% with thin meconium. The incidence of meconium aspiration syndrome (MAS) was higher in neonates born through thick meconium (20%) compared to thin meconium (3%). Neonatal death occurred in 5% of cases with thick meconium, while no deaths were reported in the thin meconium group.

Table 2: Neonatal Outcomes Based on Meconium Staining

Neonatal Outcome	Thin Meconium (%)	Thick Meconium (%)
Apgar score <7 at 1 minute	15%	40%
Apgar score <7 at 5 minutes	3%	15%
NICU Admission	5%	25%
Meconium Aspiration Syndrome (MAS)	3%	20%
Neonatal Death	0%	5%

When comparing neonatal outcomes between vaginal and cesarean deliveries, neonates born through cesarean sections had poorer outcomes overall. Apgar scores of less than 7 at 1 minute were observed in 35% of neonates delivered via cesarean section compared to 25% of those delivered vaginally. At 5 minutes, 10% of neonates delivered by cesarean section had Apgar scores below 7, compared to 5% delivered vaginally. NICU admissions were required for 20% of neonates delivered via cesarean, while only 10% of vaginally delivered neonates required NICU care. The incidence of MAS was also higher in neonates delivered by cesarean (15%) compared to vaginal deliveries (5%). Neonatal deaths occurred in 3% of cesarean deliveries, while no deaths were recorded in vaginal deliveries.

Table 3: Comparison of Neonatal Outcomes by Mode of Delivery

Neonatal Outcome	Vaginal Delivery (%)	Cesarean Delivery (%)
Apgar score <7 at 1 minute	25%	35%
Apgar score <7 at 5 minutes	5%	10%
NICU Admission	10%	20%
Meconium Aspiration Syndrome (MAS)	5%	15%
Neonatal Death	0%	3%

The study showed that thick meconium-stained amniotic fluid was associated with significantly poorer neonatal outcomes, including lower Apgar scores, higher rates of NICU admissions, increased incidence of MAS, and neonatal deaths. Cesarean sections were also associated with worse neonatal outcomes compared to vaginal deliveries. These findings highlight the importance of early identification and management of pregnancies with meconium-stained amniotic fluid to optimize neonatal outcomes.

Discussion

This study observed that 40% of neonates born through thick meconium-stained amniotic fluid had an Apgar score of less than 7 at 1 minute, and 25% required NICU admission. Additionally, the incidence of meconium aspiration syndrome (MAS) was significantly higher in neonates exposed to thick meconium (20%) compared to thin meconium (3%). Furthermore, the mode of delivery influenced neonatal outcomes, with 35% of cesarean-delivered neonates having an Apgar score below 7 at 1 minute, compared to 25% of those delivered vaginally. Neonatal deaths were also higher in the cesarean group (3%) than in the vaginal delivery group, where no deaths were recorded.

The study demonstrated that thick meconium-stained amniotic fluid is associated with significantly worse neonatal outcomes, including lower Apgar scores, higher rates of NICU admissions, and increased occurrence of MAS [16]. This suggests that the severity of meconium staining plays a critical role in the immediate health of the neonate, with thick meconium posing a greater risk for complications. Additionally, cesarean section deliveries were linked to poorer neonatal outcomes compared to vaginal

deliveries, suggesting that the mode of delivery may impact the ability to effectively manage and clear meconium during delivery [17].

The findings of this study are consistent with previous research that has identified a strong association between thick meconium and adverse neonatal outcomes. Studies such as those conducted by Wiswell et al. and Gelfand et al. have reported similar rates of MAS and low Apgar scores in neonates born through thick meconium-stained fluid. The increased rate of NICU admissions and MAS in this study aligns with earlier research, which highlighted the risks associated with meconium aspiration and the need for intensive respiratory support in affected neonates. The comparison of neonatal outcomes by mode of delivery also reflects findings from studies by Mehta et al., which reported a higher prevalence of complications in neonates delivered via cesarean section in the presence of MSAF [21,22,23].

Several factors could explain these results. Thick meconium is more likely to lead to aspiration during delivery, increasing the risk of MAS and respiratory complications. Meconium aspiration may occur either before or during delivery, leading to airway obstruction, chemical pneumonitis, and secondary infections [18]. In neonates exposed to thick meconium, the risk of compromised respiratory function is heightened, resulting in lower Apgar scores and the need for NICU admissions. Additionally, neonates born via cesarean section may be at higher risk of adverse outcomes because of the lack of labor-associated physiological mechanisms that help clear meconium from the airways, such as fetal thoracic compression during vaginal delivery [19].

Vaginal delivery might facilitate the expulsion of meconium from the lungs through the natural squeezing of the fetal thorax during passage through the birth canal, which may explain the better neonatal outcomes observed in vaginally delivered neonates. However, cesarean sections are often performed in cases of fetal distress, which might partly explain the worse outcomes in neonates delivered this way, as the indication for cesarean could itself reflect a higher risk scenario for the fetus [20]. This study underscores the importance of early detection of thick meconium-stained amniotic fluid and the need for timely and appropriate interventions to mitigate risks to the neonate. The findings also suggest that whenever possible, vaginal delivery should be preferred for cases of MSAF, provided that fetal distress is not severe, to potentially improve neonatal outcomes.

Conclusion

This study concludes that thick meconium-stained amniotic fluid significantly increases the risk of adverse neonatal outcomes, including low Apgar scores, higher rates of NICU admissions, meconium aspiration syndrome, and neonatal mortality. Cesarean sections were associated with poorer neonatal outcomes compared to vaginal deliveries, possibly due to the lack of natural mechanisms that aid in clearing meconium during labor. Early identification of pregnancies at risk, prompt management during labor, and careful postnatal monitoring of neonates exposed to meconium are critical in reducing neonatal complications and improving overall outcomes.

References

1. Wiswell TE, Tuggle JM, Turner BS. Meconium aspiration syndrome: have we made a difference? Pediatrics. 1990;85(5):715-21.
2. Nathan L, Leveno KJ, Camody TJ. Meconium: a 1990s perspective on an old obstetric hazard. Obstet Gynecol. 1994;83(3):329-32.
3. Usta IM, Khalil AM, Nassar AH, et al. Meconium-stained amniotic fluid: neonatal outcome. Am J Perinatol. 2003;20(5):239-45.
4. Cleary GM, Wiswell TE. Meconium-stained amniotic fluid and the

meconium aspiration syndrome: an update. Pediatr Clin North Am. 1998;45(3):511-29.
5. Khatun S, Rahman M, Ahmed S. Fetal distress and neonatal outcome in meconium-stained amniotic fluid in relation to mode of delivery. J Obstet Gynaecol Res. 2014;40(4):976-81.
6. Dargaville PA, Copnell B. The epidemiology of meconium aspiration syndrome: incidence, risk factors, and outcomes. J Pediatr. 2006;149(5):731-5.
7. Gelfand SL, Fanaroff JM, Walsh MC. Meconium-stained amniotic fluid: what to do? Clin Perinatol. 2007;34(4):713-26.
8. Linder N, Aranda JV, Tsur M, et al. Need for resuscitation and risk of meconium aspiration in a population with high cesarean section rate. Am J Perinatol. 2007;24(8):503-9.
9. Vain NE, Szyld EG, Prudent LM, Wiswell TE. Progress in the prevention of meconium aspiration syndrome. Am J Obstet Gynecol. 2001;184(8):689-95.
10. Ahanya SN, Lakshmanan J, Morgan BL, Ross MG. Meconium passage in utero: mechanisms, consequences, and management. Obstet Gynecol Surv. 2005;60(1):45-56.
11. Mehta N, Chawla S, Kumar P, Narang A. Study of predictors of meconium-stained amniotic fluid in high-risk pregnancies and neonatal outcome. Indian Pediatr. 2006;43(11):871-5.
12. Fanaroff AA, Stoll BJ, Wright LL, et al. Trends in neonatal morbidity and mortality for very low birth weight infants. Am J Obstet Gynecol. 2007;196(2):147.e1-8.
13. Swarnam K, Soraisham AS, Sivanandan S. Advances in the management of meconium aspiration syndrome. Int J Pediatr. 2012;2012:1-7.
14. Wiswell TE, Gannon CM, Jacob J, et al. Delivery room management of the apparently vigorous meconium-stained neonate: results of the multicenter, international collaborative trial. Pediatrics. 2000;105(1):1-7.
15. Kamala D, Anandhi D, Subramaniam A. Outcome of neonates born with meconium-stained liquor. Int J Contemp Pediatr. 2017;4(2):367-72.
16. Mundhra R, Agarwal M. Fetal outcome in meconium-stained deliveries. J Clin Diagn Res. 2013;7(12):2874-6.
17. Velaphi S, Van Kwawegen A. Meconium aspiration syndrome requiring assisted ventilation: perspective in a setting with limited resources. J Perinatol. 2008;28(S1)
18. Saade GR, Dorman K, Weinstein G. Meconium-stained amniotic fluid and risk of respiratory and nonrespiratory neonatal morbidity. Am J Obstet Gynecol. 2005;193(6):2056-60.
19. Chettri S, Adhisivam B, Bhat BV. Does resuscitation with 100% oxygen reduce mortality in meconium aspiration syndrome? Pediatr Pulmonol. 2011;46(7):646-50.
20. Fraser WD, Hofmeyr J, Lede R, et al. Amnioinfusion for the prevention of the meconium aspiration syndrome. N Engl J Med. 2005;353(9):909-17.
21. Wiswell TE, Gannon CM, Jacob J, et al. Delivery room management of the apparently vigorous meconium-stained neonate: results of the multicenter, international collaborative trial. Pediatrics. 2000;105(1):1-7.
22. Gelfand SL, Fanaroff JM, Walsh MC. Meconium-stained amniotic fluid: what to do? Clin Perinatol. 2007;34(4):713-26.
23. Mehta N, Chawla S, Kumar P, Narang A. Study of predictors of meconium-stained amniotic fluid in high-risk pregnancies and neonatal outcome. Indian Pediatr. 2006;43(11):871-5.