



IMPACT OF MECONIUM-STAINED AMNIOTIC FLUID ON MATERNAL AND PERINATAL OUTCOMES IN TERM PREGNANCIES: A PROSPECTIVE STUDY FROM A TERTIARY CARE CENTER IN NORTH INDIA

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ABSTRACT

Background: Meconium-stained amniotic fluid (MSAF) is a common finding in term pregnancies and is associated with increased risk of adverse maternal and perinatal outcomes, particularly when meconium is thick. Early identification and appropriate management are crucial to reduce neonatal morbidity and mortality.

Objectives: To evaluate maternal and perinatal outcomes associated with meconium-stained amniotic fluid in term pregnancies and to assess the impact of meconium consistency on these outcomes.

Methods: A prospective observational study was conducted at a tertiary care hospital in North India from May 2013 to November 2013, including 68 term pregnant women with MSAF. Data were collected using a structured proforma. Maternal outcomes such as mode of delivery and intrapartum complications, and perinatal outcomes including Apgar scores, NICU admission, and meconium aspiration syndrome were assessed. Statistical analysis was performed using SPSS version 25.0, with $p < 0.05$ considered statistically significant.

Results: Among 68 participants, 58.8% had thin meconium and 41.2% had thick meconium. Cesarean section rate was 38.2%, with significantly higher rates in the thick meconium group. Low Apgar score at 5 minutes was observed in 14.7% of neonates. NICU admission was required in 26.5% of cases, and meconium aspiration syndrome occurred in 8.8%. Thick meconium was significantly associated with low Apgar scores ($p < 0.05$), increased NICU admissions ($p < 0.05$), and higher incidence of MAS ($p < 0.05$).

Conclusion: MSAF, particularly thick meconium, is associated with increased perinatal morbidity and higher operative delivery rates. Early recognition and appropriate management are essential to

improve neonatal outcomes.

Key words: Meconium-stained amniotic fluid; Meconium aspiration syndrome; Perinatal outcomes; Cesarean section; NICU admission; Term pregnancy

Introduction

Meconium-stained amniotic fluid (MSAF) is a common obstetric finding, observed in approximately 8–20% of all deliveries worldwide, with higher prevalence reported in term and post-term pregnancies [1]. Passage of meconium into the amniotic fluid is considered a physiological maturation process of the fetal gastrointestinal tract; however, it is also associated with fetal hypoxia, infection, or stress, making it a clinically significant indicator during labor [2]. The presence of meconium in the amniotic fluid raises concerns due to its association with adverse maternal and perinatal outcomes, particularly meconium aspiration syndrome (MAS), which contributes significantly to neonatal morbidity and mortality [3].

Globally, MAS accounts for nearly 5–10% of cases with MSAF and is associated with complications such as respiratory distress, persistent pulmonary hypertension, and increased need for neonatal intensive care unit (NICU) admission [4]. Advances in obstetric and neonatal care, including improved intrapartum monitoring and timely interventions, have led to a decline in the incidence and severity of MAS in developed countries [5]. However, in low- and middle-income countries, including India, the burden remains substantial due to limited resources, delayed referrals, and inadequate intrapartum surveillance [6].

In the Indian context, MSAF remains a significant contributor to perinatal morbidity, with reported incidence ranging from 7% to 22% in term pregnancies [7]. Several studies have highlighted that thick meconium is more strongly associated with adverse fetal outcomes, including fetal distress, low Apgar scores, increased operative delivery rates, and higher NICU admissions compared to thin meconium [8]. Maternal outcomes such as prolonged labor, increased rates of cesarean section, and intrapartum complications have also been reported in association with MSAF [9]. These findings emphasize the need for vigilant monitoring and timely obstetric interventions in such cases.

Despite the existing literature, there is considerable variability in reported outcomes due to differences in study design, population characteristics, and healthcare settings. Moreover, most studies from India are retrospective or have heterogeneous inclusion criteria, limiting the generalizability of findings. There remains a need for prospective studies in tertiary care settings to comprehensively evaluate both maternal and perinatal outcomes associated with MSAF under standardized protocols.

Given this background, the present study aims to prospectively assess maternal and perinatal outcomes associated with meconium-stained amniotic fluid in term pregnancies in a tertiary care hospital in North India. The objective is to evaluate the incidence of adverse outcomes such as mode of delivery, fetal distress, Apgar scores, NICU admissions, and neonatal complications, thereby providing evidence to guide clinical decision-making and improve maternal and neonatal care.

METHODOLOGY

Study Design: This study was designed as a prospective observational study, conducted to evaluate maternal and perinatal outcomes associated with meconium-stained amniotic fluid in term pregnancies.

Study Setting: The study was conducted in the Department of Obstetrics and Gynecology of a tertiary care teaching hospital in North India, which caters to a large population and receives both booked and referred obstetric cases.

Study Duration: The study was carried out over a period of seven months, from May 2013 to

November 2013.

Study Population: The study population comprised pregnant women admitted in labor at term gestation (≥ 37 completed weeks) with meconium-stained amniotic fluid detected either spontaneously or after artificial rupture of membranes.

Inclusion Criteria

- Pregnant women with singleton term pregnancies (≥ 37 weeks)
- Presence of meconium-stained amniotic fluid during labor
- Women who provided informed written consent

Exclusion Criteria

- Preterm pregnancies (< 37 weeks)
- Multiple gestation
- Known fetal congenital anomalies
- Intrauterine fetal demise at admission
- Women with incomplete clinical records or who refused consent

Sample Size: The sample size was calculated using the formula for estimating a proportion in a descriptive study:

$$n = (Z^2 \times p \times q) / d^2$$

Where:

- n = required sample size
- Z = standard normal deviate at 95% confidence level (1.96)
- p = expected prevalence of meconium-stained amniotic fluid (taken as 20% based on previous studies)
- $q = 1 - p$
- d = allowable error (10%)

The calculated sample size was approximately 62. Considering feasibility and study duration, a final sample size of 68 participants was included.

Sampling Technique: A consecutive sampling technique was employed, wherein all eligible women meeting the inclusion criteria during the study period were enrolled until the desired sample size was achieved.

Data Collection Tools & Procedure: Data were collected using a pre-designed, semi-structured proforma. Upon admission, detailed obstetric history, demographic details, and clinical examination findings were recorded. The nature of amniotic fluid (thin or thick meconium) was noted during labor. Continuous fetal monitoring was performed using cardiotocography where available. Maternal outcomes such as mode of delivery, duration of labor, and intrapartum complications were recorded. Neonatal outcomes including Apgar scores at 1 and 5 minutes, birth weight, need for resuscitation, NICU admission, and occurrence of meconium aspiration syndrome were documented. All participants were followed until discharge.

Study Variables: The independent variables included maternal age, parity, gestational age, booking status, and type of meconium (thin or thick). The dependent variables included maternal outcomes (mode of delivery, intrapartum complications) and perinatal outcomes (Apgar score, fetal distress, NICU admission, meconium aspiration syndrome, and neonatal mortality).

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using Statistical Package

for the Social Sciences (SPSS) version 25.0. Descriptive statistics were expressed as mean, standard deviation, frequencies, and percentages. Inferential statistics were applied using the Chi-square test or Fisher's exact test for categorical variables and Student's t-test for continuous variables where appropriate. A p-value <0.05 was considered statistically significant.

Ethical Considerations: Written informed consent was obtained from all participants prior to enrollment. Confidentiality and anonymity of participants were maintained throughout the study. The study adhered to the ethical principles outlined in the Declaration of Helsinki.

RESULTS

A total of 68 term pregnant women with meconium-stained amniotic fluid were included in the study. The majority of participants were aged 25–30 years and slightly more than half were primigravida (Table 1). Thin meconium was observed in 58.8% of cases, while thick meconium was present in 41.2%.

Table 1: Socio-demographic and Obstetric Characteristics of Study Participants (n = 68)

Variable	Category	Frequency (n)	Percentage (%)
Maternal Age (years)	<25	28	41.2
	25–30	30	44.1
	>30	10	14.7
Parity	Primigravida	36	52.9
	Multigravida	32	47.1
Booking Status	Booked	42	61.8
	Unbooked	26	38.2
Type of Meconium	Thin	40	58.8
	Thick	28	41.2

Regarding maternal outcomes, vaginal delivery was the most common mode of delivery, although a substantial proportion (38.2%) underwent cesarean section. Fetal distress was observed in over one-third of cases (Table 2).

Table 2: Maternal Outcomes in Meconium-Stained Amniotic Fluid (n = 68)

Outcome	Category	Frequency (n)	Percentage (%)
Mode of Delivery	Vaginal Delivery	34	50.0
	Instrumental Delivery	8	11.8
	Cesarean Section	26	38.2
Fetal Distress (Intrapartum)	Present	24	35.3
	Absent	44	64.7
Prolonged Labor	Yes	12	17.6
	No	56	82.4

Perinatal outcomes indicated that nearly one-third of neonates had low Apgar scores at 1 minute, though this improved by 5 minutes. NICU admission was required in 26.5% of neonates, and meconium aspiration syndrome was observed in 8.8% of cases. Neonatal mortality was low (Table 3).

Table 3: Perinatal Outcomes among Study Participants (n = 68)

Outcome	Category	Frequency (n)	Percentage (%)
Apgar Score at 1 min	<7	20	29.4
	≥7	48	70.6
Apgar Score at 5 min	<7	10	14.7
	≥7	58	85.3
NICU Admission	Yes	18	26.5
	No	50	73.5
Meconium Aspiration Syndrome	Present	6	8.8
	Absent	62	91.2
Neonatal Mortality	Yes	2	2.9
	No	66	97.1

A statistically significant association was found between thick meconium and adverse perinatal outcomes, including low Apgar score at 5 minutes, higher NICU admissions, and increased incidence of meconium aspiration syndrome (Table 4).

Table 4: Association between Type of Meconium and Perinatal Outcomes

Outcome	Thin Meconium (n=40)	Thick Meconium (n=28)	p-value
Apgar <7 at 5 min	3 (7.5%)	7 (25.0%)	0.048*
NICU Admission	6 (15.0%)	12 (42.9%)	0.012*
MAS	1 (2.5%)	5 (17.9%)	0.036*

*Statistically significant ($p < 0.05$)

Additionally, thick meconium was significantly associated with higher cesarean section rates compared to thin meconium (Table 5).

Table 5: Association between Type of Meconium and Mode of Delivery

Mode of Delivery	Thin Meconium (n=40)	Thick Meconium (n=28)	p-value
Vaginal	26 (65.0%)	8 (28.6%)	0.021*
Instrumental	4 (10.0%)	4 (14.3%)	
Cesarean Section	10 (25.0%)	16 (57.1%)	

*Statistically significant ($p < 0.05$)

DISCUSSION

The present prospective observational study evaluated maternal and perinatal outcomes associated with meconium-stained amniotic fluid (MSAF) in term pregnancies. The key findings indicate that MSAF, particularly thick meconium, is significantly associated with adverse perinatal outcomes such as low Apgar scores, increased NICU admissions, and higher incidence of meconium aspiration syndrome (MAS). Additionally, a higher rate of cesarean section was observed in cases with thick meconium.

In this study, the majority of participants were in the age group of 25–30 years, and primigravida

constituted a slightly higher proportion. These findings are consistent with studies conducted in similar tertiary care settings, where MSAF is commonly observed among young reproductive-age women and first-time mothers [7,9]. The predominance of primigravida in MSAF cases may be attributed to longer labor duration and increased susceptibility to fetal distress.

The overall incidence of cesarean section in our study was 38.2%, with a significantly higher rate in cases of thick meconium. This aligns with previous studies that have reported increased operative delivery rates in MSAF due to concerns regarding fetal compromise [9,10]. The presence of meconium, particularly thick consistency, often prompts obstetricians to opt for early intervention to prevent adverse neonatal outcomes. The higher cesarean section rate in thick meconium cases reflects the clinical decision-making aimed at minimizing fetal hypoxia and complications.

Fetal distress was observed in approximately one-third of cases, which is comparable to findings reported in earlier studies [8]. Meconium passage is often considered a marker of intrauterine stress, and its presence necessitates continuous fetal monitoring. In our study, the association between thick meconium and adverse fetal outcomes further supports the hypothesis that thick meconium is indicative of more significant fetal compromise.

Perinatal outcomes in the present study revealed that 14.7% of neonates had low Apgar scores at 5 minutes, and 26.5% required NICU admission. These findings are in agreement with prior studies that have demonstrated increased neonatal morbidity in MSAF cases [3,8]. The statistically significant association between thick meconium and low Apgar scores highlights the importance of differentiating between thin and thick meconium during intrapartum assessment.

The incidence of MAS in this study was 8.8%, which falls within the range reported in the literature (5–10%) [4]. Notably, MAS was significantly more common in neonates born through thick meconium. This observation is consistent with earlier research indicating that thick meconium is more likely to be aspirated and cause airway obstruction, leading to respiratory distress [3,10]. Early identification and prompt neonatal resuscitation are therefore crucial in reducing morbidity.

Neonatal mortality in the present study was low (2.9%), which may be attributed to the availability of advanced neonatal care facilities in the tertiary care setting. This finding is comparable to recent improvements in neonatal outcomes due to better intrapartum surveillance and neonatal management protocols [5]. However, the presence of even minimal mortality underscores the need for continued vigilance in managing MSAF cases.

The findings of this study have important clinical and public health implications. Early identification of MSAF, especially thick meconium, should prompt enhanced intrapartum monitoring and preparedness for neonatal resuscitation. Training healthcare providers in fetal monitoring and neonatal resuscitation protocols, particularly in resource-limited settings, can significantly reduce adverse outcomes. Furthermore, strengthening referral systems and ensuring timely access to tertiary care facilities are essential to improve perinatal outcomes in MSAF cases.

The strengths of this study include its prospective design, standardized data collection, and focus on both maternal and perinatal outcomes in a tertiary care setting. However, certain limitations must be acknowledged. The relatively small sample size and single-center design may limit the generalizability of the findings. Additionally, long-term neonatal outcomes were not assessed, which could provide further insights into the impact of MSAF.

Overall, this study reinforces the association between meconium-stained amniotic fluid, particularly thick meconium, and adverse perinatal outcomes, emphasizing the need for vigilant intrapartum care and timely intervention.

CONCLUSION

This prospective study highlights that meconium-stained amniotic fluid (MSAF) in term pregnancies is significantly associated with adverse perinatal outcomes, particularly when the meconium is thick in consistency. Thick meconium was found to be linked with higher rates of cesarean section, low Apgar scores at 5 minutes, increased NICU admissions, and a greater incidence of meconium aspiration syndrome. Although maternal complications were relatively limited, the increased operative delivery rate reflects the need for timely obstetric intervention to prevent fetal compromise. These findings underscore the importance of vigilant intrapartum monitoring, early identification of high-risk cases, and preparedness for neonatal resuscitation. Differentiating between thin and thick meconium can aid in risk stratification and clinical decision-making. Strengthening fetal surveillance, ensuring availability of skilled personnel, and improving neonatal care facilities can contribute to better outcomes. Further large-scale, multicentric studies are recommended to validate these findings and explore long-term neonatal outcomes.

DECLARATIONS

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Conflict of Interest: The authors declare no conflict of interest.

Consent: Written informed consent was obtained from all participants prior to inclusion in the study.

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