



PERINATAL OUTCOME IN MECONIUM STAINED LIQUOR: A CROSS SECTIONAL STUDY

Obstetrics & Gynaecology

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ABSTRACT

Background: Meconium-stained amniotic fluid (MSAF) is a common intrapartum finding associated with increased maternal and neonatal morbidity. The presence of meconium, particularly thick meconium, may indicate fetal compromise and is frequently linked to abnormal fetal heart rate patterns, operative delivery, respiratory complications, and adverse perinatal outcomes. **Objectives:** To evaluate maternal and perinatal outcomes in pregnancies complicated by meconium-stained amniotic fluid and to determine its association with abnormal cardiotocography (CTG) findings during labour. **Materials and Methods:** This hospital-based cross-sectional observational study was conducted in the Department of Obstetrics and Gynaecology, Rohilkhand Medical College and Hospital, Bareilly, from August 2023 to July 2024. A total of 155 women with singleton term pregnancies, cephalic presentation, and meconium-stained amniotic fluid during labour were included. Continuous CTG monitoring was performed, and maternal as well as neonatal outcomes were recorded. Statistical analysis was carried out using SPSS version 23.0, with $p < 0.05$ considered statistically significant. **Results:** Among 155 women, 59 (38.1%) had thick meconium and 96 (61.9%) had thin meconium. Thick meconium was significantly associated with Category III CTG patterns (49.15% vs. 9.37%; $p < 0.001$). Caesarean section was the most common mode of delivery (57.41%; $p < 0.001$). Neonates born through thick meconium had higher rates of NICU admission (61.01% vs. 26.04%; $p = 0.043$), respiratory distress, abnormal respiratory findings, and requirement for respiratory support ($p = 0.027$). Meconium aspiration syndrome occurred in 23.0% of thick meconium cases compared with 11.46% of thin meconium cases. Neonatal mortality was higher in the thick meconium group (8.5% vs. 1.04%; $p = 0.05$). **Conclusion:** Thick meconium-stained amniotic fluid is significantly associated with abnormal CTG patterns, increased operative delivery, greater neonatal respiratory morbidity, higher NICU admission rates, and increased neonatal mortality. Continuous intrapartum fetal surveillance and prompt neonatal intervention are essential to improve perinatal outcomes in pregnancies complicated by meconium-stained liquor.

KEYWORDS

Meconium-Stained Amniotic Fluid; Meconium Aspiration Syndrome; Cardiotocography; Perinatal Outcome; NICU Admission; Fetal Distress; Thick Meconium.

INTRODUCTION

Meconium-stained amniotic fluid (MSAF) is still an important obstetric problem due to its association with adverse maternal and neonatal outcomes. The presence of meconium in the amniotic fluid during labour is frequently regarded as an indicator of fetal compromise and warrants close intrapartum surveillance. Previous studies have demonstrated that pregnancies complicated by MSAF are associated with increased rates of fetal distress, operative delivery, low APGAR scores, neonatal intensive care unit (NICU) admission and meconium aspiration syndrome (MAS).¹

Recent population-based data have demonstrated that a significant percentage of births still occur at term and late-term gestations, the time when the passage of meconium is most common during labour.² The quality and utilization of maternal and newborn health care services are important determinants of perinatal outcomes, especially in resource poor settings. Geographic inequalities in the spectrum of maternal and newborn care continue to exist in some regions of India, which subsequently impact early detection and management of intrapartum complications.³

MSAF is linked with significant neonatal morbidity. A tertiary care study of neonates born through meconium-stained liquor showed increased risk of respiratory complications, birth asphyxia, sepsis and NICU admission and emphasizes the importance of vigilant monitoring and prompt neonatal management.⁴ Similarly, comparative evaluation of delivery outcomes in pregnancies complicated by MSAF, has shown that neonatal outcomes may vary according to the mode of delivery, with respiratory distress, perinatal asphyxia and NICU admissions remaining important concerns.⁵

Several investigators have emphasized the effect of MSAF on maternal and neonatal outcomes. Kashikar et al found that the incidence of pathological cardiotocography (CTG) was higher in women with meconium stained liquor especially in cases with thick meconium.⁶ Risks of operative delivery, low APGAR scores, birth asphyxia, neonatal sepsis, MAS were increased in labouring mothers with MSAF.⁷ These increased risks were demonstrated by Tolu et al. Chhetri and Aryal identified antenatal risk factors and adverse

perinatal outcomes associated with MSAF. Kaspote et al. found fetal heart rate abnormalities and neonatal morbidity to be significantly higher as compared to clear liquor pregnancies.^{8, 9}

Despite advances in obstetric and neonatal care, disparities in maternal health service utilization continue to influence pregnancy outcomes in India.¹⁰ Moreover, evidence on the association of meconium stained liquor, CTG abnormalities and immediate perinatal outcome is limited in the North Indian populations. Therefore, the present study was conducted to evaluate maternal and perinatal outcome of pregnancies with meconium stained liquor and to find its correlation with abnormal CTG findings during labour.

MATERIAL AND METHODS

Study Design: Hospital-based cross-sectional observational study.

Study Setting: The study was conducted in the Department of Obstetrics and Gynaecology, Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh, from August 2023 to July 2024.

Study Population: Pregnant women with singleton, cephalic pregnancies at ≥ 37 weeks of gestation presenting with meconium-stained amniotic fluid during labour.

Sample Size: A total of 155 participants were enrolled. Sample size was calculated using the formula $N = 4pq/l^2$, assuming an anticipated outcome proportion of 10.8% and 5% absolute precision.

Inclusion Criteria

- Term pregnancy (≥ 37 weeks)
- Singleton pregnancy
- Cephalic presentation
- Meconium-stained amniotic fluid during labour

Exclusion Criteria

- Congenital fetal malformations
- Intrauterine fetal demise
- Breech presentation
- Oligohydramnios

Data Collection and Investigations

After obtaining informed consent, eligible women were recruited and underwent detailed clinical and obstetric evaluation. Continuous cardiotocographic (CTG) monitoring was performed during labour. Maternal characteristics, CTG findings, and mode of delivery were

recorded. Neonatal assessment included APGAR score, Downes score for respiratory distress, meconium aspiration syndrome, NICU admission, respiratory support requirement, and immediate perinatal outcome.

Ethical Consideration

Institutional Ethics Committee approval was obtained, and written informed consent was taken from all participants.

Statistical Analysis

Data were analysed using SPSS version 23.0. Continuous variables were expressed as mean ± standard deviation and categorical variables as frequencies and percentages. A p-value <0.05 was considered statistically significant.

RESULTS

Table 1: Association of MSAF with Onset of Labour

Onset of labour	Meconium Consistency				P value
	Thick		Thin		
	Frequency	Percentage	Frequency	Percentage	
PROM (Premature Rupture of Membranes)	7	11.86%	19	19.79%	0.04
Spontaneous Rupture of Membranes	33	55.93%	35	36.45%	
During ARM (Artificial Rupture of Membranes)	19	32.20%	42	43.75%	

Table 1 demonstrates the association between onset of labour and meconium consistency. Thick meconium was most frequently observed following spontaneous rupture of membranes (55.93%), whereas thin meconium was more commonly detected during artificial rupture of membranes (43.75%). Premature rupture of membranes was noted in 11.86% and 19.79% of thick and thin meconium cases, respectively. The association was statistically significant (p=0.04).

Table 2: Association of MSAF with CTG Category

CTG Category	Meconium Consistency				P value
	Thick		Thin		
	Frequency	Percentage	Frequency	Percentage	
Cat I	11	18.64%	53	55.20%	<0.001
Cat II	19	32.20%	34	35.41%	
Cat III	29	49.15%	9	9.37%	

Table 2 depicts the association between meconium consistency and CTG category. Category III CTG was observed significantly more often in cases with thick meconium (49.15%) compared to thin meconium (9.37%). Conversely, Category I CTG predominated among thin meconium cases (55.20%). This association was highly statistically significant (p<0.001), indicating a strong relationship between thick meconium and abnormal fetal heart rate patterns.

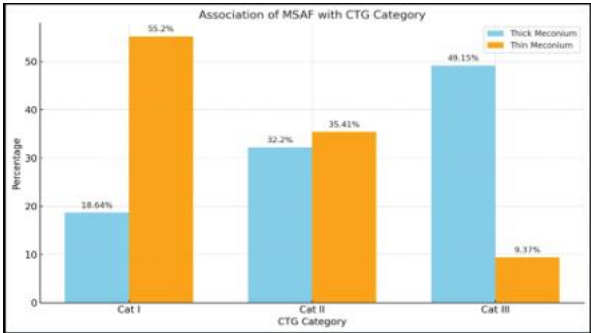


Figure 1: Association of MSAF with CTG Category

Table 3: Distribution of Patients According to Mode of Delivery

Mode of Delivery	Number of Patients	Percentage	P Value
Cesarean	89	57.41%	<0.001
Vaginal	58	37.41%	
Instrumental	8	5.16%	
Total	155	100.00%	

Table 3 shows the distribution of patients according to mode of delivery. Caesarean section was the most common mode of delivery, accounting for 57.41% of cases, followed by vaginal delivery in

37.41% and instrumental delivery in 5.16%. The predominance of caesarean delivery was statistically significant (p<0.001), reflecting the increased obstetric intervention associated with meconium-stained amniotic fluid.

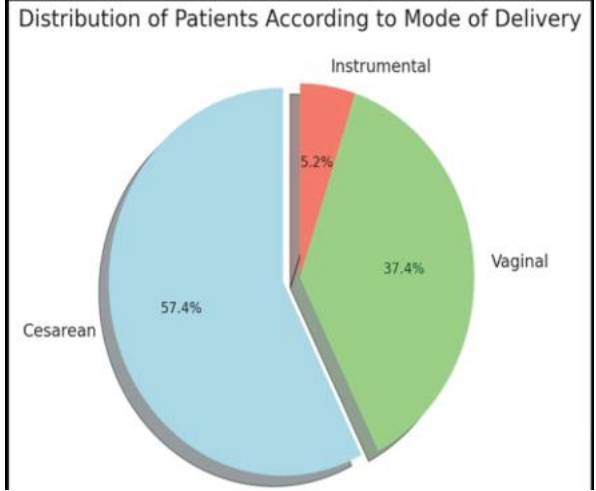


Figure 2: Distribution of Patients According to Mode of Delivery

Table 4: Association of MSAF with APGAR Score at 1 min

MSAF	APGAR Score <5 (N, %)	APGAR Score ≥5 (N, %)	Total (N, %)	P value
Thick	21 (35.59%)	38(64.40%)	59 (100.00%)	0.0533
Thin	17 (17.70%)	79(82.29%)	96(100.00%)	
Total	38 (24.51%)	117 (75.48%)	155 (100.00%)	

Table 4 illustrates the association between meconium consistency and APGAR score at 1 minute. Neonates born through thick meconium had a higher proportion of APGAR scores <5 (35.59%) compared to those with thin meconium (17.70%). Although low APGAR scores were more frequent in the thick meconium group, the association did not reach statistical significance (p=0.0533).

Table 5: Association of MSAF with APGAR Score at 5 min

MSAF	APGAR Score <7 (N, %)	APGAR Score ≥7 (N, %)	Total (N, %)	P value
Thick	19 (32.20%)	40(67.79%)	59(100.00%)	0.0551
Thin	24 (25%)	72 (75%)	96(100.00%)	
Total	43(27.74%)	112 (72.25%)	155(100.00%)	

Table 5 presents the association between meconium consistency and APGAR score at 5 minutes. An APGAR score <7 was observed in 32.20% of neonates born through thick meconium compared to 25.00% of those with thin meconium. Although low 5-minute APGAR scores were more frequent in the thick meconium group, the difference was not statistically significant (p=0.0551).

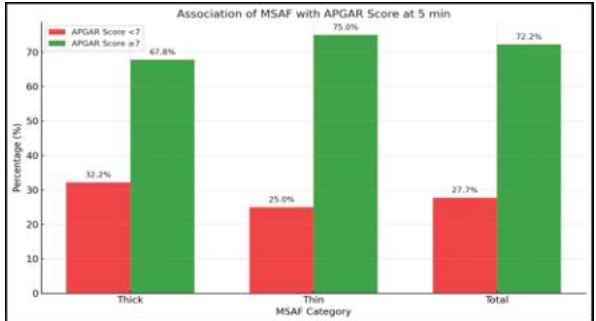


Figure 3: Association of MSAF with APGAR Score at 5 min

Table 6: Association of MSAF with Perinatal Outcomes

		MSAF		P value
Perinatal Outcomes		Thick (N, %)	Thin (N, %)	
NICU Stay	Present	36 (61.01%)	25 (26.04%)	0.043
	Absent	23 (39%)	71 (73.96%)	
Meconium Aspiration Syndrome	Yes	14 (23.0%)	7 (11.46%)	0.07
	No	45 (77.0%)	89 (88.54%)	

PPHN	Yes	5 (8.0%)	3 (3.13%)	0.177
	No	54 (92.0%)	93 (96.88%)	
Retraction	0	38 (64.4%)	71 (73.96%)	0.009
	1	12 (19.5%)	21 (21.88%)	
	2	9 (16.1%)	4 (4.17%)	
Grunting	0	41 (70.1%)	73 (76.04%)	0.03
	1	13 (21.8%)	20 (20.83%)	
	2	5 (8.1%)	3 (3.13%)	
Respiratory rate	0	40(65.57)	70(72.91)	0.00267
	1	12(19.67)	20(20.83)	
	2	9(14.75)	6(6.25)	
Cyanosis	0	51(70.83)	91(94.79)	0.228
	1	18(25)	4(4.16)	
	2	3(4.16)	1(1.04)	
Air Entry	0	37 (62.1%)	65 (67.71%)	0.031
	1	18 (31.0%)	25 (26.04%)	
	2	4 (6.9%)	6 (6.25%)	
Respiratory Support Type of respiratory support	Yes	36 (61.01%)	25(26.04%)	0.027
	No	23(39%)	71(73.96%)	
	CPAP	24(66.6%)	17 (68%)	
	Nasal Prongs	6 (16.2%)	7 (28%)	
	Mechanical Ventilation	6 (16.6%)	1 (4%)	
Outcome of Newborn	Discharge	54 (91.5%)	95 (98.96%)	0.05
	Death	5 (8.5%)	1 (1.04%)	

Table 6 demonstrates the association between meconium consistency and perinatal outcomes. Thick meconium was associated with significantly higher rates of NICU admission (61.01% vs. 26.04%, $p=0.043$), respiratory distress manifested by retractions, grunting, and abnormal respiratory rate ($p<0.05$), poorer air entry ($p=0.031$), and increased requirement for respiratory support ($p=0.027$). Neonatal mortality was also higher in the thick meconium group (8.5% vs. 1.04%, $p=0.05$), indicating less favourable perinatal outcomes.

DISCUSSION

In the present study, spontaneous rupture of membranes was the most common mode of onset among women with thick meconium (55.93%), whereas thin meconium was more frequently detected during artificial rupture of membranes (43.75%), with a statistically significant association ($p=0.04$). Similar observations were reported by Tolu et al. (2020)⁷, who found a higher frequency of labour interventions among women with meconium-stained amniotic fluid, with labour induction being required in 17.4% of cases. Chhetri et al. (2020)⁸ also noted that several intrapartum factors contributed to the occurrence of MSAF and adverse neonatal outcomes. Thobbi et al. (2020)¹ and Kashikar et al. (2021)⁶ emphasized the importance of labour events and fetal surveillance in pregnancies complicated by meconium-stained liquor. Unlike the present study, these investigators did not specifically analyse the association between meconium consistency and mode of membrane rupture, making this finding a distinctive observation of the current study.

A strong association between meconium consistency and CTG category was observed in the present study ($p<0.001$), with Category III CTG present in 49.15% of thick meconium cases compared with 9.37% of thin meconium cases. Findings comparable to ours were reported by Kashikar et al. (2021)⁶, who observed pathological CTG tracings in 36.3% of women with thick meconium, while 71.5% of those with thin meconium demonstrated reactive CTG patterns. Thobbi et al. (2020)¹ similarly reported fetal heart rate abnormalities in 45.8% of thick meconium cases. Kapote et al. (2020)⁹ documented fetal heart rate abnormalities in 36% of MSAF pregnancies, supporting the relationship between meconium staining and fetal compromise. Tolu et al. (2020)⁷ further observed increased adverse neonatal outcomes among MSAF cases requiring operative intervention. These findings collectively reinforce that thick meconium is frequently associated with abnormal fetal surveillance patterns and a higher likelihood of intrapartum fetal distress.

Caesarean section was the predominant mode of delivery in the present study, accounting for 57.41% of cases, whereas vaginal and instrumental deliveries constituted 37.41% and 5.16%, respectively ($p<0.001$). Similar trends were observed by Thobbi et al. (2020)¹, who reported a caesarean section rate of 45.8% among women with MSAF. Chhetri et al. (2020)⁸ documented caesarean and instrumental delivery rates of 39% and 13%, respectively, among neonates exposed to

meconium-stained liquor. Tolu et al. (2020)⁷ found that women with MSAF were nearly twice as likely to undergo operative delivery compared with those having clear liquor. Aina et al. (2023)⁴ also reported increased operative deliveries among pregnancies complicated by meconium-stained liquor. Although the caesarean rate in the present study was somewhat higher than that reported in these studies, all consistently indicate increased obstetric intervention in the presence of MSAF.

Neonates born through thick meconium in the present study had a higher frequency of APGAR scores <5 at 1 minute (35.59%) compared with those born through thin meconium (17.70%), although the association was borderline significant ($p=0.0533$). Similar findings were reported by Thobbi et al. (2020)¹, who observed low APGAR scores in 27% of neonates exposed to thick meconium. Tolu et al. (2020)⁷ also documented a higher incidence of low APGAR scores at birth among MSAF cases (36.8%) than among clear liquor deliveries (13.2%). Jha et al. (2021)⁵ and Kapote et al. (2020)⁹ likewise reported poorer neonatal condition at birth among pregnancies complicated by moderate-to-thick meconium, supporting the trend observed in the present study.

Evaluation of APGAR score at 5 minutes revealed scores <7 in 32.20% of neonates with thick meconium and 25.0% with thin meconium, with a borderline statistical association ($p=0.0551$). Comparable observations were reported by Kapote et al. (2020)⁹, who found APGAR scores below 7 at 5 minutes in 5% of MSAF cases, predominantly among thick meconium deliveries. Thobbi et al. (2020)¹ also noted poorer neonatal outcomes in thick meconium cases, including low APGAR scores and increased NICU admissions. Tolu et al. (2020)⁷ demonstrated a greater burden of neonatal compromise among MSAF pregnancies. In contrast, Jha et al. (2021)⁵ found no major difference in 5-minute APGAR scores despite increased neonatal morbidity, representing a partial divergence from our findings.

Perinatal morbidity was substantially higher among neonates exposed to thick meconium in the present study. NICU admission occurred in 61.01% of thick meconium cases compared with 26.04% of thin meconium cases ($p=0.043$), while MAS was observed in 23.0% and 11.46%, respectively. Similar findings were reported by Aina et al. (2023)⁴, who documented increased NICU admissions, oxygen requirement, and adverse neonatal outcomes among MSAF neonates. Thobbi et al. (2020)¹ reported NICU admission in 25% and MAS in 5% of cases, whereas Tolu et al. (2020)⁷ observed NICU admission in 21.5% and MAS in 6.3%. Chhetri et al. (2020)⁸ and Kapote et al. (2020)⁹ also reported increased respiratory morbidity and neonatal complications among thick meconium cases, consistent with the present findings.

CONCLUSION

Meconium-stained amniotic fluid, particularly thick meconium, was associated with adverse intrapartum and neonatal outcomes in the present study. Thick meconium showed a significant association with abnormal CTG patterns, with nearly half of the cases demonstrating Category III tracings, indicating increased fetal compromise during labour. Caesarean delivery was the predominant mode of birth, reflecting the need for timely obstetric intervention in high-risk pregnancies. Although APGAR scores at 1 and 5 minutes did not differ significantly between thick and thin meconium groups, neonates exposed to thick meconium experienced substantially higher rates of NICU admission, respiratory distress, respiratory support requirement, and meconium aspiration syndrome. Neonatal mortality was also higher among thick meconium cases. These findings highlight the importance of continuous fetal surveillance, prompt recognition of fetal distress, and early neonatal management to improve perinatal outcomes in pregnancies complicated by meconium-stained liquor.

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