Evaluation of Perinatal Outcome in Meconium Stained Liquor A Tertiary Care Teaching Hospital-Based Study

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Abstract

Aim: To evaluate the frequency, mode of delivery, and perinatal outcomes associated with MSAF at a tertiary care teaching hospital.

Methods: A prospective observational study was conducted in the Department of Obstetrics and Gynaecology, Associated Hospital, Government Medical College, Doda, over a period of one year. Pregnant women with singleton, cephalic pregnancies at ≥37 weeks of gestation who developed MSAF following spontaneous or artificial rupture of membranes were included. Women with multiple pregnancy, gestation <37 weeks, non-cephalic presentation, intrauterine death, or congenital malformations were excluded. A total of 124 women were enrolled by convenience sampling. Maternal characteristics, meconium consistency, mode of delivery, APGAR scores, NICU admission, respiratory support, and perinatal outcomes were assessed. Statistical analysis was performed using SPSS version 20.0, with the chi-square/Fisher exact test used for categorical variables. A p-value <0.05 was considered statistically significant.

Results: The mean maternal age was 23.03±2.79 years, and 54.8% of women were primigravida. The mean gestational age was 38.15±1.75 weeks. Thick and thin meconium accounted for 50.8% and 49.2% of cases, respectively. Thick meconium was significantly associated with unbooked status (p=0.002) and maternal anemia (p=0.003). LSCS was more frequent in women with thick meconium than thin meconium (68.3% vs. 50.8%; p=0.04). Low APGAR scores were significantly more common with thick meconium at both 1 minute (p=0.01) and 5 minutes (p=0.001). NICU admission and duration of stay were significantly associated with meconium consistency (p=0.001). CPAP requirement was higher in thick MSAF (14.3% vs. 1.6%; p=0.01), whereas nasal-prong oxygen use was higher in thin MSAF (24.6% vs. 6.3%; p=0.005). MAS (12.7% vs. 0%; p<0.001) and HIE (14.3% vs. 1.6%; p=0.01) were significantly more frequent in thick MSAF.

Conclusion: Thick MSAF was associated with increased operative delivery, lower APGAR scores, prolonged NICU requirements, greater need for respiratory support, and higher rates of MAS and HIE. Adequate antenatal care, early identification of maternal risk factors, vigilant intrapartum fetal monitoring, and timely neonatal intervention are essential to reduce adverse perinatal outcomes associated with MSAF.

Keywords: Meconium-stained amniotic fluid; Thick meconium; Meconium Aspiration Syndrome; APGAR Score; Neonatal Outcome; NICU admission.

Introduction:

Presence of meconium stained amniotic fluid [MSAF] is seen in 12-16 % of deliveries[1]. In utero, passage of meconium may simply represent the normal gastrointestinal maturation or it may indicate an acute or chronic hypoxic event, thereby making it a warning sign of a foetal compromise. Meconium passage is rare before 34 weeks of gestation and incidence increases steadily beyond 37 weeks of gestation[2]. Factors such as placental insufficiency, maternal hypertension, preeclampsia, oligohydramnios or maternal drug abuse (tobacco, cocaine) result in In utero passage of meconium[3]. Infants born through meconium-stained amniotic fluid are about 100 times more likely to develop respiratory distress than those which are born through clear fluid[4]. Even in women who are at very low risk for obstetric complications, meconium-stained amniotic fluid is common and it is associated with a five-fold increase in perinatal mortality as compared with low-risk patients with clear amniotic fluid[1].

Presence of meconium below vocal cord is known as meconium aspiration and it is seen in around 20-30 % of all infants with meconium-stained amniotic fluid[5]. Aspiration can occur in utero with foetal gasping, or after birth, with the first breaths of life Meconium aspiration syndrome (MAS) is defined as a respiratory distress that develops shortly after birth, with radiographic evidence of aspiration pneumonitis and presence of meconium stained amniotic fluid[6]. MAS occurs in about 5% of deliveries with meconium-stained amniotic fluid[5] and death occurs in about 12% of infants with MAS[7]. Meconium passage in newborn is a developmentally programmed event normally occurring within the first 24 to 48 hours after birth intrauterine meconium passage in near-term or term fetuses has been associated with fetomaternal stress factor like hypoxia and infection independent of fetal maturity.

Recent studies indicate Meconium-staining of amniotic fluid rarely seen before 37 weeks and occurs in more than 30% of the pregnancy which continue past 42 weeks of gestation. There is strong evidence most meconium passage occurs by each of three basic mechanisms:
• As a physiologic maturational event.
• As a response to acute hypoxic events occurring late in pregnancy.
• As a response to chronic intrauterine hypoxia.
Meconium passed as a maturational event is of thin consistency in most cases. Newborn with acute hypoxic events, near and after the onset of labour are more likely to pass thick meconium and to suffer meconium aspiration, interventions to clear meconium are more likely to be beneficial for newborn. The objectives of the study were as below:
1. To study frequency of Meconium Stained Amniotic Fluid.
2. To study mode of delivery labour complicated with Meconium Stained Amniotic Fluid.
3. To study perinatal outcome in Meconium Stained Amniotic Fluid.

Material and Methods: The present prospective observational study was conducted in department of obstetrics and gynaecology of the Associated Hospital Government medical college, Doda. This study was of one-year duration or before if sample size is reached after obtaining permission from Institutional Ethics Committee. Study included pregnant women admitted in labour room after 37 weeks of gestation who had Meconium Stained Amniotic Fluid after spontaneous or artificial rupture of membrane.
Inclusion criteria:
1. Singleton pregnancy
2. Cephalic presentation
Exclusion criteria:
1. Multiple pregnancy
2. GA <37 week
3. Non-cephalic presentation
4. IUD
5. Congenital malformation

Sample Size
Reference Article: Perinatal outcome of meconium stained amniotic fluid among labouring mothers at teaching hospital in urban ethiopia
The sampling technique used in the study is convenient sampling.

$$n = \frac{Z^2_{\alpha/2}\, p(\%)q(\%)}{d(\%)^2}$$

where p is the observed prevalence
q = 100- p
d is the margin of error
$Z_{\alpha/2}$ is the ordinate of standard normal distribution at α% level of significance
Prevalence 11%
n= 124

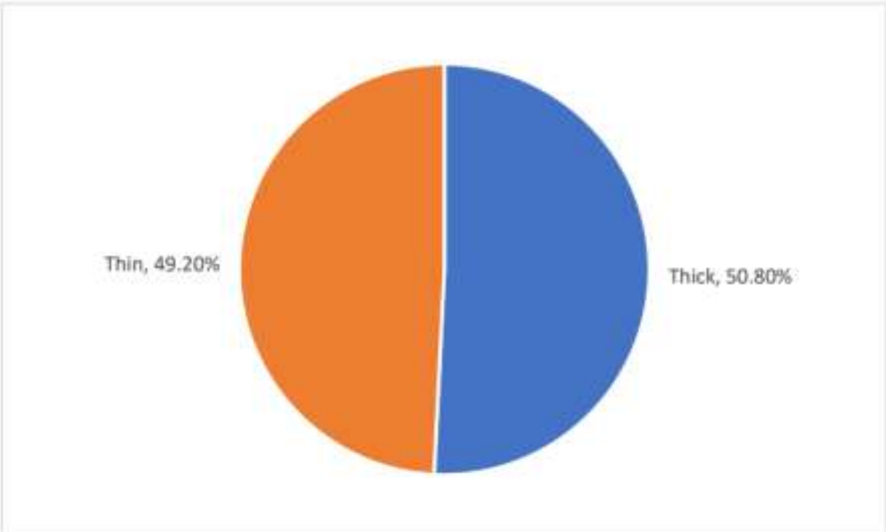
Statistical analysis: The statistical analysis was carried out using IBM SPSS (Statistical Package for Social Sciences) statistical version 20. The analysis includes frequency table, bar, pie chart, association of variables based on Chi-square test and if any cell frequency is <5, than Yates corrections is used for 2x2 contingency table or method pooling and Fisher exact test is used (for higher order than 2x2 table). All quantitative variables were estimated using measures of central location (mean and median) and measures of dispersion (standard deviation). Normality of data was checked by Kolmogorov–Smirnov tests of normality. For normality distributed data, Mean was compared in with respect to t-test. For not normality distributed data, Median compared using Mann-Whitney U (Z) test. Pearson's correlation for relationship. All statistical tests were seen at two-tailed level of significance (p ≤0.01 and p≤0.05).

Results: Most participants were aged 18–22 years (48.4%), with a mean age of 23.03 ± 2.79 years. More than half were primigravida (54.8%). The majority had a gestational age of 37–39 weeks (81.5%), with a mean gestational age of 38.15 ± 1.75 weeks (table 1).

Table 1. Sociodemographic and Obstetric Characteristics of Study Participants (N = 124)

Characteristic	Category	n (%)
Age (years)	18–22	60 (48.4)
	23–26	47 (37.9)
	27–30	15 (12.1)
	>31	2 (1.6)
	Mean ± SD	**23.03 ± 2.79**
Parity/Gravida	Primi	68 (54.8)
	Gravida 2	48 (38.7)
	Gravida 3	7 (5.6)
	≥Gravida 4	1 (0.8)
Gestational age (weeks)	37–39	101 (81.5)
	40–42	23 (18.5)
	Mean ± SD	**38.15 ± 1.75**

Of the total 124 cases studied, 50.8% had thick meconium-stained amniotic fluid (MSAF) and 49.2% had thin MSAF (graph 1).



Graph 1: Distribution based on consistency of Meconium

Thick meconium was significantly associated with unbooked status (p=0.002) and anemia (p=0.003). LSCS was more common among women with thick meconium, with a significant association between mode of delivery and meconium consistency (p=0.04). HTN, oligohydramnios, and GDM were not significantly associated with meconium consistency (table 2).

Table 2. Association of Booking Status, Risk Factors, and Mode of Delivery with Meconium Consistency (N = 124)

Variable	Category	Thick n (%)	Thin n (%)	p-value
Booking status	Booked	20 (31.7)	6 (9.8)	**0.002***
	Unbooked	43 (68.3)	55 (90.2)	
Risk factors	HTN	12 (19.0)	6 (9.8)	0.14
	Anemia	38 (60.3)	16 (26.2)	**0.003***
	Oligohydramnios	14 (22.2)	9 (14.8)	0.28
	GDM	6 (9.5)	5 (8.2)	0.79
Mode of delivery	NVD	20 (31.7)	30 (49.2)	**0.04***

	LSCS	43 (68.3)	31 (50.8)	

*: statistically significant

APGAR scores at both 1 and 5 minutes were significantly associated with meconium consistency. Low APGAR scores were more frequent among neonates with thick meconium, while all neonates with thin meconium had an APGAR score of 7–10 at 5 minutes (table 3).

Table 3. Association of APGAR Scores with Meconium Consistency (N = 124)

APGAR Score	Thick n (%)	Thin n (%)	Total n (%)	p-value
At 1 minute				
1–3	3 (4.8)	0 (0.0)	3 (2.4)	**0.01***
4–6	20 (31.7)	9 (14.8)	29 (23.4)	
7–10	40 (63.5)	52 (85.2)	92 (74.2)	
At 5 minutes				
1–3	0 (0.0)	0 (0.0)	0 (0.0)	**0.001***
4–6	10 (15.9)	0 (0.0)	10 (8.1)	
7–10	53 (84.1)	61 (100.0)	114 (91.9)	

*: statistically significant

Among thick MSAF neonates, 30.2% required NICU admission, with 12.7% staying over 7 days. In contrast, 29.5% of thin MSAF neonates required admission, with none staying beyond 6 days. The relationship was statistically significant (Chi-square = 11.29, p=0.001), indicating more prolonged NICU needs in thick MSAF cases (table 4).

Table 4. Association of NICU Admission with Meconium Consistency (N = 124)

NICU Admission	Thick n (%)	Thin n (%)	Total n (%)	p-value
Yes				
1–3 days	6 (9.5)	14 (23.0)	20 (16.1)	**0.001***
4–6 days	5 (7.9)	4 (6.6)	9 (7.3)	
>7 days	8 (12.7)	0 (0.0)	8 (6.5)	
No	44 (69.8)	43 (70.5)	87 (70.2)	
Total	**63 (100)**	**61 (100)**	**124 (100)**	

*: statistically significant

Oxygen requirement through nasal prongs and CPAP use were significantly associated with meconium consistency (p=0.005 and p=0.01, respectively). CPAP use was more frequent among neonates with thick meconium. Mechanical ventilation was more frequent with thick meconium but the association was not statistically significant (p=0.08) as shown in table 5.

Table 5. Association of Respiratory Support with Meconium Consistency (N = 124)

Respiratory Support	Thick n (%)	Thin n (%)	Total n (%)	p-value
Oxygen via nasal prongs				
Yes	4 (6.3)	15 (24.6)	19 (15.3)	**0.005***
No	59 (93.7)	46 (75.4)	105 (84.7)	
CPAP				
Yes	9 (14.3)	1 (1.6)	10 (8.1)	**0.01***
No	54 (85.7)	60 (98.4)	114 (91.9)	
Mechanical ventilation				
Yes	3 (4.8)	0 (0.0)	3 (2.4)	0.08
No	60 (95.2)	61 (100.0)	121 (97.6)	

*: statistically significant

MAS and HIE were significantly more common among neonates with thick meconium (p<0.001 and p=0.01, respectively). Stillbirth, septicaemia, and PPHN showed no statistically significant association with meconium consistency (table 6).

Table 6. Association of Perinatal Outcomes with Meconium Consistency (N = 124)

Perinatal Outcome	Thick n (%)	Thin n (%)	p-value
Stillbirth	5 (7.9)	1 (1.6)	0.10
Septicaemia	6 (9.5)	5 (8.2)	0.79
Meconium aspiration syndrome (MAS)	8 (12.7)	0 (0.0)	**<0.001***
Persistent pulmonary hypertension of newborn (PPHN)	3 (4.8)	0 (0.0)	0.08
Hypoxic-ischaemic encephalopathy (HIE)	9 (14.3)	1 (1.6)	**0.01***

*: statistically significant

Discussion:
In the present study, most women were aged 18–22 years (48.4%), with a mean age of 23.03±2.79 years. This was younger than that reported by Abdulghafor PG et al.[8] (27.15±6.11 years), Vedha et al.[9] (majority aged 26–35 years), and Qayyum et al.[10] (29.64±3.64 years), but comparable to Mohapatra et al.[11] (23.35±3.42 years) and Preeti Pushpam et al.[12] (24.4±4.0 years). The younger maternal age in the present cohort may reflect differences in population characteristics and age at first pregnancy.

Primigravida women constituted 54.8% of the present cohort, followed by gravida 2 (38.7%). This was comparable to Vedha et al.[9], who reported 46.4% primigravida and 32.7% gravida 2, but lower than the 74.81% primigravida reported by Mohapatra et al.[11]. In contrast, Abdulghafor PG et al.[8] reported a mean parity of 1.75 ± 1.93, while Qayyum et al.[10] found predominantly multiparous women (82.28%). Differences in parity may influence labour progression, operative delivery, and perinatal outcomes.

A significant association was observed between booking status and meconium consistency (p=0.002), with unbooked women constituting 68.3% of thick and 90.2% of thin meconium cases. Although Abdulghafor PG et al.[8] and Qayyum et al.[10] did not specifically report booking status, both highlighted increased complications with inadequate antenatal care. Studies by Preeti et al.[12] and Lavanya et al.[13] reported variable distributions of thin, moderate, and thick meconium, supporting differences in the severity profile across populations.

The mean gestational age was 38.15 ± 1.75 weeks, with 81.5% of deliveries occurring at 37–39 weeks. This was comparable to Vedha et al.[9] (78.2% at 37–39 weeks) and Qayyum et al.[10] (37.76 ± 0.90 weeks), but lower than Abdulghafor PG et al.[8] (39.72 ± 0.97 weeks) and Mohapatra et al.[11] (40.31 ± 0.48 weeks). Preeti et al.[12] reported 32% of MSAF cases at 40–42 weeks, while Lavanya et al.[13] found 30.03% postdated pregnancies. Overall, these findings support the recognized association between advancing gestation and increased occurrence of MSAF.

Among maternal risk factors, anemia was significantly more common in thick than thin meconium cases (60.3% vs. 26.2%, p=0.003). HTN, oligohydramnios, and other risk factors showed no significant association. Qayyum et al.[10] similarly identified anemia, GDM, and PIH as important risk factors, while Mohapatra et al.[11] reported anemia, IUGR, and preeclampsia among common complications. Lavanya et al.[13] identified postdated pregnancy, preeclampsia, and oligohydramnios as important risk factors. These findings emphasize the importance of adequate antenatal surveillance and management of maternal comorbidities.

CTG was reactive in 93.7% of thick and 98.4% of thin meconium cases, with no significant association (p=0.18). This was comparable to Vedha et al.[9], who also found no significant difference despite a higher proportion of abnormal CTG patterns with thick meconium. However, Abdulghafor PG et al.[8], Qayyum et al.[10], Mohapatra et al.[11], Preeti et al.[12], and Lavanya et al.[13] reported stronger associations between thick MSAF, abnormal CTG, and fetal distress. Differences may reflect variations in monitoring protocols, study populations, and thresholds for intervention.

Thick meconium was present in 50.8% and thin meconium in 49.2% of the present cohort. This distribution was similar to Abdulghafor PG et al.[8] (54% thick, 46% thin) and Vedha et al.[9] (43% thick, 57% thin). Preeti et al.[12] reported 47% thin, 20% moderate, and 33% thick MSAF, while Lavanya et al.[13] reported 29.39% grade I, 40.25% grade II, and 30.35% grade III MSAF.

LSCS was significantly more common in thick meconium cases than thin cases (68.3% vs. 50.8%, p=0.04). This finding is consistent with Vedha et al.[9], who reported emergency LSCS in 83% of thick versus 55.6% of thin MSL cases. Abdulghafor PG et al.[8] reported an overall LSCS rate of 48%, with fetal distress as the leading indication, while Qayyum et al.[10], Mohapatra et al.[11], Preeti et al.[12], and Lavanya et al.[13] similarly reported increased operative delivery among MSAF cases. These findings suggest that thick meconium frequently accompanies intrapartum fetal compromise and contributes to increased operative intervention.

At 1 minute, low APGAR scores (1–6) were significantly more frequent in thick than thin meconium cases (36.5% vs. 14.8%, p=0.01). At 5 minutes, 84.1% of thick and 100% of thin meconium neonates had APGAR scores of 7–10 (p=0.001), indicating delayed neonatal recovery among thick MSAF cases. Vedha et al.[9], Abdulghafor PG et

al.[8], Qayyum et al.[10], Mohapatra et al.[11], Preeti et al.[12], and Lavanya et al.[13] similarly documented increased low APGAR scores or neonatal depression with MSAF, particularly thick meconium.
NICU admission was required in 30.2% of thick and 29.5% of thin MSAF cases. Although the overall admission rates were similar, prolonged NICU stay (>7 days) occurred only in the thick group, and the association was statistically significant (p=0.001). Vedha et al.[9], Qayyum et al.[10], Mohapatra et al.[11], Preeti et al.[12], and Lavanya et al.[13] also reported increased NICU utilization among MSAF neonates, although rates varied considerably between studies.
An interesting finding was that oxygen via nasal prongs was more frequently required in thin than thick MSAF (24.6% vs. 6.3%, p=0.005). This may reflect differences in respiratory-support pathways, with severely affected thick MSAF neonates progressing directly to CPAP or more intensive respiratory support. In contrast, CPAP was significantly more common in thick MSAF (14.3% vs. 1.6%, p=0.01), supporting a greater degree of respiratory compromise. Mechanical ventilation was required in 4.8% of thick MSAF cases compared with none in the thin group, although this difference was not statistically significant (p=0.08). Abdulghafor PG et al.[8], Qayyum et al.[10] and Lavanya et al.[13] similarly reported substantial respiratory morbidity and NICU requirements among MSAF neonates.
The most important finding was the significantly higher occurrence of meconium aspiration syndrome (MAS) in thick MSAF (12.7% vs. 0%, p<0.001) and hypoxic-ischaemic encephalopathy (HIE) (14.3% vs. 1.6%, p=0.01). Stillbirth (7.9% vs. 1.6%) and PPHN (4.8% vs. 0%) were also more frequent with thick meconium, although these differences were not statistically significant. Abdulghafor PG et al.[8] reported MAS in 31% and RDS in 14% of MSAF cases, while Qayyum et al.[10] reported birth asphyxia and MAS-related NICU admissions. Mohapatra et al.[11], Preeti et al.[12], and Lavanya et al.[13] also demonstrated increased MAS, birth asphyxia, and neonatal mortality among neonates with MSAF, particularly thick meconium.
Overall, the present study demonstrates that thick MSAF is associated with greater neonatal compromise, increased CPAP requirement, lower APGAR scores, prolonged NICU stay, higher LSCS rates, and significantly increased MAS and HIE. These findings highlight the importance of careful intrapartum fetal surveillance, timely obstetric intervention, and preparedness for neonatal resuscitation and respiratory support when thick meconium is detected.

Conclusion: The study concludes that the presence and consistency of meconium stained amniotic fluid are important predictors of perinatal morbidity and neonatal complications. Thick meconium, in particular, is associated with poor fetal outcomes such as low APGAR scores, increased operative delivery rates, higher NICU admissions, and greater need for respiratory support. Unbooked status, anemia, and gestational age beyond 39 weeks were significant contributing factors. Early identification of high-risk pregnancies through adequate antenatal care, timely decision-making during labor, and effective neonatal resuscitation protocols are essential to reduce the burden of complications associated with MSAF. The findings emphasize the need for vigilant intrapartum monitoring and preparedness for emergency interventions when thick meconium is detected. Thus, MSAF should not be dismissed as a benign finding but recognized as a critical warning sign requiring multidisciplinary coordination for optimal maternal and neonatal outcomes. From this study it is concluded that proper Antenatal Care & early detection of risk factors decreases risk of meconium stained liquor related risks and improves perinatal outcome.

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