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Thick Versus Thin Meconium-Stained Amniotic Fluid and Neonatal Outcomes at Term

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Abstract: ***Meconium-stained amniotic fluid (MSAF) is frequently encountered during labour and may be associated with adverse neonatal outcomes. This prospective observational study compared intrapartum findings and neonatal outcomes in 100 women with MSAF during term labour at a hospital in Himachal Pradesh, India, between July 2019 and July 2020. The cohort included 55 women with thick and 45 with thin MSAF. Non-reactive fetal monitoring occurred in 43/55 (78.2%) women with thick MSAF and 25/45 (55.6%) with thin MSAF (risk ratio [RR] 1.41, 95% confidence interval [CI] 1.05–1.89). Among 99 liveborn infants, a one-minute Apgar score below 7 occurred in 43/54 (79.6%) and 24/45 (53.3%), respectively (RR 1.49, 95% CI 1.10–2.03). Differences in five-minute Apgar score below 7, neonatal intensive care unit admission and recorded meconium aspiration syndrome were not statistically significant. Thick MSAF was associated with more non-reactive fetal monitoring and low one-minute Apgar scores; these findings should be interpreted alongside the overall clinical assessment.***

Keywords: meconium-stained amniotic fluid; meconium consistency; Apgar score; fetal monitoring; neonatal intensive care

1. Introduction

Meconium-stained amniotic fluid (MSAF) is a common finding during term labour. Passage of meconium may occur with fetal gastrointestinal maturation or in response to intrapartum stress. Although it does not always indicate fetal compromise, MSAF may be associated with abnormal fetal heart-rate patterns and neonatal respiratory complications, including meconium aspiration syndrome (MAS).[1]

MSAF is commonly classified as thin or thick according to its colour and consistency. Thick meconium may be associated with greater neonatal risk, but its clinical significance depends on the associated fetal monitoring findings and the condition of the newborn. Published studies have reported differences in operative delivery and neonatal outcomes according to meconium consistency.[2, 3]

Evidence from district-level Indian hospitals remains limited. Assessing outcomes separately for thick and thin meconium may help clinicians interpret this finding more appropriately during labour.

The objective of this study was to compare intrapartum findings and neonatal outcomes between women with thick and thin meconium-stained amniotic fluid at term.

2. Literature Survey

Meconium passage during labour is not invariably a marker of fetal compromise. It may reflect gastrointestinal maturation, gestational age or intrapartum physiological responses. The clinical relevance of MSAF is influenced by its consistency and by concurrent fetal heart-rate findings.[1]

Studies comparing thin and thick MSAF have reported differences in operative delivery and neonatal morbidity. Attali et al. reported an association between thick MSAF and severe neonatal morbidity among nulliparous women with prolonged pregnancy.[2] A more recent study of low-risk pregnancies also examined the relationship between meconium consistency, caesarean delivery and neonatal outcomes.[3] Indian hospital-based reports have described adverse perinatal outcomes among pregnancies complicated by MSAF, although study populations and outcome definitions vary.[5,7]

The literature therefore supports assessing meconium consistency as one component of intrapartum risk assessment, while avoiding the assumption that meconium staining alone establishes fetal hypoxia or predicts an adverse outcome.

3. Problem Definition

The presence of MSAF during labour creates a need to assess fetal wellbeing and prepare for possible neonatal complications. However, the prognostic significance of thick compared with thin MSAF is not uniform across published studies. The present study was designed to compare intrapartum findings and perinatal outcomes between women with thick and thin MSAF at term. Because all enrolled women had MSAF, the study cannot estimate the incidence of MSAF or identify risk factors for its occurrence compared with clear amniotic fluid.

4. Methodology/ Approach

Study design and setting: A prospective observational study was conducted in the Department of Obstetrics and Gynaecology, Netaji Subhash Chandra Bose Zonal Hospital, Mandi, Himachal Pradesh, India, from July 2019 to July 2020.

Participants: Women with singleton, cephalic pregnancies beyond 37 completed weeks of gestation who were found to have MSAF during labour following spontaneous or artificial rupture of membranes were included. Exclusion criteria were antepartum haemorrhage, malpresentation, congenital fetal malformations, intrauterine fetal death, pre-existing maternal heart or lung disease, eclampsia and uncertain last menstrual period.

Meconium classification: Meconium-stained liquor was classified by clinical appearance. Thin MSAF was light green or yellow-green and watery, whereas thick MSAF was dark green, muddy or tarry, with a thicker consistency. Women were grouped according to the observed consistency of the liquor.

Clinical assessment: Maternal age, obstetric history, gestational age, onset of labour, intrapartum fetal monitoring and mode of delivery were recorded. Fetal monitoring was documented as reactive or non-reactive. Delivery was categorised as vaginal, operative vaginal or caesarean. Decisions regarding delivery were made by the treating obstetric team.

Neonatal outcomes: Apgar scores at one and five minutes, birth weight, neonatal intensive care unit (NICU) admission, recorded meconium aspiration syndrome (MAS), stillbirth and neonatal death were assessed. Apgar scores <7 were reported as low scores. One stillbirth had no Apgar score and was excluded from analyses restricted to liveborn infants. NICU admission was identified from a recorded stay of more than zero days. MAS was based on the diagnosis recorded in the study data.

Study size: A total of 100 women were included: 55 with thick MSAF and 45 with thin MSAF.

Statistical analysis: Continuous variables were expressed as mean ± standard deviation, and categorical variables as number and percentage. Categorical outcomes were compared using the chi-square test or Fisher's exact test, as appropriate. Risk ratios (RRs) with 95% confidence intervals (CIs) were calculated using thin MSAF as the reference group. P values <0.05 were considered statistically significant. The results were interpreted with consideration of the sample size and number of comparisons.

Ethical considerations: The study was approved by the Ethical and Scientific Committee of Shri Lal Bahadur Shastri Government Medical College, Ner Chowk, Mandi, Himachal Pradesh, India.

5. Results & Discussion

Participant characteristics: Among the 100 women, 55 had thick MSAF and 45 had thin MSAF. Mean maternal age was 24.71 ± 4.09 years and 25.27 ± 4.43 years, respectively. Mean gestational age was 39.75 ± 1.16 weeks in the thick-MSAF group and 39.74 ± 1.20 weeks in the thin-MSAF group. Primigravidae accounted for 35/55 (63.6%) and 26/45 (57.8%) women, respectively. Other maternal and obstetric characteristics are presented in Table 1.

Table 1: Baseline demographic and obstetric characteristics by meconium consistency

Characteristic	Thick MSAF (n = 55)	Thin MSAF (n = 45)
Maternal age, years, mean ± SD	24.71 ± 4.09	25.27 ± 4.43
Gestational age, weeks, mean ± SD	39.75 ± 1.16	39.74 ± 1.20
Primigravida, n (%)	35 (63.6)	26 (57.8)
Booked pregnancy, n (%)	30 (54.5)	29 (64.4)
Birth weight, kg, mean ± SD	3.03 ± 0.39	2.95 ± 0.36
Birth weight <2.5 kg, n (%)	5 (9.1)	3 (6.7)

Intrapartum findings: Non-reactive fetal monitoring was recorded in 43/55 (78.2%) women with thick MSAF compared with 25/45 (55.6%) with thin MSAF (RR 1.41, 95% CI 1.05–1.89; P=0.016). Labour was induced in 17/55 (30.9%) and 5/45 (11.1%) women, respectively (RR 2.78, 95% CI 1.11–6.95; P=0.017). Caesarean delivery occurred in 35/55 (63.6%) and 21/45 (46.7%) women (RR 1.36, 95% CI 0.94–1.98; P=0.089). Details of operative delivery are shown in Table 2.

Table 2: Intrapartum characteristics and mode of delivery by meconium consistency

Measure	Thick n/N (%)	Thin n/N (%)	Risk ratio (95% CI)	P value
Induced labour	17/55 (30.9)	5/45 (11.1)	2.78 (1.11–6.95)	0.017
Non-reactive fetal monitoring	43/55 (78.2)	25/45 (55.6)	1.41 (1.05–1.89)	0.016
Caesarean birth	35/55 (63.6)	21/45 (46.7)	1.36 (0.94–1.98)	0.089
Any operative birth	41/55 (74.5)	26/45 (57.8)	1.29 (0.96–1.73)	0.076

Apgar scores: There were 99 live births, including 54 in the thick-MSAF group and 45 in the thin-MSAF group. An Apgar score <7 at one minute occurred in 43/54 (79.6%) and 24/45 (53.3%) infants, respectively (RR 1.49, 95% CI 1.10–2.03; P=0.005). At five minutes, an Apgar score <7 occurred in 20/54 (37.0%) and 12/45 (26.7%) infants (RR 1.39, 95% CI 0.77–2.52; P=0.272) (Table 3).

Neonatal morbidity and mortality: NICU admission occurred in 19/54 (35.2%) liveborn infants in the thick-MSAF group and 14/45 (31.1%) in the thin-MSAF group (RR 1.13, 95% CI 0.64–1.99; P=0.669). MAS was recorded in 7/54 (13.0%) and 4/45 (8.9%), respectively (RR 1.46, 95% CI 0.46–4.67; P=0.750). Two neonatal deaths and one stillbirth were recorded in the thick-MSAF group, compared with one neonatal death in the thin-MSAF group. The numbers were too small to establish a difference in mortality (Table 3).

Table 3: Neonatal outcomes among liveborn infants by meconium consistency

Outcome	Thick n/N (%)	Thin n/N (%)	Risk ratio (95% CI)	P value
1-minute Apgar <7	43/54 (79.6)	24/45 (53.3)	1.49 (1.10–2.03)	0.005
5-minute Apgar <7	20/54 (37.0)	12/45 (26.7)	1.39 (0.77–2.52)	0.272
NICU stay >0 days	19/54 (35.2)	14/45 (31.1)	1.13 (0.64–1.99)	0.669
Recorded MAS	7/54 (13.0)	4/45 (8.9)	1.46 (0.46–4.67)	0.750
Neonatal death	2/54 (3.7)	1/45 (2.2)	1.67 (0.16–17.79)	1.000

In this study of 100 term pregnancies complicated by MSAF, thick staining was associated with a greater frequency of non-reactive fetal monitoring and low one-minute Apgar scores than thin staining. Differences in five-minute Apgar scores, NICU admission, recorded MAS and neonatal death were not statistically significant.

The association between thick MSAF and non-reactive fetal monitoring may reflect an increased frequency of intrapartum fetal stress. However, meconium passage can occur without fetal compromise, and its presence should be interpreted alongside fetal heart-rate findings and the overall clinical condition.[1]

A low one-minute Apgar score was more frequent in infants exposed to thick MSAF. The difference was smaller and not statistically significant at five minutes. Apgar scores assess the newborn's condition immediately after birth but do not, by themselves, establish birth asphyxia or hypoxic-ischaemic injury. Other clinical and laboratory findings are required for those diagnoses.

Our findings are broadly consistent with reports associating thick meconium with greater neonatal risk. Attali et al. observed higher severe neonatal morbidity with thick MSAF among women with prolonged pregnancies, while a larger cohort reported increased operative delivery and low Apgar scores in pregnancies with thick meconium.[2, 3] An Indian hospital-based study also described adverse neonatal outcomes among women with MSAF.[5] Differences in study populations and outcome definitions may account for variation in reported results.

Caesarean delivery was more frequent in the thick-MSAF group, although the difference was not statistically significant. Delivery decisions may be influenced by both meconium consistency and fetal monitoring findings. As an observational study, these data cannot establish whether thick meconium independently increased the need for caesarean delivery.

The recorded rates of NICU admission and MAS were similar between groups, but the small sample and few MAS events limited statistical precision. NICU admission may also be influenced by local admission practices, while MAS was based on clinical diagnoses recorded in the study. A non-significant difference should not be interpreted as evidence that risks are identical.

Other investigators have examined differences in maternal and perinatal outcomes across grades of meconium staining, including associations with infection.[6, 7] These findings reinforce the importance of considering meconium consistency within the wider maternal and fetal clinical picture.

The findings should also be considered in the context of current neonatal resuscitation practice. Routine suctioning solely because meconium is present is not recommended; airway suction is reserved for suspected obstruction when clinically indicated.[8]

The study has limitations. It was conducted at a single centre with a relatively small sample, and severe neonatal outcomes were uncommon. Meconium consistency was assessed clinically, and fetal monitoring was available only as reactive or non-reactive. Detailed fetal heart-rate tracings, cord blood gas measurements and uniform MAS diagnostic criteria were not available. The study did not include a clear-liquor comparison group, and neonatal follow-up data were limited. These factors restrict the precision and generalisability of the findings.

Clinically, thick MSAF should prompt careful fetal assessment and appropriate preparation for newborn care. Meconium consistency alone should not determine delivery decisions.

Data are presented as mean ± standard deviation or number (%). MSAF, meconium-stained amniotic fluid; SD, standard deviation.

Thin MSAF was the reference group. RR, risk ratio; CI, confidence interval.

One stillbirth in the thick-MSAF group was excluded from liveborn denominators. NICU admission was defined by a recorded NICU stay greater than zero days; MAS was a recorded clinical diagnosis. NICU, neonatal intensive care unit; MAS, meconium aspiration syndrome; CI, confidence interval; RR, risk ratio.

6. Conclusion

Thick MSAF was associated with a higher frequency of non-reactive fetal monitoring and low one-minute Apgar scores compared with thin MSAF. Significant differences in five-minute Apgar scores, NICU admission, recorded MAS and neonatal mortality were not demonstrated. Meconium consistency should be considered alongside fetal monitoring and the newborn's condition.

7. Future Scope

Future prospective studies should use standardised grading of meconium consistency, predefined fetal heart-rate interpretation criteria, clearly defined neonatal outcomes and complete follow-up. Larger multicentre cohorts would improve the precision of estimates for uncommon outcomes such as meconium aspiration syndrome and perinatal mortality. Studies including a clear-liquor comparison group

would be required to evaluate factors associated with the occurrence of MSAF itself.

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Declarations

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