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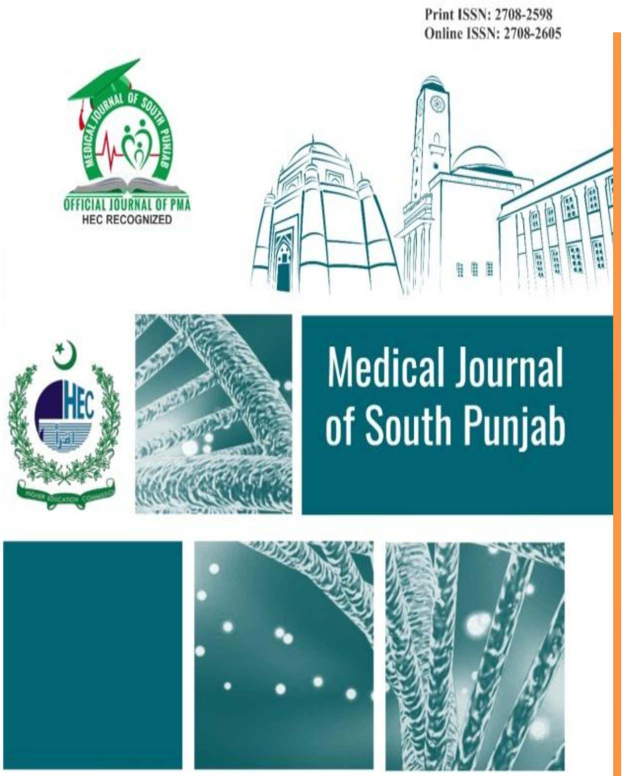

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Original Article

Neonatal Outcomes in Babies Born to Mothers with Meconium-Stained Amniotic Fluid

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ABSTRACT

Objective: This study set out to describe and compare the neonatal outcomes of babies delivered through thin versus thick meconium-stained liquor.

Methods: This prospective observational study was carried out at the Combined Military Hospital (CMH), Multan from 28 April 2024 to 27 October 2024. All neonates admitted to the neonatal intensive care unit after delivery through meconium-stained liquor were enrolled consecutively and grouped as thin or thick MSL. Birth weight, gestational age, Apgar scores, Downes respiratory distress score, type of respiratory support, perinatal depression, MAS severity, and final clinical outcome were recorded and compared between the two groups using the chi-square and Fisher exact tests, with $p<0.05$ taken as significant.

Results: A total of 125 neonates, 87 (69.6%) were born through thin MSL and 38 (30.4%) through thick MSL. Preterm delivery was more frequent in the thick MSL group (21.1% vs 5.7%, p=0.021), while birth weight distribution did not differ significantly between groups (p=0.67). A one-minute Apgar score below 7 was more common with thick MSL (50.0% vs 19.5%, p<0.001). Perinatal depression was recorded in 76.3% of the thick MSL group compared with 23.0% of the thin MSL group (p<0.001), and invasive mechanical ventilation was required more often in the thick MSL group (15.8% vs 2.3%, p=0.010). The severity grade of MAS did not differ significantly between the two groups (p=0.25).

Conclusion: Thick meconium staining was associated with a higher burden of preterm birth, low first-minute Apgar scores, perinatal depression, and the need for invasive ventilatory support, translating into a substantially higher composite morbidity rate than thin MSL.

Keywords: Meconium aspiration syndrome, Meconium-stained amniotic fluid, Respiratory distress, Neonatal outcome, Perinatal depression

1. INTRODUCTION

Meconium aspiration syndrome (MAS) develops when a term or near-term neonate inhales meconium-stained amniotic fluid (MSAF) before, during, or shortly after birth, producing respiratory compromise that can range from transient tachypnoea to fulminant respiratory failure.[1] The passage of meconium in utero, which gives rise to meconium-stained liquor (MSL), is estimated to complicate somewhere between 8% and 20% of all deliveries worldwide, and the frequency rises further with advancing gestation.[2] Although improvements in perinatal surveillance and obstetric care have reduced the burden of MSAF in high-income settings, it continues to be encountered frequently in South Asian obstetric practice, where the great majority of affected infants are born at or beyond 37 weeks of gestation.[3,4]

Not every baby exposed to MSAF develops MAS. In high-income settings roughly 3-5% of MSAF-exposed newborns go on to develop the syndrome, whereas reported rates in resource-limited settings are considerably higher, in the range of 10-25%, reflecting differences in intrapartum monitoring, timing of delivery, and access to neonatal resuscitation.[5,6] Among infants who do develop MAS, a substantial minority need some form of respiratory support, ranging from supplemental oxygen and continuous positive airway pressure (CPAP) through to invasive mechanical ventilation.6,7 The risk of MAS also rises with gestational age, and is influenced by a range of maternal and fetal factors including hypertensive disorders of pregnancy, oligohydramnios, chorioamnionitis, prolonged labour, fetal distress, and intrauterine growth restriction.[7]

The clinical severity of MAS is conventionally graded according to the intensity and duration of respiratory support required, with the most severe presentations complicated by persistent pulmonary hypertension of the newborn (PPHN).[8] Respiratory compromise is frequently tracked at the bedside using the Downes score, a composite measure of respiratory rate, air entry, retractions, grunting and cyanosis that is repeated every few hours to follow the trajectory of the illness.[9, 10] A further pathophysiological feature of MAS is inactivation of pulmonary surfactant by meconium within the alveolar space, which worsens lung compliance and gas exchange; exogenous surfactant has therefore been explored as an adjunctive therapy in more severe cases.[11,12]

Because the clinical trajectory of MSL-exposed neonates is shaped by a combination of maternal, intrapartum and neonatal factors, and because local outcome data from military and tertiary care hospitals in Pakistan remain scarce, this study was undertaken to describe the clinical outcomes, in terms of both morbidity and mortality, of neonates delivered through meconium-stained liquor at a single tertiary centre, and specifically to compare these outcomes between infants exposed to thin and thick MSL.

2. METHODOLOGY

This prospective observational study was carried out at the Combined Military Hospital (CMH), Multan from 28 April 2024 to 27 October 2024. All neonates delivered through meconium-stained liquor during the study period who were subsequently admitted to the neonatal intensive care unit (NICU) were considered for enrolment.

Neonates born after a singleton pregnancy complicated by meconium-stained amniotic fluid were eligible for inclusion irrespective of maternal age, parity, fetal presentation, or stage of labour, provided they were admitted to the NICU for observation or management. Neonates with major congenital anomalies, those from multiple pregnancies, and outborn infants delivered outside the study hospital were excluded.

Eligible neonates were enrolled consecutively as they were delivered. Routine oro-nasopharyngeal suctioning of meconium-stained babies before delivery of the shoulders was not practised as a blanket policy; selective suctioning with a bulb syringe was performed only when secretions or meconium were visibly obstructing the oral cavity or pharynx, after delivery of the head and before the onset of spontaneous breathing. Vigorous newborns, defined by strong respiratory effort, good muscle tone and a heart rate above 100 beats per minute, received routine neonatal care. Non-vigorous newborns underwent resuscitation according to standard neonatal resuscitation protocols. Neonates who went on to develop respiratory distress, a low Apgar score, or other clinical features of MAS were managed in the NICU, and their clinical course, treatment, and eventual outcome were documented. Ethical approval was obtained from the Institutional Ethics Committee prior to data collection, and the study was conducted in accordance with the principles of the Declaration of Helsinki.

The minimum required sample size was calculated using an anticipated MAS incidence of 11%, drawn from a comparable published cohort, an absolute precision of 5.5%, and a 95% confidence level, which yielded a minimum requirement of 125 neonates.[4]

Data were entered into a Microsoft Excel spreadsheet and analysed. Categorical variables, including birth weight category, gestational age category, Apgar score category, Downes score category, type of respiratory support, presence of perinatal depression, MAS severity grade, and clinical outcome, were summarised as frequencies and percentages and compared between the thin and thick MSL groups using the chi-square test was applied A two-sided p-value below 0.05 was considered statistically significant throughout.

3. RESULTS

A total of 125 neonates with meconium-stained liquor (MSL) were enrolled; 87 (69.6%) had thin MSL and 38 (30.4%) had thick MSL. Low birth weight (<2.5 kg) was present in 35 (28.0%) neonates, with no significant difference between groups (p=0.67). Preterm birth was significantly more common with thick MSL than thin MSL (21.1% vs 5.7%, p=0.021).

An Apgar score <7 at 1 minute was significantly more frequent in the thick MSL group (50.0% vs 19.5%, p<0.001). Five-minute Apgar scores also differed significantly between groups (p<0.001). Downes respiratory distress scores showed a significant overall difference (p<0.001), although a score ≥4 was not significantly different (p=0.23).

Most neonates (93.6%) required non-invasive respiratory support, while 6.4% required mechanical ventilation. Invasive ventilation was significantly more frequent with thick MSL (15.8% vs 2.3%, p=0.010). Perinatal depression occurred in 39.2% overall and was significantly higher with thick MSL (76.3% vs 23.0%, p<0.001). No neonate developed stage II or III hypoxic-ischaemic encephalopathy.

Mild MAS was the predominant severity category, with no significant difference in MAS severity between groups (p=0.25). Overall, 72.0% recovered without complications, 25.6% developed morbidity, and 2.4% died. Adverse outcomes were significantly more frequent in the thick MSL group, with morbidity in 60.5% versus 10.3% in the thin MSL group (p<0.001). Mortality was low and similar between groups (2.6% vs 2.3%, p=1.00).

Table-1: Baseline birth weight and gestational age by meconium consistency

Characteristic	Overall (n=125)	Thin MSL (n=87)	Thick MSL (n=38)	p-value
Birth weight <2.5 kg	35 (28.0%)	23 (26.4%)	12 (31.6%)	0.665
Birth weight ≥2.5 kg	90 (72.0%)	64 (73.6%)	26 (68.4%)	
Gestational age <37 weeks	13 (10.4%)	5 (5.7%)	8 (21.1%)	0.021
Gestational age ≥37 weeks	112 (89.6%)	82 (94.3%)	30 (78.9%)	

Table-2: Apgar scores and Downes respiratory distress score by meconium consistency

Score	Category	Thin MSL n=87 (%)	Thick MSL n=38 (%)	p-value
1-minute Apgar	<4	6 (6.9%)	16 (42.1%)	<0.001
	4 to 7	11 (12.6%)	3 (7.9%)	
	>7	70 (80.5%)	19 (50.0%)	
5-minute Apgar	<4	6 (6.9%)	9 (23.7%)	<0.001
	4 to 7	76 (87.4%)	3 (7.9%)	
	>7	5 (5.7%)	26 (68.4%)	
Downes score	<4	57 (65.5%)	20 (52.6%)	<0.001
	4 to 7	6 (6.9%)	15 (39.5%)	
	>7	24 (27.6%)	3 (7.9%)	

Table 3. Respiratory support, perinatal depression, and MAS severity by meconium consistency

Variable	Category	Thin MSL n=87 (%)	Thick MSL n=38 (%)	p-value
Respiratory support	Non-invasive	85 (97.7%)	32 (84.2%)	0.010
	Invasive ventilation	2 (2.3%)	6 (15.8%)	
Perinatal depression	Present	20 (23.0%)	29 (76.3%)	<0.001
	Absent	67 (77.0%)	9 (23.7%)	
MAS severity	Mild	55 (63.2%)	27 (71.1%)	0.252
	Moderate	7 (8.0%)	5 (13.2%)	
	Severe	25 (28.7%)	6 (15.8%)	

Table-4:Final clinical outcome by meconium consistency

Outcome	Overall n=125 (%)	Thin MSL n=87 (%)	Thick MSL n=38 (%)
Uneventful / recovered	90 (72.0%)	76 (87.4%)	14 (36.8%)
Morbidity	32 (25.6%)	9 (10.3%)	23 (60.5%)
Mortality	3 (2.4%)	2 (2.3%)	1 (2.6%)

4. DISCUSSION

This prospective study of 125 neonates delivered through meconium-stained liquor at a single tertiary military hospital found that just over two-thirds of the cohort were exposed to thin MSL, with the remaining third exposed to thick MSL. This proportion is broadly consistent with earlier South Asian cohorts, in which thin MSL has generally been reported to predominate over thick MSL, although the balance between the two categories has varied across settings and study periods, likely reflecting differences in local obstetric monitoring and thresholds for intervention in labour.[12,13]

Birth weight distribution did not differ significantly between the thin and thick MSL groups in this cohort, a finding that argues against the notion that thick meconium staining is simply a marker of fetal growth restriction. Gestational age, on the other hand, was significantly associated with meconium consistency, with preterm delivery roughly four times more frequent in the thick MSL group. This is consistent with the broader literature describing a rising incidence of meconium passage, and specifically of thicker staining, with advancing gestational age, which has been attributed to maturation of fetal gut motility and increasing gut peristalsis as pregnancy progresses; it is somewhat less expected, however, that preterm infants in the present cohort were disproportionately represented in the thick rather than the thin category, and this may reflect the small number of preterm births overall rather than a genuine physiological pattern.[3,9]

Thick MSL was associated with a significantly higher rate of low one-minute Apgar scores, which supports the widely held view that meconium aspiration is frequently an intrauterine phenomenon driven by fetal gasping in response to hypoxic stress, occurring before delivery and therefore not preventable by intrapartum suctioning alone.[2,14] The finding for the five-minute Apgar score in this cohort was more difficult to reconcile with prior literature: infants exposed to thin MSL were markedly more likely than those exposed to thick MSL to still have a depressed score at five minutes. Most published series report the opposite pattern, in which infants generally show recovery of their Apgar score by five minutes irrespective of meconium consistency, with any residual depression concentrated in the thick MSL group.[15,16] The reversal seen here warrants cautious interpretation. It may reflect differences in resuscitation response and NICU admission thresholds at the study site, the play of chance in a cohort of this size, or inconsistencies in bedside scoring and documentation, and it is flagged here as an area that merits confirmation in a larger, ideally multicentre, sample rather than as an established clinical pattern.

Analysis of the Downes score showed that respiratory distress, considered across its three severity bands, was distributed differently between the two groups, with a larger share of the thick MSL group falling into the intermediate band. When distress was instead considered simply as present or absent using a cut-off of 4, however, the difference between groups was no longer statistically significant, suggesting that the overall burden of at least some respiratory compromise was similar in the two groups even though its intensity, and the resources needed to manage it, differed.

The requirement for invasive mechanical ventilation was significantly higher in the thick MSL group, in keeping with previous work showing that thicker meconium staining predicts a greater need for advanced respiratory support and a longer duration of ventilation.[6,7] Only a small number of neonates in this cohort received exogenous surfactant, and all of these had thick MSL and severe MAS, consistent with current practice of reserving surfactant therapy for the most severely affected infants rather than using it routinely across the MSL-exposed population.[11,17]

Perinatal depression was the single most frequent complication in this cohort and was substantially more common in the thick MSL group, a pattern that mirrors findings from several other South Asian cohorts and reinforces the close relationship between meconium thickness and immediate perinatal compromise.[12,13,18] The proposed mechanism linking thick MSL to this spectrum of complications involves inflammatory-mediated pulmonary vasoconstriction and chronic hypoxic stress, which can progress to structural remodelling of the pulmonary vasculature and persistent pulmonary hypertension of the newborn in the more severely affected infants; meconium itself is also thought to act as both a chemical irritant and a substrate for bacterial growth, increasing the risk of secondary neonatal sepsis.[2,7]

Somewhat unexpectedly, once neonates had been graded, the overall severity of MAS did not differ significantly between the thin and thick MSL groups, even though markers of early compromise (low one-minute Apgar score, perinatal depression, need for invasive ventilation) were all significantly worse in the thick MSL group. This dissociation suggests that thick MSL exposure translates fairly consistently into a harder immediate transition and a higher chance of the composite morbidity outcome, without necessarily pushing a correspondingly larger share of affected infants into the most severe MAS grade once the full clinical picture is graded retrospectively. Composite morbidity, which combined all recorded adverse outcomes short of death, was accordingly far more common in the thick MSL group, at roughly five times the rate seen in the thin MSL group.

5. CONCLUSION

Thick meconium staining was associated with a higher burden of preterm birth, low first-minute Apgar scores, perinatal depression, and the need for invasive ventilatory support, translating into a substantially higher composite morbidity rate than thin MSL.

6. REFERENCES

1. Monfredini C, Cavallin F, Villani PE, Paterlini G, Allais B, Trevisanuto D. Meconium aspiration syndrome: a narrative review. Children (Basel). 2021;8(3):230.
2. Gallo DM, Romero R, Bosco M, et al. Meconium-stained amniotic fluid. Am J Obstet Gynecol. 2023;228(4S):S1158-S1178.
3. Dani C, Ciarcia M, Barone V, Di Tommaso M, Mecacci F, Pasquini L, Pratesi S. Neonatal outcomes of term infants born with meconium-stained amniotic fluid. Children (Basel). 2023;10(5):780.
4. Attali E, et al. Meconium-stained amniotic fluid and neonatal morbidity in nulliparous patients with prolonged pregnancy. Acta Obstet Gynecol Scand. 2023;102(8):1046-1054.
5. Shakya P, Yadav MK, Poudel S. Meconium-stained amniotic fluid among term deliveries in a tertiary care centre: a descriptive cross-sectional study. JNMA J Nepal Med Assoc. 2022;60(252):672-675.
6. Ward C, Caughey AB. The risk of meconium aspiration syndrome (MAS) increases with gestational age at term. J Matern Fetal Neonatal Med. 2022;35(1):155-160.
7. Rao P, Charki S, Aradhya AS, Diggikar S, Bilagi A, Venkatagiri P, et al. Prediction score for prolonged hospital stay in meconium aspiration syndrome: a multicentric collaborative cohort of South India. Pediatr Pulmonol. 2022;57(10):2383-2389.
8. Abu Shqara R, Hoffman N, Lowenstein L, Wolf MF. Preterm meconium-stained amniotic fluid: a red flag for infection and adverse perinatal outcomes. Int J Gynaecol Obstet. 2025 Jun 26. Online ahead of print.
9. Rawat M, Nangia S, Chandrasekharan P, Lakshminrusimha S. Approach to infants born through meconium-stained amniotic fluid: evolution based on evidence? Am J Perinatol. 2018;35(8):815-822.
10. Pandita A, Murki S, Oleti TP, Tandur B, Kiran S, Narkhede S, Prajapati A. Effect of nasal continuous positive airway pressure on infants with meconium aspiration syndrome. JAMA Pediatr. 2018;172(2):161-165.
11. Abdelaal MA, Abushanab D, Al-Badriyeh D. Surfactant therapy for meconium aspiration syndrome in neonates: a systematic overview of systematic reviews and recent clinical trials. J Comp Eff Res. 2020;9(8):527-536.
12. Singh N, Jaiswal J, Sherwani N, Nagaria T, Khandwal O, Neral A. Impact of meconium-stained amniotic fluid on neonatal outcome in a tertiary hospital. Cureus. 2023;15(4):e38235.
13. Kumar A, Kumar P, Basu S. Endotracheal suctioning for prevention of meconium aspiration syndrome: a randomized controlled trial. Eur J Pediatr. 2019;178(12):1825-1832.
14. Joshi K, Priyadarshi M, Shrivastava Y, Chaurasia S, Singh P, Bhat NK, Basu S. Transitional hemodynamics in neonates born through meconium-stained amniotic fluid: a prospective observational study. Pediatr Cardiol. 2024 May 23. Online ahead of print.
15. Edwards EM, Lakshminrusimha S, Ehret DEY, Horbar JD. NICU admissions for meconium aspiration syndrome before and after a national resuscitation program

suctioning guideline change. Children (Basel). 2019;6(5):68.

16. Hao LX, Wang F. Effectiveness of high-frequency oscillatory ventilation for the treatment of neonatal meconium aspiration syndrome. Medicine (Baltimore). 2019;98(46):e17622.
17. Li JY, Wang PH, Vitale SG, Chen SN, Marranzano M, Cianci A, et al. Pregnancy-induced hypertension is an independent risk factor for meconium aspiration syndrome: a retrospective population-based cohort study. Taiwan J Obstet Gynecol. 2019;58(3):396-400.
18. Garg N, Choudhary M, Sharma D, Choudhary JS, Choudhary SK. The role of early inhaled budesonide therapy in meconium aspiration in term newborns: a randomized control study. J Matern Fetal Neonatal Med. 2016;29(1):36-40.