International Research Journal of Pharmacy and Medical Sciences
ISSN (Online): 2581-3277

Clinical Profile and Outcome of Meconium Aspiration Syndrome in Neonates: A Prospective Observational Study at a Tertiary Care Hospital

Nikhil Gavhane[1], Rajeev Agarwal[2], Arpan Doshi[3], Sachin Shaha[4], V. Dheeraj[5]
[1]Junior Resident, Department of Paediatrics, Vedantaa Institute of Medical Sciences, Dahanu, Maharashtra, India
[2]Professor, Department of Paediatrics, Vedantaa Institute of Medical Sciences, Dahanu, Maharashtra, India
[3]Assistant Professor, Department of Paediatrics, Vedantaa Institute of Medical Sciences, Dahanu, Maharashtra, India
[4]Professor, Department of Paediatrics, Vedantaa Institute of Medical Sciences, Dahanu, Maharashtra, India
[5]Junior Resident Department of Paediatrics, Vedantaa Institute of Medical Sciences, Dahanu, Maharashtra, India
Guide & Author: Dr Rajeev Agarwal | Corresponding Author: Dr Nikhil Gavhane | gavhanenikhil5@gmail.com

***Abstract*—Background**: *Meconium Aspiration Syndrome (MAS) is a significant cause of neonatal respiratory morbidity predominantly affecting term and post-term neonates. It continues to impose a substantial clinical burden in tertiary care settings of low- and middle-income countries, including India.* **Objectives**: *To evaluate the clinical profile, hematological parameters, radiological findings, arterial blood gas (ABG) variations, and short-term outcomes of neonates admitted with MAS to a tertiary care NICU.* **Methods**: *A prospective observational study was conducted over 18 months. One hundred and fifty term/post-term neonates (GA >37 weeks, birth weight >1800 g) with MAS were enrolled. Demographic, clinical, biochemical, radiological, and outcome data were collected using a predesigned proforma and analyzed using descriptive statistics and chi-square tests (significance at $p<0.05$).* **Results**: *Males predominated (54.7%); 81.3% were term, and 68.7% were born to primigravida mothers. LSCS was the commonest delivery mode (54%). Fetal distress was the leading maternal risk factor (45.3%). Acrocyanosis (38%) was the most frequent presentation. Culture-positive sepsis (32.7%) and atelectasis (22%) were the commonest complications; pulmonary haemorrhage occurred in 5.3% of cases. Nearly 47.3% had a normal PaO2 (85-100 mmHg) and pH (7.25-7.35). Diffuse patchy infiltration was the predominant X-ray finding (38%). Overall mortality was 6% (9/150). Fetal distress ($p=0.040$), pulmonary haemorrhage ($p<0.001$), and birth weight ($p<0.001$) were significantly associated with mortality.* **Conclusion**: *MAS predominantly affects term male neonates. Pulmonary haemorrhage and birth weight are the strongest predictors of mortality. Structured NICU care, vigilant prenatal surveillance, and NRP-trained paramedical staff are critical to improving outcomes.*

***Keywords*—** *Meconium Aspiration Syndrome; Neonatal Intensive Care; Fetal Distress; Pulmonary Haemorrhage; Arterial Blood Gas; Neonatal Outcome; PPHN.*

I. Introduction

Meconium Aspiration Syndrome (MAS) is defined as respiratory distress in a neonate born through meconium-stained amniotic fluid (MSAF) with radiological findings consistent with aspiration, not explicable by other causes.[1] It arises from a combination of mechanical airway obstruction, chemical pneumonitis, surfactant inactivation, and inflammatory cascades, often complicated by persistent pulmonary hypertension of the newborn (PPHN).[2] Globally, MAS occurs in approximately 2–9% of neonates born through MSAF, representing one of the leading causes of neonatal respiratory failure. While its incidence has declined markedly in high-income countries following improvements in obstetric care, it remains a significant burden in low- and middle-income countries including India, where NICU-based rates of 5–15% among MSAF-exposed neonates continue to be reported.[4][8][5]

Established risk factors include thick meconium consistency, fetal distress, post-term gestation, low Apgar scores, and maternal comorbidities such as pregnancy-induced hypertension (PIH) and gestational diabetes.[6] Clinical management is primarily supportive — ranging from supplemental oxygen to mechanical ventilation, surfactant therapy, and inhaled nitric oxide for PPHN.

Despite a growing body of literature, there is limited comprehensive data on the simultaneous characterization of hematological profiles, radiological patterns, and ABG variations alongside clinical outcomes from Indian NICU settings. This study was conducted to bridge this gap and identify key predictors of adverse outcomes in neonates with MAS managed at a tertiary care hospital.

II. Materials and Methods

Study Design and Setting: This was a prospective observational study conducted over a period of 18 months in the Neonatal Intensive Care Unit (NICU) of Vedantaa Institute of Medical Sciences, Dahanu — a tertiary care teaching hospital equipped with advanced neonatal care facilities.

Study Population and Sample Size: A total of 150 term and post-term neonates diagnosed with MAS were enrolled using a convenience sampling method. All neonates who met the inclusion criteria during the study period were included.

Inclusion Criteria: (1) Gestational age >37 weeks; (2) birth weight >1800 g; (3) appropriate for gestational age (AGA); (4) respiratory distress within 24 hours with MSAF and compatible chest X-ray findings; (5) NICU admission.

Exclusion Criteria: Preterm neonates (GA <37 weeks), birth weight <1800 g, alternative diagnoses (TTN, HMD,

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congenital pneumonia), chest X-ray inconsistent with aspiration pneumonitis, and severe congenital anomalies.

Data Collection: After obtaining written informed consent from parents or guardians, a predesigned case record form was used to collect: demographic and perinatal data; maternal risk factors; delivery details; Apgar scores at 1 and 5 minutes (gestational age assessed by New Ballard's Score); clinical presentation assessed by Downes Score (score >6 = indication for mechanical ventilation); and investigations including complete blood count (CBC), CRP, blood culture, serial chest X-rays (within 2 hours of birth), and arterial blood gas (ABG) analysis. All neonates received standard NICU care including oxygen therapy, IV fluids, antibiotics, inotropic support, and mechanical ventilation where indicated.

Statistical Analysis: Data were entered and analyzed using SPSS version 25. Categorical variables were expressed as frequencies and percentages; continuous variables as mean ± standard deviation (SD). The chi-square (χ^2) test was applied for assessing associations between categorical variables. A two-tailed p-value of <0.05 was considered statistically significant for all comparisons.

Ethical Clearance: Institutional Ethics Committee approval was obtained prior to study commencement. The study was conducted in accordance with the principles of the Declaration of Helsinki. All data were anonymized and stored securely.

III. Results

A total of 150 neonates diagnosed with Meconium Aspiration Syndrome (MAS) were enrolled over the study period. Their clinical, biochemical, radiological, and hematological parameters are presented below.

Demographic and Perinatal Characteristics

TABLE 1: Demographic & Perinatal Characteristics (n=150)

Parameter	Category	n (%)
Gender	Male	82 (54.7%)
	Female	68 (45.3%)
Gestational Age	Term (37-42 wks)	122 (81.3%)
	Post-Term (>42 wks)	28 (18.7%)
Parity	Primigravida	103 (68.7%)
	Multigravida	47 (31.3%)
Mode of Delivery	LSCS	81 (54.0%)
	NVD	69 (46.0%)
Fetal Distress	Yes	84 (56.0%)
	No	66 (44.0%)
IUGR	Yes	57 (38.0%)
	No	93 (62.0%)

Male neonates constituted the majority (54.7%) and 81.3% were term. More than two-thirds (68.7%) were born to primigravida mothers. Caesarean section (LSCS) was the commonest mode of delivery (54%), predominantly performed for fetal distress. Fetal distress was clinically evident in 56% of cases, and intrauterine growth restriction (IUGR) was present in 38% of neonates.

TABLE 2: Apgar Score Distribution at 1 & 5 Minutes

Apgar Score	1-min n (%)	5-min n (%)
0–3	11 (7.3%)	5 (3.3%)
4–6	60 (40.0%)	43 (28.7%)
7–10	79 (52.7%)	102 (68.0%)

TABLE 3: Birth Weight Distribution

Birth Weight (kg)	n	%
1.8–2.5	84	56.0
2.6–3.0	54	36.0
3.1–3.5	11	7.3
>4.0	1	0.7

More than half (52.7%) of neonates had a 1-minute Apgar score of 7–10, improving to 68% by 5 minutes, indicating that most neonates had mild-to-moderate perinatal compromise. The predominant birth weight range was 1.8–2.5 kg (56%), followed by 2.6–3.0 kg (36%).

Maternal Risk Factors and Complications

TABLE 4: Maternal Risk Factors

Maternal Factor	n (%)
Fetal Distress	68 (45.3%)
Others (PIH+Misc.)	27 (18.0%)
PIH	25 (16.7%)
Diabetes	16 (10.7%)
Oligohydramnios	11 (7.3%)
PROM	3 (2.0%)

TABLE 5: Complications in MAS Neonates

Complication	n (%)
Culture+ve Sepsis	49 (32.7%)
Atelectasis	33 (22.0%)
Pneumonia	31 (20.7%)
Normal	19 (12.7%)
PPHN	10 (6.7%)
Pulm. Haemorrhage	8 (5.3%)

Fetal distress was the predominant maternal risk factor (45.3%), followed by PIH (16.7%) and diabetes (10.7%). Culture-positive sepsis was the commonest complication (32.7%), reflecting the inflammatory milieu of MAS and susceptibility to secondary infection. Pulmonary haemorrhage, though uncommon (5.3%), emerged as a critical complication with poor prognosis.

Arterial Blood Gas (ABG) Parameters

TABLE 6: Arterial Blood Gas Analysis (n=150)

ABG Parameter	Range	n (%)
PaO2 (mmHg)	85–100 (Normal)	71 (47.3%)
	70–85	54 (36.0%)
	<70 (Hypoxia)	25 (16.7%)
PaCO2 (mmHg)	35–45 (Normal)	71 (47.3%)
	45–55	54 (36.0%)
	>55 (Hypercapnia)	25 (16.7%)
pH	7.25–7.35 (Normal)	71 (47.3%)
	7.15–7.25	54 (36.0%)
	<7.15 (Severe Acidosis)	25 (16.7%)
HCO3 (mmol/L)	>15 (Normal)	71 (47.3%)
	12–15	54 (36.0%)
	9–12	25 (16.7%)

Approximately 47.3% of neonates had normal PaO2, PaCO2, and pH values, reflecting the broad severity spectrum of MAS. Severe hypoxia (PaO2 <70 mmHg) and severe acidosis (pH <7.15) were each present in 16.7% of neonates, indicating critical respiratory compromise in this subset.

Radiological Findings and Hematological Parameters

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TABLE 7: Radiological Findings on Chest X-Ray

Radiological Finding	n (%)
Diffuse Patchy Infiltration	57 (38.0%)
Consolidation	39 (26.0%)
Normal	37 (24.7%)
Hyperinflation	17 (11.3%)

TABLE 8: Hematological Parameters (n=150)

Parameter	Mean ± SD	Range
Hemoglobin (g/dL)	17.0 ± 1.84	8.6–19.5
WBC (/mm³)	16,079 ± 9,470	5,890–42,000
Platelets (/mm³)	205,013 ± 61,759	11,000–320,000

Diffuse patchy infiltration was the predominant radiological finding (38%), representing the combined effects of airway obstruction, atelectasis, and chemical pneumonitis. A notable 24.7% had a normal chest X-ray, reflecting clinically mild disease. Mean hemoglobin was within the normal neonatal range (17.0 g/dL); leukocytosis (mean WBC 16,079/mm³) was consistent with the systemic inflammatory response to meconium aspiration.

Clinical Presentation and Meconium Characteristics

TABLE 9: Clinical Presentation at Admission

Clinical Presentation	n (%)
Acrocyanosis	57 (38.0%)
Hypotensive Shock	45 (30.0%)
Non-Vigorous	36 (24.0%)
Respiratory Distress	12 (8.0%)

TABLE 10: Meconium Consistency

Meconium Consistency	n (%)
Thick	86 (57.3%)
Thin	64 (42.7%)

Acrocyanosis (38%) was the commonest clinical presentation, followed by hypotensive shock (30%) and non-vigorous state (24%). Thick meconium was found in 57.3% of cases, which is consistent with the established association between meconium viscosity and disease severity.

Neonatal Outcomes and Association Analysis

TABLE 11: Overall Neonatal Outcome (n=150)

Outcome	n	%
Discharged	141	94.0
Died	9	6.0
Total	150	100.0

TABLE 12: Demographic & Risk Factors vs Outcome (*Significant)

Parameter	Died n=9	Discharged n=141	p-value
Gestational Age			
Post-Term	3 (33.3%)	25 (17.7%)	0.244
Term	6 (66.7%)	116 (82.3%)	
Gender			
Male	6 (66.7%)	76 (53.9%)	0.456
Female	3 (33.3%)	65 (46.1%)	
Mode of Delivery			
LSCS	5 (55.6%)	76 (53.9%)	0.923
NVD	4 (44.4%)	65 (46.1%)	
Fetal Distress			
Yes	8 (88.9%)	76 (53.9%)	**0.040***
No	1 (11.1%)	65 (46.1%)	
IUGR			
Yes	6 (66.7%)	51 (36.2%)	0.068
No	3 (33.3%)	90 (63.8%)	

TABLE 13: Complications vs Outcome (*Significant)

Complication	Died n=9	Discharged n=141	p-value
Pulm. Haemorrhage	5 (55.6%)	3 (2.1%)	**<0.001***
Pneumonia	2 (22.2%)	29 (20.6%)	
Culture+ve Sepsis	2 (22.2%)	47 (33.3%)	
Atelectasis	0 (0.0%)	33 (23.4%)	**<0.001***
PPHN	0 (0.0%)	10 (7.1%)	
Normal	0 (0.0%)	19 (13.5%)	

TABLE 14: Birth Weight vs Outcome (*Significant)

Birth Weight	Died n=9	Discharged n=141	p-value
1.8–2.5 kg	3 (33.3%)	81 (57.4%)	**<0.001***
2.6–3.0 kg	5 (55.6%)	49 (34.8%)	
3.1–3.5 kg	0 (0.0%)	11 (7.8%)	
>4.0 kg	1 (11.1%)	0 (0.0%)	

TABLE 15: ABG & Hematological Parameters vs Outcome (NS)

ABG Parameter	Died n=9	Discharged n=141	p-value
PaO2 70–85 mmHg	4 (44.4%)	50 (35.5%)	0.216
PaO2 <70 mmHg	3 (33.3%)	22 (15.6%)	
PaCO2 45–55 mmHg	4 (44.4%)	50 (35.5%)	0.216
PaCO2 >55 mmHg	3 (33.3%)	22 (15.6%)	
pH 7.15–7.25	4 (44.4%)	50 (35.5%)	0.216
pH <7.15	3 (33.3%)	22 (15.6%)	
Hb mean (g/dL)	16.1 ± 3.0	17.0 ± 1.7	0.167
WBC mean (/mm³)	15,634	16,107	0.885
Platelet mean (/mm³)	183,333	206,397	0.279

The overall mortality rate was 6% (9/150). Fetal distress (p=0.040), pulmonary haemorrhage, and birth weight (both p<0.001) were the only parameters showing statistically significant associations with mortality. In contrast, Apgar scores, meconium consistency, radiological findings, ABG parameters, and hematological markers did not show statistically significant associations with outcome.

IV. Discussion

The present study provides a comprehensive clinical characterization of 150 MAS neonates managed in a tertiary NICU, with particular attention to hematological, ABG, and radiological parameters as outcome predictors.

Demographics: The male predominance (54.7%) is consistent with literature attributing delayed pulmonary maturation and hormonal differences to greater MAS susceptibility in males.[78] The predominance of term gestation (81.3%) reflects the well-established epidemiology — meconium passage and fetal gasping capacity increase with advancing gestational age, peaking in post-term pregnancies.

Risk Factors: LSCS was the commonest mode of delivery (54%), typically performed as an emergency response to fetal distress — the leading risk factor in this cohort (45.3%). Fetal distress was significantly associated with mortality (p=0.040), consistent with findings by Meydanli et al.[9] The high rate of primigravida mothers (68.7%) likely reflects increased vulnerability to prolonged labour and intrapartum complications, as reported by Mamo et al.[10]

Clinical Presentation: Acrocyanosis (38%) was the most frequent initial presentation, followed by hypotensive shock (30%) and non-vigorous state (24%). Thick meconium was found in 57.3% of neonates. While thick meconium is consistently reported as a significant predictor of MAS development, the present study found no statistically

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significant association between meconium consistency and mortality — consistent with observations by Fischer et al.[11]

Complications: Culture-positive sepsis (32.7%) was the commonest complication, reflecting the pro-inflammatory milieu of meconium aspiration and susceptibility to secondary infection. Pulmonary haemorrhage, though occurring in only 5.3% of neonates, was present in 55.6% of deaths and was the strongest mortality predictor ($p<0.001$). This catastrophic complication is reported by Shukla et al. to be universally fatal when it occurs in MAS.[12] PPHN was noted in 6.7% of cases, reflecting its expected but variable incidence in MAS.

ABG Analysis: Approximately 47.3% of neonates maintained near-normal PaO2 (85-100 mmHg) and pH (7.25-7.35), reflecting mild-to-moderate disease in the majority. Severe hypoxia (PaO2 <70 mmHg) was present in 16.7%, and severe acidosis (pH <7.15) in 16.7%, representing the critically ill subgroup. Notably, ABG parameters did not independently predict mortality ($p=0.216$), consistent with observations by Karabayir et al., who emphasized that serial ABG trends rather than isolated values are more clinically meaningful.[13]

Radiological Findings: Diffuse patchy infiltration (38%) was the predominant X-ray pattern, representing the combined effects of aspiration, atelectasis, and chemical pneumonitis. A notable 24.7% had normal chest X-rays on admission, underscoring the importance of serial imaging. Radiological findings did not independently predict mortality ($p=0.313$), consistent with observations that clinical-radiological mismatch is common in MAS.[14]

Hematological Parameters: Mean hemoglobin (17.0 g/dL) was within normal neonatal range, and mean WBC (16,079/mm³) reflected the systemic inflammatory response. These parameters did not significantly predict outcome, suggesting that standard hematological markers alone are insufficient for prognostication in MAS — consistent with findings by Singh et al.[15]

Mortality and Predictors: The overall mortality of 6% compares favourably with older Indian studies reporting 14–31%,[1617] and likely reflects improvements in NICU infrastructure and evidence-based management. Birth weight was a highly significant predictor ($p<0.001$), with the highest deaths in neonates weighing 2.6–3.0 kg and >4 kg, consistent with Uniyal et al.[18] This non-linear relationship may reflect extremes of fetal stress, where both low birth weight (compromised reserve) and macrosomia (associated with prolonged labour/diabetic mothers) confer increased risk.

A comparison of this study's findings with contemporary Indian and international literature is instructive. Bezboruah et al. reported a mortality of 38.46% in Assam, while Chandrakar et al. reported 27.27% in Madhya Pradesh.[1617] The significantly lower mortality in the present cohort (6%) may be attributed to the availability of advanced NICU care including mechanical ventilation, surfactant therapy, inotropic support, and comprehensive monitoring at the study institution. This trend of declining MAS mortality with improving NICU infrastructure has also been noted by Singh et al. in a large US cohort spanning 10 years.[15]

The absence of significant associations between outcome and Apgar scores, meconium consistency, ABG parameters, radiological findings, and hematological markers underscores a key clinical message: no single parameter independently determines prognosis in MAS. Integrated clinical assessment combining all available data is essential for accurate prognostication and individualized management.

V. Strengths and Limitations

This study is among the few from Maharashtra to provide a simultaneous analysis of hematological profiles, radiological patterns, and ABG parameters alongside clinical outcomes in MAS neonates. The prospective design, standardized NICU protocols, and systematic data collection using a predesigned proforma strengthen the internal validity of the findings.

However, certain limitations must be acknowledged. First, as a single-centre study, generalizability may be limited. Second, long-term neurodevelopmental outcomes were not assessed — a critical aspect of MAS prognosis, particularly for survivors of severe disease or prolonged mechanical ventilation. Third, advanced biomarkers such as serum IL-6, TNF-α, and lactate — increasingly recognized as predictors of MAS severity — were not routinely available. Fourth, echocardiography for PPHN assessment was not performed in all cases, which may have led to underestimation of its true incidence.

Future multicentric prospective studies incorporating long-term neurodevelopmental follow-up, advanced inflammatory biomarkers, and echocardiographic evaluation of PPHN are needed to further refine prognostication and management strategies for MAS in resource-limited settings.

VI. Conclusion

MAS predominantly affects term male neonates born via caesarean section in the context of fetal distress. The overall mortality was 6%, with pulmonary haemorrhage and birth weight emerging as the strongest independent predictors of adverse outcome. Routine hematological, ABG, and radiological parameters, while clinically important for monitoring and management, did not independently predict mortality — reinforcing the need for comprehensive, integrated clinical assessment.

Prevention of MAS-related complications requires strengthened antenatal surveillance, timely identification and management of intrapartum fetal distress, and readiness of NICU facilities with NRP-trained paramedical staff. These measures, combined with early evidence-based intervention, can substantially reduce MAS-related morbidity and mortality in tertiary care settings.

Declarations

Conflict of Interest: None declared by any author.
Funding: No external funding was received for this study.
Ethical Approval: Obtained from the Institutional Ethics Committee, Vedantaa Institute of Medical Sciences, Dahanu.
Informed Consent: Written informed consent was obtained from parents or legal guardians of all enrolled neonates.
Data Availability: Data are available from the corresponding author upon reasonable request.

REFERENCES

1. Swarnam K, Soraisham AS, Sivanandan S. Advances in the Management of Meconium Aspiration Syndrome. Int J Pediatr. 2012;2012:359571. doi:10.1155/2012/359571
2. van Ierland Y, de Beaufort AJ. Why does meconium cause meconium aspiration syndrome? Current concepts of MAS pathophysiology. Early Hum Dev. 2009;85(10):617-20.
3. Dargaville PA, Copnell B; Australian and New Zealand Neonatal Network. The Epidemiology of Meconium Aspiration Syndrome. Pediatrics. 2006;117(5):1712-21.
4. Christopher GL. Prevalence and Factors Associated with MAS and Clear Liquor in South Indian Newborn. Int J Clin Exp Med Res. 2020;4(4):126-37.
5. Kandpal J, Kamalarathnam CN, Anitha M, et al. Clinical Profile and Outcome of Neonates with MAS at an Indian Tertiary Care. J Neonatol. 2024. doi:10.1177/09732179241262153
6. Urbaniak KJ, McCowan LME, Townend KM. Risk Factors for Meconium-Aspiration Syndrome. Aust N Z J Obstet Gynaecol. 1996;36(4):401-6.
7. Sriram S, Wall SN, Khoshnood B, et al. Racial disparity in meconium-stained amniotic fluid and MAS in the United States. Obstet Gynecol. 2003;102(6):1262-8.
8. Paudel P, Sunny AK, Poudel PG, et al. MAS: incidence, associated risk factors and outcome in Nepal. J Paediatr Child Health. 2020;56(4):630-5.
9. Meydanli MM, Dilbaz B, Caliskan E, et al. Risk factors for MAS in infants born through thick meconium. Int J Gynecol Obstet. 2001;72(1):9-15.
10. Mamo SA. Prevalence and risk factors associated with MAS among neonates in Southern Ethiopia. 2023.
11. Fischer C, Rybakowski C, Ferdynus C, et al. A Population-Based Study of MAS in Neonates Born between 37 and 43 Weeks. Int J Pediatr. 2012;2012:321545.
12. Shukla OS, Swapna ST. Study of risk factors, clinical profile, and outcome in meconium-stained deliveries. Indian J Child Health. 2019.
13. Karabayir N, Demirel A, Bayramoglu E. Blood lactate level and meconium aspiration syndrome. Arch Gynecol Obstet. 2015;291(4):849-53.
14. Olicker AL, Raffay TM, Ryan RM. Neonatal Respiratory Distress Secondary to Meconium Aspiration Syndrome. Children. 2021;8(3):246.
15. Singh BS, Clark RH, Powers RJ, Spitzer AR. MAS remains a significant problem in the NICU. J Perinatol. 2009;29(7):497-503.
16. Chandrakar S, Markam D, Rawat K, et al. Clinical Characteristics of MAS in Relation to Gestational Age and Birth Weight. Int J Pharm Clin Res.
17. Bezboruah G, Chakraborty A, Bhunia N. Clinico-Epidemiological Profile of MAS in Newborns at Gauhati Medical College. Sch J App Med Sci. 2016;4(10A):3553-6.
18. Uniyal P, Kalra BP, Wasim S. A study of profile of MAS in relation with birth weight and gestational age. Int J Contemp Pediatr. 2021;8(6):1021.
19. Osman A, Halling C, Crume M, et al. Meconium aspiration syndrome: a comprehensive review. J Perinatol. 2023;43(10):1211-21.
20. Monfredini C, Cavallin F, Villani PE, et al. Meconium Aspiration Syndrome: A Narrative Review. Children. 2021;8