International Journal of Contemporary Pediatrics
Chauhan AV et al. Int J Contemp Pediatr. 2024 Nov;11(11):1563-1568
http://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291

DOI: https://dx.doi.org/10.18203/2349-3291.ijcp20243082

Original Research Article

Clinical profile of meconium aspiration syndrome with special reference to birth weight, gestational age and immediate outcome at tertiary care centre

Anuya V. Chauhan, Sunita Mahapatra*, Prarthana Khare

Department of Paediatrics, BJ Medical College, Ahmedabad, Gujarat, India

Received: 06 August 2024
Revised: 17 September 2024
Accepted: 26 September 2024

***Correspondence:**
Dr. Sunita Mahapatra,
E-mail: drsunita.2580@gmail.com

ABSTRACT

Background: Meconium aspiration syndrome (MAS) is a leading cause of neonatal respiratory distress, occurring in 5% of infants born through meconium-stained amniotic fluid (MSAF). It is linked to fetal distress and can lead to significant lung complications.

Methods: A prospective study was conducted from March 2021 to February 2022 in the NICU at Civil Hospital, Ahmedabad. MAS was diagnosed based on respiratory distress in neonates born through MSAF using criteria mentioned in Cloherty and Stark's manual of neonatal care. The clinical and demographic information was recorded on pre-structured proforma & they were categorized into mild, moderate and severe MAS according to fraction of inspired oxygen (fiO2), duration of oxygen required and associated complications.

Results: Among 110 neonates with MAS, 87% were full-term, 11% post-term, and none preterm. Most (49.09%) weighed between 2.50–2.99 kg, and 85.45% were appropriate for gestational age. Severe birth asphyxia was the most common comorbidity (30.90%), followed by septicemia and pneumothorax. HFNC was used in 57.27% of cases, while 32.72% required ventilation. The mortality rate was 10%, with pneumothorax being the leading cause of death.

Conclusion: Proper antenatal care with prevention and treatment of maternal risk factors, intrapartum assessment of foetal distress and use of proper aseptic techniques during delivery & resuscitation and then transport of the baby to referral centre help in reducing morbidity and mortality in MAS neonates. After birth, timely diagnosis and provision of proper respiratory support by assessment of the severity of distress can prevent the mortality and morbidity due to MAS.

Keywords: Meconium aspiration syndrome, Antenatal care, Intra partum foetal monitoring, Respiratory distress, Meconium-stained amniotic fluid, Neonatal mortality

INTRODUCTION

Meconium is the first faeces of a new-born composed of materials ingested during the time the infant spends in the uterus. The contents are intestinal epithelial cells, lanugo, mucus, amniotic fluid, bile, and water. Meconium is normally retained in the infant's bowel until after birth, but sometimes it is expelled into the amniotic fluid prior to birth or during labour and delivery. The stained amniotic fluid is called "meconium liquor" or "meconium-stained liquor" and recognized by medical staff that this may be a sign of fetal distress.1 Meconium aspiration syndrome remains one of the most common causes of neonatal respiratory distress. The overall frequency of meconium-stained amniotic fluid varies between 5% to 25%. Meconium aspiration syndrome occurs in 5% of infants born through meconium-stained amniotic fluid.[1] MSAF is noted in presence of feto-maternal stress factors such as hypoxia and infection, independent of foetal maturation. Meconium passage is a developmentally programmed post-natal event because 98% of healthy new-born pass meconium in first 24 to 48 hours after birth.

Greater than 98% of cases MSAF are noted in fetuses at or following 37 weeks of gestation. MSAF commonly occur in post term pregnancies and is relatively rare in preterm deliveries.[2] Avoidance of post term pregnancies and improving intrapartum monitoring are beneficial. Recent advances in understanding and management of acute lung injury such as appropriate use of positive end expiratory airway pressure, surfactant therapy, high frequency ventilation, has led to reduced incidence of adverse outcome and improved survival rate of infants with MAS.[3]

The purpose of this study was to evaluate neonates with respiratory distress born out of meconium-stained liquor, find out the contributing factors for meconium aspiration, incidence of aspiration among term neonates who passed meconium in utero, neonatal morbidity and mortality associated with meconium aspiration syndrome. To study the clinical profile, risk factors, aetiology, and outcomes of MAS in neonates admitted to a tertiary care centre.

METHODS

Study type

This study is a prospective observational investigation conducted in the neonatal intensive care unit (NICU) of Civil Hospital Ahmedabad.

Study duration

Study duration was of one year, from 1st March 2021 to 28th February 2022, using a purposive sampling technique after receiving approval from the institutional ethical committee. The study focused on neonates with a gestational age of 28 weeks or more who were diagnosed with meconium aspiration syndrome (MAS) based on the following diagnostic criteria, meconium staining of the amniotic fluid, umbilical cord, skin, or nails, respiratory distress, and characteristic X-ray findings such as diffuse asymmetric patchy infiltrates, areas of consolidation, and hyperinflation, typically more severe on the right side.[4]

Inclusion criteria

Parental consent was obtained for all subjects included in the study.

Exclusion criteria

Neonates with major life-threatening congenital malformations were excluded.

MAS was diagnosed if at least two of the following criteria were met, meconium staining of liquor, respiratory distress within one hour of birth, or radiological evidence of aspiration pneumonitis, including atelectasis or hyperinflation.

Data on clinical and demographic characteristics were collected using a pre-structured, pre-standard proforma, with parental consent. Gestational age was assessed using the new Ballard score, and respiratory distress was evaluated using Downe's score, alongside findings from a physical examination. Neonates were then categorized as having mild, moderate, or severe MAS based on their fraction of inspired oxygen (FiO2), the duration of oxygen therapy required, and any associated complications.[4-7]

Statistical analysis

Investigations performed during the study included hemoglobin levels, total white blood cell count, differential count, C-reactive protein levels, renal function tests, blood cultures, blood sugar levels, arterial blood gas analysis (ABGA), chest X-rays, and 2D echocardiograms as needed. The data collected were analysed using Microsoft Excel.

RESULTS

This prospective study was conducted from March 1, 2021, to February 28, 2022, in the Neonatal Intensive Care Unit (NICU) of a tertiary care centre. During this period, a total of 1,803 neonates were admitted to the NICU. Out of these, 1,169 were extramural admissions, while 634 were intramural admissions. Among the total admissions, 110 neonates were diagnosed with meconium aspiration syndrome (MAS), resulting in an incidence rate of 6.1% for MAS among the hospitalized neonates.

In the present study no preterm neonates developed MAS. Of all the cases 89% were term neonates and 11% were post-term neonates. As per the literature incidence of MAS increases with the gestational age but in practice, we do not prefer post-term deliveries due to higher chances of fetal distress. So, higher incidence of MAS in term neonates was seen.

Table 1: Incidence of MAS with reference to gestational age in weeks.

Gestational age	MAS	%
37 to less than 40 weeks	56	50.90
40 to less than 42 weeks	42	38.18
More than 42 weeks	12	10.90
Total	(n=110)	

In the present study we found that incidence of MAS increases as gestational age advances. This correlates with the theory of meconium that MSAF occur only after

GIT matures, strong enough for the peristalsis to occur that is after 37 weeks of gestational age. In the present study majority of cases had a mean gestational age of 37 to 40 weeks.

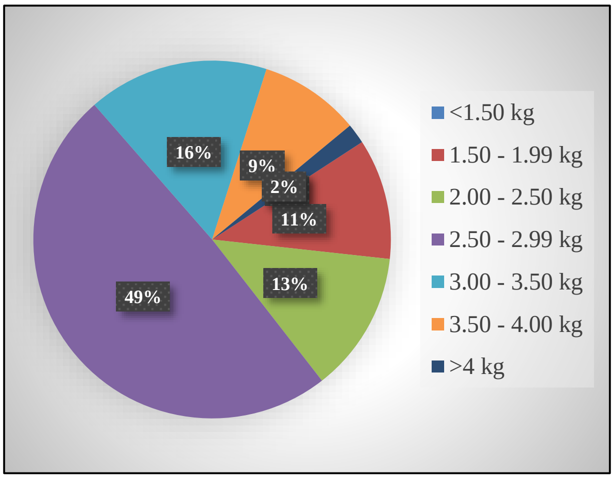

Figure 1: Incidence of MAS with reference to birth weight.

In this present study we found maximum no. of cases i.e. 54 (49.09%) were seen in babies with birth weight 2.50 kg to 2.99 kgs. 18 (16.36%) cases were in 3.00 kgs to 3.49 kg, 14 (12.72%) were in 2.00 to 2.50 kg.

As in India average birth weight of newborn is around 2.0 to 3.0 kg, so maximum incidence is around the same range of birth weight. Also, MAS in seen in term and post term neonates. Hence, maximum patients had birth weight in range of 2.50 to 2.99 kg.

Table 2: Clinical features in MAS cases.

S. no.	Clinical features	Numbers of babies (n=110)
1	Fast breathing, respiratory rate >60	110 (100%)
2	Sub-coastal in-drawing, inter-coastal in-drawing.	94 (85.4%)
3	Grunting	71 (64.54%)
4	Cyanosis a. peripheral cyanosis b. central cyanosis	39 (35.4%) 26 (66.66%) 13 (33.33%)
5	Weak cry	58 (52.72%)
6	Lethargy or reduced activity	67 (60.9%)
7	Nasal flaring	64 (58.18%)
8	Hyperinflation of chest	12 (10.91%)

In our present study we observed fast-breathing (tachypnea) was the most common reason to get admitted in NICU (in 100% of cases) and sub-coastal in-drawing and inter-costal in-drawing was the next most common (85.4%) sign on admission.

Other clinical features present were grunting in 71 cases (64.54%), cyanosis 39 cases (35.4%), weak cry in 58 cases (52.72%), lethargy in 67 (60.9%), nasal flaring in 64 cases (58.18%) and hyperinflation of chest in 12 cases (10.91%).

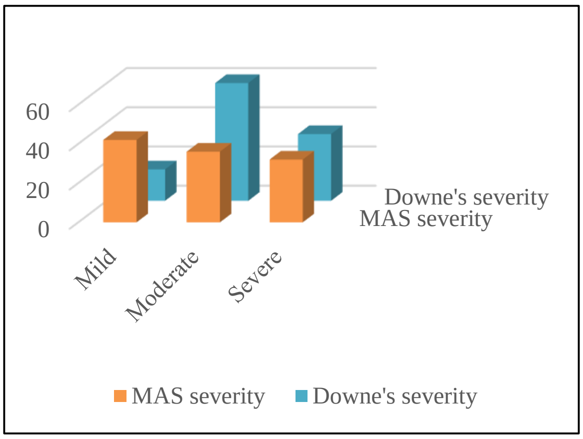

Figure 2: Comparison of severity of Downe's score and severity of MAS.

The maximum number of cases 42 (37.75%) were mild MAS, 36 (32.65%) were moderate MAS and 32 (29.09%) were severe MAS.

In this study we found that babies who had Downe's score more than 6, most of them developed severe MAS. Out of 34 (30.9%) babies who had score more than 6, 32 (29.09%) developed severe MAS. This indicates that Downe's score of >6 correlates well with severe MAS. Out of 60 (54.54%) babies, only 36 (32.65%) developed moderate MAS.

However other babies responded to initial therapy well and so, though only 16 (14.28%) had low Downe's score as good as 42 (37.75%) babies suffered from milder spectrum of the disease. So, we can conclude that timely treatment with proper FiO2 in MAS can have good prognosis.

Table 3: Correlation with risk factors.

S. no.	Risk factors	Neonates with MAS	% (n=110)
1	Anemia	55	50.06
2	Pregnancy induced hypertension	53	48.18
3	Fetal distress	52	47.27
4	Premature rupture of membrane	31	28.18
5	Oligohydramnios	16	14.54
6	Post-date pregnancy	18	16.32
7	Ante-partum bleeding	7	6.36
8	Eclampsia	3	2.72
9	Elderly primi-mother	7	6.36
10	No risk factors	28	25.45

In this study we observed that out of 110 cases of MAS. 28 (25.45%) mothers had no risk factors. Pregnancy induced hypertension (48.18%) and maternal anemia (50.06%) were most common risk factors in this study. Other associated risk factors were fetal distress (47,27%), PROM (28.18%), oligohydramnios (14.54%), postdated pregnancy (16.32%), APH (6.36%), Eclampsia (2.72%) and elderly primi (6.36%). Various risk factors may increase the likelihood of in utero passage of meconium, which if timely intervened can decrease the incidence of MSAF, subsequent MAS and hence morbidity and mortality among neonates.

Table 4: Complications and comorbidities associated with MAS.

S. no.	Comorbidities	Numbers (n=110)
1	PPHN	16 (14.50%)
2	Septicemia	23 (20.90%)
3	Pneumothorax	12 (10.90%)
4	SBA	34 (30.90%)
5	Myocardial injury	24 (21.82%)
6	Renal failure	12 (10.91%)
7	No comorbidities	25 (22.72%)

In this study it has been observed that, 34 (30.90%) patients had SBA (Severe Birth Asphyxia) which is the most common comorbidity, 24 (21.82%) had myocarditis, 23 (20.90%) had septicaemia, 16 (14.50%) had PPHN, 12 (10.90%) had pneumothorax, 12 (10.90%) had renal failure and 25 (22.72%) had no comorbidities.

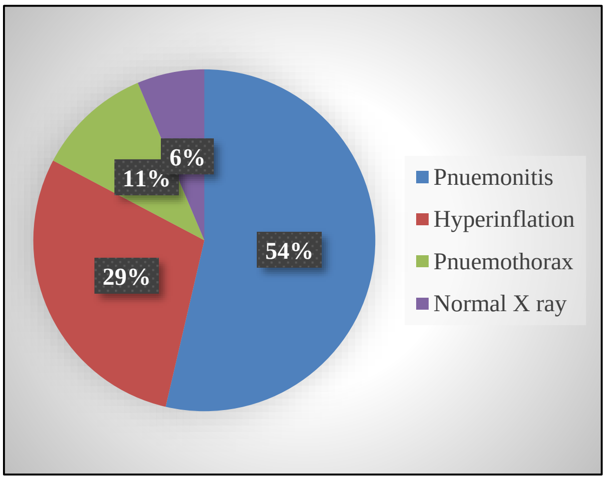

Figure 3: Radiological findings in MAS cases.

On radiological findings, pneumonitis changes were found in 59 (53.63%), hyperinflation were in 32 (29.09%), pneumothorax were in 12 (10.90%) and normal in 7 (6.36%). In this study maximum cases i.e. 63 (57.27%) required HFNC support as maximum were fitting into mild and moderate type of MAS. Ventilatory support given to 36 (32.72%) cases. Timely management with proper O2 support decreases the requirement of invasive ventilation.

Table 5: Outcome of neonates with MAS.

S. no.	Immediate outcome	(n=110)	%
1	Discharge	92	83.64
2	Expiry	11	10
3	Left against medical advice	7	6.36

In present study we found 11 (10%) neonates expired due to meconium aspiration syndrome. As ours is a tertiary center, patients were referred from various places and in terminal stages which also contributes to the mortality of the patients.

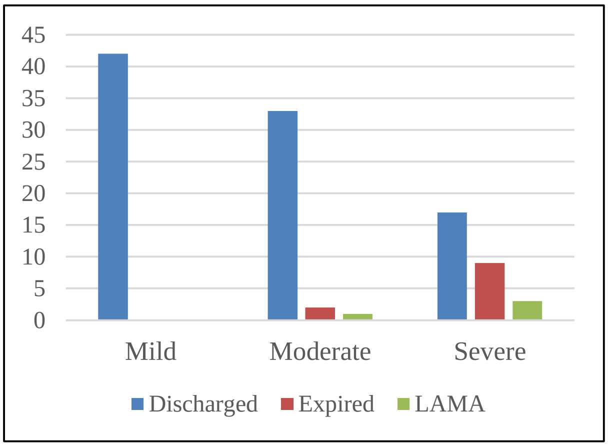

Figure 4: Correlation of mortality in MAS with severity of MAS.

Out of all expiries the majority had Severe MAS 9 (81.8%), and only 2 (18.2%) had moderate MAS. There was no expiry in mild MAS. Also, in severe MAS mortality rate was 28.1%, in moderate MAS was 5.5% and in mild MAS was 0%.

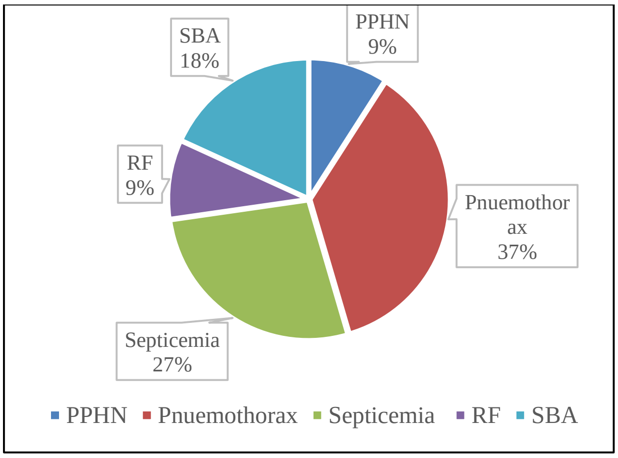

Figure 5: Mortality profile of MAS patients.

The mortality profile of neonates with MAS revealed a total of 11 deaths. The most common cause of mortality was pneumothorax, accounting for 36.36% of the deaths. Other significant causes included septicaemia, responsible for 27.24%, followed by severe birth asphyxia (SBA) at 18.2%, persistent pulmonary hypertension of the newborn (PPHN) at 9.1%, and respiratory failure, which also accounted for 9.1%. Among neonates with moderate MAS, a single death occurred due to respiratory failure.

DISCUSSION

In present study the incidence of meconium aspiration syndrome among hospitalized neonates is 6.1%. Whereas in other studies such as Prudent LM et al, National perinatal database 2002-03, Narang et al incidence was 5%, 8.7%, 10.55% respectively.[8-10] In present study, 50.90% of cases occurred in neonates between 37–40 weeks, which is lower than the 78% reported by Eiden et al.[11] but similar to the 48.27% found by Gangu et al.[12] For neonates between 40–42 weeks, our study shows 38.18% of MAS cases, comparable to Gangu et al12 (27.28%), but significantly higher than Eiden et al11 (35%). In post-term neonates (>42 weeks), our study reports 10.90% incidence, higher than both Eiden (7%) and Gangu et al (6.89%). This suggests that the incidence of MAS increases with gestational age across all studies. We found that incidence of MAS increases as gestational age advances. This correlates with the theory of meconium that MSAF occur only after GIT matures, strong enough for the peristalsis to occur that is after 37 weeks of gestational age. The majority of cases had a mean gestational age of 37 to 40 weeks. There were no cases in less than 37 weeks in the present study.

In this present study we found maximum no. of cases i.e., 54 (49.09%) were seen in babies with birth weight 2.50 kgs to 2.99 kgs. 18 (16.36%) were in 3.00 kgs to 3.49 kgs, 14 (12.72%) were in 2.00 to 2.50 kg. But in the study by Gangu et al the maximum cases (37.93%) were under 2.00-2.49 kgs and, in Kamble et al (2018) maximum patients (64.89%) were between 2.50 kgs to 3.49 kgs. Mean Weight in our study was 2.65 kg as higher number of MAS neonates were between 2.50 kgs to 2.99 kgs whereas in study by Gangu et al the mean weight was 2.68 kg.[12,13] In our study, 14.28% of cases had mild respiratory distress (score 0-3), which is lower than the 24.13% observed in Gangu et al’s study.[12] Moderate distress (score 4-6) was seen in 54.54% of our cases, which is significantly lower than the 72.41% reported by Gangu et al. However, our study had a much higher percentage of severe distress cases (score>6) at 30.9%, compared to only 3.44% in Gangu et al, indicating that our cohort experienced more severe cases of MAS.

In present study, anemia (50.06%) and pregnancy-induced hypertension (48.18%) were more prevalent than in Kamble et al, (11.7% and 22.34%, respectively).[13] Foetal distress was common across all studies, highest in Gangu et al (52%) and lowest in Kamble et al (37.23%). Premature rupture of membrane was more frequent in present study (28.18%) compared to Gangu et al. (10%), while oligohydramnios was similar across studies. Other factors such as post-date pregnancy (16.32%), ante-partum bleeding (6.36%), eclampsia (2.72%), and elderly primi women (6.36%) were exclusively reported in our study. Lastly, 25.45% of cases had no identifiable risk factors. In our study, the most common comorbidity was SBA (30.90%), which was similar in Gangu et al. (29.93%) and higher in Kamble et al study (39.36%). Septicemia was also prevalent, with 20.90% in our study, 17.24% in Gangu et al, and a significantly higher 48.93% in Kamble et al. Other notable findings include PPHN (14.50% in our study, 13.80% in Gangu et al study, but only 1.06% in Kamble et al.) and renal failure, observed at 10.91% in our study and 20.68% in Gangu et al. The category of no comorbidities was reported in 22.72% of our cases and 18.43% in Gangu et al study.

In present study, 53.63% of X-rays showed pneumonitis changes, which is slightly higher than the 47% observed by Choudhury et al.[14] The frequency of hyperinflation was notably higher in present study at 29.09%, compared to 18% in Choudhury et al.[14] Pneumothorax was observed in 10.90% of cases which is slightly higher than the 8% reported in the other study. Conversely, the percentage of normal X-rays was lower at 6.36%, compared to 23% in Choudhury et al study. This suggests that present study found a higher incidence of abnormal X-ray findings, particularly pneumonitis and hyperinflation, and a lower incidence of normal X-rays compared to Choudhury et al's findings.

In the present study, 11 (10%) neonates expired due to meconium aspiration syndrome. Mortality rate was comparable to the previous two studies done by Gangu et al (2017)12 (10.34%) and Wisewell et al (12%).[15] Also, in severe MAS mortality rate was 28.1%, in moderate MAS was 5.5% and in mild MAS was 0%. Most common cause of mortality was pneumothorax (36.36%), and other causes were septicemia (27.24%), SBA (18.2%), PPHN (9.1%) and Respiratory Failure (9.1%). On comparison with study by Gangu et al (2017)12 most common cause of mortality was meconium aspiration syndrome with severe birth asphyxia (50%) other causes were respiratory failure (16.66%), septicemias with DIC (16.66%) and pneumothorax (16.66%). The study had two main limitations. First, the sample size was relatively small, including only 110 neonates diagnosed with meconium aspiration syndrome (MAS), which may limit the generalizability of the results. Second, since the study was conducted at a single tertiary care hospital, the findings may not be representative of other healthcare settings with varying patient demographics and clinical practices.

CONCLUSION

Proper antenatal care, including the prevention and treatment of maternal risk factors such as pregnancy-induced hypertension, anaemia, preterm premature rupture of membranes (PPROM), antepartum bleeding, and oligohydramnios, plays a crucial role in reducing the incidence of MAS in newborns. Intrapartum assessment of fetal distress, along with the use of proper aseptic techniques during delivery and resuscitation, followed by the timely transport of the baby to a referral centre, can significantly decrease the morbidity and mortality associated with MAS. After birth, early diagnosis and prompt respiratory support, based on the severity of respiratory distress, are essential in preventing adverse outcomes. Effective management of MAS requires a coordinated approach between obstetricians and paediatricians, beginning with thorough monitoring of maternal risk factors, meticulous newborn care, and the anticipation and swift treatment of potential complications.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Finroff AA. Meconium aspiration syndrome: historical aspects, Perinatal. J Perinatal. 2008;211(31):3-7.
2. Nath GDR, Penchalaiah A. Study of clinical profile of meconium aspiration syndrome in relation to gestational age and birth weight and their immediate outcome at Narayana Medical College Hospital, Nellore, India. Int J Contemp Pediatr. 2017;4(6):2142-50.
3. Neff MJ. ACOG releases guidelines on management of post-term pregnancy. Am Fam Physician. 2004;70(11):2221-2.
4. Eichenwald EC, Hansen AR, Martin CR, Stark AR. Manual of Neonatal care. Pediatrics. 2017;8:475-80.
5. Ballard, Robert A. Respiratory failure in term infant: meconium aspiration pneumonia avery's disease of newborn. IJRMS. 2017;5(10)712-14.
6. Cunnigham, Gary F. Meconium aspiration William obstetrics. Obstet Gynecol. 2000;21(39):1044-5.
7. Nelson Textbook book of paediatrics 1st South Asian. 2015;3:859-60.
8. Vain NE, Szyld EG, Prudent LM, Wiswell TE, Aguilar AM, Vivas NI. Oropharyngeal and nasopharyngeal suctioning of meconium-stained neonates before delivery of their shoulders: multicentre, randomised controlled trial. Lancet. 2004;364(9434):597-602.
9. National Neonatology Forum of India. National Perinatal Database 2002-03. New Delhi: National Neonatology Forum; 2004. Available at: https://www.newbornwhocc.org. Accessed on 17th January 2024.
10. Narang A, Nair PMC, Bhakoo ON, Vashisht K. Management of meconium-stained amniotic fluid: A team approach. Indian Pediatr. 1993;30:9.
11. Eden RD, Seifert LS, Winegar A, Spellacy WN. Perinatal characteristics of uncomplicated postdate pregnancies. Obstet Gynecol. 1987;69(3):296-9.
12. Nath GDR, Penchalaiah A. Study of clinical profile of meconium aspiration syndrome in relation to gestational age and birth weight and their immediate outcome at Narayana Medical College Hospital, Nellore, India. Int J Contemp Pediatr. 2017;4:2142-50.
13. KambleMB, JainP.Meconium aspiration syndrome: clinical profile, risk factors and outcome in central India. Int J Contemp Pediatr. 2019;6:144-9.
14. Choudhury SN, Kumar B, Saji PN. A Study of meconium aspiration syndrome and neonatal outcome: a prospective study. J Med Sci Clin Res. 2020;8(6):226-31.
15. Wiswell IE, Knight OR. A multicentre, randomised controlled trial comparing surfaxin lavage Keith the standard care for treatment of meconium aspiration syndrome. Paediatrics. 2002;109:1-8.

Cite this article as: Chauhan AV, Mahapatra S, Khare P. Clinical profile of meconium aspiration syndrome with special reference to birth weight, gestational age and immediate outcome at tertiary care centre. Int J Contemp Pediatr 2024;11:1562-8.