

## Original Research Article

# A study of profile of meconium aspiration syndrome in relation with birth weight and gestational age of newborns and their immediate outcome

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### ABSTRACT

**Background:** Meconium aspiration syndrome (MAS) is one of the common causes of neonatal respiratory distress. Overall frequency of meconium stained amniotic fluid (MSAF) ranges between 5 to 25%.

**Methods:** Observational study was conducted on 96 newborns over a period of one year in the department of pediatrics, Himalayan Institute of Medical Sciences, Dehradun, Uttarakhand. All newborns, inborns and outborns with MSAF admitted in NICU of our hospital were taken.

**Results:** Out of 876 babies those had MSAF, 96 babies developed MAS with 10.95% incidence. Common maternal risk factors noted with MAS was maternal diabetes mellitus in 11 (15.71%) cases. Babies born via LSCS developed MAS in 51 (53.12%) and in babies delivered vaginally 45 (46.87%). MAS occurred mainly in term with mean gestational age of 38 weeks with SD of 1.85 weeks. The mean birth weight of newborns with MAS was 2794 g with 524 g SD. Most common complication was birth asphyxia in 36 (37.5%). Mortality occurred in 11 (11.4%). Mean gestational age and birth weight of mortality in MAS was 38 weeks with 2.5 weeks SD and 2800 g with 723 g SD respectively. Statistically significant association noted between mortality due to MAS and birth weight as  $p$  value < 0.05, but no significant association noted between mortality and gestational age.

**Conclusions:** MAS is a common cause of respiratory distress in newborns born through MSAF. With judicious use of available modes of ventilation and adjunctive therapies, infants with even the most severe MAS can usually be supported through the disease, with an acceptable burden of short- and long-term morbidity.

**Keywords:** Meconium aspiration syndrome, Meconium stained amniotic fluid, Gestational age, Birth weight

### INTRODUCTION

Meconium aspiration syndrome (MAS) is one of the most common causes of neonatal respiratory distress. It is a life-threatening respiratory condition. Overall frequency of meconium stained amniotic fluid (MSAF) varies between 5 to 25%. MAS occurs in 10% of infants born through MSAF.<sup>1</sup> Term and post-term infants who have passed meconium in utero can be affected with MAS. Aspiration of amniotic fluid stained with meconium can produce a spectrum of respiratory distress in new born which varies

from mild transient increase in respiratory rate to respiratory failure.<sup>2</sup>

When fetus is under stress in utero during labour, it leads to fetal hypoxic distress which results in neural stimulation of the mature gastrointestinal tract which is caused by vagal stimulation from head or cord compression leading to peristalsis of the gut and relaxation of anal sphincter.

Meconium-stained fluid consists of lanugo hair, mucus, intestinal epithelial cells, and intestinal secretions.<sup>3</sup> There

are so many predisposing risk factors that promote the passage of meconium into the amniotic fluid in utero like utero-placental insufficiency, maternal hypertension, cord around neck, oligohydramnios, diabetes mellitus, heavy smoking, post-term pregnancy and intra uterine growth restriction, ante-partum haemorrhage and anemia.<sup>4</sup>

Outcome of MAS mainly depends on type of meconium that is thin or thick, amount of meconium aspirated and perinatal care offered to the baby during delivery, planned team approach to MSAF babies, proper perinatal care has changed the morbidity and mortality of MAS.<sup>5</sup>

The aim of the study study was to investigate clinical profile of MAS, its risk factors and severity among newborns at our institute. This is likely to contribute to its early recognition thereby reduce morbidity and mortality of neonates due to it.

## METHODS

The type of study was cross-sectional and observational study. This study was conducted in department of paediatrics, Himalayan Institute of Medical Sciences (HIMS), Swami Ram Nagar, Dehradun, a tertiary care hospital in Uttarakhand. All newborns, delivered normally or by caesarean section, fulfilling the criteria given below for MAS and admitted to NICU from June 2018 to May 2019 were included in this study after taking written informed consent from parent and ethical clearance from ethical committee of the university.

### Inclusion criteria

MAS diagnosed by the presence of MSAF, tachypnoea, chest retractions, grunting or other abnormal sign on physical examination consistent with pulmonary disease, need for supplemental oxygen or ventilator support. Abnormal X-ray chest consistent with pneumonitis were included in study.

### Exclusion criteria

Newborns with Hyaline membrane disease (HMD), Transient tachypnoea of newborn (TTNB), congenital pneumonia and sepsis, new born with MSAF but without respiratory distress, babies born through meconium stained amniotic fluid with normal chest X-ray were not included in our study.

### Study tool

For data collection, consecutive sample technique was used. Data management done from the case sheet of study subjects, with the help of pre-structured proforma.

### Study protocol

Detailed antenatal, natal and postnatal history was elicited regarding Apgar score, birth asphyxia or any other

complication, type of delivery and any complication in the mother. Thorough clinical examination was done and severity of respiratory distress was assessed using Downe's scoring system, score above 6 indicated impending respiratory failure requiring ventilator support. All infants with the diagnosis of MAS were treated in NICU with oxygen, restricted intravenous fluids, antibiotics, inotropic support and ventilator support as and when required. Serial X-rays as directed by the condition of new born. Transient metabolic disturbances with electrolytes and arterial blood gas (ABG) were done and interpreted when required.

### Data management and statistical analyses

The data was collected and entered in MS excel 2010. Different statistical analysis was performed by SPSS software version 22. Descriptive statistics was calculated for quantitative variables. Frequency along with percentages was calculated for qualitative and categorical variables. Graphical representation of the variable shown to understand the result clearly. Chi-square test was used to find out significant association between two variables.

## RESULTS

This study was conducted at Himalayan Institute of Medical Sciences. There were total of 4174 admissions in NICU during study period, out of which 876 (20.98%) babies had MSAF. 96 babies developed MAS with 10.95% incidence. Table 1 depicts sex distribution of neonates and Table 2 depicts maternal risk factors observed with MAS.

**Table 1: Sex distribution of neonates.**

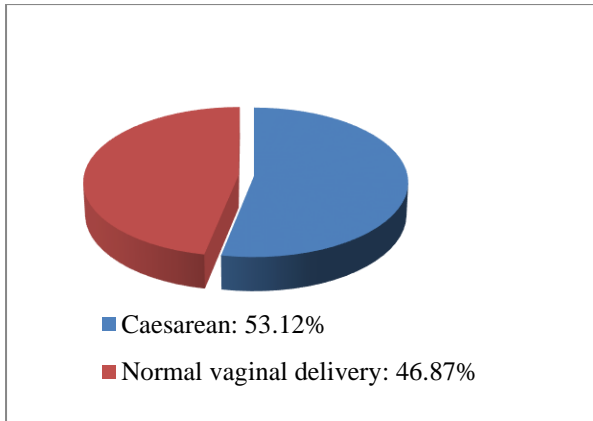
Gender	No. of cases (N=96)	Percentage (%)
Male	59	61.45
Female	37	38.54

There were 59 (61.45%) male and 37 (38.54%) were females neonates.

**Table 2: Maternal risk factors observed with MAS.**

Maternal factor	No. of cases (N=96)	Percentage (%)
Placental insufficiency	4	4.16
Pregnancy induced hypertension	8	8.33
Diabetes mellitus (DM)	11	15.71
Preeclampsia	6	6.25
Others	5	5.20
No risk factors	62	64.58

In Table 2, the most common maternal risk factor observed with MAS was maternal diabetes mellitus in 11 (15.71%) cases. Figure 1 shows mode of delivery associated with MAS. Frequency of MAS with gestational age and birth weight is depicted in Table 3 and 4 respectively.



**Figure 1: Mode of delivery.**

Babies born via caesarean section developed MAS in 51 (53.12%) cases more often than babies delivered normal vaginally in 45 (46.87%) cases.

**Table 3: MAS with gestational age.**

Gestational age (weeks)	No. of cases (N=96)	Percentage (%)
<34	1	1.42
34-36	8	8.33
37-38	24	25
39-40	55	57.3
41-42	8	8.33

**Table 4: Birth weight and MAS.**

Birth weight (g)	No. of cases (N=96)	Percentage (%)
1500-1999	4	4.1
2000-2499	18	18.75
2500-2999	43	44.8
3000-3499	20	20.8
3500-3999	8	8.33
≥4000	3	3.1

MAS occurred in term neonates with mean gestational age of 38 weeks with SD of 1.85 weeks. Maximum cases 55 (57.3%) of MAS seen in 39-40 weeks of gestation.

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The mean birth weight of newborns with MAS was 2794 g with 524 g SD. In our study, maximum i.e. 43(44.8%) of MAS was seen in babies of birth weight between 2500-2999 g. Table 5 and 6 depicts neonatal outcome and causes of mortality in MAS.

**Table 5: Neonatal outcome in MAS.**

Neonatal outcome	No. of cases (N=96)	Percentage (%)
Death	11	11.4
Discharges	84	87.5
Referred	1	1.04

Out of 96 MAS babies 84 (87.5%) were discharged after getting treatment. Mortality occurred in 11 (11.4%) babies. 1 (1.04%) baby was referred to higher centre due to associated complex cardiac disease.

**Table 6: Causes of mortality in MAS.**

Complications	No. of cases (N=96)	Percentage (%)
Isolated birth asphyxia	1	9
Isolated acute kidney injury (AKI)	2	18.1
Birth asphyxia with pneumothorax	1	9
Birth asphyxia with PPHN	2	18.1
Birth asphyxia with AKI with septicaemia	5	45

In our study, most common cause of mortality was birth asphyxia with acute kidney injury and septicaemia in 5 (45%) cases followed by birth asphyxia with persistent pulmonary hypertension (PPHN) in 2 (18.1%) cases, isolated acute kidney injury in 2 (18.1%) cases followed by isolated birth asphyxia in 1 (9%) case, and birth asphyxia with pneumothorax in 1 (9%) case.

**Table 7: Association between outcome and birth weight in newborns with MAS.**

Birth weight (g)	Outcome frequency (%)		Total	P value
	Non-survivors	Survivors		
1500-1999	2 (50)	2 (50)	4 (4.2)	0.015
2000-2499	0 (0)	18 (100)	18 (18.8)	
2500-2999	4 (9.3)	39 (90.7)	43 (44.8)	
3000-3499	2 (10)	18 (90)	20 (20.8)	
3500-3999	3 (37.5)	5 (62.5)	8 (8.3)	
>4000	0 (0)	3 (100)	3 (3.1)	
Total	11 (11.5)	85 (85.5)	96 (100)	

Table 7 depicts association between outcome and birth weight in newborns with MAS and Table 8 depicts association between outcome and gestational age in newborns with MAS.

There was significant association noted between mortality and birth weight in MAS, as the p value was <0.05.

**Table 8: Association between outcome and gestational age in new-borns with MAS.**

Gestational age (weeks)	Outcome frequency (%)		Total	P value
	Non-survivors	Survivors		
<34	0 (0.0)	1 (100)	1 (1)	0.767
34-36	2 (25)	6 (75)	8 (8.3)	
37-38	2 (8.3)	22 (91.7)	24 (2.5)	
39-40	6 (10.9)	49 (89.11)	55 (57.3)	
41-42	1 (12.5)	7 (87.5)	8 (8.3)	
<b>Total</b>	11 (11.5)	85 (85.5)	96 (100)	

There was no significant association noted between mortality and gestational age in MAS.

### DISCUSSION

MAS is a very common cause of respiratory distress in neonates and most of these neonates required neonatal intensive care unit admission. At our institute 856 babies were delivered with MSAF during period of study and 96 babies developed MAS with incidence of 11%. Similar results were found by study done by Nath et al and showed that incidence of MAS was 6.5% cases, whereas Garg et al found 8.5% incidence rate of MAS in their study.<sup>6,7</sup> Present study which was conducted over 96 new born with MAS, male new borns were more affected i.e 59 (61.45%) than female newborns 37 (38.54%) (Table 1). Similar results were found by Garg et al with male: female ratio of 1.2:1 and the study by Ramakishore et al concluded that among affected babies, male were 58% and females were 42%.<sup>7,2</sup> But Ramanathan et al found male: female ratio of 1:1.25, as a gender differentials in case of MAS.<sup>3</sup> Whereas, in the study of Nath et al the gender distribution was almost equal in both male and female with 51.72% cases in males and 48.27% cases in female.

In our study maternal diabetes mellitus has been found to be most common maternal risk factor associated with meconium aspiration syndrome in 15.71% cases followed by PIH in 8.33% cases (Table 2). Ramanathan et al in their study identified PIH in 23.50% cases as the most common maternal risk factor for MAS.<sup>3</sup> The similar study which was conducted by Nath et al, PIH i.e 20.68% was the most important maternal risk factor for MAS.<sup>6</sup> Also, the study by Rajlaxmi et al concluded that pregnancies complicated with PIH (16.97%) cases had statistically significant higher rates of MSAF.<sup>8</sup> Similar findings were found by Phirke et al that the most frequent perinatal risk factor was fetal distress in 18% cases followed by PIH in 14% cases.<sup>9</sup> Sasivarathan et al also identified that fetal distress in 42.5% was associated with MAS followed by PIH in 21.6% cases.<sup>10</sup> In the study by Hiran et al fetal distress in 51.72% cases was the commonest factor associated with MAS followed by PIH (20.68%).<sup>11</sup>

In our study, MAS was found more in babies born through caesarean section i.e 53.12% cases, as compared to babies delivered via normal vaginal delivery 46.87% (Figure 1). Similar findings were seen in study of Ramanathan et al that MAS was more in babies born through lower segment caesarean section (LSCS) in 50.9% followed by normal vaginal delivery in 31.3% and by instrumental delivery with forceps in 9.8%.<sup>3</sup> Caesarean section was very commonly done in MSAF cases and it accounted for 49.09% cases as compared to 25.79% cases in control group, rates being nearly double and difference being statistically significant in the study of Rajlaxmi et al.<sup>8</sup> Lama et al also concluded higher rates of MAS in babies born through LSCS.<sup>12</sup> Naveen also concluded that chances of LSCS were more in MSAF babies.<sup>13</sup>

The highest incidence of MAS was found in gestational age of 39-40 weeks 57.3% followed by 37-38 weeks in 25%. Pre-term babies with gestational age of 34-36 weeks and post term babies with gestational age of 41-42 weeks both had same incidence i.e 8.33% of MAS. There was only one case of gestational age of less than 34 weeks, who developed MAS (Table 3). Identical results were found in many other studies. Study conducted by Ramakishore et al concluded that, the mean gestational age was 40 weeks (38-40 weeks).<sup>2</sup> In our study, maximum number of MAS cases was found in babies with birth weight between 2500-2999 g i.e 44.8% followed by 20.8% in babies born with birth weight of 3000-3499 g. We found that, low birth weight babies of 2000-2499 g also had MAS with 18.75% and 1500-1999 g with 4.1% of meconium aspiration syndrome. 3.1% of MAS cases were reported in babies with birth weight more than 4000 g (Table 4). In the study done by Garg et al maximum number of cases of meconium aspiration syndrome 60% were seen in neonates with birth weight between 2500-3500 g, followed by neonates with birth weight less than 2500 g (34%).<sup>7</sup> Singh et al also observed that MAS was more common in babies with gestational age >37 weeks.<sup>14</sup>

In our study, out of 96 cases 53.1% babies were managed conservatively with oxygen support, restricted intra venous fluid, antibiotics and 46.8% babies needed

ventilator support. With early interventions and proper management, need of ventilation decreased, 87.5% babies were discharged after satisfactory management. Mortality occurred in 11.4% cases. 1 baby was referred due to complex cardiac disease (Table 5). Whereas in the study done by Ashtekar et al 76.9% babies with MAS were treated conservatively and 23.07% were ventilated.<sup>1</sup> According to Ramanathan et al, out of 51 cases, 12 required ventilatory supports.<sup>3</sup> In our study, most common cause of mortality was birth asphyxia with acute kidney injury (AKI) and septicaemia in 5 (45%) cases followed by birth asphyxia with persistent pulmonary hypertension (PPHN) in 2 (18.1%) cases and isolated acute renal failure (ARF) in 2 (18.1%) cases followed by isolated birth asphyxia in 1 (9%) case and birth asphyxia with pneumothorax in 1 (9%) case (Table 6). Study conducted by Nath et al found birth asphyxia (37.93%) followed by septicaemia (17.24%) among the most common causes of mortality in MAS.<sup>6</sup> Hypoxic ischemic encephalopathy stage III was the main cause of death in 37.5% cases followed by acute respiratory failure with pneumothorax with 25% mortality in study of Manivannan et al.<sup>15</sup>

In our study out of total 11 mortalities in new borns with MAS, maximum mortality were noted in babies with birth weight between 2500-2999 g in 4 (36.36%) cases followed by babies with 3500-3999 g in 3 (27.27%) cases. Babies with birth weight between 1500-1999 g and 3000-3499 g had mortality rate of 2 (18.18%) in each group. There was significant association noted between mortality due to MAS and birth weight, as the p value was <0.05 (Table 7). Out of total 11 mortality, maximum frequency of mortality in MAS was noted in gestational age of 39-40 weeks i.e. 6 (54.54%) followed by in 34-36 weeks and 37-38 weeks of gestation, each had 2 (18.18%) mortality rate. Only one (9.09%) mortality was observed in >40 weeks of gestation and there was no mortality in <34 weeks of gestational age. There was no significant association noted between mortality and gestational age in MAS (Table 8).

## CONCLUSION

MAS is a common cause of respiratory distress in newborns, born through meconium stained amniotic fluid. The most common maternal risk factor observed in newborns with MAS was maternal diabetes mellitus followed by PIH, pre-eclampsia and placental insufficiency. Occurrence of MAS was commonly found in male babies and was found commonly in babies born via caesarean section. Majority of MAS cases seen in babies with 39-40 weeks gestational age and with birth weight range 2500-2999 g. Mortality was noted mainly in 39-40 weeks gestational age. There was no statistically significant association noted between gestational age and mortality in newborns with MAS. Mortality was commonly seen in babies with birth weight of 2500-2999 g. A significant association was found between mortality and birth weight in newborns with MAS (p value<0.05). In our study, out of 96 cases, 11 (11.4%) mortalities were

recorded and most common cause of mortality was birth asphyxia with septicaemia with acute kidney injury.

We noted that with judicious use of available modes of ventilation and adjunctive therapies, infants with even the most severe MAS can usually be supported through the disease, with an acceptable burden of short-and long-term morbidity. Hence proper and timely intervention can decrease mortality in MAS.

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