

Original Research Article

A study on clinical profile of meconium aspiration syndrome in relation to gestational age and birth weight and their immediate outcome

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ABSTRACT

Background: Aim of the study was to understand the factors causing meconium aspiration syndrome (MAS) in relation to gestational age and birth weight and their immediate outcome.

Methods: This study was done on babies admitted in the neonatal intensive care unit (NICU) of Thanjavur medical college hospital, who fulfilled the criteria of MAS. Babies born with meconium stained amniotic fluid (MSAF), were resuscitated as per NRP guidelines. The babies with complications of MAS were admitted to NICU and were observed for their immediate outcome in the hospital.

Results: MAS occurred most commonly in babies having fetal distress and in mothers with history of PIH. It is seen more commonly in babies born through caesarean section and in term babies with mean gestational age of 38-40 weeks of gestation and mean birth weight of 2.71 kg. Most babies were depressed at birth and most common cause of mortality was hypoxic ischemic encephalopathy (HIE stage III), significantly contributing 37.5% of cases of MAS. There was significant and strong association between the birth weight and mortality. Thick MSAF was significantly associated with need for mechanical ventilation and subsequently higher mortality. Babies born through caesarean section with MAS also had significantly poor outcome.

Conclusions: MAS is an entity which is commonly seen in term and post term babies with birth weight >2.5 kg. There is a significant correlation between the birth weight and outcome in MAS. When thick meconium stained liquor is noted prior to birth, anticipation is necessary and non vigorous babies need aggressive management and possibly early ventilation. Asphyxiated babies should be followed up astutely. Continuous monitoring and early intervention, followed by due resuscitation as per guidelines can reduce the morbidity, complications and the mortality in MAS. .

Keywords: Birth weight, Gestational age, Immediate outcome, Meconium aspiration syndrome

INTRODUCTION

Meconium aspiration syndrome (MAS) remains one of the most common causes of neonatal respiratory distress.¹

The overall frequency of Meconium stained amniotic fluid (MSAF) varies between 5% to 25%. MAS occurs in 10% of newborns born through MSAF. Also, newborns with MSAF are 100 times more likely to develop

respiratory distress compared to counterparts born with clear amniotic fluid. And approximately 30% to 50% of infants with MAS have severe MAS, defined as the need for mechanical ventilation.

Meconium staining of amniotic fluid has been considered to be a predictor of poor fetal outcome because of the deleterious effect on neonatal lungs.²

MSAF occurs with increasing frequency along with increase in gestational age of the fetus, the incidence being as high as 30% in post term pregnancy.³ Most babies with MSAF are 37 weeks or older.⁴ An increased incidence of MSAF is also due to hypoxia and infection, independent of fetal maturation.

Meconium passage is a developmentally programmed postnatal event because 98% of healthy newborns pass meconium in the first 24 to 48 hours after birth.⁵ Treatment of MAS is a challenge to neonatologists. Appropriate use of positive end expiratory pressure, surfactant therapy, recent advances like high frequency ventilation and inhaled nitric oxide have led to reduced incidence of adverse outcome and improved survival rate of newborns with MAS.

Various studies have described the various attributes and morbidity pattern of MAS.⁶ This study was undertaken to compare and assess the mortality and morbidity patterns associated with MAS in both intramural and extramural babies admitted to a tertiary care hospital.

METHODS

Design of the study was descriptive prospective study.

Study population

This study was done in newborns admitted to the neonatal intensive care unit (NICU) of Thanjavur Medical College Hospital during the period from Jan 2014 to August 2014. 94 consecutive patients who satisfied the following inclusion criteria were studied.

Inclusion criteria

The criteria used for diagnosing MAS were:

- Presence of meconium stained amniotic fluid
- Tachypnea, retractions, grunting or other abnormal signs on physical examination consistent with pulmonary disease (i.e. Onset of respiratory distress within 24 hours of life).
- Need for supplemental oxygen or ventilator support.
- A compatible chest radiograph (consistent with aspiration pneumonitis).

All preterm, term and post term newborns, irrespective of the birth weight and mode of delivery, fulfilling all the above criteria for MAS during the study period were included.

Exclusion criteria

- Newborns with transient tachypnea of newborn (TTN), hyaline membrane disease (HMD), congenital pneumonia, sepsis as initial diagnosis.
- MSAF babies without respiratory distress or findings on x ray.

Study protocol: Data regarding the patient was entered into preset proforma as regards to the antenatal history, type of delivery, indications for assisted delivery, interventions done. APGAR score was recorded. Consistency of the meconium was categorised into thin or thick. Gestational age scoring was done as per Ballards scoring system. Resuscitation measures were recorded and the babies were followed up in the NICU.

Endotracheal suctioning or bag and tube ventilation after endotracheal intubation were done for non vigorous babies, as per newborn resuscitation protocol (NRP). Decision of mode of oxygen to be administered were made by the DOWNE's score. Stomach wash was given to all babies. Inotropes as and when needed, were used.

All the babies were subjected to complete blood count, peripheral smear, serial chest X rays, arterial blood gas analysis, blood glucose, serum calcium, serum electrolytes. Sepsis workup like ESR, CRP, blood culture and sensitivity were done when indicated by the sepsis score.

Primary outcome

- Mortality

Secondary outcomes

- Need for mechanical ventilation
- Incidence of asphyxia
- Pneumothorax and other complications.
- Duration of hospital stay.

Statistical analysis

Data was analysed using SPSS version 16. Using this software, frequencies, percentages, means, standard deviations, chi square test, paired t test, unpaired t test correlation were applied. A 'p' value less than 0.05 is considered significant.

RESULTS

During the study period, out of 6200 deliveries, 947 babies had meconium stained liquor (15.2%) and 94 had MAS (9.92%). Total admissions in NICU during the study period was 1500, out of which 728 babies had respiratory distress.

Obstructed labour causing fetal distress (51.06%) was the commonest maternal factor associated with MAS, followed by pregnancy induced hypertension (PIH 21.27%), PROM (11.70%) and oligohydramnios (9.57%). 51.06% babies were born through caesarean section while 38.29% babies were born through normal vaginal delivery.² 2 babies required vacuum extraction and 8 required forceps delivery. There was thus a significant association with active obstetric interventions in MAS (p=0.003).

In the present study, majority of the cases of MAS occurred in term babies with mean gestational age of 38-40 weeks (46 babies 48.9%) followed by 40-42 weeks maturity (26 babies 27.6%). 6 were post term babies while 10(10.6%) were preterm babies between 34 to 36 weeks gestation. None of the cases of MAS occurred in less than 34 weeks of gestation.

The mean birth weight of the admitted babies was 2.68 kg. Maximum number of cases of MAS were seen in babies with birth weight between 2 to 2.4 kgs (n 28, 29.78%), followed by babies with birth weight between 2.5 to 2.9 kg (n 36, 38.29%). Babies with birth weight between 3 to 3.4 kg formed 19.14% of the cohort. 4 babies (4.25%) were between 1.5 to 1.9 kg while none of the babies were less than 1.5 kg.

There was no significant association between sexes (male babies n 49, 52.1% and female babies n 45, 47.9%).

The APGAR score at 1 minute was less than 3 indicating severe asphyxia in 25 babies (26.5%) while it was between 3 to 6 mild to moderate asphyxia in 56 cases (59.5%). 13 cases had APGAR more than 6.

The most common complication noted in the babies was hypoxic ischemic encephalopathy (HIE) (n=32, 34%) followed by acute respiratory failure (n=20, 21.2%). Septicemia was seen in 15.9% cases (n=15), pneumothorax in 6.4% (n=6), pulmonary hemorrhage in 4.3% cases (n=4) (Figure 1).

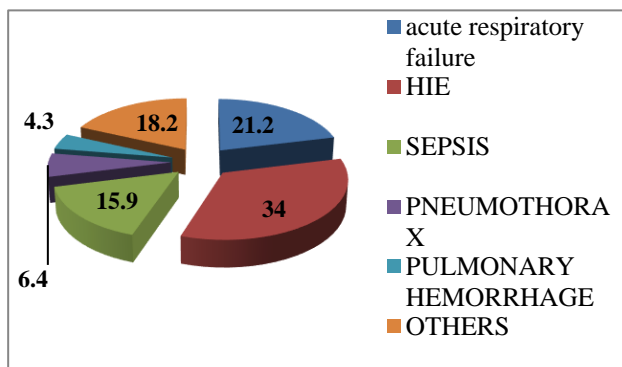


Figure 1: Complications in MAS (%).

The 24 babies with MAS died during the course of the study. The most common cause of mortality is HIE III constituting 37.5%, n=9 cases; acute respiratory failure with pneumothorax was the cause of death in 6 cases (25%) while pulmonary hemorrhage was the cause in 3 babies (12.5%). Septicemia was the cause of death in 3 babies. All these had significant correlation to both morbidity and mortality.

There was significant correlation between the birth weight and mortality ($p=0.007$). There was also significant correlation between the consistency of meconium and mortality, with thick MSAF babies having

higher mortality. But there was no correlation between mortality and other parameters viz sex, gestational maturity.

There were 28 of the total 94 cases needed ventilator support (29.8%) while 66 babies needed other modes of oxygen. Out of the 28 ventilated babies 4 were successfully weaned and were discharged. Thick MSAF had a significantly higher need for ventilation ($p<0.05$). Mechanical ventilation had a significant association with poor outcome ($p<0.05$).

DISCUSSION

Incidence of MAS in our study was 12.9% which is comparable to 10.55% in the study by Narang et al.⁷ In a study by Bhusan PK, et al, MAS occurred in 25% of all cases of MSAF.⁸ In a study by Bharati Rao et al, the incidence of MSAF was observed to be 8.54% of which MAS was found in 16.1% of cases.⁹

Of the maternal conditions associated, obstructed labour and resultant fetal distress is common in newborns who develop respiratory distress after MSAF.¹⁰ PIH was found in 23.58% cases in a study by Miller et al, and in 15.75% cases in a study by Pravin and Usha Krishna and in 11.20% by Fujikura et al. In the present study it was 21.27%.^{3,11,12} Incidence of PROM was found in 6.6% cases by Miller et al, and in the present study it was 11.7%.¹¹

National neonatal perinatal database of India says that variables showing significant association with presence of MSAF were small for gestation fetal growth status, PIH, eclampsia, PROM>24 hours, oligohydramnios, fetal bradycardia and fetal tachycardia. In a study done at BHU Varanasi, it was found that fetal distress during labour and Intra uterine growth restriction (IUGR) were significant risk factors associated with MAS. In another study by Hofmeyer GJ et al, it was found that the presence of thick meconium staining of the amniotic fluid is an indicator of oligohydramnios, as meconium passed into a normal volume of amniotic fluid will usually appear thin. In the present study, only 9.57% cases were associated with oligohydramnios (Table 1).

Caesarean section formed the highest percentage of deliveries in the present study (51.06%). In this regard, our study correlates well with Narang et al, which found 54.2% babies to be born by LSCS, 30.7% by normal vaginal delivery and 11.8% by forceps delivery. Bhusan et al showed higher incidence of caesarean section of 80%.⁸ A cross sectional study in Jordan found that caesarean section was significantly higher in babies who developed MAS than in those who did not (57.9% vs 24.3%).¹⁵ Babies delivered by caesarean section with MAS had significantly higher mortality compared to the babies with clear liquor (Table 2).

Table 1: Attributes in meconium aspiration syndrome.

Characteristics	N=94	%
Sex		
Male	49	52.1
Female	45	47.9
Birth weight		
1.5-1.9	4	4.25
2-2.4	28	29.78
2.5-2.9	36	38.29
3-3.4	18	19.14
3.5-3.9	5	5.31
>4	3	3.19
Maternal factors		
Fetal distress	48	51.06
PIH	20	21.27
PROM	11	11.7
Oligohydramnios	9	9.57
Mode of delivery		
Caesarean	48	51.06
Normal vaginal	36	38.29
Vacuum extraction	2	2.12
Forceps	8	8.51
Gestational age		
<34 weeks	0	0
34-36	10	10.6
36-38	6	6.3
38-40	46	48.9
40-42	26	27.6
>42	6	6.3
Apgar score 1 min		
0-3	25	26.5
4-6	56	59.5
>6	13	13.8
Mode of treatment		Death (%)
Conservative	66	70.2 0(0)
Mechanical ventilated	28	29.8 24(85.71) p<0.05

The mean gestational age in the present study was between 38 to 40 weeks. Eiden et al, found the frequency of meconium stained amniotic fluid increased with increasing gestational age of fetus. i.e., 7% before 38 weeks; 78% between 38 to 42 weeks and 35% or more in pregnancies lasting longer than 42 weeks.¹⁶ In a study done by Suresh GK et al, the mean gestational age was 38.41±2.31 weeks in babies born with thick meconium and 37.8±2.27 weeks in babies born with thin meconium stained liquor.¹⁷

In the present study the mean birth weight was 2.71 kg. There was also significant correlation between the birth weight and mortality (p=0.007). The national neonatal perinatal database of India quotes the mean birth weight of babies born through MSAF as 2646±552 gm. Bharati rao et al, found out birth weight of MSAF babies to be in

the range of 1600-3800 gms, with mean birth weight of 2.516kg.⁹

Table 2: Mortality attributes in MAS (24 deaths).

Characteristic	N=24	%	p value (LR#)
Complication			
Isolated HIE	9	37.5	
Isolated acute resp failure	3	12.5	
Resp failure with pneumothorax	6	25	0.000(0.000)
Pulmonary hemorrhage	3	12.5	
Septicemia	3	12.5	
Mode of delivery			
Caesarean	17	70.8	0.003(0.002)
Normal vaginal	5	20.8	
Forceps	0	0	
Vacuum extraction	2	8.3	
SEX			
Male	14	58.3	0.682
Female	10	41.7	
Birth weight			
1.5 to 2.49	3	28.6	
>2.5kg	21	71.4	0.007
Gestational age			
<36 weeks	2	8.3	
>36 weeks	22	91.7	1.000
Meconium consistency			
Thin	5	20.8	
thick	19	79.2	0.000(0.000)

#-Likelihood ratio

In the present study, APGAR score at 1 minute <3 is found in 26.5% cases with HIE III, While 59.5% cases had mild to moderate birth asphyxia as evidenced by APGAR between 4 to 6. Abramovici et al found that APGAR at 1 minute was <7 in only 7.5% cases and Miller et al found that APGAR at 1 minute was <7 in 25.4% cases.¹¹ Higher incidence of depressed babies in our study could be due to inclusion of extramural babies in our study and hence reflecting delayed delivery and interventions (Table 3).

There were 34% babies in the present study who developed HIE III, followed by 21.2% who developed acute respiratory failure, 15.9% septicemia and 6.4% airleak syndrome (Figure 1). Narang et al, in comparison had 53.8% birth asphyxia, 15.8% airleak and 3.8% PPHN.⁷ Wiswelli et al, found that 11.53% babies developed pneumothorax.¹⁸

In this study, 29.8% babies required ventilator support comparable to 29.7% in Wiswell et al.¹⁸ While Rossi et al, found 44% babies born with MAS required

mechanical ventilation. Thick MSAF babies had significantly higher need for ventilation in our study. Ventilated babies had high mortality, as expected in severe MAS (Table 1).

Table 3: Current findings on MAS compared with findings in previous reports.

Characteristic	Findings in our study*	Range (median value) in previous studies*
Deliveries with MSAF	15.2	6.8-22(25)
MSAF Developed MAS	9.92	0.37-62(56)
MORTALITY IN MAS	25.53	0-46(12)
MAS requiring ventilation	29.8	0-59(33)
Neonates with MAS and pneumothorax	6.4	0-41(23.8)
Meconium stained neonates depressed at birth (APGAR <6 AT 1 MIN)	86	21-53(33)

*Values are in percentages

HIE III was the main cause of death in 37.5% cases followed by acute respiratory failure with pneumothorax with 25% mortality (Table 2). The mortality rate from MAS is difficult to compare since quoted figures vary widely. Benney et al, reported 16.1% mortality rate in their study whereas Davis et al reported 12 deaths in 30 newborns. i.e. 40% mortality rate.²⁰ This study found significant association between mortality and the complications in MAS like asphyxia/HIE III. Mortality was also high significantly among thick MSAF babies in our study. Hence, colour and consistency of the liquor can be taken as an indicator of prolonged asphyxia and active resuscitation in the form of laryngeal suctioning may be carried out as per guidelines for such non vigorous babies.

Increased incidence of MAS was associated with:

- Increase in the gestational age
- Birth weight more than 2.5 kg
- Caesarean delivery

MAS carries a high mortality and morbidity. Highest mortality was associated with thick meconium when it was present below the vocal cords leading to non vigorous baby and poor APGAR score at 1 minute. Nearly half the cases with MAS had moderate birth asphyxia. This indicates that passage of meconium can occur in utero, often considered a feature of stressed fetus and undoubtedly aspiration can occur before delivery. In such babies, resuscitation at birth may not be much beneficial and invariably leads to severe MAS. Severe the

asphyxia, higher are the chances of thick meconium stained amniotic fluid and greater probability of MAS. Current international guidelines do not recommend intrapartum or postpartum endotracheal suctioning of vigorous infants born through MSAF, while suggesting expectant management.²¹ Continuous intrapartum monitoring and early obstetric intervention, anticipation by the attending paediatrician in thick MSAF cases, followed by due neonatal resuscitation as per guidelines can reduce the morbidity, complications and the mortality.

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