

To Study the Clinical Profile of Meconium Aspiration Syndrome (MAS) in Neonates in Relation to Birth Weight, Gestational Age and Their Immediate Outcome

Dr. B.Koteshwar¹, Dr. D.Chandraiah^{2*}, Dr. N.Sindhuri³

¹Associate Professor of Pediatrics, Niloufer hospital, OMC, Hyderabad, Telangana, India

²Associate Professor of Pediatrics, Govt. Medical College, Nizamabad, Telangana, India

³Senior Resident in Pediatrics, Nizamabad, Telangana, India

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***Corresponding author**

Dr. D.Chandraiah

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Abstract: Study the clinical profile of meconium aspiration syndrome (MAS) in neonates, in relation to birth weight, gestational age and their immediate outcome. Prospective observational cross sectional study. All preterm, term and post term infants, appropriate for gestational age with birth weight, delivered normally or by caesarean section or forceps, fulfilling all the inclusion criteria for MAS who were admitted to NICU, during the 9 months from July 2017 to March 2018 were included in the study. Over nine months' period, 574 neonates were admitted in NICU under that 312 neonates were in respiratory distress, out of which 78 neonates were suffered with MAS. A detailed antenatal and natal history was elicited. Complications during delivery and details of resuscitation at birth, was done wherever required. Endotracheal intubation was done and bag and tube ventilation was given wherever needed. In MAS neonates, APGAR score at 1 minute and 5 minutes and gestational age was assessed with New Ballard's score. A detailed clinical examination was carried out and respiratory distress was monitored by using Downes score system. Score > 6 was taken as an indication for assisted ventilation. 574 babies were admitted to NICU during the study period and out of them 312 were with respiratory distress. During the study period 78 (25%) babies had MAS. Conservative management was given to 59 cases (75.64%) and only 19 cases (24.36%) needed artificial ventilation, where indication was birth asphyxia, acute respiratory failure or other complications like pneumothorax. Out of 19 ventilated babies, 15 babies died and 4 babies survived and were discharged in good health. Conclusions: 1. Increased incidence of meconium aspiration syndrome was associated with increase in the gestational age (more in term and post term neonate, birth weight > 2.5kgs, 2. Highest mortality was associated with thick meconium and with low APGAR score at 5 minutes.

Keywords: MAS, APGAR score, NewBallard's score, Downes score.

INTRODUCTION

The first intestinal discharge from newborns is meconium, which is a viscous, dark-green substance composed of intestinal epithelial cells, lanugo, mucus, and intestinal secretions (eg. bile). Intestinal secretions, mucosal cells, and solid elements of swallowed amniotic fluid are the 3 major solid constituents of meconium. Water is the major liquid constituent, comprising 85-95% of meconium. Intrauterine distress can cause passage into the amniotic fluid. Factors that promote the passage in utero include placental insufficiency, maternal hypertension, preeclampsia, oligo-hydramnios, and maternal drug abuse, especially of tobacco and cocaine.

Meconium directly alters the amniotic fluid by reducing the antibacterial activity and subsequently

increasing the risk of perinatal bacterial infection and meconium irritates fetal skin, thus increasing the incidence of erythema toxicum. The most severe complication of meconium passage in utero is aspiration of stained amniotic fluid before, during, and after birth. Aspiration induces hypoxia via four major pulmonary effects: airway obstruction, surfactant dysfunction, chemical pneumonitis, and pulmonary hypertension. Children with meconium aspiration syndrome (MAS) may develop chronic lung disease from intense pulmonary intervention.

In the United States [1] a large retrospective analysis demonstrated that overall mortality rate for meconium aspiration syndrome to be 1.2%. The mortality rate for meconium aspiration syndrome resulting from severe parenchymal pulmonary disease

and pulmonary hypertension is as high as 20%. Other complications include air block syndromes (eg, pneumothorax, pneumomediastinum, pneumopericardium) and pulmonary interstitial emphysema occurs in 10-30% of infants with meconium aspiration syndrome. The neurologic disabilities of survivors are due to the aspiration of meconium, including chronic hypoxia and acidosis [2].

Meconium aspiration syndrome (MAS) remains one of the most common causes of neonatal respiratory distress. The overall frequency of Meconium Stained Amniotic Fluid (MSAF) varies between 5% and 25%. Meconium aspiration syndrome occurs in 10% of infants born through MSAF. Infants born through MSAF are 100 times more likely to develop respiratory distress compared to other counterparts born through clear amniotic fluid. Meconium staining of amniotic fluid has been considered to be a predictor of poor fetal outcome, because it's direct correlation to fetal distress and increased likelihood of inhalation of meconium with resultant deleterious effect on neonatal lungs. Meconium stained amniotic fluid occurs in 9% to 22% of live births with increasing frequency along with increase in gestational age of fetus.

Meconium passage is a developmentally programmed post natal event because 98% of healthy newborn pass meconium in first 24 to 48 hours after birth. MSAF commonly occur in post term pregnancies and is relatively rare in preterm deliveries. 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, and use of inhaled nitric oxide has led to reduced incidence of adverse outcome and improved survival rate of infants with MAS.

Aim of the study

Study the clinical profile of meconium aspiration syndrome (MAS) in neonates, in relation to birth weight, gestational age and their immediate outcome.

MATERIALS AND METHODS

This study was carried out in Neonatal Intensive Care Unit (NICU), Department of Pediatrics at Government Medical College, Nizamabad and Government General Hospital, Nizamabad, Telangana State. The total number of babies admitted to NICU during the study period was 574 and out of them 312 cases were with respiratory distress and admitted to NICU during the study period of 9 months from July 2017 to March 2018. In these babies 78 (25%) babies had MAS.

The criteria used for diagnosing meconium aspiration syndrome were:

- Presence of meconium stained amniotic fluid with 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 (Abnormal chest roentgenograms consistent with aspiration pneumonitis).

Inclusion criteria

All preterm, term and post term infants, appropriate for gestational age and birth weight, delivered normally or by caesarean section or forceps, fulfilling all the above criteria for MAS who were admitted to NICU, during the above mentioned period were included in the study.

Exclusion criteria

The newborns with TTNB, HMD, congenital pneumonia, sepsis, newborns with meconium stained amniotic fluid but without any respiratory distress or chest X-ray findings not consistent with aspiration pneumonitis were excluded from the study.

A detailed antenatal and natal history was elicited to find out the etiology of passage of meconium into the amniotic fluid and also find out the type of delivery and indications for any interventions or drugs used during the delivery were obtained. Postnatal history was recorded with APGAR score, birth asphyxia, cyanosis or any other complications and details of resuscitation measures done at birth and resuscitative measures taken like suctioning of the oropharynx by obstetrician after delivery of head and suctioning of trachea under direct vision using laryngoscope was done by pediatrician until no meconium could be recovered from trachea wherever required, endotracheal intubation was done and bag and tube ventilation was given. If baby was vigorous at birth, only oro-tracheal suctioning was done. Stomach wash was given to prevent further vomiting and aspiration of meconium stained fluid from the stomach. In meconium stained neonates, APGAR score at 1 minute and 5 minutes were assessed and gestational age assessment was done with NewBallard's score. A detailed clinical examination was carried out and respiratory distress was monitored by using Downes score system. Score > 6 was taken as indication for assisted ventilation.

All those newborn who were diagnosed as meconium aspiration syndrome with respiratory distress were admitted and treated in NICU with oxygen, intravenous fluids, antibiotics, inotropic support and ventilator support was given as and when required.

In all cases of MAS, routine investigations like complete blood counts (Hb, TLC, DLC, platelets, PCV and peripheral smear) were done. Septic work up with ESR, CRP and blood culture was done when indicated radiological assessment was undertaken with serial X-rays as directed by the condition. Transient metabolic disturbances with blood glucose, serum calcium, electrolytes and arterial blood gases (ABG) were done and interpreted when required.

RESULTS AND OBSERVATIONS

This study was carried out in Neonatal Intensive Care Unit (NICU), Department of Pediatrics at Government Medical College, Nizamabad and Government General Hospital, Nizamabad, Telangana State. The total number of babies admitted to NICU during the study period was 574 and out of them 312 were with respiratory distress. All 312 cases of respiratory distress were admitted to NICU during the study period of 9 months from July 2017 to March 2018, 78 (25%) babies had MAS.

Table-1: Maternal Factors associated with MAS

Maternal Data	Number of cases	Percentage
Fetal Distress	42	53.84
PIH	16	20.52
PROM	02	02.56
Oligohydrmnios	06	07.69
Others	12	15.38
Total	78	100.00

In our study, fetal distress is the leading cause of MAS followed by PIH.

Table-2: Mode of Delivery

Mode of Delivery	Number of cases	Percentage
Caesarean Section	37	47.44
Normal Delivery	30	38.46
Vacuum Extraction	03	03.85
Forceps Delivery	08	10.25
Total	78	100.00

In this study, MAS was commonly associated with Caesarean Sections followed by normal delivery

Table-3: MAS with gestational age

Gestational Age (in Weeks)	Number of Cases	Percentage
< 34	01	01.28
34-36	09	11.54
36-38	06	07.69
38-40	38	48.71
40-42	18	23.07
>42	06	07.69
Total	78	100.00

Most common age group where we encountered MAS in our study is 38 to 40 weeks.

Table-4: Birth weight and MAS

Birth weight (in Kgs)	Number of Cases	Percentage
1.5 to 1.9	04	05.13
2.0 to 2.4	24	30.77
2.5 to 2.9	34	43.59
3.0 to 3.4	13	16.66
3.5 to 4	02	02.57
>4	01	01.28
Total	78	100.00

According to our study, MAS was common in term babies between 2.5 kg and 2.9kg.

Table-5: Sex Distribution

Sex	Number of Cases	Percentage
Male	42	53.85
Female	36	46.15
Total	78	100

Table-6: Meconium Aspiration Syndrome and APGAR score at 1 Minute

APGAR score at 1 minute	Number of Cases	Percentage
0 to 3	27	34.62
4 to 6	39	50.00
7 to 10	12	15.38
TOTAL	78	100

MAS was commonly observed in babies with APGAR score between 4 and 6 followed by 0 to 3

APGAR score babies and least in babies with APGAR score more than 6.

Table-7: Complications in MAS

Complications	No of Cases	Percentage
ARF (Acute Renal Failure)	17	21.80
BA	35	44.87
Septicemia	14	17.95
Pneumothorax	05	06.41
Pulmonary Hemorrhage	04	05.12
Pneumonia	03	03.85
Total	78	100.00

Table-8: Mortality in MAS

Complications	No of cases	Percentage
Isolated Birth Asphyxia	09	33.33
Isolated ARF	05	18.52
ARF with Pneumothorax	04	14.82
ARF with Pulmonary hemorrhage & Septicemia	03	11.11
Birth Asphyxia with ARF & Septicemia	06	22.22
TOTAL	27	100

Table-9: Mode of Treatment

Treatment	No of cases	Percentage
Conservative Treatment	59	75.64
Ventilatory Support	19	24.36
TOTAL	78	100

In our study, conservative management was given with oxygen, restricted fluids, antibiotics, Vitamin K, calcium for 59 cases(75.64%) and only 19 cases (25.36%) needed ventilator support, where indication was birth asphyxia, acute respiratory failure or other complications like pneumothorax. Out of 19 ventilated babies, 15 babies died and 4 babies survived and were discharged in good health.

DISCUSSION

The total number of babies admitted to NICU during the study period was 574 and out of which 312 were suffered with respiratory distress. All respiratory distress cases were admitted to NICU during the study period of 9months from August 2017 to March 2018, 78 (25%) babies had MAS.

The incidence of MAS in our study is 25% which is in correlation with the various Indian and international studies. In a prospective study conducted in 2015 by Gayatri Bezboruah *et al.* [3] in which 119 newborn babies who met the inclusion criteria were studied over a period of 12 months. Males are affected more (63%). Our study correlates with other study conducted in hospital in the city of São Paulo, Southeastern Brazil, in March and April, 2005, Meconium-stained amniotic fluid was verified in 11.9% of the births [4]. In the study conducted by K. Supriya *et al.* [5] in the year 2014 Narang *et al.*[6] found that the incidence of MAS was 10.55%. In a study done at Banaras Hindu University, Varanasi incidence of MSAF was 14.3% of all the deliveries [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 MAS was found in 16.1% of cases [9].

Meconium and other Associated Conditions

A prospective study was undertaken by Coughtrey H *et al.* [10], who concluded that fetal distress is common in infants who develop respiratory distress after MSAF. PIH was found in 20.52% cases in a study by Miller *et al.* and in 15.75% cases in a study by Pravin and Usha Krishna [11] and in 11.20% by Fujikura [12]. In our present study incidence of PROM was 2.56%. In Miller *et al.* [13] 6.60% cases were PROM. In a study conducted by Trimmer *et al.* noted that meconium passed in 38% of post dated pregnancy with oligohydramnios. In a study at BHU, Varanasi it was found that fetal distress during labour and IUGR were significant risk factors associated with MAS. In another study by Hofmeyer GJ, *et al.* [14] it was found that the presence of thick meconium staining of the amniotic fluid present in 8.38% is an indication of oligohydramnios. In the present study only 7.69% cases were associated with oligohydramnios.

Mode of delivery and MAS

In the present study, babies with MAS born by LSCS formed the highest percentage (47.44%) followed by babies born by normal vaginal delivery (38.46%) and (10.25%) by forceps delivery. These values are almost in correlation with figures of other authors Narang *et al.* found 54.2% babies were born by LSCS and 30.7% were delivered by normal vaginal delivery and 11.8% by forceps delivery. In a study by Bhusan PK *et al.* higher incidence of meconium aspiration was associated with caesarean section (80%) in comparison to vaginal delivery (20%). A cross-sectional study at one hospital in Jordan, it was found that there was significantly higher in babies who developed MAS are born by caesarean section than in those who did not (57.9% Vs 24.3%)[15].

Incidence of MAS with gestational age

In present study mean gestational age was found to be 38-40 weeks. Erkkola *et al.* [16] found that 95% of cases were > 36 weeks gestation in their study. Green and Paul[17] say that prevalence of MAS increases to 10% or more after 38 weeks. In a study by Eiden *et al.* [18] found the frequency of meconium stained amniotic fluid increased with increasing gestational age of fetus i.e., 7% before 38 weeks; 78% between 38-42 weeks and 35% or more in pregnancies lasting longer than 42 weeks. In a study done by Suresh GK *et al.* [19]; the mean gestational age was 38.41 ± 2.31 weeks in babies born with thick meconium stained liquor and 37.80 + 2.27 weeks in babies born with thin meconium stained liquor. In a study by Balcin I *et al.* [20], it was found that the rate of meconium stained amniotic fluid increases with advancing gestational age. In National Neonatal Perinatal Database of India 2002-2003, the mean gestational age of babies born through MSAF was 39 weeks.

MAS and birth weight

In the present study mean birth weight was 2.570kg ranging from 1.7 to 4.1kg. According to a study by Pravid Goud and Usha Krishna majority of babies were weighed 2.5kg – 3kg and 4.2% of babies weighed >3.5kgs⁹. In National Neonatal Perinatal Database of India 2002-2003, the mean birth weight of babies born through MSAF was 2646 ± 552 gm. In our study the mean birth weight who are suffered with thick meconium are 2.570, in a study by Suresh GK *et al.* [27], the mean birth weight was 2685 + 536 gm in thick meconium stained liquor babies and 2669 + 637 gm in thin meconium stained liquor babies. In a study by Bharati Rao *et al.* the birth weight of babies with and clear liquor up to 38 weeks of gestation but there is a pneumothorax. In National Neonatal Perinatal MSAF were in the range of 1600-3800 gms, with mean birth weight of 2.516 gm.

Assessment of Respiratory Distress in MAS

In the present study with 78 babies, majority of them had moderate respiratory distress; assessed by Downes score (between 4 and 6) at admission. One baby had Downes score > 6 at admission and other babies who were ventilated developed progressive respiratory distress with maximum Downe's score of 8. A cohort study conducted in Hong Kong between 1996 and 1999, it was found that there was no evidence of difference in incidence of fetal distress between all MSL Database of India 2002-2003; perinatal asphyxia was single most common cause of death (40.5%) in babies born through MSAF with overall mortality of 11.6%.

Mode of treatment and MAS

In our study 75.64% cases were treated conservatively whereas 24.36 % cases needed ventilatory support. In a study by Wiswell TE *et al.* [21] it was found that of the neonates with MAS, 29.7 % required mechanical ventilation. In a study by Rossi EM *et al.* [22], out of 16 infants with meconium aspiration syndrome who were delivered through thick meconium, seven (44%) required mechanical ventilation. In our study, birth asphyxia was the main cause of death in 33% cases. Followed by birth Asphyxia with ARF & Septicemia (22.22%), isolated ARF (18.52%), ARF with pneumothorax in 14.82% of cases and then by ARF with birth asphyxia with pulmonary hemorrhage. According to Gayatri Bezboruah *et al.* 40 (43.96%) cases had severe MAS needed mechanical ventilation. Out of 40 babies who needed mechanical ventilation 35 babies (87.5%) expired. Overall mortality was 38.46%. In the study by Supriya *et al.* Neonatal morbidity due to MAS was seen in 13(26%) cases and mortality was seen in 20 (40%) cases. Death has occurred in 4.9-37% infants with MAS. Narang *et al.* found that 53.8% cases of MAS had birth asphyxia and 15.8% had air leak and 3.8% had PPHN. Wiswell TE *et al.* found that majority of babies with MAS died from acute respiratory failure,

PPHN and air leaks but some will die from associated neurological or renal sequelae of birth asphyxia. The mortality rate from MAS is more difficult to assess since quoted figures vary widely. Benney *et al.* reported 6.1% mortality rate in their study whereas Davis *et al.* [23] reported 12 deaths in 30 infants i.e. 40% mortality rate. Meconium aspiration can cause lethal respiratory failure in term infants. Recent large trials have demonstrated that the interventions to prevent meconium aspiration syndrome (MAS) intra-amniotic saline infusions prior to delivery, airway suction on the perineum at delivery, or intubation and tracheal suction of vigorous infants do not prevent MAS. If MAS occurs, more gentle approaches are needed and avoiding hyperoxygenation or hyperventilation may decrease serious cases. Postnatal surfactant, inhaled nitric oxide, and high frequency oscillatory ventilation with severe MAS have decreased the need for extracorporeal membrane oxygenation (ECMO) and mortality. Meconium aspiration often occurs prior to delivery and may be primarily an indicator of asphyxia and fetal distress. But, particulate meconium can obstruct airways and meconium can cause an inflammatory pneumonitis. Outcomes are now quite good when MAS is managed conservatively with as little intervention as possible.

CONCLUSIONS

- Meconium Aspiration Syndrome (MAS) is one of the common causes of respiratory distress in the newborn.
- Increased incidence of meconium aspiration syndrome was associated with.
 - Increase in the gestational age
 - Birth weight > 2.5kgs
- MAS mortality was associated with thick meconium when it was present below the vocal cords and low APGAR score (<3) at 5 minutes.

RECOMMENDATIONS

Timely diagnosis and appropriate intervention and management can reduce the mortality and morbidity. 2. Downes score closely relates to the severity of MAS (between 4-8). Hence Downes score holds very important.

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