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Original Research Article

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

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ABSTRACT

Background: Meconium staining of the amniotic fluid occurs in approximately 13% of live births; this percentage increases with increasing gestational age at delivery. MAS occurs in approximately 5% of infants born through MSAF. This study was undertaken to understand the factors causing MAS and clinical profile of meconium aspiration syndrome in relation to gestational age and birth weight and their immediate outcome.
Methods: The present study is a prospective study of 58 neonates admitted to NICU fulfilling the criteria of MAS were included in the study over a period of 2 years. The babies who were born with meconium stained liquor, suctioning was done by the obstetricians first at the delivery of shoulder and then handed over to pediatrician and depending upon whether the meconium is present below the vocal cords or not and whether baby is vigorous or not, endotracheal intubation and bag and tube ventilation was given. The babies with clinical features MAS were admitted to NICU and were observed for their immediate outcome in the hospital.
Results: During the study period, out of 4994 deliveries, 882 (17.6%) babies had meconium stained liquor and out of these 882 babies, 58 (6.5%) babies had MAS. Out of 426 cases of respiratory distress admitted to NICU, 58 (13.6%) cases diagnosed of MAS. 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 2.68 Kg. It was most commonly associated with babies who were depressed at birth and most common cause of mortality was due to birth asphyxia contributing 37.5% of cases of MAS.
Conclusions: MAS is an entity which is commonly seen in term and post term babies with birth weight >2.5 Kg.

Keywords: Birth weight, Gestational age, Meconium aspiration syndrome

INTRODUCTION

Meconium aspiration syndrome remains one of the most common causes of neonatal respiratory distress.[1] The overall frequency of MSAF varies between 5% to 25%.

Meconium aspiration syndrome occurs in 5% of infants born through MSAF. Infants born through MSAF are 100 times more likely to develop respiratory distress compared to the counter parts born through clear amniotic fluid.

Meconium staining of amniotic fluid has been considered to be a predictor of poor fetal outcome because of its direct correlation to fetal distress and increased likelihood of inhalation of meconium with resultant deleterious effect on neonatal lungs.[2] Meconium stained amniotic fluid occurs in 9% to 22% of live births with increasing frequency along with increase in gestational age of fetus.[3]

In utero, meconium passage rarely occur before 32 weeks of gestation and most babies with meconium stained amniotic fluid are 37 weeks or older5. The incidence of MSAF increases with gestational age reaching as high as 30% in post term pregnancy. An increase incidence of MSAF is noted in presence of feto - maternal stress factors such as hypoxia and infection, independent of fetal maturation.

Meconium passage is a developmentally programmed post natal event because 98% of healthy newborn pass meconium in first 24 to48 hours after birth.[4] G reater 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.[5] MAS remains challenging condition confronting neonatologists.

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, and use of inhaled nitric oxide has led to reduced incidence of adverse outcome and improved survival rate of infants with MAS.

The present study was undertaken to review the clinical profile of meconium aspiration syndrome (MAS) in neonates in relation to birth weight and gestational age and their immediate outcome.

METHODS

This study was carried out in Neonatal Intensive Care Unit at Narayana General Hospital attached to Pediatric Department of Narayana Medical College, Nellore, Andhra Pradesh. The study included the clinical profile of consecutive 58 cases of meconium aspiration syndrome admitted to the above center during the period of 2 years from December 2013 to October 2015.

The criteria used for diagnosing meconium aspiration syndrome 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 (Abnormal chest roentgenograms consistent with aspiration pneumonitis).

Study population consisted of 58 newborns, with meconium staining and who developed meconium aspiration syndrome (MAS) and respiratory distress. It is a heterogeneous population. The cases were taken from Neonatal Intensive Care Unit at Narayana General hospital, Nellore.

Selection of cases and methods

All preterm, term and post term infants, appropriate for gestational age and birth weight, delivered normally or by caesarean section or forceps in Narayana General Hospital fulfilling ≥3 of the above criteria for MAS who were admitted to NICU during the above-mentioned period were included in the study.

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, babies delivered and brought from outside hospitals were excluded from the study.

A detailed antenatal history was elicited to find out the etiology of passage of meconium into the amniotic fluid. Natal history was taken to find out the type of delivery and indications for any interventions or drugs used for delivery were obtained.

Table 1: APGAR scoring system.

Criteria	0	1	2
Respiration	Absent	Slow gasping	Crying
Heart rate/min	Absent	<100	>100
Muscle tone	Flaccid	Some flexion	Fully flexed
Reflex response	Nil	Grimace	Cough, sneeze, cry
Color	Pale or blue	Peripheral cyanosis	Pink

All the deliveries were attended by the pediatricians. During delivery, the type of delivery and any complications in the mother were recorded and resuscitative measures done were suctioning of the oropharynx by obstetrician after delivery of head and suctioning of trachea under direct vision using endotracheal tube was done by pediatrician until no meconium could be recovered from trachea.

When required, endotracheal intubation was done and bag and tube ventilation was given. If baby was vigorous at birth, only orotracheal suctioning was done.

Stomach wash was given to prevent further vomiting and aspiration of meconium stained fluid from stomach. In all

meconium stained infants, APGAR score at 1 minute and 5 minutes was assessed and gestational age assessment was done with Ballard's score (Table 1, Table 2, Figure 1).

Table 2: New Ballard scoring system for assessment of gestational age.

Sign	Score							Sign score
	-1	0	1	2	3	4	5	
Skin	Sticky, friable, transparent	Gelatinous, red, translucent	Smooth pink, visible veins	Superficial peeling and/or rash, few veins	Cracking, pale areas, rare veins	Parchment, deep cracking, no vessels	Leathery, cracked, wrinkled	
Lanugo	None	Sparse	Abundant	Thinning	Bald areas	Mostly bald		
Plantar Surface	Heel-toe 40-50mm: -1 <40mm: -2	>50 mm No crease	Faint red marks	Anterior Transverse crease only	Creases ant. 2/3	Creases over entire sole		
Breast	Imperceptable	Barely perceptable	Flat areola No bud	Stippled areola 1-2 mm bud	Raised areola 3-4 mm bud	Full areola 5-10 mm bud		
Eye/ear	Lids fused Loosely: -1 Tightly: -2	Lids open Pinna flat Stays folded	sl. curved pinna; soft; slow recoil	Well-curved pinna; soft but ready recoil	Formed and firm Instant recoil	Thick cartilage Ear stiff		
Genitals (Male)	Scrotum flat, smooth	Scrotum empty, Faint rugae	Testes in upper canal, Rare rugae	Testes descending, Few rugae	Testes down, Good rugae	Testes pendulous, Deep rugae		
Genitals (Female)	Clitoris Prominent and labia flat	Prominent Clitoris and small labia minora	Prominent Clitoris and enlarging minora	Majora and minora equally prominent	Majora large, Minora small	Majora cover clitoris and minora		
TOTAL PHYSICAL MATURITY SCORE								

Table 3: Maturity rating.

Score	Weeks
- 10	20
-5	22
0	24
5	26
10	28
15	30
20	32
25	34
30	36
35	38
40	40
45	42
50	44

Table 4: Downes Score system.

Score	0	1	2
Respiratory rate	<60	60-80	>80
Cyanosis	None in room air	No cyanosis in 40% O_2	Requiring >40% ambient air
Retraction	None	Mild	Moderate to severe
Grunting	None	Audible with stethoscope	Audible without stethoscope
Air entry	Good	Decreased	Barely audible

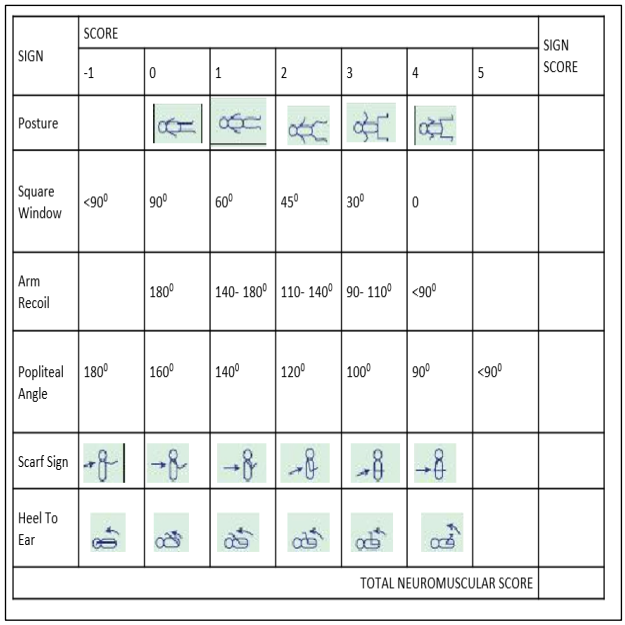

Figure 1: Ballard scoring system.

A detailed clinical examination was carried out and respiratory distress was monitored using Downes score system (Table 4). If the score >6 it was an indication for ventilation.

All infants with the diagnosis of meconium aspiration syndrome were admitted and treated in NICU with oxygen, restricted intravenous fluids, antibiotics, ionotropic support and ventilator support as and when required.

In all cases of MAS, routine investigations like complet e blood counts (Hb, TLC, DLC, platelets, PCV and peripheral smear) were done. Septic work up with ESR, CRP and blood culture were 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

The study was conducted over a period of 2 years from December 2013 to October 2015. During the study period of 2 years, out of 4994 deliveries done in Narayana General Hospital, 882 (17.6%) babies had meconium stained liquor and out of which 58 had MAS (6.5%).

Table 5: Mode of delivery.

Mode of delivery	No. of cases	%
Ceserean section	24	41.3
Normal delivery	20	34.48
Vacuum extraction	04	6.89
Forceps delivery	10	17.24

The total number of babies admitted to NICU, Narayana General Hospital during the study period was 992 and out of them total number of cases with respiratory distress were 426.

Out of 426 cases of respiratory distress admitted to NICU, Narayana General Hospital during the study period of 2 years, 58 (13.61%) babies had MAS.

In our study, babies with MAS born by caesarean formed the highest percentage (n=12, 41.3%) of cases followed by babies born by normal vaginal delivery (n=10,34.48%). Babies born by outlet forceps delivery were (n=5,17.24%) and by vacuum extraction were (n=2,6.89%).

Table 6: Maternal factors associated with MAS.

Maternal factors	No. of cases	%
Fetal distress	30	52
PIH	12	21
PROM	06	10
Oligohydraminios	06	10
Others	04	07

In present study, fetal distress was found to be the commonest (n=30, 51.72%) factor associated with MAS followed by PIH (n=16, 20.68%), PROM (n=6,10.34%) and oligohydraminios (n=6, 10.34%). Four cases (6.89%) were not associated with any factor.

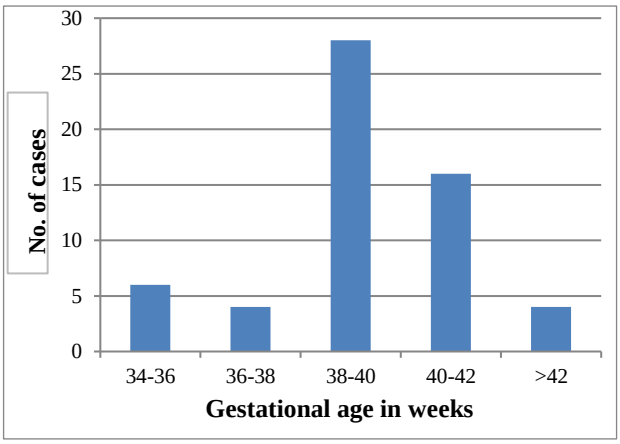

Figure 2: MAS with gestational age.

In the present study; majority of the cases of MAS occurred in term babies with mean gestational age of 38-40 weeks. 28 (48.27%) babies belonged to 38-40 weeks of gestation and 16 (27.28%) babies were of 40-42 weeks of gestation. 4 (6.89%) 4 cases occurred in babies >42 weeks of gestation. MAS was also seen in preterm babies. 6 (10.34%) cases were of 34-36 weeks of gestation and 4 (6.89%) belonged to 36-38 weeks of gestation. None of the cases were below 34 weeks of gestation.

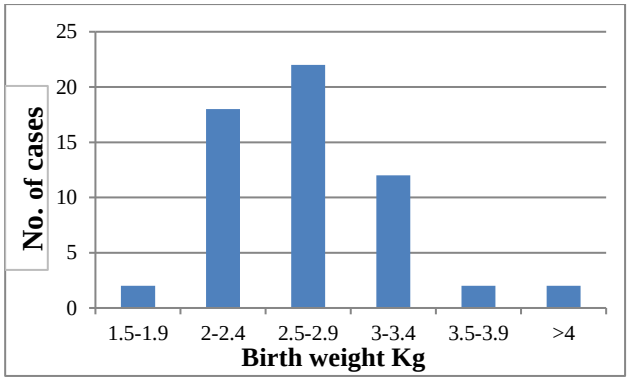

Figure 3: Birth weight and MAS.

The mean birth weight of babies with MAS was 2.68 kg (1.7- 4 kgs). In our study, maximum number of cases of MAS were seen in babies with birth weight between 2-2.4kgs (n=22, 37.93%), followed by babies with birth weight between 2.5 - 2.9 kg (n =18, 31.03%). Babies with birth weight between 3 - 3.4 formed 20.68% (n=12) of cases. Babies with birth weight between 1.5-1.9kg, 3-5-3.9kg and >4 kg had 2 cases each of MAS.

The sex distribution was almost equal in both male and female with 51.72% cases in males and 48.27% cases in females.

Assessment of respiratory distress with Downe's score system

In this study, with 58 babies of MAS at admission 42 cases (72.41%) had Downe's score < 4, and 14 cases (24.13%) had a score of 4-6; and 2 (3.44%) cases had score > 6 at admission. Some babies were recorded to have Downe's score > 6, one or two days or few hours after admission and were ventilated as per the recommendation and the recorded the maximum Downe's score was 8. After giving appropriate treatment, 52 cases recovered from respiratory distress and 06 cases expired.

Table 7: Meconium Aspiration Syndrome and APGAR score at 1 minute.

APGAR Score at 1 minute	No. of cases	%
0-3	18	31.03
4-6	34	58.62
>6	6	10.34

Out of all cases, 18 (31.03%) cases had severe asphyxia i.e., AS <3 at 1 minute and 34 (58.62%) cases had mild to moderate asphyxia i.e., AS between 4-6 at 1 minute and AS >6 is seen in 6 (10.34%) cases.

Table 8: Complications in MAS.

Complications	No. of cases	%
ARF	12	20.68
BA	22	37.93
Septicemia	10	17.24
Pneumothorax	4	6.89
Pulmonary hemorrhage	2	3.44
Pneumonia	2	3.44
Others	28	44.8

In present study of babies with MAS, the most common complication was birth asphyxia in (37.93%, n=22) of cases, followed by Acute Respiratory Failure in (n=12, 20.68 %) cases.

Septicemia was seen in 17.24% (n=10) cases, pneumothorax in 6.89% (n=4), pulmonary hemorrhage in 3.44% (n=2) and ventilated associated pneumonia in 3.44%. (n=2) of cases. Some babies had more than one of the above-mentioned complications. 28 babies (44.8%) had complication other than those mentioned above.

Table 9: Mortality in MAS.

Complications	No. of cases	%
Isolated birth asphyxia	3	50
Isolated ARF	1	16.66
ARF with pneumothorax	1	16.66
ARF with pulmonary haemorrhage with septicemia	1	16.66

In present study, the most common cause of mortality is birth asphyxia constituting (n = 3, 50%) of cases followed by acute respiratory failure with pneumothorax and isolated acute respiratory failure each in (n = 1, 16.66%) of cases. Birth asphyxia with acute respiratory failure with septicemia contributing (n=1, 16.66%) mortality.

In present study, severe birth asphyxia was found to be the main cause of death in majority of cases followed by acute respiratory failure. Mortality occurred in 06 cases (10.34%). In present study, conservative line of management was given with oxygen, restricted fluids, antibiotics, Vitamin K, calcium for 40 (68.96%) cases and only 18 cases (31.03%) needed ventilator support where indication was birth asphyxia, acute respiratory failure or other complications like pneumothorax. Out of 18 ventilated babies, 06 babies died and 12 babies survived and was discharged.

DISCUSSION

The present study was undertaken to evaluate the clinical pro file of 58 babies with meconium aspiration syndrome in relation to their birth weight and gestational age and immediate outcome. Out of 426 cases of respiratory distress admitted to NICU, 58 cases (13.61%) were diagnosed to have MAS.[6]

Narang et al found that 10.55% was the incidence of MAS in their study.[6] 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 of meconium staining of amniotic fluid was observed to be 8.54% of which MAS was found in 16.1% of cases.[9] In the present study, as per the criteria for diagnosing MAS, we have excluded the babies born through meconium stained amniotic fluid without respiratory distress and with normal chest X-ray.

Figure 4: A. Term baby with MAS treated with head box oxygen. Photograph of a term baby with mild MAS admitted in our NICU, and kept under radiant warmer and was treated with head box oxygen, and intravenous fluids. The child developed spontaneous pneumothorax on 3rd day of life. B. Term baby with MAS treated with ventilator support. Photograph of a term baby with severe MAS admitted in our NICU, and kept under radiant warmer and was treated with ventilator support and in photo baby is connected to pulse oximeter. C. Term baby with MAS treated with head box oxygen. Photograph of a term baby with moderate MAS admitted in our NICU, and kept under radiant warmer and was treated with head box oxygen and maintaining saturation.

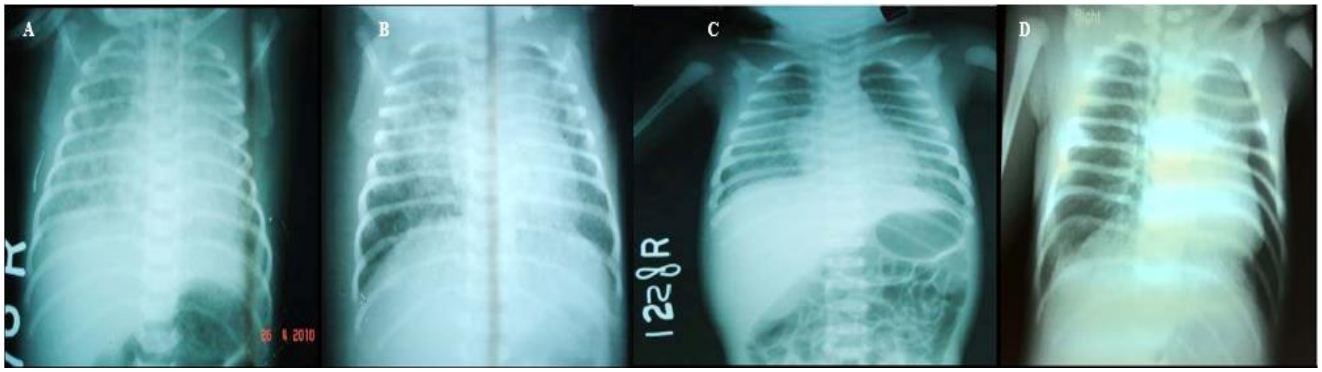

Figure 5: A. Plain X - ray Chest of a 2 day old neonate showing diffuse asymmetric patchy infiltrates characteristic of MAS admitted in our NICU. The child was ventilated ET Tube can be seen in situ. B. 10: X - ray Chest showing of a one day old neonate showing infiltrated areas alternating with emphysematous area. C. X-ray chest of 2 day old neonate showing patchy infiltrates with air trapping bilaterally in upper zone. D. X - ray chest of 3 day old neonate with MAS showing patchy infiltrates with left sided pneumothorax with collapse of left lung. The baby developed spontaneous pneumothorax on third day of life.

Meconium and other associated conditions

Meconium staining of amniotic fluid and subsequently leading on to MAS was more commonly seen with associated maternal condition like fetal distress due to various causes; PIH and post term pregnancies. Incidence of these factors in the present study has been compared with those of other authors. The cause of fetal distress and neonatal respiratory distress in association with MSAF is not always clear. A prospective study was undertaken by Coughtrey H et al, who concluded that fetal distress is common in infants 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.[3,11,12]

In the present study, it was 20.68%. Incidence of PROM was found 17 in 6.60% cases by Miller et al, and in the

present study it was 10.34%.[11] Trimmer et al, noted meconium passage in 38% cases of post dated pregnancy with oligohydramnios.[2]

In National Neonatal Perinatal Database of India 2002-2003, it was found that variables showing significant association with presence of MSAF were small for gestation fetal growth status, pregnancy induced hypertension (PIH), eclampsia, prolonged rupture of membranes (>24 hr), oligohydramnios, fetal bradycardia and fetal tachycardia.

In a study at BHU, Varanasi it was found that fetal distress during labour and IUGR were significant risk factors associated with MAS.[7] In another study by Hofmeyer GJ et al it was found that the presence of thick meconium staining of the amniotic fluid is an indication of oligohydramnios, as meconium passed into a normal volume of amniotic fluid will usually appear thin.[13] In the present study only 10.34% cases were associated with oligohydraminos.

Mode of delivery and MAS

In the present study; babies with MAS, born by LSCS formed the highest percentage (n = 24, 41.3%) followed by babies born by normal vaginal delivery (n=20 ,34.48%) and (n=10,17.24%) by forceps delivery.

Incidence of MAS with gestational age

In the present study mean gestational age was found to be 38 - 40 weeks. Green and Paul says that prevalence of MAS increases to 10% or more after 38 weeks.[14] In a study by Eiden et al they 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.[15]

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 stained liquor and 37.80 + 2.27 weeks in babies born with thin meconium stained liquor.[16] In a study by Balchin et al it was found that the rate of meconium stained amniotic fluid increases with advancing gestational age.[17] 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 2.68kg ranging from 1.7 to 4.1kg. According to study by Pravid Goud and Usha Krishna (3) majority of babies in their study weighed 2.5kg – 3kg and 4.2% of babies weighed >3.5kgs.[3] In National Neonatal Perinatal Database of India 2002-2003, the mean birth weight of babies born through MSAF was 2646 + 552 gm.

In a study by Suresh GK et al, the mean birth weight was 2685+536 gm in thick meconium stained liquor babies and 2669+637 gm in thin meconium satined liquor babies.[16] In a study by Bharati Rao et al, the birth weight of babies with MSAF were in the range of 1600-3800 gms, with mean birth weight of 2.516 gm.[9]

Assessment of respiratory distress in MAS

In the present study with 58 babies; majority of them had moderate respiratory distress; assessed by Downes score (between 4 – 6) at admission. 2 babies had Downes score >6 at admission and other babies who were ventilated developed progressive respiratory distress with maximum Downe's score of 8.

George and Goodling et al have demonstrated in puppies that meconium moves progressively to the periphery of lung with each breath, this is consistent with the observation that many infants with meconium aspiration are well for few hours after birth before developing progressive respiratory distress.[5] 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 and clear liquour upto 38 weeks of gestation but there is a strong evidence that babies with MSL were more likely to experience fetal distress compared to babies with clear liquor after 38 weeks of gestation.[18]

Meconium and APGAR Score at 1 minute

In the present study, APGAR score recorded at 1 minute <3 is found in (n=18) 31.03% of cases with severe birth asphyxia; 58.62% (n=34) of cases had APGAR score between 4-6 with mild to moderate birth asphyxia. Miller et al found that APGAR at 1 minute was <7 in 25.40% of cases.[11] In a cross- sectional study, it was found that a significantly greater incidence of Apgar score less than 7 at 1 minute for babies born 98 through MSAF, compared with babies born with clear amniotic fluid.

Complications in MAS

In the present study birth asphyxia (n=22, 37.93%) was found to be most common complication followed acute respiratory failure (n=12, 20.68%) followed by septicaemia (n=10, 17.24%), followed by air leak syndrome (n=4, 6.89%).

Other complications like pneumonia, pulmonary haemorrhage have also been noted in present study. Pneumothorax occurs in around 10% of all ventilated infants with MAS , and the presence of this complication potentiates lung atelectasis and PPHN and increases the risk of mortality.

In a study by Wiswell TE et al, it was found that 11.53% babies develop pneumothorax.[20] In National Neonatal Perinatal 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 40 (68.96%) cases were treated conservatively whereas 18 (31.03%) cases needed ventilator support. In a study by Wiswell TE et al it was found that of the neonates with MAS, 29.7 % required mechanical ventilation.[19,20] In a study by Rossi EM et al out of 16 infants with meconium aspiration syndrome who were delivered through thick meconium, seven (44%) required mechanical ventilation.[21]

Mortality in MAS

In our present study,mortality was occured in 06 cases (10.34%) with birth asphyxia was the main cause of death in 50% cases. Followed by isolated ARF and ARF with pneumothorax in 16.66% of cases and then by ARF with birth asphyxia and septicemia in 16.66% of cases.

Narang et al, found that 53.8% cases of MAS had birth asphyxia and 15.8% had air leak and 3.8% had PPHN.[6] 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.[20] The mortality rate from MAS is more difficult to assess since quoted figures vary widely. Davis et al reported 12 deaths in 30 infants i.e. 40% moratlity rate.[22]

CONCLUSION

Meconium aspiration syndrome (MAS) is one of the common causes of respiratory distress in the newborn. MAS refers to presence of meconium below the vocal cords and in the lungs.

During the study period of 2 years from December 2013 to October 2015, out of 4994 deliveries, 882 (17.6%) babies had meconium stained liquor and out of these 882 babies, 58(6.5%) babies developed MAS.

Increased incidence of meconium aspiration syndrome was associated with:

- Increase in the gestational age (more in term and post term babies).
- Birth weight > 2.5kgs.
- Caesarean delivery.

MAS carries a high morbidity and mortality. Highest mortality was associated with thick meconium when it was present below the vocal cords and low APGAR score at 1 minute. In our study, mortality occurred in 06 cases (10.34%) of cases. Hence proper diagnosis and timely intervention can reduce the mortality and mortality in meconium aspiration syndrome.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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