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Original Research Article

Respiratory Complications and Neonatal Outcome in Babies with Meconium Stained Amniotic Fluid

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Abstract:

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

Methods: This hospital based study was conducted for a period of one year at tertiary care teaching hospital of Jaipur, Rajasthan in which consecutive cases of meconium stained amniotic fluid (MSAF) during the study period were included. Antenatal and natal history was taken for etiology, type of delivery and indications for any intervention. Postnatal history was obtained regarding Apgar score, birth asphyxia, or any other complication. Respiratory complications, morbidity and mortality associated with MSAF were noted.

Results: Out of 3720 deliveries during the study period, 315 (8.46%) babies had meconium stained liquor and out of 315 MSAF babies, 26 (8.25%) had MAS. Maximum number of cases of MSAF were seen in babies with birth weight between 2.5-2.9kgs (n=146, 46.3%). Majority of the cases of MSAF 242 (76.82%) occurred in term babies with mean gestational age of 38-40 weeks. In present study maternal anemia was found to be the most common (n=127, 40.31%) possible factor associated with MSAF. In babies with MAS, the most common complication was birth asphyxia in (50%, n=13) of cases. In present study, out of 26 MAS cases, pulmonary hemorrhage was found to be the cause of death in one (3.84%) case.

Conclusion: This study concluded that Meconium aspiration syndrome (MAS) is one of the common causes of respiratory distress in the newborn. MSAF is associated with increase in the gestational age, birth weight>2.5kgs, normal vaginal delivery, maternal anemia and birth asphyxia.

Keywords: Neonate, Meconium, Asphyxia, Amniotic Fluid.

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 from 5% to 25% [2]. 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 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 [3]. Meconium stained amniotic fluid occurs in 9% to 22% of live births with increasing frequency along with increase in gestational age of fetus [4]. In utero, meconium passage rarely occurs before 32 weeks of gestation and most babies with meconium stained amniotic fluid are 37 weeks or older [5]. An increase incidence of MSAF is noted in presence of feto-maternal stress factor 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 to 48 hours after birth [6]. MAS remain 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 out come and improved survival rate of infants with MAS. The present study was planned to analyze respiratory complications, morbidity and mortality

associated with meconium stained amniotic fluid.

Materials & Methods

This study was carried out in Department of Pediatrics and Maternal and Child Health Care Unit at tertiary care teaching Hospital Jaipur. The study included the clinical profile of consecutive cases of meconium stained amniotic fluid admitted to the above center during the study period.

The criteria's used for diagnosing meconium aspiration syndrome were:

1. Presence of meconium stained amniotic fluid.
2. 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).
3. Need for supplemental oxygen or ventilator support
4. A compatible chest radiograph (Abnormal chest roentgenograms consistent with aspiration pneumonitis).

Study population consisted of newborns with meconium stained amniotic fluid. It is a heterogeneous population. The cases were taken from tertiary hospital and the babies who required HFO ventilation were referred to higher center and not included in present study.

Procedure

All preterm, term and post term infants, diagnosed with meconium stained amniotic fluid by visual inspection of liquor i.e. green colour, delivered normally or by caesarean section or forceps, which were taken care in MCH unit or admitted to NICU, during the above mentioned period were included in the study. The newborns with congenital anomalies, intrauterine death and referred to higher center 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. Postnatal history was obtained regarding Apgar score, birth asphyxia, cyanosis, or any other complication and for details of resuscitation measures done at birth.

During delivery, the type of delivery and any complications in the mother were recorded. Resuscitative measures for the baby were taken by the pediatrician on call according to NRP 7th edition. When required, endotracheal intubation was done and bag and tube ventilation was given. 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 minute was assessed and gestational age assessment was done with Ballard's score [7]. A detailed clinical examination was carried out and respiratory distress was monitored using Downes score system [8]. 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 complete blood counts (Hb, TLC, DLC, platelets, PCV and peripheral smear) were done. Septic works 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

Out of 3720 deliveries during the study period, 315 (8.46%) babies had meconium-stained liquor and out of 315 meconium stained amniotic fluid (MSAF) babies, 26 (8.25%) had meconium aspiration syndrome (MAS). The total number of babies admitted to NICU during the study period was 378 and out of them total number of cases with respiratory distress were 108 (28.57%). Out of 108 cases of respiratory distress admitted to NICU during the study period, 26 (24.07%) babies had MAS. (Table 1)

In the present study, sex distribution was more towards male, with 190 (60.32%) cases in males and 125 (39.68%) cases in females. Mean birth weight was 2.772 ±0.40 kg. In present study, maximum number of cases of MSAF were seen in babies with birth weight between 2.5-2.9kgs (n=146, 46.3%), followed by babies with birth weight between 3-3.4 kg (n=79, 25.1%) and none of the case had birth wt > 4 kg. In present study out of 315 MSAF cases, 65% belonged to lower socioeconomic status as per modified Kuppuswamy scale. (Table 1)

In the present study; majority of the cases of MSAF 242 (76.82%) occurred in term babies with mean gestational age of 38-40 weeks. MSAF was also seen in preterm babies. 6 (1.9 %) cases were of 34-36 weeks of gestation and two cases (0.63 %) were below 34 weeks of gestation.

Only one case occurred in Post-term (GA>42 weeks) baby. (Table 1) In present study, babies with MSAF born by normal vaginal delivery formed the highest percentage (n=243, 77.14%) of cases followed by babies born by Caesarian section (n=72, 22.86%). (Table 1) In present study maternal anemia was found to be the most common (n=127, 40.31%) possible factor associated with MSAF followed by PROM (n=35, 11.11%). 109

cases (34.6%) were not associated with any factor. (Table 1)In present study out of 315 MSAF cases, 262(83.14%) cases were born with thin MSAF and 53(16.83%) cases born with thick MSAF. Out of 262 thin MSAF cases, 6(2.29 %) were admitted to NICU and 256 were given routine neonatal care in post-natal care ward. Out of 53 thick MSAF cases 20(37.74%) were admitted to NICU and 33 were given routine post-natal care and followed up for any complications.

Table 1: Meconium-stained amniotic fluid (MSAF) and associated risk factors (n=315)

	No. of Cases	Percentage
Sex		
Male	190	60.32%
Female	125	39.68%
Birth weight (kg)		
1.5-1.9	10	3.2%
2-2.4	64	20.3 %
2.5-2.9	146	46.3%
3-3.4	79	25.1%
3.5-3.9	16	5.1%
>4	0	0
Socio Economic status (modified Kuppuswami scale)		
Lower	204	64.76%
Upper lower	06	1.90%
Lower middle	87	27.62%
Upper middle	06	1.90%
Upper	12	3.80%
Gestational Age (in weeks)		
< 34	2	0.63%
34 – 36	6	1.90%
36 – 38	27	8.57%
38 – 40	242	76.82%
40 – 42	37	11.74%
> 42 (Post-term)	01	0.32%
Mode of delivery		
Caesarean delivery	72	22.86%
Normal vaginal delivery	243	77.14%
Maternal Factors		
Anemia	127	40.31 %
Premature rupture of membranes (PROM)	35	11.11%
Fetal Distress	20	6.34%
Pregnancy induced hypertension (PIH)	12	3.80%
Oligohydramnios	12	3.80%
No Factor	109	34.60%

In the present study, out of total 315 cases of MSAF, n=289, 91.74% were not associated with any respiratory distress and n=26; 8.25 % cases were diagnosed as Meconium Aspiration Syndrome (MAS). Out of all cases, 5 (1.58 %) cases had severe asphyxia i.e., Apgar score 0 to 3 at 1 minute and 46 (14.6%) cases had moderate asphyxia i.e., Apgar score between 4-6 at 1 minute and Apgar score > 6 was seen in 264 (83.8%) cases. (Table 2)

Table 2: Meconium-stained amniotic fluid and Apgar score at 1 Minute (n=315)

Apgar score at 1 minute	No. of Cases	Percentage
0 – 3	5	1.58%
4 – 6	46	14.60%
> 6	264	83.80%

In present study, 54 cases were observed with Apgar score <7 at 1 min; out of these n=13, 24.07% showed respiratory complications and were admitted, 41 cases were not associated with any respiratory complications. Apgar score <7 at 5 min were noted in 16 cases of MSAF. Out of these, n=9, 56.25% showed respiratory complications and 7 were not associated with any respiratory complications. (Table 3) In the present study; out of 315 MSAF cases, 274 were vigorous at birth; out of these n=13, 4.74% were having respiratory complications. 41 cases were non-vigorous; out of these n=13, 31.70% had respiratory complications. (Table 3)

Table 3: Apgar score <7 at 1 and 5 minutes and vigorousity with respiratory complications

Apgar <7	No. of Cases	Respiratory Complications-Yes	Respiratory Complications-No
At 1 minute	54	13 (24.07%)	41(75.93%)
At 5 minute	16	9(56.25%)	7(43.75%)
Vigorousity			
Vigorous	274	13(4.74%)	261(95.26%)
Non-vigorous	41	13 (31.70%)	28(68.30%)

In present study of babies with MAS, the most common complication was birth asphyxia in (50%, n=13) of cases, followed by Persistent pulmonary hypertension of the newborn (PPHN) in (15.38%, n=4) of cases.

None of the cases developed Pneumothorax. In present study, conservative line of management was given for 22 (84.62%) cases and only 4 cases (15.38%) needed ventilator support. Out of 4 ventilated babies 3 survived and 1 expired. In the present study, out of 26 MAS cases, n=3, 11.54% cases required surfactant therapy and no mortality was noted in this group. Rest of the MAS cases n=23, 88.46% didn't required surfactant therapy; one case of mortality was noted in this group.

Two out of 3 cases were improved after First dose of surfactant. One case required a second dose of surfactant and was settled after it. In present study, out of 26 MAS cases, pulmonary hemorrhage was found to be the cause of death in one (3.84%) case.

Table 4: Complications, mode of treatment, surfactant therapy and outcome in MAS (n=26)

	No. of Cases	Percentage (%)
Complications		
Birth asphyxia	13	50%
Persistent pulmonary hypertension of the newborn (PPHN)	4	15.38%
Pulmonary Hemorrhage	1	3.84%
Pneumonitis	1	3.84%
Sepsis	1	3.84%
Pneumothorax	0	0
Others	6	23.08%
Mode of Treatment		
Conservative treatment	22	84.62%
Ventilator support	4	15.38%
Surfactant therapy		
Given	3	11.54%
Not Given	23	88.46%
Neonatal outcome		
Death	1	3.84%
Discharge	25	96.15%

Discussion

The present study showed 8.46% incidence of MAS. Narang et al also found 10.55% incidence of meconium aspiration syndrome (MAS) in their study [9]. In a study by Bhusan et al, MAS occurred in 25% of all cases of MSAF [10]. In a study by Rao et al, the incidence MAS was found in 16.1% of cases [11]. In the present study MSAF was more in male (60.32%) cases as compared to 39.68% cases in females. Ranee et al found that both male and female were equally affected in their study [12]. In present study 65% cases belonged to Lower socioeconomic status as per modified kuppuswamy scale. In a study by Wiswell et al, Incidence of meconium stained amniotic fluid was higher in blacks and south Asian ethnicity [1]. In present study, we can't attribute low socioeconomic status as risk factor as our hospital is a government teaching hospital and most of population it serve are of low/upper lower SES and hence more studies are required to attribute low SES as a causative factor of MSAF. This can possibly be a factor as poor SES leads to poor antenatal care which leads to poor birth weight, delayed outreach for medical care at the time of delivery

In the present study; majority of the cases of MSAF underwent normal vaginal delivery. Narang et al found 54.2% babies were born by caesarian delivery and 30.7% were delivered by normal vaginal delivery and 11.8% by forceps delivery [9]. In a study by Bhusan et al, higher incidence of meconium aspiration was associated with caesarean section (80%) in comparison to vaginal delivery [10]. A cross-sectional study at one hospital in Jordan, it was found that caesarean section was significantly higher in babies who developed MAS than in those who did not (57.9% vs 24.3%) [13]. the rate of caesarian delivery (23%) for MSAF in present study was same as for in general population at a tertiary level care hospital (10-30%). In present study, we

couldn't find any difference in mode of delivery and MSAF.

In the present study mean gestational age for MSAF was found to be 38-40 weeks. Erkkola et al, found that 95% of cases were > 36 weeks' gestation in their study [14]. Green and Paul say that prevalence of MAS increases to 10% or more after 38 weeks [15]. In a study by Eiden et al they found the frequency of meconium stained amniotic fluid increased with increasing gestational age of fetus [16]. Balcin et al also showed similar results [17]. In National Neonatal Perinatal Database of India 2002-2003, the mean gestational age of babies born through MSAF was 39 weeks. The present study confirmed that presence of MSAF/MAS is higher in full term and postdated babies.

In the present study mean birth weight was 2.772±0.4 kg ranging from 1.4 to 3.8 kg. According to study by Goud and Krishna majority of babies in their study weighed 2.5kg – 3kg [4]. 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 et al, the mean birth Weight was 2685±536 gm in thick meconium stained liquor babies and 2669±637 gm in thin meconium stained liquor babies [18]. In a study by Rao et al, the birth weight of babies with MSAF was in the range of 1600-3800 gms, with mean birth weight of 2.516 gm [11]. In present study, we confirm that MSAF and MAS cases have higher incidence in AGA babies.

In present study maternal anemia was found to be the most common (40.31%) possible factor associated with MSAF followed by PROM (11.11%). Incidence of PROM was found in 6.60% cases by Miller et al [19]. In a study at Varanasi it was found that fetal distress during labour and IUGR were significant risk factors associated with MAS [20]. In another study by Hofmeyer 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 [21]. The cause of fetal distress and neonatal respiratory distress in association with MSAF is not always clear. 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 present study 37.74% cases of thick MSAF were admitted to NICU as compared to 2.29 % cases of thin MSAF. Ranee et al also found a strong association (P=0.001) between thick MSAF and mortality in MSAF babies [12].

In the present study with 26 MAS babies; majority of them had moderate respiratory distress; assessed by Downes score (between 4–6) at admission. 1 baby had Downes score > 6 at admission and other babies who were ventilated developed progressive respiratory distress with maximum Downe's score of 8. Gregory 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 [22]. 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 [23].

In the present study, Apgar score < 3 was recorded at 1 minute 1.58 % of cases with severe birth asphyxia; 14.60 % of cases had Apgar score from 4-6 with mild to moderate birth asphyxia. Abramovici et al, found that Apgar score < 7 only at 1 minute was in 7.5% of cases and Miller et al found that Apgar score < 7 at 1 minute was in 25.40% of cases [24]. 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 through MSAF, compared with babies born with clear amniotic fluid [25]. In present study, Apgar score <7 at 1 min showed respiratory complications in 24.07% and Apgar score <7 showed respiratory complications in at 5 min 56.25%.

In present study of babies with MAS, birth asphyxia was found to be the most common complication in 50% in of cases, followed by PPHN in 15.38% cases. Some babies had more than one of the above mentioned complications. None of the cases developed Pneumothorax.

In a study by Wiswell et al, it was found that 11.53% babies develop pneumothorax [26]. In As per 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%. Narang et al also showed similar results [7]. In present study, out of 26 MAS cases 96.15% cases were discharged and one case ended up in mortality. Pulmonary hemorrhage was associated with mortality. The mortality rate from MAS is more difficult to assess since quoted figures vary widely. Davis et al reported 40% mortality rate [27]. Mortality because of MAS at our center was 3.8% whereas it was 4-12% in other studies [28].

In present study 84.62% cases were treated conservatively with oxygen, iv fluids, antibiotics Vitamin K, calcium etc. whereas 15.38% cases needed ven-

tilator support. In a study by Wiswell et al it was found that of the neonates with MAS, 29.7 % required mechanical ventilation [26]. In a study by Rossi et al, 44% required mechanical ventilation [29].

In the present study, 11.54% cases required surfactant therapy and no mortality was noted in this group. 88.46% didn't required surfactant therapy but one case of mortality was noted in this group. Dargaville et al mentioned in their study that bolus surfactant therapy in ventilated infants with MAS has been found to improve oxygenation in most studies, although there are a significant proportion of nonresponders and in many cases the effect is transient [30]. Pooled data from randomised controlled trials of surfactant therapy suggest a benefit in terms of a reduction in the requirement for extracorporeal membrane oxygenation (relative risk 0.48 in surfactant-treated infants) but no diminution of air leak or ventilator days.

Limitations

The sample size of moderate to severe MAS was too small to conclude role of surfactant in MAS, timing of administration, required doses (1 or 2), gap between first and second dose, and time of recovery in severe MAS with/without surfactant. We need larger case control studies to assess role of surfactant in moderate to severe cases of MAS.

Conclusion

This study concluded that Meconium aspiration syndrome (MAS) is one of the common causes of respiratory distress in the newborn. Increased incidence of meconium stained amniotic fluid is associated with increase in the gestational age (more in term and post term babies), birth weight>2.5kgs, normal vaginal delivery, maternal anemia and birth asphyxia. Most babies with MSAF and MAS are managed with less invasive, conservative support; ventilatory support is required in few cases only. Surfactant therapy may be useful in severe MAS cases and mortality in MAS is very low with proper medical management.

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