

Original Research Article

Meconium aspiration syndrome and neonatal outcome: a hospital based study

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ABSTRACT

Background: The incidence of meconium stained amniotic fluid is 8-20% among all deliveries. The Aspiration of meconium into the airway results in various short term and long term morbidities and mortality. Timely management of these neonates with meconium in amniotic fluid may prevent Meconium aspiration syndrome.

Methods: This prospective cohort study was conducted at Kempegowda Institute of Medical Sciences, Bangalore. All live Term neonates born between December 2016 and July 2018 with meconium in amniotic fluid were enrolled in the study. Details of the neonate was entered in the pre-designed Proforma. The objective of this study the outcome of MAS neonates and find factors associated with Meconium aspiration syndrome when compared with Meconium stained amniotic fluid neonates as a whole. These associated factors were presented as Odds Ratio (OR) and 95% Confidence Interval. Chi-square test was done where applicable and a p-value <0.05 was taken as significant.

Results: Meconium aspiration syndrome was seen in 79 out of the 188 neonates born with meconium stained amniotic fluid.

Conclusions: The morbidity and mortality in a neonate with Meconium stained amniotic fluid (MSAF) to develop meconium aspiration syndrome (MAS) can be avoided with timely antenatal care. Meconium-stained babies should be aggressively managed to prevent complications like perinatal asphyxia and respiratory failure which may lead to the mortality. Those neonates with risk for adverse outcome should be managed with special focus on respiratory care with use of assisted ventilation and inhaled nitric oxide and extracorporeal membrane oxygenation, where available.

Keywords: Meconium aspiration syndrome, Neonates, MSAF, Outcome

INTRODUCTION

Meconium stained amniotic fluid (MSAF), usually occurs in about 10-15% of all pregnancies, more commonly seen in term and especially in post-date deliveries.¹ The cause and pathophysiology of Meconium stained amniotic fluid is not properly understood. Maturation of gastrointestinal tract in post-dated babies may account for the large number of cases with meconium stained amniotic fluid. MSAF is considered as a marker of fetal distress and

usually associated with adverse fetal and neonatal outcome.²⁻⁴

But not all neonates with MSAF develop complications. A neonate born with meconium in amniotic fluid (MSAF) may develop respiratory distress which is otherwise not explained is known as meconium aspiration syndrome (MAS). MAS is the most common complication in neonates born with MSAF with incidence of about 5%.^{5,6}

Meconium stained neonates are 100 times more prone to develop MAS when compared to neonates born through clear amniotic fluid.⁷

There is an increased admission to neonatal intensive care units of neonates born with MSAF when compared to neonates born with clear amniotic fluid and also proves that there is strong association between MSAF and fetal distress. Nearly 24% of neonates with meconium in amniotic fluid are admitted to neonatal intensive care units when compared to 7% of neonates born with clear amniotic fluid.⁸

The aim of this study is to identify factors and other comorbidities associated with Meconium aspiration syndrome.

Historical aspects

Ancient Greek philosopher was the first to describe Meconium stained amniotic fluid and named the condition as “meconium-arion” which means “opium like”. Aristotle believed that the fetus was induced with sleep whenever there was MSAF due to the fact that these neonates when born were associated with neonatal depression or death. Aristotle compared the meconium with opium as it was black colour with tarry consistency similar to that of processed opium. Aspiration of meconium in-utero and Meconium aspiration syndrome (MAS) was first described and published in 1918.⁹

It was hypothesized that the pathogenesis mechanism for passage of meconium was due to anoxia which thereby relaxes the anal sphincter. Whereas other researchers proposed that asphyxia was the reason for meconium passage due to increased peristalsis.¹⁰

Hypoxia being the reason for meconium passage was first described in a study by Walker et al, where umbilical venous oxygen saturation levels were lesser than 30% which was associated with meconium passage.¹¹

A mortality rate of 6% and morbidity rate of about 60% was noted in neonates born with meconium in the amniotic fluid.¹²

METHODS

This is a prospective cohort study conducted at Kempegowda Institute of Medical Sciences, Bangalore. All live term neonates born with meconium in amniotic fluid between December 2016 and July 2018 were enrolled in the study. Detailed history of the, parity, mode of delivery, sex, gestational age, birth weight, and predefined neonatal morbidities were all entered in the pre-designed Proforma (Figure 1).

Associated factors were presented as Odds Ratio (OR) and 95% Confidence Interval. Chi-square test was done

where applicable and a p-value <0.05 was taken as significant.

Inclusion criteria

- All live inborn neonates >37 weeks of gestation
- Born with Meconium in amniotic fluid

Exclusion criteria

- All live neonates born <37 weeks of gestation
- Absence of Meconium in amniotic fluid
- Respiratory distress due to other etiology
- Neonates with congenital anomalies and
- Neonates with clinically identified chromosomal anomalies.

Meconium aspiration syndrome

Early onset of respiratory distress in an infant with meconium stained amniotic fluid (MSAF) who presents with poor lung compliance, hypoxemia and a characteristic lung radiograph.

Birth asphyxia

Complete cessation of breathing, inadequate or gasping for breath with APGAR <4 at 1 min.

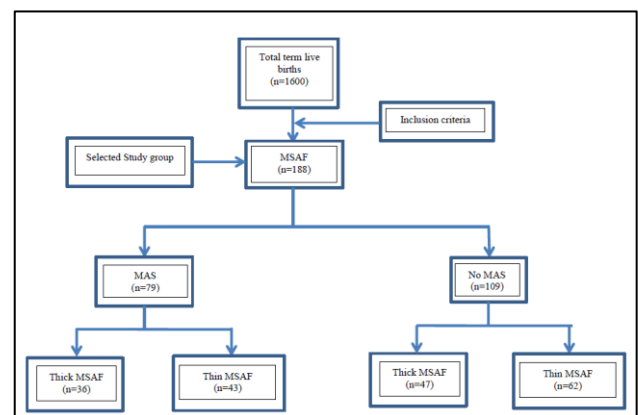


Figure 1: Flowchart of sample study.

Statistical analysis

Data were entered in Microsoft Excel and analyzed using Stata version 14. Continuous variable like age, gestational age, new born baby weight, Apgar at min 1 and Apgar at min 5 were expressed as mean (standard deviation). The distribution of categorical variables like age categories, gender, NICU admissions, diagnosis, maternal risk factors, neonatal co-morbidities and interventions were expressed as proportions. The association of maternal obstetric factors and neonatal co morbidities with late pre term labor were assessed using a chi-squared test or a Fishers Exact Test. The comparison neo natal and maternal obstetric factors between late pre

term and term labors were analyzed using a chi-squared test. The comparison of continuous variables like gestational age, new born baby weight etc. between later pre term and term labors were assessed using independent t test. A p value of less than 0.05 was considered as statistically significant.

RESULTS

Table 1 depicts the distribution of these live birth neonates with according to gestational age. Of these,

1660 were term neonates (77.1%), while 494 were preterm neonates (22.9%).

Table 1: Distribution of neonates according to gestational age.

Diagnosis	Number	Percentage
Pre term	494	22.9
Term	1660	77.1
Total	2154	100

Table 2: Comparison of Meconium aspiration syndrome with Meconium stained amniotic fluid.

Variables	MAS (n=79)		MSAF (n=188)		P value	OR	95%CI
	No	%	No	%			
Gender							
Female	29	36.7	86	45.7	0.174	0.68	0.41-1.18
Male	50	63.3	102	54.3		1.45	0.85-2.49
Post datism (>40 weeks)	12	15.2	39	20.7	0.292	0.68	0.34-1.39
GA(±SD) wks	38.17±1.16		38.54±1.32		0.031*	-	-
NICU admission	79	100.0	124	66.0	<0.001**	40.25	5.47-296.11
Diagnosis							
SGA	7	8.9	18	9.6	0.855	0.92	0.37-2.29
Birth asphyxia	3	3.8	4	2.1	0.436	1.82	0.39-8.31
PPHN	6	7.5	0	0	0.108	0.39	0.05-3.28
Birth weight (±SD) kgs	2.92±0.47		2.88±0.49		0.538	-	-
Vaginal Delivery	19	24.1	24	12.8	0.022*	2.16	1.11-4.23
APGAR 1 min <7	7	8.9	10	5.3	0.279	1.73	0.63-4.72
APGAR 5 min <7	2	2.5	3	1.6	0.607	1.61	0.26-9.77
Downe score ≥4.0	15	19.0	18	9.6	0.033*	2.21	1.05-4.65
Bag and mask	4	5.1	7	3.7	0.615	1.38	0.39-4.85
Thick meconium	36	45.6	83	44.1	0.564	3.81	0.27-2.04

Out of 1660 term babies delivered, term babies fulfilling the Inclusion criteria were enrolled in this study i.e., a total of 188 term neonates with meconium in the amniotic fluid (MSAF) were enrolled, who contributed to 8.7% of total live births. Among these neonates (MSAF), a total of 3.6% neonates developed meconium aspiration syndrome (MAS) (Table 2).

Among the total of 188 neonates with Meconium stained amniotic fluid (MSAF), 79 (42%) developed Meconium aspiration syndrome (MAS) and the remaining 109 (58%) did not develop Meconium aspiration syndrome. Among those neonates which developed MAS, 36 were having thick meconium in the amniotic fluid whereas the remaining 43 were thin meconium. Similarly, in MSAF neonates with no MAS, 47 had thick meconium in the amniotic fluid whereas the remaining 62 had thin meconium (Figure 2).

Table 2 shows that there was a total of 123 neonates admitted to Neonatal intensive care unit in neonates who

had meconium in the amniotic fluid (188). All neonates with meconium aspiration syndrome, i.e. 79 (42%) out of 188 neonates with meconium in amniotic fluid were admitted in Neonatal Intensive care unit. Whereas among those admitted to NICU 15 (19%) of them had Downe score of >4 thereby requiring assisted ventilation. Out of the 15 neonates requiring assisted ventilation, 6 required mechanical ventilation and 9 required nasal CPAP. This statistically significant (p <0.001, OR=40.25, 95% CI (5.47-296.11)).

There were 39 neonates who were born post dated (>40 weeks), out of which 12 (15.2%) developed Meconium aspiration syndrome. Birth asphyxia was found in 3 cases due to meconium aspiration syndrome. Whereas 6 cases (7.5%) out of MAS developed primary pulmonary hypertension of newborn.

The average birth weight was found to be 2.88±0.49 kgs among neonates born with meconium stained amniotic

fluid. Whereas among meconium aspiration syndrome the average birth weight was 2.92 ± 0.47 kgs.

Birth asphyxia was seen in a total of 3 cases (3.8%) of Meconium aspiration syndrome. Whereas small for gestational age neonates born by MSAF were 18 cases out of 188 cases of MSAF neonates. It was observed that it was statistically significant that neonates born with vaginal delivery had higher risk of developing MAS when delivered by vaginal delivery ($p=0.022$, $OR=1.73$, $95\% CI (0.63-4.72)$).

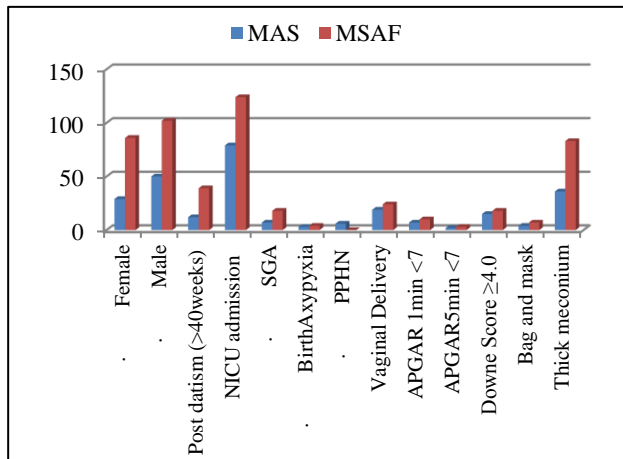


Figure 2: Graphical comparison of Meconium aspiration syndrome with Meconium stained amniotic fluid.

DISCUSSION

Meconium contains thick, green viscous substance with epithelial cells, vernix, lanugo, mucus, amniotic fluid, intestinal secretions, etc. Aspiration of meconium into the lungs of the neonate, results in a condition termed as meconium aspiration syndrome (MAS) leading to obstruction of the airways by meconium, loss of surfactant and chemical pneumonitis. In this condition, the neonate develops respiratory distress immediately or within a few hours after birth, hypoxemia, hypercapnia and acidosis. Meconium aspiration syndrome in a neonate can result in mortality in the newborn period or can have complications like persistent pulmonary hypertension.

In present study, the cases of MAS were 79 (42%) in babies born with MSAF. There were various studies where prevalence of MAS in MSAF neonates was as high as 18% like study by Firdaus et al and as low as 4.5% as in Hanoudi et al. This is due to different levels of antenatal care in different countries.^{13,14}

Studies done by Rajput et al, Bhatia et al, and Lee et al, stated that neonates who are small for gestational age (SGA) contributed to MAS.¹⁵⁻¹⁷ While other studies done by Chandran et al, and Vivian -Taylor et al, proposed that post datism (>40 wks) contributed to MAS.^{18,19} In present study, there were 12 (15.2%) neonates of post dated

babies and 7 (8.9%) of Small for gestational age(SGA) babies developed MAS, but was not significant.

Studies done by Chandran et al, Hiremath et al, and Ramakishore AV et al, proposed that MSAF babies born by vaginal delivery had high risk of developing MAS.^{18,20,21} Whereas studies done by Naqvi et al, Khatum et al, Fischer et al, proposed that MAS was more common among MSAF babies born by caesarean delivery.²²⁻²⁴ But in our study, there were no association between MAS and the route of delivery.

In present study, all the neonates which developed MAS required NICU admission (79), but only 15 (19%) required assisted ventilation with Downe score being >4 . Similarly, in other studies by respiratory distress developed immediately after birth.^{13,25-27} Total 15 neonates (19%) of MAS babies required assisted ventilation which was found to be similar in other studies.^{1,24,28-31} Out of the 15 neonates requiring assisted ventilation, babies on Mechanical ventilation were 6 and 9 neonates were put on Nasal CPAP.

In present study, there were no mortality among MAS babies noted. But in other studies mortalities rates ranging from 2.7% to 33% was noted.^{1,14-16,25,26,32} The different mortality rates results are due to different levels of care in various Neonatal Intensive care unit and availability of different adjuvant therapies for management of MAS. Like nitric oxide and extracorporeal membrane oxygenation (ECMO).

Small for gestational age neonates, 5 minutes APGAR score <7 , birth asphyxia, requirement for bag-mask ventilation and thick meconium were factors associated MAS.

CONCLUSION

Meconium aspiration Syndrome remains the major cause of morbidity as well as mortality in term and post-term neonates. Neonates born with meconium in the amniotic fluid (MSAF), are most likely to develop Meconium aspiration syndrome with respiratory distress immediately after birth, with Downe score >4 and abnormal chest x-ray findings. These neonates have adverse outcome in small for gestational age newborns, low APGAR score at 5 minutes, requirement for resuscitation at the time of delivery, severe HIE and need for assisted ventilation. For preventing morbidity associated with Meconium aspiration Syndrome (MAS), we need to prevent small for gestation births and manage non vigorous neonates born with meconium stained amniotic fluid and prevent birth asphyxia which is a contributing factor to mortality in these babies.

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