

Risk Factors for Meconium Aspiration Syndrome among the Babies Born Through Meconium-Stained Amniotic Fluid

Gupta MM, K.C. R, Sah SN

ABSTRACT

Introduction: Meconium aspiration syndrome occurs as complications in babies born through meconium-stained amniotic fluid. It presents as early onset respiratory distress mainly seen in the term and near-term infants due to the poor compliance of lungs and hypoxia which may be mild to severe. Acute or chronic hypoxia and/or infection can result in the passage of meconium in utero. Meconium aspiration before or during birth can obstruct airways, interfere with gas exchange, cause respiratory distress. The common risk factors include postdated pregnancy, Hypertensive disease of pregnancy, small for gestational age (SGA), gestational diabetes and maternal drug abuse. **Aims:** To study the risk factors for meconium aspiration syndrome, and the complications in the neonates born through meconium stained fluid. **Methods:** TA hospital based cross-sectional study was conducted in the department of pediatrics involving term and post-term inborn neonates born through meconium stained amniotic fluid at Nepalgunj Medical College from November 2024 to May 2025. **Results:** Total 300 babies were delivered with meconium stained amniotic fluid, among which 40 (13.4%) babies develop meconium aspiration syndrome. Among maternal risk factors for meconium aspiration syndrome premature rupture of membrane was most common and statistically significant, which was seen in 15 (37.5%) cases. Fetal risk factors were non-vigorous baby at birth, need of resuscitation at birth (70%), hypoxic ischemic encephalopathy (30%) and they showed statistically significance. Babies born through meconium-stained amniotic fluid showed respiratory distress as the main complication accounting for 57.5%, followed by sepsis (30%). Among babies who developed meconium aspiration syndrome 35 (87.5%) improved and were discharged, remaining 5 (12.5%) showed no improvement. **Conclusion:** Maternal risk factors for meconium aspiration syndrome were premature rupture of membrane, prolonged labor, mode of delivery. Non vigorous baby at birth, need of resuscitation were major risk factors. Respiratory distress was the main complication seen in babies born through meconium-stained amniotic fluid.

Keywords: Meconium stained amniotic fluid, Meconium aspiration syndrome, Respiratory distress syndrome

Authors:

1. Dr. Murli Manohar Gupta
2. Dr. Rajesh K.C.
3. Dr. Shyam Nandan Sah

Department of Pediatrics, Nepalgunj Medical College and Teaching Hospital, Kohalpur, Banke

Address for Correspondence:

Dr. Murli Manohar Gupta

Assistant Professor

Department of Pediatrics

Nepalgunj Medical College and Teaching Hospital

Kohalpur, Banke

Email : murligupta45@gmail.com

INTRODUCTION

Meconium aspiration syndrome (MAS) is a serious condition that occurs in a new born when they inhale a mixture of meconium and amniotic fluid into the lungs around the time of delivery. Meconium aspiration syndrome (MAS) is a term used for the respiratory distress occurring in newborn infants born to pregnancies complicated by meconium-stained amniotic fluid¹. It is mainly seen in the term and near-term infants and presenting with early onset respiratory distress due to the poor compliance of lungs and hypoxia, radiologically presenting as opacities in lung fields and hyperinflammation.² The common risk factors include postdated pregnancy, Hypertensive disease of pregnancy, small for gestational age (SGA), gestational

diabetes and maternal drug abuse.²⁴ Persistent pulmonary hypertension of newborn is severe complication of baby with MAS It is a sign of fetal distress and needs immediate evaluation and management. The degree of severity of MAS has been described as Mild MAS is defined as disease requiring <40% oxygen for <48 hours. Moderate MAS is defined as disease requiring >40% oxygen for >48 hours without air leak and Severe MAS is defined as disease requiring assisted ventilation for >48 hours often associated with persistent pulmonary hypertension.²³ MAS is defined by the following criteria:²²

- Respiratory distress (tachypnea, grunting and/or retractions);
- Requirement for supplemental oxygen to maintain hemoglobin oxygen saturation >92%;

- Requirement for supplemental oxygen beginning prior to 2 hours of life, and lasting at least 12 hrs;
- Absence of congenital anomalies of the airway or heart.

This study was done with the aim of finding the risk factors for meconium aspiration syndrome among babies born through meconium stained amniotic fluid (MSAF).

METHODS

This study was hospital based cross-sectional study, conducted in Department of Pediatrics, Nepalgunj Medical College Teaching Hospital, Nepal, done from November 2024 - May 2025. All inborn neonates (term and post term- 37 weeks- 42 weeks) born through meconium-stained amniotic fluid (MSAF) during the study period were taken for study. Preterm babies, gross life threatening any congenital anomalies, out born babies were excluded from study. Convenient sampling technique was used. Written informed consent was taken in local language. Ethical clearance was obtained from institutional review committee (NGMC) before starting the study. Detailed demographic and clinical profile were taken for those who fell in the inclusion criteria. Detailed examinations were done and findings were recorded. A detailed maternal history was elicited to find out the possible risk factors in the development of MAS in babies born through MSAF, like PROM, pregnancy induced-hypertension, smoking, gestational diabetes, oligohydramnios, prolonged labor, thyroid diseases, heart diseases. Natal history was taken to find out the mode of delivery and interventions, if any for instrumental delivery. Similarly fetal risk factors for MAS like weight of baby, sex, need for resuscitation, development of HIE, DOWNE'S score were recorded. DOWNE'S score looked for cyanosis, retraction, expiratory grunt, air entry, respiratory rate. The scores given as 0,1,2 if present, score > 4 indicates respiratory distress. Other complications developed in babies with MSAF were recorded.

Statistical Analysis

After completion of data collection, the questionnaires were checked for completeness and the filled format was handled with great care, stored, and coded for further analysis. All data were recorded and analyzed in Statistical package for social science (SPSS) version22, entered in Microsoft excel 2007. For inferential statistics: association between the risk factors and MAS was calculated, where $p < 0.05$ was taken significant by using the chi-square test. Data analysis was done by descriptive statistics as mean, SD, median, range and percentage. Comparison was done by applying Chi-square test. Significance was assessed at 5% level of significance ($p < 0.05$). Microsoft word and excel were used to generate graphs, tables, and master charts.

RESULTS

Out of two thousand three hundred and ten (2310) deliveries during the six months study period, three hundred (300) were delivered with meconium stained amniotic fluid (13%). Out of 300 MSAF babies, 40(13.4%) babies developed MAS. The following data were observed and analyzed. The major

maternal risk factors for MAS were PROM, prolonged labour, mode of delivery and other risk factors are mentioned in table I.

Risk factors	Number	Percentage (%)
PROM	45	15
>1 Risk factors	26	8.7
Hypertension	19	6.3
Diabetes	15	5
Oligohydramnios	10	3.3
Prolonged Labour	8	2.6
Anemia during pregnancy	3	1
CVS Disease	2	0.6
None	155	51.6

CVS: Cardiovascular system

Table I: Maternal risk factors for MAS

Variables (Risk factors)	Category	MAS	Percentage %	P value
Age group (years)	<20	7	17.5	>0.005
	21-30	31	77.5	
	>30	2	5	
Parity	Primigravida	30	75	>0.005
	Multigravida	10	25	
Gestational age (weeks)	37-40	13	32.5	>0.005
	40 ⁺¹ – 42	22	55	
	>42	5	12.5	
Mode of delivery	VD	19	47.5	<0.005
	LSCS	16	40	
	Instrumental	5	12.5	
Maternal illness				
Diabetes	Present	2	5	>0.005
	Absent	38	95	
Hypertension	Present	5	12.5	>0.005
	Absent	35	87.5	
Anemia	Present	1	2.5	>0.005
	Absent	39	97.5	
Heart disease	Present	1	2.5	>0.005
	Absent	39	97.5	
Oligohydramnios	Present	6	15	>0.005
	Absent	34	85	
PROM	Present	15	37.5	<0.005
	Absent	25	62.5	
Prolonged labour	Present	4	10	<0.005
	Absent	36	90	

PROM- Premature rupture of membrane, CVS-Cardiovascular system, <0.005= statistically significant

Table II: Association of maternal risk factors with MAS

When the maternal risk factors were compared with babies having MAS, it was found that mode of delivery, PROM, and prolonged labour were statistically significant (<0.005) other risk factors were not found to be statistically significant (Table-II)

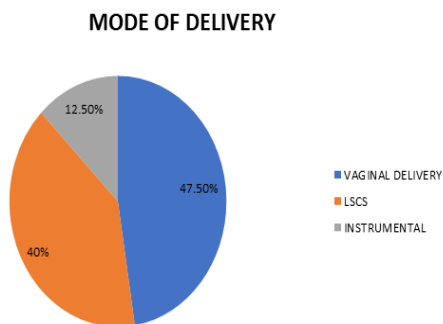


Figure1: Mode of delivery (N-40)

Out of the 40 babies with MAS, 47.5% of babies were born through Vaginal delivery (Figure-1)

Risk factors	Category	MAS	Percentage %	p-value
Weight(kg)	<2.5	8	20	>0.005
	>2.5	32	80	
Sex	Male	28	70	>0.005
	Female	12	30	
Fetaldistress				
Tachycardia	Present	0	0	>0.005
	Absent	40	100	
Bradycardia	Present	2	5	>0.005
	Absent	38	95	
Decreased movement	Present	2	5	>0.005
	Absent	38	95	
Resuscitation	Present	28	70	<0.005
	Absent	12	30	
Downe'sscore	≤4	20	50	<0.005
	>4	8	20	
	None	12	30	
HIE	Present	12	30	<0.005
	Absent	28	70	

HIE- Hypoxic ischemic encephalopathy, <0.005= statistically significant

Table III: Association of fetal risk factors with MAS

Fetal risk factors like condition of the baby at birth, need of resuscitation, DOWNE'S score, development of HIE were statistically significant (<0.005). Fetal weight, sex, fetal tachycardia, fetal bradycardia and decreased movements were statistically not significant. (Table III)

Complications: MSAF babies who developed MAS (40) were associated with development of complications which included

respiratory distress as the main complication accounting for 57.5 % and pneumonia in 5% followed by sepsis (30%), hypoxic ischemic encephalopathy (25%), and meningitis (10%). 10% of babies with MAS did not develop any complications. (Figure 2)

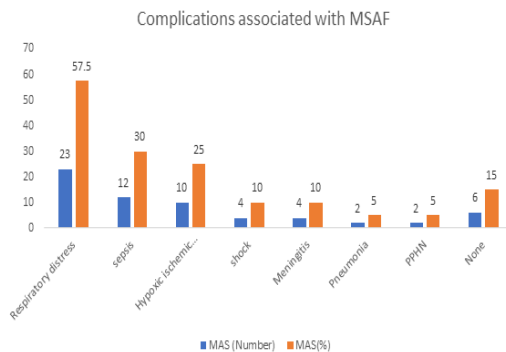


Figure 2: Complications babies born with MSAF

Outcomes of babies: All babies born with meconium stained amniotic fluid, but didn't develop MAS, were healthy and discharged. Among 40 babies who developed MAS, 5 (12.5%) showed no improvement, so 3 went in left against medical advice and 2 of them expired. However, 35(87.5%) improved and were discharged.

DISCUSSION

Out of 300 MSAF babies, 40 (13.4%) babies developed MAS. This was similar to the result of study conducted by Gauchan E et al where MSAF was seen in 13.4% and MAS developed in 1.13% of total deliveries; 8.4% of babies born through meconium-stained liquor.⁴ The study done by Bhat R Y showed MAS occurred in 11.3% of babies born through MSAF5 while in other studies it varied from 1% to 38.5%.⁶⁻¹⁰

In our study, postdated pregnancy was seen in 156 (52%) out of the MSAF but was statistically not significant. Overall, the percentage of MAS in term babies was (12.9%), but postdated and post-term groups when combined showed higher frequency of MAS (17%).

In Gauchan E et al study, postdatism was seen in 36 (46.2%) cases but this was statistically not significant, similar finding was seen in our study in which MAS was seen with the increasing gestational age, but no association was seen between the gestational age and development of MAS.⁴ Greenwood C et al also found meconium passage is more common with increasing gestationage.¹¹ In our study, maternal age and parity of mothers were statistically not significant, no association was present between development of MAS and age, parity of the mother which was similar to other studies.^{12,14} A similar study conducted by Sundaram R et al showed no association between maternal age, gestational age, parity with MAS.¹³ In our study association between mode of delivery and MAS was statistically significant, MAS was more common in babies delivered via vaginal delivery. Some studies have shown MAS to be more common in babies born through vaginal route.¹⁴ In the study done by Raju V et al¹⁶, majority of MSAF babies were

delivered through cesarean section similar to the study done by of Gupta V et al.¹⁰ In our study, out of 40 MAS cases, 28 (14.8%) were males and 12 (10.8%) female. Gender was not found to be statistically significant risk factor for MAS In a study by Milind B et al, male were more in numbers than females and the male to female ratio was 1.93:1.¹⁷ In study by Rajput S S et al high prevalence of MSAF was seen in male neonates with an incidence of 65.2%.¹⁸ In our study, PROM (50%) and prolonged labor (50%) was found to be significant. Naveen et al found prolonged labour to be a significant risk factor for meconium-stained amniotic fluid.¹⁹ A similar study by Gurubacharya S M et al, PROM was a significant risk for the development of MAS.²⁰

In our study various fetal risk factors were significantly associated with MSAF i.e., non-vigorous babies at the time of birth, mode of resuscitation, low APGAR score at 1 & 5min, DOWNE'S score and HIE. Twenty percent (20%) of babies with MSAF had low Apgar scores in the study done by Mundraetal.²¹ In a similar study conducted by Gurubacharya S M et al, found APGAR score at 1,5 minute and requirement of resuscitation as significant factors contributing to increased incidence of MAS.²⁰ In our study 5 (12.5%) babies did not show improvement and 2 (0.6%) expired which was similar to study done by Gupta V et al.¹⁰

CONCLUSION

Babies born with MSAF developing MAS had both maternal and fetal risk factors. Major maternal risk factor were premature rupture of membrane, prolonged labour, mode of delivery, major fetal risk factors were non vigorous baby at birth, need of resuscitation were significant risk factors. Most of babies developed respiratory distress as main complication.

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