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Original Research Article

Assessment of incidence, determinants and co-morbidities associated with meconium aspiration syndrome: a hospital based study

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ABSTRACT

Background: Meconium aspiration syndrome (MAS) was found to be major contributing factor towards perinatal morbidity and mortality. This condition is mainly accompanied with respiratory failure, pulmonary air leaks and pulmonary hypertension in neonates. A conservative approach of obstetrician-paediatrician combination moderates incidence of MAS and its complications. The objective of the study was to determine the incidence, determinants and co-morbidities associated with MAS in both intramural and out born admitted to the NICU and SNICU of a Chandulal Chandrakar memorial hospital located in Bhilai, Chattisgarh, India.
Methods: This was a prospective study conducted in Chandulal Chandrakar memorial hospital, Bhilai from 1st September 2013 to 31st February 2015, in newborns with history of meconium stained amniotic fluid (MSAF) in both out-born and inborn units. Neonates who met inclusion criteria they were included in the study. The data were recorded in predesigned proforma. The data was analyzed using Chi square test. Level of significance of this data was set at $p < 0.05$.
Results: Incidence of MSAF in the in-born and out-born among all children admitted was 52.4% and 47.5% respectively. Out of total 202 subjects of MSAF, those with MAS were 29.7% and of these 75% were inborn and 25% were out-born. Male preponderance was high in the study compared to female babies. Incidence of MAS was significantly more in children of >2.5 kgs (80%) and common in primiparous mothers (60%) with lower segmental caesarian sections. MAS commonly seen in post -term babies (53.33%) than those of term (36.66%) or pre-term (10%) gestation. Fetal distress was the common complication observed in most of the cases (91.1%) and one death related to this was noted. At the end of 1 year there were predominantly more children (40%) who developed respiratory morbidities. Delayed development was seen among 13.3% children and transient tone abnormalities were noted in about 2% of infants.
Conclusions: The overall incidence of MAS was found to have been 30% among cases of MSAF, which was relatively higher due to delayed referral. This percentage could have been reduced along with associated co-morbidities with appropriate antenatal check-up's and timely referral.

Keywords: MAS, Meconium stained amniotic fluid, Inborn, Out-born

INTRODUCTION

The most important consequence for a neonate born through meconium stained liquor (MSL) is meconium aspiration syndrome (MAS), and it occurs in 1-3% of live births.[1,2] The passage of meconium by the fetus occurs in 10% -15% of all live deliveries whereas the syndrome of meconium aspiration occurs in 10%-30% of all meconium stained infants and this approximates up to 1-3% of all live born infants.[3] This has been found to be a

major contributing factor towards perinatal morbidity and mortality.[4]

Meconium can be removed from the airways by orpharyngeal suctioning done by the obstetricians when the head is at the perineum followed by immediate tracheal suctioning by the pediatrician. This active obstetric-pediatrician combined intervention as compared to a conservative approach practiced previously has been shown to reduce MAS and its complications.[5] However, despite active management, some newborn infants still develop MAS and its complications including neonatal sepsis and need admission in neonatal intensive care units (NICU) and septic neonatal intensive care units (SNICU). They are supposed to have aspirated meconium in utero as a result of fetal distress due to asphyxia alone, accompanied by reactive airway changes.[6]

This study was undertaken to study the incidence, determinants and co-morbidities associated with MAS in both intra-mural and out born babies admitted to the NICU and SNICU of Chandulal Chandrakar memorial hospital in Bhilai, Chattisgarh, India.

METHODS

This was a prospective study conducted in Chandulal Chandrakar memorial hospital, Bhilai from 1st September 2013 to 31st Febrauary 2015. Babies born with history of meconium stained amniotic fluid (MSAF) in both out-born and in born umits were enrolled.

All inborn and out-born with MSAF related respiratory distress and babies showing features of meconium in the upper respiratory tract, skin/umbilical cord or on chest examination with respiratory distress were included in the study. Exclusion criteria were babies with congenital anomalies and babies born of breech or other abnormal presentations. The sample size was calculated using Cochran formula and the adequate sample size is found to be sixty (60).[7]

MAS was diagnosed when neonate had respiratory distress in the presence of meconium stained liquor with onset within first 24 hours of life, and a chest x-ray showing non homogenous infiltrates with or without hyperinflation. Babies born through MSL were managed as per National resuscitation program guidelines. The gestational age was assessed as per new Ballard score. Babies who had significant respiratory distress were started on non-invasive ventilation, continuous positive airway pressure (CPAP) or mechanical ventilation when indicated. The data was collected for variables and determinants related to MSAF and development of MAS.

Blood samples were collected from babies and analysed for complete blood count and blood culture. Chest X-rays was done interpreted and managed immediately. The babies were followed up for 1 year after discharge and their developmental growth were estimated.

Statistical analysis

Differences between categorical data was analysed with Chi square test. To describe the data, minimum, maximum, mean, range and standard deviation or medians were reported for continuous variables. For categorized variable, percentage was used. P value <0.05 was considered to be significant.

RESULTS

In total 405 inborn and 707 out-born babies were included during study period. Incidence of MSAF among the admissions in our hospital is 18.16%. Incidence of MSAF in the in-born and out-born babies among all children admitted in NICU and SNICU were 52.4% and 47.5% respectively as given in Table 1.

Table 1: Relation of total admissions with babies having MSAF.

	Total admissions	Babies with MSAF
SNICU	707 (63.5%)	96 (47.5%)
NICU	405 (36.4%)	106 (52.4%)
Total	**1112**	**202**

NICU: neonatal intensive care unit; SNICU: septic NICU.

Out of total 202 subjects of MSAF, children with MAS were 29.7% and among these 75% were inborn and 25% were out-born with MAS as in Table 2.

Table 2: Relation of total admissions with MSAF with MAS.

Meconium aspiration syndrome		
	Present	**Absent**
SNICU	15 (25%)	81 (57.04%)
NICU	45 (75%)	61 (42.95%)
Total	**60**	**142**

Of total admissions in the hospital, males with maximum incidence of MSAF were 52.58% in inborn and 47.41% in out-born. Among total female admissions maximum incidence of MSAF was 52.32% in inborn and out-borns were 47.67% as shown in Table 3.

Table 3: Relation of total admissions among male and female babies with those with MSAF.

Male babies	Total	MSAF
SNICU	412 (58.02%)	55 (47.41%)
NICU	298 (41.97%)	61 (52.58%)
Total	**710**	**116**
Female babies		
SNICU	295 (73.38%)	41 (47.67%)
NICU	107 (26.61%)	45 (52.32%)
Total	**402**	**86**

From Table 4 it was observed that MAS was more commonly seen among male and female in-born than out-born.

Table 4: Relation of admissions among male and female babies with MSAF with those having MAS.

Male babies	Meconium aspiration syndrome	
	Present	**Absent**
SNICU	8 (22.85%)	47 (58.02%)
NICU	27 (77.14%)	34 (41.97%)
Total	**35**	**81**
Female babies	**Meconium aspiration syndrome**	
	Present	**Absent**
SNICU	7 (28%)	34 (55.73%)
NICU	18 (72%)	27 (44.26%)
Total	**25**	**61**

Figure 1 presents the incidence of MAS among children more than 2.5 kgs and considered as one of the important determinant of MAS. Good weight children were more commonly post-dated and develop MAS. The difference between the birth weight was statistically significant (p <0.05) and Chi square value was 4.84, d, f.-1.

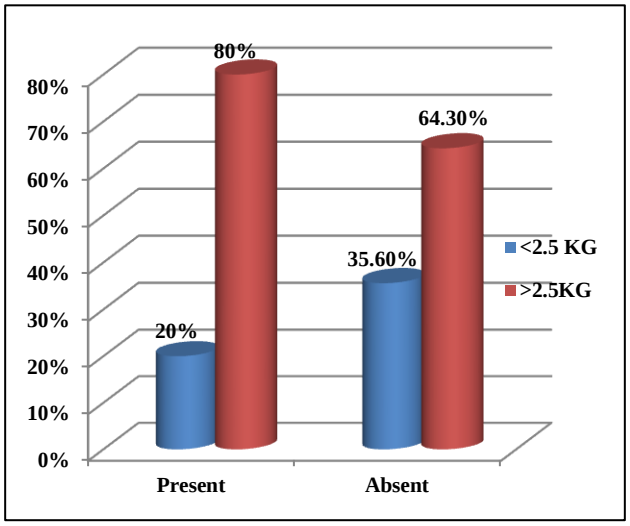

Figure 1: Relationship of birth weight with MAS.

Gestational age was also considered as one of the important factor for development of MAS as presented in Figure 2. Meconium aspiration syndrome was more commonly seen among post-term babies (53.33%) than those of term (36.66%) or pre-term (10%) gestation. The Chi square value is 3.719, d.f.-2 with p >0.05.

Meconium aspiration syndrome was more common among babies born via lower segment caesarean section (71.66%) than vaginal delivery (28.33%).This observation may be probably owing to fetal distress indicating the need for emergency (Figure 3) but the difference is not statistically significant (p >0.05) with Chi square value -0.141, d.f.- 1.

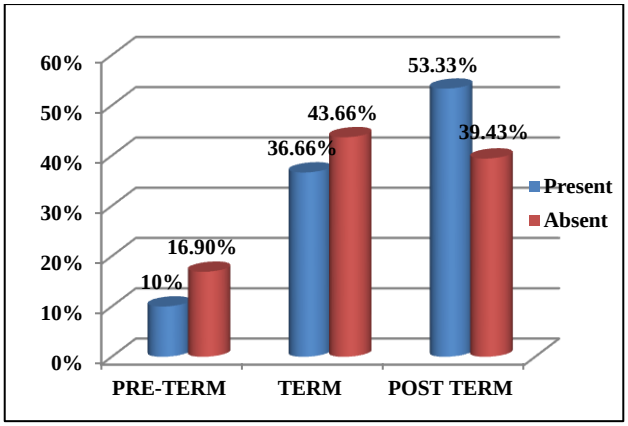

Figure 2: Relationship of gestational age with MAS.

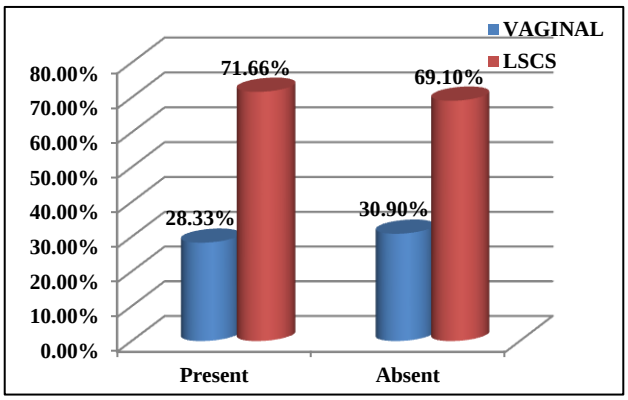

Figure 3: Relation of mode of delivery to MAS.

Figure 4 presents the relation of parity with MAS. It was more common among primi-parous (60%) mothers than multiparous (40%) mothers. The Chi square value is 0.012, d.f.-1 and the difference was not significant (p >0.05).

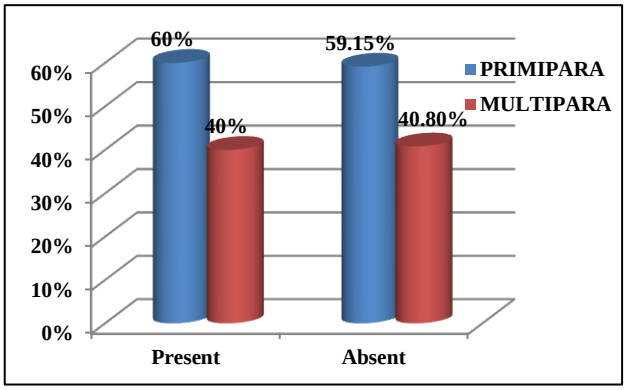

Figure 4: Relationship of parity with MAS.

Fetal distress was the most common feature among babies with MAS and it was present in 41 (91.11%) babies out of 45 as given in Table 5. There was highly significant association with fetal distress when compared with presence of MAS (p <0.001). Chi square value-11.37, d.f.-1.

Table 5: Relationship of fetal distress with MAS.

Fetal distress	Meconium aspiration syndrome	
	Present	Absent
ABSENT	4 (8.88%)	23 (37.70%)
PRESENT	41 (91.11%)	38 (62.29%)
Total	**45**	**61**

Chi square value: 11.37, d.f.:1.

Among 60 neonates with MAS, 59 survived (98.33%) and 1 was declared dead (1.66%) with MAS. Among children with MSAF 6 were declared dead (4.22%) and these deaths were attributed to sepsis and hypoxic brain damage in addition to MSAF.

The mortality rate was significantly reduced in neonates with these complications in our setup due to better management of these risks ($p<0.005$).

At the end of 1 year there were predominantly more children (40%) who developed respiratory morbidities.

Delayed development was seen among 13.3% children, transient tone abnormalities were noted in about 2% of infants, however 26 (43.33%) children, did not develop any morbidities on follow up as shown in Table 7.

Table 6: Outcomes among babies with MAS in terms of survival.

Immediate outcome	Meconium aspiration syndrome	
	Present	Absent
Deaths	1 (1.66%)	6 (4.22%)
Discharges	59 (98.33%	136 (95.77%)
Total	**60**	**142**

Table 7: Outcome on follow-up after one year.

Follow up		No of babies	%
Respiratory system	Bronchopneumonia	18	30
	Bronchiolitis	6	10
CNS	Delayed developmental milestones	8	13.33
Sepsis		2	3.33
Normal on follow up		26	43.33
Total		**60**	**100**

Hyperinflation was seen as predominant radiological findings in 25 (41.7%) neonates closely followed by infiltration and streaking in 24 (40%) neonates. Pneumothorax was observed in 11(18.3%) children. Sepsis was more commonly associated among babies with hyperinflation on chest radiograph as presented in Table 8.

Table 8: Association of MAS with radiological findings with respect to comorbid conditions and long term follow-up.

Radiological Findings	N (%)	CVS ,CNS and other co morbid conditions	Follow ups
Infilteration and Streaking	24 (40%)	Sepsis-6; H2-3	Br-3, Bo-4, DD-5
Hyperinflation	25 (41.67%)	Sepsis-11; H2-2; H3-1	Br-11, Bo-0, DD-2
Pneumothorax (IB and OB)	11 (18.3%)	Sepsis-6; H2-2	Br-5, Bo-1, DD-1
Consolidation	1 (1.7%)	Sepsis-1	Bo-1
Collapse	1 (1.7%)	H2-1	Br-1

CVS = Cardiovascular system, CNS = Central nervous system, H2 = Hypoxic Ischaemic Encephalopathy stage, H3 = Hypoxic Ischaemic Encephalopathy stage 3, Br = Bronchopneumonia, Bo = Bronchiolitis, DD = Delayed development.

DISCUSSION

This study was conducted to determine the incidence, determinants and comorbidities associated with MAS in neonates admitted in NICU and SNICU whether inborn or referred from other places of birth for management in a tertiary care hospital. In this study a total of 1112 neonates were admitted in the hospital. Of which 707 were out-born cases and 405 were in-born cases. The number of out-born versus inborn neonates studied (63.5% vs. 36.4%) were similar to a study by Orimadegun et al and Owa et al.[8,9] Among them 202 had meconium stained amniotic fluid in which 60 cases had meconium aspiration syndrome. Of total new-born studied, male preponderance of admission into SNICU and NICU was noted similar admission pattern observed in study conducted by Roy et al.[10]

The demographic distribution of population in this study (male/female and preterm/term) was in concordance to National Neonatal-Perinatal Database (NNPD) and other studies of rural India.[11,12] The study shows a high male:female ratio. In the present study of 60 cases, 25% of cases were admitted in SNICU with MAS and 75% of cases in NICU. The percentage of MSAF (18.16%) cases reported in the present study were almost similar to the cases described by Gupta et al in which they evaluated 14.3% of MSAF cases.[13] The present study reported very high incidence of MAS cases (29.7%) as compared to other studies like Wiswell et al (5.41%) and Davis et al (2.1%).[14,15] This could be due to delayed referral at our centre from peripheral low lying villages and health centers. In the present study, sepsis associated MAS was reported in 35% of babies after birth. Similar observation were made in the study of Anwar et al (27.5%).[16]

He described infection was an important complication especially associated with a longer stay in the unit. Sepsis was strongly suspected or proven in 48% of the expired babies who had stayed beyond 3 days in the hospital even though antibiotics had been started in all admitted babies. High contribution to mortality by sepsis has been documented in other studies as well.[17,18]

In the Gregory et al study, it was found that the incidence of pneumothorax (40%) was higher in the out born babies.[19] Anwar et al study also reported about total 11% in-born and out-born neonates developed pneumothorax.[16] Similar results were also found in the present study in which 18.3% of both inborn and out-born developed pneumothorax and required mechanical ventilation implicating the importance of early intervention in preventing complications.

CONCLUSION

The overall incidence of MAS was found to have been 30% among cases of MSAF, which was relatively higher due to delayed referral. This percentage could have been reduced along with associated co-morbidities if antenatal check-up and timely referral during perinatal period was done. Among the variables birth weight and fetal distress were significantly associated with MAS. Hence it is necessary to intensively monitor these fetuses during intra-partum period with a cardio-tocogram to assess for fetal compromise (hypoxia, cord compression etc). This study gave an overview on meconium aspiration cases in the present area and its determinants. However further research with large sample size is needed to support these observations in the present study.

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