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Research Article

MORBIDITY AND MORTALITY PROFILE OF BABIES BORN THROUGH MECONIUM STAINED AMNIOTIC FLUID AND ADMITTED IN NEONATAL INTENSIVE CARE UNIT (NICU) OF TERTIARY CARE HOSPITAL IN NORTH INDIA

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ABSTRACT

Objective: The aim of the study was to evaluate incidence, morbidity, and mortality of babies born through meconium stained amniotic fluid (MSAF).

Methods: It was a prospective and observational study, conducted in NICU of Government Medical College Hospital Patiala from January 2020 to June 2021. Babies born through MSAF and had meconium aspiration syndrome (MAS) were subjects of the study. Outcome measures were morbidity and mortality of babies with MAS.

Results: Out of 5175 babies during study period, 412 babies were born through MSAF, giving an incidence of 7.96%. MAS was seen in 121 babies. Majority of babies with MAS were term and low birth weight. Mean (SD) weight of babies was 2346±628 g. Morbidity of MAS was in the form of shock (34.7%), persistent pulmonary hypertension (31.4%), perinatal asphyxia (30.6%), sepsis (28%) followed by acute kidney injury (27.2%), hypoxic ischemic encephalopathy (HIE) (21.5%), and polycythemia (16.5%). Causes of mortality were perinatal asphyxia (84.6%), HIE (50%), shock (42.3%), persistent pulmonary hypertension (38.5%), and sepsis (31%). Mean (SD) weight of babies who expired was 2025±835 g.

Conclusion: Morbidities associated with MAS were shock, persistent pulmonary hypertension, perinatal asphyxia, and sepsis whereas predominant cause of mortality was perinatal asphyxia.

Keywords: Meconium stained amniotic fluid, Meconium aspiration syndrome, Neonate.

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INTRODUCTION

Approximately 7–22% of all live births have meconium stained amniotic fluid (MSAF) [1,2]. Meconium aspiration syndrome (MAS) is defined as respiratory distress in an infant born through MSAF whose symptoms cannot be explained otherwise. Development of respiratory distress is soon after birth with radiological evidence of aspiration pneumonitis (atelectasis or hyperinflation) in the presence of meconium staining of the liquor/staining of nails or umbilical cord or skin [3].

Perinatal asphyxia and hypoxic ischemic encephalopathy (HIE), persistent pulmonary hypertension of neonate (PPHN), septicemia, myocardial dysfunction, and acute kidney injury (AKI) are common morbidity associated with MSAF and MAS. A varied range of mortality from 5 to 40% of MAS has been found. With recent studies, showing <15% mortality, various causes of mortality in MAS include severe perinatal asphyxia and HIE, PPHN, myocardial dysfunction, and septic shock leading to cardiorespiratory failure. PPHN, pneumothorax birth asphyxia, need for respiratory support in first 48 h of life, and need for vasopressor support are independent predictors of mortality [4]. Thus, aggressive management in high risk babies must be started early to prevent mortality. Hence, the present study was planned to assess morbidity and mortality of babies born with MSAF in tertiary care center.

METHODS

This was a prospective and observational study conducted on neonates born with MSAF admitted in NICU of Department of Pediatrics, Government Medical College Patiala. The study period was from January 2020 to June 2021. Approval for the study was taken from Research and Institute Ethical Committee, Government Medical College, Patiala, wide number 12566. Informed consent was taken from parents of babies. Maternal and neonatal data were recorded on a predesigned proforma. Neonates were classified as pre-term, term and post-term. Pre-term were babies born up to 36 completed weeks of gestation, term born from 37 to 41 completed weeks and post-term were babies born 42 completed weeks or beyond [5]. Neonates were designated as appropriate for gestational age (AGA) when birth weight was between 10^{th} and 90^{th} percentile of the weight for that gestational age. Small for gestational age (SGA) when birth weight was <10^{th} percentile for that gestational age and large for gestational age when birth weight was >90^{th} percentile for that gestational age [6].

Babies were observed for:

- Perinatal Asphyxia: which was defined as per NNPD network definition of perinatal asphyxia, that is, Apgar <7 at 1 min of age. Slow/gasping breathing or An Apgar of 4–6 at 1 min and no breathing or Apgar 0–3 at 1 min was defined as moderate and severe asphyxia, respectively [7].
- MAS: It was described as development of respiratory distress soon after birth with radiology findings of aspiration pneumonitis (atelectasis or hyperinflation) in the presence of meconium staining of the liquor, or staining of nails, umbilical cord, or skin [3].
- Need of oxygen through hood or prongs/CPAP/mechanical ventilation.
- HIE: A diagnosis of HIE was made based on Sarnat and Sarnat staging in babies with perinatal asphyxia [8].

Myocardial dysfunction

It was diagnosed on basis of edema, third space fluid collection, hepatomegaly, S3 gallop, or cardiogenic shock, manifesting as with capillary refill time >3 s or low blood pressure along with elevated creatinine-phosphokinase myocardial band (CPK-MB >75 IU/L) [4]. The bedside 2D-echocardiography facility is not available at our center.

AKI was defined as abrupt decrease in glomerular filtration rate with/without underlying structural abnormalities. The condition often presents with diminished urinary output and or elevation of serum creatinine and other electrolyte abnormalities [9].

PPHN was defined on the basis of labile oxygen saturation, a preductal and post-ductal oxygen saturation difference of >10% with or without the presence of echocardiographic evidence of PPHN [10].

Sepsis

Neonatal sepsis is a clinical syndrome characterized by signs and symptoms of infection with or without accompanying bacteremia in 1st month of life. For the purpose of this study, we analyzed the changes in septic screen markers. Septic screen was considered to be positive if 2 or more of the following markers are abnormal:

Absolute neutrophil count: Low counts as per Manroe chart for term and Monzinhos chart for very low birth weight babies, I/T ratio >0.2, C reactive protein >1 mg/dL, and Micro ESR >15 mm in 1st h [11,12].

Polycythemia

It was defined as hematocrit of >65% or a hemoglobin concentration of more than 22 gm/dL [13].

Table 1: Maternal Characteristics Associated With MSAF and MAS

Characteriatics	MSAF (n=398)			MAS (n=121)		
	Frequency	Percent	p-value	Frequency	Percent	p-value
Parity						
Primipara	225	56.5	0.042*	65	53.7	0.088
Multipara	173	43.5		56	46.3	
Comorbidities						
Gestational DM	11	5.5	0.041*	7	7.5	1.76
Gestational HT	35	17.6		12	12.9	
PIH	22	11.1		10	10.8	
Anemia	11	6.5		8	8.6	
OH	19	9.5		12	12.9	
PROM	34	17.1		16	17.2	
Others	67	33.7		28	30.1	
MOD						
LSCS	218	52.9	0.75	64	54.8	0.085
NVD	180	47.1		57	45.2	

DM: Diabetes mellitus, HT: Hypertension, PIH: Pregnancy-induced hypertension, OH: Oligohydramnios, PROM: Prolonged rupture of membranes, MOD: Mode of delivery

Table 2: Clinical profile of babies born with MSAF and MAS

Parameter	MSAF (n=398)			MAS (n=121)		
	Frequency	Percent	p-value	Frequency	Percent	p-value
Gestation						
Pre-term	120	30.2	0.001**	48	39.7	0.02*
Term	268	67.3		69	57.0	
Post-term	10	2.5		4	3.3	
Mean(w)	37.5±2.6			36.86±2.93		
Gender						
Female	181	45.5	0.913	50	41.3	0.50
Male	217	54.5		71	58.7	
Weight (g)						
≤1499	13	3.27	0.001**	12	9.92	0.001**
1500–1999	63	15.83		23	19.0	
2000–2499	115	28.89		36	29.7	
2500–2999	117	29.4		30	24.7	
3000–3499	63	15.83		16	13.2	
≥3500	27	6.78		4	3.31	
Mean weight (g)	2531±606			2346±628		
Weight for gestational age						
SGA	95	23.9	0.033*	34	28.1	0.006**
AGA	289	72.6		83	68.6	
LGA	14	3.5		4	3.3	
Apgar at 1 min						
>6	361	90.7	0.015*	84	69.4	0.27
4–6	241	6.03		24	19.8	
<4	13	3.27		13	10.7	
Apgar at 5 min						
>6	373	93.7		96	79.3	
4–6	16	4.0		16	13.2	
<4	9	2.2		9	7.4	
Mode of resuscitation						
Nil	239	60.1	0.003**	12	9.9	0.039*
Tactile stimulation	67	16.8		18	14.9	
Bag and mask ventilation	57	14.3		56	46.3	
Bag and tube ventilation	35	8.8		35	28.9	

SGA: Small for gestational age, AGA: Appropriate for gestational age, LGA: Large for gestational age

Table 3: Morbidity profile of babies with MAS

Morbidity	Number (% age)	Gestational age			Weight for gestational age			
		Pre-term	Term	Post-term	SGA	AGA	LGA	p-value
Perinatal Asphyxia	37 (30.6)	8	28	1	14	21	2	0.013*
Shock	42 (34.7)	12	30	0	9	32	1	0.008**
AKI	33 (27.2)	10	23	0	10	22	1	0.004**
PPHN	38 (31.4)	17	20	1	9	27	2	0.023*
Sepsis	35 (28.9)	12	23	0	10	24	1	0.002**
HIE	26 (21.5)	10	16	0	8	18	0	
Polycythemia	20 (16.5)	11	9	0	4	16	0	

AKI: Acute kidney injury, PPHN: Persistent pulmonary hypertension, HIE: Hypoxic ischemic encephalopathy

Table 4: Clinical profile of expired babies with MAS (n=26)

Parameter	Frequency	Percentage
Gestation		
Pre-term	12	46.15
Term	13	50
Post-term	1	3.8
Weight for gestation		
SGA	8	30.76
AGA	17	65.38
LGA	1	3.8
Gender		
Male	13	50
Female	13	50
Birth weight (g)		
≤1499	6	23.08
1500–1999	7	26.92
2000–2499	6	23.08
2500–2999	4	15.38
3000–3499	1	3.85
≥3500	2	7.69
Mean weight (g)	2025.5±835	
Apgar at 1 min		
>6	4	15.38
4–6	9	34.6
<4	13	50
HIE	13	50
Shock	10	38.46
Hospital stay (d)		
<7	19	73.1
7–14	7	26.9
Mean stay (d)	4.34±3.2	

SGA: Small for gestational age, AGA: Appropriate for gestational age, LGA: Large for gestational age, HIE: Hypoxic ischemic encephalopathy

Data so obtained were analyzed statistically using non-parametric Chi-square tests and $p<0.05$ was considered as significant.

RESULTS

During the study period, 5175 newborns were delivered, out of which 412 were born through MSAF giving an incidence of 7.96%. However, 14 newborns were referred due to non-availability of ventilator at that time in our NICU. These newborns were not included in the study. Three hundred and ninety-eight newborns were subjects of the study. Out of 398, 121 newborns had MAS as shown in Fig. 1.

Maternal data and mode of delivery are shown in Table 1.

In comorbidities, were included antenatal risk factors. Other comorbidities included abruptio placenta, anhydramnios, Hepatitis B positive, Hepatitis C positive, hypothyroidism, intrahepatic cholestasis of pregnancy, polyhydramnios, placenta previa, and thrombocytopenia. Clinical profile of babies is shown in Table 2.

The gestational and birth weight distribution in both MSAF and MAS group was statistically significant as shown in Table 2. 40% of pre-term and post-term babies with MSAF developed MAS. Whereas 57% of term babies with MSAF had MAS. 37 babies had birth asphyxia.

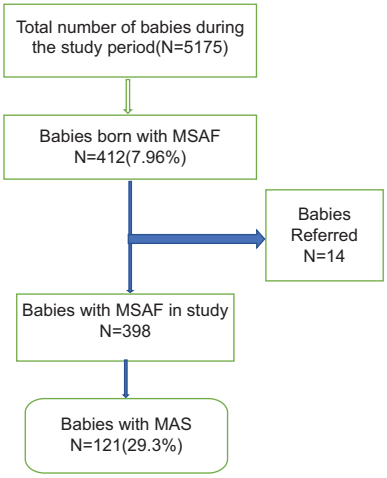

Fig. 1: Flow diagram of patients included in the study

Shock was predominant morbidity seen in 34.7% followed by PPHN in 31.4% as shown in Table 3.

Morbidity parameters are not mutually exclusive

Myocardial dysfunction (CPK-MB>75 IU/L) was observed in 20 babies with shock. HIE was observed in 26 babies. HIE Stage I, II, and III was observed in 5,12,9 babies. The distribution of individual morbidity as per weight for gestational age was statistically significant as shown in Table 3.

Twenty-six (21.5%) neonates with MAS expired, 90 (74.4%) were discharged and 5 (4.1%) left against medical advice. Maximum (50%) babies who expired were term and AGA. Maximum deaths were seen in early neonatal period as shown in Table 4.

The perinatal asphyxia was observed in maximum number of expired babies (84.6%) followed by HIE (50%), shock (42.3%), PPHN (38.5%), and sepsis (31%) as shown case-wise in Fig. 2.

Mortality profile parameters are not mutually exclusive.

DISCUSSION

In the present study, incidence of MSAF was 7.96% and MAS was 29.3%. Similar incidence has been reported in the literature [14,15]. Although MSAF is less than reported by Dilli [16] and Singh *et al.* [17] due to difference in inclusion criteria in their study which included more mothers with pre-eclampsia. Incidence of MAS in the present study is more than reported by various authors [14-16], as our institute, a tertiary care center gets a greater proportion of high-risk pregnancies in late 3rd trimester/labor. Many women diagnosed with MSAF are

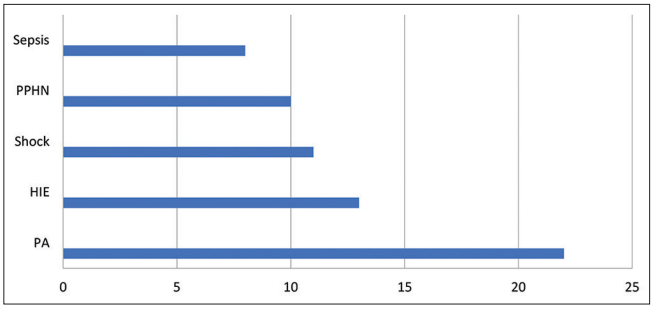

Fig. 2: Mortality profile of babies with MAS. PPHN: Persistent pulmonary hypertension, HIE: Hypoxic ischemic encephalopathy, PA: Perinatal asphyxia

referred from primary health center to our institute for further management. Baby remains in hypoxic environment for long time, hence MAS. MAS was more in term, male babies born through LSCS, as reported in the literature by various authors.

Mean weight of babies with MAS was 2346±628 g which is less than reported by other authors as most of them had term and post-term babies in their study [15,18]. Gestational hypertension was most prominent comorbidity associated with MSAF in the present study, as also reported by other authors [16,19].

The most common morbidity in the present study was shock (42 babies) followed by PPHN and perinatal asphyxia. Shock was more than reported in other studies [4,18]. It can be due to more number of pre-term babies in present study (37%) than above studies. PPHN was also more as it was diagnosed clinically; bed side echocardiography is not available in our center. Perinatal asphyxia was similar to other studies in the literature [16,20] but some authors have found lower incidence of asphyxia in their study due to higher number of term and post-term babies in their study [14] and more number of pre-term babies in the present study. Mechanical ventilation as a mode of respiratory support was given in 35.5% of babies as reported same by others [4,16,18]. About 21.5% of babies with MAS had HIE, incidence is less as compared to reported in the literature. Polycythemia was observed in 16.5% of babies as has also been reported by Behera *et al*. [21] who had incidence of 14.3%.The raised PCV in MAS babies may be due to perinatal hypoxia in these babies. Myocardial dysfunction was observed in 50% of babies due to more number of pre-term babies in the present study.

Case fatality rate of MAS was 21.5% in our study which was more than reported by Dilli *et al*. [16] (10.47%). This discordance might be due to the high number of infants with birth weight of <2000 g in our study than reported by Nath in their study where there were only two neonates <2500 g out of 58 neonates with MAS.

When gender, birth weight, and gestational age of expired babies were compared, not many studies have analyzed the same. Louis *et al.* [4] have same weight and gender distribution in expired babies (45% males, 55% females, 67.1% <2500 g, and 45% SGA). In the present study, it was 50% males, 50% females, 73.1% <2500 g, and 45% SGA. However, pre-terms were having higher mortality rate in the present study (61.5%) due to more comorbidities in them as compared with 27% as reported by Louis *et al*.

In the present study, neonates with MAS that expired had multiple comorbidities that had complicated their hospital course and management. Incidence of comorbid conditions such as HIE, shock, myocardial dysfunction, and sepsis was marginally lower than compared to reported by others [4,21-23] Whereas incidence of PPHN in the deceased in the present study was higher in the study by Lin *et al.* [22] and was almost comparable to that by Louis *et al*. [4].

CONCLUSION

MAS was associated with multiple comorbidities such as perinatal asphyxia, shock, PPHN, and often required mechanical ventilation. Perinatal asphyxia was the most common cause of mortality. Hence, a neonate with MAS should be monitored for multiorgan involvement. Adequate management of these comorbidities may also lead to decrease in case fatality rate. We must aim to prevent MSAF.

ETHICS CLEARANCE

An institutional ethical approval was obtained before the commencement of the study.

AUTHORS' CONTRIBUTIONS

JS and MS: Concept and design of the study; SM and JS: Drafting the manuscript and review of literature; and MS and SM: Critical review of the manuscript for intellectual content. All authors approved the final version.

COMPETING INTERESTS

The authors declare that there are no conflicts of interest.

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