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Frequency and Outcome of Meconium Aspiration Syndrome in Babies Born with Meconium-Stained Liquor at Secondary Care Hospital in Pakistan: A Case Series Study

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Abstract

Background: Meconium aspiration syndrome (MAS) in the newborn is characterized by hypoxia, hypercapnia, and acidosis. MAS is a leading cause of morbidity and mortality in neonates. The primary objective of this study was to estimate the frequency of meconium aspiration syndrome (MAP) in babies born with meconium-stained liquor. The secondary outcome was to estimate the meconium aspiration syndrome; in terms of hospital stay, complications, and mortality. **Methods:** The study was done at Aga Khan Maternal and Child Care Centre, Hyderabad, Pakistan. Study design was case series and the duration of the study was of 6 months. All patients who fulfilled the inclusion criteria were included in the study after taking informed written consent. A brief history was taken, clinical examination was done and laboratory investigations were sent to the institutional laboratory. Study outcomes were measured from this data *i.e.* MAS, its complications, mortality, and a number of days in the hospital. **Results:** A total of 87 babies born with meconium-stained liquor at secondary care hospital were included. A total of 45 patients (52%) were males and 42 patients (48%) were females with a mean gestational age of babies 38.896 ± 1.210 weeks. The mean Apgar score at 5 minutes was 8.896 ± 0.404. MAS was present in 13 patients (14.9%). Complications were seen only one patient (1.1%) and there was no neonatal death reported. **Discussion:** MAS was present in 14.9% of babies; the complication of subacute bacterial infection was low seen in just 1.1% cases with no neonatal mortality.

Keywords

Meconium Aspiration Syndrome, Mortality, Neonates, Outcome

1. Introduction

Meconium aspiration syndrome (MAS) is defined as respiratory distress in newborn born through meconium-stained amniotic fluid whose symptoms cannot be otherwise explained [1]. Meconium is the dark green, sterile fecal material that is produced in the intestine before birth. Normally, meconium is expelled only after birth when newborns started to feed. However, in response to stress, such as an inadequate level of oxygen in the blood, the fetus may pass meconium into the amniotic fluid [2]. Either in utero or with the first breath, thick, particulate meconium is aspirated into the lungs. The resulting small airway obstruction may produce respiratory distress within first hours, with tachypnea, retractions, grunting, and cyanosis [3].

MAS in the newborn is characterized by hypoxia, hypercapnia, and acidosis. Although the pathophysiology of this syndrome is not completely understood, recent advances in management and respiratory care have decreased the mortality rate substantially. Perinatal hypoxia, airway obstruction shortly after birth, and significant pulmonary vasoconstriction and hypertension are the three major causes of mortality and morbidity [4].

Meconium aspiration syndrome (MAS) is a leading cause of morbidity and mortality in term infants [5]. Meconium-stained amniotic fluid is found in 10% - 15% of births and usually occurs in term and post-term infants [3]. International data found the incidence of meconium aspiration syndrome (MAS) to be 4.3%. Pneumothorax remains an important complication of MAS, occurring in 9.6% of MAS and the median number of days stayed in the hospital was 13 days in an international study [6]. Death directly related to meconium aspiration syndrome was reported to be 2.5% [6].

According to a local study, in the urban Pakistani population, the frequency of meconium aspiration syndrome in meconium stained liquor was observed to be 17.4% [7], which is significantly higher than the developed countries. The neonatal mortality from MAS is also very high, reported in Pakistan study as 14% [7]. One study recorded it as high as 32% [8].

As risk factors of meconium aspiration vary in different settings, so this study will help us in finding out the frequency of MAS in our local population of Hyderabad which is the fifth largest city of Pakistan as per population and the data in secondary care facilities is lacking. Furthermore, this study will also enable us to find out the outcome of meconium aspiration syndrome, in terms of hospital stay, complications, and mortality. Results of the outcome will enable us to anticipate the need for referral of meconium aspiration syndrome patients to tertiary care hospital.

2. Methods

2.1. Study Design

Case Series

Setting:

The study was done in Aga Khan Maternal and Child Care Centre, Hyderabad. It is a secondary care unit of Aga Khan University Hospital.

2.2. Duration of Study

The duration of the study was 6 months starting from 22nd April 2018 to 22nd Oct. 2018.

2.3. Sample Size

The sample size was 87 and was calculated using the WHO calculator taking the margin of error as 8%, confidence interval as 95%, and taking frequency of meconium aspiration syndrome as 17.4% [7].

2.4. Sampling Technique

Non-probability consecutive sampling.

2.5. Sample Selection

2.5.1. Inclusion Criteria

All term and post-term neonates (*i.e.* gestational age equal to or greater than 37 weeks) born with meconium-stained liquor.

2.5.2. Exclusion Criteria

- Preterm having less than 37 weeks gestation; as per estimation from last normal menstrual period.
- Multi-fetal gestations as per ultrasound finding.
- Fetuses with major anomalies (e.g. neural tube defects & cardiac anomalies) detected on ultrasound were excluded from our study.

2.6. Data Collection Procedure

Data collection was started after approval of synopsis from The College of Physicians and Surgeons, Pakistan. The Ethical Review Committee of Aga Khan University Hospital, Karachi approved this study. All neonates born to mother with meconium-stained liquor at the secondary center of Aga Khan University Hospital in Hyderabad were enrolled in the study as per inclusion and exclusion criteria; and after taking informed consent. All the data was recorded on a structured proforma filled through history, examination, Chest X-ray for diagnosis of meconium aspiration syndrome, and its complications *i.e.* pneumothorax. For confidentiality, all study participants were allotted a unique ID (other than hospital registration number) for study enrolment. Principle investigator himself designed the proforma (See **Annex A**) and collected the data.

2.7. Data Analysis

All the collected data were entered and analyzed in SPSS software version 22.0. Frequency and percentages were computed for categorical variables like gender, mode of delivery, booking status, meconium-stained liquor grading, complica-

tions, and mortality. The mean standard deviation was calculated for gestational age, the weight of the child, Apgar score, and hospital stay. Data was stratified for confounding and effect modifiers' gender, gestational age, the weight of the child, mode of delivery, booking status, need for resuscitation at birth, and Apgar score on the outcome. The post-stratification chi-square test was applied by taking a p-value < 0.05 as significant.

3. Results

A total of 87 babies born with meconium-stained liquor at secondary care hospital were selected for this study. The mean gestational age of babies was 38.896 ± 1.210 weeks. The distribution of gestational age of babies is presented in Figure 1. The descriptive statistics of the babies are presented in Table 1. A total of

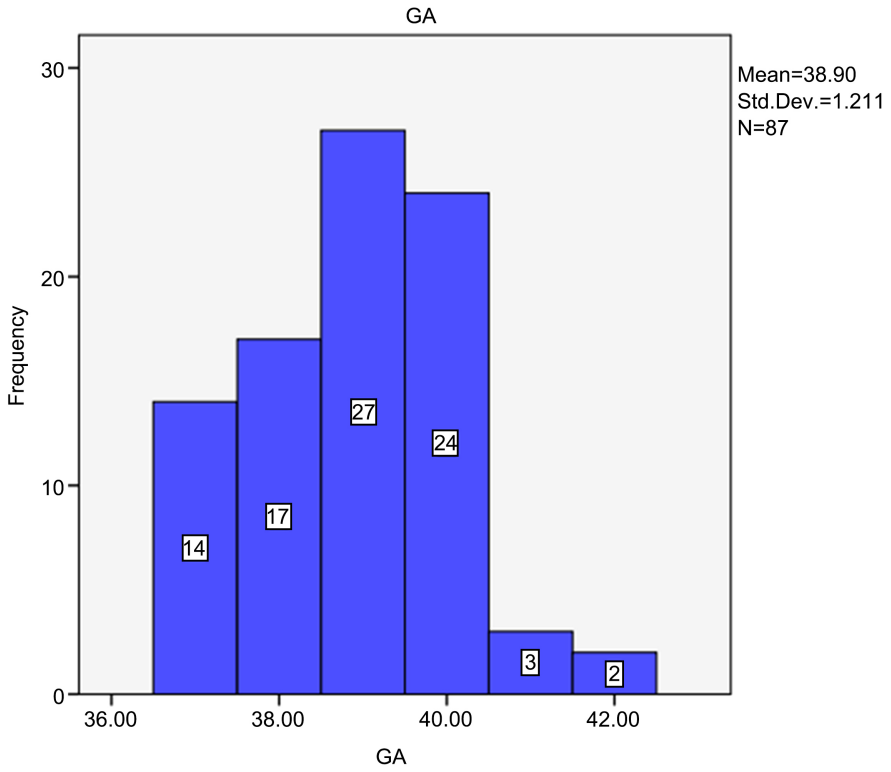

Figure 1. Gestational age of babies distribution.

Table 1. Descriptive statistics of gestational age, weight, AGAR score at 5 minutes, respiratory rate.

Statistics	Gestational Age (weeks)	Weight (kg)	AGAR Score at 5 minutes	Respiratory rate (breaths/min)	Number of days in hospital
Minimum	37	1.60	6	30	0
Maximum	42	3.90	9	72	6
Mean & Std. Deviation	38.896 ± 1.210	2.928 ± 0.4662	8.896 ± 0.404	46.586 ± 7.575	2.862 ± 1.122
Median	39.00	3.00	9.00	72.00	6.00

45 babies (52%) were males and 42 babies (48%) were females (as shown in Table 1). The mean birth weight was 2.93 kg. The mode of delivery was normal vaginal delivery in 29.9%, elective caesarian section in 16.1%, and emergency caesarian section in 54% of cases. Meconium Stained liquor Grading was thin in 74.7% of newborns and was thick in 22.25% newborns. The mean Apgar score at 5 minutes was 8.896 ± 0.404. The Apgar score at 5 minutes was 4 - 6 in (1.1%) and >6 in 98.8% of cases.

Resuscitation at birth was done for 21 (24%) babies. the intervention was done with only oxygen in 20 (22.9%) and bagging in 1 (1.1%) newborns. The mean respiratory rate was 46.586 ± 7.575 breaths/min. In this study, the MAS was present in 13 patients (14.9%). The characteristics of the MAS cases are presented in Table 2. The complications were sub-acute bacterial infection in one patient only. The mean number of days in the hospital were 2.86 days. The distribution of the number of days in the hospital is presented in Figure 2.

A total of 67 (77%) children were booked *i.e.* visit clinics through a prior appointment and 65 (75%) children had meconium-stained liquor grading classified as thin. Apgar score was more than 6 in 86(99%) of children (Table 2).

Table 2. Meconium aspiration syndrome according to booking status, meconium-stained liquor grading, Apgar score at 5 minutes (n = 87).

Booking status	Meconium Aspiration Syndrome		Total	P-Value
	Yes	No		
Booked	10 (11.49%)	57 (65.51%)	67 (77.01%)	
Unbooked	3 (3.44%)	17 (19.54%)	20 (22.98%)	0.670
Total	13 (14.94%)	74 (85.05%)	87 (100%)	
Meconium stained liquor grading	**Meconium Aspiration Syndrome**		**Total**	**P-Value**
	Yes	No		
Thin	4 (4.59%)	61 (70.11%)	65 (74.71%)	
Thick	9 (1.34%)	13 (14.94%)	22 (25.28%)	0.006
Total	13 (14.94%)	74 (85.05%)	87 (100%)	
Apgar score at 5 minutes	**Meconium Aspiration Syndrome**		**Total**	**P-Value**
	Yes	No		
<4	0 (0%)	0 (0%)	0 (0%)	
4-6	1 (1.15%)	0 (0%)	1 (1.15%)	0.199
>6	12 (13.79%)	74 (85.05%)	86 (98.85%)	
Total	13 (14.94%)	74 (85.05%)	87 (100%)	

Chi Square test was applied. P-value ≤ 0.05 considered as significant. ***NOT Significant at 0.05 levels.

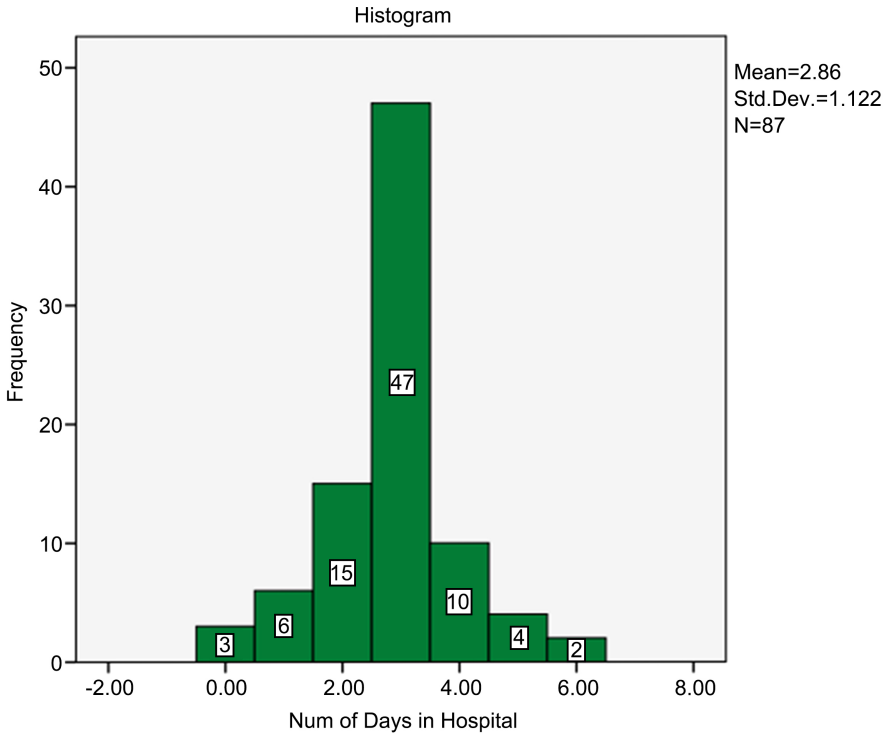

Figure 2. Histogram showing the number of hospital days distribution.

4. Discussion

Meconium aspiration syndrome continues to be a challenge for the neonatologists despite the fact that MAS has decreased in incidence, particularly in developed countries. The mortality attributed to MAS has decreased from 28 per 100,000 live births to 0.96 per 100,000 live births [6] [9]. It equates to 2.5% of the MAS cohort. This decline in developed countries has come about through an improvement in antenatal care *i.e.* avoidance of post-maturity [10] and aggressive management of fetal distress coupled with the use of advanced modalities such as surfactant [11], high-frequency ventilation [6] [9], inhaled nitric oxide [12], and extracorporeal membrane oxygenation [13] [14].

The presence of meconium liquor is a serious sign of fetal compromise, which is associated with an increase in perinatal morbidity [15], clear amniotic fluid, on the other hand, is considered reassuring. In earlier days, early amniotomy with active management of labor was done to detect meconium passed during labor. Amniotomy in labor is also commonly performed to detect meconium where fetal heart rate is unsatisfactory [16]. If meconium-stained amniotic fluid (MSAF) is found, then continuous fetal heart rate monitoring is required for fetal wellbeing. The exact etiology of MSAF remains unclear [17] [18]. Aspiration of meconium during intrauterine life may result in or contribute to meconium aspiration syndrome (MAS), representing a leading cause of perinatal death [19]. Prolonged labor is also a risk factor for the passage of meconium as proved by Saunder *et al.* [20] who showed that prolonged labor is associated with the worst outcome in the MSAF group.

As meconium should always be considered a marker for fetal distress therefore there was a significant effect on the APGAR score of neonates [7].

In our study, the mean APGAR score of neonates was 8.896 ± 0.404 as compared to Rasheed *et al.* [7] study which showed the mean APGAR score of 6.7 ± 2.3 in neonates, this is also comparable with the study of Shaikh *et al.* [21], where they reported APGAR score as 6.0 ± 0.9.

In Rasheed *et al.* study [7], 57 (38.3%) of neonates were admitted to NICU. However, Scott *et al.* [22], reported a higher incidence as compared to Rasheed et al study of neonatal admissions to NICU [7].

In this study, the MAS was present in 13 patients (14.9%), as compared to Rasheed *et al.* [7] study which showed Meconium aspiration syndrome in 26 neonates (17.4%). Sood *et al.* [23] also showed a higher incidence of MAS as in 13% in our study. Patil *et al.* [24] had reported 12.8% of MAS. It might be due to the fact that MAS was primarily associated with acute hypoxia events late in labor or often a chronic prenatal disease related to acute events that occur late in labor or after birth and also depends on increasing consistency of meconium.

In our study, there was no mortality seen in babies with MAS in contrast to Gupta *et al.* [25] that found 4.9% mortality in meconium-stained amniotic fluid group compared to 2.8% in control. Khatun [26] found 2.9% mortality in neonates. Rasheed *et al.* [7] study showed 14.1% mortality which is very high as compared to other studies.

In our study, the no pneumothorax was seen as compared to Anwar *et al.* [8] study, the prevalence of pneumothorax has been documented as 25% in 2001 and 9.6% in 2009 [8]; In the same study, pneumothorax contributed to 43% of MAS related mortality while pneumothorax resulted in death in 54.5% of these cases [8]. It is not surprising considering the fact that 84% of the babies were manually bagged for variable periods of time and only half of these (41%) could be started on mechanical ventilation.

In our study, the complications of sub-acute bacterial infection were seen in one patient (1.1%) as compared to Anwar *et al.* [8] study. The infection was another 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 despite the fact that antibiotics had started in all admitted babies. High contribution to mortality by sepsis is well documented in developing countries owing to multiple contributing factors such as cross-infection, overcrowding, and staff related negligence [6] [27].

In our study, the mean number of days in the hospital were 2.862 ± 1.122 days as compared to Anwar *et al.* [8] study where the mean duration of stay in the hospital reported in the literature has been quite varied and has changed over time, although it has been reported to be getting longer (mean of 13 days). The majority (around 70%) of the babies stayed for a week in the hospital and the stay of less than a day was associated with the highest mortality. The likely reason being that in a developed country setup, babies could have survived but due

to limitations in the local settings could not make it.

The limitation of this study is that it was a hospital-based study, so we cannot extrapolate these findings to the general population. More studies, both hospital, and population-based are needed to determine the impact of meconium aspiration on neonatal morbidity and mortality.

5. Conclusion

Meconium Aspiration Syndrome was present in 14.9% babies, the complication of subacute bacterial infection was low seen in just 1.15% case and no neonatal mortality was reported.

Ethics Approval and Consent to Participate

Aga Khan University Hospital ethical review committee approved the study in 2018 with ERC number 5249-Ped-ERC-18.

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Authors' Contributions

AM, SA, and HL contributed to drafting the article. AM and SU collected the data from the hospital. AM and HL managed and analyzed data. KH and KA designed and supervised the study. All authors approved the final version of the article for submission.

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Competing Interests

The authors declare that they have no competing interests.

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Annex A

Data Collection Instrument

S. No……

1)	Medical record number	……..		
2)	Gestational age of child	a. Term	b. Post term	
3)	Gender	a. Male	b. Female	
4)	Weight of child (kg)	a. <2.5 kg	b. 2.5 - 4 kg	
		c. >4 kg		
5)	Mode of delivery	a. Normal vaginal delivery		
		b. Elective Caesarian section		
		c. Emergency Caesarian section		
6)	Booking Status	a. Booked	b. Unbooked	
7)	Meconium Stained liquor Grading	a. Thin	b. Thick	
8)	Apgar score at 5 minutes	a. <4	b. 4 - 6	c. >6
9)	Resuscitation at birth	a. Yes	b. No	
	If Yes then intervention done		a. only oxygen	
			b. Bagging	
			c. Intubation	
10)	Elective intubation for suctioning	a. Yes	b. No	
11)	Chest X-ray	a. Done	b. Not done	
	If done then findings …….			
12)	Meconium Aspiration Syndrome	a. Present	b. Absent	
13)	Complication:	a. Present	b. Absent	
	If present, then diagnosed as ……..			
14)	Hospital stay:	a. 48 - 72 hours		
		b. 72 - 56 hours		
		c. 56 - 120 hours		
15)	Outcome	a. Discharged		
		b. Left without medical advice		
		c. Expired		
		d. Referred		
16)	Ventilator need after referral	a. Yes	b. No	