

Mortality in Meconium Aspiration Syndrome in Hospitalized Babies

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ABSTRACT

Objective: To determine the outcome of the babies in terms of mortality with the diagnosis of Meconium Aspiration Syndrome (MAS).

Study Design: An observational study.

Place and Duration of Study: The Neonatal Unit of Services Institute of Medical Sciences and Services Hospital, Lahore, Pakistan, from February 2008 to January 2009.

Methodology: All the babies admitted to the neonatal unit during the period of study with the diagnosis of MAS were included. At admission, demographic, maternal, antenatal and natal data were recorded on a specific form. The progress of the baby, including need for ventilation, medications, complications and outcome were also followed and documented.

Results: One hundred and nine babies admitted with MAS, 32% died. Most of the babies (n=73) were admitted from our obstetrical unit and the rest through the emergency department. Majority (60 of 109) were admitted within the 1st hour of life. Most (14 of 15) of the newborns requiring intubation within 1st hour of life, died. Forty four babies were ventilated and 35 of these babies succumbed. Of ventilated babies, 11 developed pneumothoraces. Seventy two percent (13 out of 18) of expired babies stayed for less than 24 hours.

Conclusion: Mortality rate for MAS was higher in the study group as compared to international figures. It was especially high in babies requiring mechanical ventilation in 1st hour of life or with co-existing severe hypoxic ischemic encephalopathy.

Key words: Meconium aspiration syndrome. Mortality. Neonatal ventilation. Pneumothoraces. HIE. Birth asphyxia.

INTRODUCTION

The passage of meconium-stained amniotic fluid (MSAF) during labour is reported to occur in 12-15% of all live births.¹⁻³ This figure is higher in deliveries associated with maternal complications (upto 24%).^{4,5} Meconium aspiration syndrome (MAS) occurs in around 5% of these pregnancies.^{1,5} The figure has declined substantially from earlier reported figure of 22% especially in developed countries,³ accompanied with advances in obstetrics and neonatal care.

With neonatal mortality rate of 54 per 1000 live births, Pakistan is eighth after Liberia, Ivory Coast, Iraq, Afghanistan, Sierra Leone, Angola and Mali.⁶ According to a study,⁷ in an urban Pakistani population, 27.3% of neonatal deaths had a history of or evidence of meconium passage during delivery.

When exposed to stress such as hypoxia, fetus passes meconium and starts reflex gasping, a combination which allows meconium to reach respiratory airways. The meconium then affects respiratory system by

mechanical airway obstruction, pneumonitis and surfactant inactivation. All of these contribute to persistent pulmonary hypertension of the newborn (PPHN), which is the final common pathway for the severe morbidity and mortality seen in infants with MAS.² Meconium aspiration can present a diverse clinical spectrum ranging from mild self-resolving respiratory distress to severe respiratory failure resulting in severe morbidity and mortality. Severe meconium aspiration is also known to be associated with long-term abnormal respiratory reactivity.³ The degree to which meconium has reached distal airways by the time of birth and the affect of meconium suction immediately after birth in preventing severe clinical picture, are still controversial.

The course and outcomes of babies admitted to neonatal units in Pakistan with the diagnosis of meconium aspiration syndrome have not been studied to the best of the authors' knowledge.

The aim of this study was to determine the outcome in terms of mortality for the babies admitted in the neonatal unit with the diagnosis of meconium aspiration syndrome.

METHODOLOGY

This observational study was conducted at Neonatal Unit of Services Institute of Medical Sciences and Services Hospital, Lahore, Pakistan, over a period of 12 months from February 2008 to January 2009. All the babies who were diagnosed with meconium aspiration

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syndrome (MAS) were included in the study. MAS was diagnosed in a baby if he/she had a history or evidence of passage of meconium stained amniotic fluid during labour, and who developed signs of respiratory distress in the presence of supportive chest X-ray findings.

Various demographic (name, hospital number, gender etc.) and clinical parameters, as shown in Tables I and II, were recorded for all the babies. The babies that were brought to nursery and observed but not admitted were not included in the study. Babies with critically severe congenital abnormalities were also excluded from the study.

The outcome of the babies was noted as being dead or survived. The survival means that the baby got discharged from the neonatal unit. The need and duration for respiratory support was also noted during the stay in neonatal unit as shown in Table II. Frequency and percentages are calculated for presenting the results (maternal and antenatal characteristics, hospital course, ventilation needs and complications in the MAS babies). The tables were constructed using Statistical Package for Social Sciences (SPSS) 13.

RESULTS

During the period of study, a total of 2250 babies were admitted in the unit and 110 of the babies (4.9%) had the diagnosis of meconium aspiration syndrome. One baby

was excluded because of complex congenital heart disease. Table I gives a comprehensive demographic review of the admitted newborns. Gravida status of mothers was another factor as babies born to > 3 gravida mothers had lower mortality (4 of 25) in comparison to primigravida (22 of 55) and gravida 2-3 (9 of 29).

A total of 73 babies were admitted from the labour room and 36 through the emergency department. Of the latter, 61.1% (22 of 36) babies were born either at home or at small private clinics without any appropriate operating theatre facilities and had a mortality of 45.5% (10 of 22) in comparison to 35.7% (5 out of 14) for babies referred from private hospitals. Both these values are higher than the overall mortality of 27.4% (20 out of 73) for babies born in our hospital. The various indications for C-section deliveries have been shown in Figure 1.

The data regarding the need for resuscitation at birth and 5-minute APGAR score is shown in Table I. A total of 25 babies out of 109 cases (22.9%) from private clinics, hospitals or homes were referred without any documented information regarding birth events. Of the remaining 84 babies, mortality was highest i.e. 85.7% (6 out of 7) for newborns intubated in the delivery room, followed by 63.6% (7 out of 11) for babies requiring bag and mask ventilation and 37% (13 of 35) for ones needing facial oxygen. APGAR score of 7 or less at

Table I: Maternal and ante-natal characteristics of MAS babies.

		Total admitted	Survived		Died	
			n	%	n	%
Total		109	74	67.9%	35	32.1%
Age of mother	< 20	11	7	63.6%	4	36.4%
	21-35	89	62	69.7%	27	30.3%
	> 35	9	5	55.6%	4	44.4%
Gravida	Primigravida	55	33	60.0%	22	40.0%
	2-3	29	20	69.0%	9	31.0%
	> 3	25	21	84.0%	4	16.0%
Mode of admission Insiders	Total	73	53	72.6%	20	27.4%
	Booked	49	36	73.5%	13	26.5%
	Un-booked	24	17	70.8%	7	29.2%
Outsiders through emergency	Total	36	21	58.3%	15	41.7%
	Hospital	14	9	64.3%	5	35.7%
	Clinics / TBA ^(a) / home	22	12	54.5%	10	45.5%
Mode of delivery	SVD ^(b)	22	15	68.2%	7	31.8%
	SVD with forceps	7	5	71.4%	2	28.6%
	C-section	80	54	67.5%	26	32.5%
Resuscitation at birth	No data	25	16	64.0%	9	36.0%
	None needed	31	31	100.0%	0	0.0%
	Only O ₂	35	22	62.9%	13	37.1%
	Ambu bagging	11	4	36.4%	7	63.6%
	ETT ^(c) + Ambu	7	1	14.3%	6	85.7%
APGAR score at 5 minutes	No Data	25	16	64.0%	9	36.0%
	< 3	0	0	0.0%	0	0.0%
	4-7	40	20	50.0%	20	50.0%
	> 7	44	38	86.4%	6	13.6%

Key: (a) TBA = Traditional birth attendant or Dai, (b) SVD = spontaneous vaginal delivery, (c) ETT = Endotracheal tube.

Table II: Hospital course and complications in MAS babies.

		Total admitted	Survived		Died	
			n	%	n	%
Total		109	74	67.9%	35	32.1%
Age at admission	Within 1st hour of life	60	42	70.0%	18	30.0%
	1-4 hours of life	40	25	62.5%	15	37.5%
	> 4 hours	9	7	77.8%	2	22.2%
Respiratory support	Total	65	65	100.0%	0	0.0%
	Not ventilated					
	No Respiratory support	2	2	100.0%	0	0.0%
	Facial/Nasal oxygen	63	63	100.0%	0	0.0%
	Ventilated - intubated at					
	Total	44	9	20.5%	35	79.5%
Associated conditions	Pneumothorax	11	5	45.5%	6	54.5%
	Sepsis	31	16	51.6%	15	48.4%
	HIE(a) 1	24	20	83.3%	4	16.7%
	HIE 2	30	23	76.7%	7	23.3%
	HIE 3	20	2	10.0%	18	90.0%
Duration of stay	< 1 day	18	5	27.8%	13	72.2%
	1 - 3 days	27	16	59.3%	11	40.7%
	4 - 7 days	49	42	85.7%	7	14.3%
	> 7 days	15	11	73.3%	4	26.7%

Key : (a) HIE = Hypoxic- ischemic encephalopathy.

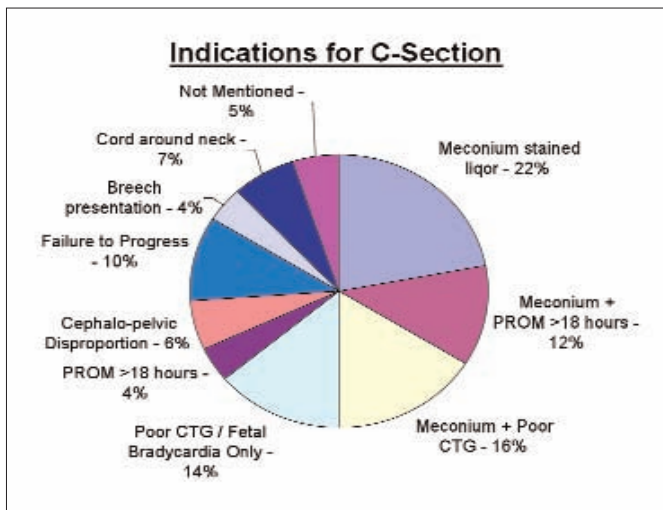


Figure 1: Indications for C-section.

5 minutes was associated with mortality of 50% (20 out of 40).

The need for ventilation was the highest contributor 77.8% (35 out of 45) to mortality in this study group (Table II). Almost all babies i.e. 93.3% (14 out of 15), who were transferred to our unit with *in situ* endotracheal tube or required intubation within the 1st hour of admission, died. Mortality figures were somewhat better for babies who were ventilated after 1st hour of admission. While being ventilated, 11 babies developed pneumothoraces, of whom 6 succumbed.

Birth asphyxia was the major co-morbid diagnosis in 67.9% (74 out of 109) along with meconium aspiration and severe asphyxia. Grade 3 hypoxic ischemic encephalopathy (HIE3) had 90% (18 out of 20) mortality. Five babies had intra-ventricular haemorrhage of grade 2 or 3. Fresh frozen plasma was transfused in 35%, packed red cell in 22%, platelets and whole blood each in 10% of the babies. Inotropic support was started with one drug (dopamine) in 71 babies but 51 of these needed addition of dobutamine.

Stay of the babies in hospital varied from less than a day to more than 7 days. Stay of less than a day was associated with mortality of 72.2% (13 of 18); which decreased with longer stay.

DISCUSSION

Meconium aspiration syndrome continues to be a challenge for neonatologists despite the fact that MAS has decreased in incidence, particularly in the developed countries. The mortality attributed to MAS has decreased from 22-28 per 100,000 live births to 0.96 per 100,000 live births.^{8,9} 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 foetal distress coupled with the use of advanced modalities such as surfactant,¹¹ high frequency ventilation,^{8,9} inhaled nitric oxide,¹² and extracorporeal membrane oxygenation.^{13,14}

Mortality (32%) in this study is very high when compared to these figures. There have been no similar studies performed locally, to the best of our knowledge. However, a study from Hyderabad, Pakistan refers to meconium being documented in 27.3% of neonatal deaths.⁷ The study centre was unable to offer proper mechanical ventilation to all the babies. This is because of the difference between the numbers of available ventilators and patients needing ventilation, and consequently we had to rely on manual ambu bagging. Lack of ventilators combined with over-crowding, over-worked and inadequate staffing,^{15,16} and inadequate or improper perinatal services,^{7,17} are the main factors that need to be addressed. Higher mortality in hospital based studies usually mirrors the high risk population, but comparative figures for developed countries are much lower.¹⁸

The relationship of asphyxia with meconium is complex as fetal hypoxia, asphyxia, and acidosis may result in *in-utero* passage of meconium and aspiration, secondary to any stress resulting in fetal asphyxia.¹⁹ Birth asphyxia was the major co-morbid condition (68%) in this study. The 5-minute APGAR score of < 7 has traditionally been used as an indicator of the degree of asphyxial insult,^{5,8,9} which in this study has been associated with 50% mortality. Twenty of our babies developed grade 3 hypoxic ischemic encephalopathy. Various indicators of neonatal antenatal compromise or stress at birth, apart from meconium stained liquor, such as needed for intubation during resuscitation at birth, mechanical ventilation within 1st hour of life and grade 3 HIE, have all been associated with very high mortality in this study. All these factors in combination, point to the poor, delayed or an inadequate antenatal and perinatal care.

In this study, the gestation could not be reliably determined because 22% of the mothers presented in labour to the obstetric unit without any antenatal record and 70% of babies referred to the study centre, were admitted without any notes from referring unit. This disregard for the referral documents has been documented in other local studies,²⁰ and it points to the poor quality of obstetric and neonatal services being provided.

The ventilation of babies with meconium aspiration syndrome is not easy even in the best of centres but we need to improve our practices. It is highlighted by the inappropriately high mortality for the babies who were ventilated after the 1st hour of life as well as the higher number of pneumothoraces. The prevalence of pneumothorax has been documented as 25% in 2001 and 9.6% in 2009;^{1,9} the latter is closer to the present figures (10.9%). In the same study pneumothorax contributed to 43% of MAS related mortality while pneumothorax resulted in death in 54.5% of these cases.⁹ 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 mechanical ventilation.

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 been 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, over-crowding and staff related negligence.^{15,21}

The mean duration of stay in 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).⁹ Majority (around 70%) of the babies stayed for a week in hospital and the stay of less than a day was associated with 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.

More studies, both hospital and population based are needed to determine the impact of meconium aspiration on neonatal morbidity and mortality.

CONCLUSION

Meconium aspiration syndrome constitutes an important contributor to hospital based neonatal mortality. Babies of meconium aspiration syndrome with severe birth asphyxia or when needing mechanical ventilation within 1st hour of life, had very poor outcome. The presently reported mortality figures are much higher than international values, thus underlying the need for improved antenatal services and better ventilatory management strategies.

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