Meconium Aspiration in Neonates: Combined Obstetric and Paediatric Intervention Improves Outcome

Pages with reference to book, From 104 To 108

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Abstract

All meconium aspiration syndrome cases admitted in the two neonatal units were compared to evaluate the antenatal and natal events including resuscitative measures and outcome of neonates and to confirm the beneficial effects of immediate combined obstetric and paediatric intervention on morbidity and mortality. Neonates managed in nursery at Mayo Hospital (Group 1, n=44) were delivered at other hospitals and birth centres, underwent resuscitation by obstetricians and/or anaesthetists and then referred, Neonates admitted in the neonatal unit of Lady Willingdon Hospital (Group 2, n=48) were inborn and resuscitated by paediatric residents. Both groups were comparable for weight, sex, booked status, maturity, history of prolonged labour, fetal distress and Apgar score at 5 minutes. Significant differences were proportion of C-section (62% in Gp 2 v 34% in Gp1), laryngoscopy and tracheal intubation (100% in Gp 2 v 9% in Gp1), time of arrival in the nursery (mean 0.14 hr in Gp 2 v 3.91 hr in Gp 1), persistent cyanosis (43% in Gp 2 v. 68% in Gp1), earlier start of feeding (mean 2.4 days in Gp 2 v 3.2 days in group 1) and shorter stay in hospital (2.87 days in Gp 2 v 5 days in Gp 1). 27% cases died in group 2 compared to 47% in group 1 (pvalue= 0.04). Combined immediate obstetric intervention (C-section) and paediatric intervention (laryngoscopy, tracheal intubation, suction, immediate transfer to nursery) led to reduced severity of meconium aspiration syndrome and lower mortality (JPMA 46:104, 1996).

Introduction

Meconiurn passage in-utero occurs in 10-15% of all pregnancies. Its passage. may be a totally unexpected event, or may be secondary to ongoing pennatal asphyxia in a majoiity of affected fetuses[1]. This has been found to be a major contributing factor towards perinatal morbidity and mortality[2]. Meconium can be recovered from trachea in upto 56% of meconium stained neonates in the delivery room[3]; however, meconium aspiration syndrome (MAS) follows in approximately 5% neonates born through mecomum stained fluid[4], reaching as high as 62% in some series[5]. The mortality rate among those developing mecomum aspiration syndrome ranges from 7% to 46%[6,7].. A study done in local population revealed mecomum aspiration to be the single most common cause of neonatal respiratory distress (50%) in the admitted cases[2]; the observed mortality ranged from 15-39% in local studies[8,9]. Mecomum can be removed from the airways by oropharyngeal suctioning done by the obstetricians when the head is at the perineum followed by immediate tracheal suctioning by the paediatrician. This active obstetric paediatne combined intervention as compared to a conservative approach practiced previously whereby, only oral suctiomng was done postnatally, has been shown to reduce MAS and its complications[11]. However, despite active management, some newborn infants still develop MAS and its complications and are supposed to have aspirated meconium in utero as a result of fetal distress due to asphyxia alone, accompanied by reactive airway changes[10].8.

We aimed at comparing the antenatal events, birth events including resuscitative measures and outcome of neonates developing meconium aspiration syndrome admitted in two neonatal units attached to the

department of pediathcs, King Edward Medical College, Lahore and to confinn the beneficial effects of immediate combined obstetric and pediatric intervention, in lowering the morbidity and mortality.

Patients and Methods

This study was carried out on neonates developing meconium aspiration syndrome, admitted in two neonatal units, one at the Department of Pediatrics, Mayo Hospital, Lahore and other at Lady Willingdon Hospital, Lahore. (The neonates born at home were excluded from study group).
The study period extended from 1st Januar , 1994 to 31st July, 1994 and all admitted neonates with the diagnosis of meconium aspiration syndrome were included. The relevant maternal and newborn infonnation was recorded including gravidity, panty, antenatal checkups, maternal complications during pregnancy (hypertension, pre-ecclampsia, toxemia, diabetes, twins) and labourcomplications (antepartum hemorrhage, prolonged labour, early rupture of membranes, cord accidents and evidence of fetal distress like decreasing fetal movements and/or fetal heart rate changes). Neonates condition at the time of birth was noted including state of activity and Apgar scoring at five minutes. Resuscitative efforts were recorded like peroral suction, stimulation, oxygen inhalation. laryngoscopy. intubation. tracheal suctioning and bagging. In case of birth taking place in other hospitals, this information was obtained from direct inquiry from obstetricians.
In case of deliveries taking place in small centers, Apgar scoring was assigned approximately. Larynx of all meconium stained neonates was inspected either in labour room or at admission in the neonatal unit (for group 1 neonates, this was done at arrival in the nursery). This was followed by tracheal intubation and suctioning in those cases where meconium was found in the pharynx, or neonate was depressed at birth.
Meconium stained neonates were kept under observation after admission in the nursery and monitored closely for any complications like meconium aspiration syndrome, persistent pulmonary hypertension, air leak, secondary pneumonia, encephalopathy, gut bleeding, renal failure, pathologic hypethilimbinemia (>12.9 rng/dl) and others. Meconium aspiration was said to occur when a neonate born through meconium stained liquor, showed respiratory distress (respiratory rate >60/mm, chest wall retractions), cyanosis and crepitations/conducted sounds in chest; with illness lasting more than 24 hours. A chest radiograph showing infiltrates, air trapping and/or collapse was taken as additional evidence. (The portable radiographic facility was not available). Neonates were managed with airway care, oxygen inhalation, maintaining body temperature, IV fluids, antibiotics and ventilation with bagging (where needed). The total period of stay was recorded in every case alongwith ultimate outcome.
Both groups were compared and data were evaluated with student's t test, chi square analysis, or the two-tailed Fisher Exact test, where appropriate. A p-value of <0.05 was considered to be statistically significant.

Results

A total of 92 neonates were studied, 44 in group 1 and 48 in group2. Those in group 1 were referred from many obstetric hospitals in Lahore and surrounding areas and were all admitted in the neonatal unit in Mayo Hospital, Lahore, while all neonates in group 2 were born in Lady Willingdon Hospital, Lahore. The study patients were mostly full-term (78%) or post-term (15%). Only 6% neonates were preterm with gestational ages from 34-37 weeks. Responses of 90% neonates were found depressed at the time of birth.
On comparing the two groups, the study infants were comparable for sex, birth weights, gestational ages, weights for gestational ages and maternal gravidity. However, pmportion of cesarean section was

higher in group 2 (62% versus 34% in group 1).

Table I. Comparison of study groups.

Parameter		Group 1 N=44		Group 2 N=48		p-value
		n	(%)	n	(%)	
Sex	Male	24	(54.5)	22	(45.83)	0.53
	Female	20	(45.45)	26	(54.16)	
Birth weight (gm)	Mean±SD	3018±650	-	3230±750		0.02
Gestational age	Term	37	(84)	35	(72.9)	0.24
	Post-term	6	(13.6)	8	(16.6)	
	Pre-term	1	(2.2)	5	(10.4)	
Weight for gestational age	AGA	37	(84)	35	(72.9)	0.24
	SGA	6	(13.6)	8	(16.6)	
	LGA	1	(2.2)	5	(10.4)	
Mode of delivery	SVD	24	(54.5)	14	(29.16)	0.01
	Assisted	5	(11.36)	4	(8.3)	
	C-section	15	(34)	30	(62.5)	
Age at admission (hour)	Mean±SD	3.91±3.04	-	0.14±0.19	-	0.00

Note: Group 1 comprised of neonates admitted in nursery at Mayo Hospital and group 2 at Lady Willingdon Hospital, Lahore. Weight for gestational age was estimated by plotting individual values on intrauterine growth charts. AGA=appropriate for gestational age, SGA= small for gestational age, LGA= large for gestational age. SVD refers to spontaneous vaginal delivery while assisted delivery implies use of forceps or vacuum).

These neonates were admitted earlier in the neonatal unit (mean agea at admission 0.14±0.19 hours versus 3.91±3.04 hours in group 1), both with a significant p-value <0.05, Complications of pregnancy like fetal distress and prolonged labour were noted equally in both groups. Other complications like antepartum hemorrhage, twins and mode of presentation were also similar. Neonates in both groups had a comparable Apgar score at five minutes (Table II).

Table II. Comparison of study groups for pregnancy and birth events.

Parameter		Group 1 n=44		Group 2 n=48		p-value
		n	(%)	n	(%)	
Maternal gravidity (mean±SD)		3.88±2.7	-	3.12±1.99	-	0.48
Booked cases*		5	(11.3)	7	(14.6)	0.20
Maternal illness#		13	(29.5)	14	(29.1)	0.10
Fetal distress		32	(72.7)	40	(83.3)	0.29
Prolonged labour		31	(70.4)	32	(66.6)	0.42
Antepartum hemorrhage		4	(9)	3	(6.25)	0.9
Twins		0	(0)	2	(4.1)	0.51
	Presentation Cephalic	39	(88.63)	45	(93.7)	0.63
	Breech	1	(2.2)	1	(2.08)	
	Transverse	4	(9)	2	(4.1)	
Depressed		38	(86.3)	45	(93.75)	0.28
Apgar Score (5min) Mean±SD		4.79±1.06	-	4.27±1.54	-	0.06
Intubation at birth		4	(9.09)	48	(100)	0.00
Bagging at birth		19	(43.18)	46	(95.8)	0.00

Note: Booked* cases included those seen in the antenatal clinic at the birth centre for a minimum of three visits.
Maternal illness# included medical and pregnancy related disorders like diabetes, hypertension, pre-ecclampsia and renal failure etc.

Both groups received tactile stimulation, oxygen inhalation and peroral suction at the time of birth. However, laiyngoscopy and intubation were done in labour room in all cases in group 2 neonates and only 9% in group 1 (p-value <0.005). Meconium was recovered from the trachea In 87% cases in group 2 and 54% cases in group 1. Persistent cyanosis despite giving oxygen ata flow rate around 8-10 litre/min through head box, was observed in 68% neonates in group 1 and 44% neonates in group 2 during first 24 hours (p-value=0.03). Air leak was noted in only 4 cases, three in group 1 and one in

group 2. Complications of secondary pneumonia, encephalopathy, gut bleed, acute renal failure, hyperbilirubinernia (serum level >12.9 mg/dI) were comparable in two groups.
Average time to startfeedingwas 3.2 daysingroup 1 and 2.48 days in group 2. Neonates in group 2 had a shorter stay (mean 2.87±2.2 versus 5±5.02 days in group 1) with a p-value=0.05. Outcome also differed significantly in these two groups, 47% died in group 1 and 27% in group 2 (p-value=0.04).

Discussion

The study addresses the problem of meconium aspiration in neonates admitted in the neonatal units, whether inborn or referred from other places of birth. It was observed that neonates born at hospitals where both obstetric and pediatric intervention was immediately practiced in the labour room or operation theatre, followed by immediate transfer to neonatal unitforobservation and furthermanagement, led to less severe disease and lower mortality. The significant differences observed in the two study groups were a higher rate of caesarean section in group 2 indicating obstetric intervention to expedite the delivery, labour room resuscitation including tracheal intubation and suctioning, with immediate transfer to nursery for further management.
Meconium aspiration caused less severe disease in group 2 as reflected by lower incidence of persistent cyanosis due to underlying persistent pulmonary hypertension, earlier start of feeding and shorter stay in the hospital. The mortality was 47% in group 1 compared to 27% in group 2 (Table III).

Table III. Comparison of study groups for neonatal course.

Parameter		Group 1 N=44		Group 2 N=48		P-value
		n	(%)	n	(%)	
Meconium in trachea		24	(54.5)	42	(87.5)	0.00
Air leak		3	(6.8)	1	(2.08)	0.54
Persistent cyanosis*		30	(68.1)	21	(43.75)	0.03
Secondary pneumonia		5	(11.3)	1	(2.08)	0.1
Encephalopathy Stage	1	21	(47.7)	25	(52.08)	0.91
	11	15	(34.09)	14	(29.16)	0.77
	111	8	(18.18)	9	(18.75)	0.80
Gut bleed		9	(20.4)	13	(27.08)	0.61
Acute renal failure		3	(6.8)	2	(4.16)	0.10
Jaundice		7	(15.9)	6	(12.5)	0.86
Start of oral feeding (Days) Mean±SD		3.28±1.37	-	2.48±1.5	-	0.00
Stay in days Mean±SD		5.081±5.02	-	2.87±2.2	-	0.15
Outcome	Discharged	23	(52.27)	32	(66.66)	0.04
	Died	21	(47)	13	(27.08)	
	Lama#	0	(0)	3	(6.25)	

Note: Persistent cyanosis* implied failure to correct cyanosis despite giving oxygen at a flow rate 8-10 litre/min through head box, in the first 24 hours.
Encephalopathy was staged according to the method proposed by Sarnat and Sarnat[22].
Lama# indicates neonates left against medical advice.

Deaths in meconium aspiration cases can be attributed to complicating factors like air leak, hypoxic-ischeniic encephalopathy, bleeding diathesis, bacterial pneumonia and others[12]. However, no attempt was made in this study to separate different causes of death. Most of these neonates died from respiratory failure secondary to mecomum aspiration and concomitant hypoxic-ischemic encephalopathy. They needed ventilatory support for a variable period of time. However, during the study period, ventilator facilities and blood gas estimation were not available at both neonatal units. Adequate provision of these facilities will help to reduce the observed high mortalit.
A two year experience with meconiurn stained neonates in another institution in Lahore[8] showed that out of 83 meconium stained neonates, 30% developed MAS while remaining 70% had no symptoms aithoughall were kept under observation for a minimum of 24 hours. The observed mortality was 15% for those developing MAS. However, all neonates managed in this study were inborn and delivered by

mothers from upper and upper middle social groups and were all booked cases antenatally. Narang et al[6] had observed meconium stained amniotic fluid in 7.4% of all deliveries in their hospital in East Punjab, India and among them 10.5% developing MAS. Combined obstetric-pediatric team approach with intrapartum suctioning and intensive neonatal management led to a reduction in neonate mortality to 7.5%[6].

Gregory et al[3] were the first one to clearly show the beneficial effects of intubation and tracheal suctiornng in meconium stained infants. They recommended tracheal intubation and vigorous suction of secretions from newborn infants born through thick, particulate ("pea soup") meconium. The American Academy of Pediatrics (1977) subsequently recommended endotracheal suction for infants with meconium in the mouth and orophaiyn.x[13]. This was universally accepted and the incidence of MAS was noted to fall markedly alongwitha significant reduction in mortality[12].

Controversy persists whether all meconium stained neonates need tracheal intubation and suctioning or not. It has been shown that meconium stained but vigorous neonates who have their first inspiration before being handed to the pediatrician do not benefit from immediate tracheal suctioning[14]. On the contrary, this intervention has been found to cause untoward laiyngopulmonaiy complications like stridor and hoarseness and predispose the neonate to pulmonary vasoconstriction and development of MAS[15]. It has been shownthat routineobstetricand pediatricinterventions cannot prevent all cases of MAS and deaths still take place. Another study described 12 neonates who died with MAS even though their trachea were suctioned vigorously in the delivery room[16]. These deaths have been explained on the basis of in utero aspiration or to a form of persistent pulmonary hypertension. On autopsy, the pulmonary vasculature of described neonates appeared structurally different from that of normal neonates; the severe narrowing of the pulmonary arterioles made these neonates refractory to treatment[17].

Recently, there are suggested guidelines for a selective approach that only depressed babies requiring positive pressure ventilation and delivered through meconium stained amniotic fluid should be intubated and suctioned though trachea[18,19]. However, strong objections have been raised by Wiswell and others on the following grounds. On reviewing their experience with meconium stained neonates, they found that 56% babies in whom MAS developed were apparently healthy and did not require delivery room resuscitation. It was found that 9% of non-intubated neonates developed MAS compared with 3.9% of the intubated babies (p=0.024). Moreover, babies with MAS in the non-intubated group were more than twice as likely to develop pneumothoraces or persistent pulmonary hypertension and significantly more likely to require mechanical ventilation and to die. Routine intubation of trachea in the delivery room was found to be quite safe in these cases11'12'20. Some authors have observed that thickness of meconium or its absence on tracheal aspiration was not associated with subsequent severity of respiratory disease[23]. In other series, from 9-44% infants with MAS were born through meconium stained fluid of thin consistency[1,21].

The American Academy of Pediatrics and American Heart Association (1992), has given guidelines on the management of meconium stained infants following obstetric phaiyngeal suctioning. The committee recommends that tracheal suctioning to be performed on all meconium stained neonates if, 1) there is evidence of fetal distress in-utero (abnormal fetal heart rate monitoring); 2) the neonate is depressed or requires positive pressure ventilation in the delivery room; 3) the meconium is thick or particulate in nature or; 4) if obstetric pharyngeal suctioning was not performed at all[24].

It is concluded that immediate combined obstetric and pediatric intervention in cases of meconium passge during delivery will help to reduce neonatal morbidity and mortality. Mothers in labour with history of meconium stained amniotic fluid should immediately be referred to hospitals where an early decision to expedite the delivery in the presence of fetal distress should be made. All maternity hospitals should have adequately trained medical staff capable of performing laiyngoscopy, intubation

and tracheal suction as part of resuscitative efforts. If their condition demands, they should immediately be shifted to neonatal units for further manage-ment.

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