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Early Outcome of Neonates Admitted with Meconium Aspiration Syndrome

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ABSTRACT

Background: Meconium aspiration syndrome is one of the commonest cause of respiratory distress in neonates. The incidence is still high in developing world. This study aims to study the clinical characteristics and early outcome of neonates admitted for meconium aspiration syndrome.

Methods: This was a cross-sectional descriptive study done among neonates admitted to the neonatal Intensive Care Unit with a diagnosis of Meconium Aspiration syndrome. Relevant epidemiological, clinical and laboratory data were obtained. The early outcome of those neonate was studied.

Results: Out of 140 neonates with a mean birth weight of 2865 ± 543 grams,73.6% were male, of which 76.4% were referred cases while 23.6% were inborn. Of them 69.3% had history of thin type of meconium while 30.7% had thick type of meconium during delivery. Of all mothers, 74.3% were primigravida, 4.3% had intrapartum fever of unknown source,11.4% suffered from urinary tract infection while 2.8% had hypertension. Premature rupture of membrane had occurred among 7.9% and oligohydramnios was found in 10%. Half of them (50.7%) had spontaneous vaginal delivery, 44.3% had caesarian section, while 4.8% had assisted delivery. Around one third of the neonates (37.1%) were given supplemental oxygen via nasal prongs, 25.7% via head box, 27.1% via continuous positive airway pressure and 10% intubated. Around half of the neonates (42.1%) had no complications. Complication noted were sepsis, birth asphyxia, seizures and polycythemia in 35%, 14.3%, 5.7% and 2.9% respectively. Mortality occurred among 5.0% of them.

Conclusions: Meconium aspiration syndrome is one of the commonest cause of respiratory distress in a neonate which is associated with common maternal risk factors especially in primigravida which included Urinary tract infection, hypertension and oligohydramnios.

Keywords: Meconium; meconium aspiration syndrome; newborn

INTRODUCTION

Meconium aspiration syndrome is one of the commonest cause of respiratory distress in neonate requiring respiratory support. Passage of meconium in utero is common after 34 weeks of gestation.[1] Multiple factors such as placental insufficiency, maternal hypertension, pre-eclampsia, oligohydramnios or maternal abuse of tobacco, cocaine and other drugs predisposes passage of meconium.[2]

Meconium staining of amniotic fluid (MSAF) occurs in about 7-22% of pregnancy while meconium aspiration syndrome (MAS) occurs in approximately 5- 7.7% of all cases of MSAF.[3, 4] About 0.05% of neonatal death is attributable to MAS.[5]

In this study, we aim to study the clinical characteristics and the early outcome of the neonates admitted with meconium aspiration syndrome.

METHODS

This is an observational cross sectional study conducted in College of Medical Sciences, Bharatpur, Nepal from November 2021 to October 2022 after receiving the ethical approval from Institutional Review Committee (2021-07). All neonates admitted with a diagnosis of

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meconium aspiration syndrome (MAS) were included in the study. Neonates born through meconium stained liquor with respiratory distress and consistent chest X-ray findings not explained otherwise were defined as a case of MAS. Staining of amniotic fluid as light green, light yellow was considered as thin meconium whereas meconium with particulate matter and pea soup consistency was considered as thick.

Convenient sampling method was used. Structured Proforma was used to obtain clinical information. Detail history of mother that included age, parity, duration of labor, oligohydramnios, antepartum complications like fever, urinary tract infection, gestational diabetes, pregnancy induced hypertension, preeclampsia and premature rupture of membrane were obtained. Similarly, clinical parameters of neonate that included Apgar scores at 1 and 5 minutes, birthweight, mode of delivery, supplemental oxygen requirement, other complications and final outcome were obtained.

The sample size was calculated using the formula, $N = Z^2 \times p \times q/e^2$

Where, N = minimum required sample size

p = prevalence from previous study, which was taken as 7.7% among patients with Meconium stained amniotic fluid in a study done in India.[4]

Z = 1.96 at 95 % confidence Interval (CI)

q = 1-p

e = margin of error, 5%

With a response rate of 0.9, we calculated the required sample size as 120 patients, however we took a sample size of 140 patients.

Data were analyzed using Statistical Package for Social Sciences (SPSS) version 18.0. Data are presented as mean (standard deviation) for continuous variables and as N (percentage) for categorical variables.

RESULTS

Table 1. Demographic and clinical characteristics.

Variable	Frequency (Percentage) N=140
Male	103 (73.6)
Female	37 (26.4)
Hindu	135 (96.4)
Buddhist	4 (2.9)
Muslim	1 (0.7)
Referred from other hospitals	107 (76.4)
Inborn	33 (23.6)
Birth weight in grams (Mean ± SD)	2866 ± 543
Thin meconium	97 (69.3)
Thick meconium	43 (30.7)
Gravida	
Primigravida	104 (74.3)
Multigravida	36 (25.7)
Maternal symptoms and signs	
Urinary tract infection	16 (11.4)
Oligohydramnios	14 (10.0)
Premature rupture of membrane	11 (7.9)
Intrapartum fever	6 (4.3)
Hypertension in pregnancy	4 (2.8)
Period of gestation at delivery	
Preterm	10 (7.1)
Term	120 (85.7)
Post-term	10 (7.1)
Modes of delivery	
Normal vaginal delivery	71 (50.7)
Caesarian section	62 (44.3)
Assisted delivery	7 (4.8)
Apgar score	
At minute 1	
Less than 5	50 (35.7)
5 or more	90 (64.3)
At minute 5	
Less than 5	10 (7.1)
5 or more	130 (92.9)

Out of 140 neonates with meconium aspiration syndrome, 73.6% were male and 26.4% were female. Majority of them were Hindus (96.4%). Outborns, who were referred from other hospital constitutes 76.4% neonates while 23.6% were delivered within our own hospital. The mean birth weight was 2866 ± 543 grams. Of these 140 child, 69.3% had thin type of meconium and 30.7% had thick type of meconium at the time of delivery.

Around three fourths (74.3%) of the mother were primigravida and 25.7% were multigravida. Few of these mothers (4.3%) had intrapartum fever of unknown source while 11.4% had urinary tract infection. Ultrasonography revealed oligohydramnios in 10% of them. Hypertension in pregnancy was diagnosed in 2.8% of the mother while 7.9% had premature rupture of membrane during delivery. Most of them had term deliveries (85.7%), while 7.1% of deliveries were preterm and post-term each. Half of the neonates (50.7%) had normal vaginal delivery, while 44.3% had caesarian section and 4.8% had assisted deliveries with either forceps or vacuum suction. At minute 1 of delivery, 64.3% of the neonates

had APGAR score of 5 or more, while 92.9% of them had APGAR score of 5 or more at 5 minutes of birth.

Table 2. Clinical Outcomes.

Variables	Frequency (Percentage) N=140
Mode of oxygen delivery Nasal prongs	52 (37.1)
Head box	36 (25.7)
CPAP	38 (27.1)
Mechanical Ventilation	14 (10.0)
Complications No complications	59 (42.1)
Sepsis	49 (35.0)
Birth asphyxia	20 (14.3)
Seizure	8 (5.7)
Polycythemia	4 (2.9)
Duration of hospital stay in days (Mean ± SD)	6.1 ± 4.4
Final Outcome Discharged	115 (82.1)
Left against medical advice	18 (12.9)
Expired	7 (5.0)

All the children were given supplemental oxygen of which nasal prongs was used the most (37.1%), followed by CPAP (27.1%), head box (25.7%) while 10% required mechanical ventilation. Almost about half (42.1%) had uncomplicated clinical course. Sepsis was the commonest complication (35.0%), followed by birth asphyxia (14.3%), seizure (5.7%) and polycythemia (2.9%). The mean duration of hospital stay of the neonates was 6.1 ± 4.4 days. In hospital mortality among those 140 neonates with meconium aspiration was found to be 5.0%, while 12.9% left against medical advice and 82.1% were discharged.

DISCUSSION

This study was done to study the clinical characteristics and early outcome of the neonates admitted with a diagnosis of meconium aspiration syndrome in NICU of a tertiary care hospital.

The mean birth weight of admitted babies was 2865 ± 543 grams. Some studies show the higher incidence of MAS among low birth weight babies. Incidence of MAS is higher in babies with low birth weight secondary to placental insufficiency.[6] Among those with meconium aspiration syndrome, reduced odds of dying was found in neonates with higher birth weight. [aOR 0.998; 95% CI (0.997–1.00); P=0.005] [7]

Our study showed almost similar percentages of the modes of delivery, with 50.7% delivered via vaginal delivery and 44.3% being delivered by caesarian. Previous studies had also found that mode of delivery had no significant association with the incidence of meconium aspiration syndrome.[8,9] However, among those babies born with moderate or thick meconium stained amniotic fluid, cesarean delivery had a higher odds for development of MAS (OR 3.0)[10]

In our study intrapartum fever was noted in 4.3% whereas it was about 49-57% in other studies.[11,12] and rupture of membrane more than 18 hours was seen in 7.9% and similar finding was shown in other studies too.[13-15] Three fourths (74.3%) of our mothers were primigravida. Most of the deliveries (85.7%) were term deliveries. A study done among live birth with meconium stained amniotic fluid found that maternal age, parity, gestational age and mode of delivery had no significant association for the development of MAS. However, the same study found that 5-minute APGAR score of 5 or less is independently associated with MAS among those having meconium stained amniotic fluid.[8] Another study had found that APGAR score less than or equal to 4 at 1 min was also significantly associated with MAS. (OR 3.1).[10]

There are multiple causative factors for passage of meconium, the most common being a simple representation of the maturation of fetal intestinal function as the myelination of the nerve fibers occur. Fetus responses to intrauterine stress with fetal hypoxia, asphyxia and acidosis to which passage of meconium in utero has been attributed. Hypoxia causes relaxation of the anal sphincter and also increases intestinal peristalsis.[16] Transient compression of umbilical cord or the fetal head also causes a vagal response leading to meconium passage.[17] An association between fetal distress and elevated levels of motilin, that stimulates the contraction of intestinal muscles, has also been reported.[18]

We found that of those with MAS, 69.3% (n=97) had thin consistency of the meconium. The findings are similar to those by Narang et al, who found that among neonates with MAS, 44% neonates had thick meconium and 56 % had thin meconium.[19] In contrast, few other studies have shown a slightly higher incidence of thick meconium ranging from 51-75% in patients with MAS.[14, 20] However, not all babies delivered with thick meconium stained liquor develop MAS. In a study of 937 vertex singleton pregnancies with moderate or thick meconium-stained amniotic fluid, only 39 developed MAS.[10]

Mechanical ventilation in MAS is risky because of the atelactatic and hyperinflated areas in the chest that increases the risk of air leak syndromes.[21] Nasal CPAP is considered to be the better way to maintain oxygenation in MAS in case simpler devices like nasal prongs and head box fail to maintain oxygenation adequately.[22] In our cohort of neonates, nasal CPAP was used in 27.1% as compared to 10.0% who required mechanical ventilation.

We found neonatal sepsis to be the commonest complication (35%), a finding similar to those from other studies as well.[23] Birth asphyxia occurred in 14.3% of the patients. The pathophysiology of MAS is complex. The hypoxia results of main four pathophysiological mechanisms namely (a) airway obstruction (b) surfactant inactivation (c) chemical pneumonitis with release of inflammatory mediators and (d) right to left extrapulmonary shunting secondary to persistent pulmonary artery hypertension.[21]

In our study mortality was found in 5% of the cases. Other studies mention a mortality rate that range from 2.7% to 33%.[24, 25]

CONCLUSIONS

MAS is still a severe neonatal disease that is responsible for significant morbidity and mortality. Even with the advances in medical technology, the treatment remains supportive, thus early detection of risk factors and their management is very important to improve the early outcomes.

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CONFLICT OF INTEREST

The authors declare no conflict of interest

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