

# Immediate Fetal Outcome in Deliveries with Meconium Stained Amniotic Fluid

Bijaya Ghimire,<sup>1</sup> Pratima Pathak,<sup>1</sup> Rashmi Gachhadar,<sup>2</sup> Pratima Ghimire,<sup>1</sup> Sujita Baidya<sup>1</sup>

## ABSTRACT

**Background:** Meconium-stained amniotic fluid is considered as the bad predictor of fetal outcome having significant perinatal morbidity and mortality. This study aimed to compare immediate fetal outcomes in meconium-stained amniotic fluid and clear amniotic fluid.

**Methods:** Hospital-based comparative observational study was conducted from a total of 204 women admitted in labour room at a tertiary level hospital. Among them, 102 were cases with meconium-stained amniotic fluid, and 102 were comparison groups with clear amniotic fluid. Fetal outcome was compared between these two groups.

**Results:** The study findings revealed that majority (74.5%) in the study group had cesarean section as compared to 14.7% in the comparative group. More than one-fourth (26.5%) of the newborns in the study group had moderate to severe birth asphyxia, needed resuscitation (25.5%) and neonatal intensive care unit admission (25.5%) as compared to 3.9% from the comparative group. Maternal age (COR=0.34, 95%CI=0.15-0.81), color of amniotic fluid (COR=0.11; 95%CI=0.04-0.33), meconium consistency (COR=0.27; 95%CI=0.17-0.43), and mode of delivery (COR=0.36; 95%CI=0.17-0.79) were associated with birth asphyxia in bivariate analysis. Maternal age (AOR=2.66; 95%CI=1.04-6.81) and color of amniotic fluid (AOR=11.50; 95%CI=2.97-44.56) were associated with birth asphyxia in the multivariate analysis.

**Conclusions:** Meconium-stained amniotic fluid was associated with increased frequency of cesarean section and adverse fetal outcome with birth asphyxia being the major complications compared with clear amniotic fluid. Predictors of birth asphyxia were maternal age and color of amniotic fluid.

**Keywords:** Deliveries; fetal outcome; meconium-stained amniotic fluid

## INTRODUCTION

Meconium is a dark greenish-black colored substance composed of gastrointestinal secretions, vernix caseosa, lanugo, blood, amniotic fluid, bile juice, debris of cells that accumulate in the fetal bowel during intrauterine life.<sup>1</sup> Different theory explain the intrauterine passage of meconium such as exposure of a fetus to intrauterine hypoxia, decreased umbilical venous saturation, vagal stimulation, and physiological response to normal gastrointestinal tract maturation.<sup>2, 3</sup>

Meconium-stained amniotic fluid (MSAF) is considered as a warning sign of intrauterine fetal compromise associated with adverse perinatal outcomes including low Apgar scores, respiratory distress, increased

incidence of neonatal intensive care unit admission leading to a high rate of perinatal morbidity and mortality.<sup>4</sup> Newborns delivered with MSAF are at greater risk of developing respiratory complications than that of clear amniotic fluid.<sup>5</sup> It is therefore important to determine the immediate fetal outcome in deliveries with MSAF and adopt the appropriate protocol to reduce the adverse outcome associated with it.

## METHODS

Hospital-based comparative observational study was carried out in the Labour room of Nepal Medical College Teaching Hospital, Kathmandu, Nepal from June 16, 2019-July 15, 2021. This is a tertiary level hospital implementing Aama Suraksha Program in the

**Correspondence:** Bijaya Ghimire, Department of Nursing, Nepal Medical College, Kathmandu University, Jorpati, Kathmandu, Nepal, Email: [bijaya379111@gmail.com](mailto:bijaya379111@gmail.com), Phone: +9779841379111.

obstetric services where pregnant women come from different locality with different backgrounds to get the obstetric services. The study was conducted after receiving ethical clearance from the Institutional Review Committee (IRC) of Nepal Medical College (Ref. No: 051- 075/076, Date: June 04, 2019) and formal permission was obtained from concerned authority to collect the data. The procedure and purpose of the study were explained and respondents were selected based on the inclusion criteria. Informed verbal and written consent was taken from the respondents before collecting the data. Participation was voluntary and confidentiality was maintained. Meconium stained amniotic fluid after spontaneous or artificial rupture of membranes were the study group whereas women in labor with clear amniotic fluid after spontaneous or artificial rupture of membrane were chosen as comparative group. Women in labor presenting with 37 completed weeks of gestation, cephalic presentation, live singleton normal pregnancy were included. Women in labor presenting with unknown last menstrual period, preterm labor, post-term labor, abnormal presentation, multiple pregnancies, antepartum hemorrhage, previous LSCS, intrauterine fetal death, intrauterine growth restrictions, congenital anomalies in fetus, maternal medical illness like pregnancy-induced hypertension, heart disease, diabetes, asthma were excluded in this study. Sample size was calculated by using formula for definite proportion on the basis of prevalence of MSAF as 7.13%.<sup>6</sup> Thus, based on this prevalence, with 95% confidence interval and 5% allowable error, sample size estimation was found to be 102. So the total sample size was 204 including both the study and comparative group.

Non-probability purposive sampling technique was adopted to collect the data. Meconium was graded as thick, moderate and thin. Face-to-face interview technique was used to collect the patients' socio-demographic data, and obstetric and fetal outcome-related information was taken by direct observation and hospital/delivery records in pre-designed proforma. Fetal outcome was measured in terms of mode of delivery, Apgar scores at one and five minutes, degree of birth asphyxia, need for resuscitation and neonatal intensive care unit (NICU) admissions and its indications. Birth asphyxia was diagnosed when baby did not take spontaneous respiration at birth and Apgar scores at one minute and five minutes was less than seven. Those babies who got the Apgar score of 7-10 were categorized as no asphyxia, 4-6 as moderate asphyxia and 3 and less as severe birth asphyxia. Resuscitation referred to bag and mask ventilation, chest compression and intubation

for those babies who did not have spontaneous respiration at birth. All the newborns born with MSAF were followed up till 2 hours of birth.

The data were entered into the excel sheet and exported into the IBM SPSS version 20. Descriptive (mean, SD, frequency, percentage) and inferential statistics (simple and multiple binary logistic regression) were used for statistical analysis. Variables with p-value <0.2 were considered for multivariate analysis. A p-value of less than 0.05 was considered as the appropriate level of statistical significance, and the strength of statistical association was assessed by odds ratios with 95% confidence interval.

## RESULTS

During the study period of 2 years from June 16, 2019 to July 15, 2021 there were a total of 4697 deliveries in Nepal Medical College and Teaching Hospital, Jorpati, Kathmandu and meconium-stained amniotic fluid was seen in 290 cases giving the prevalence rate of 6.17%.

Table 1. Age and antenatal characteristics of the respondents.

SN	Variables	Study group (n=102)		Comparative group (n=102)		
		Frequency	Percentage	Frequency	Percentage	
1	Age	Mean ± SD = 27.13 ± 4.36		Mean ± SD = 25.66 ± 4.31		
		Minimum = 20		Minimum = 20		
		Maximum = 42		Maximum = 39		
		≤ 25	40	39.2	55	53.9
	> 25	62	60.8	47	46.1	
2	Parity	Primi para		54		
		59		52.9		
		57.8		47		
		39.2		46.1		
	Grand-multi para	3	2.9	1	1.0	
3	Complete weeks of gestation	Mean ± SD = 39.03 ± 0.72		Mean ± SD = 38.88 ± 0.84		
		Minimum = 38		Minimum = 37		
		Maximum = 40		Maximum = 40		
		37	0	0.0	5	4.9
		38	25	24.5	28	27.5
		39	49	48.0	43	42.2
40	28	27.5	26	25.5		
4	Number of ANC visits	< 4		2		
		2		2		
		100		98		

Table 1 depicts that the mean age of the study group was 27.13 ± 4.36, while that of comparative group was 25.66 ± 4.31. More than half of participants were primi para in both the groups; study (57.8%) and comparative (52.9%). The mean weeks of gestation for study group was 39.03 ± 0.72 and that of comparative group was 38.88 ± 0.84. Most of the women, i.e. 98% in both study

and comparative group had more than or four antenatal visits during pregnancy.

**Table 2. Amniotic fluid related characteristics.**

Variables	Study group (n=102)		Comparative Group (n=102)	
	Frequency	Percentage	Frequency	Percentage
<b>Type of rupture of membrane</b>				
Artificial Rupture of Membrane (ARM)	51	50.0	35	34.3
Spontaneous Rupture of Membrane (SROM)	51	50.0	67	65.7
<b>Colour of amniotic fluid</b>				
Meconium stained	102	100.0	0	0.0
Clear	0	0.0	102	100.0
<b>Meconium consistency</b>				
Thin	19	18.6	0	0.0
Moderate	41	40.2	0	0.0
Thick	42	41.2	0	0.0

Table 2 depicts that half of the women in study group had rupture of membrane artificially, while less than half (34.3%) of the women in comparative group had artificial rupture of membrane. Forty-two women in study group had thick meconium.

**Table 3. Mode of delivery and viability status of the newborn after delivery.**

Variables	Study group (n=102)		Comparative group (n=102)	
	Frequency	Percentage	Frequency	Percentage
<b>Mode of Delivery</b>				
Normal	25	24.5	87	85.3
Caesarean section	76	74.5	15	14.7
Instrumental	1	1.0	0	0.0
<b>Viability Status of the newborn after delivery</b>				
Alive	100	98.0	102	100.0
Neonatal death	2	2.0	0	0.0

Table 3 depicts that majority (74.5%) in the study group had cesarean section while majority (85.3%) in the comparative group had normal delivery. Following delivery, two neonates died in the study group.

**Table 4. Fetal outcome related variables.**

Variables	Study group (n=102)		Comparative group (n=102)	
	Frequency	Percentage	Frequency	Percentage
Apgar score at one minute	Mean ± SD = 6.82 ± 1.87 Minimum = 2 Maximum = 8		Mean ± SD = 7.86 ± 0.64 Minimum = 4 Maximum = 8	
Apgar score at five minutes	Mean ± SD = 8.16 ± 1.33 Minimum = 5 Maximum = 9		Mean ± SD = 8.89 ± 0.51 Minimum = 6 Maximum = 9	
<b>Degree of birth asphyxia based on Apgar score</b>				
No Asphyxia	75	73.5	98	96.1
Moderate Asphyxia	20	19.6	4	3.9
Severe Asphyxia	7	6.9	0	0.0
<b>Need for Resuscitation</b>				
Yes	26	25.5	4	3.9
No	76	74.5	98	96.1
<b>Types of resuscitation (n = 26)</b>				
Oxygen only	26	100.0	4	100.0
Bag and Mask ventilation	15	57.7	1	25.0
Bag and mask ventilation with chest compression	7	26.9	0	0.0
Vigorous stimulation with oxygen	4	15.4	-	-
<b>Need for NICU admission</b>				
Yes	26	25.5	4	3.9
No	76	74.5	98	96.1
<b>Indications for NICU admission, Study group (n = 26), comparative group (n = 4).</b>				
Tachypnea	0	0.0	1	25.0
Grunting respiration	2	7.7	1	25.0
Birth Asphyxia	24	92.3	2	50.0

Table 4 depicts that the mean Apgar score for study group was 6.82 ± 1.87 and 8.16 ± 1.33 in one minute and five minutes respectively. While the mean Apgar score for comparative group was 7.86 ± 0.64 and 8.89 ± 0.51 at one minute and five minutes respectively. In the study group, more than one-fourth (26.5%) of the neonates had moderate to severe birth asphyxia and in the comparative group only four (3.9%) of the neonates had moderate birth asphyxia.

**Table 5. Bivariate and multivariate analysis of the variables associated with Fetal Outcome (Birth Asphyxia).**

Variables	Birth Asphyxia					
	Bivariate Analysis			Multivariate Analysis		
	Present	Absent	COR (95%CI)	p-value	AOR (95%CI)	p-value
<b>Age</b>						
≤ 25 (Ref.)	8	87	0.34 (0.15-0.81)	0.015**	2.66 (1.04-6.81)	0.042**
> 25	23	86				
<b>Color of amniotic fluid</b>						
Clear	4	98	0.11 (0.04-0.33)	<0.001**	11.50 (2.97-44.56)	<0.001**
Meconium stained (Ref.)	27	75				
<b>Meconium consistency</b>						
No Meconium	4	98				
Thin (Ref.)	2	17	0.27 (0.17-0.43)	<0.001**	3.94 (0.76-20.41)	0.101
Moderate	0	41				
Thick	25	17				
<b>Mode of delivery</b>						
Normal (Ref.)	10	102	0.36 (0.17-0.79)	0.019**	0.70 (0.24-2.09)	0.528
Caesarean	21	70				
Instrumental	0	1				

\*\* p-value significant at <0.05

Likewise, more than one-fourth (25.5%) of the baby from study group needed resuscitation following delivery, while only 4 (3.9%) of the baby from comparative group needed resuscitation. Among them, oxygen was given to all (100%) of the baby in study group followed by bag and mask ventilation (57.7%), bag and mask ventilation with chest compression (26.9%) and vigorous stimulation with oxygen (15.4%). While among the comparative group, bag and mask ventilation was used in only one of the babies.

Regarding NICU admission, more than one-fourth of the baby in study group needed NICU admission and the reason for the admission was birth asphyxia for almost all the neonates. While in the comparative group, only two of the neonates needed admission for birth asphyxia.

Table 5 describes the bivariate and multivariate analysis of the variables with birth asphyxia. Maternal age (COR=0.34; 95% CI=0.15-0.81; p=0.015), meconium stained amniotic fluid (COR=0.11; 95% CI=0.04-0.33; p=<0.001), meconium consistency (COR=0.27; 95% CI=0.17-0.43; p=<0.001), and mode of delivery (COR=0.36; 95% CI=0.17-0.79; p=0.019) were found to be associated with birth asphyxia in the bivariate analysis while maternal age (AOR: 2.66; 95% CI: 1.04-6.81) and color of amniotic fluid (AOR: 11.50; 95% CI: 2.97-44.56) were found to be associated with birth asphyxia in

multivariate analysis. Newborns with the mother’s age ≤ 25 years were 2.66 times more likely to have birth asphyxia. The probability of having birth asphyxia in the newborns delivered with MSAF was 11 times higher than that of clear amniotic fluid.

## DISCUSSION

Our study findings revealed that, on comparing mean Apgar score at one and five minutes in both groups, it was found that significantly lower Apgar scores were seen in newborns delivered with MSAF as compared to the clear liquor group. The 1 minute Apgar score was low (6.82±1.87) in newborns delivered with MSAF than that of clear amniotic fluid, where the 1 minute Apgar score was 7.86 ± 0.64. Likewise, the 5 minute Apgar score was 8.16 ± 1.33 and 8.89±0.51 in the study and comparative group respectively. Erum et al. also reported similar findings.<sup>7</sup>

In our study, more than one-fourth (26.5%) of the neonates had moderate to severe birth asphyxia in the study group whereas only four (3.9%) of them had moderate birth asphyxia in the comparative group. This finding is in line with the study findings conducted in India.<sup>8</sup> Contrast findings were seen in the study conducted in Ethiopia and Cameroon.<sup>9,10</sup> Findings from all of these studies suggest that birth asphyxia is more evident in neonates born with meconium stained

amniotic fluid than that of clear amniotic fluid.

Regarding meconium consistency, in the present study, 18.6% of women had thin meconium stained amniotic fluid. Moderate and thick meconium stained amniotic fluid was observed in almost similar percentage of women i.e. 40.2% and 41.2% respectively. Altogether in our study, the percentage of moderate to thick meconium stained amniotic fluid is 81.4%. Similar findings were noted in a study of Demisew et al.<sup>11</sup> Contrast findings were noted in many other studies.<sup>9,12-14</sup>

Regarding mode of delivery, in this study, majority (74.5%) in the study group had cesarean section while only 14.7% of the women in the comparative group had cesarean section. Similar findings were observed in the study conducted in Pakistan<sup>7</sup> and Cameroon.<sup>13</sup> The higher rate of cesarean section in the meconium stained amniotic fluid could possibly be explained due to the lack of facility for monitoring fetal scalp pH, a state of anxiety among health workers regarding the safe outcome of delivery.

In the present study, following delivery, two neonates (2%) died in the study group while no neonatal death was observed in the comparative group. This finding corresponds with the study findings of Bangladesh<sup>15</sup> and India.<sup>8</sup> These study findings could explain the fact that adverse fetal outcome is frequently seen in the newborn delivered with meconium stained amniotic fluid because intrapartum hypoxia leads to the passage of meconium.

Our study findings revealed that 25.5% of the neonates in study group required NICU admission in contrast to 3.9% of the neonates in comparative group. However, study conducted in Cameroon<sup>13</sup> showed that among the neonates born with meconium stained amniotic fluid, 40.40% require NICU admission whereas 19.20% of the neonates born with clear amniotic fluid require NICU admission. Both the study findings highlighted that the rate of NICU admission is greater in neonates born with meconium stained amniotic fluid than that of clear amniotic fluid. The possible reason behind this might be due to the exposure of fetus into intrapartum hypoxia leading to adverse outcomes following delivery requiring resuscitative measures along with NICU care.

In our study, among the newborns admitted in NICU, almost all (96%) were admitted due to birth asphyxia in the study group while 50% were admitted for the same reason among the newborns in comparative group. Contrast finding was noted in the study conducted by Mundhra et al.<sup>16</sup> where 15.15% of newborns delivered

with MSAF were admitted to NICU due to birth asphyxia as compared to 5.26% of the control group. This variation might be due to variation in the operational definitions set for birth asphyxia, subjective bias in Apgar scoring at 1 minute and 5 minutes of birth, methods and duration of resuscitation etc.

In this study, the result of bivariate analysis showed that maternal age (COR=0.34; 95% CI=0.15-0.81;  $p = 0.015$ ), meconium-stained amniotic fluid (COR=0.11, 95% CI=0.04-0.33,  $p < 0.001$ ), meconium consistency (COR=0.27, 95% CI=0.17-0.43,  $p = < 0.001$ ), and mode of delivery (COR=0.36; 95% CI=0.17-0.79,  $p = 0.010$ ) were found to be associated with birth asphyxia. Similar findings were noted in various other studies conducted.<sup>11,17-22</sup>

In the present study, the result of multivariate analysis depicts that maternal age and color of amniotic fluid were the strong predictor of birth asphyxia.

Newborns with the mother's age  $\leq 25$  years were 2.66 times more likely to have birth asphyxia as compared to newborns with the mothers age  $>25$  years (AOR=2.66; 95% CI=1.04-6.81;  $p=0.042$ ). Similar result was found by Ibrahim et al.<sup>17</sup> (AOR=0.02; 95%CI=0.050-0.091;  $p=0.03$ ). However contrast findings were reported in other studies.<sup>23,24</sup>

Regarding color of amniotic fluid, in our study, those newborns delivered with meconium stained amniotic fluid were 11.50 times more likely to develop birth asphyxia than that of clear amniotic fluid (AOR=11.50; 95% CI=2.97-44.56;  $p < 0.001$ ). Similar findings were reported in various studies.<sup>18,19,25</sup> This similarity might again be due to the established fact that meconium staining of the amniotic fluid is closely related to the intrapartum hypoxia leading to birth asphyxia.

## CONCLUSIONS

Meconium-stained amniotic fluid was associated with increased frequency of cesarean section and adverse fetal outcome with birth asphyxia being the major complications compared with clear amniotic fluid. Predictors of birth asphyxia were maternal age and color of amniotic fluid.

## ACKNOWLEDGEMENTS

We would like to acknowledge all the participants and staffs of labour room of Nepal Medical College Teaching Hospital for their valuable time and support during data



collection. We are very much grateful to IRC of Nepal Medical College for providing grant to conduct this study.

#### Author Affiliations

<sup>1</sup>Nepal Medical College, Department of Nursing, Kathmandu University, Jorpati, Kathmandu, Nepal

<sup>2</sup>Institute of Medicine, Tribhuvan University, Maharajgunj Nursing Campus

**Competing interests:** None declared

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