

Meconium-Stained Amniotic Fluid and Its Perinatal Feto-maternal Outcome

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Abstract

Meconium Stained Amniotic Fluid is associated with increased risk of operative delivery or caesarean section and increased rate of neonatal resuscitation, morbidity and mortality. A hospital-based prospective, observational study was conducted in the Obstetrics & Gynecology Department, NICU and Neonatal Ward of Naval Base Hospital, a tertiary care hospital of Bangladesh Navy, Chattogram, Bangladesh, between January 2020 and December 2021. A semi-structured questionnaire was prepared for both case and control group. 182 cases were enrolled as case and another 182 cases were as control. Antenatal checkup was significantly less in cases ($p < 0.05$). Mean weight was 2.8 ± 0.4 Kg in cases and in control 2.7 ± 0.5 Kg ($p < 0.01$). Mean fetal heart rate were 140 ± 10.5 beats/min in cases and in control 135.7 ± 7.2 beats/min ($p < 0.01$). Apgar scores at 1st minute and fifth minutes were significantly lower in cases (7 ± 1.4 and 8.2 ± 1.2 respectively) in comparison to control (7.5 ± 0.3 and 9.2 ± 1.1 respectively). Obstetric outcome of labor, that is mode of delivery was significantly dictated by the presence of MSAF. There were more than half (57.1%) of the cases were having grade three MSAF, whereas grade one and grade two were 14.8% and 28% respectively. Perinatal asphyxia, 5 min APGAR score < 7 , oropharyngeal suction needed, EONS, MAS, admission in NICU/Neonatal ward and neonatal death all were significantly higher in MSAF group. MSAF is associated with increased need for neonatal resuscitation, higher risk of perinatal asphyxia, MAS, hospital admission and mortality for fetus and higher risk for operative delivery.

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Introduction

Prevalence of meconium (a Greek word meaning 'opium' or 'poppy like substance', which was believed to increase sleepiness of fetus) stained amniotic fluid (MSAF) is 8%-20% of all the deliveries.¹⁻³ Globally, 7-22% of all live births are complicated by MSAF. But meconium aspiration syndrome (MAS) occurs in only 1-3% of all cases of MSAF and in 10-30% of these neonates, meconium is present below the vocal cords.⁴ Meconium appears very early in the fetal intestine, but it is not seen in amniotic fluid before 38 weeks of gestation. Meconium passage, a normal event within first 24-48 hours after delivery, in the uterus is also considered normal in post term as a sign of gastrointestinal maturation.^{1,5-7}

Feto-maternal stress factors like hypoxia and infection lead to meconium passage in utero in near-term or term and occurrence of MSAF is a warning sign of adverse perinatal and neonatal

events such as low APGAR score, perinatal asphyxia, chorioamnionitis, increased rate of neonatal intensive care unit (NICU) admission, MAS and mortality.^{1,5}

Aspiration may occur antepartum, intrapartum, or even at infant's first breath. In-utero gasping with aspiration of meconium is indicated by fetal distress which causes an asphyxial event in fetus that results in complications.^{2,7} Detection of MSAF is also associated with abnormal fetal

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heart rate (FHR), so once the MSAF is detected, continuous FHR monitoring is needed as is associated with abnormal fetal outcome. Meconium aspiration into the neonatal lungs, is associated with clinical entities ranging from respiratory distress to severe respiratory compromise thus leading to significant increase in perinatal morbidity and mortality.¹ MSAF is associated with increased risk of operative interference in terms of instrumental delivery or caesarean section and increased rate of neonatal resuscitation.^{1,8} Approximately 10% of all the pregnancies have MSAF, out of which 5% i.e., 1 in 200 cases goes for meconium aspiration into lungs of fetus or neonate leading to severe respiratory distress and MAS.^{1,9} MAS can cause or contribute to neonatal death. Around one third of all the cases of MSAF, in which aspiration occurs can develop long term respiratory compromise.¹⁰

MSAF is a clinical diagnosis with no confirmatory test.¹ Various methods which may help to detect MSAF include amnioscopy during early labor, oropharyngeal suction and endotracheal intubation after birth. Perinatal morbidity and mortality associated with MSAF can be decreased by identifying the high-risk factors in antenatal period and careful decisions are made about the timing and mode of delivery and vigilant monitoring of the labour.^{1,11}

MSAF is classified into three grades:¹²

1. Grade one MSAF: small amount of meconium diluted in a plentiful amount of amniotic fluid. The fluid has only a slightly greenish or yellowish discoloration.
2. Grade two MSAF: moderate meconium staining, when there is a fair amount of amniotic fluid, but it is stained with meconium. In this case, it will be 'khaki green' or brownish.
3. Grade three MSAF: heavy staining, when there is reduced amniotic fluid and a large amount of meconium, making the staining quite thick, with 'pea soup' consistency.

This study was carried out to see the correlation of MSAF with perinatal fetal and maternal outcome as there is scarcity of significant data in our country, in relation with stage and mode of delivery and antenatal complications.

Although the magnitude and associated factors of MSAF were well studied in the developed countries, there is a paucity of locally generated evidence. Therefore, our study aims to determine the prevalence of MSAF and its associated factors among women who gave birth at.

Methods

A hospital-based prospective observational study was conducted in the Obstetrics and Gynecology Department, NICU and Neonatal Ward of Naval Base Hospital, a tertiary level hospital of Bangladesh Navy, Chattogram, Bangladesh, between January 2020 and December 2021. The prospective cohort study was conducted to determine the immediate perinatal outcome of MSAF compared with clear amniotic fluid (CAF). During this 2 years duration all consented pregnant women in labor who had completed 37 weeks of gestation, with viable singleton pregnancies with cephalic presentations and who had light green, Khaki green, yellow, brownish, thin/thick ('pea soup') MSAF in labor were included. Twin pregnancy, eclampsia, antepartum hemorrhage, intrauterine fetal death, congenital malformations, preexisting maternal cardiovascular disease, other than cephalic presentation were excluded. Gestational age was calculated from last menstrual period (LMP) or

early ultrasound done before 24 weeks and those with an unknown date or without early ultrasound were also excluded.

Those with MSAF were case referred to as "MSAF group", and those with clear amniotic fluid were non-exposed groups referred to as "CAF group" is taken as control group in our study. All neonates were followed up to 7 days in NICU/Neonatal Ward or asked for a follow up visit on the 7th day at neonatal OPD in the same hospital. A semi-structured questionnaire was prepared for both case and control group. Informed written consent was taken from all participants before enrollment. Relevant investigations were done. Data were analyzed by using SPSS version 20.0.

Chi-square test was used to check statistical associations between MSAF and outcome variables and covariates. Outcome variables with a p-value less than 0.05 were selected and cross-tabulation was done to determine the strength and direction of the association between MSAF and each outcome variable.

Results

During the study period 182 cases were enrolled as case and another 182 cases were as control. Mean maternal age was 23.9 ± 5.3 years in case and 23 ± 4.6 years in controls. Among the cases 45% and 39% of control group are from rural area. There is no statistically significant difference in the sociodemographic characteristics between two groups. Antenatal checkup was significantly less in cases ($p < 0.05$). Mean Gestational age at the time of delivery was 39.7 ± 1.2 weeks in cases and 38.7 ± 1.1 weeks in control. Among the cases 86.8% and 85.7% of control group are Resus positive. Duration of labor above 24 hours was seen in 11(7.6%) of the stained fluid group compared to 10(4.5%) of

the non-stained fluid group. Prolonged rupture of membrane above 12 hours was seen in 32(19.3%) of the stained fluid group and 71(24.4%) of the non-stained fluid group.

There was no statistically significant difference in terms of duration of the rupture of membrane and labor between the two groups. Induced labor is significantly associated to MSAF in comparison to spontaneous labor. Mean gravida was in 1.9 ± 0.8 in case where as 1.8 ± 0.8 in control group. Mean weight was 2.8 ± 0.4 Kg in cases and in control 2.7 ± 0.5 Kg ($p < 0.01$). Mean fetal heart rate were 140 ± 10.5 beats/min in cases and in control 135.7 ± 7.2 beats/min. ($p < 0.01$). Apgar scores at 1st minute and fifth minutes were significantly low in cases (7 ± 1.4 and 8.2 ± 1.2 respectively) in comparison to control (7.5 ± 0.3 and 9.2 ± 1.1 respectively). Male and female ratio of newborns was 1.8:1 and 1.6:1 in cases and control respectively (Table-I). Obstetric outcome of labor, that is mode of delivery was significantly dictated by the presence of MSAF. There was 68.2% Caesarian section in cases in comparison to 49.5% in control (Table-II). There were more than half (57.1%) of the cases were having grade three MSAF, whereas grade one and grade two were 14.8% and 28% respectively (Table-III). Perinatal asphyxia was more in cases (15.4%) than control (3.8%) ($p < 0.01$). 5th minute APGAR score < 7 was found more in cases (35.7%) than control (13.2%) ($p = 0.001$). Requirement of oropharyngeal suction was also more in cases (64.8%) than control (19.8%) ($p = 0.001$). Intubations needed in cases (6%). Early onset neonatal sepsis (EONS) was more (6%) in cases ($p = 0.001$). MAS developed only in cases (16.8%). Admission in NICU/neonatal ward was more (22.5%) in cases (5.5%) ($p < 0.05$). Neonatal death was also significantly higher in cases (3.3%) than control (1%) ($p = 0.001$) (Table-IV).

Table-I: Demographic characteristics of the study population (n=364)

Variables		Case (n=182)	Control (n=182)	p value
Maternal age (in year) Mean±SD		23.9±5.3	23.±4.6	0.22
Residing area	Urban	100 (55%)	111 (61%)	
	Rural	82 (45%)	71 (39%)	
Religion	Islam	145 (79.6%)	146 (80%)	0.821
	Hindu	22 (12%)	24 (13.2%)	
	Buddha	12 (6.6%)	10 (5.5%)	
	Christian & others	3 (1.6%)	2 (1%)	
Level of education	Illiterate	14 (7.7%)	13(7.1%)	
	Primary	79 (43.4%)	75(41.2%)	
	High school	64 (35.1%)	66(36.3%)	0.96
	College & University	25 (13.75%)	28(15.4%)	
Occupational status	Home maker	135 (74.1%)	132 (72.5%)	
	Employed	38 (20.8%)	44(24.2%)	0.721
	Student	3(1.6%)	2(1%)	
	Others	5(2.7%)	4(2.2%)	
Antenatal check up		151(83%)	171(94%)	0.01
Gestational age at delivery (in week) Mean±SD		39.7±1.2	38.7±1.1	0.01
Resus status	Positive	158 (86.8%)	156 (85.7%)	
	Negative	24 (13.1%)	26 (14.2%)	
Duration of labor	<12 hours	133 (55.6%)	131 (62.4%)	
	12-24 hours	39 (36.8%)	40 (33.1%)	0.238
	>24 hours	10 (7.6%)	11 (4.5%)	
Onset of labor	Spontaneous	150 (82.4%)	166 (91.2%)	
	Induced	32 (17.6%)	16 (8.8%)	0.007
Duration of rupture of membrane	<12 hours	133 (73%)	131 (72%)	
	12-24 hours	39 (21.4%)	40 (22%)	0.264
	>24 hours	10 (5.4%)	11 (6%)	
Gravida (mean ± SD)		1.9±0.8	1.8±0.8	0.38
Associated Obstetric or Medical condition		69	57	
Chorioamnionitis		5 (7.2%)	3 (5.3%)	
Abruptio placenta		9 (13%)	13 (22.8%)	
Pregnancy Induced Hypertension (PIH)		34 (49.3%)	20 (35%)	
Growth restriction		9 (13%)	10 (17.5%)	
Pregestational DM		2 (2.9%)	6 (10.5%)	
Oligohydramnios		10 (14.5%)	5 (8.8%)	
Birth weight (Kg) Mean±SD		2.8±0.4	2.7±0,5	0.005
Fetal heart rate (beats/min) Mean±SD		140±10.5	135.7±7.2	0.003
APGAR score at 1 st min Mean±SD		7±1.4	7.5±0.3	0.001
APGAR score at 5 th min Mean±SD		8.2±1.2	9.2±1.1	0.01
Gender (Male : Female)		1.8:1	1.6:1	-

Table-II: Obstetric outcome of labor (n= 294)

Mode of delivery	Case (n=182)	Control (n=182)	p value
Vaginal delivery	58 (31.8)	92 (50.5)	0.001
Caesarian section	124 (68.2)	90 (49.5)	0.001

Figures in parentheses indicate percentage.

Table-III: Consistency of MSAF in cases (n=182)

Grade one	Grade two	Grade three
27(14.8)	51(28)	104(57.1)

Figures in parentheses indicate percentage.

Table-IV: Fetal outcome (n= 294)

Variables	Case (n=182)	Control (n=182)	p value
Perinatal Asphyxia	28 (15.4)	7(3.8)	<0.01
5min APGAR score <7	65 (35.7)	24 (13.2)	0.001
Oropharyngeal suction required	118 (64.8)	36(19.8)	0.001
Intubation needed	11 (6)	1 (0.5)	0.001
Early onset neonatal sepsis (EONS)	11 (6)	4 (2.2)	0.001
MAS	30 (16.8)	0 (0)	<0.01
Admission in NICU/Neonatal ward	41 (22.5)	10 (5.5)	<0.01
Neonatal death	6 (3.3)	2 (1)	0.001

Figures in parentheses indicate percentage

Discussion

This hospital-based study was conducted to find out the immediate perinatal outcome of those deliveries where liquor was meconium stained and to determine the risk of adverse fetal outcome associated with meconium-stained amniotic fluid. Gestational age at the time of delivery in weeks (39.7±1.2) were found

significantly higher in cases. Khatun *et al.*¹³ found significant increased rate of meconium-stained amniotic fluid at 39.3±1.5 weeks, but this study also found significant increase in rate of meconium-stained amniotic fluid in increased maternal age, in our study it was found non-significant. We found that antenatal checkup was significantly lower in cases than that of control group. Khatun *et al.*¹³ and Khatun¹⁴ also found significant correlation between antenatal checkup and MSAF. Induced onset of labor by medical means were significantly higher in cases (p=000.7) than control. Tolu *et al.*¹² and Kashikar *et al.*¹⁵ also found the significantly higher rate of induction of labor in MASF group. Mean fetal birth weight and mean FRH were also found significantly high in cases, which is similar to the findings of Khatun *et al.*¹³

In the present study, APGAR score at 1st minute and 5th minute both were significantly lower in the cases in comparison to control group. Biradar *et al.*¹ and Khatun *et al.*¹³ found similar results in case APGAR score at 5th minute, and Tolu *et al.*¹² found similar result at 1st minute. A similar study done by Tolu *et al.*¹² reported that Caesarian section as mode of delivery in 44.5% MSAF group as compared to 22.6% non-stained fluid group, which is significantly higher than the control. In our study, the rate of cesarian section is also significantly higher in MSAF group. Despite availability of fetal monitoring facilities, most obstetricians feel unsafe about fetal outcome, which eventually leads to delivery by Caesarean operation.^{11,13} Usharani *et al.*¹⁶ found Grade one MSAF in 9.1%, Grade two MSAF in 30.9% and Grade three MSAF is 60% cases, which is almost similar to our findings. Several researchers have found significant association of MSAF and poor perinatal outcome.^{1,13,15,17}

Conclusion

MSAF is associated with increased need for neonatal resuscitation, higher risk of perinatal asphyxia, MAS, hospital admission and mortality for fetus and higher risk for operative delivery. Hence, selection of pregnant woman at risk of passage of meconium during labor should be on fetal monitoring and early intervention may lead to reduction in fetal adverse outcome.

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