

Meconium Stained Amniotic Fluid: Factors affecting Maternal and Perinatal Outcomes at Jimma University Specialized Teaching Hospital, South West Ethiopia

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Abstract

Background: Meconium is not only a potential sign of fetal hypoxia but is also a potential toxin if the fetus aspirates particulate matters with a gasping breath in utero or when it takes its first breaths following birth. In addition to this the condition of the mother who gives birth in such circumstances is a concern.

Methods: A hospital based cross-sectional descriptive study was carried out on labouring mothers with meconium stained amniotic fluid who delivered in the labor ward of Jimma University Specialized Hospital during October 1, 2012 to December 30, 2012. All labouring mothers with meconium stained amniotic fluid (MSAF) during the study period were included. Data on history of the patient, patient specific demographics and obstetric information was collected using pretested structured questionnaire. Relevant data was abstracted from the neonatal chart and the logbook in the neonatology ward. Statistical tests of association using SPSS (version 16.0, IBM Corporation) were employed at the level of significance of 5%.

Results: The overall rate of meconium stained amniotic fluid was 15.4% (151/979) and 74.8% of the cases had moderate to thick meconium stained amniotic fluid. Mode of delivery in 70.2% of cases was operative delivery; and those mothers with a grade three meconium stained liquor had about 5 times increased risk of operative delivery when compared with mothers with grade 1 staining (OR=4.66, 95%CI:1.52-14.30). First minute Apgar score was less than 7 in 88% of the new born while it was less than 4 in 15% of the cases. However, there was no statistically significant association between the thickness of meconium and low first minute Apgar score. Those babies who were delivered with operative delivery had 16 times increased risk of low 5th minute Apgar score. Among the 27.1% of new born sent to the Neonatal Intensive Care Unit, 71.4% (19.9% of the total) were diagnosed to have Meconium Aspiration Syndrome with clinical examination alone. Those new-borns with first minute Apgar score <7 had three times increased risk of MAS (95% CI: 1.087-10.668) and the presence of meconium stained secretion in the oropharynx of a new born resulted in 9 times increased risk of Meconium Aspiration Syndrome.

Conclusion: The study revealed that Moderate to thick meconium stained amniotic fluid was associated with increased risk of operative delivery, low 5th minute Apgar score and Meconium Aspiration Syndrome. Shortening the threshold for intervention for labor with fetal heart rate abnormalities in the presence of meconium stained amniotic fluid and introducing further fetal evaluation methods like fetal scalp PH analysis are recommended.

Keywords: Meconium; Liquor; Meconium aspiration syndrome; Amniotic fluid

Introduction

Meconium is a black-green, odourless material first demonstrable in the fetal intestine during the third month of gestation [1] and it results from the accumulation of debris [2].

Passage of meconium slows down after 16 weeks and cease by 20 weeks of gestation. Almost all new-born infants who pass meconium are mature (term), however, in some cases; meconium passage may be associated with umbilical cord compression or increased sympathetic inflow during hypoxia and is also a potential toxin if the fetus aspirates this particulate matter with a gasping breath in utero or when it takes its first breaths following birth. In addition intrauterine exposure to meconium is associated with inflammation of tissues of the lung, chorionic plate and umbilical vessels and through various mechanisms may contribute to neonatal morbidity, independent of MAS [3-7].

Meconium stained amniotic fluid (MSAF) occurs in 12 to 20% of labouring mothers [8], and it is a confusing issue because it can be due to either physiologic or a hypoxic insult to the fetus. Birth depression occurs in 20 to 33% of infants born through MSAF and is likely caused by chronic asphyxia and infection that may lead to passage

of meconium and fetal gasping [9]. This suggest that meconium-stained amniotic fluid should be regarded as a symptom rather than a syndrome becoming more prevalent with increasing term and which might be associated with higher levels of infection or asphyxia [6].

In healthy, well oxygenated foetuses, meconium is cleared from the lungs by normal physiological mechanisms. The presence of the combination of intra-amniotic inflammation with fetal systemic inflammation is however, an important antecedent of MAS. Even with therapy, seriously affected infants frequently die or suffer long-term neurological sequelae [7,10,11].

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Early studies reported that the incidence of meconium aspiration syndrome (MAS) could be reduced by oropharyngeal suctioning (ONPS) following delivery of the fetal head, but before delivery of the chest. However, study has shown that this did not reduce the incidence or severity of MAS even in a setting of high incidence of MAS in a developing country [12] and it seems to be associated with complications.

The maternal risk associated with meconium stained liquor is that meconium-laden amniotic fluid embolism [13], puerperal metritis with meconium-stained amniotic fluid is increased two- to four fold and increased risk of operative deliveries [14].

The incidence of MAS in the developed world is low as it is shown in study of infants ≥ 37 weeks gestational age born through MSAF in USA from 1990 to 1998, MAS decreased nearly fourfold (5.8 to 1.5 percent in 1990 to 1992 and 1997 to 1998, respectively). This was associated with a significant reduction in births ≥ 41 weeks gestation (42 to 28%), as well as increased diagnosis of non-reassuring fetal heart rate pattern (NRFHP) and cesarean delivery [12].

In a retrospective cohort study of all deliveries beyond 37 weeks gestational age in University of California, USA, the overall incidence of meconium in the study group was 18.9%, with thin, moderate, and thick meconium in 8.8%, 5.5%, and 4.6% of patients respectively. In this study and others it was found that moderate-thick MSAF was not only significantly associated with increase in chorioamnionitis and endomyometritis but also it was a significant predictor for other perinatal complications (cesarean delivery, operative vaginal delivery, admission to the neonatal ICU, and 5-minute Apgar score of ≤ 6) [14-21].

A study showed the incidences of fetal distress (6.5% vs. 2.1%), clinical chorioamnionitis (0.2% vs. 0.1%), post-partum infection (0.5% vs. 0.2%), 1-minute Apgar score < 3 (1.9% vs. 1.1%) and small for gestational age (7.4% vs. 6.4%) were significantly higher in the MSAF compared with the clear amniotic fluid group [17]. There were similar findings in other study in Liaquat University of Medical Health Sciences, Hyderabad, India [15], University of Baudelocque, Paris, France [18] and in Hong Kong [11].

In a large cohort of infants in Australia and New Zealand, a higher risk of MAS was noted in 34% of cases born beyond 40 weeks. Fetal distress requiring obstetric intervention was noted in 51% of cases and 42% were delivered by cesarean section. There was a striking association between low 5-minute Apgar score and MAS. Death related to MAS occurred in 24 infants (2.5%) of the MAS cohort [13].

In a study done in Thomas Jefferson University, USA to assess whether intubation and suctioning of apparently vigorous, meconium-stained neonates would reduce the incidence of MAS, compared with expectant management, intubation and suctioning of the apparently vigorous meconium-stained infant does not result in a decreased incidence of MAS or other respiratory disorders [8].

Although maternal and perinatal outcomes in MSAF were well studied in the developed countries, very little is known about the situation in the developing countries including Ethiopia. This study was therefore, aimed at determining maternal and perinatal outcomes and associated factors among mothers with MSAF.

Methods and Participants

The study was conducted in Oromia region, Jimma Zone, Jimma Town, Jimma University Specialized Hospital Obstetrics and Gynecology department, Obstetrics ward from October 1, 2012 to

December 31, 2012. The hospital is one of the oldest teaching hospitals in the country. It provides services to people living in Jimma Zone and serves as a referral hospital in South-West Ethiopia. It is also serving as a clinical postgraduate specialty teaching hospital for Obstetrics and Gynecology, Internal Medicine, Pediatrics and Child Health since 2005 and for Ophthalmology and Surgery since 2007. The Department of Obstetrics and Gynecology has one gynecology ward, one maternity and labor ward, one gynecology OPD, one antenatal care clinic and one family planning clinic (JUSH archive).

A Hospital based cross sectional descriptive study was carried out on all laboring mothers with meconium stained amniotic fluid who delivered in the labor ward of Jimma University Specialized Hospital during the study period. Those mothers who presented with Breech presentation, non-reassuring fetal heart pattern on admission, dead fetus and those who presented to the labor ward in the second stage were excluded from the study.

A structured interviewer administered pretested questionnaire was used to collect data. One third year and two second year residents in obstetrics/gynecology were trained on how to collect data with demonstration of few cases. Data on history of the patient, patient specific demographics and obstetric information were collected through interview of the mother and by reviewing her medical records. Relevant data were abstracted from the neonatal chart and the logbook in the neonatology ward.

The collected data was analyzed using SPSS for window version 16 (IBM Corporation). Descriptive statistical measures such as frequencies and percentages were generated and presented in tables. Logistic regression analysis was conducted to identify statistical association between measures of maternal and fetal outcome (dependent variables) and the explanatory variables. Statistical significance was declared when one was not included in the 95% CI of the crude and adjusted odd ratios.

The study protocol was approved by the Ethical Review Board of Jimma University. The study participants were informed about the objectives and benefits of the study following which informed consent was obtained. All of the information accessed during the study was used for the purpose of this study alone.

In this research, the following operational definitions were used.

Apgar score

The Apgar score is determined by evaluating the newborn baby on five simple criteria on a scale from zero to two, then summing up the five values thus obtained (Annexure 1).

Grade one meconium stained liquor

Small amount of meconium diluted in a plentiful amount of amniotic fluid. This gives the fluid only a slightly greenish or yellowish discoloration.

Grade two meconium stained liquor

Moderate meconium staining, when there is a fair amount of amniotic fluid, but it is clearly stained with meconium. In this case it will be 'khaki green' or brownish in color.

Grade three meconium stained liquor

Heavy staining, when there is reduced amniotic fluid and large amount of meconium, making the staining quite thick, with 'pea soup' consistency.

Results

Of the 979 laboring mothers who gave birth in the labor ward of JUSH during the study period, 151 (15.4%) laboring mothers had meconium stained amniotic fluid (MSAF). Most of these mothers (94.7%) were in the age group of 18-35 years and from rural areas (62.9%). More than one third of the women were illiterate while close to two third of them were housewives. Majority (97.4%) of the laboring mothers were married and 87.4% of the women were para 1-4. The gestational age at delivery was between 37 and 42 weeks in 132 (87.4%) of the laboring mothers. Seven mothers (4.6%) had post term pregnancy and 12 (7.9%) were diagnosed to have preterm delivery. In 35 (23.2%) of the cases there was non-reassuring fetal heart rate pattern including bradycardia, tachycardia or late deceleration pattern. Fifty percent of the foetuses were delivered within 30 minutes of detecting the NRFHP while the other half stayed for more than 30 minutes (Table 1).

There was meconium stained secretion in the oropharynx of 46.3% of the new-borns. After birth drying and rapping was done for 45.6% of the new-borns, and or nasopharyngeal suctioning (ONPS) was done for 32.5% of the cases in addition to drying and rapping. About 11% of the new-borns were given bag mask ventilation without Oropharyngeal suctioning (ONPS) and the rest 10% were also given bag mask ventilation but it was after ONPS was done (Table 2).

Forty two (27.8%) of the new-borns were sent to the Neonatal Intensive Care Unit (NICU) in the immediate postpartum days, and 28 (70%) of these were diagnosed to have meconium aspiration syndrome (MAS), which accounts for 18.5% of the total 151 new-borns. There were 3 cases diagnosed to have early onset neonatal sepsis (EONS) and

Baseline characteristics of the participants (N=151)		Frequency	Percent
Age	<18	3	2.0
	18-35	143	94.7
	>35	5	3.3
Educational status	Illiterate	61	40.4
	Read and write	21	13.9
	Primary school	40	16.5
Occupation	Farmer	30	19.9
	Housewife	98	64.9
	Government employee	21	13.9
	Others	2	1.3
Parity	1-4	132	87.4
	5 or more	19	12.6
New born and fetal conditions			
Intrapartum fetal heart rate pattern (N=151)	Reassuring	116	76.8
	Tachycardia	7	4.6
	Bradycardia	25	16.6
	Late deceleration	3	2.0
Duration of NRFHP before delivery in minutes (N=35)	30-60	14	40
	>60	4	11.4
	<30	17	48.6
Gestational age in weeks (N=151)	<37	12	7.9
	37-42	132	87.4
	>42	7	4.6
Diagnosis of the newborns admitted to NICU (N=42)	MAS	28	70.0
	EONS	2	5.0
	Others	7	17.5
	MAS and EONS	2	5.0
	PNA	1	2.5

Table 1: Characteristics of laboring mothers and newborns with MSAF in JUSH, Oct 1, 2012 to Dec 31, 2012.

Maternal conditions		Frequency	%
Antepartum obstetrics complications (N=32)	Hypertensive disorders	17	53.1
	Prolonged pregnancy	7	21.9
	Others	8	25
Medical illnesses during the current pregnancy (N=151)	No	139	92.1
	Yes	12	7.9
Indications for induction of labor (N=13)	Preeclampsia	8	61.5
	Post term pregnancy	3	23.1
	Others	2	15.4
Time of ROM (N=151)	After the onset of labor	113	74.8
	Before the onset of labor	38	25.2
Stage of labor at diagnosis of MSAF (N=151)	Latent phase of first stage of labor	45	29.8
	Active phase of labor	106	70.2
Duration of ROM* before delivery (N=151)	<12 hrs	93	61.6
	≥12 hrs	58	38.4
Mode of delivery (N=151)	SVD	45	29.8
	Instrumental	40	26.5
	C/S	66	43.7
Indications for the Operative deliveries (N=106)	NRFHP	31	29.5
	CPD	34	32.4
	prolonged second stage	23	21.9
	Malpresentation	4	2.9
	Others	14	13.3
Length of labor (N=151)	<20 hrs	104	68.9
	≥20 hrs	47	31.1
Grade of meconium (N=151)	Grade 1	38	25
	Grade 2	60	40
	Grade 3	53	35
Mode of newborn resuscitation (N=39)	Drying and rapping	28	46
	ONPS, drying, rapping	2	33
	ONPS, drying, rapping, no BMV*	7	11
	ONPS, drying, rapping, BMV	2	10

*ROM=Rupture of Membranes, BMV=Bag Mask Ventilation

Table 2: Antepartum maternal conditions of laboring mothers with MSAF in JUSH, Oct 1, 2012 to Dec 31, 2012.

the rest had either perinatal asphyxia (PNA) or other diagnosis and all of these diagnoses were made clinically (Table 1).

Among the 32 (21%) of labouring mothers who had antepartum obstetric complications, 17 (53.3%) were diagnosed to have hypertensive disorders of pregnancy. Onset of labor was spontaneous in 138 (91.4%) of the cases and 8 (5.3%) were induced for severe preeclampsia. Thirty eight (25%) of the cases had rupture of membrane before the onset of labor and it was prolonged more than 12 hours in 58 (38.4%) of cases. In 45 (29.8%) of the cases, diagnosis of MSAF was made during latent phase of labor and the remainder were identified during active first stage of labor. In 113 (74.8%) of the cases liquor was either grade 2 or grade 3 meconium stained. Mode of delivery in 106 (70.2%) of the cases was operative delivery; Cesarean Section in 66 (43.7%) and instrumental delivery in 40 (26.5%). The indication for the operative deliveries in 34 (32.4%) of the cases was cephalopelvic disproportion (CPD). Non Reassuring Fetal Heart Rate Pattern (NRFHP) was an indication in 31 (29.5%) of cases (Table 3).

A stepwise multiple logistic regression analysis revealed that, those mothers who had a grade 3 meconium stained liquor were 5 times more likely to have either of the operative deliveries compared to the women with grade 1 liquor (OR=4.66, 95%CI:1.516-14.298). Those with Intrapartum NRFHP had 4 times increased risk of operative delivery when compared with those with reassuring fetal heart rate

Variables	Mode of delivery		COR (95% CI)	AOR(95% CI)	
	SVD	Operative			
Fetal heart rate pattern	Reassuring	42(27.8%)	74(49%)	1	1
	Nonreassuring	3(2%)	32(21.2%)	6.05(1.75-20.97)	4.17(1.20-15.81)
Status of liquor	Grade 1	18(12%)	20(13.2%)	1	1
	Grade 2	20(13.2%)	40(26.5%)	1.8(0.78-4.14)	1.50(.59-3.81)
	Grade 3	7(4.6%)	46(30.5%)	5.91(2.14-16.38)	4.66(1.52-14.30)
Parity	Multiparous	24(15.9%)	26(17.2%)	1	1
	Primipara	21(13.9%)	80(53.0%)	3.52(1.69-7.33)	2.83(1.24-6.47)
Duration of rupture of membrane	<12 hrs	34(22.5%)	59(39.1%)	1	1
	12 hrs or more	11(7.3%)	47(31.1%)	2.46(1.13-5.37)	1.26(.50-3.15)
Duration of labor	<20 hrs	38(25.2%)	66(43.71%)	1	1
	20 hrs or more	7(4.6%)	40(26.5%)	3.29(1.34-8.07)	3.47(1.27-9.52)

Table 3: Independent predictors of mode of delivery among laboring mothers with MSAF in JUSH, Oct 1, 2012 to Dec 31, 2012 (N=151).

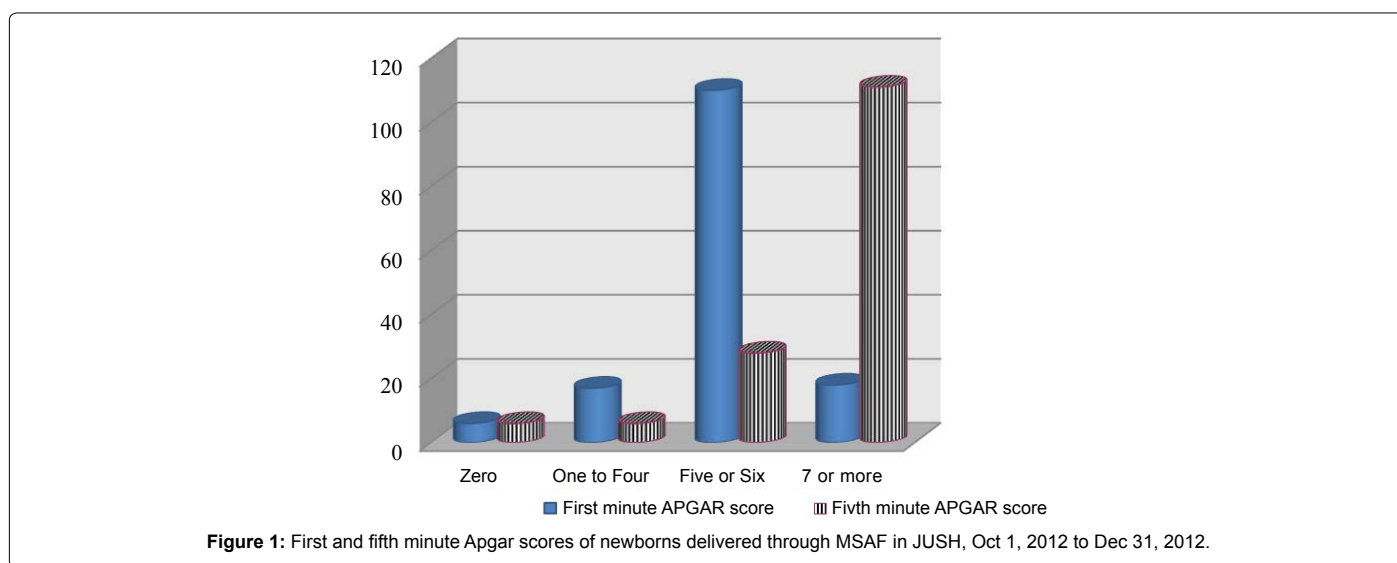


Figure 1: First and fifth minute Apgar scores of newborns delivered through MSAF in JUSH, Oct 1, 2012 to Dec 31, 2012.

pattern (OR=4.17, 95% CI: 1.097-15.809). Likewise, labor prolonged for 20 hours or more increased the possibility of operative deliveries by 3.5 times as compared to labor which stayed shorter (OR=3.47, 95% CI: 1.266-9.521). Being a primiparous increased the risk of operative delivery by about three folds compared to multiparous women (OR=2.83, 95%CI: 1.24-6.47) (Table 3).

Eighty eight percent of the new-borns had first minute Apgar score less than 7 while 15% of the new-borns scored less than 4. Fifth minute Apgar score less than 7 was recorded in 26.5% of the new-borns and 7.9% of them had score of <4 (Figure 1).

The presence of antepartum obstetrics complications or medical illnesses had no significant association with the first or fifth minute Apgar scores. Of the 133 new-borns with first minute Apgar less than 7, 98 (73.3%) were delivered by operative means and 102(76.7%) had moderate to thick meconium stained liquor. It was found that there was no statistically significant association between first minute Apgar score and status of liquor or mode of delivery ($p>0.05$). There was a 16 times increased risk of low 5th minute Apgar score for those new-borns delivered with thick meconium stained liquor (OR=15.74, 95% CI: 1.893-130.908) after controlling the effect of confounding variables. And for those delivered with operative delivery, there was a 6 times increased risk of low 5th minute Apgar score (OR=5.70, 95% CI: 1.214-26.754) (Table 4). Those new-borns with fifth minute Apgar score of <7 were 3 times more likely to be admitted to the NICU compared to those with Apgar score of 7 or greater (Table 5).

The thickness of MSAF was found to be an important predictor of low fifth minute Apgar score, admission to NICU and operative deliveries in this study (Table 6).

Discussion

The rate of meconium-stained amniotic fluid varies from 12 to 20% [13]. Our 15.4% rate of meconium-stained amniotic fluid rate is comparable with other studies. The rate of operative deliveries was higher in this study (70.2%). Generally, the detection of meconium stained amniotic fluid during labor causes anxiety in health care practitioners because it is assumed as an indicator of fetal distress. The lower rate in other studies [8,14] may be due to scalp pH sampling before deciding for cesarean section [19].

Among the 151 babies delivered through MSAF, 88% had Apgar score of less than 7 and this higher rate of low Apgar score as compared to others studies [18,19] can be explained by the high incidence of Operative deliveries for CPD and NRFHP in this study, which can be a cause and sign of intrauterine fetal distress and asphyxia, respectively.

Seventy percent of cases in our study gave birth by operative delivery (Cesarean Section among 43.7%, and instrumental delivery among 26.5%). Compared to other studies [14,21], this figure is very high which may be explained by high rate of prolonged labor and CPD in this study. However these studies have shown that the rate of operative delivery is higher in the presence of MSAF.

Meconium aspiration syndrome develops in only 2 of every 1000

Variables		5th minute Apgar score		COR (95% CI)	AOR(95% CI)
		7 or more	<7		
Fetal heart rate pattern	Reassuring	93(61.6%)	23(15.2%)	1	1
	Nonreassuring	18(11.9%)	17(11.3%)	3.38(1.71-8.54)	1.43(0.56-3.63)
Status of liquor	Grade 1	36(23.8%)	2(1.3%)	1	1
	Grade 2	46(30.5%)	14 (9.3%)	5.47(1.17-25.67)	7.30(0.87-61.69)
	Grade 3	29(19.2%)	24(15.9%)	14.9(3.25-68.33)	15.74(1.89-130.9)
New born resuscitation	Without ONPS	71(48.3%)	12 (8.2%)	1	1
	With ONPS	40(27.2%)	24(16.3%)	3.55(1.61-7.85)	1.77(0.72-4.37)
Mode of delivery	SVD	42(27.8%)	3(2%)	1	1
	Operative	69(45.7%)	37(24.5%)	7.51(2.18-25.88)	5.70(1.21-26.75)

Table 4: Independent predictors of 5th minute Apgar score among neonates born through MSAF in JUSH, Oct 1 to Dec 31, 2012 (N= 151).

Variables		NICU admission		COR (95% CI)	AOR(95% CI)
		Yes	No		
Mode of delivery	SVD	6(4.05%)	38(25.68%)	1	
	Operative delivery	36(24.32%)	68(45.94%)	3.35(1.30-8.68)	2.01(0.72-5.60)
5th minute Apgar score	7 or more	23(15.54%)	88(59.46%)	1	
	<7	19(12.84%)	18(12.16%)	4.04(1.83-8.91)	3.02(1.30-7.03)
Way of resuscitation	Without ONPS	16(10.88%)	67(45.58%)	1	
	With ONPS	26(17.69%)	38(25.85%)	2.87(1.37-6.00)	1.97(0.89-4.36)

Table 5: Independent predictors of NICU admission in neonates born through MSAF in JUSH, Oct 1, 2012 to Dec 31, 2012 (N= 151).

Variables	Grade 1		Grade 2		Grade 3		P value
	Number	Percent	Number	Percent	Number	Percent	
5 th minute<7	2	1.3	14	9.3	24	16	0.000
Admission to NICU	6	4	16	10.6	20	13.2	0.04
Operative Deliveries	20	13.3	40	26.5	46	30.5	0.002

Table 6: Comparison of the thicknesses of MSAF as a predictor of Obstetrics outcome among laboring mothers with MSAF in JUSH, Oct 1, 2012 to Dec 31, 2012.

live-born infants and 2% of those new-borns born through MSAF [22]. Ninety-five percent of infants with inhaled meconium clear the lungs spontaneously [19,21-23]. In this study, however, meconium aspiration syndrome was diagnosed in 18.5% of the neonates born through MSAF, which is very high. This may be due to over diagnosis since the diagnosis of MAS in this study was done only with clinical judgment without Chest X-ray.

The significant association between the thickness of meconium stained liquor and the fifth minute Apgar score can be explained by the high incidence of MAS in this study, MAS as a cause rather than an effect. But there was no association between thickness of meconium and first minute Apgar score. This can be due to the significance of any amount of meconium in the amniotic fluid as a sign of intrauterine fetal compromise or asphyxia which results in low first minute Apgar score [11].

Meconium aspiration is predominantly an intrauterine event which occurs in response to continued fetal gasping in a hypoxic environment and tracheal suctioning at birth cannot completely eliminate development of MAS [21,23]. Despite the current recommendations on resuscitation of neonates born through MSAF with ONPS for those with depressed first minute Apgar score and without ONPS for active newborns [18,19], the pattern of resuscitation in this study was random, with no association with 1st minute Apgar score. And there was no difference in the occurrence of MAS in both ways of resuscitation which is consistent with earlier studies [13].

In conclusion, the majority of laboring mothers with MSAF had moderate to thick meconium and thickness of meconium was a significant predictor of most of the perinatal outcomes evaluated in this study. The incidence of operative deliveries was higher and those babies delivered with operative deliveries had higher incidence of low fifth

minute Apgar score than those delivered through Spontaneous Vaginal Delivery (SVD). The incidence of MAS was also higher and the rate of low first minute Apgar score is higher despite higher rate of operative deliveries. Comparative studies should be done and the Hospital should develop its own protocol to decrease unnecessary interventions. Further studies including PH analysis of the fetus with MSAF is needed to find the factors responsible for the discrepancy in some of the findings with other studies and to develop a beneficial management protocol for mothers with MSAF. Generally it's recommended that for those newborns with depressed Apgar score and thick meconium in the Oropharynx, ONPS better be done under direct vision before stimulating to decrease MAS [12]. This study showed that moderate to thick meconium stained liquor account for more than two third of the MSAF and Shortening the threshold for intervention for labor with fetal heart rate abnormalities in the presence of meconium stained amniotic fluid is recommended. In this study, diagnosis of MAS was made by clinical examination only in all of the cases, further studies with Chest X-Ray and follow up of the neonates is needed to settle the actual prevalence of MAS and its outcomes. As a limitation in this study; mothers with uncomplicated labor sent home in the immediate postpartum days with their babies, and therefore postpartum infection couldn't be addressed. And even if in some cases, MAS start to manifest after 24 hours, neonates who were discharged earlier and develop the disease later might be under reported. And this study assessed only the immediate outcomes of deliveries with MSAF.

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