

A Retrospective Study on Deliveries Complicated by Meconium-Stained Amniotic Fluid

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Abstract

Background: Meconium is a viscid olive-green substance formed in the fetal gastrointestinal tract that consists of denuded intestinal epithelium, fetal lanugo hair, ingested amniotic fluid, mucus, digestive enzymes, bile acid and water. The significance of meconium passage in utero ranges from being a sign of normal maturation of the fetal gastrointestinal tract to a sign of fetal distress, associated with adverse perinatal outcomes including poor APGAR (Appearance, Pulse rate, Grimace, Activity, and Respiratory rate) scores, increased NICU (Neonatal intensive care unit) admissions, and a high rate of perinatal mortality due to meconium aspiration syndrome (MAS).

Objectives: To find out the proportion of deliveries complicated by MSAF (Meconium staining of amniotic fluid) in Government T.D. Medical College, Alappuzha during the period January 2018 to December 2019, and to find out the various fetal and maternal factors associated with deliveries complicated with MSAF during the same period.

Methods: The study is a descriptive retrospective record-based study conducted in the Government T.D. Medical College, Alappuzha during the period January 2018 to December 2019. Approval from Institutional Research Committee and Ethical Review Board were taken before the study. Data was collected using a pretested structured proforma. The data were entered in Microsoft Excel sheet and analysed using SPSS 16 statistical software.

Results: Out of a total of 4496 deliveries, 187(4.15%) mothers had meconium staining of amniotic fluid during the study. The mean gestational age was 37.8±1.6. 58.8% of the mothers had grade 2 meconium-stained liquor, 27.8% mothers had grade 1 meconium-stained liquor and 13.4% mothers had grade 3 meconium staining. Majority (60.4%) of the patients were primigravidas. Maximum patients (67.9%) belonged to 38 to 40 weeks of gestational age group. 44.4% of the patients had an overweight range of BMI. Thyroid disorders (13.9%) stood in the forefront of maternal medical disorders. 15 % of patients had gestational diabetes mellitus and 11.8% had gestational hypertension. Intrapartum maternal pyrexia was seen in 8.6% of patients. Among the fetal complications, majority of the babies (26.7%) had fetal growth restriction. 61.5% of mothers had a spontaneous onset of labour. Out of the induced patients, 86.1% had induction with prostaglandin E1. 65.8 % of mothers had a cesarean delivery. 8.6% of the patients had puerperal pyrexia and 8.6% had postpartum hemorrhage in the postpartum period. None of the babies with grade 1 meconium had an APGAR score less than 7 at 1'. 94.5% cases with grade 2 meconium and 88% cases with grade 3 meconium had

an APGAR score more than 7 at 1'. All 4 cases of neonatal death had grade 3 meconium-stained liquor.

Conclusion: Majority of cases in our study belonged to grade 2 meconium staining of amniotic fluid. Most of the patients belonged to the 38 – 40-week gestational age group. Among those induced, maximum number of patients were induced with prostaglandin E1 (86.1%). Among the fetal complications, fetal growth restriction was seen in majority of cases (26.7%). Thyroid disorders is the most common maternal medical disorder seen (13.9%). All the 4 cases of neonatal death were seen in the grade 3 meconium group.

Keywords: Meconium staining, neonatal, gestation, amniotic fluid

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Introduction

Meconium-stained amniotic fluid (MSAF) occurs as a result of passage of fetal colonic contents into the amniotic cavity. Meconium passage in the amniotic cavity is considered as a sign of physiological fetal gastrointestinal maturity as well as a pathological process due to fetal distress such as hypoxia or infection. Approximately 8-15 % of all infants are born with evidence of meconium-stained amniotic fluid (MSAF) and this prevalence increases with gestational age [1].

MSAF is associated with adverse fetal outcomes including Meconium Aspiration Syndrome (MAS), neonatal sepsis, cerebral palsy, seizures and pulmonary diseases. It has been associated with poor perinatal outcome including low APGAR score, increased rate of chorioamnionitis, increased incidence of neonatal intensive care unit admission and high rate of perinatal death [2].

Meconium appears very early in the fetal gastrointestinal tract, but MSAF is rarely seen before 34 weeks of gestation. An intestinal polypeptide motilin, which stimulates the contraction of intestinal muscle, is found in higher concentration in post term than in preterm fetal gastrointestinal tract. The increasing incidence as gestational age advances reflects the maturation of fetal intestinal peristalsis, as intestinal parasympathetic innervation also increases in later gestation.

This implies that meconium staining of amniotic fluid may be an event which reflects intestinal maturation.

Meconium-stained amniotic fluid is also associated with stress due to infection and hypoxia. Fetal umbilical vein oxygen saturation below 30% is often associated with passage of meconium. Post maturity and preeclampsia can cause placental dysfunction and lead to fetal hypoxia which may induce the development of MSAF. Abnormal fetal doppler indices suggestive of fetal hypoxia and acidemia are predictors of MSAF.

Fetal hypoxia may stimulate colonic activity leading to passage of meconium and may stimulate fetal gasping movements that result in meconium aspiration. The aspirated meconium can interfere with normal fetal breathing by several mechanisms including airway obstruction, chemical irritation and activation of inflammatory mediators, infection and surfactant inactivation. This can be life threatening to the fetus, complicated by respiratory failure, pulmonary air leaks and persistent pulmonary hypertension, called Meconium aspiration syndrome (MAS), a leading cause of neonatal mortality and morbidity. In this study, we aim to find out the proportion of deliveries complicated by MSAF in Government T.D. Medical College, Alappuzha for the past two years, and the various fetal and maternal factors

associated with deliveries complicated with MSAF.

Materials and Methods

The study is a retrospective descriptive study which is record based, conducted in the Department of Obstetrics and Gynaecology, Government T.D. Medical College, Alappuzha, Kerala, India during the period January 2018 to December 2019. A total of 187 mothers whose deliveries were complicated by meconium staining of amniotic fluid were included in the study. All pregnant women with gestational age more than 28 weeks who had meconium staining of amniotic fluid identified after artificial or spontaneous rupture of membranes were included in the study. Mothers with gestational age below 28 weeks or those who did not have meconium staining of amniotic fluid and those whose records were not available were excluded.

Meconium was classified in to three grades, grade I in which the amniotic fluid was slightly tinged with greenish meconium, grade II with moderate amount of meconium with an olive green colour and grade III meconium where the fluid contains thick dark green particles of meconium, and is viscous and soupy. The APGAR score of the babies were determined at 1 minute and analysed.

Observation

Out of a total of 4496 deliveries, 187 (4.1%) mothers had meconium staining of amniotic fluid during the study. The mean age of the patients was 25.5 with an SD of 4.4. The minimum age was 19 and the maximum age was 39. The mean gestational age was 37.8 with an SD of 1.6.

Table 1: Meconium grade

Grade	N(%)
Grade 1	52(27.8%)
Grade 2	110(58.8%)
Grade 3	25(13.4%)

Majority of the mothers had grade 2 meconium stained liquor, 110(58.8%), 52 mothers had grade 1 meconium stained liquor(27.8%) and 25 mothers had grade 3 meconium staining (13.4%)(Table 1).

Table 2: Demographic and clinical characteristics

Characteristics		Grade 1 (N=52) n (%)	Grade 2 (N=110) n (%)	Grade 3 (N=25) n (%)	Total (N=187) n (%)
Age	≤20	6(11.5%)	12(10.9%)	3(12%)	21(11.2%)
	21-25	23(44.2%)	50(45.5%)	11(44%)	84(44.9%)
	26-30	17(32.7%)	33(30%)	8(32%)	58(31%)
	31-35	5(9.6%)	11(10%)	2(8%)	18(9.6%)
	>35	1(1.9%)	4(3.6%)	1(4%)	6(3.2%)
Gravida	Primi	29(55.8%)	68(61.8%)	16(64%)	113(60.4%)
	Multi	23(44.2%)	42(38.2%)	9(36%)	74(39.6%)
Parity	Nulliparous	37(71.2%)	74(67.3%)	16(64%)	127(67.9%)
	Multiparous	15(28.8%)	36(32.7%)	9(36%)	60(32.1%)
Gestational age	≤34	0(0%)	6(5.5%)	1(4%)	7(3.7%)
	35-37	18(34.6%)	29(26.4%)	6(24%)	53(28.3%)
	38-40	34(65.4%)	75(68.2%)	18(72%)	127(67.9%)
BMI	Underweight	3(5.8%)	4(3.6%)	1(4%)	8(4.3%)

	Normal weight	24(46.2%)	49(44.5%)	8(32%)	81(43.3%)
	Overweight	21(40.4%)	48(43.6%)	14(56%)	83(44.4%)
	Obese	4(26.7%)	9(8.2%)	2(8%)	15(8%)

As shown in table 2, majority of the mothers were between 21-25 years of age (44.9%), 31% belonged to the 26 -30 age group whereas 11.2% were below 20, and 3.2% were above 35 years of age. Out of the 187 mothers, 113 (60.4%) were primi gravidas and 74(39.6%) were multigravidas. Majority of the cases were nulliparas 127(67.9%) whereas 32.1% were multiparas.

127 mothers belonged to the 38–40-week gestational age group (67.9%), whereas

only 3.7% belonged to the below 34-week gestational age group. Maximum number of mothers in all the three grades of meconium were seen in the 38–40-week age group, i.e., 34 among 52 cases of grade 1(65.4%), 75 among 110 cases of grade 2(68.2%), and 18 (72%) among 25 cases of grade 3.

Majority of mothers had an overweight range of BMI (44.4%), 43.3% had a normal range, 8% were obese and 4.3% were underweight.

Table 3: Maternal, Obstetric and fetal complications

Complications	N (%)
Maternal complications	
Chronic hypertension	2(1.1%)
Pre gestational diabetes	4(2.1%)
Heart diseases	5(2.7%)
Thyroid disorders	26(13.9%)
Hepatic disorders	2(1.1%)
Epilepsy	6(3.2%)
Anemia	10(5.3%)
Obstetric complications	
Gestational diabetes	28(15%)
Gestational hypertension	22(11.8%)
Obstetric cholestasis	3(1.6%)
Maternal pyrexia	16(8.6%)
Fetal complications	
Fetal growth restriction	50(26.7%)
Oligamnios	29(15.5%)
Abnormal doppler	14(7.5%)
Prematurity	10(5.3%)
Postmaturity	7(3.7%)
Fetal anomalies	1(0.5%)
Multiple pregnancy	2(1.1%)
Macrosomia	17(9.1%)

Table 3 shows the maternal, obstetric and fetal complications associated with these mothers. Thyroid disorders stood in the forefront of maternal medical disorders, seen in maximum number of mothers, 26(13.9%).10 patients had anaemia (5.3%).6 mothers had epilepsy and were on

anti-epileptic drugs (3.2%).5 Mothers had heart disease (2.7%), 4 mothers had pregestational Diabetes Mellitus (2.1%), 2 patients had chronic hypertension (1.1%) and hepatic disorders were seen in 2 patients (1.1%).

Among the obstetric complications, Gestational Diabetes Mellitus was seen in 28 mothers (15%). 22 mothers had gestational hypertension (11.8%). Obstetric cholestasis was seen in 3 mothers (1.6%), and all were taking Ursodeoxycholic acid. Intra partum maternal pyrexia was seen in 16 patients (8.6%).

Among the fetal complications, majority of the fetuses had fetal growth restriction, 50 (26.7%). 29 cases (15.5%) had oligamnios. Abnormal doppler complicated 14 cases (7.5%). 10 babies were born preterm (5.3%), and 7 babies were post term (3.7%). Fetal macrosomia was seen in 17 cases (9.1%). There was one case with multiple fetal congenital anomalies (0.5%), and 2 mothers had multiple pregnancy (1.1%).

Table 4: Details of delivery

Delivery	N(%)
Labour	
Induced	72(38.5%)
Spontaneous	115(61.5%)
Mode of induction	
Foleys	5(6.9%)
Prostaglandin E1	62(86.1%)
Oxytocin	7(9.7%)
Mode of delivery	
Vaginal	64(34.2%)
Caesarean	123(65.8%)
Indication for CS	
Unfavourable cervix	63(51.2%)
Fetal distress	37(30.1%)
CPD	5(4.1%)
Failed induction	2(1.6%)
Previous CS	15(12.2%)
Maternal Pyrexia	1(0.8%)
Postpartum complications	
Maternal Pyrexia	16(8.6%)
PPH	16(8.6%)
Peritonitis	3(1.6%)
Postpartum HELLP	4(2.1%)
Wound infection	4(2.1%)

CS-Caesarean section

PPH-Postpartum Hemorrhage

CPD-Cephalopelvic disproportion

HELLP-Haemolysis, Elevated Liver Enzymes and Low Platelets

61.5% of the mothers had a spontaneous onset of labour, while 38.5% mothers had an induced labour. Out of the 72 mothers induced, 86.1% had induction with prostaglandin E1 or Misoprostol, followed by oxytocin induction (9.7%) and Foley's catheter induction (6.9%). Out of 187 cases, majority of the mothers 123, had a Caesarean delivery (65.8%) while 64

mothers had a normal vaginal delivery (34.2%).

Among 123 cases of Caesarean section done, maximum number of cases, 63 (51.2%) were done due to meconium staining of amniotic fluid with an unfavourable cervix. 37 cases were done for fetal distress (30.1%), 15 cases had a

previous caesarean section as the indication (12.2%) and 5 patients had cephalopelvic disproportion (4.1%). 2 cases were done for failed induction (1.6%), and one case was done for intrapartum pyrexia (0.8%).

In the post-partum period, 16 mothers (8.6%) had puerperal pyrexia, 16(8.6%) had atonic postpartum haemorrhage and 3 (1.6%) had peritonitis. 4 cases were complicated with postpartum HELLP syndrome (2.1%), and 4 cases had infection of their caesarean wound (2.1%).

Table 5: Perinatal outcome

	Grade 1 (N=52) n (%)	Grade 2 (N=110) n (%)	Grade 3 (N=25) n (%)	Total(N=187) n (%)
Sex				
Male	32(61.5%)	56(50.9%)	10(40%)	98(52.4%)
Female	20(38.5%)	54(49.1%)	15(60%)	89(47.6%)
Baby weight				
<2.5	7(13.5%)	15(13.6%)	5(20%)	27(14.4%)
≥2.5	45(86.5%)	95(86.4%)	20(80%)	160(85.6%)
APGAR				
<7	0(0%)	6(5.5%)	3(12%)	9(4.8%)
≥7	52(100%)	104(94.5%)	22(88%)	178(95.2%)
NICU admission	13(25%)	43(39.1%)	9(36%)	65(34.8%)
Neonatal death	0(0%)	0(0%)	4(100%)	4(2.1%)

Regarding the neonates, 52.4% of the babies were males and 47.6% were females. 14.4% of the babies had a birth weight below 2.5 kg, while 85.6% of the babies were above 2.5kg. The mean birth weight was 2.9kg with an SD of 0.48.

All the babies with grade 1 meconium had an APGAR score more than 7 at 1 minute. Out of 110 cases with grade 2 meconium, 104 (94.5%) had an APGAR score more than 7 at 1 minute. Out of 25 cases with grade 3 meconium 22(88%) had an APGAR score more than 7 at 1 minute. 34.8% of the babies required NICU admission. Maximum cases of NICU admission had grade 2 meconium-stained liquor. All 4 cases of neonatal death had grade 3 meconium-stained liquor. Of these, 2 cases had Meconium aspiration syndrome and 2 cases had hypoxic ischemic encephalopathy grade 4.

Discussion

The proportion of cases of mothers with meconium-stained amniotic fluid in our

study was 187 (4.1%) among 4496 deliveries. The prevalence of meconium-stained amniotic fluid was 17% in a study conducted by Dagne Addisu in 2018 in Felge Hiwot comprehensive specialized referral hospital, Northwest Ethiopia [3].

The mean age of the patients was 25.5 with an SD of 4.4. In the study by Dagne Addisu, the mean age of the participants was 28.05 years with an SD of 5.1 years [3]. Majority of the mothers in our study had grade 2 meconium-stained liquor, (58.8%). In a study by Sori et al in Southwest Ethiopia, Jimma University, 25% mothers had grade 1, 40 % mothers had grade 2, and 35% mothers had grade 3 meconium-stained amniotic fluid [4]. A study conducted by Smeet Patel, in Mayflower hospital, Ahmedbad, India, reported that 46% participants had grade 1, 31.5% had grades 2 and 27.5% had grade 3 meconium staining of amniotic fluid [5]. In a study conducted by Sheiner, 78% cases had thin meconium-stained fluid and 22% had thick meconium-stained amniotic fluid [6].

Majority of the mothers were between 21-25 years of age (44.9%). 31% belonged to 26–30-year age group. In the study by Smeet Patel, 59% of mothers were between 20-30 years of age, and 27% were between 31-35 years [5]. Participants less than 20 years and more than 35 years were 9% and 5% respectively. In the study by Sori et al in Jimma university, 94.7% participants belonged to the 18–35-year age group [4]. According to David in his study in a Nigerian university, women with more than 30 years of age were 5.6 times more susceptible to develop meconium staining of amniotic fluid during labour than those with less than 30 years [7]. This is due to the fact that, in older age, the aging of uterine blood vessels and arterial stiffness results in insufficient placental perfusion leading towards fetal hypoxemia.

Out of our 187 patients, 113 (60.4%) were primigravidas and 74 (39.6%) were multigravidas. Majority of cases were nulliparas, 127 (67.9%) and 32.1% were multiparas. In a study by Basil Metti Hanoudi et al, 33% were primi paras and 67% were multiparas [8]. In a study by Masood. M in 2021, the mean parity of the pregnant women was 1.68+/- 2.53 [9].

Maximum patients in our study, 127 (67.9%) belonged to the 38–40-week gestational age group., whereas only 3.7% belonged to the below 34-week gestational age group. In the study by Sori et al in 2016, in Jimma university, 87.4% of the labouring mothers with meconium staining belonged to the 37–42-week gestational age group (4). According to Yinka Oyelese 2006 the rate of meconium stained amniotic fluid increased from 1.2% at 32 weeks to 100% at 42 weeks [10]. In the study by Osava et al in 2012, there was a positive correlation between meconium staining of amniotic fluid and gestational age more than 41 weeks [11]. In the study by Basil Metti Hanoudi, there were 90.9% mature babies, 5.6% postmature and 3.5% premature babies indicating that meconium staining is significantly associated with mature new

borns [8]. According to Scott and Walker, the incidence of meconium staining of amniotic fluid was 5% in preterm deliveries [12].

44.4% of the parturients were overweight in our study forming the majority whereas 4.3% were underweight.

Regarding the maternal medical complications, Thyroid disorders were the maximum, 13.9% followed by anaemia in 5.3%, epilepsy in 3.2%, pregestational Diabetes Mellitus in 2.1% and chronic hypertension in 1.1%. 1.1% had hepatic disorders. In the study by Enyew Abate et al in Felege Hiwot hospital in Ethiopia, 11.7% had anaemia, and 2.1% had chronic hypertension [13]. In the study by Basil Metti Hanoud in 2014, 5.2% had pregestational diabetes mellitus and 12.2% had hypertension [8].

Regarding the obstetric complications, gestational diabetes mellitus was seen in 15% cases, and 11.8% cases had gestational hypertension. In the study by Dagne Addisu et al, 4.4% had preeclampsia and 1.6% had gestational diabetes [3]. In our study, 16 mothers had intrapartum pyrexia (8.6%). Sumana Rao and Zdena Pavlova in their study has observed that the incidence of meconium staining of amniotic fluid was higher in mothers with acute chorioamnionitis [14].

In our study, fetal growth restriction was seen in 50 cases (26.7%), and 29 cases had oligamnios (15.5%). Enyew and Kassahun et al, in their study reported an 8.1% cases of fetal growth restriction and 9.4% cases of oligamnios [13]. S.M Ziadeh in 2000 in his study reported that 16% of the participants had oligamnios, 12.5% had post maturity and gestational hypertension in 11% [15].

In our study, majority of the mothers had a spontaneous onset of labour (61.5%) while only 38.5% had an induced labour. In the study by Dagne Addisu et al in Felege Hiwot hospital, 85.1% of the mothers with

meconium staining of amniotic fluid had a spontaneous onset of labour [3].

Maximum deliveries in our study were by caesarean section (65.8%) while 34.2% mothers had a normal vaginal delivery. In the study by Sori et al in Jimma University, 43.4% had a caesarean delivery while 29.8% had a normal delivery [4]. In the study by Enyew et al in Felege Hiwot hospital, 57.1% mothers had a spontaneous vaginal delivery, 4.2% had instrumental delivery and 38.7% had caesarean section [13].

In the postpartum period, 16(8.6%) had postpartum haemorrhage. In a study by Z.J. Fang et al in 2020, incidence of postpartum haemorrhage was found to be significantly higher at 2.7% in the meconium-stained group compared to 2.18% in the clear amniotic fluid group($p=0.0004$) [16].

Regarding the neonatal outcome, 52.4% of babies were males and 47.6% were females. There was no significant gender disparity. In the study by Enyew in Ethiopia 52.3% were males, and 47.7% were females with no significant gender disparity [13].

14.4% of the babies were below 2.5kg while 85.6% of the babies were above 2.5kg. According to Basil Metti Hanoudi the mean birth weight of babies was 3.44kg with only 1.74% low birth weight of new borns recorded [8].

94.5% babies with grade 2 meconium and 88% babies with grade 3 meconium had an Apgar score >7 at 1'. All the cases of grade 1 meconium had an Apgar of >7 at 1'. In the study by Sori et al in Jimma university 1.3% of grade 1, 9.3% of grade 2 and 16% of grade 3 meconium-stained amniotic fluid had 5' Apgar less than 7(4). According to Masood M 2021, the neonates of 77.4% of women with meconium stained amniotic fluid had an Apgar score of less than 6 at 1' and a significant association of meconium staining and Apgar score was noted in Primiparous women [9].

In our study 34.8% of babies required NICU admission, of these maximum cases were with grade 2 meconium. According to Sori et al, 4% of grade 1, 10.6% of grade 2, and 13.2% of grade 3 had NICU admission [4]. According to Mathews and Warshaw, in 98.4% of cases with meconium-stained liquor, the neonates were admitted to the NICU, these were delivered at 37 weeks of gestation or later as it shows maturation of autonomic nervous system [17]. The incidence of admission to NICU with respiratory distress syndrome, meconium aspiration syndrome, neonatal asphyxia, chorioamnionitis, fetal distress or fetal acidosis were seen to be increased in pregnancies with meconium-stained liquor on delivery.

In our study we had 4 neonatal deaths (2.1%), all of which had grade 3 meconium staining of amniotic fluid. In the study by S. M Ziadeh in 2000 the overall neonatal mortality in meconium-stained group was 4.5% [15].

Conclusion

Majority of cases in our study belonged to grade 2 meconium staining of amniotic fluid. Most of the patients belonged to the 38 – 40-week gestational age group. Those patients whose BMI was in the overweight range (44.4%) topped the list of cases with meconium staining. Maximum number of patients were induced with prostaglandin E1 (86.1%). Among the fetal complications, fetal growth restriction was seen in majority of cases (26.7%). Thyroid disorders is the most common medical disorder seen (13.9%). All the 4 cases of neonatal death were seen in the grade 3 meconium group.

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