Academic Journal of Science and Technology,
February, 2026, vol.8, No.1, p357-364

Risk Factors and Neonatal Outcome in Meconium-Stained Deliveries

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ABSTRACT

Background: The occurrence of meconium-stained amniotic fluid (MSAF) during labor has been long considered the predictor of adverse fetal outcomes such as meconium aspiration syndrome and perinatal asphyxia, which lead to perinatal and neonatal morbidity and mortality.

Objective: To evaluate the risk factors and fetal outcome in Meconium Stained Amniotic Fluid (MSAF).

Patients and Methods: The study was conducted on all newborn babies with history of meconium stained amniotic fluid (MSAF) who were admitted to the department of neonatal intensive care (NICU) at Ali Omar Askar tertiary hospital during a period of one year from 1st January 2017 to 31st December 2017. Retrospectively maternal risk factors, mode of delivery, babies' vital signs pre-delivery, and post-delivery and details of NICU admission, were collected in a predesigned case sheet and data analysed using SPSS statistical software. There were 300 consecutive newborns admitted during the period of study with MSAF included in this study. 90% of the mothers had regular antenatal follow up.

Results: 35 Mothers (11.7%) had a premature rupture of membrane, 97 (32.3%) were diagnosed with UTI pre-delivery. 215 (71.7%) babies were delivered by normal vaginal delivery, 17 (5.7%) were delivered by elective cesarean section and 68 (22.7%) were delivered by emergency caesarian section. Abnormal CTG was reported in 37 babies (12.3%), 250 babies (83.3%) were full term babies, 19 were preterm (6.4%) and 31 babies (10.3%) were postdate delivery. After delivery, 11 babies (3.7%) had Apgar score less than 5 at 5 minutes, 2 (0.7%) had Apgar score less than 5 at 10 minutes. 13 babies (4.3%) needed resuscitations. As to the length of stay in NICU, 42.3% stayed for less than 1 day, 36.7% stayed for 1 to 3 days whereas 21% stayed for more than 3 days. 28 babies (9.3%) had abnormal chest x-rays and 25 babies (8.3%) with high leukocytosis. 12 babies (4%) were intubated and connected to mechanical ventilation, 31 babies (10.3%) were in respiratory distress and required oxygen supply and 1 baby (0.3%) had pneumothorax. 154 babies (51.3%) received antibiotic treatment; One baby died during admission to NICU (0.3%).

Conclusion: Meconium stained amniotic fluid is associated with an increased caesarean section rate, causes birth asphyxia, MAS and increases neonatal intensive care unit admissions. Coordination of care is needed between the obstetrician and neonatologist to prevent the complications related to MSAF. Based on our observation in this study we conclude that maternal factors (urinary tract infection, diabetes, hypertension and PROM) were important risk factor for MSAF and associated complications including meconium aspiration syndrome (MAS).

KEYWORDS: Meconium stained, Amniotic fluid, Meconium aspiration syndrome, risk factors.

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INTRODUCTION

Meconium stained amniotic fluid (MSAF) is an alarming sign of fetal compromise and associated with a poor perinatal outcome (Jain et al., 2017).

Meconium is a germ-free, thick, black-green, odorless material which is first recognized in the fetal intestine around 12 weeks of gestation and stores in the fetal colon throughout gestation (Jain et al., 2017; Parvin et al., 2008).

Passage of meconium in the newborn infants is a developmentally programmed incident; normally occurring within the first 24 to 48 hours after birth. However, the fetus may pass meconium in the amniotic fluid during pregnancy due to different reasons (Jain et al., 2017; Begum et al., 2015). Meconium passage is rare before 34 weeks of gestation and after 37 weeks its incidence increases with increasing gestational age.

Incidence of Meconium stained amniotic fluid is increasing as the gestational age increase from 7-22% of term pregnancy (Siriwachirachai et al., 2014; Soni et al., 2015). While meconium aspiration syndrome (MAS) occurs in approximately 5% of all cases of MSAF. MAS contributes to neonatal death in up to 0.05% (i.e., 1 in 2000 of all pregnancies) (Parvin et al., 2008).

Placental insufficiency, maternal hypertension pre-eclampsia, oligohydramnios, or maternal drug abuse (tobacco, Cocaine) are predisposing factors of in utero passage of meconium (Curtis et al., 2004). Meconium stained neonates are more prone to develop respiratory distress than neonates born with clear fluid. MSAF predisposes perinatal mortality even in women with very low risk for obstetric complications (Mundhra and Agarwal, 2013).

MSAF is associated with higher rate of caesarean section delivery, instrumental delivery, NICU admission rate, fetal distress, low birth weight and neonatal death (Rathoria et al., 2018).

Therefore, identification of maternal factors may help to anticipate the need for neonatal resuscitation in delivery room which eventually helps to improve the perinatal outcome and reduce perinatal mortality and morbidity associated with MSAF.

Presence of meconium below vocal cord is known as meconium aspiration and it is seen in around 20-30% of all infants with meconium-stained amniotic fluid (Wiswell and Bent, 1993).

Aspiration can occur in utero with fetal gasping, or after birth, with the first breaths of life.

Meconium aspiration syndrome (MAS) is defined as a respiratory distress that develops shortly after birth, with radiographic evidence of aspiration pneumonitis and presence of meconium-stained amniotic fluid (Klinger and Kruse, 1999). MAS occurs in about 5% of deliveries with meconium-stained amniotic fluid (Wiswell and Bent, 1993) and death occurs in about 12% of infants with MAS (Mundhra and Agarwal, 2013).

Meconium-stained liquor (MSL) management (ILCOR, 2006; AHA, 2006):

- Prepare and check resuscitation equipment in advance
- Transfer the infant to the resuscitation area immediately and without stimulation
- Assess the infant's vigor, which will determine further management

Assessing infant vigor:

A vigorous infant has:

- Good muscle tone
- Active breathing efforts
- HR >100 BPM

If vigorous, provide standard care. If not vigorous and the attending operator is able to perform intubation:

1. Place infant under radiant warmer while avoiding stimulation
2. Insert laryngoscope
3. Intubate with an appropriate size ET tube (3.0 or 3.5 for an average term baby), attach the meconium aspirator, then apply suction while withdrawing ET tube
4. Or pass suction 12 or 14 G suction catheter directly through the vocal cords and apply suction (pressure 100 mmHg) while gradually withdrawing the catheter
5. Intubation and suctioning must be brief and should not compromise the infant
6. Proceed with standard resuscitation, including positive pressure ventilation as necessary

Ongoing care:

Infants born through meconium-stained liquor require the following ongoing care:

- Provide continued resuscitation as indicated by infant condition
- If apnea or respiratory distress develops subsequently, perform intubation and tracheal suctioning before commencing assisted ventilation
- Aspiration of the stomach is recommended after resuscitation is complete

- Admission to special care nursery (SCN) for observation is required when there is meconium below the cords, ongoing respiratory distress or oxygen requirement, or need for active resuscitation

American Academy of Pediatrics and the American Heart Association guidelines on neonatal resuscitation:

In 2006, the American Academy of Pediatrics and the American Heart Association published guidelines (AHA, 2006). In 2015, the guidelines were updated to reflect new evidence. Routine intubation and tracheal suctioning are no longer required (Wyckoff et al., 2015). If the infant is vigorous with good respiratory effort and muscle tone, the infant may stay with the mother to receive the initial steps of newborn care. If the infant born through meconium-stained amniotic fluid presents with poor muscle tone and inadequate breathing efforts, the initial steps of resuscitation should be completed under the radiant warmer. Appropriate intervention to support ventilation and oxygenation should be initiated as indicated for each infant (Wyckoff et al., 2015; Gomella et al., 2020).

Patients & Methods

Study design: Retrospective descriptive cross-sectional study Setting: The study was conducted in the department of neonatal intensive care (NICU) at Omar Khalifa Askar tertiary hospital which is a neuro-center hospital in (Tripoli – Libya).

Study period: The study was conducted for all newborns admitted to the NICU from 1st January 2017 to 31st December 2017.

Study Population & Inclusion Criteria:

All newborns (300) who were admitted to NICU with history of meconium-stained amniotic fluid (MSAF) irrespective of gestational age and birth weight were enrolled in this study.

Exclusion Criteria:

- Babies with respiratory distress due to other etiology and babies with major congenital anomalies
- Patients with incomplete data

Study Method:

Data collection was carried out by the Author, a "Study Information Sheet" was designed and filled up with information obtained from patients notes. The Study information Sheet consisted of three parts:

Part One: Covered the maternal risk factors which consisted of gestational diabetes, hypertension, premature rupture of membrane, fever, maternal infections and if the mothers were under any type of medication.

Part Two: Covered the situation during delivery, the mode of delivery, the baby's birth weight, the CTG findings, the maturity of the baby, the babies Apgar score and whether the babies received post-delivery resuscitation.

Part Three: Covered the situation of the babies after delivery, whether the babies received antibiotic treatment, oxygen supply, intubation and the chest x-ray findings as well as the leukocytosis count. Also, it covers if the babies developed respiratory distress or pneumothorax.

This study was carried out after obtaining approval of the hospital ethical review committee, there were no need to take subjective consent as this was a retrospective study.

Data Analysis:

All statistical analyses were carried out by using the Statistical Package for the Social Sciences (SPSS) program version 21 for Microsoft Windows. Descriptive statistics (frequencies, percentage, means, and standard deviations) were used for analyzing all variables.

RESULTS

During the period of study there was a total of 2922 deliveries, the medical records of 300 (10.3%) neonates with a history of MSAF were reviewed and included in this study.

Mother Characteristics

The maternal age ranged between 17 and 42 years with mean age (± std) of 27.2 (± 5.8) years, 87.7% of them aged less than 35 years and 12.3% aged 35 years or more, 272 (90.7%) were booked early for antenatal follow-up and almost same percentage (90%) had regular follow-up with the obstetrician. Ultrasound examination was done only once during antenatal follow-up for 3% of the mothers, but done more than 3 times for 88.7% of them.

Table 1: Mother characteristics of patients with MSAF

Feature	State	Number	%
Maternal Age	<35 years	263	87.7
	≥35 years	37	12.3
Booking	Early	272	90.7
	Late	28	9.3
Follow Up	Regular	270	90
	Irregular	30	10
Number of AN scans	Once	9	3
	2-3 scans	25	3.8
	>3 scans	266	88.7

Table 2: Maternal Risk Factors for Meconium Stained Liquor

Maternal Risk Factors	State	Number	%
Diabetes Mellitus	Yes	3	1
	No	297	99
Hypertension	Yes	2	0.7
	No	298	99.3
PROM	Yes	35	11.7
	No	265	88.3
UTI	Yes	97	32.3
	No	203	67.7
Fever	Yes	3	1
	No	297	99
Vaginal Discharge	Yes	66	22
	No	233	77.7
Vaginal Itching	Yes	38	12.7
	No	262	87.3

Regarding the distribution of maternal risk factors among the mothers of our patients, the study revealed that problems related to infections were more prevalent; urinary tract infection (UTI) diagnosed in 32.3% followed by vaginal discharge in 22%, then vaginal itching in 12.7%, prelabour rupture of membrane

detected in 11.7% of the mothers, generalized symptoms of fever established in only 3 mothers (1%), chronic diseases like diabetes mellitus and hypertension present only in 1% and 0.7% respectively.

Perinatal Data

Table 3: Perinatal data for neonates with meconium-stained liquor

Perinatal Data	State	Number	%
CTG Abnormality	Yes	37	12.3
	No	263	87.7
Mode of Delivery	Vaginal	215	71.7
	Elective CS	17	5.7
	Emergency CS	68	22.7
Maturity	Preterm	18	6
	Term	250	83.3
	Post Date	31	10.3
Neonatal Resuscitation	Yes	13	4.3
	No	287	95.7
pH at 1 hr age	≥7.25	270	90
	<7.25	30	10

CTG abnormality noticed in 12.3%; 215 (71.7%) babies delivered vaginally, elective cesarean section was the route of delivery in 17 cases (5.7%), but emergency cesarean section was needed in 68 cases (22.7%). About maturity: 18 (6%) were preterm babies, 250 (83.3%) were term but only 31 (10.3%) were postdated, 13 (4.3%) of the neonates needed resuscitation and the pH was <7.25 in 30 (10%) of babies at 1st hour of age.

Neonatal Characteristics

Table 4: Neonates with meconium-stained liquor characteristics

Neonatal Characteristics	State	Number	%
Birth Weight	LBW	14	4.7
	Normal	263	87.7
	LGA	21	7
APGAR Score 5 minutes	≤5	11	3.7
	>5	289	96.3
APGAR Score 10 minutes	≤5	2	0.7
	>5	298	99.3

The birth weight of our neonates was within the normal range in 263 (87.7%) babies, 14 (4.7%) were low birth weight (LBW) and 21 (7%) neonates were large for gestational age (LGA), Apgar score at 5 minutes was 5 or less in 11 babies (3.7%), but at 10 minutes only 2 (0.7%) had Apgar score 5 or less.

Investigations & Management

Table 5: Investigations & Management of neonates with MSAF

Investigation & Management	State	N	%
Leukocytosis >25,000	Yes	25	8.3
	No	275	91.7
Abnormal Chest X Ray	Yes	28	9.3
	No	272	90.7
Need to MV	Yes	12	4
	No	288	96
Oxygen Requirement	Yes	31	10.3
	No	269	89.7
Antibiotics Given	Yes	154	51.2
	No	146	48.7
Length of Stay in NICU	<1 Day	127	42.3
	1-3 Days	110	36.7
	>3 Days	63	21

All the patients admitted to nursery intensive care unit and underwent different types of investigations; Leukocytosis (≥25000) detected in 8.3% and abnormal chest X-Ray seen in 9.3% of them. Regarding the management lines used for these patients: antibiotics used for 51.3% and oxygen required for 10.3%, mechanical ventilation needed for only 4% of our patients. Length of stay was less than a day in 42.3% of our patients, 21% stayed in hospital more than 3 days and 36.7% stayed for 1-3 days.

Neonatal Outcome

Table 6: Outcome of neonates with MSAF

Neonatal Outcome	State	Number	%
Respiratory Distress Syndrome	Yes	34	11.3
	No	266	88.7
Pneumothorax	Yes	1	0.3
	No	299	99.7
Neonatal Death	Yes	1	0.3
	No	299	99.7

Respiratory distress syndrome complicates the course of the disease in 11.3% and pneumothorax in only one patient (0.3%). Only one patient died (0.3%) who was a baby of 31 years mother with no history of any maternal disease, had abnormal CTG but delivered vaginally, and was term with normal birth weight, Apgar score at 5 and 10 minutes was less than 5, resuscitation needed and antibiotics given, chest X ray was abnormal with no leukocytosis but pH at 1 hour of age was less than 7.25, oxygen and mechanical ventilation were needed, complicated by respiratory distress but no pneumothorax.

DISCUSSION

Meconium is the first intestinal discharge of the newborn infant. In addition to epithelial cells, fetal hair, mucus, and bile, meconium also contains a number of proinflammatory components (Tybulewicz et al., 2004). The passage of fetal colonic contents in the amniotic cavity causes the MSAF, and its frequency is between 12% and 19% (Ojha et al., 2006; Yoder et al., 2002). Meconium aspiration syndrome is the most common cause of respiratory disease in the term infant (Mahomed et al., 1998). In this study the incidence of respiratory distress syndrome was 11.3%. Mahomed et al. (1998) reported an incidence of 6.6% to 30% of cases of MSAF, and 1% to 3% of live born infants. In our study 71.7% patients delivered through normal vaginal delivery, 22.7% through EM CS and

5.7% through EL CS. Kumar et al. (2012) stated that the rate of normal vaginal delivery was 60%, and for cesarean section 40%.

Regarding the distribution of maternal risk factors among the mothers of our patients, this study revealed that maternal infection was significantly associated as 32.3% of the mothers were diagnosed with UTI, 22% with vaginal discharge and 12.7% were diagnosed with vaginal itching. A study done by Nirmala et al. (2020) studied the risk factors (both maternal and fetal) in causing meconium stained amniotic fluid in women in labour at SAT Hospital, they found out that maternal infections at term like vaginitis, UTI and LRTI are risk factors for MSAF, they recommended the detection of infections like UTI and vaginitis at the earliest and treat them.

Maternal chronic diseases such as hypertension and diabetes mellitus are significantly associated with MSAF as in our study the results showed that 1% of the cases were diagnosed with hypertension and 0.7% of them were diagnosed with diabetes mellitus. In a case controlled study done by Anju et al. (2019), they found that maternal factors associated with thick MSAF were hypertension in 12.2%, diabetes 8%, in addition to obstetric factors such as gestational hypertension in 12% and gestational diabetes 7.8%, as well as anaemia in 7.2%. In conclusion maternal factors for MSAF according to the study were maternal medical and obstetric factors like hypertension, diabetes mellitus, gestational hypertension, GDM and anaemia (Anju et al., 2019).

Regarding perinatal period, abnormal CTG was found in 12.3% of the cases and it had a significant association with MSAF. Nirmala et al. (2020) recommended a partogram to assess whether the labour is progressing at the required rate and detect prolonged labour at the earliest, as prolonged labour is a risk factor for MSAF and the CTG should be attached to detect any abnormalities showed up.

As to the mode of delivery, we found that 71.7% were delivered by normal vaginal delivery, 5.7% were delivered by elective caesarean section and 22.7% were delivered by emergency caesarean section, hence the study revealed that normal vaginal delivery mode is more common association with MSAF than caesarean section. In an observational study by Kumari et al. (2012) to determine the foetal outcome and mode of delivery in patients with meconium stained liquor during labour showed that of the total 75 cases, 45 (60%) patients were delivered through normal vaginal delivery, while 30 (40%) were delivered by caesarean section.

Regarding neonatal outcome, RDS was significantly associated with MSAF as 11.3% of total cases were diagnosed with it, whereas only 0.3% of total cases were diagnosed with pneumothorax. In a study by Olicker et al. (2021) about neonatal respiratory distress secondary to meconium aspiration syndrome, it is shown that MSAF is considered to be a sign of fetal distress or hypoxia, but only approximately 4% of infants born through MSAF go on to develop MAS.

Our study reported one patient died out of 300 babies which accounts to 0.3%, the baby was term with history of abnormal CTG, delivered by normal vaginal delivery with APGAR score less than 5 at 5 and 10 minutes. Resuscitation needed, antibiotics were given, chest x ray showed abnormalities. ABG was done and pH was less than 7.25, the baby required oxygen and connected to the mechanical ventilation complicated by RD.

Koigi-Kamau and Kungu (2006) reported on a case of severe meconium aspiration syndrome (MAS) that resulted in early neonatal death. The pathophysiologic processes of intrauterine meconium release, mechanisms of fetal effects and dilemmas in management are discussed.

Conclusion

Meconium stained amniotic fluid is associated with an increased caesarean section rate, causes birth asphyxia, MAS and increases neonatal intensive care unit admissions. Coordination of care is needed between the obstetrician and neonatologist to prevent the complications related to MSAF. Based on our observation in this study we conclude that maternal factors (urinary tract infection, diabetes, hypertension and PROM) were important risk factor for MSAF and associated complications including meconium aspiration syndrome (MAS).

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