Indian Journal of Obstetrics and Gynecology Research 2020;7(4):476–481

Content available at: https://www.ipinnovative.com/open-access-journals

Indian Journal of Obstetrics and Gynecology Research

Journal homepage: www.ijogr.org

Original Research Article

Maternal and fetal characteristics associated with meconium-stained amniotic fluid

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ARTICLE INFO

Article history:
Received 08-09-2020
Accepted 12-09-2020
Available online 07-12-2020

Keywords:
Meconium
Meconium stained liquor
Meconium aspiration syndrome

ABSTRACT

Introduction: Black-green colored odorless material known as meconium is physiologically passed by new born babies with in 48 hours of birth. Presence of meconium in the amniotic fluid could be a dangerous condition. It may expose the baby to multiple condition depending upon the amount of meconium entering in to the respiratory track of the baby. The knowledge of association of various maternal and fetal associated factors with meconium aspiration syndrome is of immense importance for appropriate clinical judgments and decisions.

Aims and Objectives: The aim of the present study was to study various maternal and fetal parameters associated with meconium stained amniotic fluid.

Results: The present study was a prospective observational study. It was conducted in the Obstetrics and Gynecology department of Tertiary Hospital & Medical Collage & Research Centre, Ahmedabad, Gujarat, India during May 2016 to May 2018 on 200 laboring mothers with meconium stained amniotic fluid who delivered or underwent cesarean section in the institute were included in the study. Majority of them were between 20–30 years of age (59%). The women between 31–35 years of age were 27%. Participants either <20 years or >35 years were 9% and 5% respectively. There were 82 patients who had grade I MSL, 63 patient who had grade II MSL whereas 55 patients who had grade III MSL. Out of 200, there were 196 women who were having associated risk factors like prolonged labour, PROM, hypertension, postdatism, GDM, IUGR and anaemia. MSL as well as MAS has been strongly associated with the parity of the mother. It was also observed that patients who's age was greater than 35 yrs. All (100%) presented with grade 3 MSL. Fetus whose gestational age was greater than 40 weeks has fewer chances of co-morbidities.

Conclusion: It was concluded in the present study that multiparity, higher maternal age, presence of Maternal Risk Factors, C-section, IUGR, oligo-hydraminos, post-datism, GDM, non-reactive CTG, prolonged labor and PROM had significant association with higher grades of meconium stained Liquor. It is strongly recommend that in such patients early and appropriate care along with constant monitoring can prove to be highly beneficial.

1. Introduction

During the gestational period, around 3rd month, a black-green colored odorless material is found in the gut of the developing fetus which is known as meconium.[1] It is composed of water, epithelial cells of the intestinal lining, lanugo, bile and mucous.[2] Majority of healthy full term babies pass meconium within 48 hours of being born. Factors those promote passage of meconium in the amniotic fluid in utero include placental insufficiency, maternal hypertension, oligohydramnios, preeclampsia, infection, maternal drug abuse, acidosis or any other reasons which can cause intrauterine distress.[3,4] The fetus may pass the meconium in to the amniotic fluid due to the conditions like

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https://doi.org/10.18231/j.ijogr.2020.103

umbilical cord compression or other vascular anomalies of it.[5] Similarly, the maturation of the GIT, vagal stimulation or the compression of the spinal cord may also cause the release of meconium in to the amniotic fluid.[6]

Presence of meconium in the amniotic fluid could be a dangerous condition. It may increase the risk of bacterial infection, aspiration of meconium resulting in gasping breathing pattern causing hypoxia due to airway obstruction, chemical pneumonitis and pulmonary hypertension.[7] The exposure of respiratory tract to the meconium results in inflammation of the lung tissues[8] along with deactivation of surfactants and inhibition of the same.[9,10]

The passage of meconium in to the amniotic fluid and its consequences are a multifactorial process which is affected by multiple factors associated with fetus as well as mother. Knowledge of association of various maternal and fetal factors with meconium aspiration syndrome is important to know and understand to timely judge the outcome and take the appropriate clinical decisions.

The aim of the present study was to study various maternal and fetal parameters associated with meconium stained amniotic fluid.

2. Materials and Methods

The present study was a prospective observational study. It was conducted in the Obstetrics and Gynecology department of Tertiary Hospital & Medical Collage & Research Centre, Ahmedabad, Gujarat, India during May 2016 to May 2018. A total of 200 laboring mothers with meconium stained amniotic fluid who delivered or underwent cesarean section in the institute were included in the study.

All the laboring mothers with Meconium Stained Liquor (MSL) who gave permission to participate in the study with singleton pregnancies were included in the study. The patients who didn't give consent, mothers who presented with intrauterine fetal death, mothers who had non-cephalic presentation and with multi fetal gestation were excluded.

A structured pretested proforma was used to collect data. The Ethical Review Board approval was taken before starting the study. The study participants were informed about the objectives and benefits of the study following which informed consent was obtained in all three languages viz. English, Gujarati and Hindi. All of the information accessed during the study was used for the purpose of this study alone. Relevant data were abstracted from the neonatal chart and the logbook in the neonatology ward.

The collected data was analyzed using SPSS version 20 (IBM Corporation). Descriptive statistical measures such as frequencies and percentages were generated and presented in tables. For finding associations between different variables, we used two chi-square test. To find the degree of association, Cramer's V was used.

Apgar score was determined by evaluating the newborn baby on five simple criteria on a scale from zero to ten, then repeating it at five minutes. Meconium stained liquor was categorized in to three categories. Grade I MSL included small amount of meconium diluted in a plentiful amount of amniotic fluid. This gives the fluid only a slightly greenish or yellowish discoloration. Grade II MSL included the cases having 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 III MSL were the cases with heavy staining, when there is reduced amniotic fluid and large amount of meconium, making the staining quite thick, with 'pea soup' consistency.

3. Observations

A total of 200 laboring mothers participated in the present study. As shown in the Table 1, majority of them were between 20 – 30 years of age (59%). The women between 31 – 35 years of age were 27%. Participants either <20 years or >35 years were 9% and 5% respectively.

Table 1: Age distribution (years)

Groups	Number of patients	Percentage %
<20 Yrs.	18	9
20-30 Yrs.	118	59
31-35 Yrs.	54	27
>35 Yrs.	10	5
Total	200	100

Table 2 Shows the gestational age at the time of delivery. Majority of the cases were more than 37 weeks of gestational age. There were only 5.5% of patients who delivered before 37 weeks.

Table 2: Gestational age

Gestational Age	Number of patients	Percentage %
<37 Weeks	11	5.5%
37-40 weeks	130	65%
>40 Weeks	59	29.5%
Total	200	100

As mentioned earlier, all the patients with meconium stained liquor were included in the study. All the three grades of MSL as mentioned in the material and methods were observed. Table 3 shows the patient distribution according to the grade of MSL. There were 82 patients who had grade I MSL, 63 patient who had grade II MSL whereas 55 patients who had grade III MSL.

Maternal risk factors like shown in Table 4 are many times associated with various grades of MSL as well as Meconium Aspiration Syndrome (MAS). Table 4 shows the

Table 3: Patient distribution based on MSL grade

MSL Grade	Number of patients	Percentage %
1	82	41%
2	63	31.5%
3	55	27.5%
Total	200	100

associated maternal risk factors observed in the participants. There were a total of 196 participants who had associated risk factors present.

Table 4: Maternal risk factors

	No. of patients
Prolonged Labor	18
PROM	34
Hypertensive disorder	34
Oligohydraminos	40
Postdatism	53
GDM	4
Rh-iso-immunization	1
IUGR	5
Severe anemia	7
Total	196

MSL as well as MAS has been strongly associated with the parity of the mother. There were a total of 82 cases of grade I MSL out of which 26 were primigravida, 40 patients were multipara and 16 had history of previous caesarian section (CS). Similarly, out of 63 grade II MSL cases 51 were primipara, 2 were multipara and 10 had previous CS. Out of 55 grade III MSL cases, 24 were primi, 10 multipara and 21 with previous history of CS. We observed MAS in 4 fetuses of primipara mother and 8 fetuses of multipara mother. 3 fetuses delivered to mother with the history of previous CS showed MAS. (Table 5) The similar correlation amongst various grades of MSL and MAS with the age of the mother is shown in Table 6. It was interesting to observe that patients who's age was greater than 35 yrs. All (100%) presented with grade 3 MSL. Based on these findings we carried out chi-square analysis to findcout association between Maternal age and grades of MSL which showed significant association between both the variables. chi-square value was $\chi 2$ (6) = 48.458 at p <0.001. Cramer's V was calculated to be 0.348 which showed moderate positive association between both the variables.

Table 7 shows the association of various fetal outcomes, MSL and MAS in relation with gestational age. Out of 200 patients 11(5.5%) belonged to group where gestational age is less than 37 weeks, 130(65%) belonged to group of gestation age 37-40 weeks and 59(29.5%) belonged to group were gestation age is greater than 40 weeks. It was observed that fetus whose gestational age was less than 37 weeks of gestation presented with higher grades of MSL viz. grade 2 (54.55%) & 3(45.45%). Fetus whose gestational age was less than 37 weeks of gestation, mode of delivery was cesarean section (100%) in all cases. Fetus whose gestational age was greater than 40 weeks has fewer chances of co-morbidities viz. birth asphyxia (13.56%), metabolic acidosis (3.39%), chemical pneumonitis (0%) & persistent pulmonary hypertension of new born (0%).

Based on above findings we carried out chi-square analysis to find out association between gestational age and grades of MSL which showed significant association between both the variables. chi-square value was $\chi 2$ (4) = 17.928 at p=0.001. Although from above table we can see that lower gestational age had higher grade, Cramer's V value showed that it was positively associated with gestational age. Cramer's V= 0.212. Which means that as gestational age was increasing, grades of MSL were also increasing. Higher grades in <37 weeks group can be attributed to less number of patients in the group.

As shown in Table 8, out of 200 patients 169(84.5%) had reactive CTG & 31(15.5%) had Non-Reactive CTG. It was observed that patients having non-reactive CTG has higher chances of grade 2 & 3 MSL (100%). Meconium aspiration syndrome was found in 15 (48.38%) patients having Non-Reactive CTG. Also all the meconium aspiration patients had non-reactive (32) CTG 15 (100%). All the patients who had Non-Reactive CTG (100%) underwent cesarean section.

Based on above findings we carried out chi-square analysis to find out association between fetal distress and grades of MSL which showed significant association between both the variables. chi-square value was $\chi 2$ (2) = 36.652 at p<0.001. Cramer's V value showed that it was highly positively associated with CTG findings. Cramer's V= 0.428.

4. Discussion

Passing meconium during the intrauterine period in to the amniotic fluid is a physiological phenomenon due to maturity of the fetus. This could result due to umbilical cord compression or fetal hypoxia also.[11] Neonate passes about 60 to 200 gm of meconium at birth.[12] Meconium stained liquor is observed in approximately 8 – 20% of newborn and out of which 2 – 9% of the cases suffer from meconium aspiration syndrome.[13]

In the present study, there were 82 (41%) patients who had grade I MSL, 63 (31.5%) patient who had grade II MSL whereas 55 (27.5%) patients who had grade III MSL. Paudel P et al.[14] studied incidence, associated risk factors and outcome evidence of meconium aspiration syndrome in Nepal. In their study, 11/122(9%) cases of MAS were among multiparous women, 78/122(63.9%) cases of MAS were among nulliparous women and 33/122(27%) cases of MAS were among primiparous women. We observed in the present study that out of 82 cases of grade I MSL out of which 26 were primigravida, 40 patients were multipara

Table 5: Association of parity with MSL and other parameters

	MSL Grade 1	MSL grade 2	MSL grade 3	MAS
Primi	26	51	24	4
Multiparity	40	2	10	8
Previous CS	16	10	21	3
Total	82	63	55	15

Table 6: Age distribution in different MSL grades

Maternal Age	Grade 1 of MSL	Grade 2 of MSL	Grade 3 of MSL	MAS
<20 Yrs	10	2	6	0
20-30 Yrs	38	51	29	5
31-35 Yrs	34	10	10	10
>35 Yrs	0	0	10	0
Total	82	63	55	15

Table 7: Association of MSL with gestational age

Gestational Age	Grade 1 of MSL	Grade 2 of MSL	Grade 3 of MSL	MAS	Birth Asphyxia	Metabolic Acidosis	Chemical Pneumonitis	Persistent pulmonary hypertension of the newborn
<37 Weeks	0.00	54.55	45.45	45.45	45.45	27.27	27.27	27.27
37-40 weeks	49.23	49.23	49.23	49.23	49.23	49.23	49.23	49.23
>40 Weeks	30.51	28.81	40.68	6.78	13.56	3.39	0.00	0.00
Total	82	63	55	15	17	7	3	3

Table 8: Association of MSL with fetal distress

CTG	Grade 1 MSL	Grade 2 MSL	Grade 3 MSL	MAS	Birth Asphyxia	Metabolic Acidosis:	Chemical Pneum onitis	Persistent pulmonary hypertension of the newborn
Reactive	82	53	34	0	0	0	0	0
Non-reactive	0	10	21	15	17	7	3	3
Total	82	63	55	15	17	7	3	3

and 16 had history of previous caesarian section (CS). Similarly, out of 63 grade II MSL cases 51 were primipara, 2 were multipara and 10 had previous CS. Out of 55 grade III MSL cases, 24 were primi, 10 multipara and 21 with previous history of CS. We observed MAS in 4 fetuses of primipara mother and 8 fetuses of multipara mother. 3 fetuses delivered to mother with the history of previous CS showed MAS.

On comparing our results with different studies, we found that in a study by Akhila S et al.,[15] 190 (54.6%) were primi-para, 139 (39.94%) were gravida-2 and 19 (5.46%) have conceived 3 or more times. In both the thin-MSL and thick-MSL groups, cases were more among primi mothers which was very similar to our study. In our study also, we saw worse grades in primi patients.

Addisu et al[16] studied prevalence of MSL and its associated factors. They showed that Women whose age greater than 30 years [AOR =5.63, 95%CI =3.35-9.44] had association with higher grade of MSL. They concluded that their results were similar to the international results which showed that higher maternal age was significantly associated with higher grade of MSL.

Various studies have been carried out to find out association between gestational age and MSL. In our study most of the higher grade MSL cases were in patients with gestational age<40 whereas in some of the studies, they have observed different trend. In one of the study by Rodriguez et al.,[17] the incidence of MSL rises with gestational age at delivery, reaching 20.7% in gestations above 41 weeks compared to 4.3% below 37 weeks which showed similar results to ours. Also, in our study we had collected data of only MSL cases and no controls were taken which can be one of the reason for this contradictory results. In another study by Carr et al.,[18] increasing gestational

age had the strongest association with meconium stained amniotic fluid; >/=42 weeks gestation occurring 3.52 (95% Confidence Interval: 2.00, 6.22, p=<0.001) more than <40 weeks gestation.

In a study by Husain et al.,[19] of the total 200 subjects, 183(91.5%) were reactive and 17 (8.5%) were non-reactive women. Most commonly noted risk factor were post-date 53 (26.5%), anaemia 35 (17.5%), premature rupture of membranes 28 (14%) and pregnancy-induced hypertension 10 (5%). They found that significant change was seen in cardiotocography of clear liquor which needs more evaluation to rule out ongoing hypoxia.

In a study by Meena P et al.,[20] among the 22 babies with abnormal CTG patterns, in Grade 3 MSL, 15 babies needed NICU admission; among those 15 babies, 12 of them needed ventilatory support of which 10 babies developed meconium aspiration syndrome and 3 babies had severe Birth Asphyxia. Hence they concluded that association of MSL with abnormal CTG is associated with poor outcome, increased caesarean section rate and increased neonatal complications.

In a study by Nirmala et al.,[21] monitoring included cardiotocography, scalp pH estimation when required and optimal care at delivery. The fetal heart rate abnormalities were more common in meconium stained patients. Thick meconium staining was associated with higher caesarean section rate, low Apgar score at one minute and more admissions to the neonatal intensive care unit. They concluded that all women with meconium staining of liquor should be cardiotocographically monitored in labour and managed by optimal timely intervention in order to avoid severe asphyxia and meconium aspiration.

In another study by Baker et al.,[22] they found that the presence of cardiotocographic abnormalities in meconium stained patients was a main indication for fetal blood sampling.

5. Conclusion

It was concluded in the present study that multiparity, higher maternal age, presence of Maternal Risk Factors, C-section, IUGR, oligo-hydraminos, post-datism, GDM, non-reactive CTG, prolonged labor and PROM had significant association with higher grades of meconium stained Liquor. All the patients who had Maternal Risk Factors and non-reactive CTG underwent C-section. Meconium stained liquor even though a commonly found condition in the newborns, if not diagnosed and treated at early stage can cause lots of grievous outcomes in the patients, aspiration syndrome being the worst. Through our study we tried to show the various co-morbidities and different parameters in these patients. We strongly recommend that in such patients early and appropriate care along with constant monitoring can prove to be highly beneficial.

6. Source of Funding

None.

7. Conflict of Interest

None.

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Cite this article: Patel S, Patel B, Shah A, Jani S, Jani C. Maternal and fetal characteristics associated with meconium-stained amniotic fluid. *Indian J Obstet Gynecol Res* 2020;7(4):476-481.