https://doi.org/10.31689/rmm.2023.30.3.205

ORIGINAL PAPERS

A Comparative Study on Fetomaternal Outcome in Patients with Meconium-stained Amniotic Fluid vs Clear Amniotic Fluid

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Abstract

Aim: To compare and study the perinatal maternal outcome and complications in neonates in patients with meconium-stained amniotic fluid. **Materials and methods:** This was a randomized comparative analysis and prospective study conducted from 1st October 2021to 30th May 2022. 120 patients with meconium-stained amniotic fluid were studied for fetomaternal outcomes and compared to 120 patients with clear amniotic fluid. The patients were monitored for fetal heart rate, mode of delivery, Apgar score at 1 and 5 minutes, NICU admissions and neonatal complications. **Result:** An increased rate of caesarean section and operative vaginal deliveries was associated with meconium-stained amniotic fluid as compared to clear amniotic fluid. The commonest fetal abnormality seen was bradycardia in 35% of meconium-stained amniotic fluid cases. The APGAR score was less than 7 at 5 min in 5% of the meconium-stained amniotic fluid group and the major complication was birth asphyxia (18.18%) which was more in the thick MSL group (14.87%). Meconium aspiration syndrome was seen in 4 in the the MSL group and 2 in thin MSL group. NICU admission was required in 18% of cases in MSL group while 7% in the control group. The morbidity was more in the MSL group (52%) than thin MSL group (20%). **Conclusion:** The study proved that meconium staining of amniotic fluid affects the fetal outcome adversely.

Keywords: APGAR score, birth asphyxia, meconium-stained amniotic fluid, meconium aspiration syndrome.

Rezumat

Scop: Compararea și studierea evoluției materne perinatale și a complicațiilor la nou-născuți la pacienții cu lichid amniotic colorat cu meconiu. **Materiale și metode:** Am realizat o analiză comparativă randomizată și un studiu prospectiv realizat în perioada 1 octombrie 2021 - 30 mai 2022. Au fost studiați 120 de pacienți cu fluid amniotic colorat cu meconiu pentru rezultatul feto-patern și comparați cu 120 de pacienți cu lichid amniotic clar. Pacienții au fost monitorizați pentru frecvența cardiacă fetală, modul de naștere, scorul Apgar la 1 și 5 minute, internarea la terapie intensivă neonatală și complicațiile neonatale. **Rezultate:** O rată crescută de operații de cezariană și nașteri vaginale operative a fost asociată cu lichidul amniotic colorat cu meconiu în comparație cu lichidul amniotic clar. Cea mai frecventă anomalie fetală observată a fost bradicardia, în 35% din cazurile de lichid amniotic colorat cu meconiu. Scorul APGAR a fost mai mic de 7 la 5 minute la 5% din grupul cu lichid amniotic colorat cu meconiu, iar complicația majoră a fost asfixia la naștere (18,18%), care a fost mai mare în grupul MSL (14,87%). Sindromul de aspirație de meconiu a fost observat la 4 din grupul MSL gros și 2 din grupul MSL subțire. Internarea la terapie intensivă neonatală a fost necesară în 18% din cazuri în grupul MSL, în timp ce în grupul de control doar 7%. Morbiditatea a fost mai mare în grupul cu MSL gros (52%) decât în grupul cu MSL subțire (20%). **Concluzie:** Studiul a demonstrat cum colorarea cu meconiu a lichidului amniotic afectează negativ rezultatul fetal.

Cuvinte cheie: scor APGAR, asfixie la naștere, lichid amniotic colorat cu meconiu, sindrom de aspirație de meconiu.

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INTRODUCTION

The fetus in utero has various protective mechanisms of which, one of them is amniotic fluid. The amniotic fluid is essential for the normal development of the fetus. It is essential for normal lung growth and fetal swallowing permits gastrointestinal tract development. Amniotic fluid also creates physical space for fetal movement which is required for neuro-musculo-skeletal development. It guards the umbilical cord from compression and protects fetus from trauma. Amniotic fluid also has bacteriostatic properties[1]. The amniotic fluid volume increases gradually from 30ml at 10weeks to approximately 800ml by mid third trimester. In early pregnancy, it is colourless and at term becomes pale straw coloured. Abnormal colours of amniotic fluid indicate different pathologies.

The amount of meconium passed out due to underlying pathology, determines the severity of neonatal morbidity. A small amount changes the colour of liquor to light green and warrants timely delivery if risk is to be minimized. Thick meconium suggests severe hypoxia and of longer duration, that will require neonatal resuscitation and intensive care.

Meconium is sterile, thick, blackish green, odourless material, formed by accumulation of debris in the fetal intestine. Passage of meconium into amniotic fluid before delivery or during stages of labour can be due to 3 theories:

1. In response to hypoxia or asphyxia as a sign of fetal compromise.
2. Gastrointestinal tract maturation under neural control
3. Due to vagal stimulation from transient umbilical cord entrapment with resultant increased bowel peristalsis[2]

The risk factors for meconium-stained amniotic fluid can be both maternal and fetal. The maternal factors are hypertension, gestational diabetes mellitus, pre-eclampsia, post term pregnancy, maternal drug abuse (tobacco, cocaine), placental insufficiency.[3] The fetal factors are oligohydramnios, intrauterine growth retardation with poor biophysical profile.[4]

The most common complication of meconium-stained liquor being meconium aspiration syndrome and birth asphyxia. Meconium aspiration syndrome is defined as respiratory distress that develops shortly after birth with radiographic evidences of aspiration pneumonitis and meconium stained amniotic fluid[5] . MAS is associated with fetal acidemia that is abnormally increased Pco2 values rather than pure acidemia[5]. MAS is 100% more likely to occur in meconium-stained amniotic fluid than in clear amniotic fluid.

METHODOLOGY

This was a randomized, observational, prospective study and was conducted in the Department of Obstetrics and Gynaecology of Dhiraj Hospital, Vadodara, Gujarat, India.
Sample size: 240 patients
Duration: 1st October 2022 to 30th May 2023.
Data was collected and then analysed by SPSS 21.

INCLUSION CRITERIA

- Patients giving consent for study
- Full term singleton pregnancy. (GA: 37 weeks to 40 weeks)
- Cephalic presentation.
- Spontaneous onset of labour
- Spontaneous or artificial rupture of membranes with meconium stained or clear liquor.
- No high-risk conditions (obstetrical or medical)

EXCLUSION CRITERIA

- Patients not consenting for study
- Gestational age <37weeks and >40weeks
- Previous uterine scar for caesarean or else.
- Any pelvic deformity or vaginal obstruction to normal delivery.
- Malpresentation
- Any evidence of fetal compromise or IUFD.
- High risk pregnancies including PIH, GDM, epilepsy, anaemia, preterm labour and infections.
- Patients with fetal congenital anomalies.
- Patients not willing to participate

Cases and control group were those with meconium-stained amniotic fluid and with clear amniotic fluid respectively. Two groups of meconium-stained cases were clinically classified according to type of staining-thin (54 cases- lightly stained amniotic fluid, yellow or greenish in colour) and thick (66 cases- dark green/black stained amniotic fluid usually thick and tenacious). Consent for participation in the study was

taken from the patients. All the information was noted in a printed performa. General and obstetrical examination of mother during labour was done. The labour was monitored, the mode of delivery, Apgar scores at one and five minutes, birth weight, resuscitation of baby, neonatal intensive care (NICU) admissions, birth asphyxia, meconium aspiration syndrome (MAS), early neonatal deaths were noted. Use of any medications was recorded. Clinical fetal monitoring i.e., fetal heart rate was noted throughout the progress of labour. All babies of both groups were followed up to 1st week of neonatal life.

In present study bradycardia was when fetal heart rate below 100 bpm and tachycardia was when fetal heart rate above 160 bpm. Fetal distress included FHR abnormalities (bradycardia, tachycardia, significant variable deceleration. Loss of beat-to-beat variability, fetal arrhythmias), decreased or absent fetal movements and Non-reactive NST. Babies were considered not asphyxiated and in good condition when the Apgar score was 7 or higher, moderately asphyxiated when the score was 4 to 6, and severely asphyxiated when the score was less than 4.

STATISTICAL ANALYSIS

The statistical analysis was done using SPSS Software. All the qualitative data were presented as .frequency and percentages and were compared using Fisher's test or Chi-square test. P- Value of < 0.05 was considered as significant.

OBSERVATIONS AND RESULTS

During the study period, 120 cases who had meconium staining of amniotic fluid, gave the incidence of 6.5%. (Total 1830 deliveries) Among these 120 cases, 66 cases had thick meconium and 54 cases had thin meconium. In study group maximum numbers of cases (54.54%) were. in the age group of 2l- 25 years .and mean age group was 23.6 years. In the control group also maximum number of cases (57.85%), were in the same age group and mean age was 22.98 years. Approximately 62.79% had gestational ages of 39-40 weeks, was higher in study group.as compared to controls (57.02), but difference was not statistically significant. Unbooked cases were more in study group as compare to in control group. Out of unbooked cases 27.72% were of thick meconium stained (Table 1).

Table 1. Prevalence of msaf in relation to maternal age, gestational age, booking status

PARAMETERS	CASES %	CONTCONTROLS%
MATERNAL AGE (years)		
< 20	23.18	25.63
21-251	54.50	57.85
26-30	18.20	16.50
31-36	4.11	00.00
GESTATIONAL AGE		
37-38 weeks	37.20	43.99
39-40 weeks	62.79	57.02
Booked	72.27	80.00
Unbooked	27.72	19.99

Table 2. Mode of delivery

	THIN MSL GROUP (N = 54)	THICK MSL GROUP (N = 66)	CON-TROL
Normal deliveries with oxytocin	17 (31.4)	10 (15.15%)	66 (55%)
Normal delivery without oxytocin	5 (9.25)	3 (4.5%)	20(1.66%)
Cesarean section	13 (24.09%)	40 (59.70%)	15 (12.39%)
Forceps deliveries	12 (22.20%)	12 (19.45%)	11 (9.09%)
Vacuum extraction	7 (12.97%)	1 (1.50%)	8 (7.44%)

Normal vaginal delivery was more in the control group and the difference was statistically significant. Incidence of caesarean was more in thick MSL group (59.70%) compared to thin MSL group (24.09%). The incidence in thick MSL group was 5 times more in the control group (12.39%) p<0.01. Outlet forceps and vacuum also has increased rates in MSL group. (Table 3)

Table 3. Perinatal outcome

Perinatal outcome	Study group			Control
	Thick MSL	Thin MSL	Total	
Birth asphyxia	18.(14.87%)	4 (3.3%)	22 (18.18)	9 (7.01%)
MAS	8.(4.95%)	2 (3.3%)	10 (8.25)	-
Still birth	1 (0.83%)	-	1 (0.83%)	1 (0.83%)
Perinatal death	4 (3.30%)	-	4.(3.30%)	-
NICU Admission	14 (18%)	8 (7%)	22 (25%)	9 (7.5%)

Approximately 18.18% babies of MSL group suffered birth asphyxia (moderate and gross) compared to 7% in control group. There was 1 still birth in the study group. The condition of the babies in thick MSL group was worse than the control group (P-value<0.01) (table 4)

Table 4. Correlation of intrapartum. fetal heart rate and condition of baby at birth in msl group and control group

	CASES				CONTROLS			
FETAL HEART RATE	**No. of Cases**	**Still birth**	**Grossly asphyxiated**	**Moderately asphyxiated**	**No. of cases**	**Still birth**	**Grossly asphyxiated**	**Moderately asphyxiated**
<120 bpm	43 (35%)	1 (0.83%)	3 (2.5%)	9 (7.5%)	20 (14%)	0 (0.0%)	2 (1.66%)	2 (1.66%)
>160 bpm	17 (14%)	0 (0.00%)	1 (0.83%)	1 (0.83%)	10 (2%)	0 (0.0%)	1 (0.83%)	0 (0.00%)
120-160 bpm	60 (51%)	0 (0.00%)	0 (0.00%)	8 (6.66%)	90 (84%)	0 (0.0%)	0 (0.00%)	6 (5%) art

There was associated bradycardia <120bpm (35%) in majority of cases in MSL group and statistically significant as compared to the control group. (Table 5).
The number of babies with non-reactive NST was more in thick MSL (50%) as compared to thin MSL (20%) and control group (16%) which was statistically significant (P-value <0.01)

Table 5. Fetal outcome

OUTCOME	THICK MSL	THIN MSL	CLEAR
APGAR SCORE (<7)			
At 1 min	4	2	2
At 5 min	3	1	1
NEONATAL RESUSCITATION			
O2 supplementation	2	1	1
AMBU ventilation	1	1	1
Immediate intubation	1	0	0
Birth trauma	2	0	1

Among the MSL group 4 cases of thick MSL babies were grossly asphyxiated and had APGAR score of 1-3 at 1 minute and score of 4-6 at 5 min. Among the MSL group 95% babies had APGAR score 7-10 at 1 min and in the control group it was 98%. Among control group 2 babies were grossly asphyxiated and Apgar score 1-3 at 1 min but the score was 4-6 at 5min. Total number of babies asphyxiated were 22 in MSL group whereas in control group it was 9. The APGAR score at 1 min was statistically significant between thick and thin MSL; MSL and control group, whereas no difference was seen in APGAR scores at 5min. In the study group, the APGAR score less than 7 at 1 min was 5% whereas in control group it was 1.66%. The APGAR score of less than 7 was observed at 5 min in 3.33% of MSL group.
Neonatal morbidity was significantly associated with MSL group and was 38% in the study group and 16% in the control group. The morbidity was more in the thick MSL group 52% than that of the thin MSL group. Admission to NICU was more in cases (18%) than that of control group (7%), it is due to MAS in study group. In the present study the perinatal deaths were 4% in the MSL group. The fetal outcome was adversely affected by the MSL in our study (P value<0.01)

DISCUSSION

In the present study, 120 cases of MSL group were studied in a period of 5 months to evaluate the effect of MSL during labour on fetal outcome, an equal number of cases with clear liquor were taken as control. 54 cases had thin MSL and 66 cases had thick MSL noted at the time of spontaneous or artificial rupture of membranes. The incidence of MSL group was 7.7%. The mean gestational age was higher (39.82 weeks). MSL does not appear to be related with the volume of amniotic fluid in. term pregnancies, and its presence increases the risk of caesarean delivery for fetal distress independent of amniotic fluid volume[6].

There is significantly higher incidence of risk factors in. MSL group that was similar to the study of Rashid etal.[7] The incidence of caesarean section was highest in thick meconium group, that was 59.70% and out of total MSL cases 48%. delivered by caesarean section whereas in control group it was 12%. In comparison to thin MSL group, incidence of cesarean section was near about double in thick MSL group. In the study group, overall percentage of caesarean section was increased due to fetal distress indicated by MSL and abnormal NST. Saunders et al., also reported that caesarean sections were performed twice as frequently in subjects with meconium-stained amniotic fluid. This higher rate may be due to lack of facilities such as, foetal scalp pH monitoring and tracings of foetal electronic monitoring[8]. Fujikura et al, observed that the incidence of meconium staining was significantly more with increased birth weight more than 3 kgs. [9] But in our study, there was no difference between MSG and control group in respect of birth weight. In both groups about same number of babies are of > 3 kgs birth weight but mean birth weight was high in study group 2.92 kg where as in control group2.88 kgs. 27% cases of study group were unbooked.in comparison to control (19%). This study showed that a majority of cases with MSAF were unbooked which is in accordance with the study done by Bhide et al,.[10] The commonest associated abnormal fetal heart rate pattern observed in this study was bradycardia (36%) in.MSG whereas tachycardia was 13%. Babies complicated. by still birth and asphyxia in bradycardia group more (29.54%) than the babies delivered having normal fetal heart rate pattern (9.52%). Non-reactive NST was two times more in study group compared to control group and more in thick group 51% compared to thin group 20%, which was consistent with Rosario[11] Majority incidence of birth asphyxia among the babies born with MSAF was higher compared to the control cases with clear liquor. MAS was present in 8.5% of cases in the MSAF group in our study. In contrast to our study, the incidence of MAS was lower in the study by Tolu et al. (6.3%)[12] Dani et al found that there is a positive correlation between the severity of meconium staining and thickness and the outcomes of term infants born after a non-eventful pregnancy.[13] MSAF is associated with higher rate of caesarean delivery, instrumental delivery, NICU admission rate, fetal distress, low birth weight and neonatal death.[14] Identification of the high-risk factors is important, and timely referral of the patients to centers with proper neonatal care facilities with mechanical ventilators reduces neonatal morbidity and mortality.[15]

CONCLUSION

Meconium-stained liquor can lead to caesarean sections, meconium aspiration syndrome, birth asphyxia and increase NICU admissions, hence concerns both obstetricians and neonatologists equally. The study proved that meconium staining of amniotic fluid affects the maternal and fetal outcome adversely. Hence in presence of thick meconium needs vigilant monitoring, prompt obstetric intervention and good neonatal care in order to prevent or minimize meconium-stained liquor related adverse outcomes.

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