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A STUDY ON THE RISK FACTORS OF MECONIUM STAINED AMNIOTIC FLUID AND A COMPARISON OF PREGNANCY OUTCOMES IN CLEAR AND MECONIUM STAINED AMNIOTIC FLUID

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ABSTRACT

Background: To identify risk factors for meconium stained amniotic fluid (MSAF) and comparison of pregnancy outcome in meconium stained vs. clear amniotic fluid. Methods: The study was conducted at labor-room of SIMSRH, Karnataka for consecutive 500 singleton deliveries at term with cephalic presentation. Detection of MSAF during delivery and follow-up of mother and baby during hospital stay was done. Results: Incidence of MSAF was 30.6% of which thick meconium was 59.4%. Anemia,<3antenatal check up, parity, dysfunctional or prolonged labor, use of Oxytocin or prostaglandin, urinary tract infection and antepartum hemorrhage had no association with MSAF. Fetal distress, cord problems and maternal hypertension came out as risk factors of MSAF. Thick meconium was significantly associated with lower Apgar score, prolonged NICU admission, neonatal sepsis and death. Mothers having MSAF showed higher rates of instrumental deliveries/cesarean section. Conclusions: Prevention of fetal distress and maternal hypertension can reduce MSAF to ultimately minimize cesarean /instrumental delivery and adverse fetal outcome

INTRODUCTION

The presence of meconium in the amniotic fluid during labor has historically been associated with the prediction of fetal distress or asphyxia. Consequently, a significant portion of contemporary obstetric practice focuses on identifying fetal asphyxia and implementing measures to safeguard the newborn from its repercussions. Meconium-stained amniotic fluid is a common finding in obstetric and neonatal care. Recent studies indicate that the overall incidence of meconium-stained amniotic fluid (MSAF) ranges from 5% to 24.6%, with a median of 14% among all deliveries. It serves as an independent predictor of fetal distress and adverse perinatal outcomes, even in low-risk pregnancies. The underlying pathology suggests that the fetus may expel meconium in response to hypoxia, indicating fetal compromise. Alternatively, the in utero passage of meconium may reflect normal maturation of the gastrointestinal tract under neural regulation. This passage could also result from vagal stimulation due to common yet transient umbilical cord entrapment, leading to increased peristalsis, which represents a

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physiological response. Research on the prevalence and clinical implications of MSAF indicates that particularly thick meconium is associated with fetal distress, meconium aspiration syndrome (MAS), and increased perinatal morbidity and mortality. We have identified various antepartum and intrapartum factors in mothers that may lead to meconium staining of the amniotic fluid. Additionally, we compared neonatal outcomes between cases of MSAF and those with clear amniotic fluid, while also examining maternal morbidities linked to MSAF.

MATERIALS AND METHODS

A prospective observational study was conducted in the labor room of SIMSRH, Karnataka, involving 360 consecutive singleton deliveries at term (≥ 37 weeks of gestation) with cephalic presentation and no congenital abnormalities. The study focused on the detection of meconium-stained amniotic fluid (MSAF) during delivery, along with the follow-up of both mother and infant throughout their hospital stay. Exclusions from the study sample included multiple pregnancies, elective cesarean sections, and stillbirths. Live births that met the specified criteria were categorized into two groups: MSAF and clear amniotic fluid (CAF), based on the presence of meconium staining at any point during labor or prior to it. The MSAF group was further divided according to the consistency of the meconium into thick (characterized by thick greenish meconium with particulate matter or a pea soup consistency) and thin (identified by light yellow or light green staining of the amniotic fluid). Maternal antenatal factors, intrapartum factors, and neonatal outcomes were meticulously recorded from both the bedside and the neonatal intensive care unit for each participant. Gestational age was confirmed through ultrasound examinations. Anemia was defined as a hemoglobin level of less than 10 g/dl. Antenatal care was characterized by three or more visits to a healthcare facility during pregnancy. Hypertension was identified as a systolic blood pressure of 140 mmHg or higher and/or a diastolic blood pressure of 90 mmHg or higher during pregnancy, while low birth weight was defined as a birth weight of less than 2.5 kg. Standard definitions were adhered to for postdated pregnancy, antepartum hemorrhage, and premature rupture of membranes. Intrauterine growth retardation was anticipated based on clinical assessments and ultrasound findings. Cord complications included cord prolapse, cord entanglement around the neck, and cord presentation. Fetal distress was characterized by abnormalities in fetal heart rate (such as bradycardia, tachycardia, significant variable decelerations, loss of beat-to-beat variability, and fetal arrhythmias), reduced fetal movements, and a non-reactive non-stress test.

The following parameters were noted and compared in the two groups- CAF vs. MSAF and CAF vs. MSAF thick: teenage mother, maternal age >30 years, primigravida, postdated pregnancy, hypertension, anemia, antenatal care <3 time, antepartum hemorrhage, urinary tract infection, premature rupture of membranes, dysfunctional (DFL) or prolonged labor (PL), cord problems, fetal distress, Oxytocin and prostaglandin usage.

Neonatal parameters compared between the above mentioned 2 groups were:- Apgar score at 1 minute and 5 minute, low birth weight, neonatal sepsis, meconium aspiration syndrome (MAS), prolonged NICU care and neonatal death during stay in hospital. Further maternal parameters compared were mode of delivery (vaginal, vaginal instrumental or cesarean) and any puerperal complication during hospital stay.

The data collected were compiled in MS Excel 2007 software and were analyzed for proportions, relative risk with 95% confidence interval and test of significance was performed by chi square test for categorical variables and unpaired t test for continuous variables with R Tool software.

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OBSERVATION AND RESULTS

Out of the total 500 singleton term deliveries with cephalic presentation, 347 (69.4%) cases recorded clear amniotic fluid (CAF) while rest 153 (30.4%) recorded meconium stained amniotic fluid (MSAF). Among those having meconium stained amniotic fluid, 59.4% had thick meconium (n=91) and the rest had thin meconium (n=62). There were 58 teenage pregnancies (11.6%); 34 mothers (6.8%) were aged >30 years; 268 (53.6%) mothers were primipara; 138 cases (27.6%) were postdated; 69 mothers had hypertension during pregnancy (13.8%); 87 (17.4%) mothers were anemic; 23 (4.6%) mothers had <3 antenatal check up; ante partum hemorrhage (APH) was reported in 6 cases and urinary tract infection in a single mother; premature rupture of membrane (PROM) was present among 99 mothers (19.8%); dysfunctional labor(DFL) was positive in 69 cases (13.8%);prolonged labor(PL) was positive in 44 cases (8.8%); cord problems were present in 35 cases (7.0%); fetal distress was evident in 101 cases (20.2%);Oxytocin was used in 118 cases (23.6%) and prostaglandin (PG) in 75 cases (15%).

All these categorical variables were compared between CAF group and MSAF group and CAF group with thick meconium group separately. Chi square test was applied to find out significant difference if any. Among CAF group vs. MSAF group only cord problem (p=0.004) and fetal distress (p=0.001) were significantly higher in MSAF group while among CAF group vs. thick meconium group only maternal hypertension (p=0.038) and fetal distress (p=0.001) were significantly higher in thick meconium group. (Table-1)

Table 1: Comparison of maternal antepartum and intrapartum factors in study groups

Variables	CAF n-347	MSAF n-153	P value for CAF Vs. MSAF	CAF n-347	MSAF (thick) n-91	P value for MSAF(T) vs. CAF
Teenage	44(75.86)	14(24.14)	0.594	44(81.48)	10(18.52)	0.294
Age >30	25(73.53)	9(26.47)	0.588	25(78.13)	7(21.88)	0.874
Primipara	203(67.8)	96(32.1)	0.429	203(67.89)	65(24.25)	0.572
Postdated	91(65.94)	47(34.06)	0.329	91(7.98)	32(26.02)	0.384
HTN	43(62.32)	26(37.68)	0.205	43(66.15)	22(33.85)	0.038
Anemia	58(66.67)	29(33.33)	0.609	58(73.42)	21(26.58)	0.464
ANC <3	16(69.57)	7(30.43)	1.000	16(72.73)	6(27.27)	0.612
APH	4(66.67)	2(33.33)	1.000	4(100)	0.(00)	0.578
UTI	1(100)	0(0.00)	1.000	1(100)	0(00)	1.000
PROM	65(65.66)	34(34.34)	0.395	65(72.22)	25(27.78)	0.266
DFL	50(72.46)	19(27.54)	0.673	50(78.13)	14(21.88)	0.879
PL	29(65.91)	15(34.09)	0.610	29(69.05)	13(30.95)	0.249
Cord PB.	16(45.71)	19(54.29)	0.004	16(61.54)	10(38.46)	0.090
Fetal D.	37(36.63)	64(63.37)	<0.001	37(42.05)	51(57.95)	<0.001
Oxy. Use	89(75.42)	29(24.58)	0.111	89(82.40)	19(17.59)	0.119
PG. use	52(69.33)	23(30.67)	1.000	52(82.54)	11(17.46)	0.265

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Relative risk (RR) was >1 for fetal distress and cord problems among MSAF group compared to CAF group while RR was >1 for fetal distress, cord problems and maternal hypertension among thick meconium group as compared to CAF group separately. (Table-2)

Table 2: Relative risk (RR) along with 95% Confidence interval (95%CI) for those predictors of meconium staining that have been significant in bivariate analysis in the group MSAF vs. CAF and MSAF (thick) vs. CAF group.

Predictors	RR (95% CI) for MSAF vs. CAF group	RR (95% CI) for MSAF (thick) vs. CAF group
Fetal distress	2.84 (2.24 to 3.60)	3.91 [2.88 to 5.29]
Cord problem	1.88 (1.35 to 2.64)	1.72 [1.03 to 2.89]
HTN	-------	1.58 [1.07 to 2.33]

Association of adverse fetal outcome was compared between the groups CAF vs. MSAF. Low birth weight (LBW), neonatal death and neonatal sepsis (NS) did not show any statistically significant association. The p-value was 0.310, 0.08 and 0.070 respectively. MAS and prolonged NICU admission with p-value 0.02 and 0.001 respectively showed a statistically significant association with RR
>1. In the group CAF vs. MSAF (Thick) only LBW did not show significant association while MAS, prolonged NICU admission, neonatal death and NS showed statistically significant association with relative risk being>1. The p-value was 0.012, 0.001, 0.04 and
0.03 respectively. (Table-3)

Table 3: Relative risk (RR) and along with 95% Confidence interval (95%CI) for adverse fetal outcomes that were significant on bivariate analysis in the group MSAF vs. CAF and MSAF (thick) vs. CAF group.

Adverse fetal outcomes	RR (95% CI) for MSAF vs. CAF group	RR (95% CI) for MSAF (thick) vs.CAF group
Neonatal Sepsis	2.65 [0.90 to 7.74]	3.30 [1.089 to 10.03]
NICU	2.80 [1.80 to 4.35]	3.64 [2.33 to 5.67]
Neonatal Death	6.80 [0.71 to 64.92]	9.91 [1.04 to 94.36]

Mean Apgar score at 1 minute was 8.11, 7.65 and 7.45 among the CAF, MSAF and MSAF (thick) group respectively while mean Apgar score at 5 minutes was 9.29, 8.67 and 8.37 among the CAF, MSAF and MSAF (thick) group respectively. The resultant differences between CAF vs. MSAF group and CAF vs. MSAF (thick) group were tested by unpaired t test and they were found to be statistically significant ($p<0.001$).

When maternal outcome in terms of mode of delivery and were compared using chi-square test it was found that, both the instrumental vaginal as well as cesarean delivery were significantly higher in both MSAF (thin) and MSAF (thick) groups, compared to the CAF group. Further cesarean delivery was significantly higher than the combined normal vaginal and instrumental vaginal delivery. Puerperal complications though occurred in 5 cases one each for complete perineal tear, UTI, perineal hematoma, secondary suture and puerperal pyrexia but even than were more with MSAF group (Table 4).

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Table 4: Comparing mode of delivery in group MSAF vs. CAF and MSAF (thick) vs. CAF.

Predictors		Mode of delivery	
MSAF	LUCS	Instrumental	Normal
CAF	91 (59.48%)	22 (14.48%)	40 (26.14%)
MSAF (T)	103 (29.68%)	29 (8.36%)	215 (61.96%)
	66 (62.86%)	20 (19.05%)	19(18.10%)
Chi-square test p value < 0.001 for both MSAF vs. CAF and MSAF (T) vs. CAF			

DISCUSSION

The incidence of MSAF greatly varies in different reports and our observation of 30.6% is a little more than the reported range of 5-24.6%1. Possible reason may be that our hospital is a tertiary referral centre. Majority of observed MSAF was of thick type (59.4%) possibly because thin MSAF being more subjective is more prone to variations in incidence.

We were in agreement with Gupta V *et al.*5 where fetal distress was significant predictive factor for MSAF [of the 101 cases of fetal distress, 64(63.4%) cases had MSAF] but other variables like maternal medical disorders, intrauterine growth retardation and postdated pregnancy did not revealed statistically significant association. In agreement with Saunders *et al.*6 we found that MSAF was more with post dated pregnancy 34.1% than with term pregnancy 29.3%, though the difference was not statistically significant possibly due to lesser study subjects. Similarly we had 10 mothers with intrauterine growth retardation of whom 50% had MSAF though not statistically significant.

The association between the occurrence of MSAF and fetal distress has been reported by several workers6, 7. In a study by Yoder8 infants with moderate to thick MSAF had significantly greater frequency of variables suggestive of intrapartum compromise (abnormal fetal heart rate pattern, fetal acidosis) compared to infants with CAF and with light meconium staining of amniotic fluid (p-value<0.01). In a study by Berkus *et al.*9 the MSAF (thick) group had significantly higher risk of an abnormal fetal heart rate tracing in each stage of labor similar to the present study. Thick MSAF has been consistently identified as a marker of increased fetal risk. Its prompt recognition or prediction is of value in selecting the mother for intensive monitoring. Three factors were identified for thick MSAF-fetal distress, cord problems and hypertension with a p- value<0.05.

We compared fetal out come in MSAF compared to CAF and found that babies born out of MSAF had significantly prolonged NICU admission and perinatal mortality than the CAF group. Ziadeh *et al.*10 reported that MSAF was significantly associated with poor neonatal outcome. Perinatal mortality increased from 2 per 1000 births with CAF to 10 per 1000 with MSAF (p<0.001). Other adverse outcome also increased; e.g., severe fetal academia, Apgar scores ≤3 at 1 and 5 minute and MAS. Delivery by cesarean section also increased with MSAF from 7-14% (p<0.001). We found that among MSAF (Thick) group only 3 babies (3.3%) had MAS (P-0.041). Comparison of Apgar score at 1 and 5 minute between groups with MSAF vs. CAF and MSAF(Thick) vs. CAF also showed statistically significant values with p<0.001. A study by Nathan *et al.*11 and Sankhyan *et al.*12 showed significantly higher rate of emergency cesarean section and consequently the low chances of having vaginal delivery with MSAF. Berkus *et al.*9 reported less cesarean section rates which could be due to better facilities to assess fetal well being. In

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our study also we found a higher rate of cesarean delivery as 59.5% in MSAF and 62.9% in MSAF (Thick) in comparison to CAF group 29.7%. In both the MSAF groups instrumental vaginal delivery were seen higher than CAF group ($p<0.001$). Swain *et al.*13showed all deliveries associated with thick MSAF had MAS and most common and significant risk factors were increased gestational age, increased cesarean section and low Apgar scores at 1and 5 minute similar to the present study. Neonatal mortality was reported 28.57% in MSAF exposed infants with MAS by Vichien *et al.*14. Erum *et al.*15 also revealed that MSAF is associated with increased neonatal morbidity and mortality, and cesarean section performed twice as frequently. They found 16% post dated deliveries in MSAF as compared to 1% in subjects with clear liquor.

CONCLUSION

MSAF is a common fetal hazard in obstetrics. By thorough observation of the antepartum and intrapartum events prediction of the meconium staining of amniotic fluid can be attempted which would be of invaluable help in reducing the neonatal morbidity and mortality. The facts remains that, apart from neonatal hazards due to MSAF, there is also significant maternal morbidity. Results of this study are to be interpreted keeping in mind the small number of cases and possible over representation of high risk cases. Hence larger studies are the call for the hour.

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