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THE STUDY OF RISK FACTORS AND PERINATAL OUTCOME OF MECONIUM STAINED AMNIOTIC FLUID AT TERM

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ABSTRACT **Background:** Meconium-stained amniotic fluid (MSAF) is a significant indicator of fetal distress, often found in 12-16% of term deliveries. It can lead to severe complications, such as MAS, respiratory distress, and increased perinatal morbidity and mortality. The study aims to investigate the relationship between MSAF and perinatal outcomes, assess fetal outcomes in thick and thin MSAF, and determine its relationship with labor stage, mode of delivery, and antenatal complications. **Methods:** Total 144 pregnant women in labor at or beyond 37 weeks of gestation with singleton cephalic presentations were included. The participants were categorized into thin MSAF (n=118) and thick MSAF (n=26) meconium consistency groups. Data on socio-demographic variables, obstetric history, labor characteristics, and neonatal outcomes were collected. Statistical analysis was performed using SPSS 23rd version. **Results:** A study involving 144 women found that 18.06% of cases had thick MSAF, while 81.94% had thin MSAF. The study found significant associations between thick MSAF and advanced maternal age, multiparity, post-term pregnancy, and intrauterine growth restriction. Neonatal outcomes, including low APGAR scores, increased NICU admissions, and higher cesarean delivery rates, were significantly worse in the thick MSAF group compared to the thin MSAF group. **Conclusion:** MSAF, especially thick meconium, increases perinatal risks, including operative deliveries and neonatal complications. Early identification and intensive monitoring are crucial for mitigating these risks and improving neonatal outcomes.

KEYWORDS : Meconium-stained amniotic fluid, perinatal outcome, neonatal morbidity, risk factors, meconium aspiration syndrome.

INTRODUCTION

Meconium-stained amniotic fluid (MSAF) is a common occurrence in deliveries, indicating normal gastrointestinal maturation or hypoxic events.[1] It is the first intestinal discharge of the fetus, usually passed after birth. It may be expelled in utero, indicating hypoxic stress or other pathological conditions. MSAF is associated with increased risks of meconium aspiration syndrome, operative delivery, respiratory distress, neonatal sepsis, resuscitation, neonatal intensive care admission, and low Apgar scores.[2] Infants born with MSAF are more likely to develop respiratory distress and perinatal mortality.[3,4]

Meconium-stained amniotic fluid (MSAF) is a condition affecting 5% to 25% of all labor-related women worldwide.[5] The incidence rate of MSAF is around 14.7%, with its prevalence increasing as the gestation week increases.[6,7] Prior to 37 weeks, MSAF was relatively uncommon, occurring in 4.3-6.9% of pregnancies. However, as the gestation week increases, the incidence increases, affecting 10.0-14.6% of pregnancies. MSAF typically occurs most frequently between 38-41 weeks of gestation.[8,9]

MSAF, or meconium in the amniotic fluid, is a condition characterized by the presence of meconium in the fetus. Factors such as obstetric conditions, medical conditions, socio-demographic and behavioral risk factors, and higher maternal age contribute to its presence. Despite its prevalence, clinical practice varies significantly, necessitating evidence-based protocols to optimize maternal and neonatal outcomes. Advanced diagnostic tools like fetal scalp blood sampling and intrapartum electronic fetal heart rate monitoring help differentiate cases requiring intervention from those that can be managed conservatively. [10-12] Understanding the risk factors and mechanisms linking MSAF to adverse outcomes is crucial for developing preventive strategies and improving clinical outcomes.

The study aims to investigate the risk factors and perinatal outcomes of meconium stained amniotic fluid, assessing fetal outcomes in thick and thin fluid, identifying relationships with labor stage, mode of delivery, and antenatal complications, and detecting MSAF (thick and thin) prior to delivery interval.

METHODS:

This was a Prospective observational study conducted at department of Obstetrics and Gynecology, Motilal Nehru Medical College, Prayagraj over a period of one year. Total 144 Women 37 weeks or more than 37 weeks of pregnancy, Cephalic presentation, Live singleton pregnancy, Patients in labor, Anemia (less than 11 gm / dl, HDP (hypertensive disorder in pregnancy), Oligohydramnios, Antepartum hemorrhage, IUGR (intrauterine growth restriction), Postdated pregnancy were included, Congenital malformations, Intrauterine fetal demise, Preterm pregnancy, Abnormal presentation, Multiple pregnancy, Previous Lower segment caesarean section, Any medical disorder like bleeding disorder, Autoimmune disorder were excluded.

The study analyzed pregnant women with at least 37 weeks of gestation, viable singleton pregnancies with cephalic presentations, and no known fetal congenital anomalies. Participants were divided into two groups: those with thick meconium stained amniotic fluid (MSAF) and those with thin MSAF. A comprehensive antenatal history, clinical examination, and investigations were conducted. The patients were closely monitored for labor progression, with intermittent auscultations used to track the fetal heart rate. Socio-demographic factors, obstetrics, and perinatal outcomes were evaluated. The mode of delivery was determined based on obstetric conditions. Comparisons were made between groups experiencing maternal outcomes during labor and within the first 7 days after delivery, focusing on chorioamnionitis, operative delivery, puerperal infections, and wound infection in the thin MSAF and thick MSAF groups.

The study used SPSS version 23 for analysis, with data organized using MS Excel. Descriptive analysis used frequency and proportions for categorical variables and mean and standard deviation for continuous variables. The independent t-test was used for continuous variables, while Pearson's chi square test was used for categorical variables. A p-value less than 0.05 was considered statistically significant. Data was effectively displayed using pie charts and bar graphs.

RESULTS

Total 126 participants aged 20 to 35 years, with the majority (64.5%)

having normal BMI in the range of 18.5-24.99 kg/m2. The majority of participants were from class III (36%), followed by class IV (31%), and class II and class V each making up 13% and 6.3% respectively. The study involved 69% multigravida participants and 31% primigravida. The majority had gestational ages of 37 weeks to 37 weeks + 6 days, with 17.36% delivering from 38 weeks to 38 weeks + 6 days, 13.88% from 39 weeks to 39 weeks + 6 days, and 9.74% having a gestation age greater than 40 weeks. The incidence of thick MSAF was 18.06%, with 81.94% having thin MSAF. Most participants were aged 20 to 35 years, from class III, and had no significant difference in age or BMI. The association between parity and thick MSAF was significant, with multiparous women more likely to have thick MSAF. A large portion of participants in the thin MSAF group had gestational ages of 37 weeks to 37 weeks + 6 days.

Table 1. Association Of Demographic Profile, BMI (kg/m2), Gravidity And Gestational Age (in Weeks) With The MSAF Outcome In The Participants

Age (in years)	Total n=144 (%)	Thin MSAF (n = 118)	Thick MSAF (n =26)	$\chi 2^1$	P value
<20	11 (7.6%)	8 (6.77%)	3 (11.53%)	1.319	0.517
20-35	126(87.5%)	105 (88.98%)	21 (80.76%)		
>35	7(4.8%)	5 (4.25)	2 (7.71%)		
BMI (kg/m^2)					
<18.50 (Underweight)	3(2.0%)	2 (1.69%)	1 (3.84%)	2.8238	0.419
18.50-24.99 (Normal)	93 (64.5%)	83 (70.33%)	10 (38.46%)		
25.00-29.99 (Overweight)	44 (30.5%)	30 (25.42%)	14 (53.84%)		
≥30.00-34.99 (Obesity 1st class)	4(2.7%)	3 (2.56%)	1 (3.84%)		
SES (Modified B.G. Prasad classification 2022)					
I	9(6.2%)	7 (5.93%)	2 (7.69%)		
II	19(13.0%)	15 (12.71%)	4 (15.38%)		
III	52(36.0%)	42 (35.59%)	10 (38.46%)	0.525	0.970
1V	45(31.0%)	38 (32.20%)	7 (26.92%)		
V	19(13.0%)	16 (13.55%)	3 (11.55%)		
Gravidity					
Primigravida	45(31.0%)	34 (28.81%)	11 (42.31%)	10.32	0.001
Multigravida	99(69.0%)	84 (71.19%)	15 (57.69%)		
Gestational Age (in weeks)					
37- 37 weeks + 6 days	85 (59.02%)	82 (69.49%)	3 (11.53%)		
38 -38 weeks + 6 days	25(17.36%)	20 (16.94%)	5 (19.23%)	45.625	0.001
39 -39 weeks + 6 days	20(13.88%)	12 (10.16%)	8 (30.76%)		
≥ 40 weeks	14(9.74%)	4 (3.41%)	10 (38.48%)		

Anemia was the most common pregnancy risk factor, followed by oligohydramnios (18.75%), pre-eclampsia/eclampsia (15.97%), IUGR (13.88%), PROM (9.72%), and APH (8.47%). Thin and thick MSAF groups had no significant difference in these factors. However, thick MSAF had a higher proportion of preeclampsia/eclampsia (19.23%), oligohydramnios (19.49%), IUGR (30.77%), and PROM (9.32%) compared to thin (13.55%). Thin MSAF had a higher proportion of APH (11.53%). (Table 2)

A study found that 78% of participants in the latent phase of labor were in the thin MSAF group, with 84.74% experiencing spontaneous labor onset and 53.84% experiencing labor induction. The thick MSAF group had a higher proportion of pregnant women experiencing labor induction. 43% of participants gave birth vaginally, with 34% undergoing LSCS delivery and 23% underwent instrumental delivery. The mode of delivery was associated with thick MSAF, with a higher proportion of pregnant women in the thick MSAF group undergoing cesarean section. 82% of participants gave birth to babies with reassuring fetal heart rate (FHR), while 18% delivered non-reassuring babies. Most participants had newborns with APGAR score 1 minute >7, and 80% had newborns without admission to the NICU ward. In contrast, 69.24% of participants in the thick MSAF group were admitted to the NICU ward, with a significant association between NICU ward admission and thick MSAF. (Table 3)

Table 2. Distribution Of Participants According To The Maternal Risk Factors (n=144)

Maternal risk factors	Total n=144 (%)	Thin MSAF (n = 118)	Thick MSAF (n =26)	$\chi 2^1$	P value
PRE ECLAMPSIA/ ECLAPMSIA	23 (15.97%)	16 (13.55%)	7 (19.23%)	2.835	.092
OLIGO	27(18.75%)	23 (19.49%)	4 (15.38%)	0.235	0.627
PROM	14(9.72%)	12 (8.33%)	8 (30.77%)	10.677	0.001
IUGR	20(13.88%)	11 (9.32%)	3 (11.53%)	0.839	0.359
APH	10(8.47%)	7 (5.93%)	3 (11.53%)	1.03	0.308
ANAEMIA IN PREGNANCY	50(34.72%)	46 (38.98%)	4 (7.69%)	5.23	.022

1 Fisher's Exact test

Table 3. Association Of Stage Of Labor, Onset Of Labor, Mode Of Delivery, NST And NICU Admission With MSAF Outcome In The Studied Participants (n=144)

STAGE OF LABOR	Total 144 (%)	Thin MSAF (n = 118)	Thick MSAF (n =26)	$\chi 2^1$	p-value
Latent phase	112 (78.0%)	100 (84.74%)	12 (46.16%)	18.358	0.001
Active phase	32 (22.0%)	18 (15.26%)	14 (53.84%)		
ONSET OF LABOR					
SPONTANEOUS	112 (78.0%)	96 (81.33%)	16 (61.53%)	4.840	0.027
INDUCED	32 (22.0%)	22 (18.67%)	10 (38.47%)		
MODE OF DELIVERY					
NVD (Normal Vaginal Delivery)	62 (43.0%)	56 (47.45%)	6 (23.07%)	13.90	0.001
IVD (Instrumental Vaginal Delivery)	33 (23.0%)	30 (25.42%)	3 (11.55%)		
CS (Cesarean Section)	49 (34.0%)	32 (27.13%)	17 (65.38%)		
NST					
FHR NON-REASSURING	26 (18.0%)	11 (9.32%)	15 (57.69%)	53.69	0.001
FHR REASSURING	118 (82.0%)	107 (90.68%)	11 (42.31%)		
NICU admission					
Yes	20 (14.0%)	12 (10.16%)	8 (30.76%)	8.84	0.002
No	124 (86.0%)	106 (89.84%)	18 (69.24%)		

1Pearson's Chi Square test

The study found that most participants in the thin MSAF group gave birth vaginally during active labor (55.55%) or the latent phase (46%), while the majority in the thick MSAF group underwent caesarean sections (57.15%) or active labor (57.15%), with a higher proportion undergoing cesarean section during the latent phase. (Table 4)

Table 4. Association Of Stage Of Labor, Mode Of Delivery With MSAF Outcome In The Studied Participants

1Fisher's Exact test

Stage of Labor	Type of Meconium	Number of cases	NVD	IVD	LSCS	$\chi 2^1$	p-value
Active	Thick	14	4 (28.57%)	2 (14.28%)	8 (57.15%)		

	Thin	18	10 (55.55%)	5 (27.79%)	3 (16.66%)	15.87	0.014
Latent	Thick	12	2 (16.66%)	1 (8.34%)	9 (75%)		
	Thin	100	46 (46%)	25 (25%)	29 (29%)		

The study found that 92% of participants had newborns with an APGAR score 5 minute >7, while 8% had newborns with a score 5 minute <7. The majority of participants (92.38%) in the thin MSAF group had newborns with an APGAR score 1 minute of >7, while the majority (61.54%) in the thick MSAF group delivered babies with an APGAR score 1 minute of <7. There was a significant association between the APGAR score 1 minute and the presence of thick MSAF, with a higher proportion of pregnant women in the thick MSAF group undergoing having an APGAR score 1 minute of <7. The study highlights the importance of understanding the relationship between APGAR scores and the presence of thick MSAF in preventing premature births. (Table 5)

Table 5. Association Of APGAR Scores At 1 And 5 Minute With MSAF

Type of MSAF	APGAR SCORE 1 MINUTE <7	APGAR SCORE 1 MINUTE >7	APGAR SCORE 5 MINUTE <7	APGAR SCORE 5 MINUTE >7
Thin MSAF (n = 118)	9 (7.62%)	109(92.38%)	5 (4.23%)	113(95.77%)
Thick MSAF (n =26)	10 (38.46%)	16 (61.54%)	7 (26.92%)	19 (73.08%)
$\chi 2^1$	17.685		14.353	
P value	0.001		0.001	

1Pearson's Chi Square test

The study revealed that 93.75% of participants had newborns without complications, with 2.77% experiencing pneumonia, 2.08% septicemia, and 1.40% perinatal asphyxia. The mortality rate was 2.78%, with 2.78% of cases expiring. The thin MSAF group had the highest number of newborns without complications (97.45%), but two cases expired in both groups, indicating a mortality rate of 2.78%. (Table 6)

Table 28. Association Of Final Diagnosis Of Babies Born Through MSAF And Their Outcome

Final Diagnosis	144 (%)	Thin MSAF (n = 118)	Thick MSAF (n =26)	$\chi 2^1$	P Value
Healthy babies without	135 (93.75%)	115 (97.45%)	20 (76.92%)	15.895	0.001
MAS with pneumonia	4 (2.77%)	1 (0.85%)	3 (11.53%)		
MAS with septicemia	3 (2.08%)	1 (0.85%)	2 (7.84%)		
Perinatal asphyxia with MAS	2 (1.40%)	1 (0.85%)	1 (3.71%)		
Outcome					
Discharged	140 (97.22%)	116 (98.30%)	24 (92.30%)	2.837	0.920
Expired	4 (2.78%)	2 (1.70%)	2 (7.70%)		

1Fisher's Exact test

DISCUSSION

The study explores the correlation between meconium-stained amniotic fluid (MSAF) and perinatal outcomes in obstetric practice. Out of 1364 deliveries, 150 cases had MSAF, revealing a significant association with abnormal fetal heart rate patterns, higher cesarean section rates, and low APGAR scores.

The study found that the majority of participants in the thin MSAF group (88.98%) and thick MSAF group (80.76%) were aged 20-35 years, with no significant difference in age. This aligns with previous studies indicating similar age incidence among pregnant women with MSAF.[13,14] There was no significant difference in maternal age distribution between the two groups. The majority of participants in the thin MSAF group were multiparous (71.19%), while in the thick MSAF group (56.69%), the association between parity and thick MSAF was significant, with multiparous women more likely to have thick MSAF due to faster labor and intense uterine activity.[15] Studies have shown varying rates of MSAF in different types of pregnancies. Multigravidas have a higher incidence of MSAF (51.52%), while primigravidas have a slightly higher incidence of meconium-stained amniotic fluid.[6,7] Thin and thick MSAF are more common in primigravidas (41.1%) and multigravidas (58.8%), respectively. Akhila S et al. reported a higher incidence of MSAF in primigravidas (54.6%), while Tayade S found an incidence of 71.66% in primigravidas and 28% in multigravidas.[16,17] Mohapatra et al. found a higher incidence of MSAF in primigravida women. [18] The study found that 59.02% of participants had a gestational age of 37 weeks to 37 weeks 6 days.

Studies have shown that the incidence of meconium-stained amniotic fluid (MSAF) increases with gestational age, particularly in post-term pregnancies. Studies by Biradar et al., Desai DS et al., and Fischer C et al. have reported varying rates of MSAF incidence.[12,19,20] Mohapatra et al.[18] also found higher MSAF incidence in post-term pregnancies. Vidya A. et al[21] found higher MSAF incidence at a mean gestational age of 39.8 weeks, compared to Millar et al., Rosario et al., and Krebs et al.[22-24] The present study found an incidence of 81.94% and 18.06% of thin and thick meconium-stained amniotic fluid, respectively. This is consistent with previous studies by Debdas and Sheikh EM et al., which reported similar incidences.[25,26] The incidence of pre-eclampsia and eclampsia cases with thick meconium-stained amniotic fluid (MSAF) was 19.23%, which is higher than previous studies by Khatun et al. (13.8%) and Mundhra R et al. (16.97%).[27,28] These findings highlight the importance of understanding the incidence of MSAF in pregnancies and eclampsia cases.

The study found no significant association between oligohydramnios and MSAF, but research in India and northwest Ethiopia showed a significant association.[28-30] Fetuses experiencing oligohydramnios often have insufficient uteroplacental reserve, leading to hypoxia during labor. This causes the anal sphincter to relax, releasing meconium into the amniotic fluid. No association was found between premature rupture of membranes (PROM) and meconium stained amniotic fluid (MSAF). However, studies at SPHMMC and Nigeria University Teaching Hospital found a noteworthy association between the two factors.[31,32] Women with PROM have a higher likelihood of MSAF, as they are more likely to develop intrauterine fetal infection, leading to fetal stress and meconium release into the amniotic fluid.

The study found a significant association between intrauterine growth restriction (IUGR) and the occurrence of multiple sclerosis (MSAF) in a study. The thick MSAF group had a higher proportion of APH cases (11.53%) compared to the thin MSAF group (5.93%). Anemia was also stronger in thin MSAF cases compared to thick MSAF. Fetal hypoxia, placental insufficiency, and acidosis are more common in IUGR and anemic patients, leading to fetal distress.[33,34] A higher proportion of participants with thick MSAF required labor induction compared to the thin MSAF group. The mode of delivery was also significantly associated with thick MSAF, with a larger percentage of pregnant women in the thick MSAF group undergoing a cesarean section.[35] Singh P et al. and Qadir et al. reported high rates of LSCS in patients with thick MSAF, with 60% and 56.2% requiring it after diagnosis.[36,37]

The study revealed that most participants with thin MSAF gave birth vaginally during active labor (55.55%) or the latent phase (46%). However, most participants with thick MSAF underwent caesarean sections (57.15%) or latent (75%) during labor, with a higher proportion undergoing cesarean sections during the latent phase. The study also found a significant correlation between thick MSAF and abnormal FHR tracings.[21]

A study at Finote Selam Primary Hospital in Ethiopia found that meconium-stained amniotic fluid (MSAF) is significantly associated with non-reassuring fetal heart rate (NRFHR).[38] This is due to the release of meconium into the amniotic fluid, leading to changes in the fetal heart rate pattern. A higher prevalence of abnormal FHR patterns was observed in cases of MSAF, with 49.4% of participants exhibiting abnormal FHR patterns. A study by Mohammad N et al. revealed that 71.2% of patients with MSAF had a reassuring CTG, while 28.8% had a non-reassuring CTG, with non-reassuring CTG predominantly associated with thick meconium.[39]

A study found a significant association between APGAR scores and birth asphyxia in newborns. Out of 26 newborns with thick meconium-stained amniotic fluid (MSAF), 16 had an APGAR score below 7 at 1 minute. The study also found a significant association between the APGAR score at 1 minute and the presence of MSAF, with a higher proportion of thick MSAF newborns having an APGAR score below 7 at 1 minute. The disparity may be due to the increased occurrence of surgical births for cephalopelvic disproportion and non-reassuring fetal heart rate patterns, attributed to intrauterine fetal distress and asphyxia. [28,37] A study by Sori DA et al. at JUSH found that 88% of cases of meconium-stained amniotic fluid (MSAF) had an APGAR score of less than seven at 5 minutes.[5] This is higher than Patil et al.'s 19%, which found only 19% of infants with MSAF had low APGAR scores.[40] The difference may be due to higher occurrences of surgical births for cephalopelvic disproportion and non-reassuring fetal heart rate patterns, attributed to intrauterine fetal distress and asphyxia. [28] The study also found that 30.76% of newborns with MSAF required admission to the neonatal intensive care unit (NICU), indicating a significant association between NICU admission and MSAF.

The study found that neonatal admissions to the NICU are lower in babies born with MSAF compared to previous studies at Yenepoya, Mangalore, Jawaharlal Nehru Hospital, Bhilai, and St. Paul's Hospital in Ethiopia.[41,42,43] The presence of moderate or thick meconium significantly increases the risk of requiring oxygen support and admission to the NICU. This finding is consistent with previous studies by Mohammad N et al., and Desai et al.[12,39] The incidence of MAS in babies born with MSAF is 6.25%, which is lower than previous reports of 2.34% and 6.6%. [44,45] The most common neonatal morbidities were MAS pneumonia, followed by MAS with culture positive septicemia and asphyxia, in decreasing order of frequency. These findings are consistent with previous research on the study.

The study on meconium-stained amniotic fluid (MSAF) has limitations, including a small sample size, single-center design, potential confounding variables, lack of long-term neonatal follow-up data, and interobserver variability. Recommendations include continuous fetal heart rate monitoring, antenatal screening, regular care education, and public health programs. Longitudinal studies are needed to assess long-term impacts.

CONCLUSIONS:

The study found that meconium stained amniotic fluid (MSAF) is linked to various maternal and fetal risk factors, including post-term pregnancy, hypertensive disorder, anemia, and fetal distress. Thin MSAF was found to be more prevalent (81.94%), while thick MSAF was 18.06%. Thick MSAF was associated with higher NICU admissions, perinatal morbidity, and mortality compared to thin MSAF. It was also linked to abnormal fetal heart rate patterns and CTG, increasing the likelihood of caesarean section. Birth asphyxia was more common with thick MSAF. While thin MSAF is not indicative of fetal distress, a non-reassuring fetal heart rate pattern should be considered an alarming sign for neonatal outcomes. Identifying risk factors and timely intervention can significantly improve maternal and fetal outcomes.

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