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# Study of neonatal outcome in meconium stained amniotic fluid

**Dr. Akhila S[1], Dr. AM Koppad[2], Dr. CD Aundhakar[3]**

[1] Resident, Department of Paediatrics, Krishna Institute of Medical Sciences, Karad, Maharashtra, India

[2] Professor, Department of Paediatrics, Krishna Institute of Medical Sciences, Karad, Maharashtra, India

[3] Professor, Head of Department, Department of Paediatrics, Krishna Institute of Medical Sciences, Karad, Maharashtra, India

**Abstract**

**Introduction:** This study was done to find out the incidence of live births with meconium stained amniotic fluid, their mode of delivery, maternal risk factors and the neonatal outcome.

**Materials & Methods:** This hospital based prospective observational study was conducted in Krishna Institute of medical Sciences, Maharashtra over a period of 2 years. 348 live births with MSAF were included and their outcomes were noted in terms of morbidity and mortality.

**Results:** Overall incidence of MSAF was 7.13. Risk factors encountered were maternal age < 25 years, pre-eclampsia, PROM, and primi-gravida. LSCS was the most common delivery among thick-MSAF group. Meconium Aspiration Syndrome developed in 7 babies (2.01%). Overall neonatal mortality was 0.86%.

**Conclusion:** The presence of MSAF at delivery is a potential sign of fetal compromise. Alerting the paediatrician and proper resuscitation of babies born through MSAF reduces the overall morbidity and mortality.

**Keywords:** MSAF, pre-eclampsia, meconium aspiration syndrome, birth asphyxia

## Introduction

Meconium stained amniotic fluid has long been implicated as a factor influencing fetal wellbeing during intra-partum and post-partum periods. It was the famous ancient Greek philosopher Aristotle who, first describing meconium stained amniotic fluid, conferred on this condition the name "meconium-arion", literally meaning "opium-like". Meconium staining of amniotic fluid (MSAF) complicates delivery in approximately 8% to 25% of livebirths. Approximately 5% of the neonates born through MSAF develop meconium aspiration syndrome (MAS) and approximately 50% of these infants require mechanical ventilation [1]. The mortality rate of meconium stained newborns is considerably higher than that of non-stained newborns. The decline in neonatal deaths due to MAS during the last decades is related to improvements in obstetric and neonatal care.

This study was undertaken to detect the incidence, mode of delivery, risk factors and neonatal outcome in neonates born through meconium stained amniotic fluid.

## Materials & Methods

The present study was conducted between December 2015 and November 2017 at Krishna Institute of Medical Sciences Deemed University, Karad, and Maharashtra.

### Inclusion Criteria

- All meconium stained live births born to singleton pregnancy irrespective of maternal age, parity, maternal risk factors, presentation and stage of labour.
- Mothers who are booked cases in KIMDSU, Karad

### Exclusion Criteria

- Babies with congenital malformations
- Still births
- Babies born to mothers who were not booked in antenatal period in KIMSDU, Karad
- Multiple gestation
- Babies with meconium stained liquor referred to NICU from other hospitals

Written informed consent was obtained prior to the enrolment of subjects in the study. Detailed mother's history, risk factors, progress of labour, meconium staining of amniotic fluid and mode of delivery were noted. Evaluation and decisions regarding resuscitation measures were guided by assessment of respiration, heart rate, and color and tone of the baby. Apgar scores were conventionally assigned and recorded in the newborn's chart. If any meconium staining was present, suctioning of the mouth and nostrils was done immediately after delivery. If the infant was depressed with poor muscle tone and/or a heart rate <100 beats/min, tracheal intubation and suctioning was performed. If the infant was vigorous then routine care was given. Babies born through meconium stained amniotic fluid were be classified into thin and thick meconium stained group for the study purpose.

If the baby was asphyxiated at birth or had signs of meconium aspiration then the baby was shifted to NICU and managed according to standard protocols and outcomes were noted in terms of morbidity and mortality. Babies who were

non-asphyxiated and had no abnormal findings were shifted to mother side in the maternity ward. These babies were observed for the development of respiratory distress or signs of sepsis over the next 72 hours and were shifted to NICU if they developed any

**Statistical Analysis**

Statistical analysis was done by descriptive statistics as mean, SD and percentage etc. Chi-square test was applied to find out association between various parameters in thin and thick MSAF. $p<0.05$ was considered as significant. The statistical software namely SYSTAT version 12 (By Cranes software's, Bangalore) was used to analyze the data.

**Results**

During the study period 5609 deliveries were conducted (4257 booked and 1352 unbooked cases). The overall incidence of MSAF was 7.13% in our study. Among the booked cases, 363 i.e., 8.53% were meconium stained out of which 348 cases were included in the present study as they satisfied the inclusion criteria.15 cases were excluded from the study (2 multiple gestation and 13 still births). 197 cases had thin meconium and 151 cases had thick meconium. Out of total 348 booked deliveries with meconium stained amniotic fluid 180 cases i.e., 51.72% were males and 168 cases i.e., 48.28% were females.

**Table 1:** Relationship of MSAF with maternal age

| Maternal age (in years) | No of MSAF cases | | | | | |
|---|---|---|---|---|---|---|
| | Thin | % | Thick | % | Total | % |
| < 25 | 97 | 49.24% | 100 | 66.22% | 197 | 56.61% |
| 25-30 | 84 | 42.64% | 48 | 31.79% | 132 | 37.93% |
| > 30 | 16 | 8.12% | 3 | 1.99% | 19 | 5.46% |
| Total | 197 | 56.61% | 151 | 43.39% | 348 | 100% |
| Mean ± SD | 24.59 yrs. ± 5.06 yrs. | | 23.39 yrs.±6.12 yrs. | | 24.07yrs.±6.47yrs. | |
| Value of $\chi^2 = 12.904$, p=0.0016, significant. | | | | | | |

In the current study, 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-MSAF and thick-MSAF groups, cases were more among primi mothers.

It was observed that the number of meconium stained cases were more among babies who were born at term (334, 95.97%). There were no meconium staining in babies who were born premature. Most of the babies with MSAF had birth weight between 2.6-3.5 kg (64.65%) followed by 1.6-2.6 kg (25.57%) and then ≥3.6 kg (9.78%) and there was no much difference between thin and thick MSAF groups.

196 (56.31%) were complicated by maternal diseases. 19 mothers (5.46%) had other pre-existing conditions like epilepsy, diabetes mellitus, heart disease, and hypothyroidism.

**Table 2:** Relation of maternal risk factors with MSAF

| Maternal risk factors | No of MSAF cases | | | | | |
|---|---|---|---|---|---|---|
| | Thin | % | Thick | % | Total | % |
| Anaemia | 12 | 6.09% | 10 | 6.62% | 22 | 6.32% |
| HDP | 52 | 26.39% | 20 | 13.24% | 72 | 20.68% |
| PROM | 37 | 18.78% | 16 | 10.60% | 53 | 15.23% |
| Obstructed labour | 5 | 2.53% | 10 | 6.62% | 15 | 4.31% |
| Oligohydramnios | 9 | 4.57% | 6 | 3.97 | 15 | 4.31% |
| Others | 10 | 5.08% | 9 | 5.96% | 19 | 5.46% |
| Nil | 72 | 36.55% | 80 | 52.98% | 152 | 43.68% |
| Total | 197 | 56.61 | 151 | 43.39 | 348 | 100 |

Value of $\chi^2 = 19.729$, p=0.0031, significant. HDP – Hypertensive Disorders of Pregnancy, PROM – Premature Rupture of Membranes

Indication for surgery was fetal distress in 78 (46.42%) cases. Of these, 45 had thick MSAF and 33 had thin-MSAF. Other indications were non-progress of labour, previous-LSCS, post maturity, eclampsia and abruptio-placenta, large-for date babies.

**Table 3:** Mode of delivery in relation to consistency of meconium

| Mode of delivery | No of MSAF cases | | | | | |
|---|---|---|---|---|---|---|
| | Thin | % | Thick | % | Total | % |
| NVD | 98 | 49.75% | 54 | 35.76% | 172 | 49.43% |
| LSCS | 96 | 48.73% | 92 | 60.93% | 168 | 48.27% |
| FAD | 2 | 1.01% | 2 | 1.32% | 4 | 1.15% |
| VAD | 1 | 0.51% | 3 | 1.99% | 4 | 1.15% |
| total | 197 | 56.61% | 151 | 43.39 | 348 | 100 |

Value of $\chi^2 = 7.879$, p=0.0486, significant. NVD – Normal Vaginal Delivery, LSCS-Lower Segment Caesarean Section, FAD-Forceps Assisted Delivery, VAD-Venthouse Assisted Delivery

In this study, 297 babies (85.34%) were born vigorous. In the delivery room, tracheal intubation for meconium aspiration

followed by immediate extubation was performed in 42 (12.07%) newborns, while intubation followed by mechanical ventilation support was used in 9 (2.59%) cases. All the newborns who required mechanical ventilator support belonged to the thick-MSAF group.

**Table 4:** Immediate intervention post-delivery in relation to MSAF

| Immediate intervention | No of MSAF cases | | | | | |
|---|---|---|---|---|---|---|
| | Thin | % | Thick | % | Total | % |
| No intervention | 181 | 91.88% | 116 | 76.82% | 297 | 85.34% |
| Endotracheal intubation for aspiration followed by immediate extubation | 16 | 8.12% | 26 | 17.22% | 42 | 12.07% |
| Endotracheal intubation followed by mechanical ventilation | 0 | 0% | 9 | 5.96% | 9 | 2.59% |
| Total | 197 | 56.61% | 151 | 43.39% | 348 | 100% |

Value of $\chi^2 = 19.873$, p=0.0001, significant.

At APGAR score of 0-3 at 1 minute, there were 9 (5.96%) severely asphyxiated newborns in thick-MSAF group and none in thin-MSAF group. Of these, 5 babies were born via LSCS, 2 via NVD and 2 via instrumental delivery. APGAR of 4-6 at 1 minute was recorded in 16 (8.12%) thin-MSAF and 26 (17.22%) thick-MSAF cases. The mean-APGAR was 6.68±1.69.

331 (95.12%) babies had APGAR 7-10 at 5 minutes. Out of the 9 babies who had APGAR of 0-3 at 1 minute, 8 improved with immediate post-delivery interventions.

Out of 197 babies with thin meconium stained amniotic fluid, 42 babies had NICU admissions i.e., 21.32%, whereas in thick meconium stained amniotic fluid out of 151 babies, 66 (43.71%) were admitted in NICU. All babies who required resuscitative efforts were shifted to NICU directly from the delivery room. Out of 297 babies who were vigorous at birth, 48 were shifted to NICU within 48 hours as they developed signs of respiratory distress within this time frame.

**Table 5:** Relationship of MSAF with NICU outcome

| Outcome | Thin MSAF | % | Thick MSAF | % | No of cases | % |
|---|---|---|---|---|---|---|
| Uncomplicated | 25 | 59.52% | 23 | 34.85% | 48 | 44.44% |
| Birth asphyxia | 15 | 35.71% | 19 | 28.79% | 34 | 31.48% |
| HIE | 1 | 2.38% | 9 | 13.64% | 10 | 9.26% |
| MAS only | 0 | 0% | 4 | 6.06% | 4 | 3.70% |
| MAS + PPHN | 0 | 0% | 3 | 4.55% | 3 | 2.78% |
| Sepsis | 1 | 2.38% | 8 | 12.12% | 9 | 8.33% |
| Total | 42 | 100% | 66 | 100% | 108 | 100% |

Value of $\chi^2 = 14.796$, p=0.0113, significant. HIE-Hypoxic Ischaemic Encephalopathy, PPHN – Persistent Pulmonary Hypertension of Newborn

34 babies were diagnosed with birth asphyxia (15 thin-MSAF and 19 thick-MSAF). MAS developed in a total of 7 (7/348-2.01%) cases, of which, 3 babies progressed to PPHN. Overall, morbidities were more in thick-MSAF group compared to thin-MSAF and it was statistically significant. 48 (44.44%) did not develop any complications.

Neonatal mortality was seen only in thick meconium stained amniotic fluid i.e., 3 (0.86%). Of these, 2 babies had MAS and the mortality rate among MAS group was 25.87% (2/7). There was no death in thin meconium stained amniotic fluid group.

## Discussion

MSAF has been implicated as a factor influencing fetal wellbeing during the intrapartum and postpartum periods. Its importance is judged by the NRP guidelines which stresses on colour of liquor (clear or meconium stained) as one of the parameters in initial assessment of newborn. Incidence of MSAF in labour widely varies as reported from time to time by different studies. In our study, there were 400 out of 5609 deliveries which had meconium stained liquor, making the overall incidence 7.13%. However, Rossi *et al.* [2] reported a higher incidence of 22% due to more number of no-care mothers attending their hospital. In the present study, booked cases were 4257, of which 363 were meconium stained (8.53%) and un-booked cases were 1352 of which 37 were meconium stained (2.7%).

In our study the male: female ratio was 1.07:1. In both the groups, cases were more among male babies. This difference was statistically non-significant (p>0.05).

In the present study, when maternal age was considered, incidence of MSAF was more in mothers <25 years old. The incidence was lower in mothers more than 30 years (5.46%). This was true in both thin and thick-MSAF groups and the result was statistically significant (p=0.0016). Most of the deliveries occurred in the age < 25 years and hence the incidence of MSAF is high in this age group. Similar study by Bharati *et al.* [3] showed an incidence of 74.3% in the age group 20-25 years.

Highest incidence of MSAF, in our study, was seen in primi-gravida in both thin and thick-MSAF groups. The result was statistically significant (p=0.0323) indicating an association between meconium staining of liquor and parity of the mother. More number of deliveries occurred in primi in our study, hence the high incidence of MSAF in this group. The present study correlates with the study done by Bharati *et al.* [3] and Gokhroo *et al.* [4].

Meconium staining in amniotic fluid increases with gestational age. This can be explained by that the hormone 'motilin' is secreted in increasing quantities by the fetus as gestational age advances and most meconium discharges are said to occur in post-dated gestations because the motilin levels are highest then [5]. Gupta *et al.* [6], in his study,

observed that the highest incidence of MSAF was in post-term babies (55%) and lowest in premature babies (7.8%).

In the present study, highest incidence of MSAF occurred in babies who were born at term (95.97%). Among our included cases, there were no premature deliveries with meconium. In both thin and thick-MSAF groups, more number of meconium stained deliveries were at term but the difference was not statistically significant (p>0.05). Very few cases were noted in post-term births (4.03%). This is probably due to more number of booked cases, regular antenatal check-ups and early interventions in case of meconium stained amniotic fluid. Our study is in co-relation with 2012 study conducted in Hyderabad by Joseph *et al.* [7]. He observed an incidence of 97.5% among term babies and 2.5% among post-term babies. There were no preterm babies with meconium stained liquor.

We observed that most of the babies with MSAF had birth weight between 2.6-3.5 kg (64.65%). Sedaghatian *et al.* [8] in 2000 and Mundhra *et al.* [5] in 2013 observed similar results in their studies. In our study, the differences in relation to birth weight between the 2 groups were not statistically significant (p>0.05).

Hypertensive disorders are one of the common maternal medical conditions associated with pregnancy. Association of PIH with MSAF is caused by an underlying utero-placental insufficiency, which causes fetal hypoxia, resulting in meconium passage. In a study done by Vora *et al.* [9] in 2014, 50% cases had maternal risk factors. The most encountered was PIH (60%) followed by oligohydramnios (28%). Our study is in co-relation with Vaghela *et al.* [10] in which, 59% meconium stained cases were associated with maternal risk factors mainly pre-eclampsia and PROM.

In the present study almost equal number of patients delivered by normal vaginal delivery (49.43%) as well as by caesarean section (48.27%). Only 2.3% cases had assisted vaginal delivery. There is statistically significant difference in patients who had NVD and LSCS between thin-MSAF and thick-MSAF groups. Our study is in tune with the study conducted by Bharati *et al.* [3] and Naveen *et al.* [11].

Another finding we noticed is that among 168 LSCS cases, indication for surgery was fetal distress in 78 (46.42%) cases. In contrast to our study, Wong *et al.* [12] found that only 13.2% of MSAF underwent LSCS. Such lower rate of LSCS could be due to incorporation of scalp pH sampling in their study unlike ours.

In the present study, there was a good correlation between Apgar score and MAS. Out of the 9 neonates, all belonging to thick-MSAF group, who had APGAR ≤ 3 at 1 minute, 7 (2.01%) developed MAS. This gives credence to the theory that meconium aspiration is predominantly an intrauterine event which occurs in response to continued fetal gasping in a hypoxic environment and tracheal suctioning at birth cannot completely eliminate development of MAS [13, 14]. Also, none of the neonates who were vigorous at birth and required only routine newborn care, developed MAS. Therefore, a "selective" approach of tracheal suctioning can be adopted for babies born through MSAF, reserving it for those babies with evidence of fetal distress in-utero and/or, who are in a depressed state at birth. Vigorous neonates only need careful observation after thorough oro-naso-pharyngeal suction [15, 16, 17].

NICU admissions were more with thick-MSAF (43.7%) as compared to thin-MSAF (21.3%). Our study is comparable with Vaghela *et al.* [10] and Rajput *et al.* [18] who also observed a higher incidence of NICU admission among thick meconium stained neonates.

Of 348 cases, morbidity in thin MSAF group was 21.32% and thick MSAF group was 41.72% and this difference was statistically significant (p=0.02).This was comparable with Vaghela *et al.* [10] and Rajput *et al.* [18]. MAS occurs in 1-3% of all cases of MSAF and in 10-30% of neonates with meconium aspiration [6]. In this study, MAS was noted only in thick-MSAF group and the incidence was 2.01%. All of them required ventilator support and administration of surfactant. 3 of these neonates subsequently developed PPHN. Vaghela *et al.* [10] and Rajput *et al.* [18] found an incidence of 5% and 6% in their studies respectively. Bhide *et al.* [19] reported a high incidence of 22% meconium aspiration syndrome.

In our study, 3 babies expired, all belonging to thick-MSAF group. 2 babies expired due to MAS itself and 1 due to late onset septicemia. The overall mortality was 0.86% (3 out of 348 MSAF) and is comparable with mortality rate observed by Hanoudi *et al.* [7, 4]. Mortality rate among babies who developed MAS was 25.87% (2/7).

## Conclusion

The presence of Meconium stained amniotic fluid (MSAF) at delivery is a potential sign of fetal compromise. Our study shows thick meconium stained amniotic fluid is associated with increased rate of intervention, neonatal morbidity and mortality compared with thin MSAF. Alerting the paediatrician about the meconium staining of amniotic fluid and proper resuscitation of babies born through MSAF reduces the overall morbidity and mortality.

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