# Frequency and Risk Factors of Meconium Aspiration Syndrome in Babies Delivered to Mothers with Meconium Stained Amniotic Fluid

**Sidra Tanveer, Faisal Basheer*, Arshad Khushdil**, Fady M.A Motlaq***, Raazia Nawaz, Maria Javed**

Pak Emirates Military Hospital/National University of Medical Sciences (NUMS) Rawalpindi Pakistan, *Combined Military Hospital Bahawalpur/National University of Medical Sciences (NUMS) Pakistan, **Combined Military Hospital Quetta/National University of Medical Sciences (NUMS) Pakistan, ***Evangelisches Hospital, Hattingen, Germany

## ABSTRACT

***Objective:*** To determine the frequency and risk factors of meconium aspiration syndrome in babies delivered to mothers with meconium-stained amniotic fluid attending neonatal unit of tertiary care hospital.

***Study Design:*** Cross-sectional analytical study.

***Place and Duration of Study:*** Neonatal Unit, Pak Emirates Military Hospital, Rawalpindi, from Jan to Sep 2018.

***Methodology:*** All pregnant women with cephalic presentations with either spontaneous vaginal delivery (SVD) or lower segment caesarian section (LSCS) mode of delivery and having light-yellow to thick dark-green color liquor after spontaneous or artificial rupture of membrane were enrolled. Meconium aspiration syndrome along with risk factors like gestational age, weight, gender, mode of delivery, grades of meconium, and mortality were noted.

***Results:*** Of 384 patients, 190 (49.5%) were males and 194 (50.5%) females. The meconium aspiration syndrome was observed in 37 (9.6%) patients. Meconium aspiration syndrome was 2.97 times higher among patients with >36 weeks of gestation (AOR: 2.97, 95% CI: 1.12-7.89), 61% higher among patients with ≤3 kg weight (AOR: 0.39, 95% CI: 0.19-0.85), 89% higher among females (AOR: 1.89, 95% CI: 0.91-3.95), 83% higher among patients with SVD (AOR: 1.83, 95% CI: 0.89-3.75), 4.12 times higher among patients with grade III (AOR: 4.12, 95% CI: 0.51-33.45) and 8.65 times higher among patients with grade II color liquor (AOR: 8.65, 95% CI: 1.11-67.45).

***Conclusion:*** A high frequency of meconium aspiration syndrome was found in our cohort. In particular, newborn having higher gestational age, increased weight, female gender, SVD as the factors.

**Keywords:** Meconium aspiration syndrome, Meconium-stained amniotic fluid, Membrane rupture.

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## INTRODUCTION

Meconium aspiration syndrome is defined as a breathing distress that occurs shortly post-birth in a meconium-stained environment with specific radiological characteristics that can't be described differently. It is a rare but life-threatening pulmonary illness distressing causes significant respiratory morbidity among babies born with meconium-stained amniotic fluid. Meconium aspiration syndrome is a serious condition as 30-50% of meconium aspiration syndrome requires mechanical ventilation support or constant positive airway pressure.[1,2] Meconium aspiration syndrome can affect breathing in various respects, such as chemical irritation of the pulmonary tissue, meconium-plug-in airway blockade.

Meconium, which includes hepatic, pancreatic and gastrointestinal secretions, cell debris, amniotic-fluid swallowed, vernix-caseosa, and blood could be seemed gradually in the intestines of the fetus at birth at the 10th week. Though, owing to the absence of powerful peristalsis, excellent anal-sphincter tone, low motilin concentrations and a cap of viscous meconium in the rectum, the passage in-utero is unusual until the end. In utero, hypoxia and acidosis, a vagal reaction leads to an increased peristaltic and relaxed anal sphincter leading to the passage of meconium.[3]

The severity of the meconium aspiration syn-drome depends on the amount of inhalation and underlying conditions, such as, uterine or postmaturity conditions. In the general population, prevalence of meconium aspiration syndrome is reported to be 0.20-0.54% in multiple studies.[4,5]

Various risk factors, including defects in fetal heart rate (FHR), low Apgar score, low cord pH, cesarean delivery, gender, and increased gestational age, were noted in prior research.[1,3,5,7]

Limited studies are available in Pakistan which have reported the meconium aspiration syndrome and its risk factors among children born through meconium stained amniotic fluid. This research was therefore conducted in order to find out the frequency and risk

**Correspondence: Dr Sidra Tanveer,** Neonatal Unit, Pak Emirates Military Hospital, Rawalpindi Pakistan

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factors of meconium aspiration syndrome in meconium stained amniotic fluid and risk factors for meconium aspiration syndrome. This will help in introducing management strategies to decrease the meconium aspiration syndrome associated morbidity and mortality and in turn the disease burden.

## METHODOLOGY

This cross-sectional analytical study was conducted from January to September 2018 at the Neonatal Care Unit of a tertiary care Pakistan Emeritus Military Hospital, Rawalpindi. The study was conducted after getting approval from the Ethical Review Committee of Pak Emirates Military Hospital Rawalpindi (IEC#: A/28/PEMH/EC-19/19). Signed informed consent was obtained from parents/guardians of all enrolled babies prior conducting of the study.

**Inclusion Criteria:** All pregnant women with cephalic presentations who were found to have light yellow (grade-I), green (grade-II) or thick green (grade III) meconium after "spontaneous" or "artificial rupture of membrane" were included to the study through non-probability consecutive sampling.

**Exclusion Criteria:** While women with breech presentation, still-births, twin pregnancies, APH with blood stained liquor, any low pregnancy limit e.g., terminations or delivered at less than 30 weeks gestation, or congenital fetal abnormalities were excluded.

Epi Info sample size calculator was used for the estimation of sample size using confidence interval 95%, margin of error 5%, reported prevalence of meconium aspiration syndrome in a local study 30.5%.[8] The minimum sample size came out to be 326. However, we have enrolled 384 cases in this study.

The presence of respiratory distress, i.e., respiratory rate of more than 60 per minute and cyanosis (SPO2 more than 87%), streaky, linear densities similar in appearance to transient tachypnea of the newborn or chest x-rays were labelled as having meconium aspiration syndrome. The presence of meconium aspiration syndrome along with several risk factors like gestational age, weight, gender, mode of delivery, grades of meconium, and mortality was noted.

Statistical Package for Social Sciences (SPSS) version 23.0 was used for the data analysis. Frequency and percentages were calculated for qualitative variables. Binary logistic regression was applied to evaluate the significant association between various risk factors and meconium aspiration syndrome. The *p*-value ≤0.05 was considered significant.

## RESULTS

Out of total 384 patients, 190 (49.5%) were males and 194 (50.5%) females. Majority of the patients 344 (89.6%) had >36 weeks of gestation while 40 (10.4%) had ≤36 weeks of gestation. There were 197 (51.3%) patients with ≤3 kg weight and 187 (48.7%) had >3 kg weight. Lower segment Cesarean section (LSCS) was found higher as compared to Spontaneous vaginal delivery (SVD), i.e., 240 (62.5%) and 144 (37.5%) respectively. Grade of meconium showed that grade III was found to be higher (n=156, 40.6%) followed by grade-II 180 (46.9%) and grade-I 48 (12.5%).

Frequency of meconium aspiration syndrome was observed in 37 (9.6%) patients. A significant association of meconium aspiration syndrome was observed with weight (*p*-value 0.016), mode of delivery (*p*-value 0.029), and grades of meconium (*p*-value 0.004) (Table-I).

**Table-I: Comparison of meconium aspiration syndrome with baseline characteristics (n=384).**

| | Meconium Aspiration Syndrome | | |
|---|---|---|---|
| **Characteristics** | **Yes (n=37) n (%)** | **No (n=347) n (%)** | ***p*-value** |
| **Gestational Age** | | | |
| >36 Years | 7 (17.5) | 33 (82.5) | 0.075 |
| ≤36 Years | 30 (8.7) | 314 (91.3) | |
| **Weight** | | | |
| ≤3 Kg | 12 (6.1) | 185 (93.9) | 0.016 |
| >3 Kg | 25 (13.4) | 162 (86.6) | |
| **Gender** | | | |
| Male | 14 (7.2) | 180 (92.8) | 0.105 |
| Female | 23 (12.1) | 167 (12.1) | |
| **Mode of Delivery** | | | |
| SVD | 20 (13.9) | 124 (86.1) | 0.029 |
| LSCS | 17 (7.1) | 223 (92.9) | |
| **Grades of Meconium** | | | |
| Grade I | 1 (2.1) | 47 (97.9) | 0.004 |
| Grade II | 12 (6.7) | 168 (93.3) | |
| Grade III | 24 (15.4) | 132 (84.6) | |

LSCS, Lower segment Cesarean section, SVD: Spontan-eous Vaginal Delivery "Chi-Square Test Applied"

Univariable analysis revealed that the odds of meconium aspiration syndrome were found higher among patients with >36 weeks of gestation, having SVD, having grade-II and III meconium, while lower among patients with ≤3 kg weight. Somewhat similar findings were observed in multivariable analysis as well. After adjusting for all other covariates, the odds of meconium aspiration syndrome were found higher among patients with >36 weeks of gestation, among patients with ≤3 kg weight, having SVD, and having grade-II and III meconium (Table-II).

**Table-II: Regression analysis of meconium aspiration syndrome with baseline characteristics (n=384).**

| | OR (95% CI) | *p*-value | AOR (95% CI) | *p*-value |
|---|---|---|---|---|
| **Gestational Age** | | | | |
| >36 years | 2.22 (0.91-5.45) | 0.082 | 2.97 (1.12-7.89) | 0.029 |
| ≤36 years | Ref | | Ref | |
| **Weight** | | | | |
| ≤3 kg | 0.42 (0.21-0.86) | 0.018 | 0.39 (0.19-0.85) | 0.018 |
| >3 kg | Ref | | Ref | |
| **Gender** | | | | |
| Female | 1.77 (0.89-3.56) | 0.108 | 1.89 (0.91-3.95) | 0.087 |
| Male | Ref | | Ref | |
| **Mode of Delivery** | | | | |
| SVD | 2.12 (1.07-4.19) | 0.031 | 1.83 (0.89-3.75) | 0.098 |
| LSCS | Ref | | Ref | |
| **Grades of Meconium** | | | | |
| Grade III | 3.35 (0.43-26.49) | 0.250 | 4.12 (.513-3.45) | 0.185 |
| Grade II | 8.54 (1.13-64.92) | 0.038 | 8.65 (1.11-67.45) | 0.039 |
| Grade I | Ref | | Ref | |

*AOR: Adjusted Odds Ratio, LSCS, Lower segment Cesarean section, OR: Odds Ratio, SVD: Spontaneous vaginal delivery*

Of 37 patients with meconium aspiration syndrome, pregnancy induced hypertension/gestational diabetes was observed in 2 (5.41%) patients, previous scar in 3 (8.10%) patients, and Premature rupture of membrane (PROM) in 3 (8.10%) patients. Moreover, mortality was observed in 7 (18.9%) (Figure).

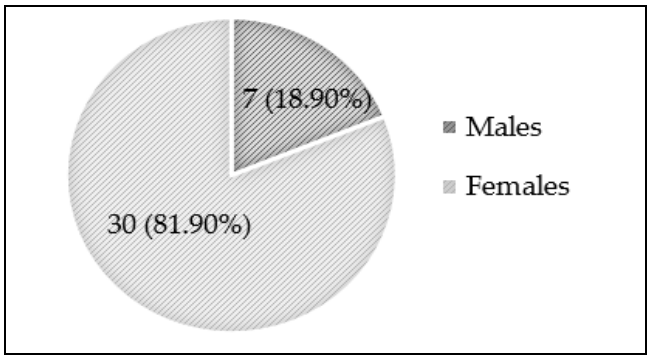


**Figure: Outcome of the patient with meconium aspiration syndrome (n=37).**

## DISCUSSION

Breathing distress that occurs shortly after birth in a child born in a meconium stained environment with compatible radiological findings that cannot otherwise be clarified continues to be a challenge despite the fact that the incidence has decreased. Meconium aspiration syndrome can present clinically with different degrees of severity, ranging from a mild form of pulmonary problem compromise to severe forms that may result in perinatal death despite mechanical ventilation support or extracorporeal membrane oxygenation.[9,10] This study was conducted in order to find out the frequency and risk factors of meconium aspiration syndrome in meconium stained amniotic fluid and risk factors for meconium aspiration syndrome.

The findings of this study have reported meconium aspiration syndrome in 9.6% of the newborns. This proportion was found to be considerably lower when compared to studies previously conducted in Pakistan.[11-13] In a study by Qadir *et al*, from Peshawar reported meconium aspiration syndrome in 5.9% neonates.[14] Studies from developed countries also revealed that among all meconium stained amniotic fluid cases, the frequency of meconium aspiration syndrome was observed in 5% cases.[15,16] However, a recent study from Karachi has reported that the actual hazard of meconium aspiration syndrome secondary to lung damage is much less. However, the authors failed to give the actual statistics as it was not checked up in intrapartum period due to limitation of unavailability of scalp pH.[17]

The findings of the current study have reported that meconium aspiration syndrome was found to be considerably higher among patients with higher gestational age, increased weight, female gender, SVD as the mode of delivery, grade-III and grade-II meconium. These findings matched with the findings of previous studies as well. Various studies have reported a higher proportion of meconium aspiration syndrome amongst new born with higher gestational age.[18,21] A study conducted in India reported a higher proportion of SVD in newborns with meconium aspiration syndrome in their study.[18]

Similar to our study findings, the mortality rate was also found consistent with a studyconducted in North America.[22] However, in a study, deaths with in seven days was reported 3.03% of the cases.[18] A study from United-States has reported that the frequency of meconium aspiration syndrome improved significantly with gestational age.[23]

Anwar *et al,* in their study reported that amongst 132 babies with meconium aspiration syndrome admitted in their hospital during one-month period, mortality was reported in 32% of the patients. Furthermore, Anwar *et al*, reported that mortality rate for meconium aspiration syndrome was higher in their study.[11] In addition, it was also reported that meconium aspiration syndrome was especially high in babies requiring

mechanical ventilation in the first hour of life or with co-existing severe hypoxic ischemic encephalopathy.[12,13] Another study conducted in Lahore has also reported that 150 babies with meconium aspiration syndrome were admitted in their hospital. The findings of their study have reported pulmonary hypertension as the most common complication followed by air leak syndrome.[14]

Contrary to our study finding, a previous study conducted in Lahore has also reported high frequency of meconium aspiration syndrome in males than in females.[13] Moreover, a higher proportion of males was also reported in the study by Buzdar *et al,* as well.[24] Similar to our study findings, Buzdar *et al*, in their study has reported higher proportion of birth through SVD.[24] In prospective study conducted in New South Wales, Australia, a decrease in incidence of meconium aspiration syndrome from 5.8% to 1.5% over an 8 year period was attributed to a reduction in births at more than 41 weeks of gestation.[25] This statement is also supported by the findings of our study as well. In our study, meconium aspiration syndrome was found considerably higher among neonates with low gestational age.

The findings of this study could be high-lighted in the light of limitation that various significant risk factors were not reported in the current study. In studies by Fisher *et al*, and Cleary *et al*, insufficient follow-up care, fetal heart rate (tachycardia/brady-cardia), day time delivery, Apgar at 1 min, Apgar at 5 min, and first care (pediatrician/midwife) were reported as the significant risk factors.[19,22] Never-theless, many improvements have been seen in latest developments in health care management. With improvements in prenatal and intrapartum care, the incidence of still-born births is reduced, and the result is a newborn. However, ongoing attempts are necessary in lesser and middle revenue nations like us. This could be evident by the statement given by Mundhra *et al,* in their study conclusion stated that obstetrics and pediatrics healthcare providers both should be worried about the increasing negative consequences of meconium stained amniotic fluid.[18] This study has revealed a considerable disease burden with considerable adverse events. Further studies on a bigger scale are suggested adding more significant variables to the results of this research.

## CONCLUSION

Meconium aspiration syndromewas present in a considerable number of the newborns. In particular newborn having higher gestational age, increased weight, female gender, SVD as the mode of delivery, grade-III and grade-II meconium were reported as significant risk factors. Further, large scale prospective studies are recommended to validate the findings of the study considering several other determinants of the meconium aspiration syndrome as well.

**Conflict of Interest:** None

**Author's Contribution**

ST: Data collection, article writing, FB: Methodology writing and review, AK: Article review, data analysis, FMAM: Statistical analysis, RN:, MJ: Data collection.

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