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RESEARCH ARTICLE
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CLINICAL OUTCOMES OF NEONATES WITH MECONIUM ASPIRATION SYNDROME IN A TERTIARY CARE CENTRE: A PROSPECTIVE OBSERVATIONAL STUDY

Dr. Vivekanand Giri[1], Dr. Vijaykumar Rathod*[2] & Dr. Sanghratna Kambale[3]

[1]Senior Resident, Department of Pediatrics, MIMER,Talegoan dabhade,Maval,Pune, Maharashtra, India.
*[2]Assistant Professor, Department of Pediatrics, Government Medical College,Satara, Maharashtra, India – [415001].
[3]Assistant Professor, Department of Forensic Medicine, Government Medical College,Chatrapati Sambhajinagar, Maharashtra, India – [415001].

Corresponding Author: Dr. Vijaykumar Rathod
*Assistant Professor , Department of PediatricsGovernment Medical College,Satara
Satara, Maharashtra, India – 415001

Abstract:

Background: Meconium aspiration syndrome (MAS) remains a major cause of neonatal respiratory distress, occurring in 5% of infants born through meconium-stained amniotic fluid (MSAF). It is linked to fetal distress and can lead to significant lung and cardiac complications. Early identification of risk factors and outcomes is essential for improving neonatal survival.

Methods: A prospective observational study was conducted in the neonatal intensive care unit of a tertiary care center over three years (June 2019–December 2022). MAS was diagnosed based on respiratory distress in neonates born through MSAF using criteria mentioned in Cloherty and Stark's manual of neonatal care. A total of 77 term and post-term neonates diagnosed with MAS were included. Clinical characteristics, antenatal risk factors, complications, radiological findings, and outcomes were analyzed.

Results: Out of 77 neonates, 61% were born to primigravida mothers. Pregnancy-induced hypertension was the most common antenatal risk factor (20.7%). Common complications included septic shock (40.25%), followed by respiratory distress (24.67%), and birth asphyxia (23.37%). Atelectasis was the most frequent radiological finding (33.7%). Mechanical ventilation was required in 20.8% cases. Overall survival rate was 88.3%, with mortality rate of 11.7%

Conclusion: MAS is associated with significant neonatal morbidity, particularly septic shock and respiratory complications. Antenatal care with prevention and treatment of maternal risk factors, intrapartum assessment of fetal distress and use of proper aseptic techniques during delivery & resuscitation and then transport of the baby to referral centre help in reducing morbidity and mortality in MAS neonates. After birth, timely diagnosis and provision of proper respiratory support by assessment of the severity of distress can prevent the mortality and morbidity due to MAS.

Keywords: Meconium aspiration syndrome, neonatal respiratory distress, neonatal outcomes, risk factors, MAS.

Introduction

Meconium, the first stool of a newborn, is a viscous, multi-component substance composed of epithelial debris, fetal hair, and digestive secretions that accumulates throughout fetal life. While its presence is physiological, meconium staining of amniotic fluid (MSAF) occurs in approximately 10–13% of pregnancies and serves as a critical clinical marker for potential fetal distress [1,2]. Infants born through MSAF face a significantly higher risk—up to 100-fold—of developing respiratory distress compared to those born through clear fluid. This phenomenon is often triggered by increased vagal tone and intestinal peristalsis resulting from umbilical cord compression or placental insufficiency [3].

Despite advancements in obstetric timing that have reduced the incidence of post-term pregnancies, Meconium Aspiration Syndrome (MAS) remains a primary cause of neonatal morbidity. Meconium aspiration triggers physical airway obstruction, chemical pneumonitis, and pulmonary hypertension, severely impairing neonatal gas exchange. This respiratory failure often leads to systemic perinatal asphyxia, where combined hypoxemia and ischemia cause metabolic acidosis and multi-organ dysfunction. The resulting hypoxic-ischemic injury particularly targets the high-metabolic regions of the brain, potentially progressing to permanent encephalopathy or death [4,5].

The presence of MSAF alongside non-reassuring fetal heart rates often heralds neonatal hypoxia, necessitating immediate intervention in intensive care settings. This is particularly relevant in cases of Persistent Pulmonary Hypertension of the Newborn (PPHN), where oxygen must be carefully titrated to manage pulmonary vascular resistance. Consequently, balancing the prevention of hypoxia with the risks of oxidative stress is essential for improving outcomes in this vulnerable population [6]. The study highlights the evolving obstetric practices in developed countries that have reduced the incidence of MAS by preventing pregnancies from continuing beyond 41 weeks.

Several studies have evaluated its incidence, risk factors, and outcomes. Paudel et al. [7] reported an incidence of about 2 per 1000 live births, with higher risk among post-term infants and those with intrapartum complications, and noted increased neonatal mortality. Pokharel et al.[8] observed that nearly half of neonates born through meconium-stained liquor developed MAS, with major risk factors including thick meconium, low Apgar score, and need for resuscitation at birth. Uniyal et al. found MAS to be more common in term infants, with birth asphyxia being the most frequent complication and a mortality rate of around 11%. Fetal distress, male sex, and small-for-gestational-age status as predictors of MAS. Recent reviews emphasize that MAS pathophysiology involves airway obstruction, inflammation, surfactant inactivation, and persistent pulmonary hypertension, highlighting the need for early recognition and effective neonatal respiratory support [9].

Materials and Methods-

Study Design: Prospective observational study.

Study Setting:

Ethics Committee has unanimously approved Title & Synopsis of Dissertation- Study of the Clinical Outcome of newborns with Meconium Aspiration Syndrome within neonatal period -2020-21, Dated 28/11/2020 Ethics Committee meeting held on Dr. Vasant Pawar Medical College, Adgaon, Nashik on 28/11/2020 -June 2019 to December 2022.

Study Population:

77 term and post-term neonates diagnosed with MAS.

Inclusion Criteria

- Meconium-stained amniotic fluid
- Respiratory distress within 24 hours of birth
- Requirement of oxygen therapy or ventilatory support.

Exclusion Criteria

- Preterm neonates

Data Collection :

Detailed antenatal, natal, and postnatal history was recorded. Clinical examination, Apgar scoring, radiological evaluation, and laboratory investigations were performed.

Statistical Analysis:

Data were analyzed using descriptive statistics and presented as frequency and percentage.

Observation and Results:

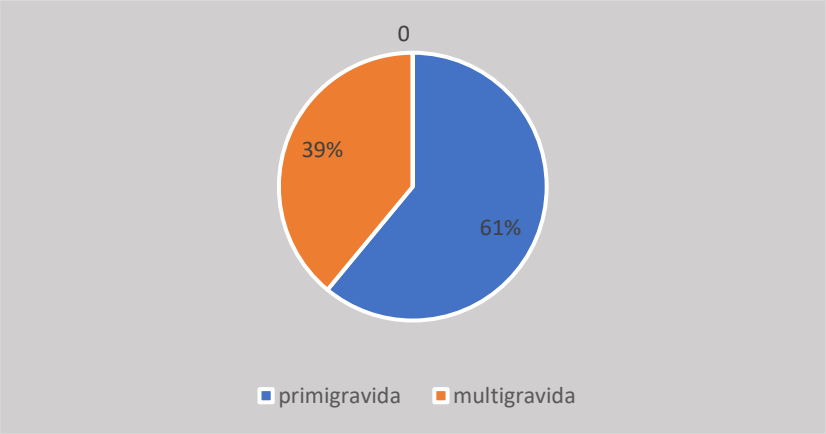


Figure 1: Gravida in cases

In present study out of 77 cases, majority of case 61.0% were primigravida and 39.0% were multigravida.

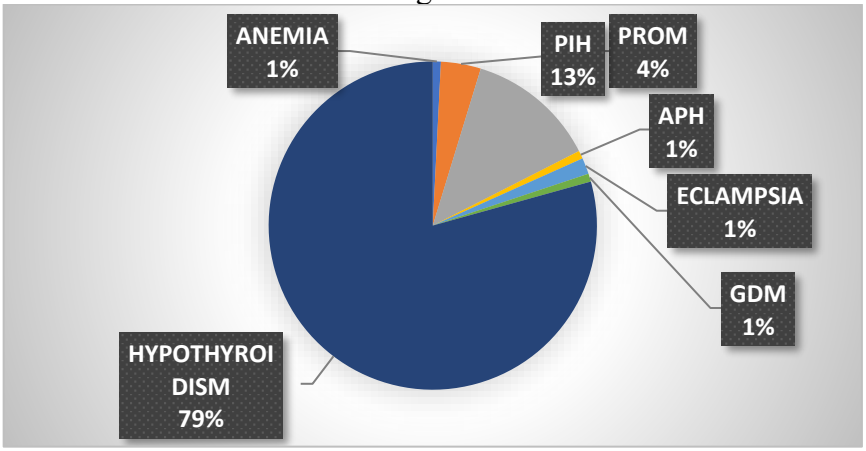


Figure 2: cases according to antenatal risk factors

In this study we observed that out of 77 cases of MAS most common risk factor for Meconium Aspiration Syndrome was Pregnancy Induced Hypertension (20.77%) next risk factor was anemia (1.29%) followed by Premature Rupture of the Membranes (6.4) Other risk factors associated with MAS were Eclampsia (1.29%), Antepartum Hemorrhage (APH) (1.29), Hypothyroidism (1.29) and Gestational Diabetes Mellitus (GDM)(1.29).

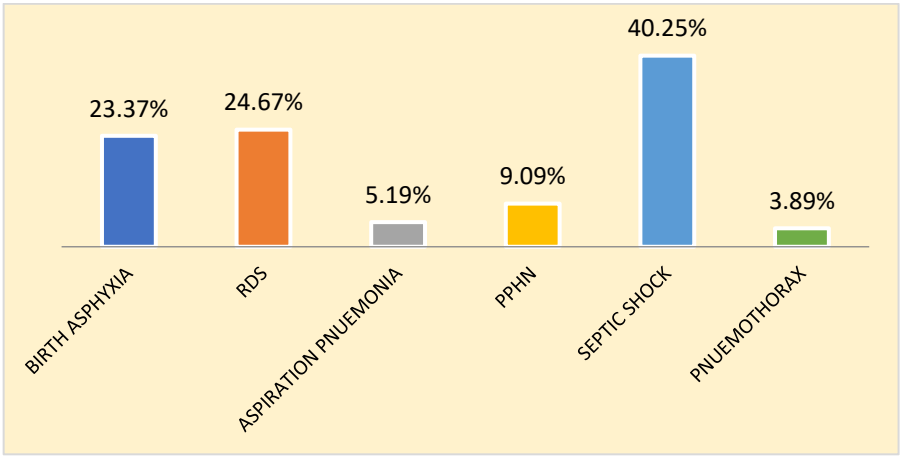


Figure 3:

In Present study it was observed that, septic shock (40.25%). (23.37%) cases of MAS had Birth Asphyxia followed by PPHN with (9.09%) cases. (6.4%) had DIC, (5.19%) cases had Aspiration Pneumonia, (3.89%) cases had Pneumothorax.

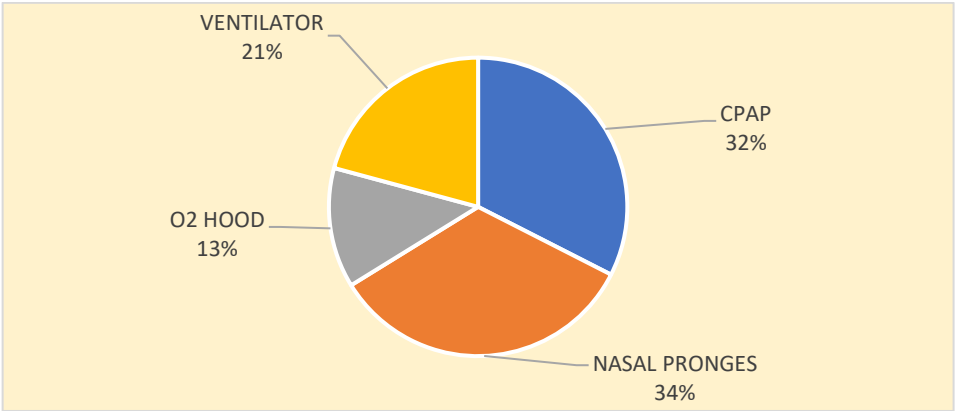


Figure 4: Cases According to Mode of Oxygen Delivery

Out of 77 babies, 26 (33.7%) babies required oxygen support by nasal prongs. 25 (32.5%) cases were on CPAP and 10 (13.0%) cases required oxygen by hood. 16 (20.8%) cases required ventilator support.

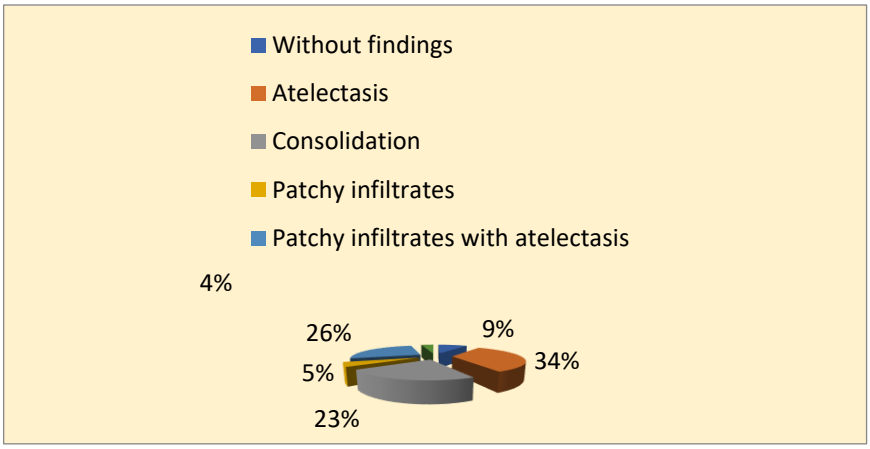


Figure 4: Cases According to the Chest X-Ray Finding.

Out of 77 babies, 26 (33.7%) babies required oxygen support by nasal prongs. 25 (32.5%) cases were on CPAP and 10 (13.0%) cases required oxygen by hood. 16 (20.8%) cases required ventilator support.

In present study, Atelectasis was the most common finding in 26 (33.8%) cases on the chest X-ray followed by patchy infiltrates with atelectasis in 20 (25.97%) cases. Consolidation was found in 17 (22.1%) cases, patchy infiltrates in 2 (2.6%) cases and pneumothorax in 3 (3.9%) cases.

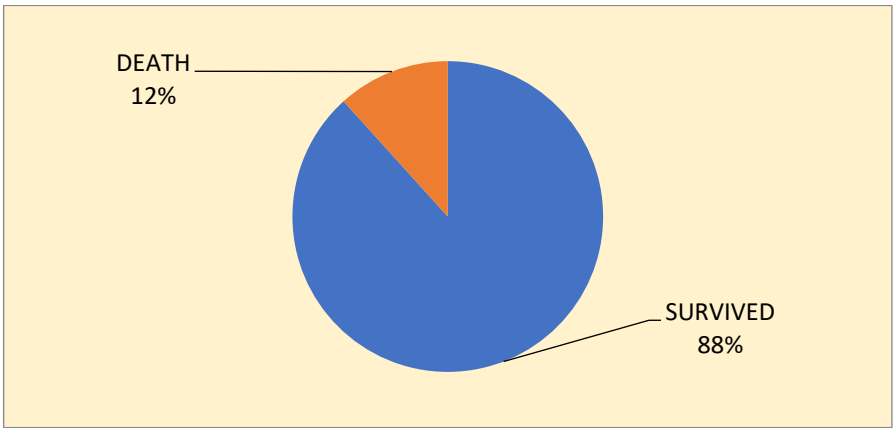


Figure 5: **Survival Rate among the Patients with Meconium Aspiration**

In present study, Out of 77 cases, mortality occurred in 9 (11.7%) cases. Out of 16 ventilated babies, 9 babies died due to the complications.

Discussion:

MAS continues to be an important contributor to neonatal morbidity, particularly in pregnancies complicated by maternal risk factors. In present study of 77 cases, primigravida (61%) were more frequently affected, suggesting a higher vulnerability in first-time pregnancies. A significant correlation was observed between spontaneous vaginal delivery and earlier passage of meconium, contrasting with Gulcan et al. [9] but aligning with the physiological stress of labor. While Osava et al.[10] reported higher vaginal birth rates in MAS cases, our study showed a nearly even distribution between vaginal (46.7%) and C-section (53.3%) deliveries.

Antenatal risk factors were present in 40.25% of the cohort, with Pregnancy Induced Hypertension (PIH) emerging as the most prevalent independent risk factor (20.7%). This reinforces the conclusions of J.-Y. Li et al.[11] regarding the role of placental insufficiency in MAS pathogenesis.

The incidence of PROM (6.49%) in our study similar to 6.60% reported by Miller et al.[12] Furthermore, maternal anemia (12.98%) was more frequent in our cohort than in studies by Mundhra and Agarwal, highlighting regional variations in maternal health.The high prevalence of complications, including PPHN, birth asphyxia, and sepsis, underscores the multisystemic impact of meconium inhalation.

Radiologically, atelectasis was the most common finding, indicating airway obstruction and inflammatory changes. Early use of CPAP reduced the requirement for mechanical ventilation in many cases.

The mortality rate of 11.7% observed in this study is comparable to other tertiary care studies.These findings emphasize that early identification of PIH and anemia is vital for improving neonatal outcomes. Ultimately, MAS management requires a multidisciplinary approach to mitigate long-term respiratory and neurological morbidities.

Conclusion

Meconium aspiration syndrome is a significant cause of neonatal respiratory distress with considerable morbidity. Pregnancy-induced hypertension is an important risk factor. Early diagnosis, appropriate respiratory support, and timely management of complications can improve neonatal outcomes.

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