



## Risk Factors and Clinical Follow-Up Features of Meconium Aspiration Syndrome

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### Abstract

**Aim:** Meconium aspiration syndrome is usually seen in full-term and post-term infants and may cause complications including respiratory failure, pulmonary air leaks, and persistent pulmonary hypertension. The aim of this study was to determine risk factors of meconium aspiration syndrome and assess the clinical course of the disease.

**Material and Methods:** Fourteen of 508 infants diagnosed with meconium aspiration syndrome between January 2013 and April 2014 were retrospectively analyzed. The risk factors including the first and fifth minute Apgar scores, the mode of delivery, need for advanced intervention and deep tracheal aspiration in the delivery room, and the presence of perinatal asphyxia were recorded and patients were classified according to the severity of disease. The clinical features and complications of the disease were also recorded.

**Results:** Fourteen infants with a mean gestational age of  $38.7 \pm 2.1$  weeks and mean birth weight of  $2828 \pm 810$  grams enrolled in the study. Two patients had perinatal asphyxia, three pulmonary hypertension, and one of our patients developed pneumothorax. During the follow-up, nine patients needed mechanical ventilation support while five patients received surfactant therapy. In our study, one infant had mild, ten infants had moderate, and three infants had severe meconium aspiration syndrome. All patients responded well to the treatment.

**Conclusion:** Meconium aspiration syndrome is an important problem with high morbidity and mortality rates. The determination of risk factors and close follow-up during perinatal and neonatal period may prevent the disease and decrease morbidity and mortality rates.

**Key Words:** Meconium Aspiration Syndrome; Risk Factor; Complications.

### Mekonyum Aspirasyon Sendromunda Risk Faktörleri ve Klinik İzlem Bulguları

#### Özet

**Amaç:** Mekonyum aspirasyon sendromu sıklıkla zamanında doğan veya postmatür bebeklerde görülen, solunum yetmezliği, pulmoner hava kaçağı veya persistan pulmoner hipertansiyon gibi komplikasyonlara yol açan hayatı tehdit edebilen bir durumdur. Bu çalışmanın amacı mekonyum aspirasyon sendromu için risk faktörlerinin belirlenmesi, hastalığın klinik seyri ve tedaviye yanıtın incelenmesidir.

**Gereç ve Yöntemler:** Bu çalışmada yenidoğan yoğun bakım ünitemizde Ocak 2013-Nisan 2014 tarihleri arasında izlenen 508 bebekten mekonyum aspirasyon sendromu tanısı konulan 14 hastanın dosyaları geriye dönük olarak incelendi. Mekonyum aspirasyon sendromu için risk faktörlerinden birinci ve beşinci dakika Apgar skoru, doğum şekli, doğum salonunda ileri girişim ve derin trakeal aspirasyon ihtiyacı, perinatal asfiksi varlığı kaydedildi ve mekonyum aspirasyon sendromu şiddetine göre hastalar sınıflandırıldı. Bebeklerin klinik izlemi ve gelişen komplikasyonlar kaydedildi.

**Bulgular:** Çalışmadaki 14 bebeğin gebelik yaşları ortalama  $38.7 \pm 2.1$  hafta, doğum ağırlıkları  $2828 \pm 810$  gr idi. Çalışmamızda 2 olguda perinatal asfiksi, 3 olguda pulmoner hipertansiyon ve 1 olguda pnömotoraks görüldü. İzlemede 9 hastaya mekanik ventilasyon desteği verildi ve 5 hastaya surfaktan uygulandı. Çalışmamızda bir bebekte hafif düzeyde MAS, 10 bebekte orta düzeyde MAS ve 3 bebekte ağır düzeyde MAS görüldü. Komplikasyon görülen tüm hastalarda tedaviye iyi yanıt alındı.

**Sonuç:** Mekonyum aspirasyon sendromu yüksek morbidite, mortalite oranı nedeniyle günümüzde önemini koruyan bir sorundur. Mekonyum aspirasyon sendromunun önlenmesi; morbidite ve mortalitenin azaltılmasında risk faktörlerinin bilinmesi, perinatal ve neonatal dönemde bebeklerin yakın izlemi büyük önem taşımaktadır.

**Anahtar Kelimeler:** Mekonyum Aspirasyon Sendromu; Risk Faktörleri; Komplikasyonlar.

## INTRODUCTION

Meconium aspiration syndrome (MAS) is often seen in babies at term or postterm and may show a broad clinical spectrum from mild respiratory distress to life-threatening cardiorespiratory failure (1). The frequency of meconium presence in the amniotic fluid at birth is 5% in babies who are born before the 37 weeks of life while it is 25% in term infants and 23-52% in babies who are born at postterm (2, 3). MAS can be seen in 5% of the babies born with meconium stained amniotic fluid (MBAS) (4). Although there is a decrease in MAS

prevalence due to improved health services and developments in obstetric practices in recent years, MAS still has high mortality and disability rates which is why it is very important to identify risk factors and appropriate approaches for this disease (5). In this study, we aim to assess the clinical signs, treatment methods, and prognosis of the patients developing MAS in our neonatal intensive care unit.

## MATERIALS and METHODS

In this study, we retrospectively studied 14 babies who were followed for MAS in our neonatal intensive care

unit between January 2013 and April 2014. Infants with chromosomal abnormalities, congenital heart diseases, metabolic diseases, and major congenital anomalies were excluded from the study. Throughout the study, we evaluated the infants with MAS in terms of gestational age, birth weight, gender, type of delivery, the first-minute and fifth-minute Apgar scores, reanimation in the birth room, tracheal aspiration requirements, and prenatal and birth characteristics. We assessed perinatal asphyxia according to the presence of severe metabolic acidosis ( $\text{pH} < 7$ ), a fifth-minute Apgar score of  $\leq 3$ , encephalopathy, and multiple organ dysfunction (6).

Regardless of other symptoms pointing to breathing difficulty in neonatal babies with MBAS, meconium aspiration syndrome is defined by the presence of early tachypnea, intercostal-subcostal retractions, respiratory distress symptoms such as cyanosis, crackles or rhonchi in lung auscultation, patchy infiltration on chest x-ray, and excessive aeration (7). MAS criteria according to severity are as follows: [1] Mild MAS: 40% less oxygen requirement within less than 48 hours; [2] Moderate MAS: oxygen requirement more than 40% for at least 48 hours regardless of any air leakage; [3] Severe MAS: need for mechanical ventilation for more than 48 hours often accompanied by persistent pulmonary hypertension (8). We recorded the data concerning patchy infiltration on chest radiograph, increased aeration, MAS associated complications, need for mechanical ventilation and oxygen, extended hospital stays, and mortality rates of the infants monitored for meconium aspiration syndrome.

We used SPSS (Statistical Package for Social Sciences, Version 20, Chicago, IL, USA) statistical software package in the evaluation. Categorical data were presented in proportions and percentages. Ordered variables were determined by mean  $\pm$  standard deviation or median (range).

## RESULTS

Of the 508 infants hospitalised in the neonatal intensive care unit, we diagnosed 14 with MAS. During this period, the patients diagnosed with MAS constituted 2.8% of the patients hospitalised in the neonatal intensive care unit. Of the 14 infants with MAS, 5 (35.7%) females girls and 9 (64.3%) were males. Their average gestational age was  $38.7 \pm 2.1$  weeks with an average birth weight of  $2828 \pm 810$ g. 11 (78%) of these babies were delivered with cesarean section. MAS developing babies shared an average 1-minute Apgar score of  $4.07 \pm 1.2$  and an average of 5-minute Apgar score of  $6.3 \pm 0.9$ . The mothers of these babies had several medical issues as well: 7.1% (1/14) had chorioamnionitis; 28.6% (4/14) had hypertension; 7.1% (1/14) had preeclampsia; 7.1% (1/14) had gestational diabetes; 35.7% (5/14) had urinary tract infections; 7.1% (1/14) had oligohydramnios; 7.1% (1/14) had premature membrane rupture; and % 35.7 (5/14) had systemic diseases. 10/14 (71.4%) of these infants required advanced intervention in the delivery room. All our patients (14/14) had serious

tracheal aspiration needs as each baby had respiratory distress symptoms (tachypnea, retraction) while 2 of them (14.2%) additionally had perinatal asphyxia. The clinical characteristics of our MAS patients are shown in Table 1. When we classified the babies accruing to the severity of MAS, we found out that 1 had mild MAS, 10 had moderate MAS, and 3 had severe MAS. In 2 of the 3 MAS patients with pulmonary hypertension, we applied intravenous magnesium sulfate infusion and oral sildenafil therapy in the other. All these 3 patients with pulmonary hypertension responded well to the treatment.

**Table 1.** Clinical characteristics of patients with MAS.

	MAS (n=14)
Perinatal asphyxia, n (%)	2 (14,2)
Pulmonary hypertension, n (%)	3 (21,4)
Pneumothorax, n (%)	1 (7,4)
Surfactant therapy, n (%)	5 (35,7)
Mechanical ventilation support, n (%)	9 (64,2)
Nasal-CPAP, n (%)	10 (71,4)
Duration of hospital stay, (days) ( $\pm$ SD)	13,2 $\pm$ 6,9
Death	0

MAS: Meconium aspiration syndrome ; CPAP: Continuous positive airway pressure.

## DISCUSSION

Meconium aspiration syndrome is still an important problem today due to its high morbidity and mortality rates. Damage in the lungs caused by meconium brings about a complex mechanism; eventually, mechanical obstruction in the airway, chemical pneumonia, surfactant inactivation, and persistent pulmonary hypertension result in MAS (9, 10). At least one third of the infants with meconium aspiration syndrome require intubation and mechanical ventilation, high frequency ventilation, inhaled nitrite oxide or surfactant treatment (11, 12). Mechanical ventilation and nasal-CPAP requirement rate was high in our study. This can be explained by the need for hospitalisation in the newborn intensive care units for babies who needed advanced intervention in the delivery room. We administered surfactant therapy to five babies and found out that our application rates were similar to those in the literature. Surfactant therapy is seen as an integral part of the treatment of infants with MAS (13). The presence of fetal distress, postterm pregnancy, low Apgar scores, birth by cesarean section, advanced maternal age, maternal hypertension, cardiovascular diseases are all regarded as risk factors for meconium aspiration syndrome (14-17). There is decrease in the incidence of MAS due to the prevention of postmaturity, aggressive approaches in case of fetal distress, and close monitoring of risky pregnancies related to the developments in obstetrics and perinatology (17). One of the studies to investigate the influence of the first 24-hour monitoring results on MAS development was conducted among 394 term newborns with meconium stained amniotic fluid. The study reports meconium aspiration syndrome rate of 4.8% (19 newborns) and a significantly low 5th-minute Apgar scores in these babies with MAS (18). In the light of these studies, it should be considered that MAS can

cause low Apgar scores and these scores may be a result of the disease. In our study, the babies diagnosed with and monitored for MAS had low Apgar scores, a cesarean birth rate of 78.2%, a fetal distress rate of 14.2%, and a mean gestational age of  $38.7 \pm 2.1$  weeks. In our study, the incidence of MAS among the patients admitted to the neonatal intensive care was 2.8%. This rate is similar to that of a single-center study on patients diagnosed with and monitored for MBAS and/or MAS (19).

Acute intrapulmonary meconium contamination causes hypertensive pulmonary response. 15-20% of babies who develop MAS also develop persistent pulmonary hypertension (7). It is important to provide adequate respiratory support and acid-base balance in the treatment of pulmonary hypertension. Today inhaled nitric oxide therapy and extracorporeal membrane oxygenation has increased the survival rates of infants with pulmonary hypertension (1). Our study has shown a pulmonary hypertension rate of 21.4% similar to the literature. Three of our patients received and responded well to sildenafil and magnesium therapy while none of our patients required any further treatment.

Despite all the advances in neonatal intensive care unit services and obstetrics in general, MAS is still associated with high morbidity and mortality (9). In our study, three MAS patients responded well to treatment and we did not observe any MAS-related complications.

As a result, implementation of new treatment approaches, close monitoring in the perinatal period, and proper approaches in the delivery room can prevent complications related to meconium aspiration syndrome and, in turn, reduce morbidity and mortality rates.

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