

An Investigation of the Mortality Rate and Risk Factors in Newborn Infants With Meconium Aspiration Syndrome

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Received 2016 May 19; Revised 2016 June 21; Accepted 2016 August 12.

Abstract

Background: One of the serious challenges facing neonatal medicine is meconium aspiration syndrome, delays in the treatment of which can lead to high mortality.

Objectives: This study was designed and conducted with the aim of determining the mortality rate and risk factors affecting this rate in newborn infants with meconium aspiration syndrome.

Methods: This study was conducted as a retrospective descriptive research on newborn infants with meconium aspiration syndrome hospitalized at the neonatal intensive care unit (NICU) of Fatemeh and Be'sat hospitals in Hamadan city during a 10-year period from 2004 to 2014. Demographic information of the mother and the newborn, hospitalization course, the need for mechanical ventilation, and complications and outcomes of disease were extracted and were analyzed using the SPSS software version 22.

Results: Sixty-three newborn infants, diagnosed with meconium aspiration syndrome, were entered in this study, 40% of them were male, 85.7% weighed more than 2500 g, and 17.5% were post term, 25.3% had a five-minute Apgar Score (AS5min) of less than seven, 39.6% were nonvigorous at birth, 31.8% needed to be placed on mechanical ventilation, and 14.3% died during the hospitalization course. There was a significant relationship between the need for mechanical ventilation, nonvigorous state at the birth, complications of disease and mortality rate.

Conclusions: Despite the progress made in medicine, meconium aspiration syndrome is still one of the causes of newborn infants' mortality. The mortality and morbidity rates can be reduced by improvement in perinatal care, prevention of post term delivery, timely caesarean and effective neonatal resuscitation at birth.

Keywords: Newborn, Meconium Aspiration Syndrome, Mortality, Complications

1. Background

Meconium-stained amniotic fluid (MSAF) disposal occurs in 10 to 15% of all deliveries, and 20 to 30% of deliveries take place with depression at birth with a low Apgar score. Meconium aspiration syndrome (MAS) occurs in 1.3% of live births and symptoms range from mild respiratory distress syndrome with auto recovery to progressive respiratory failure, complications and death, and in the most severe cases, respiratory distress, hypoxia, hypercapnia and respiratory acidosis increase, requiring intensive care and mechanical ventilation (1-3), and 10 to 40% of cases result in infant's death (4, 5).

Meconium aspiration syndrome diagnosis is made based on symptoms such as meconium-stained amniotic fluid, respiratory distress after birth and aspiration radiological evidence. Risk factors for disease include mother's high blood pressure, diabetes mellitus, post term delivery,

preeclampsia and eclampsia, Intrauterine Growth Retardation (IUGR) and oligohydramnios (6-8).

Over the past decade, because of improved delivery care, including post-term delivery prevention and cesarean delivery prior to evidence of fetal distress, the incidence of meconium aspiration syndrome has decreased, however, meconium aspiration syndrome is still one of the causes of newborns' mortality (9, 10).

2. Objectives

This research was designed and conducted with the aim of determining the mortality rate and risk factors affecting this rate in newborns with meconium aspiration syndrome at the neonatal intensive care unit (NICU) of Fatemeh and Be'sat hospitals of Hamadan city, during a ten-year period.

3. Methods

This study was conducted as a retrospective descriptive research on newborn infants diagnosed with meconium aspiration syndrome, hospitalized at the neonatal intensive care unit (NICU) of Fatemeh and Be'sat hospitals of Hamadan city, during a ten-year period from 2004 to 2014. All infants' records were extracted from the archive and studied. Newborn infants with severe congenital anomalies and cases with incomplete information were excluded from the study. Then demographic information including age of mother, underlying diseases, parity (the number of pregnancies), gestational age, birth weight, gender, mode of delivery, Apgar score at one and five minutes, neonatal resuscitation at birth, concentration of meconium-stained amniotic fluid (thin or thick), and being vigorous or non-vigorous (lack of respiratory effort, reduced muscle tone and heart rate less than 100 beats per minute), were collected.

Meconium aspiration syndrome was defined as an infant born through meconium-stained amniotic fluid, respiratory distress within 24 hours of birth, and radiological findings, which cannot be otherwise explained. Radiological findings include patchy infiltration, hyperaeration, and sometimes air leak. Neonatal resuscitation at birth was conducted based on the neonatal resuscitation program (NRP) Guidelines by the American heart association (AHA) and American academy of pediatrics (AAP), and in non-vigorous newborn infants, endotracheal tube suction was done. Length of stay at the NICU, requirement of mechanical ventilation, and clinical outcomes including recovery or death were recorded. After data collection, data were analyzed using the Lee Chi-square test, Fisher's exact test and Mann-Whitney U by the use of SPSS software version 22, and significance level was $P < 0.05$.

4. Results

Cases and records of 63 newborn infants hospitalized during a period of 10 years were investigated in this study. Forty (63.5 %) of the infants were male, 85.7% weighed more than 2500 g, 17.5% were post term, 25.3% had a five-minute Apgar score of less than seven, 39.6% were nonvigorous at birth, 60.4% were vigorous, 31.8% required mechanical ventilation, and 14.3% died during the hospitalization course. A significant relationship was observed between the need for mechanical ventilation, non-vigorous state at the time of birth and complications of disease with mortality rate. A comparison of some risk factors between living and dead infants diagnosed with neonatal meconium aspiration syndrome is presented in [Table 1](#).

5. Discussion

Despite scientific advances in developed countries, meconium aspiration syndrome is still a serious challenge faced by neonatologists due to morbidity and mortality of the disease. The mortality rate in newborn infants has been reported between 10 and 40% (4, 5). In our study, 14.3% of newborn infants, diagnosed with meconium aspiration syndrome, died. In other studies conducted by Anwar et al. (9) and Jehan et al. (11), 32% and 27.3 % of infants died, respectively. In recent studies this rate has been reduced to less than 15%. The reduction of mortality, especially in developed countries has been due to increased prenatal care including prevention of post-term delivery (12), surfactant treatment in newborn infants (13), use of high frequency oscillatory ventilation (HFOV) (14), inhaled nitric oxide (NO) (15), and ECMO (16). Considering the mentioned studies, newborn infants' mortality rate was acceptable in our study.

Due to the severity of the disease and its complications, the need for mechanical ventilation in newborn infants with meconium aspiration syndrome has been associated with very high mortality. The need for mechanical ventilation in our study, and the studies of Anwar et al. (9), Espinheira et al. (10) and Goldsmith (17) was 33.3%, 41%, 43.1% and 33%, respectively. There is a significant relationship between the need for mechanical ventilation and newborn infants' mortality between these studies and our research.

Regarding other factors associated with the mortality rate in our study, there was no significant relationship between low Apgar score at birth (five-minute Apgar score of less than seven), post term delivery, cesarean and mortality. However, in the studies of Anwar et al. (9) and Ibrahim (14), there was a significant relationship with low Apgar score at birth. There was also a significant relationship between newborn infant depression (nonvigorous infant) at birth and mortality rate. This relationship was also significant in Vora and Nair's study (7), which implies that meconium aspiration syndrome is an intrauterine process, and due to long-term hypoxia the newborn infant will be depressed at birth and the need for neonatal resuscitation at birth and respiratory support, namely mechanical ventilation, will increase, which will be followed by increased mortality.

Moreover, in our study, a significant relationship was seen between disease complications such as pneumothorax, infection, etc., and mortality. A significant relationship was reported between pneumothorax and mortality in the studies of Dargaville et al. (18) and Kamat et al. (19), in a way that in 40-50% of cases, it resulted in infant's death, the reason is that with the occurrence of pneumothorax, the underlying disease requiring mechanical ventilation intensi-

Table 1. The Results of Variables Comparison in Living and Dead Infants With Meconium Aspiration Syndrome

Variable	Alive No (%)	Dead No (%)	P Value
Birth weight, g	54 (85.7)	9 (14.3)	0.816
1001 - 1500	2 (3.2)	0	
1501 - 2500	5 (8)	2 (3.2)	
> 2500	47 (74.6)	7 (11.1)	
AS1min			0.901
< 7	32 (50.7)	2 (3.2)	
≥ 7	22 (35)	7 (11.1)	
AS5min			0.153
< 7	10 (15.8)	6 (9.5)	
≥ 7	42 (66.6)	3 (4.7)	
Vigorous at birth			0.001
Yes	37 (58.7)	1 (1.5)	
No	17 (27)	8 (12.7)	
Gestational age, week			0.318
(pre-term) < 37	8 (12.7)	2 (3.2)	
(term) 37 - 42	35 (55.5)	7 (11.1)	
(post-term) ≥ 42	11 (17.5)	0	
Mode of delivery			0.44
Cesarean	31 (49.2)	6 (9.5)	
NVD	23 (36.5)	3 (4.8)	
The average age of mothers, y	23.5 ± 0.5	28.9 ± 2.3	0.281
Underlying diseases in mothers			0.052
Yes	2 (3.2)	1 (1.5)	
No	52 (82.5)	8 (12.7)	
Complications of disease			< 0.001
Yes	14 (22.2)	9 (14.3)	
No	40 (63.5)	0	
Need for mechanical Ventilation			< 0.001
Yes	11 (17.5)	9 (14.3)	
No	43 (68.2)	0	
The average length of stay (ALOS), day	7.96 ± 0.6	3.78 ± 1	0.011

fies and gas exchange is disrupted. Furthermore, in different studies such as the studies of Anwar et al. (9) and Khurshid and Rashid (20), the infection leads to increased mortality. Long-term hospitalization, the bustle of the unit or increased number of hospitalized infants, the shortage of personnel and mechanical ventilation are amongst the important reasons for infection, which lead to increased mortality (21).

The average length of stay (ALOS) is different in various studies and an average of 13 days has been reported (18). Similar to Anwar's study, the average length of stay was one week in our study. A significant relationship between mortality and the average length of stay was reported in our study. This average was less in the group of infants, who died due to the severity of the disease.

The results of the current survey show that despite the

therapeutic advances in neonatal science, meconium aspiration syndrome is still a significant cause of mortality in newborns. Therefore, accurate monitoring of high-risk pregnancies with evidence of meconium-stained amniotic fluid, performing cesarean section in time, if there is any indication of fetal distress, and reducing number of post term deliveries will decrease the incidence of infant mortality.

Acknowledgments

This research was adapted from Dr. Hamideh Tajnesaei's thesis. We are very grateful for her efforts and appreciate the assistance of the neonatal intensive care unit respected staff.

Footnotes

Authors' Contribution: Mohammad Kazem Sabzehei and Behnaz Basiri designed the study, provided the intellectual content, performed data collection, and carried-out the initial analyses; Behnaz Basiri and Maryam Shokouhi: conceptualized and designed the study, performed the literature search, and provided the intellectual content, drafted the initial manuscript, and approved the final manuscript, before submission; Mohammad Hossein Eslamian and Zahra Razavi: collected the data, performed the literature research and wrote the early draft of the manuscript.

Funding/Support: This study was financially supported by the Hamedan University of Medical Sciences.

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