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Evaluation of the Neonates Born Through Meconium Stained Amniotic Fluid: A Single-Center Experience

Mekonyuım Boyalı Amnios Sıvılı Yenidoğanların Değerlendirilmesi: Tek Merkez Deneyimi

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ABSTRACT

Objective: Meconium stained amniotic fluid (MSAF) has been reported to be associated with an obstetric hazard and significantly increase risks of adverse neonatal outcomes at term, preterm and postterm neonates. We aimed to evaluate the neonates born through meconium stained amniotic fluid in this study.

Materials and Methods: Delivery room data of the all liveborn neonates (n=2866) and clinical data of the meconium stained amniotic fluid neonates.

Results: Ten percent of liveborn neonates were complicated by meconium stained amniotic fluid (n=288). Gestational age, birth weight, height, head circumference, female gender, active resuscitation, admission to the neonatal intensive care unit were statistically higher, and Apgar scores at 1 minute were lower in meconium stained neonates than the neonates born without meconium. Neonates born through meconium stained amniotic fluid were delivered from singleton pregnancies (p=0.007). Regression analysis showed that female sex and birth length were might affect the presence of meconium.

Conclusion: This study results were shown that tracheal suctioning is not full prevent to meconium aspiration syndrome for who neonates born through MSAF. Meconium below to vocal cord was not present all MSAF neonates. Female gender and birth height may be related for neonates with born through MSAF.

Keywords: Meconium stained amniotic fluid, meconium aspiration syndrome, neonate

ÖZ

Amaç: Mekonyumla boyanmış amniotik sıvı (MSAF) obstetrik bir risk ile ilişkili olduğu ve term, preterm ve postterm yenidoğanlarda advers neonatal sonuçların riskini önemli ölçüde arttırdığı bildirilmiştir. Bu çalışmada mekonyumlu lezyonlu amniyon sıvısı ile doğan yenidoğanları değerlendirmeyi amaçladık.

Gereç ve Yöntemler: Tüm canlı doğanlarda (n=2866) doğumhane verileri ve mekonyumlu lezyonlu amniotik sıvı yenidoğanların klinik verileri.

Bulgular: Canlı doğan yenidoğanların %10'u mekonyum lekeli amniyon sıvısı (n=288) ile komplike idi. Mekonyum boyalı yenidoğanlarda, gebelik yaşı, doğum ağırlığı, boy, baş çevresi, kadın cinsiyet, aktif resüsitasyon, yenidoğan yoğun bakım ünitesine kabul ve istatistiksel olarak daha yüksekti ve Apgar skorları mekonyumdan doğan yenidoğanlara göre daha düşüktü. Mekonyum lekeli amniyon sıvısı ile doğan yenidoğanlar tekil gebeliklerden alındı (p=0,007). Regresyon analizi, kadın cinsiyet ve doğum öyküsünün mekonyum varlığını etkileyebileceğini göstermiştir.

Sonuç: Çalışmanın sonuçları, trakeal emilimin, MSAF ile doğan yenidoğanlar için mekonyum aspirasyon sendromu önlemek için tam olmadığını gösterdi. Vokal kordonun altındaki mekonyum, tüm MSAF yenidoğanlarında mevcut değildi. MSAF yoluyla doğan yenidoğanlarda kadın cinsiyeti ve doğum yüksekliği olabilir.

Anahtar kelimeler: Mekonyumlu lekeli amniyon sıvısı, mekonyum aspirasyon sendromu, yenidoğan

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INTRODUCTION

Meconium aspiration syndrome (MAS) is a life threatening respiratory disorder that occurs in 2% to 5% of neonates born through meconium stained amniotic fluid (MSAF) (1,2). Approximately 8-13% of all live births are complicated by MSAF (3,4). Routine intubation for tracheal suction in this setting is not suggested, because insufficient evidence to continue recommending this practice (Class IIb, LOE C-LD) according to 2015 new guideline (5,6).

In making this suggested change, greater value has been placed on harm avoidance over the unknown benefit of the intervention of routine tracheal intubation and suctioning. Therefore, emphasis should be made on starting ventilation within the first minute of life in non-breathing or ineffectively breathing infants. Appropriate intervention to support ventilation and oxygenation should be initiated as indicated for each individual infant. This may include intubation and suction if the airway is obstructed (7).

The objective of this study was to evaluate delivery room data including delivery room management and short-term outcomes of the liveborn neonates born through MSAF in a year in a tertiary care teaching hospital with a capacity of 26 level 3 beds in İstanbul, Turkey.

MATERIALS AND METHODS

In this intervention study, neonatal team (neonatologist and/or pediatrician with assistant pediatrics and neonatal nurse) was present in delivery room for attending every delivery.

Delivery room data of the all liveborn neonates [gender, birth weight (BW), birth lenght (BL), birth head circumference (HC), weeks of gestation (WG)], APGAR scores at 1 and 5 minutes after birth, mode of delivery, born through MSAF, need of active delivery room resuscitation and tracheal suctioning, meconium presence below the vocal cords, and clinical data of the meconium-stained neonates [admission to the neonatal intensive care unit (NICU)], diagnosis and severity of MAS, chest X-ray findings, need for mechanical ventilation, need for surfactant treatment, NICU stay and survival who were admitted to the NICU) prospectively recorded.

Hospital antepartum management protocol for MSAF is conventional therapy, and routine prophylactic amnioinfusion for the dilution of MSAF is not performed (7).

Our hospital postnatal delivery room management protocol of the meconium-stained neonates:

In 2010, this committee was published guidelines on newborn resuscitation: no recommendation is given to suction the upper airways at the perineum but it is recommended to inspect the oropharynx and trachea for obstruction and suction the lower airway before inflations are given when the infant is depressed as in 2005 (5,6).

Based on these protocols, hospital pediatric intervention in the meconium stained neonates depends on the infant is vigorous (5,6,9,10). Vigorous is respiratory efforts, good muscle tone and a heart rate more than 100 beats/min. When the neonate is not vigorous and depressed, intubation for tracheal suctioning is done without intrapartum suctioning.

NICU Criteria for diagnosis of MAS was accepted for born through MSAF; having an abnormal chest radiograph examined by a staff radiologist; and developing symptoms of respiratory distress within 12 hours of life that persists beyond 24 hours of life and requires oxygen (4). Severity criteria to define MAS proposed by Cleary and Wiswell (4,10): Incidence of MSAF and MAS were determined. Delivery room data of the neonates born through MSAF were compared with the neonates born without MSAF. Diagnosis and severity of MAS, chest X-ray findings, need for mechanical ventilation, need for bolus natural bovine surfactant treatment, NICU stay, and survival were evaluated. This study has been approved by the hospital local ethical committees.

NICU Criteria for diagnosis of MAS (4):

1. Being born through MSAF;

2. Having an abnormal chest radiograph examined by a staff radiologist; and

3. Developing symptoms of respiratory distress within 12 hours of life that persists beyond 24 hours of life and requires oxygen.

Severity criteria to define MAS proposed by Cleary and Wiswell (4,10):

1. Mild MAS is disease that requires less than 40% oxygen for less than 48 hours,

2. Moderate MAS is disease that requires more than 40% oxygen for more than 48 hours,

3. Severe MAS is disease that requires assisted ventilation for more than 48 hours and is often associated with persistent pulmonary hypertension of the newborn.

Incidence of MSAF and MAS were determined. Delivery room data of the neonates born through MSAF were compared to the neonates born without MSAF. Diagnosis and severity of MAS, chest X-ray findings, need for mechanical ventilation, need for bolus natural bovine surfactant treatment (150 mg/kg/dose) (11), NICU stay, and survival were evaluated. This study has been approved by the hospital ethical committees.

Statistical Analysis

In this study, statistical analyses were performed using the NCSS (Number Cruncher Statistical System) 2007 Statistical Software (Utah, USA) package program, unpaired-t test and chi-square tests were used. Multiple logistic regression model was used to analyze the variables such as BW, BL, HC, WG. P-values <0.05 were considered to be statistically significant.

RESULTS

There were 2866 live born neonates from 1 January 2011 to 31 December 2011. Two hundred eighty eight liveborn neonates (10%) were complicated by MSAF, and 9.3% of them were diagnosed with MAS (27/288). Anthropometric data and Apgar scores at 1 minute and 5 minutes after birth were compared between the meconium-stained neonates and the neonates born without MSAF (Table 1). WG, BW, BL, HC were statistically higher, and the APGAR scores at 1 and 5 minutes after birth were statistically lower in the meconium-stained neonates (p<0.001). Comparison of the WG and BW between the meconium-stained neonates, and the neonates without MSAF is shown in Table 2. WG of the meconium-stained neonates was statistically higher than the neonates born without meconium (p=0.0001). Ninety point thirty percent of neonates born through MSAF was term neonates (37-42 completed WG) (n=260), 1.40%

Table 1: Delievery room characteristics in neonates born through meconium-stained amniotic fluid and without meconium-stained amniotic fluids

	MSAF$^{\alpha}$ absent (n=2578)	MSAF present (n=288)	t	p
WG*	38.51±2.5	39.11±1.65	-4.00	<0.001
BW, g**	3119.2±630.38	3251.63±510.68	-3.44	<0.001
L*, cm**	48.26±3.21	49.15±2.18	-4.61	<0.001
HC**, cm**	33.72±2.18	34.19±1.7	-3.58	<0.001
Apgar score				
1-minute	8.56±1.17	8.08±1.58	6.34	<0.001
5-minute	9.78±0.71	9.55±1.05	4.88	<0.001

*WG: Weeks of gestation, **BW: Birth weight, ***L: Birth length, ****HC: Head circumference, MSAF$^{\alpha}$: Meconium-stained amniotic fluid

Table 2: Neonates born through meconium-stained amniotic fluid and without meconium-stained amniotic fluid in relation to weeks of gestation and birth weight classification

	MSAF$^{\alpha}$ absent (n=2578)		MSAF present (n=288)		p	χ^2
WG* ≤27	28	1.10%	0	0.00%	-	-
28-33	84	3.30%	3	1.00%	-	-
34-36	305	11.80%	21	7.30%	-	-
37-42	2160	83.80%	260	90.30%	-	-
>42	1	0.00%	4	1.40%	<0.001	40.37
BW,g <750**	17	0.70%	0	0.00%	-	-
750-1000	10	0.40%	0	0.00%	-	-
1000-1499	36	1.40%	1	0.30%	-	-
1500-2499	257	10.00%	20	6.90%	-	-
2500-3999	2115	82.00%	250	86.80%	-	-
>4000	143	5.50%	17	5.90%	0.13	8.45

$^{\alpha}$MSAF: Meconium-stained amniotic fluid, *WG: Weeks of gestation, ** BW: Birth weight

(n=4) was posterm neonates (>42 WG), 8.30% (n=24) was preterm neonates (<37 completed WG). Considering the incidence of MSAF according to gestational age, it was 80% (4/5) in posterm neonates, 5.8% (24/417) in preterm neonates, and 12% /260/2160) in term neonates. On the other hand, the distribution of the neonates according to the BW classification was not statistically different in the two groups (p>0.05). Delivery room features and admission to the NICU of the meconium-stained neonates and the neonates without MSAF were presented in Table 3. Females was statistically higher than males in the meconium stained neonates (p=0.04). The neonates born through MSAF were resuscitated 0.56 times higher than the neonates born without meconium (p=0.0001), and admitted to the NICU 0.45 times higher than the neonates born without meconium (p=0.0001). Tracheal suctioning was performed in 43 non-vigorous meconium-stained neonates (14.9%), and meconium below the vocal cords was present in 29 of them (67.44%). All the neonates born through MSAF were delivered from singleton pregnancies, and this finding was statistically significant (p=0.007). Female gender and BL indicated a significant association with neonates born through MSAF. Neonates born through MSAF have been found in female neonates 0.71 (0.55 to 0.91) times greater than male neonates. The odds of MSAF were 1.15 times greater in high length neonates [95% confidence interval (CI): 1.05, 1.27]. WG, HC and BW have not found to have a statistically significant effect on MSAF. Anthropometric data and delivery room features in non-vigorous meconium-stained neonates were compared according to diagnosis of MAS and summarised in Table 5. Gender, WG, BW, BL, HC,

Table 3: Neonates born through meconium-stained amniotic fluid and without meconium-stained amniotic fluid according to delivery room features

		MSAF$^{\alpha}$ absent (n=2578)		MSAF present (n=288)		p	χ^2	RR (CI)$^{\pi}$
Gender	**Male**	1327	51.50%	130	45.10%	0.04	4.21	-
	Female	1249	48.50%	158	54.90%			-
Delivery mode	**Vaginally**	1582	61.40%	161	55.90%	0.07	3.24	-
	C-section$^{\beta}$	996	38.60%	127	44.10%			-
Breech delivery		77	3.00%	5	1.70%	0.22	1.46	-
Vacuum extraction delivery		2	0.10%	1	0.30%	0.18	1.8	-
Pregnancy	**Singleton**	2514	97.50%	288	100.0%	-	7.31	-
	Twin-siblings	64	2.50%	0	0.00%	0.007	-	-
Active delivery room resuscitation		216	8.40%	43	18.40%	<0.0001	12.74	0.56 (0.41-0.76)
Tracheal suctioning		none	none	43	14.93%	-	-	
Meconium below the vocal cords		none	none	29	10.0%	-	-	-
Admission to the NICU$^{\infty}$		196	7.60%	48	14.90%	<0.001	26.17	0.45 (0.34-0.61)

$^{\alpha}$MSAF: Meconium-stained amniotic fluid, $^{\beta}$C-section: Cesarean section, $^{\infty}$NICU: Neonatal intensive care unit, $^{\pi}$RR (CI): Rolative risk (confidence interval)

Table 4: Multiple logistic regression analysis for neonates born through meconium-stained amniotic fluid

	p	Exp(B) coefficient	95% CI$^{\pi}$ for Exp(B) coefficient	
			Lower	Upper
Gender (female)	0.009	0.714	0.555	0.919
BW*, g	0.069	1.000	0.999	1.000
L, cm**	0.002	1.157	1.053	1.272
HC*, cm**	0.229	1.061	0.964	1.167
WG****	0.258	1.057	0.960	1.163
Constant	0.0001	0.000		

*BW: Birth weight, **L: Birth length, ***HC: Head circumference, ****WG: Weeks of gestation, $^{\pi}$CI: Confidence interval

Table 5: Characteristics of tracheal suctioning in non-vigorous neonates with the diagnosis of meconium aspiration syndrome

	Neonates receiving the tracheal suctioning (n=43)							
	MAS$^{\mu}$ absent (n=21)			MAS present (n=22)			p	χ^2
WG*	38.52±2.19			37.9±2.66			NS$^{£}$	-
BW, g**	3023.33±547.85			3023.33±775.91			NS	-
L*, cm**	48.05±2.10			48.33±3.32			NS	-
HC**, cm**	34.12±1.48			33.9±2.59			NS	-
Apgar score								
1-minute	5.62±2.03			5.1±1.7			NS	-
5-minute	8.48±1.43			7.71±2.17			NS	-
Gender	Male	13	62%	13	59%		0.90	0.01
	Female	8	38%	9	41%			
Meconium below the vocal cords	Absent	13	62%	1	4%		0.0002	13.59
	Present	8	38%	21	96%			
Delivery mode	Vaginally	1	4%	6	27%		0.11	2.51
	C-section	20	96%	16	73%			

$^{\mu}$MAS: Meconium aspiration syndrome ,*WG: Weeks of gestation, **BW: Birth weight, ***L: Birth length, ****HC: Head circumference, $^{\beta}$C-section: Cesarean section, $^{£}$NS: Not significant

Apgar scores at 1 minute and 5 minutes after birth, and delivery mode were not significantly different between the two groups (p>0.05). On the other hand, meconium below the vocal cords was significantly higher in the neonates with MAS (21/22) than those without MAS (8/21) (p=0.0002).

Five meconium-stained neonates who did not received tracheal suctioning were admitted to the NICU after developing symptoms of respiratory distress in their first 12 hours of life, and considered as having MAS.

Six (13.95%) non-vigorous meconium stained neonates (3 of them with meconium below the vocal cords) were followed up in the level 1 basic care nursery after the immediate tracheal meconium suctioning and delivery room care. The rest of the non-vigorous meconium-stained neonates (n=15, 34.88%) were admitted to the NICU with a different diagnosis other than MAS (feeding intolerance and early neonatal sepsis) with normal chest X-ray findings. According to the severity criteria; severe, moderate, and mild MAS ratio were 18.5% (n=5), 29.6% (n=8), 51.85% (n=14), respectively (p>0.05). Chest X-ray findings were moderate to diffuse infiltration (n=13, 48%), minimal infiltration (n=7, 26%), and overinflation (n=7, 26%) in neonates with MAS. Three neonates were intubated and mechanically ventilated immediately after tracheal suctioning in the delivery room, and total 9 (33%) neonates needed mechanical ventilation, 3 (11%) neonates needed bolus surfactant replacement therapy, and none of them had persistent pulmonary hypertension in their echocardiographic examination performed by a single pediatric cardiologist. All the meconium-stained neonates admitted to the NICU were survived and their mean NICU stay was 12.95±11.42 days.

DISCUSSION

MAS is a common problem that most pediatricians will encounter in the delivery room and normal newborn nursery. The current thinking on prevention of MAS requires that depressed non-vigorous neonates be tracheally intubated and suctioned in the delivery room. Clearly, this approach will not prevent all cases but may attenuate the severity of MAS (4). Our prospective study showed that 10% of all live births were born through MSAF, and 9.3% of them was diagnosed with MAS. According to the studies previously reported, 7.9-20.4% live births were born through MSAF (2,3,12,13) and 2-11.3% were complicated by MAS (2,3,12,14,15). Our incidences of MSAF and MAS were similar to these above cited reports. In our study, meconium-stained neonates were observed as having higher anthropometric measures (BW, L, and HC), WG, and lower Apgar scores than the neonates born without meconium. In the study reported by Lee et al., WG, BW, and Apgar scores <7 were higher in meconium stained neonates. These results were similar to our results (16). However, we did not find any study comparing BL and HC between the neonates with and without meconium.

The frequency of MSAF was observed to increase with advanced WG in the present study. Meconium is uncommon before 36-38 WG (17). It is a common finding in amniotic fluid and placental specimens, particularly in term or post-term pregnancy (18). In post-term pregnancies the incidence varies from 28-52% (17). Gupta et al. reported the incidence of MSAF in post-term pregnancies as 55%, and in preterms as 7.8% (19). In a recent study published by Espinheira et al., posterm and term neonates with MAS were 22.2%, and 70.8%, respectively (17,19). In another study, Tybulewicz et al. reported that MSAF in preterm neonates born at <33 WG was 4.3% (20). In our study, the incidence of MSAF in post-term pregnancies was 80% whereas in preterms it was 5.8%. Among the 24 preterms, 21 (87.5%) were between 34-36 completed WG and the remaining 3 (12.5%) were <34 completed WG (28-33 weeks). Sedaghatian et al. showed that a BW of ≥4000 g is a risk factor for MSAF (21). However in our study, we could not observe a result supporting this finding. Females were observed in 54.9% of 288 neonates born through MSAF in our study and we found an association between female gender and MSAF. This finding was similar with the finding reported in the study of Balchin et al. (22). Lee et al., reported the higher risk of MSAF in term singleton gestation (16). Likewise, meconium-stained neonates were born only from singleton pregnancies in our study. In other words, twin pregnancy was not observed in the study period. Fischer et al. has reported similar finding in twin pregnancy related MSAF in their recent published study (23).

In the study of Lee et al., the association of nulliparity, increase of WG, Caesarean delivery, low Apgar score (<7 points), and increase of BW were found to be risk factors for MSAF (16). In our study, female gender and BL were found to be risk factors for MSAF. There was no significant difference in mode of delivery (including breech and vacuum extraction) between MSAF absent and MSAF present. Neonates born through MSAF needed more admission to the NICU (relative risk: 0.45, 95% CI: 0.34 to 0.61). Our NICU admission result is in accordance with the study of Lee et al. in their study, NICU admission of the neonates with MSAF was higher than the neonates without meconium (16). On the other hand, in our study we observed that they needed higher resuscitation immediately after birth than these neonates born without MSAF. According to the report of Hageman et al. in 1988 meconium below the vocal cords was present in 76% of the neonates born through MSAF, and 10% of these neonates developed MAS (24). In our study, meconium below the vocal cords was present in 67.44%, and 50% developed MAS.

The current thinking on prevention of MAS requires that depressed infants be tracheally intubated and suctioned in the delivery room (5,6,8,9). In our study, severe MAS was found 18.5% in the depressed neonates with the presence of meconium below the vocal cords. Also, 13.95% of the depressed neonates did not admitted to the NICU after the delivery room care. We observed that tracheal suctioning of meconium in depressed meconium stained neonates can prevent MAS and attenuate the clinical severity of MAS. In the other hand, some vigorous neonates born through MSAF (18.5%) can develop MAS as seen in our study.

Espinheira et al. reported in their study radiographic abnormalities were observe d in 63.9% newborns and 26.4% newborns presented normal chest radiography, and of the newborns with MAS 43.1% required ventilatory support and surfactant therapy was used in 8.3% newborns (17). Similar to this study, radiographic abnormalities such as diffuse, moderate, minimal infiltration, and overinflation were observed in all the neonates who diagnosed with MAS in our study. Of these neonates, 33% required ventilatory support, and 11% needed surfactant therapy.

Study Limitation

The limitation of this study is the absence of the comparison of the effect of our delivery room policy with any other mode of management.

CONCLUSION

As a conclusion, when to do tracheal suction and how to do it well for MSAF neonates are still a hot topic. Every step in perinatal and postnatal care affects their outcomes. Tracheal suctioning after birth seems to be an optimal perinatal management strategy to the depressed meconium stained neonates. Further studies comparing different modes of management are needed.

Ethics Committee Approval: It was taken.

Informed Consent: It was taken.

Authorship Contributions

Surgical and Medical Practices: Ö.S., E.C., Concept: Ö.S., S.H., C.H.A., Design: Ö.S., E.C., Data Collection or Processing: C.H.A., S.H., Analysis or Interpretation: C.H.A., S.H., Literature Search: S.T.L., Ş.H., Writing: D.E., Ö.S., E.C., C.H.A, Ş.H., S.A.

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