

# Assesment of Fetal Acidosis in Infants with Meconium-Stained Amniotic Fluid

## EYLEMDE MEKONYUMLU AMNİON MAYİSİ OLAN GEBELERDE FETAL ASİDOZ ORANLARI

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### Summary

**Objective:** To determine the fetal acid-base status in patients with meconium-stained amniotic fluid in labor.

**Material and Method:** Umbilical artery blood gas analysis of one hundred and six infants at term with meconium-stained amniotic fluid were compared with one hundred and eleven infants with clear amniotic fluid. The attending physician determined the grade of meconium by visual examination at the bed side. Immediate umbilical artery blood were obtained, at each delivery. Neonatal acidosis was defined as pH values <7.20. Statistical analysis was performed by independent samples t-test,  $\chi^2$  analysis and Fisher's exact probability test, as appropriate.

**Results:** Mean maternal age and birth weight was significantly higher in meconium group when compared to no-meconium group ( $p=0.04$ ,  $p<0.0001$  respectively). Of the 32 cesarean deliveries 19 were with meconium-stained amniotic fluid. The rate of neonates having pH values <7.20 was 23.6% in meconium group and 8% in no-meconium group. There was a significant increase in low 1-minute Apgar scores (<7) and neonatal intensive care unit admission rates in meconium-stained neonates ( $p=0.03$ ,  $p=0.001$  respectively). No significant difference was found in low 1-minute Apgar scores, fetal acidemia and neonatal intensive care unit admissions when infants with thin meconium were compared with clear amniotic fluid group ( $p>0.05$ ).

**Conclusion:** Thick meconium is a more ominous sign than is thin meconium and should alert the the physician to a high risk fetal condition.

**Key Words:** Meconium-stained amniotic fluid, Fetal acidosis, Umbilical cord blood gas

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### Özet

**Amaç:** Eylemde mekonyumlu amnion mayi olan hastalarda umbilikal arter kan gazı ile fetal asidoz oranlarını tesbit etmek.

**Materyal ve Metod:** Termde eylemde 111 berrak ve 106 mekonyumlu amnion mayi olan hasta çalışmaya dahil edilmiştir. Mekonyumlu amnion mayi yoğunluğu görsel muayene ile tespit edilmiş, ince ve koyu olarak derecelendirilmiştir. Doğumdan hemen sonra umbilikal korddan kan gazı örneği alınmıştır. Umbilikal arter pH <7.20 neonatal asidoz olarak değerlendirilmiştir. İstatistiksel analizde iki ortalama arasındaki farkın önemlilik testi,  $\chi^2$  analizi ve Fisher's exact test kullanılmıştır.

**Bulgular:** Mekonyumlu amnion mayi olan gebelerde ortalama maternal yaş ve doğum ağırlığı istatistiksel olarak anlamlı derecede yüksektir (sırasıyla  $p=0.04$ ,  $p<0.0001$ ). Toplam 32 sezaryan ile doğumun 19'u mekonyumlu amnion mayisi olan hastalardır. Fetal asidoz, mekonyumlu grupta %23.6, berrak amnionu olan grupta %8 oranındadır. Birinci dakika Apgar skoru <7 ve yenidoğan yoğunbakım ünitesine çıkan bebek oranları mekonyumlu amnionu olan grupta istatistiksel olarak anlamlı derecede yüksektir (sırasıyla  $p=0.03$ ,  $p=0.001$ ). İnce mekonyumlu grup ile berrak amnionu olan grup, düşük 1' Apgar skorları (<7), fetal asidoz, yenidoğan yoğun bakıma çıkan bebek oranları açısından istatistiksel olarak karşılaştırıldığında anlamlı fark yoktur ( $p>0.05$ ).

**Sonuç:** Düşük Apgar skorları, yüksek fetal asidoz, artmış yenidoğan yoğun bakım ihtiyacı nedeni ile koyu mekonyumlu amnion mayinin eylemde tespiti fetus için yüksek riski göstermektedir.

**Anahtar Kelimeler:** Mekonyumlu amnion mayi, Fetal asidoz, Umbilikal kordon kan gazı ds

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In recent years, meconium-stained amniotic fluid has been a major topic of interest in many studies and several theories have been proposed to define the clinical importance of meconium passage during labor. There are two contrary opinions about meconium-stained amniotic fluid. Some investigators believe in that meconium is associated with fetal hypoxia and acidosis and others do not (1).

It is still not certain if the risk of adverse neonatal outcome is increased because of meconium-stained amniotic fluid or if accompanying intrapartum events predicts a poor outcome in the presence of meconium. To define the

risk of adverse perinatal outcome associated with meconium-stained amniotic fluid, detection of fetal asphyxia at birth is important. Fetal monitoring and Apgar scores are also helpful in assessing this risk but to quantify the extent of fetal acidosis these diagnostic techniques have limited value (2).

The purpose of this study was to explore umbilical artery pH values of infants at term from pregnancies complicated by meconium passage in utero and to correlate these findings with those having clear amniotic fluid in ascertaining the risk of acidosis in the presence of meconium.

## Materials and Methods

Two hundred and seventeen women at term in labor were identified after spontaneous or artificial rupture of membranes revealed either clear (n=111) or meconium-stained (n=106) amniotic fluid. Patients with a gestational age of more than 37 weeks and live born, singleton pregnancies without medical, obstetric complications or fetal anomalies were included in the study. Gestational ages were calculated using the first day of the last normal menstrual period and gestational age at birth was given as completed weeks of gestation. The grade of meconium was determined by visual examination and categorized as thin (green or yellow, with or without particulate matter) or thick (the consistency of pea soup). Fetal heart recordings of at least 30 minutes were obtained in all patients using an external monitor during the first stage of labor whenever possible. The fetal heart rate tracings were considered as normal if the basal heart rate was between 120-160 beats per minute, the heart rate variability was between 5 to 25 beats per minute and there were no decelerations. A cardiotocograph was abnormal if the basal heart rate was less than 120 beats per minute or greater than 160 beats per minute, the heart rate variability was greater than 25 or less than five beats per minute, there were early or variable or late decelerations.

Immediately after delivery, the cord was doubly clamped and blood samples were collected by using preheparinized 3 ml syringes. The analysis were performed within 15 minutes of delivery. Fetal acidosis was defined as umbilical artery pH values below 7.20. Apgar scores were determined at one and five minutes after delivery. Statistical analysis was performed by independent samples t-test,  $\chi^2$  analysis, and Fisher's exact probability test, as appropriate. Significance was set at  $p < 0.05$ .

## Results

Table 1 summarizes the characteristics and outcomes of the 217 pregnancies with meconium or clear amniotic fluid included in the study. Mean maternal age and birth weight was significantly higher in the meconium-stained pregnancies ( $p=0.04$ ,  $p < 0.0001$  respectively). There were 185 vaginal deliveries, of which 98 were with clear and 87 with meconium-stained amniotic fluid. Of the 32 cesarean sections, 19 were with meconium-stained amniotic fluid. Cesarean delivery were performed for fetal distress in 19 patients (13 with meconium and 6 with clear amniotic fluid), for fetal macrosomia in 4 patients (3 with meconium and 1 with clear amniotic fluid), for failure to progress in 3 patients (all with meconium) and the remainder for other reasons.

Of the total 106 neonates with meconium, 25 (23.6%) had umbilical arterial pH of less than 7.20. In the group of clear amniotic fluid there were 9 (8.1%) infants with acidemia (pH less than 7.20). There was a significant increase in the incidence of fetal acidosis and low 1-minute Apgar (less than 7) scores in newborns with meconium ( $p=0.002$ ,  $p=0.031$  respectively). The numbers of newborns with low 5-minute Apgar (less than 7) scores were too small (one in meconium-stained and one in clear amniotic fluid group) to allow for meaningful statistical analysis. Neonatal care unit admission rates were significantly increased in newborns with meconium (22.6%) as compared with those with clear (6.3%) amniotic fluid ( $p=0.01$ ).

Table 2 presents the correlation between the type of meconium and fetal outcome. There was a significant increase in the incidence of low 1-minute Apgar scores, fetal acidosis and neonatal care unit admission in newborns with thick meconium. No significant difference was found in low Apgar scores, umbilical cord pH values less than seven or neonatal care unit admission rates for patients with thin meconium versus clear amniotic fluid ( $p=0.666$ ,  $p=0.170$ ,  $p=0.297$  respectively).

**Table 1.** Pregnancy characteristics and neonatal outcome

	Clear (n=111)	Meconium (n=106)	p
Mean maternal age (years)	23.2 ± 4.1	24.9 ± 5.2	0.04*
Parity=0 (%)	54 (48.6)	52 (49.1)	0.201
Parity=>1 (%)	57 (51.3)	54 (50.9)	
Mean birth weight(grams)	3217 ± 471	3324 ± 336	<0.0001*
Delivery method (%)	98 (88.3)	87 (82.1)	
-Vaginal	13 (11.7)	19 (17.9)	0.251
-Nonelective cesarean			
Apgar score	6.8 ± 0.6	6.5 ± 0.8	0.005*
-1-minute (mean)	8.8 ± 0.6	8.5 ± 0.8	0.1
-5-minute (mean)			
-1-minute<7 (%)	13 (11.7)	25 (23.6)	0.031*
Mean arterial blood cord pH			
-pH <7.20 (%)	7.4 ± 0.1	7.2±0.1	-
	9 (8.1)	25 (23.6)	0.002*
NICU admission (%)	7 (6.3)	24 (22.6)	0.001*
FHR abnormal (%)	22 (19.8)	33 (31.1)	<0.0001*

\*statistically significant (NICU= neonatal intensive care unit; FHR= fetal heart rate)

**Table 2.** Neonatal outcome and grade of meconium

	Clear (n=111)	Thin (n=83)	Thick (n=23)	P
Cesarean delivery (%)	13 (11.7)	12 (14.5)	7(30.4)	0.105
1-Minute Apgar <7 (%)	13 (11.7)	12 (14.5)	13 (56.5)	<0.0001*
Umbilical cord pH <7.20 (%)	9 (8.1)	12 (14.5)	13 (56.5)	<0.0001*
NICU admission	7 (6.3)	9 (10.8)	15 (65.2)	<0.0001*

\*statistically significant (NICU= neonatal intensive care unit)

Electronic fetal heart rate tracings were also significantly altered in thick meconium group ( $p<0.0001$ ) (table 1). Abnormal fetal heart rate tracings were observed in 65% of the newborns with thick meconium but only 21.7% and 19.8% of the newborns with thin and clear amniotic fluid respectively had abnormal fetal heart rate tracings.

### Discussion

Many theories have been proposed to explain meconium passage in utero and the significance of meconium-stained amniotic fluid is controversial (3). In ascertaining the risk associated with meconium-stained amniotic fluid the present study was planned. Umbilical cord arterial pH value is an objective indicator of birth asphyxia (4) and a clear relation between 1-minute Apgar scores and umbilical artery pH values have been proven (5). The results of this study shows adverse neonatal outcomes associated with meconium-stained amniotic fluid, especially thick meconium. The results reflects increased risk for fetal acidosis in patients with thick meconium. Evaluation of neonatal outcome also revealed a significantly greater incidence of 1-minute Apgar scores less than 7 for thick meconium. However, using Apgar scores is not an accurate method for measuring the sequelae of meconium. Not only because Apgar scores are subjective but also they can be affected by gestational age, anesthesia and vigorous endotracheal suctioning at birth (6). Fetal acid-base status at delivery provides a more objective way of evaluating the newborn condition (1). Both in meconium and in no-meconium group the rates of umbilical cord pH values less than 7.20 and low 1-minute Apgar scores (less than 7) were higher than reported previously (6).

Cunningham et al. (7) emphasized that meconium aspiration was not always preventable and the best way of prevention was suctioning of the head on the perineum. In the present study all infants were managed by suction of nasopharynx and oropharynx after delivery of the head, followed by tracheal suctioning. Endotracheal intubation was not the standart procedure performed to all infants with meconium stained amniotic fluid. The rates of neonatal care unit admission in meconium-stained group were observed higher than reported by Berkus et al. (6) who performed endotracheal intubation as a routine. The high rates of neonatal care unit admission might be due to this difference in study protocols. Neonatal care unit admission is

another indicator in assessing the significance of meconium (6) and the results of this study represents that newborns with thick meconium requires more neonatal care when compared with clear amniotic fluid group.

Our data demonstrate that the true effect of meconium on adverse outcome is due to thick meconium. In intrapartum assessment the consistency of meconium should be regarded as no difference was found in Apgar scores, umbilical cord pH values and neonatal care unit admission for patients with thin meconium when compared to no-meconium group. Previous investigation by Starks et al.(8) also reported similar results but have used intrapartum fetal scalp values as the measure of asphyxia.

Analysis of the relation between meconium passage and various fetal heart rate patterns revealed significantly higher rates of abnormal fetal heart rate patterns in meconium group. Previous studies (4,7), also reported on the significance of abnormal fetal heart rate tracings in the presence of meconium, especially thick meconium.

In conclusion, the consistency of meconium is important. Thin meconium is associated with little or no increase in risk of adverse outcome while thick meconium is a high risk fetal condition associated with low Apgar scores and fetal acidosis, therefore requires continous fetal heart rate monitoring.

### REFERENCES

1. Yeomans ER, Gilstrap LC, Leveno KJ, Burris JS. Meconium in the amniotic fluid and fetal acid-base status. *Obstet Gynecol* 1989; 73(2):175-8.
2. Gordon A, Johnson JWC. Value of umbilical blood acid-base studies in fetal assessment. *J Reprod Med* 1985; 30(4):329-36.
3. Houlihan CM, Knuppel RA. Meconium-stained amniotic fluid. Current controversies. *J Reprod Med* 1994; 39(11): 888-98.
4. Baker PN, Kilby DM, Murray H. An assessment of the use of meconium alone as an indication for fetal blood sampling. *Obstet Gynecol* 1992; 80(5): 792-6.
5. Dijkhoorn MJ, Visser GHA, Fidler VJ, Touwen BCL, Huisjes HJ. Apgar score, meconium and acidaemia at birth in relation to neonatal neurological morbidity in term infants. *Br J Obstet Gynecol* 1986; 93: 217-22.
6. Berkus MD, Langer O, Samueloff A, Xenakis EMJ, Field nt, Ridgway LE. Meconium-stained amniotic fluid: increased risk for adverse neonatal outcome. *Obstet Gynecol* 1994; 84(1): 115-20.
7. Cunningham AS, Lawson EE, Martin RJ, Pildes RS. Tracheal suction and meconium: a proposed standart of care. *J Pediatr* 1990; 116(1): 153-4.
8. Starks GC. Correlation of meconium-stained amniotic fluid, early intrapartum fetal pH, and Apgar scores as predictors of perinatal outcome. *Obstet Gynecol* 1980; 56:604-9.

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