Original Article

An 8-Year Study of Meconium Stained Amniotic Fluid in Different Ethnic Groups

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ABSTRACT

Background: The prevalence, determinants, and clinical significance of Meconium Stained Amniotic Fluid (MSAF) have not been studied well. A few previous studies have shown that the prevalence of MSAF varies among women of different ethnicity and that black women are at greater risk than others. However, the clinical importance of these findings is unclear. The main objectives of this study were to estimate the prevalence of MSAF in women of different ethnicity and to assess the clinical significance of the condition.

Methods: During the 8-year period from January 1, 1992 through December 31, 1999, 18,084 consecutive live born infants representing 33 nationalities and seven main ethnic groups were evaluated for birth weight, sex, gestational age, gravidity, presentation, type of delivery, one and five minute Apgar scores, air leak at birth, respiratory distress syndrome, meconium aspiration and infection. In addition, meconium staining was graded as thin or thick at time of delivery.

Results: All selected clinical variables were distributed similarly in different ethnic groups except for gravidity, birth weight > 4000 g, and MSAF. MSAF and Meconium Aspiration Syndrome (MAS) were associated positively with gestational age and birth weight and negatively with the Apgar score. The prevalence of MSAF was the highest in East African black women (18%) and North African mainly black women (13%) and the lowest (8%) in Peninsular Arab women. The greater risk noted in black African women remained unaltered even after multivariate adjustment for several clinical variables.

Conclusion: This study of a larger number of women over a longer period confirmed and extended our previous findings that, 1) the prevalence of MSAF varied by ethnicity, 2) the risk of MSAF is highest in black African women, and, 3) the greater risk in black women is independent of the clinical factors examined. The greater risk of MSAF in black women may be because of the more advanced gastrointestinal system maturity in their fetuses. This is being currently investigated in our institution, and does not necessarily indicate a need for intervention.

KEY WORDS: black ethnicity, meconium aspiration syndrome, meconium stained amniotic fluid

INTRODUCTION

Meconium Stained Amniotic Fluid (MSAF) is a common condition detected during 7-22% of all deliveries[1-4]. The presence of MSAF at delivery is a potential sign of fetal compromise[5-7]. MSAF is known to be associated with advancing gestational age, gravidity, increased birth weight, amnionitis, and funisitis[8-11]. However, there is a lack of data on the prevalence and clinical significance of MSAF in women of different ethnicity[12-14]. Previous studies by us and others indicate that, 1) the prevalence of MSAF varies in different ethnic groups, 2) the risk is greater in black women, and 3) the greater risk in black women is independent of several other maternal and fetal characteristics[12,14].

We conducted this eight year study of over 18,000 women of different ethnicity to: (a) estimate the prevalence of MSAF, (b) assess the clinical significance of the condition, and (c) carefully explore role of potential risk factors for MSAF. These findings have clinical significance for provision of obstetric services to a multi-ethnic population such as that in the United Arab Emirates.

METHODS

The study population consisted of all babies delivered alive at the Mafraq Hospital, Abu Dhabi city, United Arab Emirates (UAE) during the eight year period from January 1, 1992 through December 31, 1999. During the study period, as per the UAE Ministry of Health annual reports, 25% of all babies born in Abu Dhabi city were delivered at the Mafraq Hospital.

All infants who had meconium staining of the amniotic fluid (MSAF) at the time of delivery were

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Table 1:
Clinical characteristics of patients with MSAF and MAS

Feature	Number of Patients (%)	MSAF (%)	Thin MSAF (%)	Thick MSAF (%)	MAS (%)
Gestational Age (Wk)					
30	181	5 (2.8)	5 (2.8)	0	0
31-33	204	4 (2)	2 (1)	2 (1)	0
34-36	716	28 (3.9)	18 (2.5)	10 (1.4)	0
37-38	1016	93 (9.2)	63 (6.2)	30 (3.0)	1 (0.1)
39-40	14954	1721 (11.5)	1249 (8.4)	472 (3.2)	43 (0.3)
41-42	936	251 (26.8)	160 (17.1)	91 (9.7)	5 (0.5)
> 42	77	30 (39)	13 (16.9)	17 (22.1)	2 (2.6)
Total	18084	2132 (11.8)	1510 (8.3)	622 (3.4)	51 (0.3)
p value	-	0.0001	0.0001	-	-
Weight (Gm)					
<1000	101	3 (3.0)	3 (3.0)	0	0
1000-1499	133	5 (3.8)	3 (2.3)	2 (1.5)	0
1500-1999	258	14 (5.4)	12 (4.7)	2 (0.8)	0
2000-2499	824	64 (7.8)	34 (4.1)	30 (3.6)	1 (0.1)
2500-3999	15188	1756 (11.6)	1256 (8.3)	500 (3.3)	37 (0.2)
4000	1580	290 (18.4)	202 (12.8)	88 (5.6)	13 (0.8)
Total	18084	2132 (11.8)	1510 (8.3)	622 (3.4)	51 (0.3)
p value	-	0.0001	0.0001	0.0001	-
1'Apgar Score					
0-1	45	15 (33.3)	2 (4.4)	13 (28.9)	2 (4.4)
2-3	148	23 (15.5)	8 (5.4)	15 (10.1)	3 (2.0)
4-5	336	73 (21.7)	38 (11.3)	35 (10.4)	10 (3.0)
6-7	1385	293 (21.2)	162 (11.7)	131 (9.5)	15 (1.0)
8-10	16153	1728 (10.7)	1300 (8.0)	428 (2.6)	21 (0.1)
Total	18067*	2132 (11.8)	1510 (8.4)	622 (3.4)	51 (0.3)
p value	-	0.0001	0.0001	0.0001	0.001
5'Apgar Score					
0-1	9	3 (33.3)	1 (11.1)	2 (22.2)	1 (11.1)
2-3	21	4 (19)	1 (4.8)	3 (14.3)	1 (4.8)
4-5	76	10 (13.2)	4 (5.3)	6 (7.9)	1 (1.3)
6-7	323	59 (18.2)	25 (7.7)	34 (10.5)	9 (2.8)
8-10	17631	2055 (11.7)	1479 (8.4)	576 (3.3)	39 (0.2)
Total	18060+	2131 (11.8)	1510 (8.4)	621 (3.4)	51 (0.3)
p value	-	0.001	NS	0.001	0.001
Gravidity					
1-3	7563	810 (10.7)	561 (7.4)	249 (3.3)	20 (0.3)
4-6	5706	631 (11.1)	468 (8.2)	163 (2.9)	13 (0.2)
7-9	3138	447 (14.2)	319 (10.2)	128 (4.1)	12 (0.4)
10-12	1306	189 (14.5)	132 (10.1)	57 (4.4)	4 (0.3)
>13	368	55 (14.9)	30 (8.2)	25 (6.8)	2 (0.5)
Total	18081#	2132 (11.8)	1510 (8.3)	622 (3.4)	51 (0.3)
p value	-	NS	NS	NS	NS
Gender					
Male	9239 (51.1)	1082 (11.7)	775 (8.4)	307 (3.3)	33 (0.4)
Female	8845 (48.9)	1050 (11.9)	735 (8.3)	315 (3.6)	18 (0.2)
Total	18084	2132 (11.8)	1510 (8.3)	622 (3.4)	51 (0.3)
p value	NS	NS	NS	NS	NS

NS: Not Significant, *: Not recorded in 17, +: Not recorded in 24, #: Not recorded in three

Table 2
Multivariate logistic regression analysis of the association between the presence of MSAF at birth and selected variables

Independent variables	Adjusted odds ratio	95% confidence interval	p - value
GA(weeks)			
< 37	1.55	0.90 - 3.85	0.4
38 - 42	1.00	Reference	
> 42	2.70	1.60 - 4.69	0.002
Gravidity			
< 5	1.00	Reference:	
5 - 10	0.64	0.22 - 1.84	0.4
> 10	0.96	0.32 - 2.89	0.9
Birth weight (g)			
< 2500	0.70	0.65 - 1.35	0.1
2500 - 3999	1.00	Reference	
4000	1.42	1.20 - 1.98	0.02
1 Min Apgar Score			
< 3	2.32	1.72 - 9.44	< 0.001
3 - 5	2.48	1.38 - 6.06	< 0.001
6 - 7	2.22	1.10 - 3.65	< 0.001
> 7	1.00	Reference	
5 Min Apgar Score			
< 5	1.29	0.91 - 8.81	0.07
5 - 7	2.37	1.90 - 6.26	< 0.01
> 7	1.00	Reference	
Nationality			
1. East African	2.51	1.64 - 3,92	< 0.001
2. North African	1.62	1.27 - 2.86	< 0.001
3. Peninsular Arab	1.58	1.15 - 1.78	< 0.001
4. Mediterranean	1.29	0.82 - 1.95	0.08
5. Indian Subcontinent	1.15	0.57 - 2.48	0.17
6. Middle Eastern	1.00	Reference	
7. Mixed	0.72	0.31 - 1.69	0.4

p < 0.05 significant

included in the study. MSAF was graded as thin (if it was homogenous, watery, yellow or green) or thick (if it was like pea soup or particulate). The actual time of passage of meconium in utero was not available. The gestational age was determined by a certain 1st day of last menstrual period and/or ultrasound fetometry before the 20th week of pregnancy and confirmed by postnatal gestational age assessment. Infants who had MSAF were assessed for meconium aspiration syndrome (MAS) along with other variables such as birth weight, sex, gestational age at birth, nationality of father, gravidity, presentation, type of delivery, one and five minute Apgar scores, meconium aspiration syndrome and infection. The MAS was defined as respiratory distress in the first 6 hours after birth with abnormal chest X-ray (including bilateral or unilateral infiltrations, hyperinflation, patchy areas of atelectasis, and air leaks) and oxygen requirement in any infant delivered through MSAF. Infection was considered to be present if there was a positive blood, cerebrospinal fluid, and/or urine culture and/or positive chest X-ray along with clinical findings.

Table 3
Incidence of post-term, MSAF (thin & thick), MAS and infection in different ethnic groups

Ethnic Group	Birth (%)	MSAF (%)	Meconium Thin (%)	Thick (%)	MAS (%)	Post - Term > 42 Wks. (%)	1 min Apgar <3 (%)	5 min Apgar <5 (%)	Infection (%)
East African	2083 (11.5)	375 (18)	237 (11.4)	138 (6.6)	10 (0.5)	13 (0.6)	25 (1.2)	13 (0.6)	6 (0.3)
North African	1491 (8.2)	19 (13.3)	150 (10.1)	49 (3.3)	6 (0.4)	6 (0.4)	15 (1.0)	9 (0.6)	7 (0.5)
Peninsular Arab	9345 (51.7)	109 (11.7)	798 (8.5)	293 (3.1)	20 (0.2)	38 (0.4)	92 (1.0)	45 (0.5)	33 (0.3)
Mediterranean Arab	1742 (9.6)	187 (10.7)	137 (7.9)	50 (2.9)	5 (0.3)	5 (0.3)	19 (1.1)	14 (0.8)	7 (0.4)
Indian Subcontinent	1208 (6.7)	100 (8.3)	67 (5.6)	33 (2.7)	4 (0.3)	6 (0.5)	12 (1.0)	7 (0.6)	5 (0.4)
Middle East	1967 (10.9)	158 (8)	105 (5.3)	53 (2.7)	6 (0.3)	8 (0.4)	26 (1.3)	14 0.)	7 (0.4)
Other Mixed	248 (1.4)	22 (8.9)	16 (6.5)	6 (2.4)	0 (0.0)	1 (0.4)	4 (1.6)	4 (1.6)	2 (0.8)
Total	18084 (100)	2132 (11.8)	1510 (8.3)	622 (3.4)	51 (0.3)	77 (0.43)	193 (1.1)	106 (0.6)	67 (0.4)
p Value	-	0.01	NS	NS	NS	NS	NS	NS	NS

NS = Not Significant

Women of 33 different nationalities were included in the study. These women were divided into seven main ethnic groups: East African black (Somalia, Sudan, Ethiopia, Tanzania, Kenya, and Djibuti); North African, mainly black (Egypt, Morocco, Tunisia, and Mauritania); Peninsular Arab, mixed (United Arab Emirates, Yemen, Oman, Saudi Arabia, Bahrain, Kuwait and Qatar); Mediterranean Arabs, mainly white (Jordan, Syria, Lebanon and Palestine); Middle East Asia, mainly white (Iran, Iraq, Afghanistan, and Pakistan); Indian subcontinent (India, Sri Lanka, and Bangladesh); and 'other' consisting of a few babies of several different nationalities (Philippines, Indonesia, Malaysia, Europe and Canada) not classified into the preceding groups.

All data were abstracted from medical records and verified for errors. The data were computerized and analyzed on an IBM-PC compatible computer using the Statistical Packages for Social Sciences (SPSS). As appropriate, the chi-square test and the Fisher's exact test were used to detect significant differences between proportions. Multivariate logistic regression analysis was used to assess the relation between occurrence of MSAF and several independent variables. A two-sided p-value of <0.05 was considered as the cut-off level for significance.

RESULTS

18,084 consecutive live births occurred at the Mafraq Hospital during the 8-year study period. The distribution of all previously mentioned clinical variables were similar among the seven ethnic groups studied except for infants with birth weights >4000 g [highest in Mediterranean Arab (15%) and lowest in Indian Subcontinent (4%)] and gravidity of 5-10 [highest in Peninsular Arab (15%) and lowest in Indian subcontinent (4%)].

Both MSAF and MAS were significantly associated positively with gestational age and birth weight and negatively with one and five minute Apgar scores; however, the prevalence of MSAF or MAS did not vary significantly with gravidity and sex of the infant (Table 1). In multivariate logistic regression analysis, presence of MSAF remained significantly associated with birth weight >4000 g, low one and five minute Apgar scores, gestational age > 42 weeks, and black ethnicity (Table 2). When the occurrence of MSAF in different ethnic groups was compared, it was found to be significantly higher in black African women without any concomitant increase in the occurrence of low Apgar scores, MAS, post-maturity, and infection (Table 3 and Fig. 1).

DISCUSSION

Whereas the overall clinical significance of MSAF remains a matter of debate, there seems to be general agreement that the MSAF alone is a poor marker for perinatal asphyxia[8,16]. There are two main theories explaining the passage of the meconium in utero. First, meconium passage may constitute a normal physiological event in the fetal gastrointestinal (GI) system as it matures and becomes more responsive to exogenous stimuli. Second, meconium passage may be in response to fetal hypoxia. The finding of this study that the presence of MSAF was associated with advancing gestational age and heavier birth weight supports the first theory [8,10,17]. In this study, MSAF was also associated with lower one and five minute Apgar

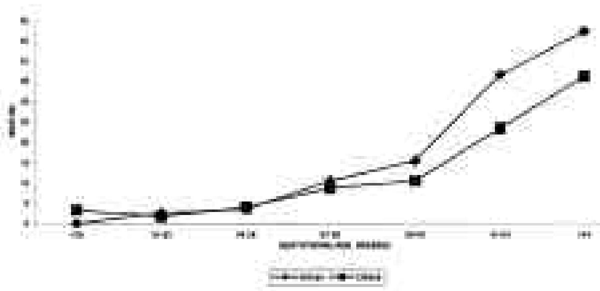

Fig. 1: MSAF comparison between east and north African patients with other nationalities

scores suggesting that the condition was indicative of fetal compromise.

We have also clearly shown in this study and in two of our previous studies[13,14] that, the prevalence of MSAF is significantly higher in black African women (east as well as north African) as compared with women of other ethnicity. Also, this increased risk in black African women is independent of low Apgar scores, the MAS, infections, and advancing gestational age. Other investigators using physical and neurological assessment methods have documented that Afro-American infants are more mature than white infants of the same gestational age[18,19]. Perhaps the higher prevalence of MSAF in black women is due to the earlier maturation of the gastrointestinal system of their fetuses with passage of meconium as a normal physiological event. It needs to be stressed that we have no information on maternal diet, socio-economic status, height, weight, prenatal care use, and drug intake that may influence the passage of meconium in utero.

If the presence of MSAF without other signs of fetal distress is indicative of fetal gastrointestinal maturity, particularly in black infants, then the condition by itself may not necessarily require any interventions. At present, we are measuring different GI hormones at different gestational ages in a multiethnic group of women. This may help us to quantify the rate of maturation of the fetal GI system in different ethnic groups.

In conclusion, our findings confirmed that in black women MSAF occurs more frequently, without obvious clinical signs of fetal compromise, and independent of important relevant clinical variables. This may be due to earlier maturation of the fetal GI system in black women. However, this needs to be examined in further studies.

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