Maternal and Perinatal Outcomes in Childbirths with Meconium Stained Amniotic Fluid in a Low-resource Setting: A Prospective Cohort Study

Gregory E. Halle-Ekane1*, Phyllis N. Fon2, Paul N. Koki3, Alexis A. Tazinya2, Rodrigue Ekollo4 and Emile Mboudou3

1Department of Obstetrics and Gynecology, Faculty of Health Sciences, University of Buea, Cameroon.
2Department of Internal Medicine and Pediatrics, Faculty of health Sciences, University of Buea, Cameroon.
3Faculty of Medicine and Biomedical Sciences, University of Yaoundé 1, Yaoundé, Cameroon.
4Faculty of Health Sciences, University of Buea, Cameroon.

Authors’ contributions

This work was carried out in collaboration among all authors. Authors GEHE, PNF and PNK did the study design and wrote the protocol. Authors PNF and GEHE did the literature search, cross-checked the statistical analysis. Authors AAT, RE and EM made important inputs in the drafting of the manuscript. Author PNF did the data entry and analysis the data. Author GEHE is the corresponding author. All authors read and approved the final manuscript.

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ABSTRACT

Meconium stained amniotic fluid (MSAF) can be associated with a high maternal and perinatal mortality. There is paucity of data on maternal and fetal outcomes of MSAF in Cameroon.

Aim: The study was to determine the maternal and perinatal outcomes in patients with MSAF.

Study Design: Prospective cohort study.

Place and Duration of Study: The study carried out in the Limbe Regional Hospital maternity, Cameroon from 10th January 2017 to 20th April 2017.

*Corresponding author: Email: halle-ekane.edie@ubuea.cm;
Methodology: Fifty-two mothers who had MSAF and their neonates, were matched with controls (without MSAF) in a 1:1 ratio after matching for: age, gestational age, parity and body mass index. Risk ratio (RR) of MSAF on the various perinatal outcomes were calculated by multivariate logistic regression with MSAF (-) being the reference. Data was analyzed with Epi Info 7.

Results: Two hundred and three deliveries were conducted during the study period with fifty-two with MSAF enrolled in the study. The proportion of participants with MSAF was 19.1%. Parturients who had thick MSAF were 3 times more likely to have caesarean sections (RR: 3.2, 95% CI= 1.1 - 10.2, p = 0.04). Two (3.9%) parturients with chorioamnionitis had MSAF. The neonatal complications were: non-reassuring fetal heart rate (RR=4.4, 95%CI: 1.1-16.8, p=0.02), neonatal sepsis (RR=3.7, 95%CI: 1.4-9.8, p=0.01) and neonatal intensive care unit admissions (RR=2.9, 95%CI: 1.2-6.9, p=0.02), were associated with MSAF. Two (3.9%) had meconium aspiration syndrome on clinical examination. No maternal death was recorded. However, a perinatal death occurred in a parturient with MSAF.

Conclusion: The proportion of parturients with MSAF was high. MSAF was associated with increased maternal and neonatal morbidity. We recommend larger and robust cohort studies to further refine our findings.

Keywords: Meconium stained; amniotic fluid; maternal and perinatal morbidity; mortality; Cameroon.

ABBREVIATIONS

ANC : Antenatal Care
BMI : Body Mass Index
MAS : Meconium Aspiration Syndrome
MSAF : Meconium Stained Amniotic Fluid
NRFHR : Non-Reassuring Foetal Heart Rate
NS : Neonatal Sepsis
PIH : Pregnancy Induced Hypertension
PROM : Prolonged Rupture of Membranes
ROM : Rupture of Membranes

1. INTRODUCTION

Meconium is a term derived from the Greek “mekoni”, meaning poppy juice or opium.[1] Meconium stained amniotic fluid (MSAF) is a common finding in the labour and delivery wards and is associated with a high perinatal mortality in some cases. The incidence of MSAF seems to be higher in low-income countries due to limited availability of prenatal care as well as a high incidence of home births [2].

Almost all neonates who pass meconium are mature (term) because their digestive system has reached maturity and the bowel has started functioning. This is the most common reason why 30-40% of post term babies will have passed meconium in uterus [3]. Usually neonates pass meconium soon after birth but under stressful conditions the foetus can pass meconium in utero.

Risk factors that may cause stress on the foetus leading to MSAF include: placental ageing due to post-dated pregnancy, oligohydramnios, hypertensive disorders of pregnancy, gestational diabetes mellitus, overt diabetes mellitus, injudicious use of oxytocin and maternal drug use (cocaine, tobacco). [4]

The maternal risk associated with meconium stained liquor include: meconium-laden amniotic fluid embolism [5], two- to four-fold increase in puerperal metritis and increased risk of operative deliveries [6]. The main neonatal complication of MSAF is meconium aspiration syndrome (MAS) which is the presence of meconium below the vocal cord. It is more frequent in post term neonates [3]. Meconium aspiration syndrome refers to respiratory compromise with tachypnoea, cyanosis, and reduced pulmonary compliance in new-born infants. In literature, the incidence of MSAF in post-term pregnancies was at 25.45%, [7] whereas a local study described the frequency of 16% in postdate deliveries [8].

MSAF is a common finding during child birth but there is paucity of information on this phenomenon in our setting. It is a confusing issue because it can be due to either physiologic or a hypoxic insult to the foetus. Furthermore, the subjective nature of diagnosis of meconium staining, resuscitative measures and expertise in neonatal resuscitation are issues that cannot be ignored. Thus, this study aimed at describing the maternal and perinatal outcomes in childbirths with MSAF. This will provide scientific data that will help in the management of parturients with MSAF and it will enhance the understanding of the impact of MSAF in our health facilities.
2. METHODS

2.1 Study Design and Setting

This was a comparative prospective cohort study carried out in the Limbe Regional Hospital maternity from 10\textsuperscript{th} January 2017 to 20\textsuperscript{th} April 2017. Limbe is an urban coastal city at the shores of the Atlantic Ocean in the South West region of Cameroon. It has a population of 84,233 inhabitants [9] and has one of the regional hospitals in the South West region.

The Limbe Regional hospital is a 200-bed hospital and one of the principal referral health facilities in the region. Eight hundred childbirths are carried out in the maternity per year. The personnel of the maternity include: 2 midwives, 4 nurses and 2 Obstetrician/Gynaecologists. The maternity is made up of a labour room, delivery room, procedure room and 5 wards with 23 beds. There is a neonatal care unit with 5 incubators, 8 beds, 5 nurses and a paediatrician. There are limited neonatal resuscitation equipment such as Ambu bags and suction machines. However, oronasal aspirations are carried out with mechanical suction.

2.2 Sample Size Calculation

The sample size was calculated using the formula for estimating proportions [10]. A pre-study estimate of proportion of fetal distress in the two groups in a previous study in India as 40% for MSAF and 20% for non-MSAF [7].

\[ N = \left( Z_{\alpha/2} + Z_{\beta}\right)^2 \times (p_1(1-p_1)+p_2(1-p_2)) / (p_1-p_2)^2 \]

Where \( Z_{\alpha/2} \) is the critical value of the normal distribution at \( \alpha/2 \) (e.g. for a confidence level of 95%, \( \alpha = 0.05 \) and the critical value is 1.96), \( Z_{\beta} \) is the critical value of the normal distribution at \( \beta \) (e.g. for a power of 80%, \( \beta = 0.2 \) and the critical value is 0.84) and \( p_1 \) and \( p_2 \) are the expected sample proportions of the two groups.

\( p_1 = \) Prevalence of an adverse foetal outcome (Apgar <7 in 1\textsuperscript{st} minute) in cases with MSAF as 40% and \( p_2 = \) Prevalence of an adverse foetal outcome (Apgar <7 in 1\textsuperscript{st} minute) in cases with no MSAF as 12% [7].

The minimum sample size needed for each group is 35 parturients. However, fifty-two parturients were included in each group to increase the validity of the study.

2.3 Study Population and Sampling

All pregnant women who had completed 37 weeks of gestation with singleton pregnancies in cephalic presentation were eligible for the study. Moreover, all neonates of parturients with the aforementioned characteristics were included. All who did not give consent were excluded from the study.

2.4 Study Procedure and Approach to Participants

Ethical approval for the study was obtained from the Institutional Review Board of the Faculty of Health Sciences, University of Buea. After administrative approval of the hospital management, the parturients who fulfilled the inclusion criteria were evaluated and enrolled in the study by approaching them at the maternity and explaining the procedure and purpose of the study. A diagnosis of MSAF was made by two senior midwives or the principal investigator by naked eye examination of the amniotic fluid at the time of rupture of membranes (ROM) for vaginal birth and caesarean section.

Each case of MSAF was matched with a reference population for age (<20 years, 20-25 years, 26-30 years, >30 years), pre-pregnancy BMI (Underweight=<18.5 kg/m\(^2\), normal=18.5-24.9 kg/m\(^2\), overweight=25-29.9 kg/m\(^2\), obese >=30 kg/m\(^2\)), parity (primiparous, multiparous and grand multiparous) and gestational age (term and post term).

Progress of labour was monitored using a partograph and foetal heat variations were monitored using a handheld Doppler. Where needed, augmentation of labour with oxytocin was done. Childbirth was expedited by the safest method when foetal heart abnormalities were detected. Neonates with Apgar score <7 at the 1\textsuperscript{st} minute and those with meconium aspiration syndrome were transferred to the neonatal unit for re-evaluation and management by the paediatrician.

2.5 Data Collection

Data was collected using a pretested structured questionnaire which included the following
variables for each parturient: socio-demographic characteristics, detailed medical history, booking status, parity, gestational age, relevant clinical examination (including general physical examination, abdomen examination, speculum, and vaginal examination) and maternal outcomes (e.g. puerperal sepsis and chorioamnionitis). The foetal variables included; foetal heart rate, Apgar score at 1st and 5th minute, temperature, birth weight, birth asphyxia, neonatal sepsis, MAS, and foetal death.

For the purpose of this study, meconium was graded as thick and thin. “Thick” if the amniotic fluid was dark green in colour, viscous, tenacious and containing large amount of particulate material and “Thin” if the fluid was lightly stained without particulate material [11].

2.6 Data Management

Data was cleaned, keyed into, and analyzed using the statistical software Epiinfo version 7.

Descriptive statistics (frequency and percentage) were computed for categorical variables like booking status, mode of delivery, parity, Apgar score, and foetal outcome. Mean, standard deviation, 95% confidence interval were computed for quantitative variables. Bivariate analysis was used to determine the factors associated with MSAF. Multivariate analysis using binary logistic regression was used to determine those variables that were statistically significant on bivariate analysis to control for confounders. Variables with a p < 0.05 were considered significant risk factors associated with MSAF.

3. RESULTS

A total of 273 parturients were admitted to the maternity unit of the Limbe Regional Hospital during the study period. Of these parturients, 180 met the inclusion criteria and 113 who were excluded (multiple gestation, non-cephalic presentation, pre-terms and those who did not consent). After matching for age, parity, GA and BMI, 52 parturients with MSAF were compared with a reference group. The ages ranged from 15 to 40 years with a mean age of 31± 4.9 years. The majority of women, 36.5% (n=19) with MSAF were in the >30 years’ age group. The mean parity was 3 ±1.2. Among the cases, most were multiparous (52.9%, n = 27). The mean gestational age was 40 ± 1.4 weeks. The mean BMI was 30 ± 4.5 kg/m², the maximum BMI was 42 kg/m² and minimum was 19 kg/m² as shown in Table 1.

Among the 273 parturients presenting during the study period, 52 (19%) had meconium stained liquor. Out of the 52 who had MSAF, 30 (57.7%) had thick meconium while 22 (42.3%) had thin meconium stained liquor.

As shown in Table 2, prolonged labour was more frequent in the MSAF group than the reference population but this was not statistically significant. No parturients had gestational or overt diabetes and none used recreational drugs.

Parturients with MSAF were twice times more likely to have caesarean childbirths (RR=1.9, 95% CI:0.9-4.2, P=0.1) but this association was not statistically significant (Table 3).

A sub-analysis of parturients with meconium stained amniotic fluid revealed that those with thick meconium were thrice more likely to have caesarean childbirths than their counterparts (p=0.04) Fig. 1.

Furthermore, the study revealed that, majority of participants 48 (92.3%) with MSAF had did not have any complication. Two parturients with chorioamnionitis were from the MSAF group however, the association was not statistically significant. The incidence of puerperal sepsis was the same in both the MSAF group and the reference population as shown in Table 4. No maternal death was recorded in both groups.

Non-reassuring foetal heart rates (NRFHR) (RR=4.4, 95%CI 1.1-16.8, P=0.02) and neonatal sepsis (RR=3.7, 95%CI: 1.4-9.8, P=0.01) were 4 times more likely to occur in cases than in the reference population and this association was statistically significant. Furthermore, NICU admissions were 3 times more likely to occur in cases than controls (RR=2.9, 95% CI: 1.2-6.9, p=0.02) Table 5. Two neonates, (3.9%) had meconium aspiration syndrome.

From logistic regression, none of the factors evaluated for foetal outcomes was independently associated with MSAF Table 6.
### Table 1. Socio-demographic and obstetrical characteristics of parturients

<table>
<thead>
<tr>
<th>Variables</th>
<th>MSAF+ (%) N=52</th>
<th>MSAF- (%) N=52</th>
<th>P values</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;20</td>
<td>3(5.8)</td>
<td>6(5.3)</td>
<td>0.8</td>
</tr>
<tr>
<td>20-25</td>
<td>15(28.9)</td>
<td>16(30.8)</td>
<td>0.8</td>
</tr>
<tr>
<td>26-30</td>
<td>15(28.9)</td>
<td>14(26.9)</td>
<td>0.8</td>
</tr>
<tr>
<td>&gt;30</td>
<td>19(36.5)</td>
<td>20(38.5)</td>
<td>0.8</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>34(66.7)</td>
<td>36(70.6)</td>
<td>0.5</td>
</tr>
<tr>
<td>Single</td>
<td>17(33.3)</td>
<td>16(30.8)</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skilled</td>
<td>26(50.0)</td>
<td>30(58.8)</td>
<td>0.3</td>
</tr>
<tr>
<td>Unskilled</td>
<td>26(50.0)</td>
<td>22(41.2)</td>
<td>0.3</td>
</tr>
<tr>
<td><strong>Parity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primiparous</td>
<td>21(40.4)</td>
<td>21(40.4)</td>
<td>1.0</td>
</tr>
<tr>
<td>Multiparous</td>
<td>27(51.9)</td>
<td>27(51.9)</td>
<td>1.0</td>
</tr>
<tr>
<td>Grand multiparous</td>
<td>4(7.7)</td>
<td>4(7.7)</td>
<td>1.0</td>
</tr>
<tr>
<td><strong>Gestational age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Term</td>
<td>39(75.0)</td>
<td>37(71.2)</td>
<td>0.7</td>
</tr>
<tr>
<td>Post term</td>
<td>13(25.0)</td>
<td>15(28.9)</td>
<td>0.7</td>
</tr>
<tr>
<td><strong>BMI</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight</td>
<td>0(0.0)</td>
<td>0(0.0)</td>
<td>-</td>
</tr>
<tr>
<td>Normal</td>
<td>18(34.6)</td>
<td>20(38.5)</td>
<td>0.7</td>
</tr>
<tr>
<td>Overweight</td>
<td>22(42.3)</td>
<td>18(34.6)</td>
<td>0.4</td>
</tr>
<tr>
<td>Obese</td>
<td>12(23.1)</td>
<td>14(28.9)</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>ANC coverage</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Booked</td>
<td>39(75.0)</td>
<td>46(88.5)</td>
<td>0.1</td>
</tr>
<tr>
<td>Unbooked</td>
<td>13(25.0)</td>
<td>6(11.5)</td>
<td>0.2</td>
</tr>
</tbody>
</table>

*BMI= body mass index, ANC= Antenatal care coverage

### Table 2. Prenatal and intrapartum factors and MSAF ((N=104))

<table>
<thead>
<tr>
<th>Variables</th>
<th>MSAF+ (%) N=52</th>
<th>MSAF- (%) N=52</th>
<th>RR</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anemia</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>48(92.3)</td>
<td>49(94.2)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>4(7.7)</td>
<td>3(5.8)</td>
<td>1.4</td>
<td>0.3-6.4</td>
<td>0.7</td>
</tr>
<tr>
<td><strong>PIH</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>52(98.1)</td>
<td>48(92.3)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1(1.9)</td>
<td>4(7.7)</td>
<td>0.2</td>
<td>0.03-2.2</td>
<td>0.2</td>
</tr>
<tr>
<td><strong>PROM</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>49(94.2)</td>
<td>49(94.2)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>3(5.8)</td>
<td>3(5.8)</td>
<td>1.0</td>
<td>0.2-5.2</td>
<td>1.0</td>
</tr>
<tr>
<td><strong>Spontaneous labour</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>5(9.6)</td>
<td>8(15.4)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>47(90.4)</td>
<td>44(84.6)</td>
<td>1.7</td>
<td>0.5-5.6</td>
<td>0.4</td>
</tr>
<tr>
<td><strong>Prolonged labour</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>41(78.9)</td>
<td>48(92.3)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>11(21.2)</td>
<td>4(7.7)</td>
<td>3.2</td>
<td>1.0-10.9</td>
<td>0.1</td>
</tr>
</tbody>
</table>

*PROM- Premature rupture of membranes
Pregnancy Induced Hypertension
Table 3. Mode of delivery among the parturients (N=104)

<table>
<thead>
<tr>
<th>Mode of delivery</th>
<th>MSAF+ (%) N=52</th>
<th>MSAF- (%) N=52</th>
<th>RR</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caesarean</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>27(51.9)</td>
<td>35(67.3)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>25(48.1)</td>
<td>17(32.7)</td>
<td>1.9</td>
<td>0.9-4.2</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Fig. 1. Mode of delivery based on type of meconium stained liquor

Table 4. Maternal outcomes in parturients (N=104)

<table>
<thead>
<tr>
<th>Maternal outcomes</th>
<th>MSAF+ (%) N=52</th>
<th>MSAF- (%) N=52</th>
<th>RR</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>48(92.3)</td>
<td>47(90.4)</td>
<td>1</td>
<td></td>
<td>0.7</td>
</tr>
<tr>
<td>Chorioamnionitis</td>
<td>2(3.8)</td>
<td>0(0.0)</td>
<td>-</td>
<td>-</td>
<td>0.2</td>
</tr>
<tr>
<td>Puerperal sepsis</td>
<td>1(1.9)</td>
<td>1(1.9)</td>
<td>1.0</td>
<td>0.1-16.4</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Table 5. Perinatal outcomes

<table>
<thead>
<tr>
<th>Parameters</th>
<th>MSAF+ (%) N=52</th>
<th>MSAF- (%) N=52</th>
<th>RR</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asymptomatic</td>
<td>25(48.1)</td>
<td>40(76.9)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NRFHR</td>
<td>11 (21.2)</td>
<td>3(5.8)</td>
<td>4.4</td>
<td>1.1-16.8</td>
<td>0.02</td>
</tr>
<tr>
<td>Apgar score at 1 minute (&lt;7)</td>
<td>8(15.4)</td>
<td>3(5.8)</td>
<td>3.0</td>
<td>0.7-11.9</td>
<td>0.1</td>
</tr>
<tr>
<td>Apgar score at 5th minute (&lt;7)</td>
<td>1(1.9)</td>
<td>0(0.0)</td>
<td>-</td>
<td>-</td>
<td>0.3</td>
</tr>
<tr>
<td>Birth asphyxia</td>
<td>2(3.9)</td>
<td>2(3.9)</td>
<td>1.0</td>
<td>0.1-7.4</td>
<td>1.0</td>
</tr>
<tr>
<td>Neonatal sepsis</td>
<td>19(36.5)</td>
<td>7(13.5)</td>
<td>3.7</td>
<td>1.4-9.8</td>
<td>0.01</td>
</tr>
<tr>
<td>NICU admission</td>
<td>21(40.4)</td>
<td>10(19.2)</td>
<td>2.9</td>
<td>1.2-6.9</td>
<td>0.02</td>
</tr>
<tr>
<td>Stillbirth</td>
<td>1(1.9)</td>
<td>0(0.0)</td>
<td>-</td>
<td>-</td>
<td>0.3</td>
</tr>
</tbody>
</table>

*NRFHR= Non reassuring fetal heart rate, *NICU= Neonatal intensive care unit

4. DISCUSSION

The aim of this study was to determine the proportion of MSAF in women presenting for childbirths, their risk factors and the maternal and perinatal outcomes of MSAF.

The proportion of MSAF was 19.1% per 273 parturients in the four-month period. Thick meconium was present in majority of the cases. Overweight multiparous parturients accounted for the majority of cases. Gestational age and post- date had no significant effect on MSAF.
Poor Apgar at the 1st minute, neonatal sepsis, MAS, FHR abnormalities, NICU admission were the perinatal outcomes associated with MSAF.

We reported a proportion of 19.1% for incidence of parturients with MSAF which was similar to the 11.2% incidence over a period of 5 months by Dohbit et al in Yaoundé [2]. This difference could be explained by the fact that the study in Yaoundé was carried out in a tertiary centre, thus the lower incidence was probably due to the fact that there were more specialists and facilities for the provision of adequate obstetric care and also the study in Yaounde had a bigger sample size.

The incidence of MSAF was higher in the age group of >30 years which was different from that reported in Pakistan where parturients in 26-30 age group were more likely to have MSAF [12]. Maternal age in the present study did not exert a significant effect on MSAF despite being an important variable having many adverse effects on the foetuses and neonates.

Anemia, PIH and prolonged rupture of membranes were not significantly associated with MSAF. The results of this study are similar to those in Yaoundé [2] but contrary to those in India [7] where PIH was associated with MSAF due to fetal hypoxia probably resulting from utero-placental insufficiency.

MSAF was twice more likely with parturients who had induction of labor as compared to their counter parts. The difference was not however statistically significant. This difference is because when misoprostol is used as an inducing agent it causes ileal contraction leading to passage meconium. This was similar to the results reported in India [11].

MSAF was three times more likely in those who had prolonged labor though this was not statistically significant. This was similar to the study carried out in Yaounde [2] This could be explained by the fact that prolonged labor causes an increase production of foetal cortisol which increases colonic contraction leading to passage meconium. This was also in accordance with the results in USA [13]. Furthermore, parturients with MSAF were two times more likely to have caesarean births. This partly reflects the abnormal foetal heart rate patterns associated with MSAF which was an indication of foetal distress in our setting due to lack of foetal scalp pH sampling and electronic foetal monitoring. Additionally, dilemma on the part of the obstetrician in managing such labours may have contributed to this observation as in such situations, most would opt for the fastest means of delivery. This finding was similar to that reported in India [7] and in Yaoundé [2]. The incidence of CS was twice more likely in parturients with thick MSAF when compared to those with thin MSAF. A statistically significant finding that was also reported in India [7].

All cases of chorioamnionitis were from the MSAF group. Meconium which is sterile in normal conditions reduces the antibacterial property of amniotic fluid by altering levels of zinc and thus facilitate intra-amniotic infections. Chorioamnionitis was present in 3.8% of cases with MSAF which was higher than that reported in Yaoundé [2]. In Yaounde, the study was carried out in two tertiary centres which are better equipped to identify and prevent the intra-amniotic infections. All cases with chorioamnionitis and puerperal sepsis had thick meconium stained liquor. Similar findings were documented in India [14].

Parturients with MSAF were four times more likely to have NRFHR. This can be explained by the fact that, NRFHR in combination with meconium is a sign of fetal hypoxia. This was similar to the results documented in India [14]. We found that, those with MSAF were 4 times more likely to have neonatal sepsis. This could be explained by the fact that meconium reduces the antibacterial properties of amniotic fluid thus causing intra-amniotic infections which is a risk factor for neonatal sepsis. A similar finding was reported in India [7]. The neonates with MSAF were three times more likely to be admitted at the 1st minute, neonatal sepsis, MAS, FHR abnormalities, NICU admission were the perinatal outcomes associated with MSAF.

<table>
<thead>
<tr>
<th>Obstetric factors</th>
<th>MSAF+(%) N=52</th>
<th>MSAF-(%) N=52</th>
<th>RR</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asymptomatic</td>
<td>25(48.08)</td>
<td>40(76.92)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NRFHHR</td>
<td>11(21.20)</td>
<td>3(5.80)</td>
<td>2.14</td>
<td>0.20-22.47</td>
<td>0.53</td>
</tr>
<tr>
<td>Neonatal sepsis</td>
<td>19(36.50)</td>
<td>7(13.50)</td>
<td>3.50</td>
<td>0.46-26.67</td>
<td>0.23</td>
</tr>
<tr>
<td>NICU admission</td>
<td>21(40.40)</td>
<td>10(19.20)</td>
<td>0.48</td>
<td>0.02-13.70</td>
<td>0.67</td>
</tr>
</tbody>
</table>

*NRFHHR=Non-Reassuring fetal heart rate, *NICU= Neonatal intensive care unit

Table 6. Multivariate analysis of factors significantly associated with MSAF
NICU like neonates in a study carried out in India [15]. This could be explained by the fact that, these neonates with adverse outcomes needed care at the NICU. MAS was present in 3.8% of cases with MSAF as in Yaoundé [2] but our incidence was lower than that reported in Ethiopia [16] because of the larger sample size in their study. There was a still birth in the group of parturients with thick meconium stained Liquor, similar to the study carried out in India [17]. With respect to meconium grading; NRFHR, Apgar Score < 7 at 1st minute, NS, NICU admission were more frequent in neonates of parturients with thick than thin MSAF. Neonates with MAS and low Apgar at 5th minutes occurred only with parturients who had thick MSAF. This could be explained by the fact that, thick meconium stained amniotic fluid is associated with more adverse outcomes because of its particulate nature causing respiratory obstruction during aspiration.

5. CONCLUSION

The proportion of parturients with MSAF was high at 19.1%. Caesarean deliveries were more frequent in parturients with thick MSAF. We recommend larger and robust cohort studies to further refine our findings.

This study confirmed the preexisting data already published in studies targeting various populations. However, we believe that every area should have their own data regarding the effect of MSAF on perinatal outcome since MSAF is a very frequent finding. The present study provided important data in medical policy making in this corresponding area. Also, this data may be, at least partly, generalizable in many developing countries.

6. STUDY LIMITATIONS

The diagnosis of MSAF in this study was based on clinical evaluation by naked eye examination of the amniotic fluid which is subjective. Furthermore, meconium was classified as “thick” or “thin” which was subjective and creates a risk of misclassification bias. The small sample size and consequent low study power likely led to type 2 error. It was a single centre study as such the results cannot be generalized. Furthermore, the study was carried in a secondary health care centre where procedures, equipment and expertise of staff were suboptimal for the proper evaluation and management of neonates of mothers with MSAF. However, the working conditions of this hospital reflect those of similar standing in other parts of the country. Moreover, our study has added to the understanding of MSAF and related maternal and foetal outcomes which had limited data in Cameroon.

AVAILABILITY OF DATA AND MATERIALS

The datasets of the study are available from the corresponding author on reasonable request.

CONSENT

All participants consented to participate in the study by signing or thumb printing a consent form. An assent for was also signed by parents or guardians for potential participants less than 21 years.

ETHICAL CONSIDERATIONS

The protocol was approved by the research panel of the Faculty of Health Sciences and Ethical clearance was sought from the Institutional Review Board of the Faculty of Health Sciences, University of Buea (N° 2017/003-504-04/SG/IRB/FHS) of 12/04/2017). Administrative authorization was obtained from the Regional Delegation of Public health for the South West Region, and the Medical Directors of the various health facilities involved in the study. All participants consented to participate in the study by signing or thumb printing a consent form. An assent for was also signed by parents or guardians for potential participants less than 21 years.

ACKNOWLEDGEMENTS

We are grateful to all the parturients who took part in the study and their guardians for accepting to participate. We thank the administration of the Limbe Regional Hospital for permitting us to conduct this study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES


QUESTIONNAIRE

Maternal and Perinatal Outcomes in Childbirths with Meconium Stained Amniotic Fluid in the Limbe Regional Hospital

Patient Code…………..

A. Maternal characteristics

1. Age (years)………………
2. Level of Education
   - None
   - Primary
   - Secondary
   - University
3. Occupation ……………
4. Marital Status……………
5. Parity …………………….  
6. Weight (Kg)……………
7. Height (m)…………….
8. BMI (kg/m²)……………
9. Gestational Age (weeks)………
10. Antenatal coverage
   - Booked
   - Unbooked
11. Medical illness during pregnancy
   - None
   - Chronic hypertension
   - Preeclampsia/Eclampsia
   - DM
   - HIV
   - Malaria
   - Anemia
   - Others……………
12. Drug Use
   - Yes
   - No
   If yes, which……
13. Previous history
   - None
   - Stillbirth
   - IUFD
   - Abortions
   - Others…………

B. Labour Characteristics

1. Onset of labour
   - Spontaneous
Induced

2. Time of rupture of membranes (ROM)
   □ Before onset of labour
   □ After onset of labour

3. Duration of ROM before delivery (mins)

4. Duration of Labour (hrs.)

5. Meconium Staining
   □ YES
   □ NO

6. Colour of meconium

7. Grade of Meconium
   □ Grade1
   □ Grade2
   □ Grade3

8. Stage of labour at diagnosis of MSAF
   □ Latent phase
   □ Active phase

9. Mode of Delivery
   □ Spontaneous vaginal Delivery (SVD)
   □ Instrumental
   □ Caesarean Section (CS)

10. Indications for operative delivery

11. Maternal complications

12. Temperature (°C)

C. Neonatal Characteristics

1. Sex

2. Mode of New-born resuscitation

3. Apgar Score (1st/5th min)

4. Birth Weight (kg)

5. Perinatal Complications

6. Time of birth to onset of complication (hrs.)

7. Duration of hospitalization (days)