Umbilical cord PH in pregnancies with and without meconium stained amniotic fluid

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Abstract: Meconium stained amniotic fluid (MSF) is a leading cause of neonatal mortality and morbidity. The aim of this study was to assess the association of umbilical cord vessels’ PH with pregnancies complicated by meconium stained amniotic fluid. This cross sectional study was conducted among 195 pregnant women. The umbilical cord blood samples of 96 neonates (52 neonates with normal vaginal delivery (NVD) and 44 with cesarean section (C/S)) with MSF and of 99 neonates (49 neonates with NVD and 50 with C/S) with clear amniotic fluid were collected. Demographic data (age, gestational age), antenatal characteristics (duration of labor, active pHase and second stage of labor, duration of induction, type of anesthesia), postnatal characteristics (Apgar score at 1 and 5 min) was documented for each patient. Women with preterm labor or other pregnancy related diseases (hypertension, preeclampsia, gestational diabetes mellitus, prolonged rupture of membrane) and multifetus pregnancies were excluded. Data was analyzed using SPSS (V.18) by statistical tests (independent T-test, chi-square, ANOVA). P-value below 0.05 considered statistically significant. The mean age of participants was 26.8 ± 5.4. The mean PH value in all participants was 7.26± 0.07. There was no significant difference between the two groups (case and control) for PH (p > 0.05). The results showed that, duration of active pHase of labor, Apgar score at 1 min and the number of pregnancies had significant correlation with umbilical cord PH (P < 0.05). There was no significant relation between umbilical cord PH and duration of labor and second stage of labor, meconium concentration, type of anesthesia, duration of induction (p > 0.05). The mean umbilical cord PH among patients with meconium stained amniotic fluid was higher in neonates born through cesarean section. Apgar score at 1 min was related to umbilical cord PH.


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Keywords: Pregnancy, Amniotic Fluid, Umbilical Cord. Acid-Base Imbalance

1. Introduction

Meconium stained amniotic fluid (MSF) is a leading cause of mortality and morbidity of neonates after delivery. Also, it is a diagnostic sign in pregnancies demonstrates the maturity of fetal intestinal tract. The prevalence of MSF was reported between 7 to 22 % of pregnancies, up to 42 weeks of gestation (Balchin, Whittaker et al. 2011, Lee, Mi lee et al. 2011, Gun Eryilmaz, Tavil et al. 2012).

The incidence of meconium passage increases with gestational age and it is estimated that 30% of post-term pregnancies are complicated with MSF (Ahanya, Lakshmanan et al. 2005). This physiologic phenomenon can lead to several complications such as meconium aspiration syndrome (MAS), fetal heart rate abnormalities and brain damage induced by hypoxia during intrauterine period and delivery (Kumar, Gupta et al. 2012, Narli, Kirimi et al. 2013).

After delivery, it can lead to lower APGAR score (Oddie 2010). It is estimated that about half of the patients with MSF, develop MAS (Hiremath and Gane 2012). several studies have demonstrated that the risk of MAS increases with decreasing PH level of umbilical cord vessels (Roett, Lawrence et al. 2010, van Ierland, de Boer et al. 2010). Nevertheless, some other studies have shown that, there is no relationship between the risk of MAS and acid – base status of umbilical cord (Fischer, Rybakowski et al. 2011).

The assessment of acid – base status of umbilical cord vessels, is an objective, noninvasive diagnostic method for evaluation of fetal hypoxia, early uteroplacental insufficiency in hospital, consequently results in therapeutic interventions and prevent more complications such as respiratory distress and ischemic – hypoxic encephalopathy of neonates (De Paco, Florido et al. 2011). Maternal complications containing recurrent urinary tract infections, chorioamnionitis and postpartum
infections are higher in women with MSF than in those without MSF (Markovitch, Mazor et al. 1993).

Treatment strategies include amnioinfusion to dilute amniotic fluid (Siri 2010). Because of maternal and fetal complications of MSF, it is necessary to pay special attention and care for the patients with this problem. Accordingly, we aimed to assess the association of umbilical cord vessels’ pH with pregnancies complicated with meconium stained amniotic fluid.

2. Material and Methods

This cross sectional study was carried out in 2011-2012 among the pregnant women attended to Shariati Hospital in Bandar Abbas, southern Iran.

A number of 195 pregnant women were included in the study. The study was approved by Ethical committee of Shariati Hospital and written informed consent was obtained from the participants. Random alignment was considered for age and gestational age. The umbilical cord blood samples of 96 neonates (52 neonates with normal vaginal delivery (NVD) and 44 with cesarean section (C/S)) with MSF and 99 neonates (49 neonates with NVD and 50 with C/S) with clear amniotic fluid were collected. The umbilical cord was double clamped just after delivery and a segment of 10-20 cm of umbilical cord was excised. The umbilical cord blood samples were poured into heparinised syringes and placed on ice dishes and transported to laboratory for assessing the blood gas status of samples.

Other information such as meconium concentration (thick or thin), gestational age, duration of induction, the length of rupture of membrane (ROM), mode of delivery, duration of delivery were collected for all patients. The Apgar scores were calculated for all neonates at 1 and 5 minutes of age. The umbilical cord arterial and venous PH was 7.26 ± 0.07 and among patients with MSF was 7.27 ± 0.023. There was no significant difference in PH between the patients with and without MSF (P-value = 0.35). The umbilical cord PH, had significant negative correlation with the duration of active pHase of labor (P < 0.001).

In this study patients with underlying disease or history of gestational diabetes mellitus, gestational hypertension, multifetal pregnancies, breech presentation, and placenta previa and placenta abruptio were excluded. Data analysis was performed by SPSS (V.19) using descriptive statistics such as frequency, mean and standard deviation and statistical tests such as independent T-test, chi square and Pearson correlation. P-value < 0.05 was considered as statistically significant.

3. Results

Among the participants, the mean age was 26.8 ± 5.4 years. The mean gestational age at delivery was 39.1 ± 1.1 weeks and the mean birth weight was 3155.6 ± 393.3 g.

As table 1 shows, the mean age of gestation and duration of rupture of membrane (ROM) were significantly different among patients with MSF and those with clear amniotic fluid.

Table 1: demographic and antenatal characteristics of population with MSF and without MSF

<table>
<thead>
<tr>
<th>Variable</th>
<th>Case</th>
<th>Control</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal age (y, mean ± SD)</td>
<td>26.7 ± 5.6</td>
<td>26.9 ± 5.1</td>
<td>NS*</td>
</tr>
<tr>
<td>Gravida (median and range)</td>
<td>2 (1-8)</td>
<td>2 (1-8)</td>
<td>NS</td>
</tr>
<tr>
<td>Gestational age (wk, mean and range)</td>
<td>39.6 ± 1.1</td>
<td>38.5 ± 1</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Duration of induction (min, mean ± SD)</td>
<td>18.94 ± 57.1</td>
<td>3.14 ± 2.24</td>
<td>NS</td>
</tr>
<tr>
<td>Duration of active pHase (min, mean ± SD)</td>
<td>67.34 ± 48</td>
<td>89.76 ± 67.06</td>
<td>NS</td>
</tr>
<tr>
<td>Duration of ROM (min, mean ± SD)</td>
<td>126.72 ± 172.15</td>
<td>205.39 ± 231.46</td>
<td>0.023</td>
</tr>
</tbody>
</table>

*: Not significant
+: standard deviation

The mean umbilical cord arterial and venous PH was 7.26 ± 0.07. The mean value of PH in patients with MSF was 7.27 ± 0.07 and among patients with clear amniotic fluid was 7.26 ± 0.08. There was no significant difference in PH between the patients with and without MSF (P-value = 0.35). The umbilical cord PH, had significant negative correlation with the duration of active pHase of labor (P < 0.001).

In this study, 8 neonates needed to ambo mask and oxygen after delivery; 6 were in MSF group and 2 were in group with clear amniotic fluid. There was no evidence of respiratory distress syndrome, and no one needed ventilator therapy. Also, there was no evidence of intracranial hemorrhage or other brain damage among the neonates.

In table 2, characteristics of neonates with and without MSF after delivery are listed with details.

Table 2: characteristics of neonates with and without MSF after delivery

<table>
<thead>
<tr>
<th>Variable</th>
<th>Case</th>
<th>Control</th>
<th>NS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth weight</td>
<td>3177.94 ± 3133.8</td>
<td>±</td>
<td>NS</td>
</tr>
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</table>
predict the maternal metabolic status (Vandenbussche, Oepkes et al. 1999). Thus, considering arterial and venous sampling can predict the metabolic status of both neonate and mother.

### Table 3: association of umbilical cord PH with number of pregnancy

<table>
<thead>
<tr>
<th>Gravid</th>
<th>Number</th>
<th>Mean (SD)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>55</td>
<td>7.22 ± 0.08</td>
<td>0.007</td>
</tr>
<tr>
<td>2</td>
<td>66</td>
<td>7.28 ± 0.06</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>33</td>
<td>7.27 ± 0.08</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>19</td>
<td>7.28 ± 0.07</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>7.23</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>7.32 ± 0.04</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>7.19 ± 0.07</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>7.31 ± 0.07</td>
<td></td>
</tr>
<tr>
<td>total</td>
<td>183</td>
<td>7.26 ± 0.07</td>
<td></td>
</tr>
</tbody>
</table>

In this study, the mean birth weight was 3155.6 ± 393.3 g. This finding is higher than other studies conducted in India (Agarwal, Agarwal et al. 1991), Saudi Arabia (Zakzouk 1997) and Egypt (Dhar, Mowlah et al. 2011). This could be due to better sanitary systems in Iran compared to other countries in western Asia.

As our results showed, gestational age among case groups was higher than the control group. It could be due to a pPhysiologic process in which, increasing gestational age leads to fetal intestine maturation, consequently meconium passage will happen. It also could be due to increasing uterine activity with increasing gestational age. A finding reported by Bakker and colleagues (Bakker, Kurver et al. 2007).

The results of our study showed that, Apgar score at 1 min was higher among case group in comparison to control group. While, in a study conducted by Gun Eryilmaz, they concluded that, Apgar score at 1 min was not significantly different among case and control groups (Eryilmaz, Aksakal et al. 2012). Several authors demonstrated umbilical cord PH depends various factor such as elective cesarean section, parity of mothers, spinal anesthesia during operation and uterine contraction during the second stage of labor (by impairment in placental flow) (Leung, Lok et al. 2004, Banerjee, Stocche et al. 2010).

Our results showed neonates who were born with C/S had higher umbilical cord PH. This finding was consistent with other studies performed by Pence and colleagues (S, H et al. 2002).

In this study we found that there was no statistically significant difference between patients
underwent general and spinal anesthesia. While, jain and colleagues demonstrated patients with spinal anesthesia had lower umbilical cord pH in compared with general anesthesia (Jain, Bhardwaj et al. 2013). It is notable that, in our study umbilical cord PH value for patients with spinal anesthesia was higher than general anesthesia. Also, in our study only 5 patients underwent general anesthesia, and the patient number in this group was too small to be conclusive.

Our results showed meconium passage and induction had no significant association with umbilical cord PH. On the other hand, duration of active phase had significant associations with cord blood PH. Therefore patients induction during active phase may be beneficial in pregnancies with meconium stained amniotic fluid.

We enrolled all of the patients with cesarean either elective or emergency in our study, the neonates who classified in emergency may affect the final results of our study, therefore we recommend further studies with considering elective and emergency deliveries with sufficient sample size for both groups. Also, we suggest to consider general and spinal anesthesia as a separate variable with sufficient population size.

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