Study of correlation between maternal fatigue and uterine contraction pattern in the active phase of labour

Samira Ebrahimzadeh, Nahid Golmakani, Maryam Kabirian and Mohhamad T Shakeri

Aims and objectives. To evaluate the correlation between maternal fatigue and uterine contraction pattern at the beginning of the active phase of labour.

Background. Fatigue is one of the most common complaints in pregnant women that often continues until delivery. Maternal fatigue prolongs the labour process and increases the rate of cesarian section. Studies on the pattern of uterine contractions have shown that the length of the fall time is longer in prolonged labours than in normal deliveries.

Design. A cross-sectional study.

Methods. This study was conducted on 100 primiparous women who were referred to Ommolbanin Hospital (Mashhad, Iran) in 2011. Maternal fatigue was assessed at the beginning of the active phase of labour. Then, the pattern of uterine contractions was monitored for 30 minutes by an external tocodynamometer. The F/R ratio was determined by measuring the time for a contraction to return to its baseline from its peak and the time for a contraction to rise to its peak. The data were analysed by chi-square and ANOVA tests.

Results. The results showed that there was a significant relationship between maternal fatigue and uterine contraction pattern. The F/R ratio was increased with increase in fatigue severity.

Conclusions. Fatigue causes changes in the pattern of uterine contractions. The return time of a contraction from its peak to its baseline (fall) is increased with increase in fatigue severity.

Relevance to clinical practice. Offering strategies to prevent tiredness and reduce the related fatigue complications.

Key words: active phase of labour, maternal fatigue, uterine contraction pattern

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Introduction

Childbirth is a period of woman’s life that encompasses physiological and psychological fatigue and often has bad effects on women in labour (Tzeng et al. 2008). Fatigue is also one of the most common complaints of women during pregnancy (Chien & Ko 2004, Greenfield & Samaras 2006) that often lasts until delivery (Chien & Ko 2004). Fatigue has also been commonly accepted as a part of the experience of childbirth (Pugh et al. 1998). Although the main causes of fatigue during pregnancy have not yet been identified entirely; however, based on the physiological principles and theories of many researchers, it occurs because of energy imbalance owing to hormonal and metabolic changes, psychological and
physical adjustments or diseases in pregnancy (Pugh & Milligan 1995, Pugh 1999, Abasi et al. 2007). Reasons for predelivery fatigue are pressure of enlarged uterus, foetal movements, hormonal changes and changes in sleep patterns (Cinar et al. 2007).

Researchers suggest that the highest level of fatigue appears in the third trimester and that it has a direct relationship with sleep disorder (Pugh & Milligan 1995). Also, such problems as nocturnal frequency, sleep disorder because of foetal movements, uterine contractions, leg cramps, digestive and respiratory disorders and maternal weight gain in the last months of pregnancy can cause fatigue (Abasi et al. 2007). Increasing fatigue can cause some problems, during the pregnancy, delivery and postpartum, like increasing incidence of preterm labour, prolonged labour, instrumented delivery, cesarian section (CS) and postpartum depression (Pugh et al. 1998, Chien & Ko 2004, Lee & Gay 2004, Cinar et al. 2007).

Prolonged labour may be associated with some problems such as intrauterine infection, dehydration, maternal fatigue, vesicovaginal fistula, secondary infertility, neonatal asphyxia, cerebral palsy, foetal death, neonatal death and even maternal death (Murphy 2001, Kordi & Ebrahimi 2002). According to the World Health Organisation reports, about 3% of children (3-6 millions) are suffering from moderate to severe asphyxia caused by prolonged labour (Kordi & Ebrahimi 2002). Timely diagnosis of abnormal labour progress and prevention of prolonging labour significantly may reduce the risk of postpartum haemorrhage and infection. It may also eliminate the risk of obstructed labour, uterine rupture and the related complications (Chhabra et al. 2000, Kordi & Ebrahimi 2002).

The most common cause of poor labour progress is inadequate uterine contractions (El-Hamamy & Arulkumaran 2005). Poor function of uterine may be due to incomplete uterine polarisation (Gyselaers et al. 1991). Studies on isolated myometrial tissue have shown that there is a relationship between electrical events and uterine contractions (Schlembach et al. 2009). Studies conducted to investigate the pattern of uterine contractions have shown that the length of time a contraction takes to return from its peak to its baseline (the fall time) in relation to its time to reach its peak (the rise time) was longer in abnormal labours than in normal deliveries (Driggers et al. 2001, Althaus et al. 2006). Researchers found that the mean F/R ratio was 1:77 in the CS group and 1:55 in the vaginal delivery group, indicating that the women who had CS delivery, the time of return from peak to baseline was longer for each contraction (Althaus et al. 2006).

There are many different patterns of uterine contractions (Gyselaers et al. 1991). Some studies have shown that coupling of uterine contractions is a sign to dysfunctional labour, which is associated with high prevalence of abnormal delivery (Cronje & Westhuizen 1988, Gyselaers et al. 1991, Ferreira & Odendaal 1994). It has also been suggested that the number of contractions $\geq$12 per hour makes more progress of cervical condition and foetal station and, consequently, causes the progress of labour (Pates et al. 2007). Inadequacy of uterine contractions is influenced by several physical and psychological factors, including lack of providing energy, dehydration, ketoacidosis, fatigue and psychological and physical factors (Enkin et al. 2000).

Prevention of difficult labour and the role of effective uterine contractions in labour progress are very important. Therefore, identifying the factors associated with uterine contraction pattern that can be predictive of delivery pattern seems necessary.

Methods

Study design and data collection

This cross-sectional study was conducted on 100 primiparous women referred to Ommolbanin Hospital (Mashhad, Iran) in 2011 under an institutional review board–approved protocol. Ommolbanin Hospital is a specialised hospital in Obstetrics and Gynaecology. In this educational hospital (related to the Mashhad University of Medical Science) about 400–500 deliveries are carried out per month (average of 57% primiparous, 38% second to fourth delivery and 5% fifth delivery and more) that 40% of them are CS.

Inclusion criteria were the following: maternal age between 18–35 years, primiparity, singleton pregnancy with cephalic presentation, gestational age between 37–42 weeks, no medical diseases, no history of psychiatric hospitalisation owing to mental diseases, no nicotine dependency or addiction to other drugs, no specific maternal diseases during the pregnancy, no limitations on physical activity or diet, no medication in except of prenatal vitamins and BMI $< 26$. The eligible primiparous women were explained about the study and its objectives. The consent forms were filled in, and the questionnaires that contained demographic, obstetric information, maternal fatigue and sleep status during pregnancy and the 48 hours before of the admission to the hospital were accomplished.

Methodology

Maternal fatigue was assessed at the beginning of the active phase of labour (cervical dilation 3–4 cm), using visual analogue scale. The visual analogue scale is a single, 10-cm
line. For this study, the visual analogue scale for fatigue anchors from ‘no fatigue at all’ to ‘the most fatigue I’ve ever had’. Fatigue was measured by tape that was 10 cm, and it had no numbers recorded on it. The tape was shown to the participants in the beginning of the first of labour. The samples were marked their fatigue from 0–10 with an × mark on the tape. Then, the fatigue score was obtained by measurement of tape with a ruler.

Fatigue was divided into three groups: 0–3 (mild fatigue), 4–6 (moderate fatigue) and 7–10 (severe fatigue).

Then, the pattern of uterine contractions was monitored for 30 minutes with an external Tocodynamometer, model FC1400. All pregnant women in the labour room were routinely monitored to confirm foetal well-being and quality of uterine contractions for 20 minutes, but the participants in this study were monitored 10 minutes longer (approximately 30).

Pelvic examination were performed and recorded in the checklist. To register uterine contractions, a sensor belt was closed on the abdomen between the navel and uterine fundus, slightly inclined to the right. Before and during monitoring, the exclusion criteria were use of oxytocin or any stimulating or sedating drugs, rupture of membrane longer than 12 hours and suspicious or true cephalopelvic disproportion. The mothers were being taken routine care, and the first stage of labour was assessed by childbirth (partograph) (chart). Variables such as amount of fluids, received oxytocin and no pain medication were also evaluated and recorded in the checklist. The cases of emergency CS for any reasons in except of lack of labour progress were excluded.

Analysis

The recordings were coded by the assistance researcher. Then, the recordings were studied and calculated individually by the researchers. The F/R ratio was determined by measuring the time for a contraction to return to its baseline from its peak and the time for a contraction to rise to its peak. The F/Rs were averaged over the number of contractions. The data were collected, and statistical analysis was performed using spss 11.5 (SPSS Inc., Chicago, IL, USA) software and chi-square test, correlations and ANOVA tests.

Results

In this study, among the 118 participants who had entrance criteria, four cases avoided cooperation with researchers, nine of them needed CS as a result of the deceleration of foetal heart rate, meconium stained, placenta abruptia, and five cases did not allow monitoring to continue of as long as 30 minutes. So the drop-out rate was estimated <20%.

Characteristics of the subjects showed that their mean age was 23.65 ± 4.01. Also, the ANOVA test results showed a significant relationship between fatigue and age of the participants (p = 0.037, F = 3.424) as fatigue level was higher in the younger women.

In terms of education, 38.1% of the women had secondary education and 98.9% were housewives. Their spouses were mostly self-employed, and 65.7% of their incomes were in sufficiency level. No significant correlation was observed between fatigue severity and education level, body mass index, occupation, spouse’s income, prenatal care, unwanted pregnancy and neonatal birth weight (p > 0.05) (Tables 1 and 2).

The sample’s mean amount of sleep was 9.77 ± 4.43 hours within the range of 3–20 hours in 48 hours before admission. In this study, 18.3% of the sample expressed less than six hours of sleep during 48 hours. But the difference between the amount of sleep and fatigue level was not statistically significant (p = 0.837 and F = 0.178).

The mean fatigue level was calculated as 6 ± 2.85, and the correlation between F / R ratio and fatigue level and fatigue severity was statistically significant (p < 0.001 and p = 0.007, r = 0.27, respectively).

A significant correlation was observed between the maternal fatigue severity and the pattern of uterine contractions using the Spearman’s correlation test (r = 0.22, p = 0.026). Accordingly, with increasing fatigue level, the return time of the contractions to baseline was prolonged in each contraction.

The length of the first stage of labour was increased with increase in the maternal fatigue severity (p = 0.014 and r = 0.25) (Table 3).

The results showed that fatigue level was higher in the women who had CS (6.45 ± 1.7) comparing to those with vaginal delivery (5.84 ± 3.3). Also by using the chi-square test, a significant statistical relationship was observed between fatigue level and the mode of delivery (p < 0.001).

Discussion

Pregnancy physiological changes and foetus’s nutritional needs elevate maternal energy requirements. If it cannot be provided sufficiently, fatigue will occur (Cahill 1999). The results of this study revealed that about one-third of the women had severe fatigue at the onset of the active phase of labour. Similar to our study, Tzeng et al. (2008) have also reported the highest fatigue-increasing rate in the active phase.
of labour. Fatigue in the second and third trimesters of pregnancy is related to maternal weight gain, increased cardiac output, increased foetal weight and lack of sleep (Lee & DeJoseph 1992).

Pregnancy and childbirth make changes in the lifestyle of women, and some new psychological and biological experiences happen during these periods. Psychological changes are naturally associated with the physiological and hormonal

Table 1 Comparison of the relationship between demographic characteristics and fatigue severity in pregnant women

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Mild fatigue $n = 23$</th>
<th>Moderate fatigue $n = 41$</th>
<th>Severe fatigue $n = 36$</th>
<th>ANOVA test results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years) mean ± SD</td>
<td>23 ± 3.44</td>
<td>24.88 ± 4.42</td>
<td>22.6 ± 3.5</td>
<td>3.357 0.039</td>
</tr>
<tr>
<td>Weight (kg) mean ± SD</td>
<td>66.79 ± 11.8</td>
<td>69.37 ± 11.8</td>
<td>87.85 ± 1.19</td>
<td>0.773 0.465</td>
</tr>
<tr>
<td>Height (cm) mean ± SD</td>
<td>159.5 ± 4.5</td>
<td>159.3 ± 4.2</td>
<td>160.4 ± 5.07</td>
<td>0.565 0.569</td>
</tr>
<tr>
<td>Education (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uneducated</td>
<td>5</td>
<td>52.5</td>
<td>8.6</td>
<td>Chi-square test results</td>
</tr>
<tr>
<td>Elementary school</td>
<td>10</td>
<td>32.5</td>
<td>20</td>
<td>df = 8 0.376</td>
</tr>
<tr>
<td>Middle school</td>
<td>50</td>
<td>45</td>
<td>43.3</td>
<td></td>
</tr>
<tr>
<td>High school</td>
<td>30</td>
<td>20</td>
<td>31.4</td>
<td></td>
</tr>
<tr>
<td>Higher</td>
<td>5</td>
<td>–</td>
<td>5.7</td>
<td></td>
</tr>
<tr>
<td>Income (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than sufficient level</td>
<td>31.6</td>
<td>17.5</td>
<td>31.4</td>
<td>df = 4 0.374</td>
</tr>
<tr>
<td>Sufficient level</td>
<td>68.4</td>
<td>82.5</td>
<td>65.7</td>
<td></td>
</tr>
<tr>
<td>More than sufficient level</td>
<td>–</td>
<td>–</td>
<td>2.9</td>
<td></td>
</tr>
</tbody>
</table>

Table 2 Comparison of the relationship between pregnancy characteristics and fatigue severity

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Mild fatigue $n = 23$</th>
<th>Moderate fatigue $n = 41$</th>
<th>Severe fatigue $n = 36$</th>
<th>Chi-square test results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prenatal care (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>94.4</td>
<td>97.4</td>
<td>94.3</td>
<td>2 0.772</td>
</tr>
<tr>
<td>No</td>
<td>5.6</td>
<td>2.6</td>
<td>5.7</td>
<td></td>
</tr>
<tr>
<td>Unwanted pregnancy (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>5.6</td>
<td>10.3</td>
<td>8.6</td>
<td>2 0.842</td>
</tr>
<tr>
<td>No</td>
<td>94.4</td>
<td>89.7</td>
<td>91.4</td>
<td></td>
</tr>
<tr>
<td>Delivery (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vaginal</td>
<td>73.9</td>
<td>69.4</td>
<td>36.5</td>
<td>2 &lt;0.001</td>
</tr>
<tr>
<td>Cesarian</td>
<td>26.1</td>
<td>30.6</td>
<td>63.5</td>
<td></td>
</tr>
<tr>
<td>Neonatal weight (g) mean ± SD</td>
<td>3278.42 ± 397.27</td>
<td>3493.4 ± 4.3</td>
<td>3324.12 ± 367.21</td>
<td>2.608 0.079</td>
</tr>
</tbody>
</table>

Table 3 Comparison of fatigue severity and pattern of uterine contractions and the length of the first stage of labour

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Mild fatigue $n = 23$</th>
<th>Moderate fatigue $n = 41$</th>
<th>Severe fatigue $n = 36$</th>
<th>ANOVA test results</th>
</tr>
</thead>
<tbody>
<tr>
<td>F/R ratio mean ± SD</td>
<td>1.08 ± 0.25</td>
<td>1.3 ± 0.37</td>
<td>1.4 ± 0.38</td>
<td>9.296 0.001</td>
</tr>
<tr>
<td>Number of contractions</td>
<td>84.2 ± 2.3</td>
<td>77.7 ± 2.11</td>
<td>75.1 ± 2.3</td>
<td>1.070 0.347</td>
</tr>
<tr>
<td>The length of the first stage of labour mean ± SD</td>
<td>5.58 ± 3.09</td>
<td>6.3 ± 2.7</td>
<td>7.9 ± 3.8</td>
<td>0.604 0.014</td>
</tr>
</tbody>
</table>
changes that occur during a normal pregnancy. Because of approaching to the delivery date, some anxieties may emerge (Cinar et al. 2007). Fatigue is affected by various factors that naturally occur, such as production of metabolites, changes in energy level and energy-producing enzymes, activity/rest pattern, sleep/wake-up pattern, social status, lifestyle, psychological condition, environmental factors, diseases and their severity and methods of treatment (Cinar et al. 2007, Rosenthal et al. 2008).

In this study, exclusion criteria included the history of medical diseases, psychological disorders and any complications during pregnancy and childbirth. The results of assessing of the correlation between the demographic information and pregnancy with fatigue showed that among all of the controlled demographic characteristics, fatigue levels were only associated with age ($p = 0.039$). So fatigue was higher in younger women. In addition, there is no significant correlation between birth weight, prenatal care and wanted/unwanted pregnancy with fatigue levels and intensity.

Our results showed that the $HR$ ratio increases with increase in fatigue severity ($p = 0.026$). Studies have shown that the pattern of uterine contractions is different in the women with normal vaginal delivery than in those with CS because of the lack of labour progress and that the fall time of contractions is shorter in vaginal delivery (Driggers et al. 2001, Althaus et al. 2006). The most common cause of poor progress of labour is inadequate uterine contractions (El-Hamamy & Arulkumaran 2005) because foetal head station and cervical dilation are two main physiological parameters by which the progress of labour is evaluated, and uterine contractions make both of them increase (Luria et al. 2009).

Muscle fatigue increases the probability of ischaemia. Changes in fibro-muscle permeability decrease the speed of ion conduction (when the motor neuron activates, electro-chemical events will be occur. Exit of potassium through the membrane increases the permeability of ionic membrane to sodium. This activity can potentially spread throughout all the muscle fibres). Fibro-muscle conduction velocity is not only affected by ischaemia, but also created by the imbalance between sodium and potassium ions and low muscle temperature, which reduces the conduction velocity of muscle fibres (Mayberry et al. 1999).

In this study, the length of the first stage of labour was longer in the women with higher fatigue level. It is possible that some factors that cause a prolonged labour make more maternal fatigue, and the $F/R$ ratio is greater in these cases. In our study, the women in the CS group expressed more fatigue than those in the vaginal delivery group ($p < 0.001$). Similarly, Chien & Ko (2004) reported more caesarean deliveries in women with higher fatigue scores ($p < 0.001$). The decision for CS depends on several factors, but mother’s tolerance and energy level are considered as important factors.

In this study, less number of samples is a limitation but it helped the researchers to show high-quality control of interfering variables.

Fatigue during pregnancy may negatively affect pushing and tolerating labour pain by decreasing the maternal effectiveness. Therefore, the women who are more tired may choose CS or the caregivers may recommend it to them (Chien & Ko 2004). Also, normal and abnormal factors that are the causes of CS and abnormal uterine contractions might be the reasons for fatigue, but more studies in this topic seem necessary (Althaus et al. 2006).

In our study, 89.9% of the samples were housewives. Doing housework and taking care of children without psychosocial support lead to maternal fatigue (Hung et al. 2002). As this fatigue is repeated and continues every day, so it may turn into chronic fatigue. Acute fatigue has a protective role owing to the avoidance of harmful activities while, owing to poor attention paid to chronic fatigue because, it has fewer acute complications, so it can be more dangerous (Cinar et al. 2007).

There are two types of fatigue, central and peripheral. Central fatigue occurs when the nerve messages are transferred from the central nervous system to the environment and enough muscle contractions do not happen. Furthermore, it can be caused by sleep disturbances and neurological disorders or sepsis. Central fatigue is associated with physiological sleepiness. (Mayberry et al. 1999).

According to the result of the study, there is no significant correlation between the rates of sleep (especially less than six-hours sleep during the 48 hours before of the admission) and fatigue ($p = 0.83$).

Sleep disorder is exacerbated during the pregnancy and affect a large number of pregnant women (Suri et al. 2009). In this study, 18.3% of the pregnant women expressed less than six hours of sleep during 48 hours. Sleep disorder is an important problem during the pregnancy, especially in the third trimester. Researchers have found that the quality of sleep is deteriorated over the last five days of pregnancy, and the lowest quality is on the night before hospitalisation. They concluded that there was a significant relationship between the amount of sleep during the night before hospital admission and pain sensation in the women whose labour has started spontaneously (Beebe & Lee 2007).

Peripheral muscle fatigue is caused by constantly stretching of muscle fibres (Mayberry et al. 1999). Fatigue is a common aspect of pregnant women’s life, and the highest level of fatigue appears at the delivery time that may affect on the uterine contraction pattern and quality, the length of labour and the...
mode of delivery. It may, finally, result in bad outcomes in both mother and infant. Therefore, this aspect of health should be diagnosed as soon as possible. Women should be screened for fatigue in the prenatal period, and a structured plan for regular physical activity such as aerobic exercise and walking should be trained (Rosenthal et al. 2008).

Conclusion

The findings of this study confirmed that fatigue causes changes in the uterine contraction pattern. The return time of a contraction from its peak to its baseline (the fall time) is increased with increase in fatigue severity. Also, the length of the first stage of labour and the rate of CS are increased with increase in the maternal fatigue severity.

Relevance to clinical practice

Considering the correlation between fatigue and prolonged labour, timely diagnosis of fatigue during labour seems necessary to prevent maternal and neonatal complications. Furthermore, it offers strategies to prevent tiredness and reduce related fatigue complications.

Acknowledgements

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Contributions

Study design: SE; data collection and analysis: SE, NG, MK, MTS and manuscript preparation: SE, NG.

Conflict of interest

None.

References


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