Factors impairing exclusive breastfeeding initiation in women who received labor neuraxial analgesia: A single-center retrospective observational study in Japan

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Research Article

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Abstract

Background

Breastfeeding is beneficial for both the mother and infant. However, the factors impairing initiation of exclusive breastfeeding have not been sufficiently investigated in women that received labor neuraxial analgesia. This study aims to clarify the rate of successful initiation of exclusive breastfeeding in women that received labor neuraxial analgesia in our hospital, and any factors impairing it at one month postpartum.

Methods

We retrospectively reviewed the 376 women who had received labor neuraxial analgesia between January 2011 and May 2022. Univariate and multivariate logistic regression analyses were performed to determine factors influencing exclusive breastfeeding.

Results

The rate of exclusive breastfeeding at one month in women who received labor neuraxial analgesia was 43.1%. Exclusive breastfeeding was shown to have univariate association with multiparity ($P = 0.0001$), second stage of labor ($P = 0.046$), oxytocin use ($P < 0.0001$), vacuum extraction delivery ($P = 0.001$), amount of bleeding ($P = 0.027$), and neonatal birthweight ($P = 0.010$). Multivariate logistic regression analysis revealed that oxytocin use and vacuum extraction delivery were mother-related factors and lower birthweight was an infant-related factor that were significant predictors of impairment of the initiation of exclusive breastfeeding at one month after delivery.

Conclusion

Oxytocin use and vacuum extraction delivery as maternal factors and lower birthweight as an infant factor were shown to be a significant predictors of impairment of the initiation of exclusive breastfeeding at one month after delivery.

Introduction

Breastfeeding is beneficial for both the mother and the infant, and the World Health Organization (WHO) recommends exclusive breastfeeding [1]. For the mother, breastfeeding increases uterine contractions [2], increases bone mineral density, and decreases the risk of developing type II diabetes mellitus, and it may decrease the risk of ovarian cancer and breast cancer [3]. Breastfeeding has also been shown to accelerate the return to the mother’s pregestational bodyweight and to be associated with a decreased risk of developing postpartum depression [4]. Beneficial effects of breastfeeding for the infant include lower risks of sudden infant death syndrome, respiratory infections, diabetes, and leukemia [3]. Factors associated with successful breastfeeding have been investigated. Meta-analysis showed that maternal smoking, cesarean delivery, parity, infant-mother separation (including both early skin-to-skin contact and
rooming-in of infants in the hospital), maternal educational attainment, and breastfeeding education received by the mother or parents are associated with initiation and continuation of breastfeeding [5]. The effects of labor neuraxial analgesia on breastfeeding have also been investigated. A systematic review regarding the effects of labor neuraxial analgesia on breastfeeding showed heterogenous results [6], and further clarification is needed on the factors involved.

In Japan, the overall rate of exclusive breastfeeding in the first month has been reported to be 51.3%, although 93% of expectant mothers had the intention to initiate exclusive breastfeeding [7]. Significant risk factors for unsuccessful initiation of exclusive breastfeeding have reportedly included pre-pregnancy obesity, older maternal age, primiparity, cesarean delivery, earlier gestational week, status of a light-for-date infant, and maternal–child separation [8]. A nation-wide survey in Japan showed that the percentage of women receiving labor analgesia has been gradually increasing and has reached 8.6% (Ministry of Health, Labour and Welfare 2020 Medical Facilities (static) Survey) [9]. However, the rate of exclusive breastfeeding and the factors impairing breastfeeding in women who received labor neuraxial analgesia have not been sufficiently investigated.

This retrospective cohort study was designed to clarify the rate of exclusive breastfeeding in women that received labor neuraxial analgesia. We aimed to determine the factors involved in impairment of initiation of exclusive breastfeeding at one month postpartum in women who received labor neuraxial analgesia in our hospital.

**Methods**

**Patient Sample**

The protocol of this study was approved by the Wakayama Medical University Institutional Research Ethics Review Committee (No. 3097) and it was conducted in accordance with the declaration of Helsinki. We conducted a retrospective cohort study of the women who received neuraxial analgesia during labor between January 2011 and May 2022 at a single academic medical center (Wakayama Medical University Hospital). Our institution has about 450–500 deliveries each year and the rate of labor neuraxial analgesia has gradually been increasing: 6.5% in 2019, 8.0% in 2020 and 14.5% in 2021. Our hospital has been actively promoting breastfeeding by providing prenatal information classes and pamphlets about breastfeeding and its benefits. In the labor room, all newborns are placed on the mother’s chest immediately after delivery for early mother-infant contact. Midwives visit on a daily basis to observe and improve breastfeeding techniques. After discharge from the hospital, outpatient breast care is available upon request. The initial cohort was 437 women that received labor neuraxial analgesia. Exclusion criteria were women whose neonate was admitted to the intensive care unit (n = 31), women who had an emergency cesarean section after induction of neuraxial analgesia during labor (n = 20), women who had multiple pregnancies (n = 4), women who had medication that meant breastfeeding was not appropriate (n = 1), fetal death (n = 1), and incomplete data (n = 4). The final study cohort included 376 women (Fig. 1). The women were divided into two groups according to success of initiation of
exclusive breastfeeding at one month after delivery. Labor neuraxial analgesia was either by epidural anesthesia alone or combined with spinal-epidural analgesia (CSEA).

**Labor Neuraxial Analgesia**

Neuraxial analgesia was started during the labor period whenever the pregnant women requested it. For CSEA, the needle-through-needle technique was used. Dural puncture was made with a 27-gauge spinal needle through an 18-gauge Touhy needle at the L3–4 or L4–5 vertebral interspace. After confirming the correct placement of the spinal needle by outflow of cerebrospinal fluid, 2.5 mg bupivacaine and 20 µg of fentanyl was administered. Then, an epidural catheter was inserted 5 cm cephalad through an 18-gauge Touhy needle. For epidural analgesia alone, an epidural catheter was inserted at the level of L3/4. Epidural drug administration was performed using patient-controlled epidural analgesia (PCEA) for both CSEA and epidural alone. The PCEA regimen for CSEA was 5 mL bolus dose of 0.12% ropivacaine with 2 µg/mL fentanyl without background infusion, 30 mL maximum allowable dose per hour and 5-min lockout interval. For epidural anesthesia alone, 0.1% levobupivacaine with 1.6 µg/ml fentanyl was continuously administered at a rate of 8 ml/h and a 3 ml bolus was administered every 30 min. Labor neuraxial analgesia was stopped at the end of delivery.

**Data Analysis**

Information obtained from medical records included information on maternal and neonatal characteristics and information regarding delivery. To determine factors impairing exclusive breastfeeding at one month postpartum in women who received labor neuraxial analgesia, we performed univariate and multivariate logistic regression analyses. Continuous variables are presented as mean ± standard deviation (SD) or median (interquartile range) and categorical variables were presented as number (proportion). Comparisons were made by χ² test, t test, Mann–Whitney U test or Fisher's exact test. Clinically significant predictors of exclusive breastfeeding from the univariate analyses with P values < 0.05 were included in multivariate logistic regression models. Data are presented as odds ratio [95% confidence interval (CI)]. A P value < 0.05 is considered statistically significant. All statistical analyses were performed using JMP Pro Version 16.0.0 software (SAS Institute, Cary, NC, USA).

**Results**

The percentage of women with successful initiation of exclusive breastfeeding at one month among the women who received labor neuraxial analgesia was 43.1% (163/376). Table 1 shows the univariate variables associated with initiation of exclusive breastfeeding. For factors related to the mother, multipara (P = 0.0001), shorter second stage of labor time (P = 0.046), less oxytocin use (P < 0.0001), less vacuum extraction delivery (P = 0.001), and smaller amount of bleeding during labor (P = 0.027) were univariate predictors of successful initiation of exclusive breastfeeding. CSEA (64/163, 39.5%) compared with epidural analgesia alone (98/163, 60.5%) was not a significant predictor (P = 0.452). For factors
regarding infants, higher birthweight was a univariate predictor \( P = 0.010 \). Multivariate logistic regression analysis was then performed for the univariate variables associated with successful initiation of exclusive breastfeeding. Multivariate logistic regression analysis revealed that significant predictors of impairment of the successful initiation of exclusive breastfeeding were oxytocin use, vacuum extraction delivery and lower birthweight (Table 2).
Table 1
Maternal characteristics and delivery and infant outcomes

<table>
<thead>
<tr>
<th>Variables</th>
<th>Total (n = 376)</th>
<th>Exclusive breastfeeding (n = 162)</th>
<th>Non-exclusive breastfeeding (n = 214)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maternal characteristics</strong></td>
<td></td>
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<tr>
<td>Age (yr)</td>
<td>33.6 ± 4.7</td>
<td>33.2 ± 4.3</td>
<td>33.9 ± 4.9</td>
<td>0.145</td>
</tr>
<tr>
<td>BMI before pregnancy (kg/m²)</td>
<td>21.2 ± 3.2</td>
<td>20.8 ± 3.0</td>
<td>21.4 ± 3.3</td>
<td>0.062</td>
</tr>
<tr>
<td>BMI at delivery (kg/m²)</td>
<td>25.0 ± 3.3</td>
<td>24.7 ± 3.0</td>
<td>25.1 ± 3.5</td>
<td>0.220</td>
</tr>
<tr>
<td>Weeks of delivery (w)</td>
<td>39.0 ± 1.2</td>
<td>39.1 ± 1.0</td>
<td>38.9 ± 1.3</td>
<td>0.249</td>
</tr>
<tr>
<td>Multipara</td>
<td>157 (41.8%)</td>
<td>86 (53.1%)</td>
<td>71 (33.2%)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Smoking before pregnancy</td>
<td>39 (10.3%)</td>
<td>11 (6.8%)</td>
<td>28 (13.1%)</td>
<td>0.060</td>
</tr>
<tr>
<td><strong>Delivery outcomes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cervix dilation at the start of labor analgesia (cm)</td>
<td>5 (3–6)</td>
<td>5 (–5)</td>
<td>5 (3–6)</td>
<td>0.635</td>
</tr>
<tr>
<td>Second stage of labor (min)</td>
<td>114.7 ± 118.1</td>
<td>100.8 ± 111.8</td>
<td>125.3 ± 121.9</td>
<td>0.046</td>
</tr>
<tr>
<td>Amount of bleeding (ml)</td>
<td>566.6 ± 402.3</td>
<td>514.0 ± 366.1</td>
<td>606.5 ± 424.1</td>
<td>0.027</td>
</tr>
<tr>
<td>Oxytocin use</td>
<td>215 (57.3%)</td>
<td>74 (45.7%)</td>
<td>141 (66.2%)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Vacuum delivery</td>
<td>120 (31.9%)</td>
<td>37 (22.8%)</td>
<td>83 (38.8%)</td>
<td>0.001</td>
</tr>
<tr>
<td><strong>Anesthetic data</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spinal anesthesia</td>
<td>140 (37.2%)</td>
<td>64 (39.5%)</td>
<td>76 (35.5%)</td>
<td>0.452</td>
</tr>
<tr>
<td>Post dural puncture headache</td>
<td>12 (3.2%)</td>
<td>3 (1.9%)</td>
<td>9 (4.2%)</td>
<td>0.246</td>
</tr>
<tr>
<td><strong>Infant factors</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Data are presented as mean ± standard deviation (SD), median (range) or number of patients.</td>
<td></td>
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<tr>
<td>BMI: body mass index</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Variables</td>
<td>Total (n = 376)</td>
<td>Exclusive breastfeeding (n = 162)</td>
<td>Non-exclusive breastfeeding (n = 214)</td>
<td>P value</td>
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<tr>
<td>--------------------------------------</td>
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</tr>
<tr>
<td>Neonatal height (cm)</td>
<td>48.5 ± 1.9</td>
<td>48.6 ± 1.7</td>
<td>48.3 ± 1.9</td>
<td>0.110</td>
</tr>
<tr>
<td>Birthweight (g)</td>
<td>3045.2 ± 362.1</td>
<td>3100.5 ± 330.0</td>
<td>3003.3 ± 380.0</td>
<td>0.010</td>
</tr>
<tr>
<td>Umbilical cord arterial blood pH</td>
<td>7.257 ± 0.06</td>
<td>7.256 ± 0.06</td>
<td>7.258 ± 0.06</td>
<td>0.813</td>
</tr>
<tr>
<td>Apgar score 1 min</td>
<td>9 (8–9)</td>
<td>9 (8–9)</td>
<td>9 (8–9)</td>
<td>0.281</td>
</tr>
<tr>
<td>Apgar score 5 min</td>
<td>10 (10–10)</td>
<td>10 (10–10)</td>
<td>10 (10–10)</td>
<td>0.534</td>
</tr>
</tbody>
</table>

Data are presented as mean ± standard deviation (SD), median (range) or number of patients.

BMI: body mass index

Table 2
Logistic regression analysis

<table>
<thead>
<tr>
<th>Predictive factor</th>
<th>Odds ratio</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Second stage of labor</td>
<td>0.793</td>
<td>0.169–3.721</td>
<td>0.770</td>
</tr>
<tr>
<td>Amount of bleeding</td>
<td>3.072</td>
<td>0.771–12.233</td>
<td>0.107</td>
</tr>
<tr>
<td>Oxytocin use</td>
<td>1.823</td>
<td>1.148–2.894</td>
<td>0.011</td>
</tr>
<tr>
<td>Vacuum delivery</td>
<td>1.702</td>
<td>1.044–2.776</td>
<td>0.033</td>
</tr>
<tr>
<td>Multipara</td>
<td>0.641</td>
<td>0.380–1.083</td>
<td>0.097</td>
</tr>
<tr>
<td>Birthweight</td>
<td>0.178</td>
<td>0.041–0.761</td>
<td>0.018</td>
</tr>
</tbody>
</table>

Discussion

Our study showed that the percentage of women with exclusive breastfeeding at one month after delivery among the women who received labor neuraxial analgesia was 43.1% (n = 163/376). Significant predictors of impairment of the initiation of exclusive breastfeeding were oxytocin use, vacuum extraction delivery and lower birthweight of infants.

In this retrospective cohort study, the rate of successful initiation of exclusive breastfeeding in women who received labor neuraxial analgesia at one month was 43.1%, which was lower than the rate at one month for all deliveries in Japan (51.3%) [7]. In a 20-day postpartum study by Mauri et al., the rate of exclusive breastfeeding among women who received epidural analgesia was 68.9% [10], and Mahmoodi et al. reported an exclusive breastfeeding rate of 81.4% at one month postpartum among women who
received epidural analgesia [11]. On the other hand, some studies have shown that the groups that received epidural analgesia had lower rates of breastfeeding (43-51.5%) within 6 weeks postpartum compared with the rates of breastfeeding in the groups that did not receive epidural analgesia [12, 13]. In addition, a systematic review of studies on the effects of labor neuraxial analgesia showed heterogeneous results [6]. The effects of labor neuraxial analgesia on the rate of exclusive breastfeeding have therefore been unclear.

Oxytocin use and vacuum extraction delivery as mother-related factors and lower birthweight as an infant-related factor were identified as significant predictors of impairment of exclusive breastfeeding in our study. Birthweight was reported in a previous study to be an important predictor of exclusive breastfeeding after caesarean section and vaginal delivery [14]. Infant breast milk energy intake was shown to be positively associated with birthweight [15]. Lower birthweight infants did not promote the establishment of adequate milk production due to weak suckling [16] and may have lower rates of exclusive breastfeeding.

Epidural analgesia has been associated with prolongation of the second stage of labor [17]. The use of oxytocin is considered in cases in which labor is prolonged or if weak labor persists. Labor epidural analgesia in combination with oxytocin infusion negatively influenced endogenous oxytocin levels, and women who received oxytocin infusion at delivery reportedly had lower levels of endogenous oxytocin at lactation on the second postpartum day [18]. A systematic review of the long-term effects of administration of oxytocin during peripartum suggested that exogenous administration of oxytocin might negatively impact upon breastfeeding [19], which is supportive of our findings. Oxytocin administration may decrease endogenous oxytocin and reduce the rate of postpartum lactation.

Vacuum extraction delivery has not previously been reported as a risk factor for breastfeeding, regardless of whether neuraxial analgesia was received during labor. Vacuum delivery is used in cases with a prolonged second stage of labor. The mother is more likely to experience stress during delivery if she has undergone a prolonged delivery or multiple delivery interventions [12]. Maternal stress during childbirth may inhibit oxytocin secretion after delivery and adversely affect breastfeeding [20]. We expected that a history of smoking before pregnancy would be negatively associated with exclusive breastfeeding because maternal smoking was identified as a factor that impairs exclusive breastfeeding [5]. However, such a relationship was not found in our study. This could be because we did not examine smoking during pregnancy or smoking after delivery because the medical records were not available for all of the women.

This study has some limitations. The decision regarding oxytocin use or vacuum extraction was left to the discretion of each obstetrician. Previous studies including both women who did and did not receive labor neuraxial analgesia showed that risk factors for impairment of exclusive breastfeeding were infant-mother separation, maternal educational attainment, breastfeeding education received by the mother or parents, parenting stress, and maternal income [5][8]. However, those were not included as variables in our study because the relevant data was not recorded.
Conclusion

Oxytocin use and vacuum extraction delivery as maternal factors and lower birthweight as a neonatal factor are predictors of impairment of exclusive breastfeeding at one month after delivery in women who have received labor neuraxial analgesia.

Abbreviations

BMI
Body mass index
CI
Confidence interval.

Declarations

Acknowledgements

We gratefully acknowledge the contribution of all study participants.

Authors’ contributions

AH: designed and conducted the research, analyzed data, wrote the paper, and had primary responsibility for final content. MH, MW, SY, SM and KI: critically reviewed the manuscript and provided feedback on each subsequent version.TK: Supervision; writing – review & editing and all authors: read and approved the final manuscript.

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None.

Ethics approval and consent to participate

The study was approved by the Wakayama Medical University Institutional Research Ethics Review Committee (No. 3097)

Consent for publication

Not applicable.

Competing interest

The authors declare that they have no competing interests.

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References


Figures
Figure 1

Flow chart illustrating the selection of patients

All women undergoing labor neuraxial analgesia (2011-2022): n = 437

Excluded:
- Data missing (n = 4)
- Neonatal intensive care unit (n = 31)
- Emergency cesarean section after induction of labor neuraxial analgesia (n = 20)
- Multiple pregnancy (n = 4)
- No wish to breastfeed due to medication (n = 1)
- Fetal death (n = 1)

Available data: n = 376

Exclusive breastfeeding: n = 162

Non-exclusive breastfeeding: n = 214