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Delivery mode and maternal and neonatal outcomes of combined spinal–epidural analgesia compared with no analgesia in spontaneous labor: A single-center observational study in Japan

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Abstract

Aim: We aimed to assess the outcomes of combined spinal–epidural (CSE) analgesia compared with no analgesia in spontaneous labor.

Methods: We performed a retrospective cohort study of deliveries between 2008 and 2014 comparing two groups based on the use of CSE analgesia in both nulliparous and multiparous women. Adjusted odds ratios (aOR) were calculated using logistic regression analysis.

Results: Among 5247 (3334 nulliparous, 1913 multiparous) singleton deliveries, 3041 (2045, 996, respectively) patients received CSE analgesia and 2206 (1289, 917, respectively) had no analgesia. CSE analgesia was associated with increased risk of oxytocin augmentation ($P < 0.01$), prolonged duration of labor ($P < 0.01$), instrumental delivery (aOR, 3.35; 95% confidence interval (CI), 2.69–4.19 for nulliparous and aOR, 2.13; 95% CI, 1.32–3.53 for multiparous women), blood loss volume during vaginal delivery ($P < 0.01$), meconium-stained amniotic fluid (aOR, 1.23; 95% CI, 1.02–1.51 and aOR, 1.39; 95% CI, 1.01–1.93) and Apgar score less than 7 at 1 min (aOR, 1.85; 95% CI, 1.28–2.74 and aOR, 2.65; 95% CI, 1.35–5.61) in both nulliparous and multiparous women, respectively, and umbilical arterial blood gas pH less than 7.15 (aOR, 2.69; 95% CI, 1.35–5.75) and umbilical arterial blood gas pH less than 7.10 (aOR, 3.69; 95% CI, 1.11–16.69) in multiparous women. There was no significant difference in incidence of cesarean delivery or Apgar score less than 7 at 5 min.

Conclusion: We observed several increased risks in obstetric and neonatal outcomes among pregnant women who received CSE analgesia during labor. Preparations for these risks are needed when administering CSE analgesia during labor.

Key words: combined spinal–epidural analgesia, delivery mode, labor analgesia, meconium-stained amniotic fluid, neonatal cardiopulmonary resuscitation.

Introduction

Labor and delivery are considered to be one of the most stressful and painful experiences for women, and various methods of support have been developed to provide relief.[1,2] Administration of analgesia during labor was previously uncommon in Japan; however, the use of analgesia has recently been growing in popularity and the proportion of women who use analgesia during labor is reported to have increased from 4.6% in 2014 to 6.1% in 2016.[3] Yet, the number of institutions that can provide labor

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analgesia by an anesthesiologist are limited in Japan, and there are concerns about the safety of labor analgesia, given the country's context. Half of deliveries in Japan are in small clinics where advanced maternal and neonatal care is not readily available. Although outcomes of labor analgesia in Japan need to be clarified, there are few clinical studies on labor analgesia among a large population in Japan.

Although epidural analgesia is the most commonly used labor analgesia in Japan, combined spinal–epidural (CSE) analgesia has been increasingly used owing to its effectiveness for pain relief.[4,5] However, there are concerns about the effects of labor analgesia on the mode of delivery as well as maternal and neonatal outcomes. A relatively large number of studies have compared the effects of CSE analgesia for labor with those of epidural analgesia in Western countries.[6–9] CSE analgesia compared with traditional epidural analgesia during labor reportedly shows no significant difference in incidence of cesarean delivery and decreased incidence of instrumental delivery.[8] There is reportedly no significant difference in the rate of cesarean delivery for epidural analgesia versus nonepidural analgesia (e.g., relaxation therapy, acupressure, acupuncture, reflexology, aromatherapy, transcutaneous electrical nerve stimulation, intradermal injection of sterile water, nitrous oxide inhalation, and parenteral opioid injection) or for epidural versus no analgesia; however, these are associated with increased risk of instrumental delivery.[10] Information about the outcomes of CSE analgesia during labor, in comparison with outcomes of labor without analgesia, which is the most common type of delivery in Japan, would be useful information. However, there are few studies comparing the outcomes of CSE analgesia with those of no analgesia.

The purpose of the present study was to describe the outcomes of CSE analgesia compared with those of no analgesia in spontaneous labor, among a large population at single center in Japan.

Methods

Study population

We conducted this single-center retrospective cohort study at the National Center for Child Health and Development (NCCHD), which is a comprehensive perinatal center based in Tokyo, Japan. We obtained clinical data of all deliveries at the NCCHD between January 1, 2008, and May 31, 2014, from the electronic medical records. The institutional review boards of the NCCHD approved the study protocol (#73, approved November 27, 2014).

We included low-risk pregnant women with singleton pregnancies who attempted vaginal delivery and had spontaneous onset of labor between 37 and 41 weeks of gestation. We excluded multiple pregnancies, delivery at gestational age less than 37 or greater than or equal to 42 weeks, scheduled cesarean deliveries, induction of labor, cases with perinatal maternal complications (e.g., hypertensive disorder of pregnancy, fetal growth restriction [defined as less than −1.5 standard deviations of the estimated fetal weight calculated using a formula of the Japanese Society of Ultrasound in Medicine]),[11] cases with congenital anomalies, vaginal birth after cesarean, and emergent cesarean deliveries in women originally scheduled for elective cesarean delivery but who went into labor before the planned date or who attempted vaginal delivery but could not enter the active phase of labor (defined as regular contractions with cervical dilatation ≥3 cm). We only focused on women who had spontaneous onset of labor because induction of labor may affect the final mode of delivery.

Obstetric care and anesthetic procedures

In our center, obstetricians manage all deliveries together with obstetric anesthesiologists. Labor analgesia and emergent cesarean delivery are readily available, 24 h a day. Obstetric practice is conducted in accordance with Japan Society of Obstetrics and Gynecology guidelines.[12,13] In general, pelvic examination is performed every 1 to 2 h to evaluate the progress of labor during the active phase. If labor augmentation is necessary, oxytocin is initiated at 2 mU/min and then increased by 2 mU/min every 30 min, up to 20 mU/min, until effective labor is achieved. At the time of this study, we allowed 3 h' duration for the second stage of labor with CSE analgesia in nulliparous women, and 2 h' duration for the second stage of labor with CSE analgesia in multiparous women. When prompt delivery is necessary, each obstetrician evaluates the position of the infant's head by vaginal examination and determines whether the delivery mode is instrumental or cesarean delivery. At the time of instrumental or cesarean delivery, a neonatologist also attends the delivery, to provide neonatal cardiopulmonary resuscitation (NCPR), in accordance with NCPR guidelines.

Our center uses CSE analgesia for labor analgesia. Any woman can receive CSE analgesia anytime they

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wish, provided they have no contraindications (e.g., nonreassuring fetal status, unstable maternal circulatory status, or maternal blood coagulopathy). CSE analgesia is started at the request of the pregnant woman for pain relief, regardless of uterine cervix dilatation. We perform CSE analgesia for labor pain as follows: with the patient in the right lateral or sitting position, an 18-gauge Tuohy needle (Smiths Medical Japan Ltd., Tokyo, Japan) is inserted into the epidural space, identified by loss-of-resistance to saline, at the L3–4 or L4–5 interspace. Dural puncture is then performed using a 27-gauge spinal needle (Smiths Medical Japan Ltd.). After clear cerebrospinal fluid is aspirated, spinal injection is administered, containing 0.5% bupivacaine 0.5 mL, fentanyl 10 μg, and saline 1.3 mL. Finally, an epidural catheter is introduced at the skin-to-epidural depth plus 5 cm. Patient-controlled epidural analgesia (PCEA) is used to maintain analgesia for the rest of labor and delivery. According to the records of our participants, the PCEA bolus dose was 5 mL 0.1% ropivacaine in 2008, and 0.1% levobupivacaine during 2009–2014, with 2 μg/mL fentanyl; the lockout interval was 15 min. If the patient requests further pain relief, the obstetric anesthesiologist evaluates the anesthetized area and administers appropriate additional dosages: 5–15 mL 0.1% levobupivacaine with fentanyl or 5 mL 1.0% lidocaine with fentanyl.

The standard of care of pregnant women with neuraxial labor analgesia in our center is following: The pregnant women rest on bed. A comfortable position is allowed when maternal vital signs and fetal heart rates are normal. Maternal blood pressure is monitored every 5 min for 30 min after giving a bolus of local anesthetic. Subsequently, maternal blood pressure is monitored every 15 min during labor analgesia. For the prevention and treatment of maternal hypotension, semilateral position and hydration of lactated Ringer's solution are provided during this study period. Despite these measures, ephedrine hydrochloride use as the vasopressor of first choice for maternal hypotension. Continuously monitoring during labor analgesia includes the following: maternal pulse rate, SpO2, and the fetal heart rate. Solid foods are prohibited, only clear liquids are allowed during labor analgesia.

Variables and statistical analysis

The collected data of the pregnant women included in this study were maternal age, maternal height, maternal weight before pregnancy, maternal weight at delivery, body mass index before pregnancy, gestational age at delivery, and infant birth weight. Maternal outcomes included oxytocin augmentation, duration of the first stage and second stage of labor, mode of delivery, blood loss volume with vaginal delivery, need for blood transfusion, and presence of meconium-stained amniotic fluid (MSAF). Prolonged duration of the second stage of labor with CSE analgesia was defined as 3 h or more in nulliparous women and 2 h or more in multiparous women. Blood loss volume during vaginal delivery was estimated by measuring the amount of blood clots and weighing the medical gauze used. Post-partum hemorrhage with vaginal delivery was defined as the estimated blood loss of 500 mL or more within the first 2 h after delivery. Neonatal outcomes included incidence of low Apgar score (i.e., Apgar score less than 7 at 1 min and less than 7 at 5 min) and low umbilical arterial blood gas pH (UA-pH) (i.e., UA-pH less than 7.15 and less than 7.10).

We stratified participants by parity (nulliparous and multiparous women) and divided them into two groups: pregnant women who received CSE analgesia (CSE analgesia group) and those who did not receive analgesia (no analgesia group) during labor. We first described the background characteristics of the included pregnant women. Continuous variables were presented as mean and standard deviation and categorical variables as number and percentage. We then compared maternal and neonatal outcomes between the two groups. Finally, we assessed the effect of CSE analgesia on maternal and neonatal outcomes, controlling for potential confounders using logistic regression models. Potential confounders included maternal age, maternal height, maternal weight before pregnancy, maternal weight at delivery, gestational age at delivery, and infant birth weight in both nulliparous and multiparous women. Crude odds ratios and adjusted odds ratios (aOR) were reported with their 95% confidence intervals (CI). A *P*-value less than 0.05 was considered statistically significant. All statistical analyses were conducted using the JMP software, version 9 (SAS Institute).

Results

Between January 1, 2008 and May 31, 2014, a total 10 804 deliveries were recorded in the NCCHD. After exclusion, this study population ultimately consisted of 5247 singleton deliveries between 37 and 41 weeks

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of gestation, including 3334 (63.5%) nulliparous women and 1913 (36.5%) multiparous women (Fig. 1). Among nulliparous women, 2045 (61.3%) received CSE analgesia and 1289 (38.7%) had no analgesia. Among multiparous women, 996 (52.1%) received CSE analgesia and 917 (47.9%) had no analgesia.

The characteristics of nulliparous and multiparous women included in the analysis are shown in Table 1. Maternal age was significantly higher in the CSE analgesia group than in the no analgesia group among both nulliparous and multiparous women. There were significant differences between the CSE analgesia and no analgesia groups among nulliparous women for gestational age at delivery and infant birth weight.

The maternal and neonatal outcomes for the CSE analgesia and no analgesia groups are shown in Table 2. The incidence of oxytocin augmentation was significantly higher in the CSE analgesia group than in the no analgesia group among both nulliparous women (aOR, 2.00; 95% CI, 1.59–2.53) and multiparous women (aOR, 2.92; 95% CI, 2.04–4.25). Mean duration of the first stage of labor in the CSE analgesia group (11.8 h) was significantly longer than that in the no analgesia group (8.7 h) among nulliparous women ($P < 0.01$) as well as multiparous women (6.9 h in the CSE analgesia group vs 5.2 h in the no analgesia group; $P < 0.01$). The mean duration of the second stage of labor showed the same tendency as the first stage (2.2 h in the CSE analgesia group vs 1.3 h in the no analgesia group among nulliparous women, $P < 0.01$; and 1.2 h in the CSE analgesia group vs 0.39 h in the no analgesia group among multiparous women, $P < 0.01$). The incidence of prolonged duration of the second stage of labor was significantly higher in the CSE analgesia group than in the no analgesia group both among nulliparous women (aOR, 3.09; 95% CI, 2.41–4.00) and multiparous women (aOR, 10.79; 95% CI, 6.12–20.88).

There was no significant difference in the incidence of cesarean delivery between the two groups among both nulliparous women (aOR, 1.03; 95% CI, 0.78–1.37) and multiparous women (aOR, 1.85; 95% CI, 0.76–4.95) after adjustment. The incidence of instrumental delivery was significantly higher in the CSE analgesia group than in the no analgesia group among both nulliparous women (aOR, 3.35; 95% CI, 2.69–4.19) and multiparous women (aOR, 2.13; 95% CI, 1.32–3.53). The mean blood loss volume with vaginal delivery in the CSE analgesia group (594 mL) was significantly higher than that in the no analgesia group (493 mL) among nulliparous women ($P < 0.01$) as well as multiparous women (438 mL in the CSE analgesia group vs 388 mL in the no analgesia group;

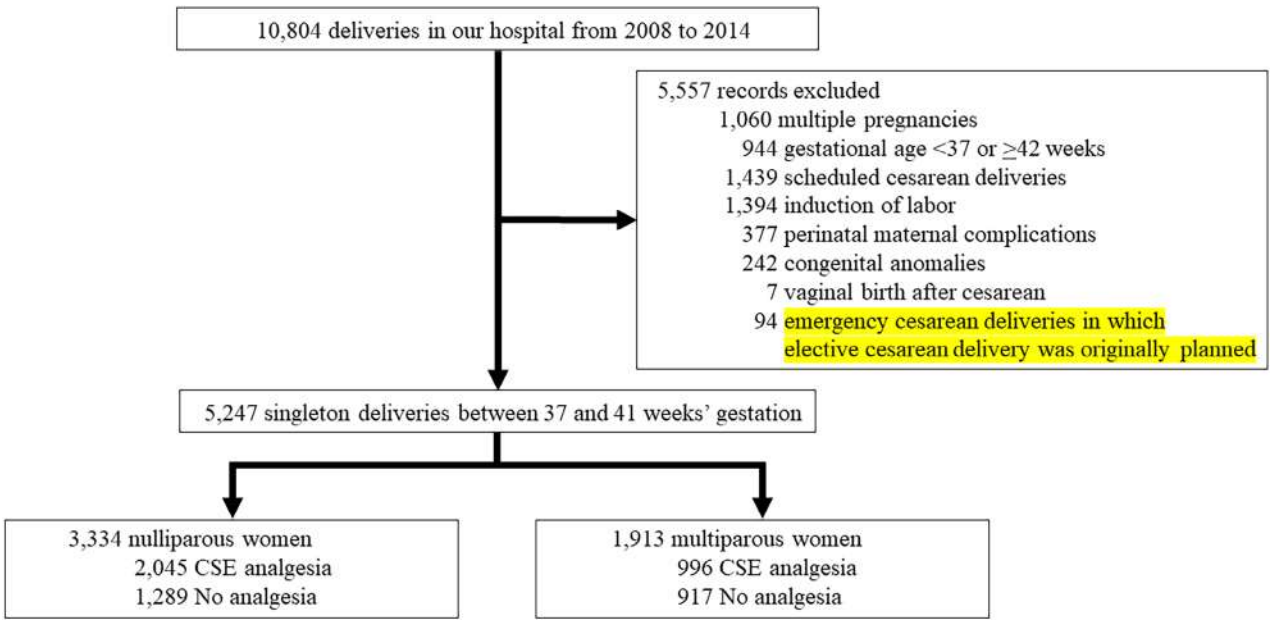


Figure 1 Flow chart of the study population. According to the defined exclusion criteria, 5247 singleton deliveries were enrolled in the present study. CSE, combined spinal–epidural.

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$P < 0.01$). The incidence of post-partum hemorrhage with vaginal delivery was significantly higher in the CSE analgesia group than in the no analgesia group among both nulliparous women (aOR, 1.51; 95% CI, 1.26–1.81) and multiparous women (aOR, 1.61; 95% CI, 1.25–2.07). However, there were no significant differences in the incidence of blood transfusion between nulliparous and multiparous women when comparing the two groups. The incidence of MSAF was significantly higher in the CSE analgesia group than in the no analgesia group for both nulliparous women (aOR, 1.23; 95% CI, 1.02–1.51) and multiparous women (aOR, 1.39; 95% CI, 1.01–1.93).

The incidence of Apgar score less than 7 at 1 min was significantly higher in the CSE analgesia group than in the no analgesia group among both nulliparous women (aOR, 1.85; 95% CI, 1.28–2.74) and multiparous women (aOR, 2.65; 95% CI, 1.35–5.61). However, there were no significant differences in the incidence of Apgar score less than 7 at 5 min between the two groups for both nulliparous and multiparous women. In multiparous women the incidence of UA-pH less than 7.15 (aOR, 2.69; 95% CI, 1.35–5.75) and UA-pH less than 7.10 (aOR, 3.69; 95% CI, 1.11–16.69) was significantly higher in the CSE analgesia group than in the no analgesia group.

Table 1 Characteristics of the nulliparous and multiparous women included in the study

	CSE analgesia	No analgesia	*P*-value
Nulliparous women	$n = 2045$	$n = 1289$	
Maternal age (years)	35.0 ± 4.4	33.2 ± 4.7	<0.01
Maternal height (cm)	159.4 ± 5.2	159.6 ± 5.2	0.44
Maternal weight before pregnancy (kg)	51.2 ± 6.8	51.3 ± 7.1	0.99
Body mass index before pregnancy (kg/m^2)	20.1 ± 2.4	20.1 ± 2.5	0.84
Maternal weight at delivery (kg)	61.0 ± 7.4	61.3 ± 7.7	0.33
Gestational age at delivery (weeks)	39.8 ± 1.0	39.2 ± 1.0	<0.01
Infant birth weight (g)	3063 ± 341	3012 ± 343	<0.01
Multiparous women	$n = 996$	$n = 917$	
Maternal age (years)	36.1 ± 3.5	35.1 ± 4.1	<0.01
Maternal height (cm)	159.6 ± 4.9	159.6 ± 5.2	0.64
Maternal weight before pregnancy (kg)	51.3 ± 6.5	51.7 ± 7.1	0.24
Body mass index before pregnancy (kg/m^2)	20.1 ± 2.4	20.3 ± 2.7	0.23
Maternal weight at delivery (kg)	61.3 ± 6.8	61.1 ± 7.1	0.56
Gestational age at delivery (weeks)	39.3 ± 1.0	39.3 ± 1.0	0.72
Infant birth weight (g)	3074 ± 343	3067 ± 337	0.87

Missing data, *n* (%). Nulliparous women: maternal height, 199 (6.0); maternal weight before pregnancy, 495 (14.8); body mass index before pregnancy, 546 (16.4); maternal weight at delivery, 687 (20.6). Multiparous women: maternal height, 91 (4.8); maternal weight before pregnancy, 358 (18.7); body mass index before pregnancy, 377 (19.7); maternal weight at delivery, 450 (23.5). and CSE, combined spinal–epidural.

Discussion

This retrospective cohort study revealed the characteristics and outcomes of CSE labor analgesia in comparison with no labor analgesia in more than 5000 singleton deliveries with spontaneous labor onset at a single center in Japan. CSE analgesia was associated with oxytocin augmentation, prolonged duration of labor, increased incidence of instrumental delivery, increased blood loss volume during vaginal delivery, increased incidence of MSAF, and increased incidence of Apgar score less than 7 at 1 min. CSE analgesia

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Table 2 Outcomes and crude and adjusted OR for outcomes in the CSE analgesia group and no analgesia group, calculated using logistic regression analysis

	CSE analgesia	No analgesia	*P*-value	Crude OR (95% CI)	*P*-value	Adjusted OR (95% CI)	*P*-value
Nulliparous women	*n* = 2045	*n* = 1289					
Oxytocin augmentation, *n* (%)	490 (24.6)	162 (12.9)	<0.01	2.21 (1.82–2.69)	<0.01	2.00 (1.59–2.53)	<0.01
Duration of the first stage of labor (h)	11.8 ± 6.3	8.7 ± 5.5	<0.01				
Duration of the second stage of labor (h)	2.2 ± 1.3	1.3 ± 1.2	<0.01				
Prolonged duration of the second stage of labor	397 (28.5)	100 (10.1)	<0.01	3.54 (2.80–4.51)	<0.01	3.09 (2.41–4.00)	<0.01
Cesarean delivery, *n* (%)	235 (11.5)	118 (9.2)	0.03	1.29 (1.02–1.63)	0.03	1.03 (0.78–1.37)	0.83
Instrumental delivery, *n* (%)	688 (33.6)	166 (12.9)	<0.01	3.43 (2.85–4.15)	<0.01	3.35 (2.69–4.19)	<0.01
Blood loss volume with vaginal delivery (mL)	594 ± 454	493 ± 353	<0.01				
Post-partum hemorrhage with vaginal delivery	784 (43.3)	384 (32.8)	<0.01	1.56 (1.34–1.83)	<0.01	1.51 (1.26–1.81)	<0.01
Blood transfusion, *n* (%)	7 (0.39)	4 (0.33)	0.79	1.19 (0.36–4.54)	0.78	0.73 (0.21–2.90)	0.63
Meconium-stained amniotic fluid, *n* (%)	571 (28.0)	278 (21.8)	<0.01	1.40 (1.19–1.65)	<0.01	1.23 (1.02–1.51)	0.03
Apgar score < 7							
At 1 min, *n* (%)	135 (6.6)	48 (3.7)	<0.01	1.83 (1.31–2.58)	<0.01	1.85 (1.28–2.74)	<0.01
At 5 min, *n* (%)	16 (0.78)	6 (0.47)	0.27	1.69 (0.69–4.71)	0.26	1.15 (0.40–3.79)	0.80
Umbilical arterial blood gas							
pH <7.15, *n* (%)	84 (4.3)	46 (3.7)	0.41	1.17 (0.81–1.70)	0.41	1.03 (0.67–1.60)	0.89
pH <7.10, *n* (%)	24 (1.2)	13 (1.0)	0.64	1.17 (0.61–2.38)	0.64	1.19 (0.53–2.84)	0.69
Multiparous women	*n* = 996	*n* = 917					
Oxytocin augmentation, *n* (%)	170 (17.1)	61 (6.7)	<0.01	2.85 (2.11–3.91)	<0.01	2.92 (2.04–4.25)	<0.01
Duration of the first stage of labor (h)	6.9 ± 3.8	5.2 ± 3.7	<0.01				
Duration of the second stage of labor (h)	1.2 ± 1.0	0.39 ± 0.5	<0.01				
Prolonged duration of the second stage of labor	123 (17.6)	14 (2.0)	<0.01	10.46 (6.17–19.21)	<0.01	10.79 (6.12–20.88)	<0.01
Cesarean delivery, *n* (%)	21 (2.1)	9 (0.98)	0.04	2.17 (1.02–5.02)	0.04	1.85 (0.76–4.95)	0.18
Instrumental delivery, *n* (%)	81 (8.1)	34 (3.7)	<0.01	2.30 (1.54–3.51)	<0.01	2.13 (1.32–3.53)	<0.01
Blood loss volume with vaginal delivery (mL)	438 ± 385	388 ± 333	<0.01				
Post-partum hemorrhage with vaginal delivery	276 (17.6)	190 (2.0)	<0.01	1.49 (1.21–1.85)	<0.01	1.61 (1.25–2.07)	<0.01
Blood transfusion, *n* (%)	4 (0.40)	2 (0.22)	0.37	2.12 (0.41–15.28)	0.37	1.74 (0.32–12.98)	0.53
	138 (13.9)	94 (10.3)	0.02	1.41 (1.07–1.86)	0.02	1.39 (1.01–1.93)	0.04

(*Continues*)

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Table 2 Continued

	CSE analgesia	No analgesia	*P*-value	Crude OR (95% CI)	*P*-value	Adjusted OR (95% CI)	*P*-value
Meconium-stained amniotic fluid, *n* (%)							
Apgar score < 7							
At 1 min, *n* (%)	43 (4.3)	16 (1.8)	<0.01	2.53 (1.45–4.66)	<0.01	2.65 (1.35–5.61)	<0.01
At 5 min, *n* (%)	2 (0.20)	1 (0.11)	0.62	1.83 (0.18–39.49)	0.61	0.93 (0.037–23.51)	0.96
Umbilical arterial blood gas							
pH <7.15, *n* (%)	37 (3.8)	14 (1.6)	<0.01	2.48 (1.36–4.77)	<0.01	2.69 (1.35–5.75)	<0.01
pH <7.10, *n* (%)	13 (1.3)	5 (0.56)	0.09	2.40 (0.90–7.51)	0.08	3.69 (1.11–16.69)	0.03

Missing data, *n* (%). Nulliparous women: duration of labor, 596 (20.0); oxytocin augmentation, 83 (2.5); meconium-stained amniotic fluid, 18 (0.54); Apgar score at 1 min, 8 (0.24); Apgar score at 5 min, 9 (0.27); umbilical arterial blood gas, 113 (3.4). Multiparous women: duration of labor, 514 (26.9); oxytocin augmentation, 3 (0.16); meconium-stained amniotic fluid, 9 (0.47); Apgar score 1 min, 7 (0.37); Apgar score 5 min, 8 (0.42); umbilical arterial blood gas, 56 (2.9). and CI, confidence interval; CSE, combined spinal–epidural; OR, odds ratio.

was not associated with incidence of cesarean delivery or incidence of Apgar score less than 7 at 5 min.

Regarding the effects of analgesia on delivery mode, there are some reports of comparisons between CSE analgesia versus epidural analgesia and between epidural analgesia versus no analgesia; however, there are few comparisons between CSE analgesia versus no analgesia. Some randomized control trials [7,9,14,15] have found no difference between CSE analgesia versus epidural analgesia in the rate of cesarean delivery; however, CSE analgesia was found to reduce the rate of instrumental delivery compared with traditional epidural analgesia. Although epidural analgesia is suspected to increase the incidence of cesarean delivery compared with no epidural analgesia, according to previous retrospective studies,[16,17] a meta-analysis revealed that there was no evidence of significant differences between them for risk of cesarean delivery.[10] However, epidural analgesia increases the incidence of instrumental delivery compared with no analgesia.[10] Therefore, it is suspected that there is no difference between CSE analgesia and no analgesia with respect to risk of cesarean delivery, but a difference in the risk of instrumental delivery is difficult to confirm. This study added evidence that CSE analgesia does not increase the incidence of cesarean delivery but increases the incidence of instrumental delivery, as compared with no analgesia, in both nulliparous and multiparous women.

Our study showed that the duration of labor in CSE analgesia was significantly prolonged in both the first and second stage of labor. Previous reports showed that duration of the first stage of labor was also prolonged with epidural analgesia. Chestnut *et al.*[18] explained that motor blockade owing to epidural analgesia would lead to increased labor duration, which is associated with a higher risk of instrumental delivery. Similarly, increased incidence of instrumental delivery with CSE analgesia in our study can be explained by motor blockade associated with prolonged duration of labor. Our study showed that the incidence of oxytocin augmentation was significantly higher in the CSE analgesia group than in the no analgesia group among both nulliparous and multiparous women. It was considered that prolonged duration of labor increased the incidence of oxytocin augmentation of labor. It has been reported that prolonged duration of labor are risk factors for post-partum hemorrhage.[19,20] In our study, blood loss volume was increased in the CSE analgesia group; however, the increase did not necessitate blood transfusion.

Surprisingly, in our study we found CSE analgesia to be associated with an increased incidence of MSAF and low Apgar score less than 7 at 1 min among both nulliparous and multiparous women. Although CSE analgesia was not associated with an increased incidence of Apgar score less than7 at 5 min, it was associated with an increased incidence of UA-pH less than 7.15 and UA-pH less than 7.10 in multiparous women. Prolonged duration of labor or increased instrumental delivery could affect the increased low Apgar score at 1 min. Increased incidence of MSAF with CSE analgesia is a notable finding. MSAF has been reported to affect neonatal outcomes.[21–23] The association between prolonged duration of labor and MSAF[22] as well as that between prolonged duration of labor and unfavorable neonatal outcomes[24,25] have been reported. In some cases, CSE analgesia might cause mild unfavorable neonatal outcomes in

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association with MSAF owing to prolonged duration of labor. Greater attention regarding NCPR in the delivery room is required with CSE analgesia.

The present study has several limitations. First, given the observational nature of the study, differences in characteristics between the CSE analgesia group and the no analgesia group may persist, even after adjustment in logistic regression analysis. Some variables known to be related to women's choice of labor analgesia were not measured in the present study. In addition, there is a possibility that progression of labor may have affected women's choice for labor analgesia, given that CSE analgesia is available upon patient request at any time in our center. For example, women with prolonged labor may tend to choose CSE analgesia more often than women with labor that progresses smoothly. However, a randomized controlled trial of CSE analgesia versus no analgesia is quite difficult to perform, for practical reasons. Therefore, we believe that our findings are very valuable. Second, we evaluated only short-term indicators for neonatal outcomes (i.e., Apgar sore at 1 min, Apgar score at 5 min and UA-pH). Further studies regarding long-term neonatal outcomes are warranted, to confirm that CSE analgesia is not related to any adverse neonatal outcomes. Third, we did not calculate the incidence of fetal heart rate abnormalities after administration of intrathecal anesthetics in this study. Although the effects of fetal heart rate abnormalities caused by analgesia on neonatal outcomes should be considered, the deliveries were managed in the same manner among the both groups when fetal heart rate abnormalities were found.

In conclusion, this retrospective observational cohort study examined obstetric and neonatal outcomes of CSE analgesia compared with no analgesia in spontaneous labor among a large population in Japan. We add evidence that CSE analgesia during labor poses several risks in obstetric and neonatal outcomes. CSE analgesia during labor requires preparation to cope with these obstetric and neonatal risks.

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Disclosure

None declared.

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