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CLINICAL ARTICLE

Effect of combined spinal–epidural analgesia in labor on frequency of emergency cesarean delivery among nulliparous Chinese women

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ABSTRACT

Objective: To determine whether combined spinal–epidural analgesia (CSEA) during labor increases the frequency of emergency cesarean delivery among Chinese nulliparous women. *Methods:* In a retrospective study, the medical records of nulliparous women with a singleton fetus in cephalic presentation who delivered at term at Tongling Maternity Hospital, China, between January 2012 and December 2014 were reviewed. Information about CSEA, mode of delivery, labor duration, oxytocin augmentation, and neonatal outcome was obtained. Logistic regression was used to examine independent associations between CSEA and emergency cesarean after controlling for confounding variables. *Results:* Among 3456 women included, 1786 (51.7%) received CSEA and 1670 (48.3%) received no labor analgesia. Emergency cesarean was more frequent among CSEA users (219/1786 [12.3%]) than non-users (119/1670 [7.1%]; $P<0.001$). Among the maternal–fetal variables included in multivariate regression, maternal age, maternal height, cervical dilatation at admission, birth weight, and CSEA use were significantly associated with emergency cesarean. After adjustment, women with CSEA maintained a slightly increased risk for cesarean (adjusted odds ratio 1.54, 95% confidence interval 1.20–2.00). *Conclusion:* Among Chinese nulliparous women, use of CSEA for labor pain was associated with an increased risk of emergency cesarean delivery; moreover, this effect was maintained after adjustment for other potential obstetric risk factors.

1. Introduction

Common approaches to neuraxial analgesia during labor include continuous lumbar epidural and combined spinal–epidural analgesia (CSEA) [1]. However, there has been considerable debate about whether the rising rate of cesarean delivery has been affected by the increasing use of neuraxial analgesia during childbirth. On the one hand, the results of one meta-analysis of early observational studies [2] support a strong association between the use of neuraxial analgesia and operative delivery. On the other hand, two large randomized controlled trials [3,4] demonstrated that, even when initiated before a cervical dilatation of 2 cm, neuraxial placement had no effect on labor progression or cesarean rates. In 2006, the American College of Obstetricians and Gynecologists [5] reported that none of the analgesia techniques seemed to be associated with an increased risk of cesarean delivery.

The CSEA method was first described in the early 1990s as an alternative neuraxial technique for both labor and cesarean delivery [6]. It combines rapid pain relief from the spinal regional block with an indefinite duration of action from the continuous epidural infusion. Intrathecal administration facilitates the use of a lipid-soluble opioid without significant changes in voluntary motor function, permitting patient ambulation. In the past decade, CSEA has become increasingly popular worldwide.

The overall rate of cesarean delivery in China is higher than 50% in many regions, and a substantial portion of procedures is performed for non-medical reasons [7]. Cesarean delivery increases both maternal and neonatal morbidity in the current and subsequent pregnancies. In our experience at Tongling Maternity and Child Health Care Hospital, the assurance of good labor analgesia might persuade some women who are considering cesarean as a delivery option to undertake a trial of labor and vaginal delivery, subsequently reducing the incidence of cesarean for "social" reasons.

Since 2009, the CSEA technique has been used routinely at the study center among parturients who request and consent to neuraxial analgesia for pain relief in labor; however, many patients refuse neuraxial analgesia owing to concerns about its possible interference with the outcome of labor. Against this background, the aim of the present study was to compare the rate of emergency cesarean delivery among patients who received CSEA and those who did not receive labor analgesia, with a particular focus on risk factors that might potentially confound the association of CSEA with emergency cesarean.

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2. Materials and methods

The present retrospective clinical study was conducted among women who delivered at the Tongling Maternity and Child Health Care Hospital, Tongling, China—an inpatient obstetric center where approximately 3000 neonates are delivered per year—between January 1, 2012, and December 31, 2014. The study included nulliparous women with uncomplicated labor at term (37^{+0}–41^{+6} weeks of pregnancy) and a singleton fetus in vertex presentation, and who elected for a trial of vaginal delivery. Women with common mild medical complications of pregnancy, including gestational diabetes mellitus (not requiring insulin), non-severe gestational hypertensive disorders (i.e. non-severe hypertension with no profound signs and symptoms), and pregnancy-induced hepatic dysfunction (i.e. aminotransferase level ≤250 U/L with no major hepatic histologic changes) were included in the study. Women were excluded from the study if they were younger than 18 years or older than 38 years, had a cervical dilatation of more than 6 cm on admission to the delivery room, underwent elective or emergency cesarean before a cervical dilatation of 3 cm, or had a total labor duration (from onset to delivery) of less than 3 hours. Because the study was based on a retrospective review of the medical records, the ethics board of the hospital exempted it from consent requirements. Person-specific data were coded to ensure that anonymity was maintained.

All parturients with planned vaginal delivery were admitted to the delivery room at a cervical dilatation of at least 1 cm, regular contractions every 3–5 minutes, and cervical effacement. Routine intrapartum management and definitions of the stages of labor for all women were in accordance with the standard procedure in the Obstetrics and Gynecology Guidelines published in Chinese by People's Medical Press [8]. Cervical dilatation was assessed by midwives or obstetricians, and was recorded on a partogram. Onset of labor was defined as a state with regular contractions, effacement of the cervix, and the fetus descending; the active phase was defined as cervical dilatation of 3 cm or more. Slow progress was defined as a slow rate of cervical dilatation or descent, which for nulliparous women was dilatation of less than 1.2 cm/hour or descent of less than 1.0 cm/hour for a minimum of 4 hours. Oxytocin augmentation was defined as stimulation of labor with oxytocin owing to insufficient uterine contractions leading to failed cervical dilatation and fetal descent.

Indications for emergency cesarean in labor were classified into two categories: dystocia (including abnormalities of cervical dilatation, and the presentation or rotation and absence of fetal head descent) and non-reassuring fetal status (including bradycardia and/or meconium-stained amniotic fluid). Postpartum hemorrhage was defined as a blood loss of 500 mL or more within the first 24 hours of delivery, including cesarean deliveries.

Clinical and demographic data were extracted from the delivery records of all eligible women. Age, height, length of pregnancy, mode of labor onset (spontaneous or induced), cervical dilatation at admission to the delivery room, mode of delivery, indication for emergency cesarean, cervical dilatation at cesarean, oxytocin augmentation, amniotic fluid status, labor duration, blood loss, neonatal birth weight, and neonatal Apgar score at 5 minutes were recorded.

For the present study, the exposure was use of CSEA during labor. Parturients who received labor analgesia at a cervical dilatation of 3–6 cm were allocated to the CSEA group, whereas those who had no labor analgesia were allocated to the no analgesia group. The primary outcome of interest was the rate of emergency cesarean delivery. Secondary outcome measures included the duration of labor, oxytocin augmentation, and neonatal outcome.

The rate of emergency cesarean delivery was known to be approximately 10% among nulliparous women undergoing labor with no analgesia at the study hospital. It was calculated that the sample size in the present study was sufficient to detect a 10% difference in cesarean rate between the two groups with a two-tailed α error of 5% and a statistical power of 80%.

Data analyses were performed with SPSS version 19.0 (IBM, Armonk, NY, USA). The level of significance used for all tests of significance was 0.05. χ^2 analysis or Fisher exact test was used to compare categorical variables. The Student *t* test was used to compare continuous variables between the two groups. Cumulative-event curves of labor duration by group were estimated via the Kaplan–Meier method, and a log-rank test was used to compare differences between the curves.

Logistic regression was used to examine independent associations between CSEA and emergency cesarean after controlling for confounding variables. The adjusted analysis included seven covariates presented in the latent phase: maternal age, height, length of pregnancy, mode of labor onset, oxytocin augmentation, cervical dilatation at admission, and birth weight. All analyses were additionally adjusted for meconium-stained amniotic fluid. However, the role of meconium-stained amniotic fluid in the associations is unclear: in addition to being a potential risk factor, it could also be involved in the causal pathway between CSEA and labor complications.

3. Results

Overall, data from 5252 women who had a trial of labor during the 3-year study period were screened (Fig. 1). Of the 3456 eligible nulliparous women, 1786 (51.7%) received CSEA during labor and 1670 (48.3%) had no analgesia. Women using CSEA were slightly older, had a longer pregnancy at delivery, gave birth to heavier neonates, and underwent induction of labor with oxytocin more often as compared with those without analgesia ($P<0.001$ for all) (Table 1). On admission to the delivery room, a higher percentage of women using CSEA had a cervical dilatation of less than 3 cm, although the difference between the two groups was not significant ($P=0.088$) (Table 1). During labor, women using CSEA were more often treated with oxytocin augmentation, and they had a significantly higher incidence of meconium-stained amniotic fluid ($P<0.001$ for all) (Table 1). There was no difference in the incidence of an Apgar score of 7 or less at 5 minutes between CSEA users and non-users ($P=0.094$) (Table 1).

Overall, 338 (9.8%) women underwent emergency cesarean. Emergency cesarean was more frequent in the CSEA group than in the no analgesia group ($P<0.001$) (Table 2). The indications for cesarean and the timing of the procedure did not differ between groups (Table 2).

On the basis of Kaplan–Meier curve analysis, the median lengths of the first stage and second stage of labor in vaginal delivery were

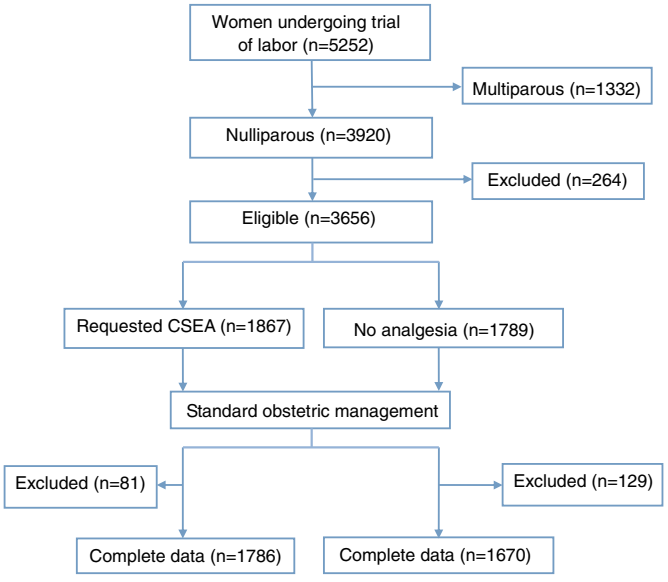

Fig. 1. Flow of patients through the study. Abbreviation: CSEA, combined spinal–epidural analgesia.

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