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CLINICAL ARTICLE

Impact of the introduction of neuraxial labor analgesia on mode of delivery at an urban maternity hospital in China

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ABSTRACT

Objective: To evaluate the association between the introduction of neuraxial (epidural) labor analgesia and mode of delivery in a large urban maternity hospital in China. **Methods:** A single-intervention impact study was conducted at Shijiazhuang Obstetrics and Gynecology Hospital in Shijiazhuang. Baseline data collection occurred between August 1 and December 31, 2009, when no analgesic method was routinely employed during labor. An intervention was then implemented, consisting of a neuraxial labor analgesia service. The service was fully operational from September 1, 2010, and data were collected to August 31, 2011. The mode of delivery was compared between the different periods. **Results:** Neuraxial analgesia rate was used in none of the 3787 deliveries during the baseline period and 3429 (33.5%) of 10 230 in the implementation period. Cesareans were performed in 1533 (40.5%) deliveries in the baseline period and 3441 (33.6%) in the implementation period (difference –6.8%, 99.8% confidence interval [CI] –9.7% to –3.9%; $P < 0.0017$). The proportion of vaginal deliveries in which forceps were used was unchanged (difference –0.8%, 99.8% CI –0.7% to 2.2%; $P = 0.92$). **Conclusion:** The introduction of epidural analgesia reduced the frequency of cesarean delivery, which improved obstetric and neonatal outcomes.

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1. Introduction

Neuraxial (epidural, spinal, and combined spinal–epidural) techniques are the most effective methods of pain relief during labor [1]. In addition, neuraxial analgesia has physiological benefits for the mother and fetus [2–6]. The use of neuraxial labor analgesia has progressively increased in high-income countries. In the USA, the proportion of parturients who received neuraxial analgesia rose from 21% in 1981 to 77% in 2001 [7]. In the UK, approximately 33% of parturients chose neuraxial analgesia in 2010–2011 [8].

In China, there are approximately 16.4 million deliveries per year [9]. The estimated cesarean delivery rate in China in 2010 was greater than 50% [9]. A WHO survey conducted in 2007 and 2008 [10] showed that 11.7% of deliveries in China—i.e. approximately 2 million—occur by cesarean without medical indications. Nonmedically indicated cesarean

deliveries result in excess maternal morbidity and mortality [11], as well as increased costs of medical care [12]. A factor possibly contributing to the high rate of cesarean delivery in China is the lack of readily available labor analgesia: less than 1% of laboring women in China currently receive some type of labor analgesia [13].

Despite the analgesic and physiological benefits of neuraxial labor analgesia, its impact on obstetric outcomes is controversial. Randomized controlled trials comparing neuraxial analgesia with systemic opioid analgesia have conclusively demonstrated that neuraxial analgesia does not increase the cesarean delivery rate, but the impact of neuraxial analgesia on the overall duration of labor and the rates of operative vaginal delivery and episiotomy is uncertain [1]. In addition, there is a paucity of data comparing obstetric outcomes between women who received neuraxial analgesia and those who received no pain medication.

The purpose of the present study was to report on the association between the implementation of a neuraxial labor analgesia service and the mode of delivery in a large urban maternity hospital in Hebei Province, China. The introduction of neuraxial labor analgesia was predicted to be associated with a decrease in the cesarean delivery rate and an improvement in maternal and neonatal outcomes.

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2. Materials and methods

The present study was a single-institution, single-intervention impact investigation conducted at Shijiazhuang Obstetrics and Gynecology Hospital in Shijiazhuang, China, from August 1, 2009, to August 31, 2011. All deliveries that occurred during the study period were included. The study was approved by the hospital's institutional review board. Informed patient consent was waived because de-identified data were collected retrospectively from hospital databases.

Shijiazhuang Obstetrics and Gynecology Hospital provides obstetrics and gynecology care for low-risk patients and deals with approximately 34% of all births in Shijiazhuang, the capital of Hebei Province. Midwives manage uncomplicated deliveries and make most of the intrapartum care decisions, including need for fetal heart monitoring and episiotomy. Obstetricians (35 in total) provide prepartum and postpartum care but do not participate in nonoperative vaginal deliveries.

Baseline data collection for the present study began on August 1, 2009. During the baseline period, no systematic labor analgesic method was routinely employed. Women were encouraged to use breathing exercises, visualization, and change in position to cope with labor pain.

On January 11, 2010, a transition period began in which the implementation of a modified No Pain Labor & Delivery protocol derived from the current practice at Prentice Women's Hospital (Northwestern University Feinberg School of Medicine, Chicago, IL, USA) was initiated [14]. A neuraxial labor analgesia service was established and was initially available on weekdays from 8:00 AM to 5:30 PM. The service was expanded to 24-hour care, 7 days per week, on July 17, 2010.

On August 28, 2010, a 1-day educational event was provided by L-Q.H., which included several components: prenatal education; training sessions for obstetricians, anesthesiologists, and midwives; and a meeting with hospital administration. The anesthesia labor pain service was then fully operational by September 1, 2010 (start of implementation phase). On November 12, 2010, an incentive program for anesthesiologists, obstetricians, and midwives was started, in which monetary compensation was provided on the basis of the number of laboring women who received neuraxial analgesia. In April 2011, a Chinese–American obstetrician fluent in Mandarin Chinese gave a lecture addressing episiotomy indications and complications. Data collection was continued for 1 year from full implementation until August 31, 2011.

Following implementation of the intervention, anesthesiologists provided neuraxial labor analgesia when requested by patients irrespective of the extent of cervical dilation, unless contraindicated. The epidural catheters were sited with patients in the lateral position; an epidural test dose of 1.5%–2% (2–3 mL) lidocaine was administered to rule out intrathecal placement. Labor analgesia was initiated using 0.075%–0.1% ropivacaine with 0.1–0.2 µg/mL sufentanil (10–20 mL) followed by a maintenance infusion (10 mL/hour) of the same solution. Manual epidural boluses of the anesthetic solution were administered to treat breakthrough pain. The continuous infusion was discontinued for the second stage of labor.

Apgar scores and estimated blood loss were assessed by midwives following routine vaginal deliveries and by operating room nurses following uncomplicated cesarean deliveries. Obstetricians estimated the blood loss if postpartum hemorrhage was diagnosed and made decisions regarding blood transfusions. Apgar scores were determined by a neonatologist for high-risk vaginal deliveries and by an anesthesiologist or/and neonatologist for high-risk cesarean deliveries.

The primary outcome variable was the mode of delivery. Secondary outcomes were episiotomy, maternal death, 7-day infant mortality, and a 5-minute Apgar score of three or less. Monthly summary data were obtained from four independently maintained data collection systems—the databases maintained in the labor and delivery suite (including obstetric anesthesia data), the blood bank, the pharmacy, and by the hospital administration (including operating room data)—and from the anesthesia case logs. The labor analgesia method was

obtained from the anesthesia case logs and was validated using the labor and delivery suite database. The rate of cesarean delivery was obtained from the labor and delivery database and validated using the administrative operating room database. The episiotomy and maternal death rates and infant outcomes were obtained from the hospital administration database.

Exploratory outcomes were the indication for cesarean delivery (medical vs nonmedical indication), assisted vaginal delivery, postpartum hemorrhage (estimated blood loss >500 mL after vaginal delivery or >1000 mL after cesarean delivery) and blood transfusion (packed red blood cells, fresh frozen plasma, cryoprecipitate, and platelets). Data for these outcomes were obtained from one data source. The number of units of packed red blood cells transfused in the labor and delivery suite was obtained from the labor and delivery suite database, and the total number of transfused products in the peripartum period was obtained from the blood bank database. The indication for cesarean delivery was recorded by the charge nurse on the labor and delivery unit.

On the basis of a birth rate of 9000 births per annum and a cesarean delivery rate of 40% before the intervention, a post-hoc power calculation suggested that the present sample size has a power of 0.9 to detect an effect size of 0.26 using a χ^2 test with an alpha of 0.05. This effect size represents a decrease in the cesarean delivery rate of 3% in the full-implementation phase, assuming no difference during the transition period.

The primary outcome (mode of delivery) was compared between the baseline period (August 1 to December 31, 2009), transition period (January 1 to August 31, 2010), and implementation period (September 1, 2010, to August 31, 2011) using the χ^2 test. $P < 0.01$ was considered statistically significant and post hoc comparisons were corrected for six comparisons using the Bonferroni method ($P < 0.0017$). Differences in the outcome rates and 99.8% confidence intervals (CIs) of the differences (Wald method) are reported. Secondary and exploratory outcomes were analyzed using the χ^2 test or the Kruskal–Wallis H test. The analyses were performed with R version 3.0.3 (R Foundation for Statistical Computing, Vienna, Austria).

3. Results

Overall, there were 19 938 deliveries in the study period; 18 547 (93.0%) of the parturients were nulliparous. The monthly delivery rate increased from 757 in August 2009 to 1056 in August 2011 (Fig. 1). Cross-validation of the primary outcome (comparing data from the labor and delivery database and the administrative operating room database) demonstrated a discrepancy of 0.7% in the rate of labor analgesia and 0.6% in the cesarean delivery rate.

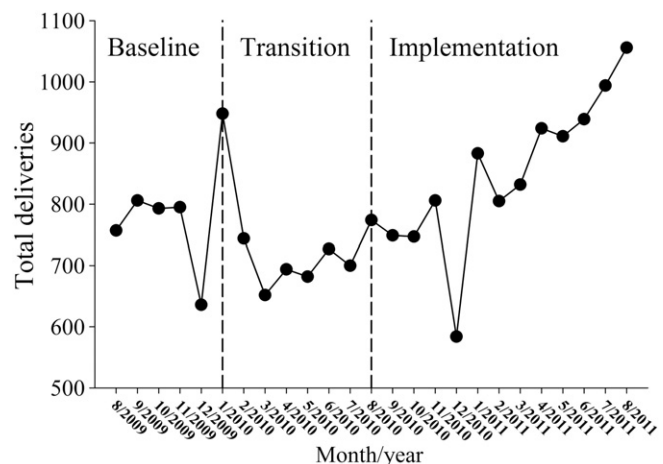


Fig. 1. Number of deliveries per month.

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