Journal of Anesthesia & Clinical Research
ISSN: 2155-6148

Shilkrut et al., J Anesth Clin Res 2013, 4:9
DOI: 10.4172/2155-6148.1000356

Research Article Open Access

The Use of Combined Spinal-Epidural Analgesia Utilizing Intrathecal Morphine for Labor Pain in a Community Hospital

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Abstract

Purpose: To assess the incidence of adverse outcomes in pre-selected laboring patients who received low dose intrathecal morphine as part of the regional technique for labor analgesia.

Methods: Retrospective observational study of 205 laboring patients who delivered at a large community hospital between January 2007 and December 2010. All patients received Duramorph, 250 μg, and fentanyl, 25 μg intrathecally. The primary adverse outcome was delayed maternal respiratory depression. Secondary adverse outcomes included high pain scores, low Apgar scores, and postpartum hemorrhage.

Results: No cases of respiratory depression requiring naloxone administration were reported during the study. No infants had Apgar scores <7 at five minutes for reasons related to anesthesia, 25% of patients (N=53) underwent cesarean section, and <1% of deliveries (N=2) were complicated by postpartum hemorrhage. Among all study participants, only 4% (N=9) had pain scores >4.

Conclusion: This study demonstrates that regional analgesia utilizing low doses of intrathecal morphine and fentanyl in selected laboring patients is safe and effective.

Keywords: Anesthesia; Obstetric; Combined spinal-epidural analgesia; Duramorph

Introduction

In the US, 50-60% of eligible pregnant women receive regional (neuraxial) analgesia as a part of labor pain management [1]. Combined Spinal-Epidural (CSE) analgesia is a well-established modality of pain control. It includes a single injection of local anesthetic and/or opiate into the cerebrospinal fluid (spinal analgesia, SA) in addition to insertion of an epidural catheter (epidural analgesia, EA).

CSE shows a faster onset of pain relief and provides more reliable analgesia with fewer operative vaginal births and less urinary retention than low-dose or traditional EA alone [2]. However, the optimal drug combinations and dosages for CSE are not established. Although fentanyl is a well-accepted analgesic for use in SA, it has short-lasting effects.

Thus, the combination of fentanyl and morphine allows the achievement of an excellent quality of analgesia with almost immediate onset and duration of up to 3-4 hours, meanwhile avoiding epidural infusion of local anesthetic with or without opioids, and a potential for associated EA side effects.

Intrathecal morphine has been described for several decades as a viable option for labor analgesia and cesarean sections [3]. After initial enthusiasm with this technique, there were several reports of delayed respiratory depression, after which many anesthesia providers stopped offering it to patients [4,5]. Early reports utilized doses of intrathecal morphine as high as 2000 μg [6]. Recently, intrathecal morphine at low doses (<400 μg) has started to regain popularity [7]. Moreover, with most studies in obstetrics focused on patients with cesarean deliveries, few studies have reported the use of intrathecal morphine among laboring patients [8,9].

The purpose of this study was to evaluate the incidence of respiratory depression, high pain scores, low Apgar scores, and postpartum hemorrhage with the use of low-dose intrathecal morphine as part of planned combined spinal-epidural analgesia in laboring patients.

Methods

We performed a retrospective review of 205 patients who received combined spinal-epidural analgesia with intrathecal morphine while in labor. Institutional review board approval was obtained. Using a Department of Anesthesia database maintained by one of the authors (M.G.), we identified patients who delivered at Metropolitan Hospital from January 2007 to December 2010, completed at least 35 gestational weeks, and received intrathecal morphine as part of the regional anesthesia during labor.

The database includes the incidence of respiratory depression that required airway manipulation, significant oxygen desaturation (<90%), naloxone use, and any requirement for cardiovascular support by medications or mechanical means. We documented the demographic data including age, parity, weight (BMI), and comorbid conditions.

The following patients were excluded from the study: patients with a history of drug abuse, patients with known difficult airway, patients with a significant history of obstructive sleep apnea, and patients allergic to opioids.

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Received August 19, 2013; **Accepted** October 16, 2013; **Published** October 18, 2013

Citation: Shilkrut AG, Kuklina EV, Xenakis C, Inchiosa Jr MA, Nitz SM, et al. (2013) The Use of Combined Spinal-Epidural Analgesia Utilizing Intrathecal Morphine for Labor Pain in a Community Hospital. J Anesth Clin Res 4: 356. doi:10.4172/2155-6148.1000356

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All women carried healthy infants at greater than 35 week's gestation with normal fetal heart tracings. All parturients had functional intravenous access and received at least 500cc of fluid load prior to anesthesia administration.After obtaining consent for neuraxial anesthesia and performing the bedside "time-out" procedure, combined spinal-epidural anesthesia was performed under sterile conditions.All patients received fentanyl, 25 μg and preservative-free morphine, 250 μg (Duramorph) in the subarachnoid space. Then the epidural catheter was tested with 3 cc lidocaine with epinephrine 1:1,000,000 and was otherwise not activated, unless indicated for further pain treatment or cesarean section. Our epidural solution consists of 0.0625% Bupivacaine with 2 mcg/cc of Fentanyl. No additional sedatives or opioids were given during the course of labor. Continuous monitoring of fetal heart rate and uterine contractions was performed for at least 30 minutes after the injection of intrathecal opioids, according to our institution's guidelines. Intrapartum monitoring included hourly maternal blood pressure, respiratory rate, and heart rate (monitored by nurses) for the first 12 hours after narcotic injection, and then every 2 hours until 24 hours after intrathecal injection of morphine. Nurses were instructed to call the anesthesiologist when respiratory rate was 8 breaths per minute or less or when oxygen saturation was 95% or less.

Outcomes recorded included mode of delivery, pain scores, postoperative complications, neonatal birth weight, and Apgar scores. Patients reported pain scores on a 0-10 scale (0- no pain and 10- the worst pain imaginable) before neuraxial anesthesia administration and at 5, 10, and 15 minutes after injection.

The Anesthesiology Department quality analysis data as well as Nursing quality analysis and improvement data have been reviewed independently for any evidence of respiratory depression, significant oxygen desaturation, somnolence, or opioid antagonist [naloxone] use.

Statistical methods

Since the comparisons among the various variables include factors that are scored data (e.g., ordinal data such as delivery score, etc.) as well as interval data, such as BMI, we used the non-parametric Spearman Rank Correlation analysis for all comparisons.The statistical software used for the analyses was Statmost (Dataxiom Software Inc., Los Angeles, CA 90010).

Results

Intrathecal morphine was administered to 205 patients from January 2007 to December 2010 who met inclusion criteria.Maternal demographic characteristics are presented in Table 1.

There were no cases of respiratory depression resulting in bradypnea (respiratory rate <8 breaths/minute), oxygen saturation (SpO_2) <95% on room air, or requirement for naloxone administration.Excellent pain relief was obtained within 15 minutes of intrathecal injection administration and only 9 patients (4%) reported a pain score > 4 at any point after the neuraxial anesthesia was administered (Table 2).

Population Demographics and Fetal Weight	Mean ± SD	Median (Range)
Age (years)	25.4 ± 6.4	24 (15-45)
ASA score	2 ± 1	2 (1-4)
BMI (kg/m^2)	31.5 ± 6.5	31 (20-44)
Gravity number	2.3 ± 1.8	2 (1-11)
Parity number	0.74 ± 1.12	1 (0-6)
Fetal Weight (g)	3281 ± 489	3310 (2125-4700)

Table 1: Maternal demographic characteristics.

BMI value	20-25	25-30	30-44
Number of patients/percentage	26/13.6%	69/36.3%	95/49.4%

Table 2: BMI Distribution.

Parameters	Correlation		Explanation
	R value	P value	
BMI vs. Initial Pain Score	-0.221	0.003	Overweight patients experienced less labor pain
BMI vs. Fetal wt.	0.158	0.031	Overweight patients were more likely to have larger fetuses
BMI vs. Cesarean Birth	0.196	0.008	Overweight patients were more likely to have Cesarean Section

Table 3: Results of statistically significant correlations in the studied cohort.

Fifty-three patients (25%) underwent cesarean section, and the average neonatal birth weight was 3284 g (2125 g-4700 g). Rate of cesarean section was directly related to BMI (P=0.008). Two infants (0.9%) were delivered with Apgar scores less than 7 at 5 minutes for reasons unrelated to anesthesia. Two patients (0.9%) had vaginal deliveries complicated by postpartum hemorrhage. 101 patients (49%) received subsequent epidural infusion.Additional analyses revealed several statistically significant associations presented in Table 3, with suggested interpretations.

Patients who experienced higher initial pain had a tendency to experience higher residual pain (P<0.05) Also, there was a negative correlation between BMI and degree of initial and residual pain (P<0.005). There was a tendency following Duramorph injection, for slightly higher pain scores in patients who later received follow-up epidural infusions. In fact, this difference reached statistical significance in pain scores that were recorded 5 min after Duramorph injection (Figure 1).

Obese patients were also more likely to deliver larger fetuses (P<0.05) and undergo cesarean section (P=0.008). Cesarean section rate was also directly related to the number of co-morbidities (P=0.01).

Discussion

In our retrospective study of 205 laboring patients who received spinal analgesia or combined spinal epidural analgesia with the use of 250 μg intrathecal morphine [Duramorph] and 25 μg fentanyl, excellent pain control with no incidence of respiratory depression requiring supplemental oxygen and/or naloxone administration was observed.

Delayed respiratory depression is the most severe and feared potential side effect of intrathecal opioids [10-12]. The diminished respiratory drive has been attributed to rostral spread of subarachnoid morphine to the cisterns and subsequently to the pons [13]. It is hard to estimate the incidence of respiratory depression with intrathecal morphine as authors use different definitions [14]. In the largest currently available study on the use of intrathecal morphine (about 2000 patients), the incidence of severe bradypnea requiring naloxone in patients receiving low doses of intrathecal morphine for post-cesarean section analgesia was 0.05% [15]. In recent years, providers have utilized lower doses of morphine and fentanyl combined with more vigilant patient monitoring, including frequent vital signs assessment and continuous pulse oximetry monitoring in the early recovery period, which has dramatically reduced the incidence of severe respiratory depression and other side effects [7]. In our study, no patients required supplemental oxygen or naloxone administration. Although our results may be due to the limited number of well selected young patients, they are consistent with the results of several previous

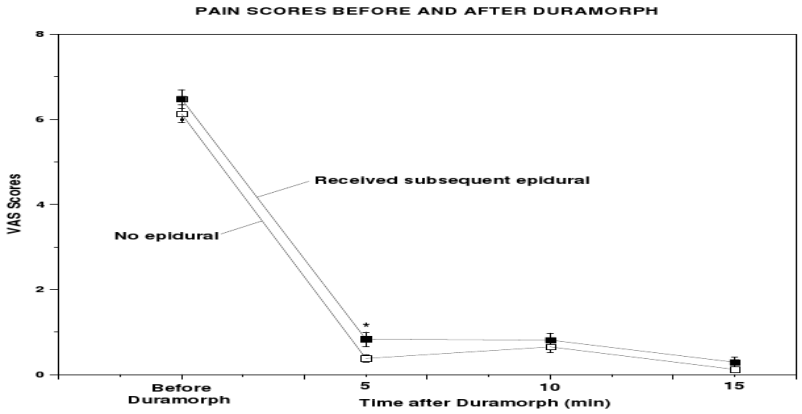

Figure 1: Pain Scores before and after Duramoprh injection.

studies of cesarean sections. In these studies, intrathecal morphine was utilized in various low dose ranges (<400 μg) either without evidence of respiratory compromise or a rare incidence of respiratory depression that was successfully treated with supplemental oxygen [16,17]. Other factors contributing to the absence of respiratory depression in our study patients may include a low dose of Duramorph 250 μg, the absence of any premedication, limited comorbidities, young age, and the stimulatory effect of progesterone on ventilation.

In our study, 86 percent of the patients were overweight or obese, which shows the excellent safety profile of intrathecal morphine in this group of patients, who represent an increasing percentage of laboring patients in the US. Aboulesh et al. suggested that morbidly obese patients were at higher risk of developing respiratory depression [18]. In our study we showed that despite patients' increased Body Mass Index (BMI), (46% percent of patients had a BMI ≥ 31) there was no incidence of respiratory depression. Therefore our conclusion is that isolated obesity is not a contraindication to neuraxial analgesia with low dose Duramorph. In our study, overweight women had lower initial and subsequent pain scores. The relatively higher pain threshold of obese patients has been described in previous publications and is beyond the scope of this study [19]. Subsequent studies might be needed to examine whether overweight patients can achieve similar pain relief with lower doses of opioids. It was of interest that patients who received a follow-up epidural infusion did demonstrate slightly higher VAS pain scores following Duramorph injection; the differences at 5 min after Duramorph were statistically significant ($p<0.05$).

In order to evaluate the effect on the neonate we used the Apgar scores. Apgar scores less than 7 were recorded in two patients secondary to causes unrelated to the anesthetic. One patient had chorioamnionitis during labor with fetal tachycardia.The other patient had an antepartum course significant for a hydropic fetus, and her delivery was complicated by neonatal demise. There was no significant effect of intrathecal morphine on the neonates of all 205 patients.

In several publications the use of intrathecal opioids is mentioned as an alternative to more costly, labor-intensive, and technically more complex epidural analgesia [20]. Although single-shot intrathecalopioids (without an epidural catheter) for labor analgesia are not widely used by anesthesiologists, some obstetricians or family practitioners use them when the availability of anesthesia services is limited [21]. In our study, each participant had an epidural catheter placed and conversion to epidural anesthesia was done if needed. If in the course of labor, a cesarean delivery was indicated, the patient already had a tested epidural catheter in place that was ready to be activated to create surgical anesthesia.

However, about half of participants delivered within the analgesia period provided by single-shot intrathecal opioids, without activation of epidural infusion. Therefore, demonstrating the feasibility of using spinal analgesia alone in resource-limited settings.

The limitations of our study include that, as with any retrospective observational study, causal relationships cannot be established. Additionally, patient selection for intrathecal analgesia was based on the anesthesia provider's preference. Pruritis and vomiting remain well-known and common side effects of narcotic administration. The frequency and severity of these side effects varies among different populations and correlates with the degree of analgesia.We did not focus on these side effects, since they have been extensively studied in the literature [21,22].

In conclusion, the results of our retrospective study of 205 patients showed that low dose intrathecal morphine can be a valuable tool in the armamentarium of the anesthesiologist administering analgesia to parturients. Prospective studies may be needed to compare different dose regimens in combined spinal-epidural analgesia, determine "ideal" concentrations of medication and identify women who would benefit the most from intrathecal analgesia.

Acknowledgements

The authors thank Andrew Sylverstein and Andreas Codreanu for collecting and organizing data used in our study and Michael Orloff for submission editing.

Financial Disclosure

The funding sources were from departmental, hospital, and college funds. The authors did not report any potential conflict of interest.

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