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Spinal Analgesia in Labor on Maternal and Neonatal Outcomes: A Retrospective Cross Sectional Study

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ABSTRACT

Background & Objective: Spinal analgesia and Entonox analgesia are used as pain relief methods during labor. This cross-sectional study was conducted to determine the effect of spinal analgesia and Entonox analgesia on the duration of the first, second, and third stages of labor, Apgar score, and maternal and fetal outcomes.

Materials & Methods: Clinical information of 1,000 patients who delivered at Shahid Akbarabadi Hospital and underwent painless delivery with Entonox gas and spinal anesthesia was assessed; then, according to the inclusion criteria, 280 cases were enrolled and then they divided into two groups: the spinal analgesia group (n=140) and Entonox analgesia group (n=140). In the spinal analgesia group, 25 µg of fentanyl and 1-2 mg of bupivacaine were administered. For the Entonox group, Entonox inhalation was administered via a face mask at the initiation of pain at each contraction. The duration of labor, mode of delivery, side effects, and maternal satisfaction were also compared in the two groups.

Results: The duration of the first stage was significantly shorter in the spinal analgesia group than in the Entonox analgesia group (P<0.001), but the duration of the second stage in the spinal analgesia group was longer (P<0.001). There were no significant differences in the cesarean section rates, Apgar score, weight of newborn,, and acidity (PH) and the pressure of carbon dioxide (pCO_2) in arterial blood gas between the two groups. Measured pain was significantly lower in the spinal analgesia group (P=0.01) than in the Entonox analgesia group regarding visual analog scale (VAS) scores.

Conclusion: Spinal analgesia is a safe, suitable, and effective method for pain reduction with no adverse effects on the outcome of labor compared to Entonox analgesia.

Keywords: Labor pain, Labor stage, Nitrous oxide, Pregnancy outcome, Spinal analgesia

Introduction

Labor is a physiological and natural process, as well as a complicated and subjective experience **(1)**. Except for a few women, childbirth is unquestionably a painful experience. Women's understanding of delivery's pain is influenced by various factors, making each experience special **(2)**. As opposed to other painful life events, labor pain consistently ranks high on the pain rating scale **(3, 4)**.

Currently, most women choose pain relief methods, such as Entonox and epidural or spinal anesthesia. The main goal of pain relief in labor and delivery is to make the parturient as pain-free as possible while also allowing them to engage in the birthing process; on the other hand, it should have no adverse effects or dangers to both mother and newborn. There are many pain-relieving options, but none of them are perfect or ideal **(4)**. Entonox gas that is a combination of oxygen and nitrous, is a method used for painless delivery through inhalation. Because of its immediate effect, it is desirable for many mothers. Entonox for painless delivery is a fast and effective method, and, due to rapid recovery from anesthesia, it is preferred by mothers **(4)**.

One of the other popular ways to relieve pain during labor is epidural analgesia **(5)**. However, in low-resource countries, the availability of this method during delivery is restricted **(6)**. Previous studies have shown that from 85% of women who requested analgesia during labor, only 40% received it **(7-9)**. The cost of personnel and equipment for epidural analgesia can be excessively high, and the cost of morphine consumption for epidural analgesia is ten times higher in developing countries than in developed countries **(6)**. From this point of view and due to the limited

resource of epidural analgesia, spinal analgesia may be a good and affordable way for pain relief **(10)**. In spinal analgesia, the local anesthetic is injected in subarachnoid space, while in epidural analgesia, the local anesthetic is infiltrated in the epidural space using an epidural needle **(11)**.

Previous studies have indicated that spinal opioids can provide effective analgesia during labor with no risk of neonatal and maternal complications; however, controversy exists over the possible benefits and drawbacks of using this method during labor **(12)**.

Although in many countries, epidural analgesia is suggested and used as the best choice to relieve the pain of natural delivery, in Iran, due to the concerns about the effects of epidural analgesia on mother and fetus compared to other analgesic methods (such as spinal), it has not been very well received. Therefore, comparing the timing of different phases of labor in various analgesic procedures can help determine how serious the problem is.

On the other hand, although the best method for inducing labor analgesia has not been agreed upon, a method should be considered that has the most desirable quality of analgesia with the least side effects and the least amount of medication used in it **(13)**.

In the meantime, spinal anesthesia is a very effective, efficient, and uncomplicated method; if it is accompanied by proper training for mothers, the patients' fear of doing is greatly reduced and, in turn, can be very effective in alleviating pain; however, due to ethical and methodological problems and confounding factors, the use of this type of anesthesia in labor has been questioned; also, the review of available sources in this area does not provide enough information about the effect of this type of analgesia on different phases of labor **(14, 15)**. Therefore, the aim of this study was to investigate the effects of spinal analgesia vs. Entonox analgesia on the duration of the first, second, and third stages of labor and Apgar score, as well as to understand the consequences and efficiency of this technique on mothers and neonates.

Materials and Methods

After receiving institutional ethics approval, this retrospective cross-sectional study was conducted in a hospital affiliated with the Iran University of Medical Sciences (in Tehran, Iran).

Clinical information of 1,000 patients who had painless delivery at Shahid Akbarabadi Hospital was assessed from June 2018 to December 2019. Then, according to the inclusion criteria, 280 cases were enrolled in the study.

The healthy subjects at term gestation (≥37 weeks) with a singleton pregnancy, aged between 18 and 30 years with a normal shape of the uterus in vertex presentation and in the active phase of labor with cervical dilatation of 3-4 cm requested for labor analgesia were included in the study.

Subjects with any doubt about cephalopelvic disproportion by clinical pelvimetry or with bleeding disorders, pregnancy-induced hypertension, severe anemia, complications like diabetes mellitus, and oligohydramnios, intrauterine growth retardation, previous cesarean section, and uteroplacental insufficiency were excluded from this study.

A detailed medical and obstetric history was taken, and general history forms and checklists were completed; then, the cephalic fetal presentation was confirmed by an ultrasound scan. The participants were moved to the labor room after the obstetric team announced and confirmed that they were in the active phase of labor (contraction were regular, with cervix effaced and dilated 3-4 cm). In painless delivery with Entonox, gas is inhaled through a face mask. As the contraction begins, the mother begins to breathe the gas, which continues until the end of the contraction. Then, the mother inhales room air. The severity of the mother's contractions, vital signs, and fetal heart rate are monitored at all times.

In the spinal analgesia group, a lactated Ringer's solution infusion was administered, and the women were positioned in a sitting position. The labor process was started in the aseptic situation, and spinal analgesia was conducted using a prepacked kit containing pencil-point spinal needles (22, 24-26, 28, 29-G _Pajunk compani) at the L3-L4 L4-L5 interspace, based on the patient's body and anesthesiologist's discretion.

Laboring women were then positioned in the left lateral position to limit aortocaval compression and hypotension. The administered analgesia mixture included 25 µg of fentanyl (Fentanyl injection 50 mcg/ml , 10 ml _ janssen pharmaceutical)and 1-2 mg of bupivacaine(Bupivacaine injection 0.5% ,20ml , mylan SAS ,France). The mother's vital signs were checked every 5 min for the first 15 min, every 15 min for the next half hour, and then every half hour until the end of labor.

In both groups, the labor process was routinely monitored by the midwife in charge of each delivery. The time of onset of the active phase of labor, as well as the time of complete dilatation, and the time of delivery, were recorded in a checklist. The Friedman curve was used to determine how the first stage progressed, and the reasons for the lack of progress in delivery and cesarean section were recorded. An obstetric resident determined the first- and fifth-minute Apgar scores and recorded them.

Twelve hours after delivery, an oral thermometer was used to check for hyperthermia every 4 h, and if the fever was higher than 38 °C, it was reported. There was also a question about headaches or other complaints such as nausea and post-partum hemorrhage; after delivery, if there was a symptom in the relevant section, it was noted and recorded.

Data analysis from these documents was performed using a statistical software package (SPSS inc.,chicago ,USA).Chi-square and *t* tests were used for data analysis. A P-value of less than 0.05 was considered statistically significant, and the confidence coefficient was 95%.

Results

In this retrospective research, a total of 280 subjects were studied, with 140 women in each group. Table 1 indicates subjects' characteristics in both groups. Both groups had no significant differences in age, weight, height, body mass index (BMI), and gestational age.

The analysis showed that the overall duration of labor was shorter in the spinal analgesia group than the Entonox group (Table 2).

The duration of the active labor phase (first stage) was significantly shorter in the spinal analgesia group than in the Entonox group (P<0.001), but the duration of the second stage was longer in the spinal analgesia group (P<0.001). The finding showed that the third stage of labor duration was not significantly different between the two groups (P=0.875).

Cervical dilatation at analgesia administration was the same in the two groups, and no significant difference was observed (P>0.01). There were no significant differences in terms of Apgar score and weight. None of the newborns in the two groups had an Apgar score of less than seven at 5 min.

A slightly higher incidence of cesarean section was observed in the Entonox group (15% vs. 14.3% in the spinal analgesia group); it was not statistically significant.

The result of acidity (PH) and the pressure of carbon dioxide (pCO_2) as an indicator of fetal breathing is shown in Table 2. There were no significant differences between the two groups in the PH, pCO_2, and base excess value.

The side effects of Entonox were dry mouths, vertigo, lethargy, vomiting, and uncomfortable feeling.

The most common side effects in women with spinal analgesia were pruritus, hypotension, and prolonged declaration, which occurred in 47%, 40%, and 15% of subjects, respectively; they were significant. The analysis showed that spinal analgesia has no significant effect on headaches, nausea, lactation, fever, bladder function, or walking ability (P>0.01). All of the delivery outcomes were transient and tolerable, requiring no treatment.

Discussion

Spinal analgesia is commonly used to treat labor pain and increase movement in labor, resulting in higher satisfaction among parturients. Over the years, researchers have looked into the effects of spinal analgesia on labor and obstetric outcomes **(16, 17)**.

The duration of the first and second stages of labor, side effects of the analgesia method on the mother and neonatal outcomes, and pain after delivery were all analyzed as endpoints.

The first finding of our study was the effect of spinal analgesia on the duration of different phases of labor, the mean duration in the first stage of labor in the spinal analgesia group decreased 89 min and, in the second stage, increased 35 min, respectively, compared to the Entonox group. Thus, it should be noted that the use of this method of anesthesia is associated with a shorter active phase—but a longer second phase—of labor. This finding is similar to previous studies **(18, 19)**. Wong et al., in his research, proved that the injection of fentanyl into the intrathecal space tends to create faster cervical dilation and hasten the first stage of labor **(20)**. It was mentioned in other systemic reviews that this type of analgesia prolonged the second stage of labor **(21)**. However, the finding of another study indicated that the mean duration in the first and second stages of labor in the spinal analgesia group increased 108 and 21 min, respectively.

There are inconsistent results in some previous studies comparing epidural analgesia to systemic opioids; in most of them, epidural analgesia did not affect the first stage. The results of a study by Tsen *et al*. indicated that combined spinal-epidural technique for analgesia was linked to a higher rate of opening the cervix or cervical dilatation **(22)**. The reason for these different results can be related to the type of protocol, method of study, and type of substance used for anesthesia.

Also, we found that despite the effect of spinal anesthesia on the second phase of labor, its effect on the hemodynamic conditions of infants (birth weight and Apgar score), as well as acid and base conditions, was not confirmed. In other words, this anesthesia protocol did not adversely affect the hemodynamic conditions of mothers and infants. These findings are consistent with those of a 2020 study conducted by Rad et al.on 50 parturients with spinal analgesia **(23)**. There was no difference between the two groups in terms of newborn weight and 1 and 5 min Apgar scores in this studyRahimi et al. **(24)** found no statistically significant relationship between delivery and analgesia methods and blood gas levels (PH, pCO2, and HCO_3). Huang J-H et al found that lactate values in umbilical artery blood and pCO_2 in umbilical vein blood were affected by epidural analgesia delivery; however, he reported no significant differences in parturients and neonates' basic characteristics, such as score, acidity (pH) , Base Excesss ,HCO_3, and so on **(25)**.

It is necessary to explain that the occurrence of some effects following the use of spinal anesthetic is considerable, but these side effects are mild and reversible and can be avoided or eliminated by changing the drug dose or calibrating the method.

The study findings showed no correlation between the labor analgesic method and breastfeeding success or

adverse infant-feeding effects. Evidence shows that obstetric anesthesia does not affect breastfeeding **(26)**. Breastfeeding and lactation are multifactorial, multidimensional, and complex phenomena, and spinal analgesia is only one of these factors. The most important factors on breastfeeding success seem to be the delivery room and post-partum activities that promote breastfeeding. There is no prospective, randomized proof that epidural analgesia reduces breastfeeding success at the moment. Some of the studies have also stated that a dose-response relationship exists **(22)**.

All of the women who participated in the current study could walk after delivery, and there was no relationship between walking and analgesia methods. In the final stages of labor, the walking status, headache, fever, blurred vision, post-partum hemorrhage, and urinary retention were investigated. In this regard, there were no significant differences between the two groups. According to other studies, spinal anesthesia does not affect bladder function or walking ability **(27)**. No previous study has shown that spinal analgesia is associated with a greater magnitude of core hypothermia in the clinical setting **(28)**.

The most common complications and side effects of spinal analgesia in parturients were nausea and vomiting, pruritus, hypotension, prolonged declaration, and headache, which occurred in 61%, 47%, 40%, 15%, and 10% of our parturients, respectively. These side effects were transient and did not require medical intervention. Previous studies have indicated that nausea and vomiting are most commonly related to hypotension, can be relieved in conjunction with successful hypotension treatment, and do not require any specialized treatment. Further, other reasons for nausea during spinal anesthesia might include brain hypoxia, insufficient anesthesia, and surgical manipulation-induced traction-related parasympathetic responses **(5)**. Pruritus may be due to intrathecal opioids used in combination with local anesthetics. Hypotension is more common in pregnant women, with occurrences ranging from 50% to more than 90%; this variation among papers may be due to the different definitions of hypotension, different patient materials, and different methods used to prevent hypotension **(6)**.

Our study has several limitations. First, the most important limitation is that this study is a retrospective study; we had to read many files to be included in the entry criteria. Second, the findings of this research cannot be extrapolated to women with serious medical or pregnancy-related illnesses since it only involved healthy and safe parturients. These comorbidities may affect obstetric management (impacting the rate of instrumental or cesarean deliveries) and neonatal outcomes. Third, subjective assessments of cervical dilatation can differ among doctors with varying experience levels, affecting the actual period of labor.

As a result, in the use of spinal anesthesia, the increased duration of the second phase of labor with hemodynamic stabilization is predictable, and this method will continue to be regarded as a safe and effective method of labor pain alleviation. These methods are more commonly used than general analgesia. The goal of painless delivery is to reduce the cesarean section rate, increase the desire for normal delivery, create peace of mind during the delivery process, and reduce morbidity due to cesarean section and difficult deliveries. With these circumstances, it appears that in Iran, painless delivery may be a viable alternative to cesarean section without indication.

Overall, this study confirms previous findings that spinal analgesia has no negative effects on labor outcomes. We should alleviate parturient women's concerns and convince them that with spinal analgesia, they will have superior analgesia and be able to have a standard and safe delivery.

Conclusion

The current study found no significant difference in the frequency of emergency cesarean section or neonatal outcome between parturients who received and those who did not receive spinal analgesia. However, the use of this method is associated with a shorter active phase—but a longer second phase—of labor. The most important side effects of spinal analgesia in parturients were pruritus, hypotension, and the prolonged declaration that all were transient and tolerable, requiring no treatment.

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The ethics committee approved this study of Iran University of Medical Sciences with the code: IR.IUMS.FMD.REC.1399.295.

Conflict of Interest

The authors declare no conflicts of interest.

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