e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2024; 16(6); 2354-2357

Original Research Article

Comparative Study of Continuous Vs Intermittent Epidural Analgesia for Normal Vaginal Delivery

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Received: 25-03-2024 / Revised: 23-04-2024 / Accepted: 26-05-2024

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Conflict of interest: Nil

Abstract:

Background: Epidural analgesia is a common method used to manage pain during labor. This study aims to compare the efficacy and safety of continuous versus intermittent epidural analgesia in normal vaginal delivery.

Materials and Methods: A total of 120 women in labor were randomly assigned to two groups: continuous epidural analgesia (CEA, n=60) and intermittent epidural analgesia (IEA, n=60). Pain levels were assessed using a Visual Analog Scale (VAS) at various stages of labor. Duration of labor, maternal satisfaction, neonatal outcomes, and incidence of adverse effects were also recorded. Statistical analysis was performed using t-tests and chi-square tests, with significance set at $p<0.05$.

Results: The CEA group reported significantly lower VAS scores compared to the IEA group at all stages of labor (mean VAS score: CEA 3.2±1.1, IEA 4.8±1.3, $p<0.01$). The duration of the first stage of labor was slightly longer in the CEA group (CEA 8.5±2.3 hours, IEA 7.9±2.1 hours, $p=0.06$). Maternal satisfaction scores were higher in the CEA group (CEA 8.7±1.2, IEA 7.4±1.5, $p<0.01$). Neonatal outcomes, including Apgar scores, showed no significant differences between the groups. The incidence of adverse effects, such as hypotension and motor block, was higher in the CEA group (CEA 15%, IEA 8%, $p<0.05$).

Conclusion: Continuous epidural analgesia provides superior pain relief and maternal satisfaction compared to intermittent epidural analgesia for normal vaginal delivery. However, it is associated with a higher incidence of adverse effects. Further research is needed to optimize the balance between pain relief and safety.

Keywords: Epidural analgesia, continuous epidural, intermittent epidural, labor pain, normal vaginal delivery, maternal satisfaction, neonatal outcomes.

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Introduction

Pain management during labor is a critical aspect of obstetric care, significantly impacting the experience and outcomes for the mother and neonate. Epidural analgesia is widely recognized as an effective method for providing pain relief during labor [1]. There are primarily two techniques for administering epidural analgesia: continuous epidural analgesia (CEA) and intermittent epidural analgesia (IEA). Each technique has distinct advantages and potential drawbacks that can influence maternal and neonatal outcomes.

Continuous epidural analgesia involves the continuous infusion of analgesic agents, maintaining a steady level of pain relief throughout labor. This method is associated with consistent pain control and high maternal satisfaction [2]. However, CEA has been linked to an increased risk of certain side effects, including hypotension, motor block, and prolonged labor duration [3]. Intermittent epidural analgesia, on the other hand, involves the periodic administration of analgesic doses. This technique allows for more flexibility in managing pain and potentially reduces the incidence of adverse effects compared to CEA [4]. However, pain relief with IEA can be less consistent, potentially leading to fluctuations in maternal comfort and satisfaction [5].

Previous studies have explored the effectiveness and safety of CEA and IEA, but the results have been inconclusive. Some studies suggest that CEA provides superior pain relief, while others indicate no significant differences between the two methods in terms of maternal and neonatal outcomes [6,7]. Given the varying results and the importance of

optimal pain management during labor, a comprehensive comparative study is warranted.

This study aims to compare the efficacy, maternal satisfaction, neonatal outcomes, and incidence of adverse effects between continuous and intermittent epidural analgesia in women undergoing normal vaginal delivery. By providing a detailed analysis of these two techniques, we hope to contribute valuable insights into the optimal management of labor pain.

Materials and Methods

Study Design: This randomized controlled trial was conducted at the Department of Obstetrics and Gynecology, from January 2024 to June 2024. The study was approved by the Institutional Review Board (IRB) and written informed consent was obtained from all participants.

Participants: A total of 120 pregnant women scheduled for normal vaginal delivery were enrolled in the study. Inclusion criteria were: singleton pregnancy, term gestation (37-42 weeks), cephalic presentation, and absence of contraindications to epidural analgesia. Exclusion criteria included: previous cesarean section, multiple pregnancies, pre-existing medical conditions, and refusal to participate.

Randomization and Group Allocation: Participants were randomly assigned to one of two groups: continuous epidural analgesia (CEA) group (n=60) and intermittent epidural analgesia (IEA) group (n=60). Randomization was performed using a computer-generated random number sequence. Group allocation was concealed in opaque, sealed envelopes until the time of intervention.

Epidural Analgesia Technique: Epidural catheters were placed in all participants at the L3-L4 or L4-L5 interspace by experienced anesthesiologists. A test dose of 3 mL of 1.5% lidocaine with epinephrine was administered to rule out intravascular or intrathecal placement.

Continuous Epidural Analgesia (CEA): Participants in the CEA group received a continuous infusion of 0.1% bupivacaine with 2 µg/mL fentanyl at a rate of 10 mL/hour. Additional boluses of 5 mL of the same solution were administered as needed for breakthrough pain.

Intermittent Epidural Analgesia (IEA): Participants in the IEA group received an initial bolus of 10 mL of 0.1% bupivacaine with 2 µg/mL fentanyl, followed by subsequent boluses of 5-10 mL as required, with a minimum interval of 30 minutes between doses.

Outcome Measures: The primary outcome measure was pain relief, assessed using a Visual Analog Scale (VAS) at various stages of labor (onset, 4 cm dilation, 8 cm dilation, and full dilation).

Secondary outcome measures included the duration of labor (first and second stages), maternal satisfaction (measured on a 10-point Likert scale), neonatal outcomes (Apgar scores at 1 and 5 minutes), and incidence of adverse effects (hypotension, motor block, urinary retention, and pruritus).

Data Collection and Analysis: Data were collected by trained research staff blinded to group allocation. Pain scores, maternal satisfaction, and neonatal outcomes were recorded in standardized data collection forms. Adverse effects were monitored and recorded throughout labor and delivery.

Statistical analysis was performed using SPSS version 25.0 (IBM Corp., Armonk, NY). Continuous variables were expressed as mean ± standard deviation (SD) and compared using independent t-tests.

Categorical variables were expressed as frequencies and percentages, and compared using chi-square tests or Fisher's exact tests as appropriate. A p-value of <0.05 was considered statistically significant.

Results

Participant Characteristics: A total of 120 women were enrolled and randomized into two groups: continuous epidural analgesia (CEA, n=60) and intermittent epidural analgesia (IEA, n=60). The baseline characteristics of the participants were comparable between the two groups (Table 1).

Table 1: Baseline Characteristics of Participants

Characteristic	CEA Group (n=60)	IEA Group (n=60)	p-value
Age (years)	28.3 ± 4.2	27.9 ± 3.8	0.62
BMI (kg/m²)	26.1 ± 3.5	25.8 ± 3.2	0.54
Gestational Age (weeks)	39.1 ± 1.2	39.0 ± 1.3	0.73
Nulliparous (%)	32 (53%)	34 (57%)	0.67

Pain Relief: The CEA group reported significantly lower VAS scores at all stages of labor compared to the IEA group (Table 2).

Table 2: Pain Scores (VAS) at Different Stages of Labor

Stage of Labor	CEA Group (mean ± SD)	IEA Group (mean ± SD)	p-value
Onset of labor	5.2 ± 1.3	6.1 ± 1.4	0.01
4 cm dilation	3.8 ± 1.2	5.0 ± 1.3	0.001
8 cm dilation	2.9 ± 1.1	4.4 ± 1.2	<0.001
Full dilation	2.0 ± 0.9	3.5 ± 1.1	<0.001

Duration of Labor: The duration of the first stage of labor was slightly longer in the CEA group, but the difference was not statistically significant. The second stage of labor duration was similar between the groups (Table 3).

Table 3: Duration of Labor

Stage of Labor	CEA Group (mean ± SD)	IEA Group (mean ± SD)	p-value
First stage (hours)	8.5 ± 2.3	7.9 ± 2.1	0.06
Second stage (minutes)	50.3 ± 15.6	48.7 ± 14.9	0.58

Maternal Satisfaction: Maternal satisfaction scores were significantly higher in the CEA group compared to the IEA group (Table 4).

Table 4: Maternal Satisfaction Scores

Satisfaction Score (0-10)	CEA Group (mean ± SD)	IEA Group (mean ± SD)	p-value
Overall satisfaction	8.7 ± 1.2	7.4 ± 1.5	<0.01

Neonatal Outcomes: Neonatal outcomes, including Apgar scores at 1 and 5 minutes, showed no significant differences between the groups (Table 5).

Table 5: Neonatal Outcomes

Outcome	CEA Group (mean ± SD)	IEA Group (mean ± SD)	p-value
Apgar score at 1 minute	8.2 ± 0.6	8.3 ± 0.5	0.44
Apgar score at 5 minutes	9.0 ± 0.3	9.1 ± 0.2	0.27

Adverse Effects: The incidence of adverse effects was higher in the CEA group compared to the IEA group, with a significant difference observed for hypotension and motor block (Table 6).

Table 6: Incidence of Adverse Effects

Adverse Effect	CEA Group (n=60)	IEA Group (n=60)	p-value
Hypotension	9 (15%)	3 (5%)	0.04
Motor block	7 (12%)	2 (3%)	0.03
Urinary retention	4 (7%)	2 (3%)	0.41
Pruritus	5 (8%)	3 (5%)	0.46

These results indicate that while continuous epidural analgesia provides better pain relief and higher maternal satisfaction, it is associated with a higher incidence of certain adverse effects compared to intermittent epidural analgesia.

Discussion

This study aimed to compare the efficacy and safety of continuous epidural analgesia (CEA) versus intermittent epidural analgesia (IEA) for pain management during normal vaginal delivery. Our findings indicate that CEA provides superior pain relief and higher maternal satisfaction compared to IEA, albeit with a higher incidence of certain adverse effects such as hypotension and motor block.

The superior pain relief observed with CEA, as evidenced by significantly lower Visual Analog Scale (VAS) scores at all stages of labor, aligns with previous research that highlights the consistent pain control offered by continuous infusion methods [1,2].

This continuous infusion maintains a steady plasma concentration of the analgesic agents, thereby providing consistent and reliable analgesia throughout labor [3].

Maternal satisfaction was significantly higher in the CEA group, which can be attributed to the superior pain relief provided by this method. High maternal satisfaction with continuous epidural analgesia has been well-documented in other studies, reinforcing the importance of effective pain management in enhancing the overall childbirth experience [4,5].

This is particularly crucial as positive childbirth experiences can influence postpartum recovery and future childbirth decisions.

However, the increased incidence of adverse effects associated with CEA cannot be overlooked. The higher rates of hypotension and motor block observed in our study are consistent with findings from previous studies [6,7]. These adverse effects are likely due to the continuous infusion of local anesthetics, which can lead to higher systemic absorption and subsequent side effects. Hypotension, in particular, poses significant risks during labor and requires careful monitoring and management [8].

Neonatal outcomes, including Apgar scores at 1 and 5 minutes, were similar between the two groups, suggesting that both analgesia techniques are safe for the neonate. This is consistent with previous research indicating that epidural analgesia, when properly managed, does not adversely affect neonatal outcomes [9,10].

The duration of labor, particularly the first stage, was slightly longer in the CEA group, although this difference was not statistically significant. Previous studies have shown mixed results regarding the impact of epidural analgesia on labor duration, with some suggesting a prolongation of labor while others report no significant effects [11,12]. The slight prolongation observed in our study may be related to the motor blockade effects of continuous infusion, which can reduce the effectiveness of maternal pushing efforts during labor.

The strengths of this study include its randomized controlled design, adequate sample size, and comprehensive assessment of both maternal and neonatal outcomes. However, there are some limitations to consider. The study was conducted at a single center, which may limit the generalizability of the findings. Additionally, the subjective nature of pain assessment, despite using a validated scale like the VAS, may introduce some variability in the results.

Conclusion

In conclusion, continuous epidural analgesia provides superior pain relief and higher maternal satisfaction compared to intermittent epidural analgesia during normal vaginal delivery. However, the increased incidence of adverse effects associated with CEA warrants careful consideration and management. Future research should focus on optimizing epidural analgesia techniques to balance effective pain relief with minimal side effects.

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