Analysis of the Application Effect of Painless Delivery Technology in Clinical Obstetrics

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Abstract: *Objective:* To explore the application effect of painless delivery technology in clinical obstetrics. *Methods:* Clinical data of 900 women who gave birth were collected and randomly divided into groups A and B, each comprising 450 cases. Group A served as the control group, while Group B acted as the observation group. Group A underwent natural delivery, whereas Group B received combined spinal-epidural anesthesia for painless delivery. The effects of these two delivery techniques were comprehensively evaluated based on maternal pain level, postpartum recovery, postpartum lactation, and other relevant indicators. *Results:* In Group B, there were more individuals with pain levels of 0 and 1 compared to Group A, and significantly fewer individuals with pain levels of 2 and 3 than in Group A ($P < 0.05$). This suggests that the pain level in Group B was significantly superior to that in Group A. Additionally, postpartum recovery indicators among mothers in Group A were significantly higher than those in Group B ($P < 0.05$). Furthermore, the time for the onset of colostrum mobilization and adequate breast milk production was significantly longer in Group A compared to Group B ($P < 0.05$). *Conclusion:* Combined spinal-epidural anesthesia with ropivacaine + sufentanil demonstrates a positive application effect in painless delivery.

Keywords: Painless delivery; Obstetrics; Combined spinal-epidural anesthesia; Application effects

1. Introduction

With the rapid development of modern medicine, painless delivery technology has become an integral component of contemporary obstetric practice [1]. Its primary objective is to mitigate or eliminate pain during childbirth through pharmacological anesthesia or other technical interventions, thereby enhancing the delivery experience in terms of comfort and safety. The advent of painless delivery technology signifies a significant departure from traditional delivery methods, marking the onset of a new era in obstetrics. However, despite the manifold advantages offered by painless delivery technology, its clinical application is not devoid of controversies and challenges.

For instance, various painless delivery techniques exhibit disparities in terms of safety and efficacy, while the adaptability of different mothers' physical constitutions and delivery conditions to such technology varies. Consequently, conducting an in-depth analysis of the application effects of painless delivery technology in

clinical obstetrics holds immense significance for guiding clinical practice, enhancing delivery standards, and ensuring maternal and infant well-being.

This article endeavors to compare the application of natural delivery with the use of combined spinal-epidural anesthesia employing ropivacaine + sufentanil for painless delivery in clinical obstetrics. By doing so, it aims to furnish clinicians with more scientifically informed and rational guidance regarding the utilization of painless delivery technology, thereby facilitating the provision of superior and safer delivery services to mothers.

2. Materials and methods

2.1. General information

The clinical data of 900 parturients who underwent painless delivery surgery were collected and randomly divided into groups A and B, each comprising 450 cases. Group A served as the control group, while Group B constituted the observation group. Inclusion criteria encompassed: (1) Women with singleton pregnancy; (2) Women with full-term pregnancy; (3) Women with no serious systemic diseases such as heart, lung, liver, kidney, etc., and no serious complications during the entire pregnancy; (4) Women who signed the relevant informed consent agreement, comprehended the research's purpose, methods, and risks, and were willing to participate in this study. Exclusion criteria included: (1) Parturients with serious diseases such as cardiovascular disease, respiratory disease, liver and kidney insufficiency, etc.; (2) Parturients with pregnancy complications such as placenta previa, placental abruption, gestational hypertension, fetal distress, abnormal fetal position, etc.; (3) Parturients who failed to complete the entire research process or had incomplete data records due to various reasons, thereby affecting the analysis and evaluation of research results.

2.2. Methods

Group A underwent natural delivery. Upon admission, intravenous access was established, and respiration, pulse, non-invasive blood pressure, and fetal heart rate were monitored. No analgesic intervention was administered during labor.

Group B received combined spinal-epidural anesthesia for painless delivery. Upon admission, intravenous access was established, and respiration, pulse, non-invasive blood pressure, and fetal heart rate were monitored. Subsequently, in the operating room, the mother assumed a lateral position, and local anesthesia was applied to the lumbar region. Anesthetic drugs containing ropivacaine and sufentanil were injected into the subarachnoid space via lumbar puncture. These drugs collaborated to block nerve conduction and achieve analgesic effects. Following the completion of anesthesia injection, 10 mg of dexamethasone was administered intravenously to prevent anesthesia allergy.

2.3. Observation indicators

This study utilized the pain standards specified by the World Health Organization to assess the degree of maternal pain; hospitalization time, lochia disappearance time, and lochia amount were utilized to evaluate maternal postpartum recovery; while the time to the onset of colostrum and the time to sufficient breast milk supply were employed to evaluate maternal postpartum lactation.

2.4. Statistical analysis

SPSS 20.0 software was employed to analyze the research data. Measurement data conforming to the normal distribution were expressed as mean ± standard deviation (SD), with a t-test conducted between groups. The rank sum test was employed for registration data. A significance level of $P < 0.05$ was considered statistically significant.

3. Results

3.1. Comparison of maternal pain effects between the two groups

There were more individuals in Group B experienced pain levels of 0 and 1 compared to Group A, while there were significantly fewer individuals in Group B experienced pain levels of 2 and 3 compared to Group A ($P < 0.001$; **Table 1**), indicating that Group B's pain level is superior compared to Group A.

Table 1. Comparison of maternal pain effects between the two groups

Pain index	Group A (*n* = 450)	Group B (*n* = 450)	Z	P
Level 0	146	259		
Level 1	138	131		
Level 2	97	60	9.377	0.000
Level 3	69	0		

3.2. Comparison of postpartum recovery indicators between the two groups

As seen in **Table 2**, Group B exhibited significantly shorter postpartum recovery indicators as compared to Group A ($P < 0.001$).

Table 2. Comparison of postpartum recovery indicators between the two groups

Rehabilitation indicators	Group A (*n* = 450)	Group B (*n* = 450)	t	P
Length of stay (d)	3.76 ± 1.39	3.16 ± 1.01	7.408	0.000
Lochia disappearance time (d)	17.59 ± 4.38	14.62 ± 3.63	11.075	0.000
Amount of lochia (mL)	276.34 ± 15.48	262.21 ± 12.82	14.913	0.000

3.3. Comparison of postpartum lactation indicators between the two groups

Table 3 shows that Group B displayed significantly shorter postpartum lactation indicators as compared to Group A ($P < 0.001$).

Table 3. Comparison of postpartum lactation indicators between the two groups

Lactation index	Group A (*n* = 450)	Group B (*n* = 450)	t	P
Colostrum onset time	32.67 ± 8.86	27.36 ± 7.57	9.666	0.000
Sufficient breast milk supply time	38.51 ± 10.23	32.10 ± 7.22	10.860	0.000

4. Discussion

Painless delivery technology, also known as labor analgesia, encompasses various methods aimed at reducing or eliminating maternal pain during childbirth. This technology strives to enhance the comfort and safety of childbirth, enabling mothers to remain composed and relaxed throughout labor, thereby better coping with the challenges of childbirth [2]. Principally, painless delivery technology revolves around the principle of pain control, employing pharmacological or non-pharmacological means to block or interfere with pain signal transmission, ultimately diminishing or eradicating the pain. Drug-induced analgesia primarily relies on the effects of narcotic drugs, while non-drug analgesia alleviates pain through physical stimulation or psychological intervention. Painless delivery technology is generally applicable to most women, particularly those sensitive

to labor pain or apprehensive about childbirth. Nonetheless, certain special conditions, such as coagulation disorders, spinal deformities, spinal surface infections, hypertension, cardiac insufficiency, etc., may render painless delivery unsuitable.

When implementing painless delivery, selecting an appropriate method is crucial [3,4]. Epidural anesthesia and combined spinal-epidural anesthesia are commonly utilized in clinical practice [5]. Epidural anesthesia involves local anesthesia in the mother's lumbar region, with drugs injected into the epidural space via an epidural catheter. Following drug metabolism within the mother's body, minimal amounts are absorbed through the placenta, posing negligible risks to the fetus. This anesthesia technique disperses around nerve roots through the epidural space, effectively blocking pain signal transmission from the uterus to the brain, thus achieving analgesia [6]. Despite its analgesic efficacy, epidural anesthesia presents certain drawbacks. Firstly, its muscle relaxation effect may be inadequate, potentially leading to intraoperative injuries and prolonged incision healing time. Secondly, the procedure necessitates local anesthesia in the mother's lumbar region and the insertion of an epidural catheter, which consumes time; hence, it may not be ideal for parturients requiring urgent pain relief. Moreover, as the preparation and administration of epidural anesthesia require time, it might prolong the labor process, particularly in emergencies such as fetal distress, potentially impeding rapid delivery.

Combined spinal and epidural anesthesia entails the fusion of spinal and epidural anesthesia techniques. Initially, a small dose of local anesthetic is administered via lumbar puncture to swiftly induce analgesia. Subsequently, additional drugs are introduced through an epidural catheter to sustain analgesia until labor concludes. Compared to epidural anesthesia, combined spinal and epidural anesthesia offers distinct advantages. Firstly, it swiftly delivers a small dose of local anesthetic drugs via lumbar puncture, thereby promptly relieving pain for parturients in urgent need. Secondly, by combining spinal and epidural anesthesia, the technique minimizes overall drug dosage, thereby reducing potential side effects and risks [7]. Thirdly, by supplementing drugs via an epidural catheter, combined spinal and epidural anesthesia ensures continuous and effective analgesia throughout labor, accommodating various delivery scenarios, whether natural or surgical.

In combined spinal-epidural anesthesia, the choice of anesthetic medication typically comprises local anesthetics and analgesics. Local anesthetics such as lidocaine, bupivacaine, and ropivacaine alleviate pain by impeding nerve conduction. Analgesics such as fentanyl and sufentanil mitigate pain by inhibiting pain receptor activity. These drugs are usually administered epidurally or intravenously, with a specific regimen tailored to the mother's condition and physician's recommendations. In this study, ropivacaine and sufentanil were the preferred anesthetics and analgesics. Ropivacaine, an amide local anesthetic, inhibits nerve fiber conduction, providing adequate analgesia while minimizing the impact on maternal motor function, and allowing mobility during delivery [8,9]. Sufentanil, a potent synthetic opioid analgesic, rapidly and durably alters pain perception signal transmission by binding to brain pain receptors, thereby inducing analgesia [10]. In combined spinal-epidural anesthesia, sufentanil is frequently combined with local anesthetics like ropivacaine to enhance analgesia. It swiftly reduces maternal pain, aiding in surgical procedures or the birthing process. Consistent with many studies, this study's findings demonstrate that compared to natural delivery (Group A), painless delivery with sufentanil combined with ropivacaine under combined spinal-epidural anesthesia (Group B) resulted in reduced maternal pain and shorter postpartum recovery and lactation time ($P < 0.001$). Zhang *et al.* proposed that the combined use of sufentanil and ropivacaine can reduce the dosage of both drugs and is safer for both mothers and infants [11]. Wang also found that sufentanil combined with ropivacaine has a more significant effect on combined spinal-epidural labor analgesia [12].

It is imperative to note certain considerations when utilizing these drugs for anesthesia. Firstly, ropivacaine exhibits relatively low cardiotoxicity, necessitating caution in patients with cardiovascular conditions. Secondly,

sufentanil may induce side effects such as respiratory depression, nausea, vomiting, and drowsiness. Thus, close monitoring of vital signs during administration is essential to prevent unexpected side effects, including dizziness, headache, and dyspnea. Thirdly, in patients with respiratory or liver diseases, sufentanil should be used cautiously, as it may exacerbate respiratory depression. In conclusion, combined spinal-epidural anesthesia with ropivacaine + sufentanil demonstrates significant efficacy in painless delivery and warrants further clinical promotion.

Disclosure statement

The author declares no conflict of interest.

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