ORIGINAL ARTICLE

Small-Dose Ropivacaine Hydrochloride with Fentanyl *versus* Large-Dose of Ropivacaine Hydrochloride for Cesarean Section

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ABSTRACT

Objective: To compare the effect of small-dose ropivacaine hydrochloride combined with fentanyl *versus* large-dose of ropivacaine hydrochloride for cesarean section.

Study Design: Experimental study.

Place and Duration of Study: Department of Anesthesiology, Gansu People's Hospital, China, from February 2017 to April 2018.

Methodology: A total of 134 maternal women, who underwent cesarean section, were randomly divided into control group and observation group, with 67 cases in each group. Control group was anesthetized with a large dose (1.5 mL) of ropivacaine hydrochloride, and observation group was anesthetized with a small dose (1 mL) of ropivacaine hydrochloride in combination with 10 μg of fentanyl. Then anesthetic effects of the two groups were compared.

Results: The onset time of anesthesia and postoperative pain scores of the anesthesia in observation group were better than those in control group (both p<0.001). There was no significant difference in HR, SpO_2, and MAP between the two groups after 15 minutes of anesthesia, and after the operation (p=0.393, 0.275, 0.108, 0.740, 0.068 and 0.230, respectively). After the delivery of the fetuses, the HR, SpO_2, and MAP of the parturients in observation group were better than those in control group (all p<0.001). Frequency of adverse reactions of parturients in observation group was lower than that in control group (p=0.033).

Conclusion: In comparison to large-dose of ropivacaine hydrochloride, small-dose of ropivacaine hydrochloride combined with fentanyl, in combined spinal-epidural analgesia on parturients accepting cesarean section, can more effectively maintain their hemodynamic stability, relieve postoperative pain, and have a low incidence of adverse reactions.

Key Words: *Cesarean section, Parturient, Ropivacaine hydrochloride, Combined spinal-epidural analgesia, Hemodynamics.*

INTRODUCTION

The time required for cesarean section surgery is shorter, which puts higher requirements on the anesthetic effect. In the anesthesia process, it is necessary to ensure the surgical treatment and the life safety of the parturients and the newborn babies. In the past, cesarean section anesthesia was often treated with continuous peridural block anesthesia, but the effect was slow and the anesthetic effect was less than ideal.[1] With the continuous advancement of surgical techniques, the surgical incision has changed from the previous straight incision to the suprapubic transverse incision in cesarean section surgery, which greatly reduced the operation time, and the anesthesia program also changed.[2,3]

Ropivacaine is a commonly used amide local anesthetic preparation, which has very light toxicity to the nervous system and heart, and does not affect the respiratory and circulatory systems of the parturients and the newborn babies.[4,5] This provides an important basis for the safe implementation of cesarean section. However, ropivacaine may affect hemodynamics in patients with combined spinal-epidural analgesia, accordingly affecting the safety of anesthesia.[6] Fentanyl is an opioid, a small amount of which can reduce the amount of ropivacaine to achieve the goal of minimal motor block and it is not easy to pass through the placenta.[7] Compatibility of ropivacaine hydrochloride and fentanyl has the advantages of easy administration, quick onset of action, good analgesic effect; it also can avoid motor block, do not affect the progress of delivery.[8] Different doses of anesthetic agents may exert different anesthetic effects in combined spinal-epidural analgesia, and have different effects on hemodynamics.

The objective of this study was to compare the effect of small-dose ropivacaine hydrochloride combined with fentanyl *versus* large-dose of ropivacaine hydrochloride for cesarean section, in order to provide reference for improving the quality of parturients with cesarean section.

METHODOLOGY

This study was conducted at Department of Anesthesiology, Gansu People's Hospital, China, from February 2017 to April 2018. The study was approved by the Medical

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Received: July 09, 2018; Accepted: November 02, 2018

Ethics Association of our Hospital, and all patients signed the informed consents. A total of 134 maternal women, who underwent cesarean section, were selected as study subjects. All patients met the indications for cesarean section, and were rated Class I to II, according to the evaluative criteria of American Society of Anesthesiologists (ASA), and had no history of allergic reaction to the studied medicines. Those who had the histories of pregnancy complications, intraspinal anesthesia contraindications, severe cardiovascular and cerebrovascular diseases, liver and kidney system diseases, and mental disorders were excluded. The patients were randomly divided into control group and observation group, with 67 cases in each group.

The control group was anesthetized with 1.5 mL of 1% ropivacaine hydrochloride. The specific method was as follows: Take the right lateral position, select L_{2-3} or L_{3-4} gap to puncture (use the combined block matching needle), after puncturing the needle into the epidural space, a 25G pen-point lumbar spinal needle was placed through the epidural puncture needle, and then the lumbar puncture needle was inserted into the subarachnoid space. After successful puncture (with cerebrospinal fluid flow), 3 mL ropivacaine diluent was slowly injected at a rate of 2 mL/s. The lumbar needle was pulled out and a 4cm epidural catheter was placed at the patient's head end and the patient returned to the supine position. The patient was tested for a sensory block plane by using needle point method. If the patient's effect of spinal anesthesia was not satisfactory, an appropriate amount of 0.25% ropivacaine may be administered according to the patient's condition to maintain anesthesia. The observation group was anesthetized with 1 mL of 1% ropivacaine hydrochloride + 10 μg fentanyl, and the control group accepted the same anesthesia method. The two groups of parturients underwent cesarean section using conventional methods after anesthesia was completed.

The anesthesia-related indices of the two groups were compared, including the onset time of anesthesia and the postoperative pain scores. Postoperative pain was evaluated according to the visual analogue scale (VSA). In VSA pain scores methods, 0 point meant painlessness, 1-4 points meant slightly pain, 4-7 points meant moderate pain, 7-9 points meant severe pain, 10 points meant unbearably severe pain. The hemodynamic indexes (HR, SpO_2 and MAP) change after 15 min of anesthesia, after the delivery of the fetuses, and after the end of the surgery, were observed. The incidence of postoperative adverse reactions in the two groups were observed.

SPSS 21.0 software was adopted for data statistical analysis. Mean ±SD was calculated for numerical variables like onset time of anesthesia and postoperative pain scores, HR, SpO_2, MAP, examined by independent sample t-test. Frequencies and percentages were calculated for categorical variables like incidence of adverse reactions, examined by Chi-square test. The p-value of less than 0.05 was considered significant.

RESULTS

The patients were aged 24-42 years, with an average of 32.64 ±5.17 years. The gestational age was 36-41 weeks, with an average of 39.35 ±1.08 weeks. The average body weight was (54.13 ±4.85) 49-62 Kgs. There were 30 cases (22.39%) of multiparae and 104 cases (77.61%) of primiparae. According to the ASA classification, there were 61cases (45.52%) in grade I and 73 cases (54.48%) in grade II.

The onset time of anesthesia and postoperative pain scores in the observation group were better than those in the control group (both p<0.001, Table I). There was no significant difference in HR, SpO_2, and MAP between the two groups after 15 minutes of anesthesia and the end of the surgery (p=0.393, 0.275, 0.108, 0.740, 0.068 and 0.230, respectively); and the HR, SpO_2, MAP of the parturients in the observation group were better than those in the control group after the delivery of the fetuses (all p<0.001, Table II). The incidence of adverse

Table I: Comparison of the anesthetic effects between the two groups.

Groups	n	Onset time of anesthesia (min)		Postoperative pain scores (score)	
		Mean ±SD	p-value	Mean ±SD	p-value
Control group	67	11.47 ±2.22	<0.001	5.73 ±1.10	<0.001
Observation group	67	9.56±0.66		4.26 ±0.62	

Table III: Comparison of the adverse reactions between the two groups.

Groups	n	Nausea and vomitting	Pruritus	Shivering	Incidence of adverse reactions	p-value
		n (%)	n (%)	n (%)	n (%)	
Control group	67	5 (7.46)	4 (5.97)	3 (4.48)	12 (17.91)	0.033
Observation group	67	1 (1.49)	2 (2.99)	1 (1.49)	4 (5.97)	

Table II: Comparison of the hemodynamic indexes at each time-point between the two groups.

Time	Groups	n	HR (min^{-1})		SpO_2 (%)		MAP (mmHg)	
			Mean ±SD	p-value	Mean ±SD	p-value	Mean ±SD	p-value
15 minutes of anesthesia	Control group	67	73.78 ±1.72	0.393	96.82 ±1.66	0.275	95.49 ±2.76	0.108
	Observation group	67	74.24 ±4.04		97.36 ±3.67		96.29 ±2.96	
After the delivery of the fetuses	Control group	67	91.31 ±3.45	<0.001	94.58 ±2.20	<0.001	92.95 ±3.95	<0.001
	Observation group	67	82.16 ±3.94		97.96 ±1.09		98.01 ±4.18	
The end of the surgery	Control group	67	81.87 ±4.61	0.740	97.94 ±1.74	0.068	97.86 ±1.61	0.230
	Observation group	67	82.13 ±4.43		97.03 ±3.66		97.24 ±3.88	

reactions in the observation group was 5.97% (4 cases), which was significantly lower than that in the control group (12 cases, 17.91%, p=0.033, Table III).

DISCUSSION

Safe anesthetic methods that have less impact on the parturients shall be chosen when parturients are accepting cesarean section. As general anesthesia may have a certain negative impact on maternal and infant safety, local intraspinal anesthesia is generally recommended for clinical use.[9] Although traditional spinal anesthesia has the advantages of quick onset of anesthesia and reliable clinical implementation effects, it also has the disadvantages that the anesthesia plane is not easy to control and has a great influence on maternal hemodynamics.[10,11] Separate epidural anesthesia is difficult to be used as an anesthesia for cesarean section because of slow onset of anesthesia, insufficient block, and for other reasons. Therefore, the combination of the above two anesthesia methods, namely combined spinal-epidural analgesia, has received increasing attention in recent years.[12,13]

Relevant data show that combined spinal-epidural analgesia has the advantages of fast onset, perfect block, good controllability, small dosage, rapid onset of analgesia, less complications; and the anesthesia block time can be extended based on surgical needs, *etc*.[14,15] In the combined spinal-epidural analgesia of this study, the ropivacaine hydrochloride used is a common clinical analgesic agent, which only blocks the sensory conduction and has almost no effect on motor conduction.[16] Modern pharmacology has proved that ropivacaine hydrochloride can effectively block the sodium ion influx activity of nerve cells, leading to the failure of nerve signaling, thus exerting a good analgesic effect.[17,18]

Hemodynamics is an important monitoring index for cesarean section. Ensuring hemodynamic stability is especially important for maternal and infant safety. The results of this study showed that after the delivery of fetuses, compared with the observation group, the HR of the control group increased significantly, and SpO_2 and MAP decreased significantly. The main reason may be that after the large-dose (1.5 mL) of ropivacaine hydrochloride anesthesia, the regional blood vessels expend obviously, resulting in a temporary reduction of returned blood volume; and the anaesthetic vasoconstriction compensation cannot be established effectively which in turn, cause HR increase of the parturients.[19]

Anaesthetic onset time of anesthesia and postoperative pain scores in observation group were better than those in control group, which also indicates that small-dose of ropivacaine hydrochloride combined with fentanyl can achieve better anesthetic efficacy.

The conclusions of this study are basically consistent with other literature reports.[20] It is suggested that ropivacaine hydrochloride combined with fentanyl has the advantages of easy administration, quick onset, and good analgesic effect. The incidence of adverse reactions in the observation group was lower than that in the control group, indicating that small-dose of ropivacaine hydrochloride combined with fentanyl can effectively reduce the incidence of adverse reactions with higher safety.

CONCLUSION

In comparison to large-dose of ropivacaine hydrochloride, small-dose of ropivacaine hydrochloride combined with fentanyl, in combined spinal-epidural analgesia on parturients accepting cesarean section, can more effectively maintain their hemodynamic stability, relieve postoperative pain, and have a low incidence of adverse reactions. Thus, it is a perfect method of cesarean section anesthesia.

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