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# **Review Article**

# Investigating the Hemodynamic Responses of Women Candidates for Elective Cesarean Section to Two Drugs, Bupivacaine and Ropivacaine: a Systematic Review Bahman Naghipour<sup>1</sup>, Vahideh Rahmani <sup>1, 2\*</sup>

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# K E Y W O R D S

Ropivacaine Bupivacaine Elective Caesarean Section Hemodynamic Status

### ABSTRACT

**Background:** Since the minimum effective dose of the two drugs bupivacaine and Ropivacaine has not been included in the anesthesia reference books and different doses have been suggested for the drugs in the current study, as well as in previous studies, these drugs are combined with other drugs have been used, which affect the side effects and length of anesthesia, in this systematic review study on the hemodynamic changes of patients who are candidates for elective cesarean surgery by spinal anesthesia using two Bupivacaine and Ropivacaine drugs should be evaluated at the minimum dose in terms of low hemodynamic disorders, side effects and anesthesia, and suggest the appropriate drug in this field.

**Methodology:** In this review article, all databases including Google Scholar, Scopus, Web of Science, PubMed, SID, MagIran, and the Cochrane Library were searched and reviewed by both authors of this article based on PRIZMA guidelines without time and language limitations.

**Results:** So that the percentage of blood pressure drop in bupivacaine group patients was 50% higher than Ropivacaine group with 23%, and in other words, it can indicate more stability of blood pressure in Ropivacaine group.

**Conclusion:** Based on this study, statistically, the rate of systolic blood pressure drop, the need for ephedrine, as well as the incidence of nausea and vomiting in patients receiving Ropivacaine were lower, which are important when anesthetizing people with hemodynamic instability, such as pregnant women with Valvular cardiomyopathy can be important.





#### **GRAPHICAL ABSTRACT**

#### **1. Introduction**

Pain is a mental and personal phenomenon, and unlike many quantitative phenomena such as blood pressure, body temperature, etc. it is very difficult to measure and evaluate the intensity of pain, and many biological and psychological factors affect the intensity of perceived pain [1-3]. Patients' pain is classified into four groups based on the intensity and amount of painkiller consumption: no pain, mild pain, moderate pain, and severe pain [4-6].

The correct management of labor and the selection of appropriate anesthesia method to provide analgesia and maintain the health of the mother and fetus during cesarean section are very important issues [7-9]. Currently, the most common method used for anesthesia in cesarean section is spinal anesthesia. During a study conducted in 2004, spinal anesthesia was used in 90% of elective cesarean sections and 80% of emergency cesarean sections [10-13].

Spinal anesthesia has a faster onset and produces more reliable anesthesia than other local anesthesia methods, and the possibility of incomplete block in this method is less than other methods, on the other hand, one of its major disadvantages is high blood pressure drop rate in this method [14-16]. It has been reported that the hypotension incidence in pregnant women candidates for caesarean section who undergo spinal anesthesia is about 50 to 65 percent [17-19].

Bupivacaine (Figure 1) is a long-acting amide anesthetic that is mainly used for spinal anesthesia. In terms of chemical structure, it is very similar to mepivacaine, the only difference between these two anesthetics is that in bupivacaine, the butyl group has replaced the methyl group at the amino end of mepivacaine [20-22]. Although these two materials are slightly different in terms of structure, the chemical properties of these two materials are significantly different [23-25].



Fig. 1. Bupivacaine molecule

Due to these chemical differences, this substance has the ability to dissolve in fat and bind with high protein, which leads to the long shelf life of bupivacaine and long effect of this substance. The bupivacaine potency is four times that of lidocaine [26-28]. It is metabolized in the liver and excreted through the kidneys [29-31]. Ropivacaine (Figure 2) is a long-acting amide anesthetic that is structurally very similar to bupivacaine; this drug creates effective epidural anesthesia for cesarean delivery, and is also used in spinal anesthesia [32-34]. Ropivacaine has less fat solubility than bupivacaine and causes less movement block. In caudal block, peripheral nerve block, local infiltration or intra-articular administration is also used [35-37]. When it is used with a low dose, it has less potential, but at a high dose, for example, it has the same effect in peripheral nerve block [38-40]. The efficacy and required dose of Ropivacaine for cesarean section is unclear.



Fig. 2. Ropivacaine molecule.

Among the characteristics of the ideal drug for spinal anesthesia is to have less hemodynamic disturbance along with appropriate duration of anesthesia, quick return of sensation, movement, and minimal side effects. Since the minimum effective dose is not included in the anesthesia reference books and different doses have been suggested for the drugs in the present study, as well as in previous studies, these drugs are combined with other drugs (such as fentanyl, sufentanil, dexmedetomidine, morphine, bicarbonate, opioids, Neferin, etc.) have been used that affect the side effects and duration of anesthesia, in this systematic review on the animus and hemodynamic changes of patients candidates for elective cesarean surgery with spinal anesthesia using two drugs bupivacaine and ropivacaine at the minimum dose [41-43]. The subjects were evaluated in terms of low hemodynamic disorders, side effects, and suitable anesthesia and suggested the appropriate drug in this field [44-46].

#### 2. Methodology

In this review article, all databases including Google Scholar, Scopus, Web of Science, PubMed, SID, MagIran, and the Cochrane Library were searched and reviewed by both authors of this article based on PRIZMA guidelines without time and language limitations. The keywords selected based on MeSh and based on which the search was conducted included Sensorcaine, Marcaine, Bupivacaine, Ropivacaine, Naropin, Local anesthesia, Regional Anesthesia, Cesarean section, C-section, Cesarean birth, surgical delivery, hemodynamically stable, and hemodynamically.

These keywords were determined by both authors in one meeting, and then the search was performed in the mentioned databases by each researcher separately. The search process is given as follow:

### Table 1. Search strategy in PubMed database based on MeSh criteria

(Sensorcaine [mh] OR Marcaine [tiab] OR Bupivacaine [tiab]) AND (Papillomavirus Vaccines[mh] OR Ropivacaine [mh] OR Naropin [tiab] OR Local Anaesthesia [tiab] OR Regional Anesthesia [tiab] OR Cesarean Section [tiab] OR C-Section [tiab] OR Cesarean Birth [tiab] OR Surgical Delivery [tiab] OR Hemodynamically Stable [tiab] OR hemodynamically [tiab]

The inclusion criteria of studies in this present article included the following:

1. The time limit was not applied.

2. Language restriction was not applied.

3. The studies had clear results.

4. The studies had a prospective approach.

5. The studies were in the form of clinical trials.

6. Randomization was done for all studies.

7. The study should be single-blind or doubleblind.

8. The results of the study are expressed without bias.

9. Studies should be of good and high quality.

The criteria for excluding studies from the present study included the following:

1. Case studies, reviews, reports of rare cases, letters to the editor, and descriptive.

2. The age of the participants should be less than 18 years old.

3. The method of randomization is not clearly stated.

4. The dosage of the drugs used are not stated.

5. There is no control group in the study.

6. The expected results have not been achieved.

7. Exclusion criteria have not been stated.

8. The method of intervention is not clearly stated.

9. The conclusion is ambiguous.

All the studies in the initial search were evaluated according to the inclusion and exclusion criteria, and if they met the necessary criteria, they were included in the evaluation. Next, the title and purpose of the study were reviewed and evaluated, and studies were included in the review that had a clear purpose in the title and were in line with our study. Finally,the full text of each article was reviewed by both authors, and the studies that had the appropriate and desirable quality were included in this systematic review.

All the important information of each article was written and recorded separately by both authors in a paper sheet, and then in a face-to-face meeting, the important information was discussed and finally the important information of each article was included in this study.

### 3. Results

In terms of the time to reach the appropriate level of anesthesia, a significant difference was observed between the two groups, so that the average time in the bupivacaine group was 3.36±3.3 minutes less than the ropivacaine group with 7.45±1.25 minutes (Figure 3).



Fig. 3. MAP and Heart rate results Hazardous regions surrounding factory

Therefore, the percentage of blood pressure drop-in bupivacaine group patients was 50% higher than ropivacaine group with 23%. In other words, it can indicate more stability of blood pressure in ropivacaine group [47-49]. Also, there was no significant difference in the incidence of bradycardia and shivering between the two groups of patients [50-52]. In terms of the nausea-vomiting occurrence, there was a significant difference between the two groups of patients, so that the percentage of nauseavomiting in patients of the bupivacaine group was 50% higher than that of the ropivacaine group with 18% (Figure 4).



Fig. 4. Complication between to drugs

### 4. Discussion

In this study, none of the patients needed general anesthesia, but 2 patients from the bupivacaine 5% group and 8 patients from the ropivacaine group had partial anesthesia, which required the administration of intravenous pain relievers such as ketamine or narcotics [53-55].

The results of this study were consistent with the results of our study, but regarding hemodynamics, the results of this study were different from the results of our study, which could be due to the time of hemodynamic evaluation or diverse definition of а hemodynamic difference (Figure 5).



Fig. 5. Two groups complication

In a study, the researchers examined elderly patients selected for major orthopedic surgery in

two drug groups and showed that 12 mg of hyperbaric Ropivacaine + 20 micrograms of intraspinal fentanyl caused less motor block and less hemodynamic disturbance than 8 mg. Hyperbaric bupivacaine + 20 micrograms of fentanyl is injected intrathecally. In this study, although the dosage of drugs is different compared to the present study, but they were tested in combination with intraspinal narcotics. However, the difference in hemodynamic parameters and the duration of anesthesia were similar in the two studies. Researchers in a study entitled: "Comparing the effectiveness and safety of Ropivacaine and bupivacaine in abdominal and lower limb surgery", put 70 patients in two drug groups of 3 cc bupivacaine and 3 cc Ropivacaine under standard spinal anesthesia (Figure 6).



Fig. 6. Heart rate in bupivacaine and Rupivacain

### **5.** Conclusion

According to this study, the rate of systolic blood pressure drops statistically, the need for ephedrine, as well as the incidence of nausea and vomiting was lower in patients receiving ropivacaine, which are the points when anaesthetizing people with hemodynamic instability, such as pregnant women with valvular disease. Cardiomyopathy can be important. Since the needed time to reduce the anesthesia level was calculated to be shorter in the ropivacaine group, this issue can be important during the delivery of patients from the recovery unit to the inpatient department and faster mother-baby communication. On the other hand, in cases of emergency surgery, bupivacaine is a more suitable option than ropivacaine due to faster anesthesia and better relaxation of the operative field.

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