

THE HEMODYNAMIC EFFECTS OF COMBINED SPINAL-EPIDURAL VERSUS SPINAL ANESTHESIA IN CESAREAN SECTION

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Submitted: 27/5/2022; Accepted: 21/10/2022; Published: 21/12/2022

ABSTRACT

Background

Hypotension and bradycardia are the main problems in parturients anesthetized with spinal anesthesia for cesarean section. It is a common cause of maternal and fetal morbidity and mortality; the combined spinal-epidural anesthesia technique is a new way to solve the problem.

Objectives

The hemodynamic effects of combined spinal-epidural anesthesia will be compared to spinal anesthesia alone in cesarean section.

Patients and Methods

After the approval of the local ethical committee and taking patients' consent, 100 parturients at Sulaimani Maternity Hospital scheduled for cesarean section were involved in the study. They were divided into two groups; group S (n_50) received (3ml) of bupivacaine in a single spinal shot technique. Group CSE (n_50) received (2 ml) of the same drug with the insertion of an epidural catheter to give additional doses later in a combined spinal-epidural technique. Blood pressure and pulse rate were measured regularly at 5 minutes intervals throughout the operation. After shifting the patient to the ward, they continued the measurement postoperatively for one hour with 15 minutes intervals.

Results

Hypotension was more common in group S in 42 cases versus 7 in the CSE group. It was significant (P=0.012). Also, bradycardia occurred in 15 cases in the S group while it was only in 6 cases in the CSE group which were significant (P = 0.008).

Conclusion

The maternal hemodynamic changes were less significant with the combined Spinal-Epidural technique compared to routine spinal anesthesia of cesarean section.

Keywords: *Combined spinal-epidural, cesarean section, hypotension, bradycardia.*

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INTRODUCTION

Spinal and epidural anesthesia were widely utilized in obstetric and lower abdominal surgeries, but hypotension occurs following the induction of regional anesthesia, especially in anesthesia for cesarean section delivery ^(1,2).

Hemodynamic changes result from the blockade of sympathetic vasomotor activity. The higher the segmental sympathetic blockade (more significant than T4), the greater the risk of hypotension and bradycardia. In addition, the supine position significantly increases the incidence of hypotension. Bradycardia can occur after regional anesthesia and may be due to blockade of the cardio accelerator fibers (arising from T1–T4), decreased venous return, or activation of the great vein and right atrial cardiac receptors, which reflexively slow the heart rate. Finally, there is the dominance of vagal stimulation. It is more prominent and dangerous in obstetric patients and can progress to cardiac arrest ^(3,4).

The significance of maternal hypotension lies in the threat to the well-being of both mother and fetus if decreases in blood pressure and cardiac output are not promptly recognized and corrected. Brief episodes of maternal hypotension can lower Apgar scores, prolong the time for sustained respiration, and produce fetal acidosis ⁽⁴⁾.

Efforts have been directed at preventing maternal hypotension by prehydration or acute volume expansion (15–30 min before cesarean delivery) with 1,000–1,500 mL of lactated Ringer's solution and or normal saline; on the other hand, the value of the administration of a prophylactic vasopressor is still controversial ⁽⁴⁾. The dose of local anesthetic drugs also affects the hemodynamic stability of the parturient. Using a lower dose of local anesthetics also decreases maternal intraoperative hypotension [javascript: newshowcontent\('active', 'references'\);](#) ⁽⁵⁾.

Combined spinal-epidural anesthesia offers advantages over epidural or single injection spinal anesthesia alone; it combines the benefits of certainty with a definitive end point (the appearance of cerebrospinal fluid) characteristic of spinal anesthesia with the flexibility of continuous epidural anesthesia. In addition, it involves using a minimal dose of spinal anesthetic for a shorter duration but allows flexibility of epidural reinforcement if necessary ⁽⁶⁾.

This study compares the hemodynamic effects of combined spinal-epidural anesthesia versus spinal anesthesia in parturients undergoing cesarean section delivery.

PATIENTS AND METHODS

The approval of the Research Ethical committee of the college of medicine at Sulaimani University and taking informed written patient consent, A 100 ASA (American society of anesthesiologists) physical status II and II E parturients who were admitted for elective and emergency cesarean section delivery in the Sulaimani Maternity hospital were recruited in this study.

Exclusion criteria:

- Parturients with an allergy to the study drugs.
- Contraindications to central neuraxial block.
- Patients with a top emergency condition.
- Obstetric complications such as preeclampsia or placenta previa were excluded from our study.
- Parturients with technical difficulty.
- Patients with failed spinal changes to general anesthesia.

A sensory block level T8 (subcostal level) 15 min after intrathecal drug administration or patient complaint of pain intraoperatively was classified as an “inadequate block,” and supplemental analgesia was given and excluded from the study.

Patients with an accidental dural puncture during the insertion of the Tuohy needle were excluded from the study and seen daily by an anesthetist.

All parturient prepared by the following procedures

Left lateral pelvic tilt

Intravenous cannulation with double wide bore cannulae of gauge ⁽¹⁸⁾, administration of IV. 1000 ml of Ringer's lactate solution and normal saline for hydration before anesthesia.

Maternal systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate (HR) were measured noninvasively (using the monitor compact with an anesthesia machine) and starting the measurements 5

minutes before giving the anesthesia and recorded at a regular 5 minutes intervals throughout the time of operation and continue the measurement postoperatively for 1 hour with 15 minutes intervals after shifting the patient to the ward, oxygen saturation, and electrocardiogram also recorded

All Patients were positioned in the sitting position for spinal and combined spinal epidural anesthesia. Under the aseptic technique, the patients are sitting and supported by the anesthesia nurse to achieve an optimum position. For the combined technique, infiltration of the skin at the injection site with 20 mg (1mL) of 2% lidocaine.

O₂ is administered through the nasal cannula throughout the time of operation.

Patients were divided into two groups.

Group S: In the spinal group (n = 50), the subarachnoid space was entered using a 27-gauge Whitacre spinal needle at the L3-4 interspace. After confirming the free flow of cerebrospinal fluid (CSF), the designated dose, which was (3 ml) of 0.5% (15 mg) bupivacaine, was injected over 15 seconds with the spinal needle orifice facing the cephalad. Afterward, the injection site was dressed in sterilized gauze and adhesive plaster; the patient was turned rapidly to the supine with a left lateral pelvic tilt position.

Group CSE: The combined spinal and epidural group, group CSE (n = 50), received the combined technique. The CSE technique was performed with an 18-gauge Tuohy needle of the Epidural set inserted into the L2-3 intervertebral space. The loss of resistance to 2 ml of air was used to identify the epidural space, then an epidural catheter of the same epidural set was inserted for distances about 14-15 cm from the proximal end of the needle to the inside of the epidural space according to the different weights and thickness of the subcutaneous fat of the patients, we removed the Tuohy needle immediately after insertion of the epidural catheter.

An aspiration test of the catheter with an empty syringe was done to exclude any intravascular insertion or dural puncture; with a negative test, fixation of the catheter on the back of the patient done by adhesive plaster to prevent any dislodgment of the catheter and put a marker that the patient has an epidural catheter to be known postoperatively, 2ml of normal saline administered through the catheter.

The second step of the CSE technique is the intrathecal injection which was performed by passing a 27-gauge Whitacre spinal needle in the lower intervertebral space. L3-L4 was also confirmed by the free flow of CSF, followed by the administration of 10 mg equal to (2ml) of 0.5% bupivacaine local anesthetic, removal of spinal needle, and dressing of the injection site, and immediately the parturients were placed supine with pelvic tilt also.

For all patients, dermatomal sensory block level examined by alcohol-soaked cotton test, maximal dermatomal sensory block achieved time taken to reach maximal sensory block, maximum motor block of lower limb based on the modified Bromage scale (0 = no impairment, one = unable to raise extended legs but able to move knees and ankles, two = unable to raise extended legs as well as flex knees, able to move feet, three = not able to flex ankle, feet, or knees). Surgery was allowed to start after a sensory height block of T4 was achieved.

Throughout the study period, hypotension after regional block (defined as a decrease in SBP of more than 25% from baseline) was treated with the fluid of Hartman's solution and or normal saline (1000 -1500 ml).

Bradycardia, a heart rate below 60 beat/minute, were treated with an anticholinergic drug.

(Atropine in a dose of 0.01- 0.02 mg/kg body weight).

Nausea and vomiting were treated accordingly.

After surgery, all patients were monitored in the ward. Hemodynamic and sensory monitoring was continued at 15-minute intervals for one hour postoperatively.

The subsequent postoperative management of the patient was left to the discretion of the primary obstetrician.

Results were analyzed with Statistical Package for Social Science (SPSS) (SPSS, Chicago, IL). (P-value) used to analyze parametric data, demographic data, and hemodynamic profiles and compare the data between the two groups. (Incidence of complications: hypotension, bradycardia), P value < 0.5 % consider significant.

RESULTS

There were no significant differences between the patient's age, body weight, and gestational weeks in both groups (S, CSE), Table 1 and Table 2.

The other demographic data, which included the surgery interval duration, were comparable between the groups (Table 2). The time required to achieve the anesthesia technique was (3 – 9) minutes in group S versus (10 – 20) minutes in group CSE, Table 2.

In comparing systolic arterial blood pressure to the baseline value, we found that:

In group S (42) cases, equal to (84%) developed hypotension (blood pressure <25%).

In group, CSE (6) cases equal to (12 %) developed hypotension also (blood pressure <25%),

In comparing both groups, systolic blood pressure decreased less in the CSE group than in the S group, which was statistically significant (P = 0.012), Figure 1.

Also, the heart rate decreased to less than 60 beats/minute in 15 cases in spinal group S (30%), but it occurred only in 6 patients of the group CSE (12 %), and this was statically significant (P = 0.008), Figure 2.

Table1. Shows the distribution of age groups for the patients in the study.

| Patients age group | Number of patients in In group S | Percentage % | Number of patients in In group CSE | Percentage % |
|--------------------|----------------------------------|--------------|------------------------------------|--------------|
| ≤ 20 years | 4 | 8% | 3 | 6% |
| 21 - 30 | 28 | 56% | 24 | 48% |
| 31 - 40 | 17 | 34% | 20 | 40% |
| ≥ 41 | 1 | 2% | 3 | 6% |
| Summation | 50 | 100% | 50 | 100% |

Table2. Representing Patient's Demographic Data.

| | Group S | Group CSE |
|----------------------------------------------|-----------|-----------|
| Weight in kg | 78 ± 19 | 77 ± 13 |
| Weeks of Gestational | 37 ± 2 | 38 ± 1 |
| Time to achieve Anesthesia in minutes | 6 ± 3 | 15 ± 5 |
| Duration of surgery in minutes | 35 ± 12 | 30 ± 10 |
| Duration of Anesthesia in hours | Two ± 0.5 | 2.5 ± 0.5 |

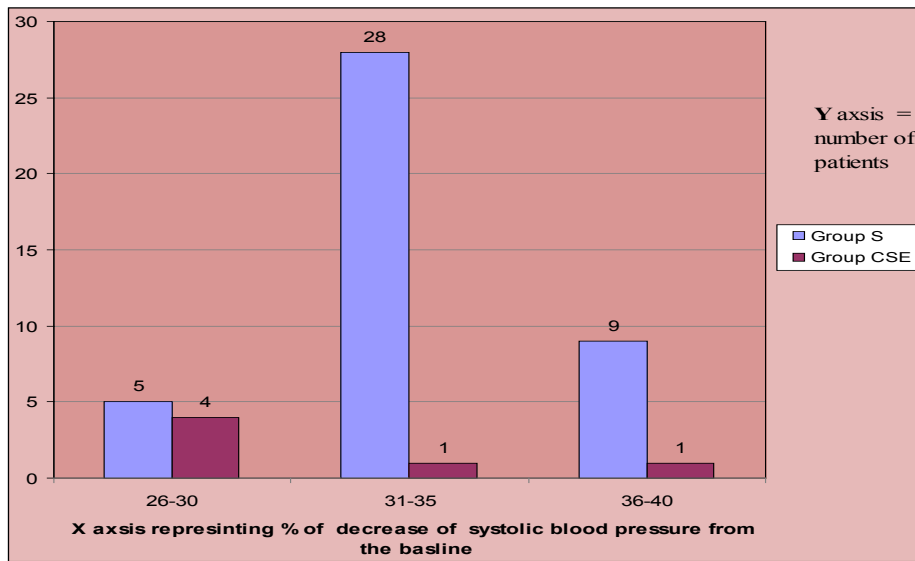


Figure 1. Shows the frequency of percentage of decrease in systolic blood pressure and the number of patients affected in the two groups of the study.

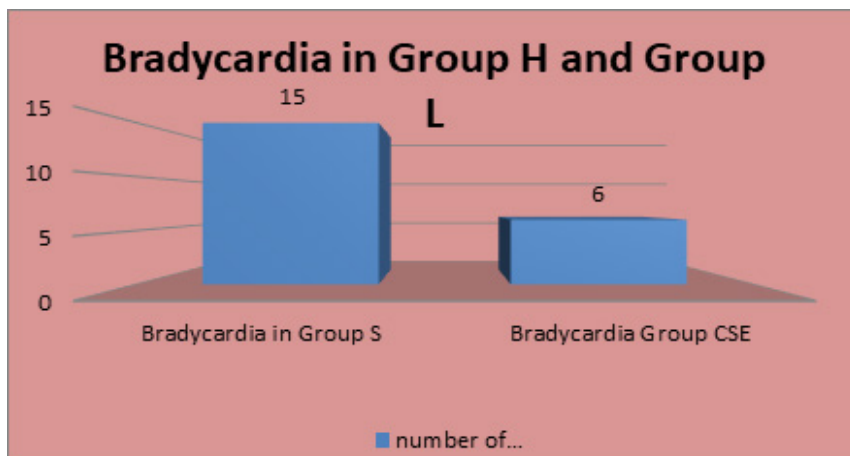


Figure 1. Shows the frequency of percentage of decrease in systolic blood pressure and the number of patients affected in the two groups of the study.

DISCUSSION

The distribution of patient age in both groups (S, CSE) is nearly similar (Table 1), and the peak of frequency lie in the age group (20 -30 year) for both, which is usually the most productive age. These other demographic data, including the height, weight of the patients, and duration of surgery intervals, were comparable between the groups (Table 2). The weeks of gestation for both groups (S, CSE) are the same, and the mean of both is 37 and 38 weeks, respectively, but in group S, the presence of 35 weeks of gestation does not mean

this is a premature delivery and this did not affect the results of our study.

The time required to achieve the technique of anesthesia was (3-9) minutes in group S versus (10-20) minutes in group CSE (Table 2), and this is important where the CSE technique takes 10 minutes more than that of the S technique, which is a short time as compared with the time needed for other preparation to surgery. The duration of anesthesia (Table2) for group CSE is longer than that for spinal anesthesia, and this longer duration offers more time for analgesia postoperatively; this

can be explained by epidural volume extension, a low subarachnoid block can be extended in a cephalad direction by an epidural 'top-up' of normal saline (7). However, this concept has been challenged by other researchers who found that the epidural volume expansion neither increases the level of the block nor decreases the dose of the local anesthetics injected into the subarachnoid space (8, 9).

Our results confirmed that the CSE technique performed for the anesthesia of cesarean section with the placing of an epidural catheter resulted in a significantly lower incidence of hypotension and bradycardia when compared with the single shot spinal technique done in group S, where a higher dose of local intrathecal anesthetic was given and this agreed by the following researches:

Choi DH, Ahn HJ, and Kim JA found that patients in the single-shot spinal group had a higher incidence of hypotension than the combined spinal-epidural group (10).

Static Violeta and Cojocar Victor evaluated the results of the combined spinal-epidural anesthesia versus spinal anesthesia in the routine cesarean section of 102 cases. Hypotension was more common in the spinal anesthesia group in 13 cases versus 6 cases in the combined spinal-epidural anesthesia group (11).

A. Malvasi et al. studied 200 women undergoing elective cesarean section to compare combined spinal-epidural anesthesia (CSE) versus spinal anesthesia (SA) in cesarean section. The result of his study denotes that vomiting, bradycardia, and hypotension were a major percentage in the SA group but only significant for hypotension (12).

A randomized study by Mohamed S Mebazaa, Riadh Ben Meftah, and Maher Abbasi et al. found that combined spinal-epidural anesthesia provides better hemodynamic stability in preeclamptic patients (13).

Brizzi A, Greco F, Malvasi A, et al. examined 100 women submitted to cesarean section; the results showed that the incidence of motor block and hypotension in the single shot spinal anesthesia group is more significant than in the combined spinal-epidural group (14). J. Ko, C. Kim, H. Cho et al. examined 200 women undergoing elective cesarean delivery. They concluded that colloid preload and low-dose spinal anesthesia alone or in combination lower the incidences of hypotension and

nausea (15).

The same results were found by Roofthoof E; Van de Velde M. Found that Low-dose spinal anesthesia as part of a combined spinal-epidural technique is a valuable method in improving maternal and fetal outcomes during anesthesia for operative delivery (16).

The following researchers disagreed with our study for the following reasons:

The use of a higher complete epidural dose of local anesthetics in addition to the spinal dose, unlike the small adjunct doses used in our study and the use of needle through needle technique which differ quietly from our technique as in a study done by Farida Ithanin; et, al, they recruit 30 cases divided into group S 15 and group CSE 15, they claimed that the use of CSE technique results in a high block and higher incidence of hypotension than single spinal shot (17).

The results were not among cesarean section patients but in other groups of patients. In a study by Joachim Klasen et; al, they found that the incidence of hypotension was higher in the CSE group than in the spinal group (18). Many factors could interfere with their results, including the mass body index involving two groups with different weights. Also, alcoholic cases in the case study interfered with their results.

Differences in sample size Yvonne Lim et; al; tested the hypothesis assuming that the combined spinal epidural (CSE) technique results in a higher sensory block than an equivalent single-shot spinal in 40 women undergoing elective cesarean delivery. Both patients found the same block level with less hypotension in group CSE, but this was not significant in their study (19). While in our study, we found that hypotension was significantly less in the CSE group.

In conclusion, the results of our study show that using the CSE technique for cesarean sections will lead to fewer maternal hemodynamic changes compared to single-shot spinal anesthesia.

Conflict of interest

None

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