



## ORIGINAL RESEARCH ARTICLE

### LOW DOSE HYPERBARIC BUPIVACAINE WITH FENTANYL IN SPINAL ANESTHESIA IN ELECTIVE CESAREAN SECTION

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**Received:** 30 March, 2019

**Accepted:** 12 June, 2019

**Published:** 15 June, 2019

**Key words:** Bupivacaine; Cesarean section; Fentanyl; Spinal anesthesia.

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DOI:<http://doi.org/10.3126/jcmc.v9i2.24560>

#### Citation

Regmi BDS, Deo GP, Shrestha S, Shrestha S, Mishra RT. Low dose hyperbaric bupivacaine with fentanyl in spinal anesthesia in elective cesarean section. Journal of Chitwan Medical College. 2019; 9(28): 79-82.



#### ABSTRACT

**Background:** Spinal anesthesia with hyperbaric bupivacaine provides a dense neural block in cesarean delivery but associated with side effects like hypotension, bradycardia nausea and vomiting. Addition of low dose fentanyl with low dose of hyperbaric bupivacaine may decrease the incidence of these complications. The aims of study was to compare the hemodynamic parameters (blood pressure and heart rate), nausea and vomiting with low dose intrathecal hyperbaric bupivacaine with fentanyl vs a conventional dose of intrathecal hyperbaric bupivacaine in patient undergoing elective cesarean section.

**Methods:** Seventy-four pregnant women aged 20-35 years old which underwent elective cesarean section at Chitwan Medical College were randomized into two groups. One group received spinal anesthesia with 8mg of 0.5% hyperbaric bupivacaine and 25µg fentanyl and another group received 12mg 0.5% bupivacaine.

**Results:** The mean age, baseline heart rate, systolic and diastolic blood pressure were comparable in both groups. Significant difference in hypotension (24.31% vs. 62.16%,  $p < 0.05$ ) and Nausea and vomiting (16.20% vs. 27%,  $p < 0.05$ ) were found in bupivacaine-fentanyl group versus a conventional dose of spinal bupivacaine group.

**Conclusions:** Low dose of bupivacaine with Fentanyl provides good spinal anesthesia for cesarean section with less hypotension, nausea and vomiting in comparison to bupivacaine alone.

#### INTRODUCTION

Spinal anesthesia with hyperbaric bupivacaine provides a dense neural block in cesarean delivery but associated with higher incidence of hypotension, nausea and vomiting.<sup>1</sup> Spinal anesthesia is often used for most cesarean sections and it offers some advantages like very rapid onset, dense neural block and because of the small doses used, little risk of local anesthetic toxicity and minimal transfer of drug to the fetus. However, it has some disadvantages including higher incidence of hypotension and nausea

and vomiting.<sup>2,3</sup>

Nausea and vomiting are closely related to maternal hypotension following spinal anesthesia and is due to increase vagal tone and visceral stimulation during surgical procedure.<sup>3</sup> Hypotension can be defined as a systolic blood pressure of less than 90 mmHg, or a decline of 20% from baseline.<sup>1</sup> Treatment strategies for hypotension includes, I.V fluids, ephedrine, Phenylephrine, Mephentermine etc. Spinal anesthesia with a single dose of bupivacaine up to 5mg yielded only a moderate incidence of hypotension

but in 15% of patients this low dosage did not provide an adequate level of sensory block.<sup>4,5</sup>

Opioids and local anesthetics administered together intrathecally have a potent synergistic analgesic effect.<sup>2,3</sup> Intrathecal opioids enhance analgesia from sub therapeutic doses of local anesthetic and make it possible to achieve successful spinal anesthesia using otherwise inadequate doses of local anesthetic.<sup>6</sup>

The goal of this study was to compare the intraoperative hemodynamics (blood pressure and heart rate), nausea and vomiting with low dose (8 mg 0.5% hyperbaric bupivacaine plus 25µg fentanyl) spinal anesthetic versus conventional dose (12mg 0.5% hyperbaric bupivacaine only) in parturient undergoing cesarean section.

## METHODOLOGY

This is a prospective study conducted at Chitwan Medical College from 17 November 2018 to 16 February 2019. After ethical approval from CMC-IRC and with informed consent seventy four ASA (American society of anesthesiologist) physical status II patients (According to ASA physical Classification System 2014, pregnancy is classified under ASA II) and not contraindicated for neuraxial block who were scheduled for elective cesarean section under spinal anesthesia. Patient aged more than 35 years and less than 20 years, ASA more than II and not fit for spinal anesthesia were excluded. The included patients were preloaded with rapid infusion Ringer lactate 10ml/kg and kept in left lateral position.

Group FB (bupivacaine-fentanyl) was given 8 mg 0.5% heavy bupivacaine (1.6ml) plus 25µg fentanyl (0.5ml) total volume 2.1 ml, group B received 12mg (2.4ml) 0.5% heavy bupivacaine. Patient's assessment, care and data were recorded before spinal block. Each patient's baseline blood pressure, heart rate was noted. Subarachnoid injection was performed in the sitting position using a 26-gauge Quincke needle positioned midline at the L3-L4 interspace. After aspiration of CSF, the drug was injected. Aspiration was done to make sure that the needle was in sub arachnoid space. After injection the patient was immediately kept in supine position, with left uterine displacement. The systolic & diastolic BP, HR was recorded every two minutes up to

the delivery of baby and then every five minutes by using an automated non-invasive device. Adequate block was recorded if a bilateral T4-T5 sensory to pin prick was attained within 10 minutes after the time of intrathecal drug administration, otherwise a failure was recorded and these patients were excluded from study. Hypotension is defined as systolic blood pressure less than 90 mm of Hg or to more than 20 % less than baseline reading<sup>1</sup> and was treated promptly by left uterine displacement to prevent aorto-caval compression and rapid intravenous fluid administration. If hypotension persisted despite these measures; IV Mephentermine bolus 6 mg was injected and repeated till hypotension persisted. All patients received 1500-2000 ml of ringer solution during whole surgery. No additional sedative or narcotics were given during the operation. The systolic & diastolic blood pressure, heart rate, number of hypotension episodes, number of Mephentermine bolus doses, and total Mephentermine dose in mg. for each patient were recorded. Intraoperative patient complaints were recorded. Statistical analysis was performed using SPSS 20. Student T- test was applied and results were considered significant at  $P = <0.05$ .

## RESULTS

The demographic data in both groups were similar and there were not significant differences. Mean age was  $25.71 \pm 4.01$  in fentanyl plus bupivacaine group and  $26.41 \pm 5.1$  years in bupivacaine group. Base line heart rate ( $81.91 \pm 19.02$  vs.  $79 \pm 18.32$ ), systolic blood pressure ( $112.14 \pm 10.42$  vs.  $109 \pm 15.64$ ) and diastolic blood pressure ( $75.32 \pm 8.75$  vs.  $72 \pm 16.01$ ) were comparable in both group and statistically insignificant ( $p < 0.05$ ). Hypotension occurred in 9(24.31%) patients in fentanyl and bupivacaine group and 23(62.16%) in bupivacaine only group. Nausea and vomiting were found in 6(16.2%) fentanyl and bupivacaine group and 10 (27.01%) in conventional bupivacaine group. Both these values were statistically significant ( $P < 0.05$ ).

Total number of hypotensive, nausea and vomiting episodes were statistically less in fentanyl and bupivacaine group in comparison to conventional bupivacaine group.

**Table 1: The comparison of demographic data and complications**

	Fentanyl and bupivacaine group	Bupivacaine only group	p-value
Mean age	25.71 ± 4.01	26.41 ± 5.1	> 0.05
Heart rate	81.91 ± 19.02	79 ± 18.32	>0.05
Systolic BP	112.14 ± 10.42	109 ± 15.64	>0.05
Diastolic BP	75.32 ± 8.75	72 ± 16.01	>0.05
Hypotension	9(24.31%)	23(62.16%)	<0.05
Nausea and vomiting	6(16.2%)	10 (27.01%)	<0.05

## DISCUSSION

Hyperbaric bupivacaine is the most commonly used agent for spinal anesthesia when performing cesarean sections.<sup>6</sup> Doses above 15mg significantly increase the risk of complications including high block and are not recommended.<sup>1,7</sup> The level of the block depends on many factors like height of the patient, age of the patient, pregnancy state, site of injection, rate of injection, position of patient etc. The usual dose is 10mg to 15mg. The most commonly used dose in most of the centers, conventionally, is 12 mg for cesarean section. If we add fentanyl, the dose of bupivacaine required is significantly decreased which is low dose bupivacaine as compared to conventional dose.<sup>5,8</sup> Most of the studies use 7.5-10mg bupivacaine and 15- 25mcg fentanyl.<sup>9,10,11</sup> The difference in demographic data between two groups in our study was comparable and statistically not significant. The hemodynamic stability of group FB patients was reflected in the minimal need for vasopressor support of blood pressure. Mephentermine was used as a vasopressor agent in this study which is a cardiac stimulant appears to act by indirect stimulation of  $\beta$ -adrenergic receptors causing the release of norepinephrine from its storage sites. It has a positive inotropic effect on the myocardium. AV conduction and refractory period of AV node is shortened with an increase in ventricular conduction velocity. It dilates arteries and arterioles in the skeletal muscle and mesenteric vascular beds, leading to an increase in venous return. It is commonly used in Hypotension secondary to spinal anesthesia in obstetric patients, 15mg as a single dose, repeat if needed and maximum to 30 mg.<sup>12</sup>

Fluid administration may prevent a decrease in central venous pressure and may diminish or even reverse the decrease in cardiac index, but blood pressure falls nevertheless because of a substantial decrease in systemic vascular resistance.<sup>6,7</sup> Intravenous fluid loading,

has rapidly been shown to be of little benefit if used without an adrenergic agonist.<sup>6</sup> In this study the incidence of hypotension in-group B was higher than group FB and the need for intravenous mephentermine was significantly greater in group B than group FB.

Bruce Ben-David studied 32 women undergoing cesarean section with spinal anesthesia, and their study showed that a mini dose of 5mg bupivacaine in combination with 20 $\mu$ g fentanyl provides successful spinal anesthesia and cause less hypotension, vasopressor requirement and nausea than 10mg bupivacaine.<sup>8</sup>

Nausea and vomiting during spinal anesthesia may be related to a postural hypotension and hypoxemia of the vomiting center, excessive rise in blood pressure following administration of a vasopressor is also to produce nausea.<sup>3</sup> This problem is unpleasant during surgery. In one study Chung and co-workers reported that the incidences of hypotension in patients given 10-11mg bupivacaine (Group-I) was significantly higher than in group received 8-9mg bupivacaine (Group-II) but the efficacy of intraoperative analgesia in group I was significantly better than group II.<sup>6</sup>

Yehuda Ginosar reported that the ED95 (11.2mg) of intrathecal bupivacaine under the conditions of their study is considerably in excess of the low doses proposed for cesarean section in some recent publication, when doses of intrathecal bupivacaine less than the ED95 particularly near the ED50 (7.6 mg) are used, the doses should be administered as part of a catheter based technique.<sup>9</sup>

P. Dadakar suggested that reduced doses of hyperbaric bupivacaine 0.75% median 9.38 mg and fentanyl 15 $\mu$ g and left sitting for two minutes prevent high block, and suggested that spinal anesthesia for ce-

sarean section following suboptimal cesarean labor epidural analgesia be considered avoiding epidural boluses immediately preceding spinal injection.<sup>10</sup>

In the study by Jaishri Bogra on comparing the hemodynamic stability of equipotent doses of bupivacaine and bupivacaine–fentanyl for spinal anesthesia, the group with bupivacaine 8mg and fentanyl 12.5µg was stable than other groups, and they proved that by adding fentanyl adequate depth of spinal anesthesia can be achieved at much lower doses of bupivacaine. Incidence of hypotension as well as fall in the systolic BP increases with the dose of bupivacaine.<sup>11</sup>

A study by Mohammed S et al At Prince Rashid Hospital, 100 adult patients were randomized into two groups. Fifty patients received spinal anesthesia with Bupivacaine 7.5-9 mg and fentanyl 25 µg, while other 50 patients received Bupivacaine 12.5-15 mg only. The homodynamic stability of the patients and the quality of the blocks were compared. They concluded that, a reduced dose of bupivacaine in combination with fentanyl provided reliable spinal anesthesia in adults for variable kinds of surgical procedures with few events of hypotension and little need for vasopressor support of blood pressure. It offers a reliable block, good post-operative analgesia and satisfactory for the patient and surgeon.<sup>13</sup>

## CONCLUSION

In summary this study has shown that a low dose of bupivacaine in combination with fentanyl, low volume provides completely satisfactory spinal anesthesia for cesarean section. The small dose combination, in comparison with a 12mg dose of bupivacaine causes dramatically less hypotension and less Mephentermine support of blood pressure, and decreases the incidence of nausea and vomiting.

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