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Two syringes technique for spinal anesthesia to prevent hypotension in patients undergoing elective cesarean section

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ABSTRACT

Aims: To compare the incidence of hypotension after intrathecal administration of hyperbaric bupivacaine and fentanyl in two different syringes against standard single injection of mixed fentanyl with hyperbaric bupivacaine.

Methods: This was a prospective comparative study conducted in 174 parturients undergoing elective caesarean section at Paropakar Maternity & Women's Hospital. Hemodynamic effects and characteristics of block were monitored and recorded and compared between the two groups, group S (single syringe) and group D (double syringe).

Results: The incidence of hypotension was almost similar in the two groups but the drop in systolic blood pressure and mean arterial pressure at 5 minutes and 7.5 minutes after subarachnoid block was significant in group S as compared to group D ($p < 0.005$ and $p < 0.005$ respectively).

Conclusion: Hyperbaric bupivacaine with fentanyl, which when injected separately without mixing, is associated with lesser incidence of hypotension following subarachnoid block.

Keywords: fentanyl, hyperbaric bupivacaine, hypotension, spinal anesthesia

INTRODUCTION

Spinal anesthesia is a popular method of anesthesia for cesarean section (CS), however, there are some complications like hypotension, post-dural puncture headache and failed spinal anesthesia.¹ Hypotension is the most common problem with spinal anesthesia. Around 55% of the parturients undergoing caesarean section under spinal anesthesia experience hypotension when hyperbaric bupivacaine is used.² It is mainly due to the sympathetic blockade leading to peripheral vasodilatation and pooling of blood in dilated vascular bed with subsequent decrease of venous return and cardiac output. This is because the gravid uterus compresses the inferior vena cava resulting in decreased venous return.^{3,4,5}

Hyperbaric bupivacaine is commonly used local anesthetic for spinal anesthesia. Usually only hyperbaric bupivacaine is used as a single agent for spinal anesthesia but other drugs can also be added for intrathecal injection. One of the drugs other than bupivacaine can be opioids as they act synergistically and the incidence of hypotension is reduced due to decreased dose of bupivacaine.⁶ Mixing these drugs may alter the density of the hyperbaric solution, affecting the spread of local anesthetic and opioid⁷ thereby reducing the complications associated with spinal anesthesia. Even though mixing fentanyl may delay the onset of block, incidence of hypotension has been found to be reduced with mixing of fentanyl.^{8,9}

Using two different syringes for injecting heavy bupivacaine and fentanyl may reduce the incidence of hypotension when compared with single syringe injection containing both heavy bupivacaine and fentanyl.¹⁰ So, this study was done to compare the incidence of hypotension after intrathecal administration of hyperbaric bupivacaine and fentanyl in two different syringes against standard single injection of mixed fentanyl with hyperbaric bupivacaine.

METHODS

This was a prospective comparative study, conducted among parturients planned for elective cesarean section under spinal anesthesia (SAB) over a period of three months in Paropakar Maternity & Women's Hospital, Thapathali, Kathmandu. Ethical approval was obtained from the Institutional Review Committee (IRC). Before enrolling in the study, informed written consent was taken. Cases with singleton uncomplicated full term pregnancy, ASA physical status II patients, planned for elective caesarean section with BMI < 30 kg/m² were enrolled in this study. Patients having age less than 18 years and more than 45 years, pre-eclampsia, eclampsia, intrauterine fetal death (IUFD),

contraindication to regional anesthesia and allergic to used medications were excluded. Spinal anesthesia was given in sitting position. Under all aseptic technique, painting and draping was done. After skin infiltration with 2% lidocaine 2 ml, a 27-gauge Whitacre spinal needle was inserted at the L3– L4/L4-L5 interspace with needle tip facing cephalad direction. After free flow of CSF, syringe was attached to spinal needle and aspiration was done for confirmation. The study drugs were administered according to group distribution which was done based on closed envelope method which was chosen by the patient. Group S received: 0.5% hyperbaric bupivacaine 1.8 ml + 0.4 ml (20 µg) fentanyl mixed in a single syringe of 5 ml. Group D received: 0.5% hyperbaric bupivacaine 1.8 ml and 0.4 ml (20 µg) fentanyl in two different syringes of 5 ml without barbotage. They were kept in supine immediately with left uterine displacement. Mean arterial blood pressure (MAP) and heart rate was measured at every 2.5 minutes interval till 15 minutes and every 5 minutes interval till the end of the surgery. Assessment of block height by the researcher was performed on both sides using blunted needle in a standardized manner on each parturient. Five minutes after intrathecal injection, level of sensory block was checked for cold sensation with ice pack. Further checking of the block height was done before the start of surgery and highest level of block was recorded and the surgery was allowed to be started when level of T6 block was achieved. The motor block was assessed by using Modified Bromage Scale.¹¹ The time of skin incision; uterine incision and delivery of the neonate were recorded. The lactated Ringer's solution was continued and hemodynamic parameters were measured till the end of the surgery. After delivery of the

baby and cord clamping, 3 IU of oxytocin was given IV slowly as per hospital protocol. Complications during the perioperative period were managed as per the hospital protocol. Failed spinal anesthesia was excluded from the study and the surgery was continued under general anesthesia as per hospital protocol.

Statistical Analysis: Collected data were entered in and analyzed using statistical software IBM-SPSS (Statistical Package for Social Sciences) version 20.0. Analyzed data were presented as mean \pm standard deviation for continuous variables and as numbers and percentages for categorical variables. Analyzed data were presented in the form of tables, graphs and charts. The P-value of less than 0.05 was considered significant.

RESULTS

Total of 174 patients were included in the study, 87 patients in each group were analyzed. The mean age was 27.43 ± 6.826 years in Group S and 26.48 ± 9.628 years in Group D. Similarly, mean BMI was 27.07 ± 2.242 Kg/m² in Group S and 26.60 ± 2.218 Kg/m² in Group D. The demographic data in both the groups were comparable but not significantly significant.

Mean pre-anesthetic baseline MAP in Group S was 91.15 ± 13.749 mm Hg whereas in Group D was 90.82 ± 11.867 mm Hg. They were comparable but not statistically significant with p-value of 0.512. The mean MAP at 2.5 minutes in Group S was 68.77 ± 12.848 mmHg and in Group D was 78.43 ± 16.771 mm Hg. They were statistically significant with p-value of 0.007. Similarly, the mean MAP of 71.77 ± 13.946 mm Hg in Group S at 5 minutes and 79.01 ± 13.858 mm Hg in Group D was also statistically significant with p value of 0.002. [Table-1]

Table-1: Comparison of mean of MAP in mmHg at different time interval between Group S and D

Mean MAP by interval	Group S (n=87) (Mean \pm SD)	Group D (n=87) (Mean \pm SD)	P-value
MAP	91.15 \pm 13.749	90.82 \pm 11.867	0.512
2.5 minutes	68.77 \pm 12.848	78.43 \pm 16.771	0.007
5 minutes	71.77 \pm 13.946	79.01 \pm 13.858	0.002
7.5 minutes	76.14 \pm 12.997	77.74 \pm 14.548	0.065
10 minutes	77.03 \pm 12.630	77.39 \pm 13.412	0.693
12.5 minutes	77.91 \pm 15.851	78.15 \pm 10.754	0.791
15 minutes	78.64 \pm 15.923	78.40 \pm 11.486	0.939
20 minutes	77.40 \pm 12.185	77.78 \pm 10.879	0.805
25 minutes	75.98 \pm 10.341	74.12 \pm 11.639	0.231
30 minutes	72.63 \pm 12.499	74.75 \pm 11.986	0.268
35 minutes	72.63 \pm 10.126	75.25 \pm 11.454	0.138
40 minutes	73.48 \pm 10.602	75.047 \pm 10.164	0.382
45 minutes	75.57 \pm 11.874	75.73 \pm 11.302	0.942
50 minutes	76.16 \pm 12.004	77.05 \pm 9.455	0.722
55 minutes	75.44 \pm 10.529	80.36 \pm 8.981	0.107
60 minutes	80.00 \pm 7.036	82.07 \pm 8.731	0.506
65 minutes	86.00 \pm 13.711	90.50 \pm 5.891	0.482
70 minutes	84.00 \pm 7.000	92.40 \pm 11.349	0.299

The incidence of hypotension was more in Group S as compared to Group D. The overall incidence of hypotension in Group S was 57.45 % and while in Group D, it was 24.12%. [Table-2]

Table-2: Comparison of incidence of hypotension between Group S and Group D

Episodes	Group S (n= 87)	Group D (n=87)	P-value
1	35 (40.22%)	15 (17.24%)	0.000
2	13 (14.94%)	4 (4.59%)	0.000
3	2 (2.29%)	2 (2.29%)	0.000

In Group S, there were changes in mean MAP from baseline at different time interval. They were statistically significant till 60 minutes of the surgery with p-value <0.05. After that, they were comparable but statistically non-significant. There were drop in mean MAP from baseline till 60 minutes which were statistically significant within Group D with p value <0.005. Later, they were comparable but statistically not significant. [Figure-1]

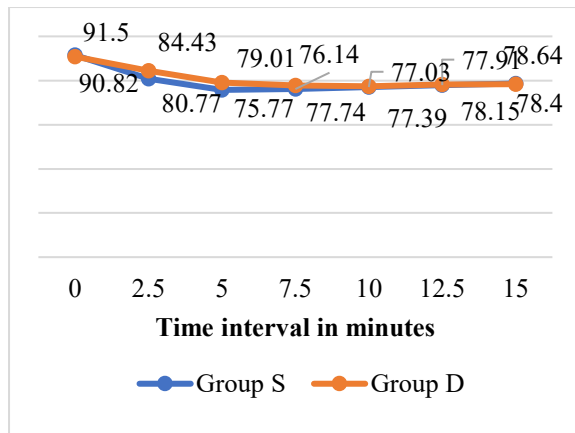


Figure 1: MAP changes between group S and group D

The mean baseline, post spinal and hourly heart rate till the end of surgery was comparable in Group S and Group D but not statistically significant with p-value > 0.05. [Table-3]

Table-3: Comparison of mean HR at different time interval between the Group S (n=87) and D (n=87)

HR (beats/min)	Group S (Mean ± SD)	Group D (Mean ± SD)	P-value
Baseline	92.10 ±19.569	96.49 ±16.284	0.110
2.5 minutes	91.57±18.075	93.60 ±20.575	0.492
5 minutes	90.46±18.032	91.90±24.719	0.662
7.5 minutes	88.28±18.640	90.52±28.070	0.536
10 minutes	86.63±18.205	87.83±19.112	0.673
12.5 minutes	86.72±20.226	87.46±20.278	0.811
15 minutes	90.16±20.399	88.00±19.712	0.478
20 minutes	93.24±16.940	89.44±16.637	0.138
25 minutes	92.84±18.759	90.94±20.790	0.533
30 minutes	93.38±16.312	93.94±15.372	0.820
35 minutes	91.81±16.872	94.14±16.144	0.387
40 minutes	93.77±13.502	87.65±21.428	0.051
45 minutes	94.67±11.687	91.67±18.987	0.0320
50 minutes	94.53±15.085	91.86±14.710	0.448
55 minutes	88.26±19.838	89.74±16.853	0.796
60 minutes	88.92±13.345	93.64±25.862	0.561
65 minutes	94.40±15.868	103.17±24.774	0.513
70 minutes	84.33±13.317	88.33±44.410	0.886

DISCUSSION

In total of 174 parturient, hyperbaric bupivacaine and fentanyl was used for spinal anesthesia in cases scheduled for cesarean section in single syringe and in different syringes and compared the mean arterial pressure (MAP), heart rate (HR), highest level of block, time required to achieve the highest level of block, requirement of rescue

analgesia. No patients were excluded from the study during the study period. We found that use of double syringe technique decreased the frequency of hypotension as compared to single syringe of local anesthetics which can be attributed to the fact that separately injected hyperbaric bupivacaine sinks down which delays the onset of action and takes longer time to reach the final level which leads to decrease the frequency of hypotension.

In this study, there was significant decrease of MAP at 2.5 and 5 minutes, in group S when compared to group D after spinal anesthesia (p- value 0.007 & 0.002 respectively). When the trend of hypotension was compared within the group, in group S, the drop in MAP from baseline was statistically significant till 60 minutes. Similarly, the drop in MAP from baseline was also statistically significant within group D with p value <0.000. A similar result was reported by Keera et al.¹⁰ Similarly, Bansal et al¹² found that there was significant difference among study and control groups in view of systolic and diastolic blood pressure 10 min after induction of anesthesia. However, they haven't mentioned the p-value of blood pressure of their study.

The incidence of hypotension was more in Group S than in Group D. The overall incidence of hypotension in Group S was 57.45 % and while in Group D, it was 24.12% which was statistically significant. In a study conducted by Keera et al¹⁰ showed that the percentage of hypotension was statistically significant when bupivacaine and fentanyl was given in separate syringe rather than in a single syringe as a mixture. The frequency of hypotension was more in single syringe group in late phase. Similar study was conducted by Joshi S et al¹³ where they found significant decrease in mean

blood pressure in single syringe group (group M) than in double syringe group (group S). They observed hypotension in 16 patients in group M than four patients in group S. In another study done by Bansal et al¹², they found significant difference between the mean systolic and diastolic blood pressures of study and control groups at 1 min, 2 min, 3 min and 4 min after induction of anesthesia. However, in all study, they have used 2 ml of 0.5% hyperbaric bupivacaine and 0.5 ml of fentanyl whereas in our study, we have used 1.8 ml of 0.5% hyperbaric bupivacaine and 0.4 ml of fentanyl.

Heart rate were comparable in both group S and group D of our study which was similar to Chinachoti et al¹⁴ and Shrestha SN et al¹⁵ where they found no significant change in the heart rate when fentanyl was used with hyperbaric bupivacaine for caesarean section in spinal anesthesia. Another study done by Shawagfeh et al¹⁶ also showed no significant decrease in the heart rate. The study done by Yesuf et al¹⁷ where they compared the analgesic effect of intrathecal fentanyl with bupivacaine in spinal anesthesia for emergency caesarean section also showed no statistical significant change in mean heart rate.

The limitation of this study was the number of times of use of mephentermine for hypotension was not recorded.

CONCLUSION

Hyperbaric bupivacaine with fentanyl when injected intrathecally in separate syringes without mixing, is associated with lesser incidence of hypotension as compared to single syringe thereby reducing the risks associated with spinal anesthesia.

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