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Original Research Article

The efficacy of intrathecal fentanyl and buprenorphine as an adjuvant to bupivacaine in caesarean section

[1]Dr. Naziya Sultana, [2]Dr. Triveni N Hiremath, [3]Dr. Gayathri Bhat, [4]Dr. Kiran K N

[1]Consulting Anaesthesiologist, Gadag, Karnataka, India

[2]Senior resident, Department of Anaesthesia, JSS medical College, Mysore, Karnataka, India

[3]Professor, Department of Anaesthesia, K.S Hegde Medical Academy, Mangalore, Karnataka, India

[4]Associate Professor, Department of Anaesthesia, RIMS, Raichur, Karnataka, India

Corresponding Author:

Dr. Kiran K N (id-drknkirannayak@gmail.com)

Abstract

Introduction: The addition of intrathecal opioids to local anaesthetics has been found to improve the quality and duration of sensory and motor blockade, providing post-operative pain relief for a longer period.

Method: 60 parturients of ASA grade I and II scheduled for elective LSCS under subarachnoid block were randomly allocated into 2 groups. Group A were administered 2ml of 0.5% hyperbaric bupivacaine with 90 µg of buprenorphine (0.3 ml). Group B were administered 2ml of 0.5% hyperbaric bupivacaine with 15 µg of fentanyl (0.3 ml). Efficacy of buprenorphine and fentanyl as adjuvants in terms of haemodynamic variables, onset and duration of sensory block and motor block along with side effects were recorded.

Results: There were no significant hemodynamic changes between the two groups. There was significant decrease in the time required to reach peak sensory blockade in fentanyl when compared to buprenorphine group compared to control group (p value <0.0001). Mean duration of analgesia was significantly prolonged in Group A (309.23±14.32 min) than Group B (284 ± 15.22min). There was no significant effect on Apgar score of the neonate.

Conclusion: Intrathecal hyperbaric bupivacaine with opioid as adjuvants are well tolerated by the parturient and neonate during caesarean section with quality analgesia and increased duration of post-operative analgesia

Keywords: Subarachnoid blockade, caesarean section, adjuvants, opioids

Introduction

Spinal anaesthesia was introduced into clinical practice by Karl August Beir in 1898. Spinal anaesthesia is defined as “the temporary interruption of transmission of nerve impulses produced by the injection of local anaesthetic solution into the cerebrospinal fluid [1]. The advantages of spinal anaesthesia includes awake patient, alleviates the need for airway manipulation, decreases the chances of aspiration, minimal drug cost, reduces postoperative morbidity, deep vein thrombosis, pulmonary embolism, bleeding and pneumonia [2].

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Spinal anaesthesia is the preferred means for caesarean section, being simple to perform, economical and produces rapid onset of anaesthesia and complete muscle relaxation. It carries a high efficiency, involves less drug doses, minimal neonatal depression, awake mother and lesser incidences of aspiration pneumonitis [3].

One disadvantage with spinal anaesthesia using hyperbaric bupivacaine alone is relatively shorter duration of action which means that early analgesic intervention is needed in the postoperative period. Another disadvantage although infrequent is intraoperative nausea during manipulation of the uterus and at the time of peritoneal closure [4].

Hence, intrathecal opioids are combined with local anaesthetics to improve the onset time of block, duration and quality of analgesia both intraoperatively and postoperatively.

This study was designed to compare the efficacy of intrathecal fentanyl and buprenorphine as an adjuvant to bupivacaine in caesarean section.

Methodology

Study design: Prospective, randomized comparative study.

Study population: Study was conducted on 60 patients, allocated into 2 equal groups by randomization using computer generated table, posted for lower segment caesarean section under spinal anaesthesia

Sample size: (60 patients) 30 parturients in each group.

Sample selection

Selection method: Patients were randomly assigned into two groups by computer generated table.

Group A were administered 2ml of 0.5% hyperbaric bupivacaine with 90 µg of buprenorphine (0.3 ml).

Group B were administered 2ml of 0.5% hyperbaric bupivacaine with 15 µg of fentanyl (0.3 ml).

Procedure

After preanesthetic evaluation, written informed consent was taken. The procedure of subarachnoid block and visual analogue scale (VAS) was explained to the patient VAS consists of a 10cm line anchored to one end by a label 'No Pain' and at the other end by a label 'Worst pain imaginable'. Patients were informed to point out the intensity of pain on the scale.

All patients were kept nil per oral as per standard guidelines. Patients were premedicated with Tab ranitidine 150mg IV HS and 2hrs before surgery and Tab metoclopramide 10mg 2hr prior to surgery.

After shifting the patient to operation theatre, monitors were connected and baseline values of heart rate (HR), non-invasive blood pressure (NIBP), oxygen saturation (SpO2) were noted. Intravenous (IV) access was secured. Preloading was done with Ringer Lactate infusion. 20ml/kg. Observations were noted by an individual unaware of the nature of the study. Patients were placed in lateral position. Under aseptic precaution, 23G quincke babcock needle was inserted in the subarachnoid space at L3-L4 interspinous space using midline approach. After confirmation of position by free flow of CSF, study drug was injected at the rate of 0.2ml/sec. Patients were then be placed in supine position. Wedge of 10 cm height was placed under right buttock. Oxygen (4 l/min) was supplemented via a facemask.

The following parameters were observed and recorded

- HR, BP and SpO_2 every 2 min for first 15 min and every 3 min for next 15 min and every 5min till end of surgery.
- Sensory block was assessed with pin prick (23G needle) in midclavicular line every 2 min till peak height of block is reached (i.e., till block height remains sustained after 4 consecutive pin pricks).
- Motor blockade was assessed with bromage scale every 2 min till the onset of complete motor blockade.
- Apgar score of baby at 1 and 5 min.
- After the extraction of baby, injection midazolam 1mg IV was given.
- Hypotension was defined as a systolic blood pressure below 100 mm Hg or a decrease in systolic pressure of more than 30% of the baseline value and was treated with IV ephedrine 6mg.
- Any significant blood loss was treated with IV fluids and blood as required.
- Bradycardia was defined as absolute heart rate < 60/min and was treated with atropine IV 0.6 mg.
- Any other complications like giddiness, nausea, vomiting, pruritus, shivering were attended appropriately and noted in the study sheet.
- In the postoperative period, motor blockade was monitored every 15 min till the bromage scale is grade 1.
- Postoperatively patient's vital parameters, duration of analgesia, time for return of sensory block were monitored till regression to S2 dermatome.

Results

Table 1: Comparison of onset of sensory block

Onset of sensory blockade	Fentanyl group	Buprenorphine group
Mean	9.40	10.73
St dev	1.19	1.14
P value	<0.0001	
Inference	Onset of sensory blockade is significantly earlier in Fentanyl group	

Comparison of onset of sensory blockade was done using unpaired student t test. There was significant decrease in the time required to reach peak sensory blockade in fentanyl group compared to buprenorphine group (p value < 0.0001).

Table 2: Comparison of onset of motor blockade

Onset of motor blockade (mins)	Fentanyl group	Buprenorphine group
Mean	5.27	5.37
St dev	1.26	1.45
P value	0.78	
Inference	Non-significant difference in Onset of motor blockade	

Onset of motor blockade in fentanyl group was 5.27±1.26 minutes and in buprenorphine group was 5.37±1.45minutes. The onset of motor blockade there was no statistically significant difference in onset of motor blockade between fentanyl and buprenorphine groups (p=0.78)

Table 3: Comparison of duration of sensory blockade

Duration of sensory blockade	Fentanyl group	Buprenorphine group
Mean	284.00	309.23
St dev	15.22	14.32
P value	<0.0001	
Inference	Duration of sensory blockade was significantly higher in the Buprenorphine group	

Duration of sensory blockade was compared using unpaired student t test. There was significant prolongation in the duration of sensory blockade in fentanyl compared to buprenorphine group (p = < 0.001).

Table 4: Comparison of duration of analgesia

VAS time	Fentanyl group	Buprenorphine group
Mean	254.00	265.33
St dev	15.22	17.75
P value	0.0103	
Inference	Significantly higher in Buprenorphine group	

There was significant prolongation in the duration of analgesia in buprenorphine group when compared with fentanyl group (p = 0.0103).

There was no difference in APGAR score of the babies at 1 and 5 minutes in both groups. In our study,3 patients in fentanyl group and 5 patients in buprenorphine group had hypotension which was treated with 6mg bolus of ephedrine IV and it was not statistically significant. 7 patients in fentanyl group and 6 patients in buprenorphine group had nausea which was treated with ondansetron 4mg slow IV. 1 patient in fentanyl group had vomiting for which ondansetron 4mg slow IV was given. There were no episodes of respiratory depression and pruritus in both groups.

Discussion

Onset of sensory blockade in fentanyl group was 9.40±1.19 minutes and in buprenorphine group was 10.73± 1.14 minutes. There was significant decrease in the time required to reach peak sensory blockade in fentanyl group compared to buprenorphine group (p value <0.0001). A study was conducted by Shende D *et al.* in which 15µg of fentanyl added to 2.5ml of 0.5% hyperbaric bupivacaine was compared with control group (0.3ml of 0.9% saline added to 2.5ml of 0.5% hyperbaric bupivacaine). In this study the onset time of sensory blockade was 6.5min in fentanyl group and 8min in control group which was not statistically significant [5].

Onset of motor blockade in fentanyl group was 5.27±1.26 minutes and in buprenorphine group was 5.37±1.45minutes. The onset of motor blockade was not statistically significantly different in fentanyl and buprenorphine groups (p value =0.78). A study was conducted by Dahlgren *et al*. in which patients were randomly allocated into 4groups (20 parturients in each group). 1ml of test solution containing saline, sufentanil 2.5µg, sufentanil 5µg, or fentanyl 10µg was given intrathecally, immediately followed by the injection of 2.5 mL 0.5% hyperbaric bupivacaine. This study showed that there was no statistically significant difference in the onset of sensory and motor blockade between the groups [5].

Hunt *et al*. conducted a study to compare different doses of fentanyl (0, 2.5, 5, 6.25, 12.5, 25, 37.5 and 50µg) as adjunct to 0.75% hyperbaric bupivacaine. This study showed that there is no statistically significant difference in onset of sensory and motor blockade between the group [7].

Dixit S conducted a study in 60 parturients in which 30 of them received 1.7ml (8.5mg) of hyperbaric bupivacaine (control group) and 30 parturients received 1.7ml (8.5mg) of hyperbaric bupivacaine along with 60μg buprenorphine (study group). The onset of sensory blockade was 5.35±1.79 in control group and 1.85±1.39 min in study group which was statistically significant (p<0.001). The results of this study are similar to our study [8].

In our study, duration of motor blockade was comparable between the groups. Dahlgren *et al*. conducted a study comparing fentanyl (10μg), sufentanil (2.5 μg and 5μg) with placebo (saline) as an adjunct to 2.5ml of 0.5% hyperbaric bupivacaine. This study showed that duration of motor blockade was comparable between the groups similar to our study.

Duration of analgesia is significantly prolonged in buprenorphine group (265.33±17.75 min) when compared with fentanyl group (254±15.22 min) (p =0.0103). Duration of analgesia was comparable between fentanyl and buprenorphine group. Study conducted by Dahlgren *et al*. also showed that duration of effective analgesia was significantly prolonged in fentanyl group (10μg with 2.5ml of 0.5% hyperbaric bupivacaine) compared to control group (2.5ml of 0.5% hyperbaric bupivacaine). Similarly, Sunil Dixit conducted a study comparing the effect of buprenorphine as an adjunct to 0.5% hyperbaric bupivacaine with control group in 60 parturients. The study showed that duration of effective analgesia in control group was
145.16 ± 25.86 min and in buprenorphine group it was 491.26 ± 153.97 min which was statistically significant [8].

Sergio D Belzerena conducted a study in 120 parturients who were divided into 4 groups. All patients received 3ml of 0.5% hyperbaric bupivacaine immediately following which 2 mL of a solution containing either 0 (group 0), 1.25 μg/kg (group 25), 0.5 μg/kg (group 50), or 0.75 μg/kg (group 75) of preservative-free fentanyl was given intrathecally. Duration of analgesia was significantly increased with increasing concentration of fentanyl {Group 0-199± 77min, Group 25-305 ± 89 min, Group 50-640 ± 142 min and Group 75-787 ± 161 min} which was similar to our study [9].

Our study showed that APGAR score of the babies was not affected by addition of intrathecal opioids. A study was conducted by Bogra *et al*. to compare the effects of addition of 12.5μg of fentanyl to different doses of hyperbaric bupivacaine. Addition of fentanyl did not affect the APGAR score in this study similar to our study [3].

A study was conducted by Shaloo Ipe *et al*. in which 90 parturients were divided into 3 groups. Gp I Received 2ml of 0.5% hyperbaric bupivacaine with 0.5ml of buprenorphine (150μg) intrathecally. Gp II: Received 2.5 ml Bupivacaine 0.5% intrathecal with 3 ml of 2% xylocaine with adrenaline (15mcg) and 6.5ml of Normal Saline + 0.5ml Buprenorphine (150mcg) epidural. Gp III received 2.5 ml Bupivacaine 0.5% intrathecal with 3 ml of 2% xylocaine with adrenaline (15mcg) and 6 ml of Normal Saline + 1ml Buprenorphine (300mcg) epidural. This study also showed that addition of buprenorphine either intrathecally or epidural did not affect the APGAR score of the new born [10].

In our study, 3 patients in fentanyl group and 4 patients in buprenorphine group had hypotension which was treated with 6mg bolus of ephedrine IV. A study conducted by Dahlgren *et al*. comparing between fentanyl and sufentanil with the control group as an adjunct to hyperbaric bupivacaine for subarachnoid blockade also showed that there was no statistically significant difference in the hypotensive episodes and requirements of ephedrine. 7 patients in fentanyl group and 6 patients in buprenorphine group had nausea which was treated with ondansetron 4mg slow IV. 1 patient in fentanyl group had vomiting for which ondansetron 4mg slow IV was given. A study conducted by Hunt *et al*. comparing different doses of fentanyl as an adjunct to hyperbaric bupivacaine with the control group also showed that the incidence of nausea was more in patients in which 6.25μg fentanyl was used as an adjunct to hyperbaric bupivacaine [7].

There were no episodes of respiratory depression and pruritus in both groups.

Conclusion

Results of our study has shown that addition of intrathecal opioids-fentanyl and buprenorphine as adjuvants to hyperbaric bupivacaine had no significant difference in onset of motor block but hastened the time for achieving highest sensory blockade in fentanyl group and prolonged the duration of analgesia significantly in patients with buprenorphine group without any effect on neonatal outcome. Hence, we conclude that the combination of 0.5% hyperbaric bupivacaine with buprenorphine (90µg) is better compared to 0.5% hyperbaric bupivacaine with fentanyl (15µg) in providing analgesia, as the combination offers a convenient, simple, inexpensive, effective and safe means of good post-operative analgesia.

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