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Original Research Article

A comparative study of intrathecal hyperbaric ropivacaine with varying doses of buprenorphine for postoperative analgesia after cesarean section

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Abstract

Background: Postoperative analgesia after cesarean section poses unique clinical challenges to anesthesiologist. Intrathecal buprenorphine is a promising drug for postoperative analgesia.
Objective: The aim of this study was to compare the efficacy of two doses of buprenorphine (30µg and 60 µg) as an adjuvant to hyperbaric ropivacaine for postoperative analgesia in cesarean section.
Setting and Design: Prospective randomized controlled study involving ninety parturients posted for elective cesarean section under subarachnoid block.
Materials and Methods: Group A (n = 30) received 1.8 ml of 0.75% hyperbaric ropivacaine with 30µg buprenorphine, Group B (n = 30) received 1.8 ml 0.75% hyperbaric ropivacaine with 60 µg buprenorphine, Group C (n = 30) received 1.8 ml of 0.75% hyperbaric ropivacaine with 0.2 ml normal saline, respectively. Following parameters were observed: onset and duration of sensory block, postoperative pain scores based on visual analog scale (VAS), rescue analgesic requirement and maternal and neonatal side effects if any.
Statistical analysis: Unpaired t-test and Chi-square test were used.
Results: Duration of postoperative analgesia was significantly prolonged in Groups A and B in comparison to Group C and it was longest in Group B. Rescue analgesic requirement and VAS score were significantly lower in the buprenorphine groups. No major side effects were observed.
Conclusion: Addition of buprenorphine to intrathecal ropivacaine prolonged the duration and quality of postoperative analgesia after cesarean section. Increasing the dose of buprenorphine from 30µg to 60 µg provided longer duration of analgesia without increase in adverse effects.

Keywords: Ropivacaine, buprenorphine, cesarean, intrathecal, postoperative analgesia

Introduction

The rate of cesarean deliveries has increased globally over recent years. Adequate postoperative pain relief after cesarean section avoids the adverse effects of pain on various systems in the mother and facilitates early mobilization and better nursing of the baby. It is inevitable that the mode of analgesia should be safe and effective, which will not interfere

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with the mothers' ability to take care of her baby along with zero adverse effects to the newborn. Eisenach *et al*. found 2.5 times increased risk of persistent pain and 3.0 times increased risk of postpartum depression in women experiencing severe acute postpartum pain [1]. Subarachnoid block (SAB) has become the preferred anesthetic technique for patients undergoing elective cesarean delivery [2]. Opioids remain the mainstay among the various adjuvants to local anesthetics (LAs) in SAB primarily by virtue of its various properties such as reducing the dose of LA, minimizing side effects and prolonging the duration of anesthesia [3]. American Society of Anesthesiologists (ASA) recommends neuraxial opioids over intermittent administration of parenteral opioids for postoperative analgesia after neuraxial anesthesia for caesarean section [4]. Buprenorphine is an agonist-antagonist opioid, about thirty times more potent than morphine. It is a centrally acting lipid soluble analog of the alkaloid thebaine with both spinal and supraspinal components of analgesia [5, 6]. In addition, it has a ceiling effect on respiratory depression but not on analgesia [7]. The antihyperalgesic property of buprenorphine helps in preventing central sensitization [5]. Its high lipid solubility, high affinity for opioid receptors, and long duration of action makes buprenorphine a good choice as an adjuvant to intrathecal LA for managing moderate to severe postoperative pain [8, 9]. Buprenorphine is readily available as a preservative-free preparation which is compatible with the cerebrospinal fluid (CSF). Intrathecal doses (30-150 µg) are much smaller than parenteral doses and are known to prolong analgesia without sensory or motor blockade.

Materials and Methods

This was a prospective randomised controlled study involving parturients aged between 20 to 45 yrs posted for elective cesarean section in Mamata General Hospital for a period of one year after obtaining approval from the institutional ethics committee. Minimum of 90 patients (30 in each group) divided into Groups A, B & C.

Inclusion criteria

Patient willing for study and who has given informed and written consent, Patients with ASA class I and II between the age of 20 and 35 years, No local infection, No neurological deficit.

Exclusion criteria

Patient's refusal. Patients on anti-coagulants or with any coagulopathies. ASA grade III and IV. Allergy to protocol drug. Emergency surgeries. Patients with cardiorespiratory, hepatic, and renal problems.

A thorough preoperative assessment was done on the day before surgery to exclude any systemic illness and to select patients according to the criteria.

Methodology

Body weight, height, and vitals were recorded. All patients were advised overnight fasting. Procedure was explained to the patient and visual analog scale (VAS) discussed. Patients were brought to theatre in the left lateral position. Monitors were attached and oxygen was administered with simple face mask throughout the surgery. Intravenous access was secured using an 18-gauge cannula sited in the nondominant hand under local anesthesia and preloading was done with 20 ml/kg normal saline. After bladder catheterization, patients were turned to lateral position. Under strict aseptic precautions, SAB was performed at L3-L4 interspace using a 25-gauge spinal needle by midline approach. After clear CSF tap, the drug was injected into the subarachnoid space. Buprenorphine was taken in a syringe so as to add

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it precisely.

- Group A received 1.8 ml of 0.75% hyperbaric ropivacaine with 30 μg buprenorphine with 0.1 ml normal saline.
- Group B received 1.8 ml of 0.75% hyperbaric ropivacaine with 60 μg buprenorphine.
- Group C (control) received 1.8 ml of 0.75% hyperbaric bupivacaine to which 0.2 ml of sterile normal saline.

After the subarachnoid injection, patients were immediately turned to the supine position and a wedge was kept under the right buttock. Heart rate, blood pressure, and respiration were monitored every 2 min for 30 min and every 5 min thereafter. Surgery was started when the sensory level reached T4 level (assessed with pinprick) and this was taken as the time of onset of analgesia. Intraoperative fluid maintenance was done with normal saline. After delivery of the baby, 10 units of oxytocin was administered as an infusion in normal saline. Neonatal status was assessed by Apgar scores at 1 min and 5 min after delivery. Sensory level was rechecked during the procedure and peak sensory level attained was noted. The total duration of surgery was noted and the time of completion of surgery was taken as the postoperative 0 h. No other analgesics or sedatives were given intraoperatively. Postoperatively, pulse rate, blood pressure, and respiration were monitored every 15 min for 2 h and then hourly for 24 h.

Postoperative analgesia was assessed hourly using VAS. The duration of postoperative analgesia was calculated as the time interval between the completion of surgery to the appearance of pain corresponding to VAS score of 4. Other side effects such as postoperative nausea and vomiting (PONV) and pruritus were watched for.

Unpaired t-test and Chi-square test were used to test the significance of difference between the groups. Peak sensory levels, maximum pain score, and side effects were analyzed using Chi-square test and the rest using unpaired t-test. $p<0.05$ was considered statistically significant.

Results

All three groups were comparable with respect to age, weight, height, and duration of surgery as P was > 0.05.

Table 1: Demographic data and duration of surgery

Parameters	Group A	Group B	Group C
Age (years)*	24.5±2	26.30±3.00	27.41±3
Weight (kg)*	58.7±4.0	59.55±4	65.53±336
Height (cm)*	150.5±5.6	153.3±5	159.8±5.65
Duration of surgery (min)*	50.5±133	49±10.3	61.3±8.5

***Data:** Mean +SD. SD= Standard Deviation

Table 2: Onset of analgesia between groups

Parameters	Group A	Group B	Group C	Group A versus Group C (P)	Group B versus Group C (p)	Group A versus Group B (p)
Onset of analgesia (min)*	8.68±0.64	8.22±0.62	8.96±0.8	0.12	0.00049	0.01

There was a significant difference in the onset of analgesia in Group B when compared to Group A and C. Onset of analgesia was comparable between Group A and Group B [Table 2].

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Table 3: Peak sensory level

Peak sensory level	Group A, n*(%)	Group B, n*(%)	Group C, n*(%)	Group A versus Group C (P)	Group B versus Group C (P)	Group A versus Group B (P)
T2	1(3)	2(7)	1(3)	0.85	0.16	0.12
T4	7(23)	12(40)	8(27)			
T6	22(64)	16(53)	21(70)			
* Number of patients attaining the sensory level						

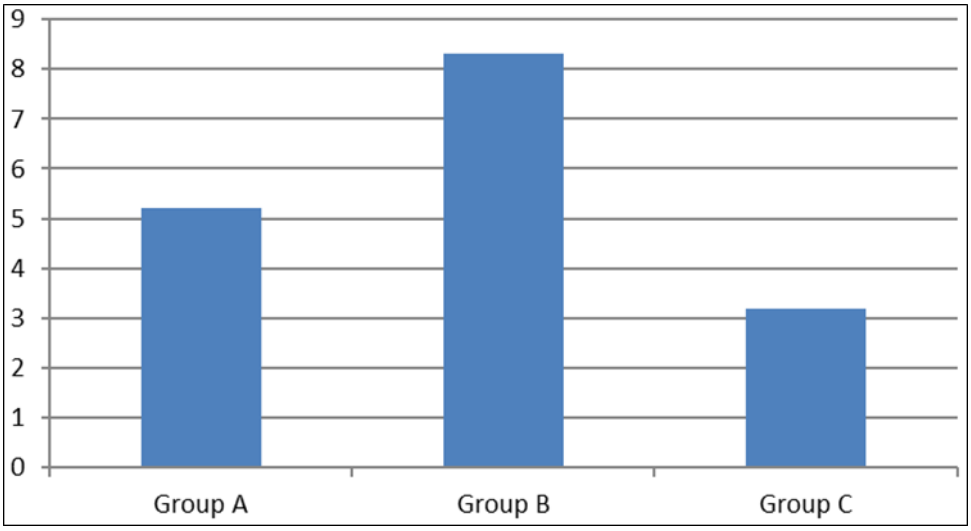

Fig 1

Table 4: Duration of postoperative analgesia between groups

	Group A	Group B	Group C	Group A versus Group C (P)	Group B versus Group C (p)	Group A versus Group B (p)
Duration of postoperative analgesia(h)*	5.2+4.3	8.3+5.18	3.2+2.1	0.12	0.00049	0.01

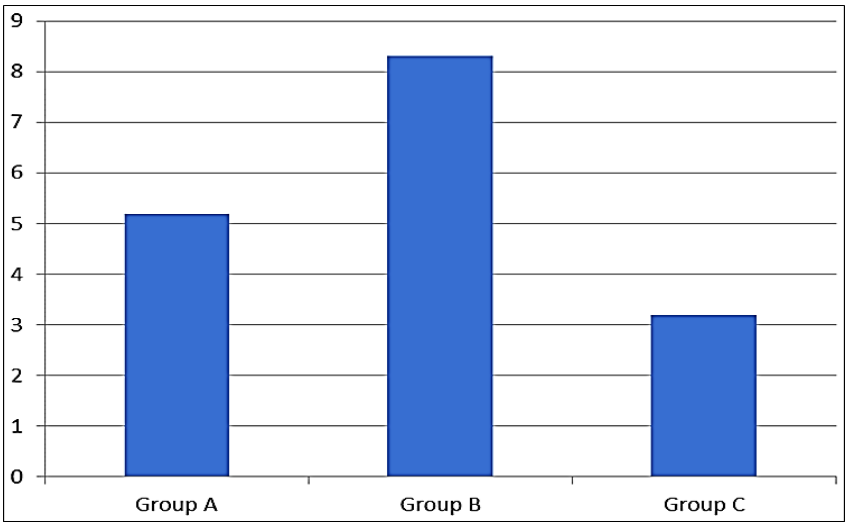

Fig 2

Duration of postoperative analgesia was significantly longer in Group A and Group B when compared to Group C [Figure 3]. There was a significant difference in postoperative analgesia between Group A and Group B also [Table 4].

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Table 5: Maximum Pain Score

Maximum pain score attained over 24 (h)	Group A, n*(%)	Group B, n*(%)	Group C, n*(%)	Group A versus Group C (P)	Group B versus Group C (P)	Group A versus Group B (P)
1	0	0	0	0.002	0.0000+	0.0001
2	4	1	0			
3	4	5	0			
4	12	20	8			
5	10	4	10			
6	0	0	12			

*Number of patients + Highly Significant

Maximum pain scores were significantly lower in Group A and B compared to the control group. Group B had lower pain scores compared to both Group A and C [Table 5]

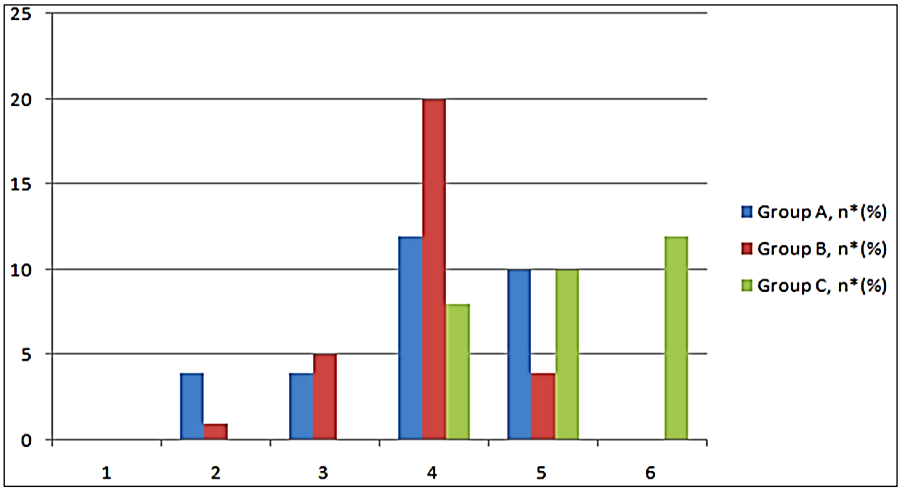

Fig 3

Discussion

Postoperative analgesia after cesarean section poses unique clinical challenges to anesthesiologist as it should allow early ambulation of the mother to prevent thromboembolic episodes and ensure bonding with the baby. It should have no undesirable effects on the mother or newborn. SAB with LA alone provides limited postoperative analgesia. Opioid adjuvants can subjugate this limitation. Buprenorphine is a highly potent and lipophilic agonist-antagonist opioid with long duration of action which makes it an excellent choice for postoperative analgesia [5, 10]. High lipid solubility and high-molecular weight limit rostral spread of buprenorphine reducing the incidence of adverse effects compared to morphine. Different doses of buprenorphine ranging from 30 µg to 150 µg have been used as adjuvant to LA in SAB [11-13].

Postoperative analgesia

The mean duration of postoperative analgesia was 5.2 h for 30 µg group and 8.3 h for 60 µg group. There was significantly prolonged analgesia in both study groups when compared to control group. The mean duration of analgesia was highly significant in 60 µg group compared to both the other groups. Rescue analgesic requirement was less in 30 µg group and 60 µg group compared to control group, which was statistically significant. In the control group, analgesic requirement was more than twice that in 60 µg group.

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Conclusion

In our study we have seen that: Low-dose hyperbaric Ropivacaine is safe & easy-to-use in cesarean section since it provides sufficient analgesia and motor block and hemodynamic stability. Increasing the dose of buprenorphine from 30 µg to 60 µg produced significantly prolonged duration of analgesia without increase in the incidence of adverse effects. Hence, addition of 60 ug buprenorphine to intrathecal Ropivacaine is a safe, and effective method of postoperative analgesia after cesarean section.

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Conflicts of interest: There are no conflicts of interest.

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