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A Comparative Study of Butorphanol Versus Pethidine with Bupivacaine Heavy During Spinal Anaesthesia

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Abstract

Background: Management of postoperative pain is essential for the smooth recovery of the patients. Intrathecal opioids are commonly used adjuvants to bupivacaine heavy for improving the quality of spinal anaesthesia. There are less number of studies comparing intrathecal butorphanol and pethidine. *Aims:* To compare the effects of intrathecal butorphanol versus pethidine on spinal anaesthesia produced by bupivacaine heavy. *Settings and design:* A prospective randomized double blind study. *Materials and methods:* 100 patients of ASA 1 & 2 undergoing spinal anaesthesia were randomly allotted to group A or B. Group A received intrathecal 0.5 mg butorphanol + 2.5 ml 0.5% bupivacaine heavy. Group B received intrathecal 25 mg pethidine + 2.5 ml 0.5% bupivacaine heavy. All patients were monitored for sensory and motor blockade, and occurrence of any side effects. *Statistical analysis used:* SPSS statistical software version 21.0. The mean and standard deviation computed for quantitative data. Proportions calculated for qualitative data. Appropriate test of significance used and a P value < 0.05 considered significant. *Results:* Mean time of duration of sensory blockade was 161.40 ± 12.291 minutes in group A and 147.10 ± 8.087 minutes in group B, which is statistically significant ($p<0.001$). Mean time of duration of analgesia was 304.70 ± 22.484 minutes in group A and 215.26 ± 16.359 minutes in group B, which is statistically significant ($p<0.001$). Neither of the groups had prolonged motor blockade or adverse effects. *Conclusion:* Intrathecal butorphanol and pethidine work synergistically with bupivacaine heavy to prolong the duration of sensory blockade and analgesia without prolonging the motor blockade and without causing any significant side effects. The effect is more pronounced with butorphanol compared to pethidine.

Keywords: Butorphanol; Pethidine; Spinal anaesthesia; Bupivacaine.

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Introduction

Spinal anaesthesia with 0.5% Bupivacaine heavy is widely used method for below umbilical surgeries. However, bupivacaine alone induced anaesthesia may be inadequate for the prolonged surgeries. Therefore intrathecal adjuvants are used to enhance the quality of subarachnoid block [1]. Commonly used adjuvants are opioids, dexmedetomidine, clonidine, neostigmine, magnesium sulphate, ketamine and midazolam. But no drug is without associated adverse effects.

Opioids such as morphine, butorphanol, pethidine, fentanyl and sufentanil are commonly being used as adjuvants to intrathecal bupivacaine. They have synergic effect with local anaesthetics [2]. They enhance the intraoperative and postoperative analgesia of spinal blockade [3]. They also reduce

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the dose of bupivacaine used for subarachnoid block thereby decreasing the incidence of spinal anaesthesia induced hypotension [4,5]. They help in prevention of shivering in subarachnoid block [6].

There are less number of studies comparing intrathecal butorphanol and pethidine. Butorphanol has good analgesic and some sedative properties without respiratory depression [7]. Pethidine has good analgesic and some local anaesthetic properties, but may produce respiratory depression [8,9]. Intrathecal opioids may have other side effects like pruritus, nausea, vomiting, and urinary retention. In this study effects of intrathecal butorphanol and pethidine are compared as adjuvants to bupivacaine heavy during spinal anaesthesia.

Materials and methods

We conducted a prospective randomized double blind study at our institute on "A comparative study of butorphanol versus pethidine with bupivacaine heavy during spinal anaesthesia". 100 patients were selected based on following calculation, $n = 4pq/l^2$ of q, where p = difference of incidence, q =1-p, l = probable error (taken as 10% of q), n =sample size. After obtaining institutional ethical committee clearance and written informed consent from the patients, 100 patients of ASA I and ASA II grade, aged 18 to 50 years of either sex (M & F), scheduled for elective lower abdominal and lower limb surgeries were included in the study. Patients with all contraindications to subarachnoid block, or addicted to opioids were excluded from the study. Patients were divided into two groups, each group includes 50 patients by computer generated randomized number. Group-A patients received Inj. Bupivacaine heavy (0.5%) 2.5 ml + Inj. Butorphanol 0.5 ml (0.5 mg)= Total 3.0 ml and Group-B patients received Inj. Bupivacaine heavy (0.5%) 2.5 ml + Inj. Pethidine 0.5 ml (25 mg) = Total 3.0 ml.

After shifting the patients to operation theatre all basal parameters heart rate, blood pressure, SpO_2 and respiratory rate were recorded. IV cannula (18G) secured and preloaded with intravenous Ringer lactate solution 10-15 ml/ kg before the subarachnoid block. Under strict aseptic precaution subarachnoid block performed in left lateral position between the L3-L4 inter vertebral space with 25G Quincke Babcock spinal needle. Pulse rate, blood pressure, respiratory rate, oxygen saturation (SpO_2), and occurrence of side effects were recorded in every 2 minutes interval for first 10 minutes and then every 10 minutes for 120 minutes for rest of the operation. Hypotension (BP <20% of baseline) treated with increasing dose of iv fluids and 5-10 mg of iv bolus dose of inj. mephentermine sulphate. Bradycardia (Heart rate < 60/min) were treated with inj. atropine 0.6 mg i.v. Nausea and vomiting treated with inj. ondansetron 4 mg i.v. Following parameters will be noted:

1. Onset of sensory block: Time elapsed from the end of injection to absence of pain sensation to pinprick at the T10 dermatome.
2. Duration of sensory block: Time elapsed from the end of injection to return of pain sensation to pinprick at the T10 dermatome.
3. Maximum height (level) of sensory block with respect to time
4. Duration of two level regressions: Time elapsed from the end of injection to regression of sensory block by two dermatomes.
5. Onset of motor block: It is time elapsed from end of injection to attain a motor block of intensity of Bromage 3 on modified Bromage scale [10].

   O = No paralysis

   1 = Inability to raise extended leg

   2 = Inability to flex the knee

   3 = Inability to flex the ankle (complete motor block)
6. Duration of motor block: Time elapsed from end of injection to recede the modified Bromage scale to score of 2.
7. Duration of analgesia: The period from subarachnoid injection to the time of administration of first rescue analgesia for pain postoperatively assessed by visual analogue score of ≥ 4.
   - ✓ Visual analogue scale (VAS) is of 10 cm in length with markings from 0 to 10. VAS Score of 0 means no pain and 10 means maximum pain.
8. Occurrence of any side effects.
9. Modified Wilson Sedation scale [11].

   1 Alert

   2 Drowsy but arousable to commands

   3 Arousable to mild physical stimulation (earlobe tug)

   4 Unrousable to mild physical stimulation

Results and analysis

The data collected was further processed and analyzed using SPSS statistical software version 21.0. The mean and standard deviation computed for quantitative data. Proportions calculated for qualitative data. Appropriate test of significance used and a P value < 0.05 considered significant. Table 1 describes the study groups.

Demographics of the patients in both the groups were comparable in terms of age and sex (Table 2).

Mean time of onset of sensory blockade is 3.89 ± 0.428 minutes in group A and 3.90 ± 0.463 minutes in group B, difference of which between two groups is statistically not significant (p=0.37) (Table 3). Mean time of duration of sensory blockade is 161.40 ± 12.291 minutes in group A and 147.10±8.087 minutes in group B, difference of which between two groups is statistically significant (p<0.001) (Table 3).

Mean time of onset of motor blockade is 5.30 ± 0.678 minutes in group A and 5.08 ± 0.695 minutes in group B, difference of which between two groups is statistically not significant (p=0.112) (Table 4). Mean time of duration of motor blockade is 120.30 ± 6.95 minutes in group A and 121.62 ± 4.907 minutes in group B, difference of which between two groups is statistically not significant (p=0.276) (Table 4).

Table 1: Study Groups

Groups (no. of patients)	Study drugs and their doses
Group A (n=50)	Inj. Bupivacaine heavy (0.5%) 2.5 ml + Inj. Butorphanol 0.5 ml = Total 3.0 ml
Group B (n=50)	Inj. Bupivacaine heavy (0.5%) 2.5 ml + Inj. Pethidine 0.5 ml = Total 3.0 ml

Table 2: Showing demographic profile of patients in two groups

Parameters	Group A	Group B
Age (18-50 Yrs)	39.90 ± 8.58	38.58 ± 8.79
Sex (M/F)	29/21	36/14

Table 3: Showing comparison of sensory blockade between two groups

Parameters	Group A		Group B		p value
	Mean	±SD	Mean	±SD	
Onset of sensory blockade (min.)	3.98	0.428	3.90	0.463	0.37
Duration of sensory blockade (min.)	161.40	12.291	147.10	8.087	<0.001

Table 4: Showing comparison of motor blockade between two groups

Parameters	Group A		Group B		p value
	Mean	±SD	Mean	±SD	
Onset time of motor blockade (min.)	5.30	0.678	5.08	0.695	0.112
Duration of motor blockade (min.)	120.30	6.950	121.62	4.907	0.276

Table 5: Showing duration of analgesia between two groups

Parameters	Group A		Group B		p value
	Mean	±SD	Mean	±SD	
Duration of Analgesia (min.)	304.70	22.484	215.26	16.359	<0.001

Table 6: Statistical analysis of visual analogue scale (VAS) score (mean ± sd) between two groups

VAS Score	Group A		Group B	
	Mean	±SD	Mean	±SD
10 min	0.000	0.00	0.000	0.00
15 min	0.000	0.00	0.000	0.00
25 min	0.000	0.00	0.000	0.00
30 min	0.000	0.00	0.000	0.00
45 min	0.000	0.00	0.000	0.00
60 min	0.000	0.00	0.000	0.00
120 min	0.00	0.00	0.00	0.00
180 min	2.12	0.66	3.40	0.50
240 min	2.76	0.59	4.48	0.65
330 min	3.92	0.86	5.56	0.50

Table 7: Showing distribution of sedation score between two groups

Sedation Score	Group A		Group B	
	n	%	n	%
1	0	0	0	0
2	21	42	16	32
3	0	0	0	0
4	0	0	0	0

Table 8: Showing side effects and complications in two groups

Side effects	Group A [n=50]	Group B [n=50]	Total	p value
Hypotension	4 8.0%	4 8.0%	8 8.0%	0.99
Bradycardia	3 6.0%	3 6.0%	6 6.0%	0.99
Respiratory depression	0	0	0	NA
Pruritus	0	0	0	NA
Nausea & Vomiting	0	0	0	NA
Shivering	0	0	0	NA

Mean time of duration of analgesia is 304.70 ± 22.484 minutes in group A and 215.26 ± 16.359 minutes in group B, difference of which between two groups is statistically significant ($p<0.001$) (Table 5). Mean VAS score remained zero up to 2 hrs in both the groups. Thereafter it increased throughout the study (Table 6).

Sedation score was 2 (drowsy but arousable) in 42% and 32% patients of group A and group B respectively. Remaining patients had no sedation in either of the groups (Table 7).

Eight percent patients in both the groups had hypotension and six percent patients in both groups had bradycardia. There was no incidence of nausea, vomiting, pruritus and shivering in both the groups (Table 8)

Discussion

Butorphanol is a lipid soluble opioid with weak mu (μ) receptor agonist and antagonist activity and strong kappa (K) receptor agonist. It has good analgesic and some sedative properties without respiratory depression [7]. Pethidine is an intermittent lipid soluble opioids. It has good analgesic and some local anaesthetic properties but may produce respiratory depression [8,9].

We compared butorphanol and pethidine as adjuvant to intrathecal bupivacaine heavy. From our study we found that butorphanol prolongs the duration of sensory blockade and duration of analgesia more than pethidine. But onset time of sensory block was comparable in both study groups. Onset time and duration of motor block were comparable. Also maximum height of blockade, time at maximum height and time of two level regression were comparable.

Following are the studies which support our finding of butorphanol prolonging the duration of sensory blockade and analgesia. Singh V et al compared butorphanol and fentanyl as adjuvants with intrathecal bupivacaine for patients undergoing lower limb surgeries and found that quality of sensory blockade and duration of analgesia improved but without affecting the motor blockade [1]. Mathias N et al. compared intrathecal fentanyl and butorphanol as an adjuvant to bupivacaine heavy and found that butorphanol has faster onset of analgesia and comparable duration of analgesia [7]. Kaur M et al. compared bupivacaine alone and intrathecal sufentanil or butorphanol used in combination with bupivacaine in patients undergoing endoscopic urological procedures and showed that both the opioids improve the analgesia and butorphanol causes less motor blockade [12]. Chari et al. studied the effects of intrathecal butorphanol as an adjuvant to hyperbaric bupivacaine in patients undergoing lower segment caesarean section and observed that butorphanol prolongs the duration of postoperative analgesia [13]. Binaykumar et al. compared intrathecal fentanyl and butorphanol with bupivacaine heavy for lower limb orthopedic surgeries and observed that both the groups had comparable onset time of sensory and motor blockade but butorphanol prolonged duration of

analgesia more than fentanyl [14].

Following are the studies which support our finding of pethidine prolonging the duration of sensory blockade and analgesia. Yu et al. studied the effects of intrathecal pethidine as an adjuvant to bupivacaine for caesarean section and found that pethidine prolongs the postoperative analgesia but associated with intraoperative nausea and vomiting [9]. Farzi et al. compared pethidine and fentanyl used as adjuvant to intrathecal lignocaine for caesarean section cases and found that pethidine prolongs the duration of analgesia than fentanyl [15].

Haemodynamic changes and respiratory rate changes were comparable between two groups. Hypotension was observed in 8% patients in both the groups and bradycardia was observed in 6% patients in both groups. Singh et al. observed that haemodynamic changes are comparable between fentanyl and butorphanol groups [1]. Asehnoune K et al. showed that small dose bupivacaine with sufentanil decreases spinal anaesthesia induced changes in cardiac output [4]. Atalay C et al. observed that intrathecal low dose bupivacaine with pethidine decreases spinal anaesthesia induced hypotension during caesarean section [5].

Complications were comparable between two groups. Sedation score was 2 (drowsy but arousable) in 42% and 32% patients of group A and group B respectively but none of them had respiratory depression. Remaining patients had no sedation in either of the groups. Mathis et al. observed that 13.3% patients in fentanyl group were drowsy but arousable, whereas only 3.3% patients had sedation in butorphanol group but none of them had respiratory depression [7]. Binay kumar et al. observed that 6 patients in butorphanol group had sedation without respiratory depression, but none had sedation in fentanyl group [14]. There was no incidence of nausea, vomiting, pruritus and shivering in both the groups.

Conclusion

Intrathecal butorphanol and pethidine work synergistically with bupivacaine heavy to prolong the duration of sensory blockade and duration of analgesia without prolonging the motor blockade and without causing any significant side effects. The effect is more pronounced with butorphanol compared to pethidine.

Key message

Opioids can be safely used to prolong the spinal analgesia without prolonging the motor blockade. This study has shown that butorphanol provides longer duration of spinal analgesia than pethidine, and neither of them have any significant side effects.

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Conflict of interest: Nil

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