Original Article

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A Comparative Study of Hyperbaric Bupivacaine 0.5% Versus Hyperbaric Bupivacaine 0.5% with Buprenorphine in Spinal Anesthesia for Lower Abdominal and Lower Extremity Surgeries

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Abstract

Background and Objectives: The study was conducted to compare the differences in onset, duration of analgesia of intrathecal hyperbaric bupivacaine 0.5% (Group-I) versus intrathecal hyperbaric bupivacaine 0.5% with buprenorphine 3 mg/kg (Group-II) in spinal anesthesia for lower abdominal and lower extremity surgeries. The combination of bupivacaine and buprenorphine helps anesthesiologist to prolong duration of analgesia without significant side effects. *Materials and Methods*: The study was prospective, randomized and double blinded. It involved 100 patients (50 per group) of ASA-I and II, aged 18-60 years undergoing lower abdominal and lower extremity surgeries under spinal anesthesia. The time of onset of sensory and motor block, duration of sensory and motor block, hemodynamic stability, visual analogue scale and postoperative analgesia were assessed. *Results*: The onset of sensory and motor blockade was significantly faster in group-II compared to group-I . The two-segment regression of sensory level and time to complete sensory recovery were significantly longer in group-II. The duration of analgesia was significantly prolonged in group- II compared to group-I, Patients treated with intrathecal buprenorphine had a better pain relief as judged by visual analogue scale postoperatively. Adverse effects were minimal and easily treatable. *Conclusion*: Addition of intrathecal buprenorphine 3 mg/kg to hyperbaric bupivacaine 0.5% in spinal anesthesia provides better quality of anesthesia with hemodynamic stability and prolonged duration of analgesia postoperatively without significant side effects.

Keywords: Intrathecal Buprenorphine; Intrathecal Bupivacaine; Post Operative Analgesia; Visual Analogue Scale.

Introduction

Regional anaesthesia is the preferred technique for most of the surgeries involving the lower abdomen and lower extremities as it allows the patient to remain awake, minimize or completely avoid problems associated with airway management [1].

The technique is easy to perform and provides fast onset and effective sensory and motor block. Many additives have been added to local anesthetics in an attempt to improve the duration and quality of spinal analgesia but have been limited by their side effects [2].

Spinal anesthesia with hyperbaric bupivacaine 0.5% is a popular method but there is a need for increasing the duration of analgesia without increasing the duration of motor blockade, thus reducing postoperative analgesic requirements, facilitating early ambulation, thereby resulting in early discharge of the patient

It has been shown that addition of neuraxial opioids like morphine to local anaesthetic provides prolonged postoperative analgesia without any risk of hemodynamic instability [3].

This study was designed to analyze analgesic effects of buprenorphine in a dose of 3 µg/kg administered intrathecally with 0.5% bupivacaine in patients undergoing lower abdominal and lower extremity surgeries.

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Materials and Methods

After obtaining approval from ethical committee and written informed consent from the patients, the prospective randomized clinical study was carried out on 100 patients belonging to ASA grade I and II posted for lower abdominal and lower extremity surgeries.

Inclusion Criteria

- Aged between 20 to 60yrs
- Height between 150 to 170cms
- Surgery duration not exceeding 180 min

Exclusion Criteria

- Patients belonging to ASA III and IV
- Patients posted for emergency procedures
- Patients with coagulopathies and increased intra cranial tension
- Patients allergic to drugs used in study

A detailed pre anaesthetic evaluation was done. Patients were kept nil per orally for 8 hours prior to surgery.

Patients were allocated into two groups viz.,

Group-I 50 patients receiving 3 ml of hyperbaric bupivacaine 0.5%.

Group-II 50 patients receiving 3 ml of hyperbaric bupivacaine 0.5% with buprenorphine 3 μg/Kg.

All the patients were instructed about the visual analogue scale (VAS) [4]. A Scale of 10cms length with '0' on the scale corresponding to 'no pain' and 10 as 'maximum intolerable pain' (worst pain ever). The intensity of pain gradually increases from 0 to 10. The patients were informed to point out the intensity of pain on the scale.

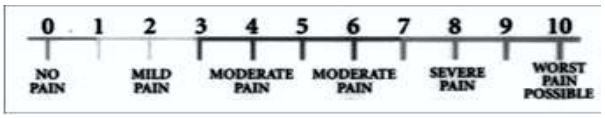

Table 1: visual analogue scale

Whenever VAS >6, patient was given rescue analgesic in the form inj.diclofenac 75 mg im.

A intravenous line was secured with 18G intravenous on arrival to the pre anaesthesia room. Patients were preloaded with 10ml/kg of crystalloid solution. Drugs were prepared and procedure was performed by two independent investigators (anesthesiologist) who did not take part in the study.

Under strict aseptic precaution subarachnoid block was performed at L3-L4 intervertebral space using midline approach with 23 Gauge Quincke Babcock's spinal needle.

Monitoring consist of non invasive blood pressure, pulseoximetry, electrocardiography and respiratory rate. Patient's pulse rate, blood pressure, respiratory rate and SPO_2 were recorded at 0 (basal), 15, 30, 45, 90 and 180 minutes. Postoperatively pulse rate, blood pressure, respiratory rate and SPO_2 were monitored at regular intervals. Quality of analgesia was assessed at 360, 540 minutes using VAS.

Assessment of Sensory Blockade

This was tested by pin-prick method. The time of onset was taken from time of injection of the drug into the subarachnoid space to loss of pin-prick sensation. The highest level of sensory block was noted. Duration of complete sensory recovery was recorded from time of onset to time of return of pin-prick sensation at multiple dermatomal levels [5].

During postoperative period, the patients were asked to point out the intensity of pain on the visual analogue scale and when value of VAS is >6 rescue medication was given and this was recorded as the duration of analgesia.

Assessment of Motor Blockade

This was assessed by Bromage Scale [6]. The time interval between injection of drug into subarachnoid space to the patients inability to lift the straight extended leg was taken as onset time. The duration of complete motor recovery was recorded from onset time to time when the patient was able to lift the extended leg.

Bromage Scale

- Full flexion of knee and feet
- Just able to flex knee, full flexion of feet
- Unable to flex knee, but some flexion of feet possible
- Unable to move legs or feet.

Patients will be assessed for urinary retention, nausea, vomiting, pruritis, headache and respiratory depression.

Hypotension was defined as a decrease in systolic

blood pressure more than 20% of the baseline value and was treated with injection mephentramine 6 mg intravenous increments and bradycardia defined as pulse rate <50/min was treated by injection atropine 0.6 mg intravenous stat.

The collected data was summarized by calculating the mean and standard deviation and presented in the form tables and diagrams for statistical analysis Large sample test, i.e., z-test was used. For the analysis of significance chi-square test was used to obtain other possible association.

Results

100 patients of ASA – physical status I and II were selected for the study. They were randomly allotted to 2 groups of 50 patients each. The two groups were compared with regards to age, height and duration of surgery. The demographical profile i.e. age , sex, height, ASA grade, duration of surgery between two groups were comparable and statistically not significant ($p>0.05$).

From the above Table 3 ,The time of onset of sensory and motor blockade was earlier in group-II compared to group-I The difference between the groups was statistically highly significant ($p<0.01$).

The time for two dermatomal segment regression of sensory level is prolonged in group-II compared to group-I. The difference between either groups was statistically highly significant ($p<0.01$).

The time for complete motor recovery in group-II is prolonged compared to group-I. The difference between the groups was statistically significant ($p<0.05$).

The time for request of first analgesia is prolonged in group-II compared to group-I .The difference between the groups was statistically highly significant ($p<0.01$).

Table 2: Age and sex distribution in both the groups

Parameters	Group-I (Bupivacaine only)	Group-II (Bupivacaine with buprenorphine)
Age (yrs)	43.5±4.77	44.1±2.68
Height (cms)	161.36±5.08	160.95±5.14
Weight (kgs)	62.36±6.11	61.40±6.38
Duration of surgery (mins)	135.12±5.12	136.28±6.15

Table 3: Comparison of parameters between two groups

Parameters	Group I	Group II	Z value	P value
Onset time to sensory Blockade (secs)	365.50±49.39	122.40±21.00	32.40	<0.01(HS)
Onset time to complete motor blockade(secs)	454.70±64.19	185.90±28.14	28.00	<0.01(HS)
2 segment regression time(mins)	84.00±4.74	122.90±5.81	36.95	<0.01(HS)
Duration of motor blockade(mins)	176.60±5.19	185.40±9.99	5.53	<0.05(S)
Duration of effective analgesia(mins)	203.40±7.10	514.60±5.81	36.95	<0.01(HS)

Table 4: Intraoperative and postoperative VAS

Time	Group-I	Group-II	z-value	p-value
90 min	0	0		
180 min	5.96±0.71	1.00	49.60	<0.01 HS
360 min	--	2.04±0.20	-	-
540 min	--	5.72±0.81	-	-

VAS at 180 minutes was 1 for group-II and it was 5.96±0.71 for the group-I with a statistically highly significant value and this was taken as the end point and rescue medication was given, thus the VAS were not compared at 360, and 540 mins. VAS score of 5.72±0.81 was noted in group-II patients at 540 minutes.

Nausea and vomiting was noted in 5 patients of group-II and one patient in group-I. Hypotension was noted in 4 patients of group-II and 6 patients of group-I. Shivering was seen in one patient and bradycardia in one patient of group-II.

Discussion

Spinal anesthesia has the advantage that it is easy to perform, Protective airway reflexes are intact, good

abdominal muscle relaxation with contracted gut making operative conditions easier and favorable.

The use of neuraxial opioids along with local anesthetics prolongs the duration of analgesia provided by local anesthetics by directly binding to the spinal opioid receptor, bringing about analgesia.

Buprenorphine is compatible with CSF and produces no adverse inflammatory reaction when administered intrathecally. Its high lipid solubility and high affinity for opioid receptor, which is twice that of morphine, prolongs the duration of action as it is a non-ionized drug without causing respiratory depression.

The patients studied across the group did not vary much with respect to age sex, weight, height, duration of surgery, parameters were kept identical to minimize the bias.

In the present study, the onset of sensory blockade in group-II was 122.40±21.00 seconds whereas in Group-I it was 365.50±49.39 seconds and the onset of motor blockade in Group-II was 185.90±23.14 seconds whereas in Group-I it was 454.70±64.19. Thus, the difference in the onset of sensory and motor blockade between the two groups was highly significant. Our results were in accordance to the study conducted by Sunil Dixit et al [7], Thomas W.Abraham V [8] who in their study showed that onset of sensory block was significantly earlier in buprenorphine group (111.10 ±2.10 secs) as compared to control group (321.21±1.79 secs).

The results of this study shows that there is a statistical difference in the onset of sensory and motor blockade and that addition of buprenorphine hastens the onset of action of bupivacaine.

In the present study, the duration of analgesia was 514.60±5.81 minutes in group-II compared to 203.40±7.10 minutes in group-I which was statistically highly significant.

Sarkar M, Dewoolkar L et al [9] showed in their study that the mean duration of analgesia was 420±10.32 minutes in buprenorphine group compared to 209.67±36.5 minutes in control group.

Sen M et al [10] in her study using buprenorphine 300 mg along with hyperbaric bupivacaine alone as control group showed that the pain increased from 12 hours in study group whereas in control group pain increased gradually from 4 hours.

In the present study the visual analogue pain scale at 90 minutes were 1 in group-I (control) and 1 in group-II (study). At 180 minutes it was 1 in group-II, whereas 5.96±0.71 for the group-I patients, which was statistically highly significant. In the group-II, the VAS score was lower at 180 minutes, 360 minutes and 540 minutes in the postoperative period, which indicates the duration of analgesia was better in group-II patients.

Lalla RK [11] et al in their study using VAS scale from 0-10 showed that the mean duration of action in the control group (A) and buprenorphine group (B) patients were 3 hours and 12 hours, who had VAS of >6 were in the rescue medications were given and that was the end point.

From the above studies, we can conclude that intrathecal buprenorphine potentiates the sensory blockade of bupivacaine thereby reduce the VAS score, bringing about better postoperative outcomes.

Incidence of side effects like pruritis,respiratory depression, Nausea and vomiting & Sedation were statistically not significant across groups.

Conclusion

Intrathecal buprenorphine 3 μg/Kg added to hyperbaric bupivacaine 0.5% in spinal anesthesia hastens the time of onset of sensory and motor blockade, increases the duration of sensory recovery without prolonging motor recovery and provides prolonged duration of postoperative analgesia without causing significant hemodynamic disturbances and side effects.

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