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Evaluation of intrathecal buprenorphine as an adjuvant to bupivacaine for lower abdominal surgeries

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Abstract

Aim and Objectives: To evaluate the effect of Inj. buprenorphine 60 mcg as an adjuvant to intrathecal bupivacaine 0.5% (heavy) 3 ml on quality of sensory and motor block and haemodynamic parameters.
Method: Total 40 patients were randomly allocated in two groups having 20 patients each. 'Group B' received 15 mg (3 ml) of 0.5% hyperbaric bupivacaine heavy with 60 µg of buprenorphine (0.2 ml) (Study group) and 'Group N' received 15 mg (3 ml) of 0.5% hyperbaric bupivacaine heavy with 0.2 ml Normal saline (control group).
Results: Buprenorphine group had a significant faster onset and prolongs the duration of sensory and motor blockade than control group. Decrease in MAP and PR was observed in both the groups after subarachnoid block but the vital parameters between the two groups were comparable during different time intervals. The quality of block was found to be better in study group but difference was not significant. 3 patients in group N and 1 patient in group B required sedation. Both groups had minimal side effects but postoperative nausea and vomiting was more in buprenorphine group.
Conclusion: The intrathecal buprenorphine (60µg) can be used as an adjuvant to 0.5% (heavy) bupivacaine in spinal anesthesia for lower abdominal surgeries.
Keywords: Buprenorphine; Bupivacaine; Intrathecal; Haemodynamic; Sensory; Motor block.

1. Introduction

August Bier, a surgeon, and his assistant Hiselbrandt, made history using intrathecal cocaine on each other, at the Royal Chirurgical Clinic in Kiel in 1898. They used 5 mg of intrathecal cocaine and complete loss from legs sensations lasted almost 45 minutes[1]. Spinal anaesthesia was first given using lidocaine by Gordh in 1949 [2] and bupivacaine by Emblem in 1966. Since then, subarachnoid block is most performed anaesthesia technique for lower abdominal and lower limb surgeries. Spinal anaesthesia is easy to perform, safe, efficient, provides rapid onset of action and good muscle relaxation, no airway manipulation and early recovery [3,4]. One of the disadvantages of spinal anaesthesia is its limited duration of action.

Additions of various adjuvants (opioids and non opioids) have attracted interest to improve the quality and duration of spinal blockade [5]. An adjuvant helps in minimizing the dose of local anaesthetic agent thereby reducing the side effects caused by higher doses of intrathecal LA and prolongs post-operative analgesia [6]. We conducted this study to evaluate the effect of Inj. buprenorphine 60 mcg as an adjuvant to intrathecal bupivacaine 0.5% (heavy) 3 ml on quality of sensory and motor block and haemodynamic parameters.

2. Material and Method

After obtaining Institutional Ethical Committee approval and written informed consent from patients, this prospective randomized controlled study was conducted in the Department of Anaesthesiology at Tertiary Care Centre. Total 40 patients of ASA Grade I or II, age between 18-60 years, weight between 40-70 Kg and who were posted for elective lower abdominal surgeries were included in the study. Exclusion criteria were refusal for the study, hypersensitivity to local anaesthetic agents, Opioids, deranged coagulation profile, pregnant and lactating women as well as significant respiratory, cardiovascular, renal, hepatic or CNS disorder.

A thorough preanaesthetic checkup was done and all relevant investigations i.e. complete blood count, Liver function test, Kidney function test, Electogram and X-ray chest were noted. The patients were randomly allocated in two groups having 20 patients each, based on study drug. 'Group B' received 15 mg (3 ml) of 0.5% hyperbaric bupivacaine heavy with 60 µg of buprenorphine (0.2 ml) and 'Group N' received 15 mg (3 ml) of 0.5% hyperbaric bupivacaine heavy with 0.2 ml Normal saline. All patients were advised Tab. Ranitidine 150mg and Tab. Alprazolam 0.25 mg night before surgery and kept nil per oral for 8 hours. In the operative theater, intravascular access was established using 18 G canula and patients were preloaded with 10 ml/ kg of Lactate Ringer solution. Baseline parameters like Blood pressure, Heart

rate, SpO_2 were noted. Under all aseptic precaution, subarachnoid block was given in left lateral position using 23 G spinal needle at I3-L4 interspace. All observations were done by an anaesthesiologist blinded to patient grouping.

Onset of sensory block was determined as time from injection of intrathecal drug to loss of sensation of pin prick at L1. Duration of sensory block was defined as loss of pin prick sensation at L1 up to reappearance of pinprick sensation at L1. Onset of motor block was recorded when the patient was unable to lift extended legs but able to move knees and feet (Modified bromage scale-grade I). The duration of motor block was defined as the time period from onset of motor block to time of reappearance of ankle movements. Quality of spinal block was determined as excellent when no supplement was needed, good when supplemented with sedative and analgesics and poor when general anaesthesia was required. Blood pressure (SBP, DBP), HR, SpO_2 and respiratory rate were noted 1 min, 3 min, 5 min, 10 min after block and then every five minutes throughout surgery. Hypotention was labeled when there was 20 % or more reduction in blood pressure from baseline and treated with Inj. Mephentermine 6mg i.v. Bradycardia was labeled as Heart rate < 60 beats/min and treated with Inj. Atropine 0.6 mg i.v. Intraoperative and postoperative side effects like pruritis, respiratory depression, nausea, vomiting, pain etc. were recorded and managed accordingly. Patients were observed at recovery room for 2 hours after completion of surgery.

3. Observations and Results

Both the groups were comparable in terms of mean age, weight, height, gender distribution and duration of surgery and found no significant difference between two groups as shown in table 1.

Table 1: Comparison of demographic profile between two groups

Demographic data	Group B	Group N	P value
Age (years)	42.141±1.71	37.531±1.1	0.124
Weight (Kg)	70.0±12.5	72.1±9.5	0.42
Height (cm)	162.63±8.23	164. ±9.14	0.59
Male/female	8 (40%)/12 (60%)	7 (35%)/ 13 (65%)	
Duration of Surgery (min)	117.5±8.2	118.38±.4	0.69

Table 2 shows that the onset of both sensory and motor block was faster as well as the duration of both the sensory and motor block was prolonged in study group than control group and the difference between two groups was statistically significant.

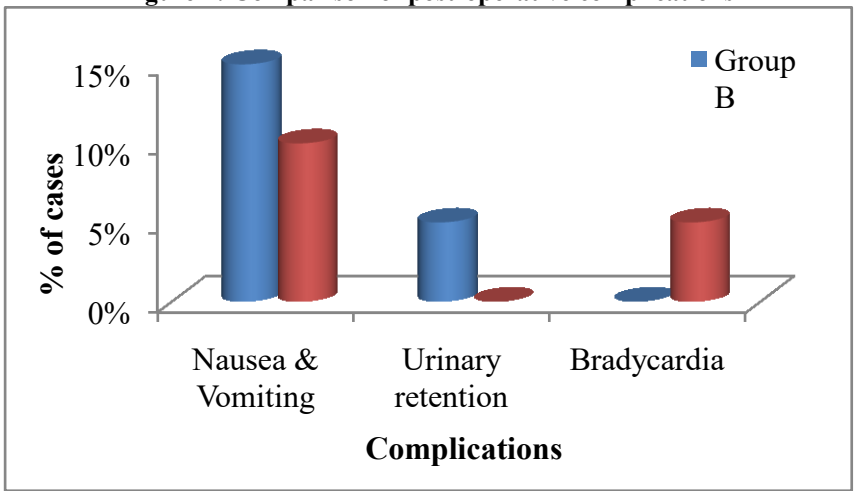
Table 2: Comparison of characteristics of block in both groups

Parameters	Group B	Group N	P value
Onset of sensory block (secs)	93.34±32.49	206.10± 41.20	<0.001
Duration of sensory block (mins)	298.11±15.43	152.67±24.72	<0.001
Onset of Motor block (secs)	160.03± 61.34	257.83±34.76	<0.001
Duration of motor block (mins)	265.46±12.3	138.25±19.21	<0.001

No patient required general anaesthesia in both groups. 3 patients in group N and 1 patient in group B required sedation. The quality of block was found to be better in study group however there was no significant difference between two groups in terms of quality of block. Baseline haemodynamic parameters include MAP and PR was comparable in both groups. Decrease in MAP and PR was observed in both the groups after subarachnoid block but the vital parameters between the two groups were comparable during different time intervals.

Both groups had minimal side effects. No drowsiness, pruritus and respiratory depression were observed in both groups. Figure 1 show the post-operative complications.

Figure 1: Comparison of post-operative complications



4. Discussion

Subarachnoid block with bupivacaine has been most extensively used for lower abdominal surgeries because of its simplicity, speed, reliability and minimal exposure to depressant drugs. However, a single intrathecal injection of bupivacaine alone provides analgesia for only 2 – 2.5 hours. Most patients require further analgesia during post operative period. In recent years, the supplementation of local anaesthetics with adjuvants is widely in practice, to reduce the dose of local anaesthetic, minimize side effects and prolong the duration of anaesthesia. The study drugs, Buprenorphine, a highly lipophilic and centrally acting partial opioid agonist has rapid onset of action following intrathecal administration. It has been found recently that prolonged duration of action of buprenorphine is due to its local anaesthetic action [7]. Few studies have been conducted with a higher dosage of buprenorphine. Capogna *et al* [8], and Sapkal *et al* [9], have chosen 60µg of buprenorphine as an additive to intrathecal bupivacaine and showed to have a significant prolonged duration of analgesia along with nausea and vomiting that were not statistically significant. Similarly present study had chosen 60µg of buprenorphine as an additive to intrathecal bupivacaine. In terms of demographic data, there was no significant differences were observed between two groups in regards to age, sex, weight, height and duration of surgery.

The mean onset of sensory block (second) was 93.34±32.49 in Group B and 206.10± 41.20 in Group N. The mean onset of motor block (second) was 160.03± 61.34 in Group B and 257.83±34.76 in Group N. The onset of both sensory and motor block was faster in study group and the difference between two groups was statistically significant. The mean duration of sensory block was 298.11±15.43 (minutes) in group B (study group) and 152.67±24.72 in Group N (control group). The mean duration of motor block was 265.46±12.3 in group B and 138.25±19.21 in Group N. The duration of both sensory and motor block was prolonged in study group than control group. The difference was statistically significant. However, the faster and prolonged effect of buprenorphine could be a result of its high lipid solubility resulting in faster penetration into lipid membrane, causing fast and prolonged binding to receptors and thus hastening the block. The quality of block was found to be better in study group however there was no significant difference between two groups in terms of quality of block. These findings are correlated with the study done by Dixit and Sunil[10]. In terms of hemodynamic parameters, there was decrease in MAP and PR was observed in both the groups after subarachnoid block but the vital parameters between the two groups were comparable during different time intervals. Our results are linked with the study conducted by Dixit and Sunil[10].

In terms of side effects, both groups had minimal side effects. No drowsiness, pruritus and respiratory depression were observed in both groups. However, postoperative nausea and vomiting was more in buprenorphine group patients. Similar observations were made by other investigations[11]. Urinary retention seen in 1 patient of study group and bradycardia was seen in one patient of control group. The lesser side effects in study group in the post-operative period were due to its high lipid solubility [12]. Further studies are obligatory to rule out any long-term or short-term adverse effects of the drugs. Besides, the study involved only patients undergoing lower abdominal surgeries. Further, futures studies need to be conducted on other surgeries using the intrathecal buprenorphine to assess whether similar results can be achieved with lesser doses.

5. Conclusion

The present study concludes that, the intrathecal administration of 60µg of buprenorphine with bupivacaine 0.5% (heavy) has a significant faster onset and prolongs the duration of sensory and motor blockade than control group. The quality of block was found to be better in study group but difference was not significant. Both the groups had stable and comparable hemodynamics during the study. The degree of sedation was better in the control group when compared to buprenorphine group.

Thus, intrathecal buprenorphine can be used as an adjuvant to 0.5% (heavy) bupivacaine in spinal anesthesia for lower abdominal surgeries.

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