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Comparison of intrathecal hyperbaric bupivacaine 0.5% with intrathecal hyperbaric bupivacaine 0.5% with low dose buprenorphine for post-operative analgesia in lower abdominal surgeries

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Abstract
Lower abdominal surgeries are usually performed under subarachnoid block, also called spinal anesthesia. The drug which is routinely used for spinal anesthesia is 0.5% hyperbaric Bupivacaine. Addition of adjuvants to the hyperbaric Bupivacaine helps in prolonging the duration of anesthesia and provides better and prolonged post-operative analgesia.
Materials and Methods: This study was done on 100 ASA 1 & 2 patients between 18 and 70 years who underwent various lower abdominal surgeries at our hospital. Patients were divided into two groups, Group I were given 0.5% hyperbaric Bupivacaine and Group II were given 0.5% hyperbaric Bupivacaine along with 60 mcg Buprenorphine in the intrathecal space.
Results: The onset of sensory blockade was significantly earlier in patients in group I, while the duration of analgesia was significantly longer in group II, 426 ± 41.17 minutes as compared to 203.49 ± 41.35 minutes in group I. More than 80% patients in group II had mild post-operative pain only after 8 hours, whereas patients in group I started having moderate to severe pain after 4 hours. About 15% patients in group II experienced nausea, vomiting and drowsiness.
Conclusion: Buprenorphine is an effective adjuvant to provide prolonged post-operative analgesia with minimal hemodynamic changes and minor side effects.
Keywords: Buprenorphine, bupivacaine, sensory blockade, abdominal surgeries, duration of analgesia

Introduction

One of the most common methods of anesthesia for lower abdominal surgeries is spinal anesthesia. This is done by injecting local anesthetic into the subarachnoid space. Spinal anesthesia is not only easy to administer, but also cost effective [1, 2]. Subarachnoid block also has rapid onset of action, superior blockade, low risk of infection and less failure rates [3]. 0.5% hyperbaric bupivacaine is usually used for spinal anesthesia. Local anesthetics have a limited duration of action and spinal anesthesia also causes certain side effects such as hypotension and bradycardia. Therefore, there has been various studies regarding use of adjuvants along with local anesthetics, to reduce the side effects and increase the duration of anaesthesia [4, 5].

Post-operative pain is a huge cause of concern and still a challenge to the anesthesiologist. A lot of effort has been put in to understand and control it. As the post-operative pain is transient, it is more amenable to therapy. Opioids remain the first line of drugs for post-operative pain relief. Addition of opioids to the local anaesthetic agents has been shown to

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improve the quality and duration of pain relief in the post-operative period.
In 1979, Morphine was the first opioid to be used intrathecally for post-operative analgesia in patients with genito urinary malignancies [6,7]. Since then, many opioids have been tried to prolong the duration of anesthesia, reduce post-operative pain, improve patient satisfaction and promote faster recovery [8].
Buprenorphine is a long acting, lipophilic, mixed agonist-antagonist opioid. The analgesic property of this drug is seen both at the spinal and supraspinal level [9]. It is a Thebaine derivative and said to be 30 times more potent than Morphine [9, 10]. It can be administered via intrathecal, epidural, intravenous, intramuscular, and subcutaneous routes. It has a long duration of action and minimal addiction potential. This makes it an attractive option as an adjuvant for spinal anesthesia. It has been used extensively in the past few decades for prolonging analgesia and with success in increasing duration of anesthesia. However at higher doses, it is known to cause, nausea, vomiting, pruritis and drowsiness [11]. It is one of the most preferred adjuvant to intrathecal local anesthetics for prevention and management of post-operative pain [12, 13].
This study was done to assess the efficacy of Buprenorphine as an adjuvant to hyperbaric Bupivacaine for providing post-operative analgesia in lower abdominal surgeries.

Materials and Methods

This study was done by the Department of Anesthesiology, Mediciti Institute of Medical Sciences, during the period of March 2021 to February 2022. 100 patients who came to our hospital for various lower abdominal surgeries, belonging to ASA classes I and II and aged between 18 to 70 years, were included into the study. This study was presented to and cleared by our Institutional Ethical Committee. The nature of the study was explained to the patients in detail and informed consent was taken from all of them. Those who refused to give consent were not included in the study. The demographic details were collected from all the patients and they were subjected to a complete clinical examination. Routine investigations like Complete blood picture, Blood sugars, lipid profile, liver profile, renal profile, urine analysis, bleeding and clotting time, ECG and Chest X Ray were done for all the patients. Pregnant women, patients with metabolic, neurological disorders and those with bleeding diathesis were excluded from the study.
Patients were randomly divided into 2 groups, Group I patients received plain 0.5% hyperbaric Bupivacaine and Group II patients received 0.5% hyperbaric Bupivacaine along with 60 µg Buprenorphine as adjuvant for Spinal anesthesia.
All the patients were kept Nil per oral for 6 hours prior to the surgery. No analgesics or sedatives were given prior to surgery. Baseline Pulse rate, Blood pressure, respiratory rate and SpO_2 were noted. 500 ml ringer's lactate was started intravenously. Under complete asepsis, lumbar puncture was done with 25 gauge needle at the level of L3-L4 interspace and spinal anaesthesia was administered. Patients in group I received 17.5mg 0.5% hyperbaric Bupivacaine and patients belonging to Group II received 17.5 mg 0.5% hyperbaric Bupivacaine and 60 µg Buprenorphine.
The patients were immediately placed in Supine position. The level of sensory blockade and motor blockade was noted. The haemodynamic parameters were noted every 5 minutes for the first 30 minutes of surgery, and after that, for every 10 minutes till the end of the surgery. After the surgery, hemodynamic parameters were noted for every 2 hours for the first 12 hours and once for every 4 hours after 24 hours of surgery.
Side effects such as drowsiness, pruritus, nausea, vomiting, headache, respiratory depression and the time taken for these to occur after the administration of anesthesia were recorded. The time duration from the administration of the drug to disappearance of the pain to its reappearance again was noted. Time of onset of Post-operative pain and its intensity were noted. Visual Analogue Scale was used to measure the pain, with a score range from 0 to 10, 0 for no pain and 10 being the maximum unbearable pain. If the score was more than 6, the patients were given rescue analgesia (Inj. Tramadol 2mg/kg). Chi square test and Fisher's test

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were used for statistical analysis.

Results

Most patients were in the age group of 30-39 years. 26 patients (52%) in group I were males and 24 (48%) were females. In Group B, 23 (46%) were males and 27 (54%) were females. This difference in the male and female ratio was comparable between both the groups and was not statistically significant (Table: 1).

Table 1: Gender and age distribution of patients

Age	Group A		Group B	
	Male	Female	Male	Female
18-29	2	1	1	1
30-39	14	13	13	16
40-49	6	9	5	6
50-59	3	1	4	3
60-70	1	0	0	1
Total	26	24	23	27

The onset of sensory block was at 5.91 ± 0.88 minutes in Group I and 2.85 ± 0.69 in Group II, while the time to achieve the highest level of analgesic effect was 18.61 ± 5.27 minutes in Group I and 12.22 ± 4.78 in Group II. The motor blockade onset was in 11.96 ± 5.40 minutes in Group I and 7.94 ± 4.11 minutes in Group II. The time for two segment regression was 86.31 ± 12.58 minutes and for L1 regression was 158.73 ± 18.46 minutes in Group I and 128.92 ± 14.79 minutes and 202.74 ± 20.85 minutes respectively in Group II. The total duration of analgesia was 203.49 ± 41.35 minutes in Group I and 426.87 ± 41.17 minutes in Group II.(Table: 2).

Table 2: Onset and Duration of anesthesia

Onset/duration	Group I	Group II
	Mean	Mean
Onset of sensory Block (in minutes)	5.91 ± 0.88	2.85 ± 0.69*
Time to achieve highest level (in minutes)	18.61 ± 5.27	12.22 ± 4.78*
Onset of motor blockade (in minutes)	11.96 ± 5.40	7.94 ± 4.11*
Time for 2 segment regression (in minutes)	86.31 ± 12.58	128.92 ± 14.79*
Time for L1 regression (in minutes)	158.73 ± 18.46	202.74 ± 20.85*
Duration of analgesia (in minutes)	203.49 ± 41.35	.87 ± 41.17 *

*$p<0.05$

The post-operative pain was assessed using the VAS score (0-10), with Score 0 being no pain and 10 being severe unbearable pain. Immediately after the surgery, none of the patients developed any pain. After 2 hours, 2 patients (4%) in group I developed mild pain, while in Group II, no patient had any post-operative pain. After 4 hours of surgery, all the patients in Group I experienced pain, with only 1 patient (2%) having mild pain, 13 (26%) having moderate and 36 (72%) having severe pain. In Group II, only 3 (6%) patients had mild pain. 8 hours post operation, most patients in Group II (44-88%) experienced mild to moderate pain with none having severe pain, but in Group I, all the patients experienced severe pain. 16 hours post operation, 4 (8%) of the patients experienced severe pain, while all the patients experienced severe pain in Group II after 30 hours of surgery (Table: 3).

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Table 3: Post op analgesic effect assessed with VAS score

Post OP Duration (in hours)	0		Mild (VAS=1,2,3)		Moderate (VAS=4,5,6)		Severe (VAS=7,8,9)	
	Group I	Group II	Group I	Group II	Group I	Group II	Group I	Group II
0	50 (100%)	50 (100%)	0	0	0	0	0	0
2	48 (96%)	50 (100%)	2 (4%)	0	0	0	0	0
4	0	47 (94%)	1 (2%)	3 (6%)	13 (26%)	0	36 (72%)	0
8	0	6 (12%)	0	41 (82%)	0	3 (6%)	50 (100%)	0
12	0	0	0	36 (72%)	0	14 (28%)	0	0
16	0	0	0	17 (34%)	0	29 (38%)	0	4 (8%)
20	0	0	0	3 (6%)	0	32 (64%)	0	15 (30%)
24	0	0	0	0	0	5 (10%)	0	45 (90%)
30	0	0	0	0	0	0	0	50 (100%)

Side effects of the drugs were noted. In Group I, 3 (6%) patients experienced nausea and 1(2%) had vomiting and 4 patients had drowsiness. In Group II, 8 (16%) patients experienced nausea, 7 (14%) had vomiting, 8 (16%) had drowsiness, while 1 (2%) patient had pruritus and 2 (4%) had urinary retention. None of patients in Group I had either pruritus or urinary retention. None of the patients in either groups had headache or respiratory depression (Fig: 1). none of the patients in both the groups developed any serious complications.

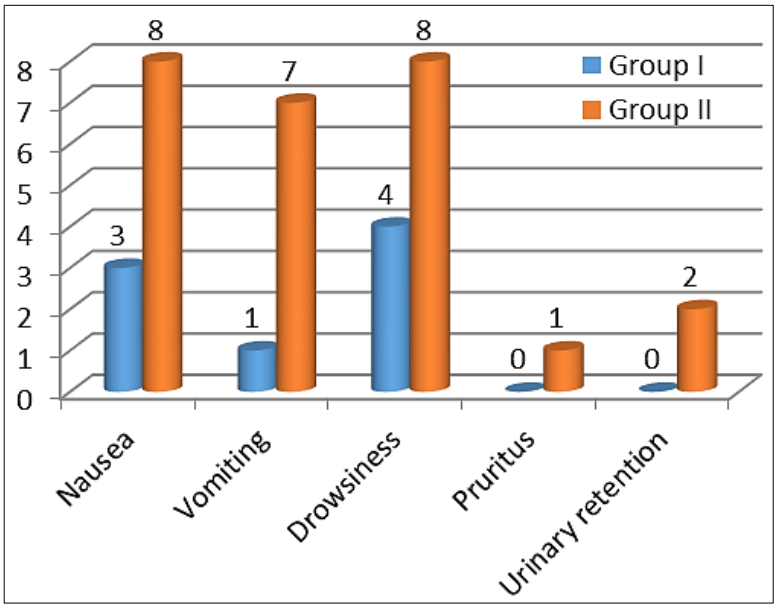

Fig 1: Side effects

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Discussion

Opioids and intrathecal anesthetics have a synergistic effect [14]. Anesthesia through intrathecal route is of great advantage, as it is easy to administer, and the duration of anesthesia with one single injection is for a longer time. With Buprenorphine, this long lasting analgesic effect is more so observed as it has a high lipid solubility and has a high affinity for opioid receptors [14].

In the present study, there was no statistically significant difference in the demographic data of the two groups. The mean onset of analgesia in our study was 5.91 ± 0.88 minutes in the group given only hyperbaric Bupivacaine (Group I) and 2.85 ± 0.69 minutes in the patients administered Bupivacaine with Buprenorphine (Group II). In a study by Dixit *et al*, analgesic effect was seen within 2 minutes in 83% of the patients when Buprenorphine was added to Hyperbaric Bupivacaine [10]. However, a study by Borse *et al*. found the time of onset of analgesia in both these groups to be comparable, with no significant difference either in the onset of the sensory block or the motor block [15].

The sensory regression to L1 was statistically significant in our study, with the time being 158.73 ± 18.46 minutes in Group I and 202.74 ± 20.85 minutes in Group II. In a study by Arora *et al*, patients given Bupivacaine alone reached L1 regression faster than the group given either Bupivacaine with clonidine or Bupivacaine with Buprenorphine [13]. Another study by Sethi *et al*, also reported similar results [16].

The duration of anaesthesia in the group given only hyperbaric Bupivacaine was 203.49 ± 41.35 minutes and in the group with Bupivacaine and Buprenorphine was 426.87 ± 41.17 minutes. In a study by Dixit *et al*, it was found that patients given only hyperbaric Bupivacine had an overall anaesthesia duration of 7.1 hours and with Buprenopine added, the duration was 8.2 hours [10]. The duration of analgesia was significantly prolonged in the patients who were given Buprenorphine in addition to Bupivacaine in a study by Borge *et al*. [15]. Capogna *et al*. also found that Sensory blockade prolonged from 183 minutes to 430 minutes in patients given both drugs rather than only Bupivacaine [17].

The VAS score of the patients in our study showed that in patients of Buprenorphine group, the score was <4 in more than 80% of the cases even after 8 hours, while in patients given only Bupivacaine, most of the patients had severe pain > 6 VAS by 4 hours itself. Similar observations were reported in a study by Ravindran *et al*. [18]

The side effects of Buprenorphine in our study were nausea in 16% of the patients, vomiting in 14%, drowsiness in 16%, while urinary retention and pruritus were seen in 4% and 2% respectively. None of the patients had any headaches or respiratory depression. This was corroborated by a study by Borse *et al*., who also observed nausea and vomiting to be the predominant side effects in patients given Buprenorphine [15], however, they did not observe any cases of urinary retention or pruritus in their study. Similar side effects were observed in studies by Capogna *et al*. and Sen M [17, 19]. Drowsiness was a major side effect in a study by Sunil Dixit and was seen in more than 50% of the cases, but all were arousable [10]. 20% of the patients complained of vomiting and 20% complained of pruritis in a study by Korula *et al*. [20].

Conclusion

Buprenorphine increases the sensory blockade without causing any significant haemodynamic changes in patients. This can be used as an adjuvant to hyperbaric Bupivacaine to provide effective post-operative analgesia in comparison to Bupivacaine alone. Though there are minor side effects, but the benefits of this opioid outweigh the side effects. Buprenorphine is an easily available and predictable drug, which can safely be used as an adjuvant to Hyperbaric Bupivacaine in spinal anesthesia for lower abdominal surgeries.

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