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Original Article

Anaesthesia Section

Intrathecal Hyperbaric Bupivacaine 0.5% with Varying Dose of Buprenorphine in Elective Adult Lower Limb Orthopaedic Surgeries: A Randomised Control Study

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ABSTRACT

Introduction: Postoperative pain is a universal phenomenon and usually under treated and its intensity varies widely among patients. Spinal anaesthesia with opioid and local anaesthetics to prolong postoperative analgesia is common practice in recent years. Buprenorphine is an agonist-antagonist opioid. Intrathecal buprenorphine (30-150 µg) along with local anaesthetics is safe and known to increase the postoperative analgesia without affecting sensory or motor blockade and with lesser side effects.

Aim: To compare the anaesthetic characteristics and its side effects in subarachnoid block with bupivacaine 0.5% heavy and varying dose of buprenorphine (90 µg and 120 µg).

Materials and Methods: This randomised control trial study was conducted in the Jhalawar Medical College, Jhalawar, Rajasthan, India, from March 2019 to November 2019. The study included 90 patients belonging to American Society of Anaesthesiologists (ASA) class I and II of either sex age between 18 to 60 years posted for elective lower limb orthopaedic surgeries. The patients were divided into three groups; group A which included a patient count of 30 received plain hyperbaric bupivacaine 0.5% (2.5 mL) with 0.5 mL saline. Group B which included 30 patients, receive plain hyperbaric bupivacaine 0.5% (2.5 mL) along with buprenorphine 90 µg diluted in 0.5 mL saline. Group C with a patient count of 30 received hyperbaric bupivacaine 0.5% (2.5 mL) with buprenorphine 120 µg mixed with 0.5 mL saline. Analgesic characteristics, haemodynamic parameters, side effects, sedation scores by Ramsay Sedation Score and pain scores by Visual Analogue Score (VAS) (0-10) were measured postoperatively till 24 hours. Statistical analyses of data were done by One-way Analysis of Variance (ANOVA) test and Chi-square test, where p-value less than 0.05 was considered to be a statistically significant value.

Results: The onset time of sensory blockade (group A: 5.14±1.34, group B: 4.54±1.10, group C: 4.50±1.18 in minutes), time of onset of motor blockade (group A: 10.10±1.00, group B: 9.43±1.30, group C: 9.21±1.49 in minutes) and maximum level of sensory block at T6 level (group A: n-01/30, group B: n-04/30, group C: n-04/30) were comparable between the three groups and were not statistically significant. Sensory recovery time was significantly ($p<0.0001$) delayed in group B and C (178.9±7.18 min and 189.23±7.4 min.), while in group A it was 152.86±8.9 min. Duration of postoperative analgesia was significantly ($p<0.0001$) prolonged in group C (group A 165.53±8.5, group B 391.49±19.8, group C 493.23±18 in minutes). Side-effects like Postoperative Nausea and Vomiting (PONV) and sedation were increased with dose of buprenorphine, but easily treatable and not significant ($p>0.05$).

Conclusion: A higher dose of buprenorphine shows to provide an adequate and longer postoperative analgesia without any major side effects.

Keywords: Postoperative analgesia, Ramsay sedation score, Visual analogue scale

INTRODUCTION

Among the various regional anaesthesia techniques practised, subarachanoid block is a good option when surgery is in the lower limb (orthopaedic surgery). Subarachanoid block provides a perfect pain relief as compared to Intravenous Regional Anaesthesia (IVRA) or epidural anaesthesia. As it reduces the duration of stay in the hospital, it is beneficial to the patient in terms of money expenditure. Spinal anaesthesia is associated with few major complications like fall in blood pressure, bradycardia, delayed recovery from motor block and high spinal blockade, mainly due to the sympathetic blockade caused the local anaesthetic used. These sympatholytic effects can be minimised by administering a lower dose or a diluted concentration of the local anaesthetic. Even though, spinal anaesthesia has many benefits and adverse effects, the major drawback is the shorter duration of action associated with it [1].

Bupivacaine, an amino amide local anaesthetic causes a decrease in the entry of the sodium ions into the cell by blocking the voltage gated sodium channel, thus, inhibiting depolarisation. Since depolarisation is inhibited, the transmission of action potential is stopped. Bupivacaine is good lipophilic drug, so it penetrates large myelinate motor fibres Aβ and also pain transmitting Aδ, C fibers and its onset of action is around 5-10 minutes with spinal blockade duration ranging around one and a half to two hours [2]. To overcome the major drawback which is associated with spinal anaesthesia that has shorter duration of blockade, adjuvants to local anaesthetics are being tried and used for spinal anaesthesia [3].

Wang JK et al. in 1979,were the first to use opioids intrathecally for acute pain management. The main idea of adding an opioid adjuvant to the local anaesthetic is to improvise the quality of analgesia and to reduce the dose of postoperative pain killers [4]. Now-a-days, opioids are gaining more popularity due to adjuvants as they cause more sensory block than motor without affecting the sympathetic activity and better postoperative analgesia. The dorsal horn of the spinal cord release substance P which is blocked by the opioids administered and the impulse transmission occurring at the nerve axonal level are blocked by the local anaesthetic drug administered. These two actions together act synergistically in producing analgesia.

Buprenorphine is mixed agonist/antagonist activity with partial mu receptor agonist can be delivered in subarachnoid space safely.

Rostral spread of buprenorphine is prevented by high lipophilicity and larger molecular weight, so that the occurrence of side effects like nausea, vomiting, somnolence, pruritus is lesser, making it an attractive alternative. Intrathecal varying dose of buprenorphine in combination with bupivacaine has known to improve the quality and duration of postoperative analgesia compared to bupivacaine alone. Previously studies have demonstrated safety and efficacy of buprenorphine as an adjuvant to local anaesthetics in subarachnoid block. Intrathecally dose of buprenorphine varies from 30-150 µg, however, optimal dose which provides a balance between analgesia and adverse effects has not been described yet [5-7]. The present study was conducted to evaluate and compare the characteristics of spinal block and its side effects in adult patient undergoing lower limb orthopaedic surgeries, who received a subarachnoid block with bupivacaine 0.5% heavy with varying dose of buprenorphine (90 µg and 120 µg) to prolong postoperative analgesia.

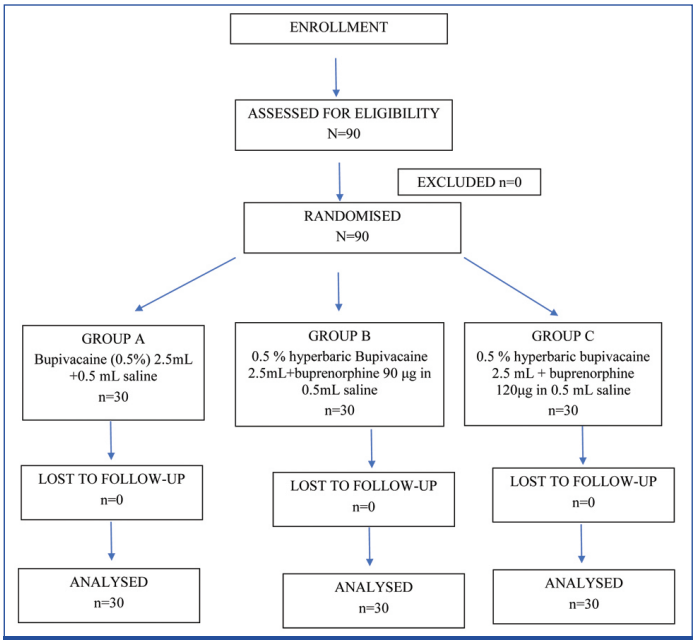
MATERIALS AND METHODS

This randomised control trial study was conducted in the Jhalawar Medical College, Jhalawar, Rajasthan, India, from March 2019 to November 2019. Approval of local Institutional Ethical Committee was taken prior to trail as per order no Sr.06/07 dated 31 January 2019.

Inclusion criteria: Ninety patients aged between 18 to 60 years of physical status ASA grade 1 and 2, of either sex, of height more than 150 cm, weighted 50-80 kilograms, undergoing elective lower limb surgeries, lasting less than two hours were included in the study.

Exclusion criteria: Patients with allergy to local anaesthetics or opioids, local site infection, pregnant or lactating females, raised intracranial tension, progressive neurodegenerative disorder, Central Nervous System (CNS) infections, spine deformities, hypovolaemic shock and bleeding diathesis and coagulopathy were excluded from the study.

Ninety patients who were planned to go elective lower limb surgeries were recruited by convenient sampling method. They were randomly divided into three groups (n=30 each) by using computer generated programme. Assigned random groups were enclosed in a sealed envelope to ensure concealment of allocation sequence. Group A (30 patients) received intrathecally bupivacaine (0.5%) 2.5 mL mixed with 0.5 mL saline, group B which also included 30 patients, received intrathecally 0.5% hyperbaric bupivacaine 2.5 mL with buprenorphine 90 µg in 0.5 mL saline and group C (30 patients) received intrathecally 0.5% hyperbaric bupivacaine 2.5 mL mixed with buprenorphine 120 µg in 0.5 mL saline [Table/Fig-1].



[Table/Fig-1]: Consolidated Standards of Reporting Trials (CONSORT) flow chart.

Study Procedure

Preoperative evaluations of the patient were done on the day before surgery. After explaining the procedure, written and informed consent was obtained. Patients were advised overnight fasting and were premedicated with tab. alprazolam 0.5 mg the night before the day of surgery. In the operating room, intravenous (i.v.) line was secured with 18 G cannula and patients were preloaded with Ringer's lactate solution at 10 mL/kg.Baseline heart rate, Non Invasive Blood Pressure (NIBP), SpO_2, respiratory rate was recorded using multi-parameter monitor, before starting the procedure. Under aseptic precautions with patient in lateral position or sitting position with, 25 G Quincke spinal needle was introduced in to L3-L4 space, after confirming clear flow of Cerebrospinal Fluid (CSF) and negative aspiration for blood, 3.0 mL of test drugs were injected, intrathecally. Patients were made supine after giving the subarachnoid block and i.v. line ensured. Then pulse rate, NIBP were recorded and O_2 by mask was started and then checked the onset and effect of spinal block to allow the surgery to be started. Intraoperatively, vital parameters were recorded till completion of surgery and postoperatively till 24 hours.

Parameters Assessed

Alteration in the haemodynamic parameters such as hypotension and bradycardia were treated with injection mephentermine 6 mg/mL and atropine 0.6 mg i.v bolus. Any adverse events like nausea, vomiting, pruritis, urinary retention etc. were noted and treated accordingly.

Assessment of sensory blockade and duration was tested by pin prick test using hypodermic needle with Hollmen scale and the time of onset, highest level of sensory blockade, duration of sensory block were noted. The assessment motor blockade and duration was assessed by Modified Bromage scale. Sedation were assessed with Ramsay sedation scale and recorded, score of 4 and above was considered as sedated. Quality of analgesia was assessed using VAS on a 0-10 scale, where a score of 0 represents no pain and 10 was the worst pain imaginable. Postoperatively patient was assessed every half hourly till S1 regression (great toe sensation) to measure the duration sensory block. If VAS was noted more than 4 scale, then inj. diclofenac 75 mg intramuscular was given as rescue analgesia. Intravenous Inj. ondansetron 4 mg was administered to the patients, who compained for nausea and vomiting.

Primary objective were to study onset and duration of sensory and motor blockade, maximum level of sensory block and duration of analgesia. Secondary objectives were to study haemodynamic parameters, complications or associated side effects.

STATISTICAL ANALYSIS

Statistical analysis of data was done by help of Statistical Package for the Social Sciences (SPSS) 20.0 Software (trial version), one way ANOVA test and Chi-Square test was used in data analysis. A p-value <0.05 was considered as significant. Chi-square test was used to find the association between two qualitative variables. One way ANOVA test was used to find variation between more than two groups mean.

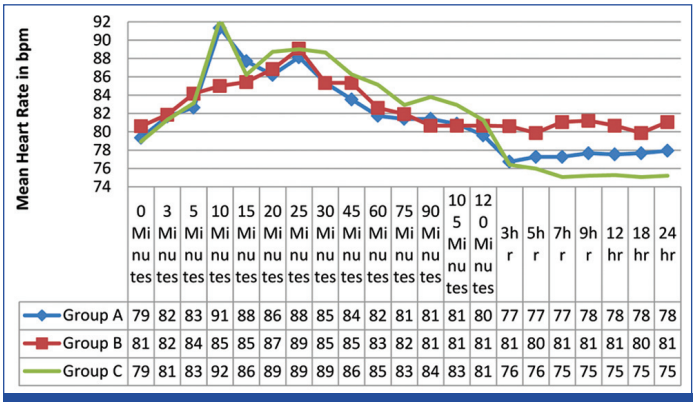
RESULTS

As shown in [Table/Fig-2] there was no statistically significant (p>0.05) difference between the mean age, gender, height and weight among the three groups.

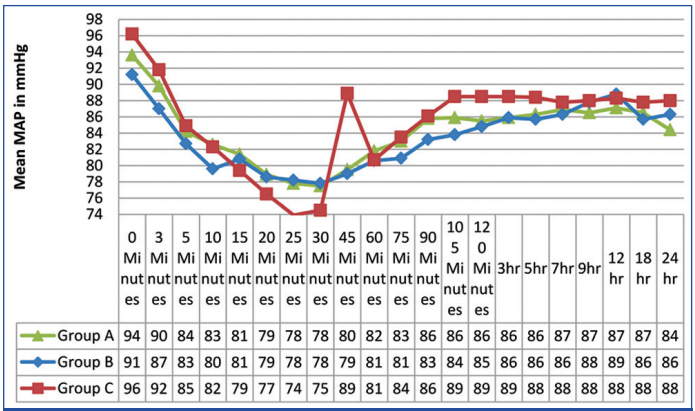
As shown in [Table/Fig-3,4] there were no significant changes in haemodynamic variability in all three groups during the operation and postoperatively as well. There was no difference in the incidence of hypotension and bradycardia in the intraoperative period. There was no significant requirement of crystalloid and vasoconstriction agents.

Parameters	Group A	Group B	Group C	F-value	Chi-square test	p-value
Age (mean±SD)	37.8±11.4	39.7± 12.5	35.0±10.5	1.261		0.289
Gender (m:f)	21:09	22:08	22:08		0.111	0.946
Height (mean±SD)	164.7±6.9	165.0±7.0	165.9±7.1	0.221		0.802
Weight (mean±SD)	64.2±7.6	63.4±9.7	62.1±8.3	0.472		0.625
Total duration of surgery (Mean±SD)	110.8±6.4	110.9± 6.5	111.2± 6.7	0.030		0.970

[Table/Fig-2]: Comparison of patient's demographics and total duration of surgery according to groups.



[Table/Fig-3]: Distribution of heart rate according to groups in different time periods.



[Table/Fig-4]: Distribution of Mean Arterial Pressure (MAP) according to groups in different time periods.

There was no significant difference found between the three groups (p-0.078). Maximum sensory level achieved was similar (T6 level) in all the three groups and found between T6-T10. The addition of buprenorphine to bupivacaine did not change the height of block (p-0.164). Addition of buprenorphine to bupivacaine did not change the onset of motor block much (p-0.052). The mean time of regression to S1 had significant difference between the groups C>B>A. It was observed that addition of buprenorphine increased time of sensory regression (p<0.0001). The mean duration of the motor blockade was statistically significant between the groups C>B>>A [Table/Fig-5].

The duration of analgesia was considered from the time of intrathecal administration of the study drugs to the time of demand for the rescue analgesics, and this difference was highly significant (p<0.0001) between all groups (C>B>A).

VAS was low and remained low for a significant time in the postoperative period with addition of 90 µg and 120 µg buprenorphine to bupivacaine. The VAS scores were statistically highly significant (p<0.0001) in group B and C compare to group A. During the surgery, only two patients in control group complained of pain (VAS-2) and they did not require rescue analgesia within two hours, rest of the patients in all the three groups were comfortable. VAS scores were statistically significant from the second hour of postoperative period onwards between the groups. In control group A patients showed VAS score >4 and most of patients demanded rescue analgesia immediately after 2-3 hours. In group B, most of patient demanded analgesia in ranged between 5-8hours. In group C, 27 patients demanded rescue analgesia in between 08-10 hours postoperatively [Table/Fig-6].

According to Ramsay sedation score scale of 1-6 was measured intra and postoperatively. When compared with control group, the buprenorphine group patients had statistically significant (p<0.0001) sedation score. In group B and group C, all patients had sedation score 2 [Table/Fig-7].

Adverse effects like nausea and vomiting was more associated with group C > B> A [Table/Fig-8]. Pruritis, urinary retention, bradycardia and hypotension were not observed in any patient.

DISCUSSION

Relief of pain in postoperative period extends the anaesthesiologists's interest beyond the confines of the operating theatre. In postoperative period when the effect of anaesthesia disappears tissue injury still persists. Substances like prostaglandins, histamine, bradykinin, 5-Hydroxytryptamine (5HT), substance P produced during local tissue damage occuring during surgery, are transduced by nociceptors and transmitted by A and C fibers to the pain centers [8]. The method for postoperative analgesia performed should have simplicity and safety. The clinical effects of intrathecally administered, 0.5% hyperbaric bupivacaine were assessed in patients, who underwent lower limb orthopaedic surgery under spinal anaesthesia, using preservative free buprenorphine as an adjuvant and it was observed that increasing the dose of buprenorphine resulted in increased duration of sensory regression and total duration of analgesia without any significant increase in adverse effects.

Addition of buprenorphine to bupivacaine does not result in much faster onset of sensory block. Onset time in group A was 5.14±1.34 min, in group B was 4.54±1.10 min and 4.50±1.18 min in group C, which was statistically insignificant between the three groups (p=0.078). Khan F and Hamdani GA [9] (2006) found that onset of sensory block was 3.2±2 min with buprenorphine and 4.5±2 min in control group and found that addition of buprenorphine does not change the time of onset of sensory block. The reason for insignificant difference could be due to clinical action of local anaesthetic and opioids are additive only after some time has elapsed.

Analgesic characteristics	Group-A (n=30)	Group-B (n=30)	Group-C (n=30)	F-value	Chi-square test	p-value
Onset of sensory block in minutes (mean±SD)	05.14±01.34	04.54±01.10	04.50±01.18	2.630		0.078
No. of patients achieved maximum sensory level of T6	01 (03.30%)	04 (13.3%)	04 (13.3%)		9.182	0.164
Onset of motor block in minutes (mean±SD)	10.10±01.00	09.43±01.30	09.21±01.49	3.064		0.052
Time of regression to S1 in minutes (mean±SD)	152.86±8.93	178.90±7.18	189.23±7.42	298. 31		<0.0001
Time of motor block in minutes (mean±SD)	141.90±8.13	160.06±6.71	161.93±6.35	72. 194		<0.0001
Total duration of analgesia in minutes (mean±SD)	165.53±8.58	391.40±19.84	493.23±18.00	3198		<0.0001

[Table/Fig-5]: Comparison of analgesic characteristics between groups.

VAS at different time interval	Group	n	Mean rank	K-value	p-value
0 hours	Group A	30	48.77	0.851	0.653
	Group B	30	43.87		
	Group C	30	43.87		
1 hours	Group A	30	45.50	0.000	1.000
	Group B	30	45.50		
	Group C	30	45.50		
2 hours	Group A	30	48.50	6.136	0.047*
	Group B	30	44.00		
	Group C	30	44.00		
3 hours	Group A	30	75.50	84.847	<0.0001*
	Group B	30	30.50		
	Group C	30	30.50		
4 hours	Group A	30	75.50	85.167	<0.0001*
	Group B	30	30.50		
	Group B	30	30.50		
5 hours	Group A	30	75.50	84.747	<0.0001*
	Group B	30	30.50		
	Group C	30	30.50		
6 hours	Group A	30	73.62	68.502	<0.0001*
	Group B	30	40.88		
	Group C	30	22.00		
7 hours	Group A	30	71.80	65.139	<0.0001*
	Group B	30	46.18		
	Group C	30	18.52		
8 hours	Group A	30	69.07	52.067	<0.0001*
	Group B	30	45.73		
	Group C	30	21.70		
9 hours	Group A	30	64.70	34.850	<0.0001*
	Group B	30	45.32		
	Group C	30	26.48		
10 hours	Group A	30	68.88	39.372	<0.0001*
	Group B	30	30.42		
	Group C	30	37.20		
11 hours	Group A	30	73.72	66.373	<0.0001*
	Group B	30	23.93		
	Group C	30	38.85		
12 hours	Group A	30	71.55	59.245	<0.0001*
	Group B	30	25.08		
	Group C	30	39.87		
15 hours	Group A	30	75.10	73.929	<0.0001*
	Group B	30	26.50		
	Group C	30	34.90		
18 hours	Group A	30	71.13	56.967	<0.0001*
	Group B	30	25.60		
	Group C	30	39.77		
24 hours	Group A	30	67.83	38.063	<0.0001*
	Group B	30	34.33		
	Group C	30	34.33		

[Table/Fig-6]: Distribution of VAS according to groups in different time periods.

The addition of buprenorphine to bupivacaine did not change the height of block and the highest level of analgesia achieved was T6. Borse YM et al., [10] (2015) found that maximum sensory level ranged between T6-T10, when buprenorphine 150 mcg was added to 2.5 mL of 0.5% bupivacaine heavy.

Sedation score at different time interval	Group	N (Total)	Mean rank	K-value	p-value
0 hours	Group A	30	45.50	0.000	1.00
	Group B	30	45.50		
	Group C	30	45.50		
1 hours	Group A	30	45.50	0.000	1.00
	Group B	30	45.50		
	Group C	30	45.50		
2 hours	Group A	30	41.50	8.276	0.016*
	Group B	30	47.50		
	Group C	30	47.50		
3 hours	Group A	30	35.50	22.250	<0.0001*
	Group B	30	50.50		
	Group C	30	50.50		
4 hours	Group A	30	66.50	53.282	<0.0001*
	Group B	30	35.00		
	Group C	30	35.00		
5 hours	Group A	30	45.50	0.000	1.00
	Group B	30	45.50		
	Group C	30	45.50		
6 hours	Group A	30	45.50	0.000	1.000
	Group B	30	45.50		
	Group C	30	45.50		
7 hours	Group A	30	45.50	0.000	1.000
	Group B	30	45.50		
	Group C	30	45.50		
8 hours	Group A	30	45.50	0.000	1.000
	Group B	30	45.50		
	Group C	30	45.50		
9 hours	Group A	30	34.50	24.785	<0.0001*
	Group B	30	51.00		
	Group C	30	51.00		
10 hours	Group A	30	45.50	0.000	1.000
	Group B	30	45.50		
	Group C	30	45.50		
11 hours	Group A	30	31.50	32.789	<0.0001*
	Group B	30	52.50		
	Group C	30	52.50		
12 hours	Group A	30	45.50	0.000	1.000
	Group B	30	45.50		
	Group C	30	45.50		
15 hours	Group A	30	34.50	24.785	<0.0001*
	Group B	30	51.00		
	Group C	30	51.00		
18 hours	Group A	30	35.50	22.250	<0.0001*
	Group B	30	50.50		
	Group C	30	50.50		
24 hours	Group A	30	36.50	19.778	<0.0001*
	Group B	30	50.00		
	Group C	30	50.00		

[Table/Fig-7]: Distribution of sedation score according to groups In different time periods.

Adverse effect	Group A, n (%)	Group B, n (%)	Group C, n (%)
PONV	01 (03.33%)	02 (06.66%)	04 (13.33%)
Somnolence	0	01 (03.33%)	03 (10%)

[Table/Fig-8]: Distribution of adverse effect according to groups.

Onset of motor block in group A was at 10.10±1.0 min, in group B was at B 9.43±1.30 min and 9.21±1.49 min in group C (p-0.052). Arora MV et al., [11] (2016) found that onset of motor block in group A (control) was 10.9±1.9 min and 10.2±3.7 min in group B (buprenorphine). Borse YM et al., [10] (2015) have observed quick onset of motor block as 77±9.5 sec in control (2.5 mL 0.5% bupivacaine heavy) and 75±7.6 sec with buprenorphine 150 mcg.

Borse YM et al., [10] (2015) found that duration of sensory regression was prolonged with addition of 150 mcg buprenorphine to 215.4±26.2 min as compared to (132.8±16.5 min) in control group. Another study done by Arora MV et al., [11] (2016) found that duration of sensory regression in group A (control) was 129±16.3 min and with buprenorphine was 209±33.8 min, respectively. This prolongation of sensory recovery is attributed to the clinical action of local anaesthetic and opioids as additive only after some time following intrathecal administration. This is due to the time taken by the opioid from CSF to penetrate the deeper layer (substantia-gelatinosa), where opioid receptors are present.

The mean time of motor block had significant difference between the groups A, B and C but not statistically significant between group B vs C and similar prolongation was observed by others studies also. Arora MV et al., [11](2016) found that addition of buprenorphine 50 mcg to bupivacaine prolonged duration of motor block 262±46.7 min as compared to 153.8±19.3 min control group. Raju G et al., [12] (2014) found that duration of motor block increased with addition of buprenorphine (100 mcg) 182.50±8.69 min.

Total duration of analgesia in group A was 165.53±8.5 min in group B 391.40±19.8 min and 493.23±18 min in group C which was highly significant (p<0.0001) between all groups (C>B>A). Borse YM et al., [10] (2015) found that duration of analgesia with buprnorphine (150 mcg) was 909±216.9 min while in control group 158±17.3 min. Harshavardhan P et al., [13] (2015) found duration of analgesia was 584.3±19.11 min with buprenorphine as compared to control group 170.03±6.7 min. Raju G et al., [12] (2014) found duration of analgesia 474.42±165.68 min with 100 mcg buprenorphine. Capogna G et al., [14] (1988) found that mean pain free interval were 183.06 minutes in group B (30 mcg), 430.16 minutes in group C (45 mcg). In group B, pain increased gradually from 5-8 hours. In Group C pain increased from 7-12 hours. Capogna G et al., [14] (1988), suggested duration of analgesia is dose dependent which supports the present study. Buprenorphine has prolonged duration of action, due to complex receptor kinetics. It has high affinity to opiate receptors, it forms avid complex with the receptor and tends to persist for long duration of period. The opiate receptor affinity for buprenorphine is 50 times more than that of morphine. The high lipid solubility and high affinity for opiate receptors of buprenorphine explains buprenorphine's longer duration of action, when compared to other lipid soluble drugs like fentanyl, which produces short-lived analgesia due to rapid clearance from spinal cord sites [15].

The pain scores as assessed on the VAS were low and remained low for a significant time in the postoperative period with addition of 90 mcg and 120 mcg buprenorphine to bupivacaine. The VAS scores were statistically highly significant (p<0.0001) in group B and C, compared to group A. All three groups of patients were comfortable during surgery, except two patients in control group complained of pain, but they did not require analgesia within two hours. From the second hour of postoperative period onwards, there was a significant change in the VAS reading. In control group A, patients showed more than score of 4 in VAS scale and most of patients demanded analgesia immediately after 2-3 hours. In group B, most of patient demanded analgesia in range between 5-8 hours. In Group C, all patients demanded analgesia between 7-10 hours and three patients did not demand analgesia till 24 hours. Rao BD and Chandraprakash K [16] (2016) found that the pain scoring through VAS in the group BN (buprenorphine) was nil to mild pain till about 12 hours, while in the group B (control) analgesic effect was felt only till first 2 hours. Nelamangala K et al., [17] (2016) found that the pain intensity was significantly lower with buprenorphine (mean±SD=4.20±0.81 hrs) as evaluated by VAS score which coincides with the present study.

Capogna G et al., [14] (1988) found that intrathecal buprenorphine in higher concentration offers more prolonged analgesia with minimal change in consciousness. Sen M [18] (1992) also found that buprenorphine had prolonged postoperative analgesia with minimal disturbance of consciousness.

The incidence of nausea and vomiting was increased in postoperative ambulation. This may be due to the rostral spread of opioid in spinal fluid to intracerebral structures, including the vomiting center and chemoreceptor trigger zone. Since, most of the patients in the present study were in plaster of paris immobilisation and were not ambulatory, so the incidence of nausea and vomiting were low. Somnolence was observed more in group C (03/30) than group B (01/30) and there was no case observed with somnolence in control group. Sapkalpravin S et al., [19] (2013) observed somnolence in 03/40 patients.

Limitation(s)

The study may be under powered with small sample size. A lower limb orthopaedic surgery, usually differs in term of tissue trauma as a longer duration of postoperative analgesia in arthroscopic-guided surgeries was observed, than open or closed reduction and internal fixation surgeries.

CONCLUSION(S)

It can be concluded that, intrathecal buprenorphine along with bupivacaine does not result in earlier sensory and motor blockade onset time, but increases sensory regression to S1 time and increasing the dose of buprenorphine results in increased duration of sensory regression. Buprenorphine prolongs duration of analgesia and increasing dose of buprenorphine result in increased duration of analgesia. Adverse effects like PONV and sedation increased with dose of buprenorphine, but it is easily treatable and not significant (p>0.05). Buprenorphine with increasing dose helps in providing a good and a longer postoperative analgesia with minimal side effects. So, this combination can be used to provide alonger postoperative analgesia for lower limb orthopaedic surgeries which is cost effective and safe by intrathecal route.

REFERENCES

[1] Morgan GE, Maged JR, Mikhail S, Michael JM. Clinical Anaesthesiology. Mc Graw Hill: 2006, 5th ed; 45; 937-45.
[2] Stoelting RK, Hillier SC. Pharmacology and physiology in anaesthesia practice. Lippincott Williams and Wilkins. 2015, 5th ed;(2);179-07.
[3] Carpenter RL, Caplan RA, Brown DL, Stephenson C, Wu R. Incidence and risk factors for side effects of spinal anaesthesia. Anaesthesiology. 1992;76;906-17.
[4] Wang JK, Nauss LA, Thomas JK. Pain relief by intrathecally applied morphine in man. Anaesthesiology. 1979;50:149-51.
[5] Cousins MJ, Mather LE. Intrathecal and epidural administration of opioids. Anaesthesiology. 1984;61(3):276-310. PMID: 6206753.
[6] Carl C. Opioids pharmacology in relation to anaesthesia and postoperative pain control. In International practice of anaesthesia. 1996;Ed.5th,Ch-18:167-183.
[7] Budd K. High dose of buprenorphine for postoperative analgesia. Anaesthesia. 1981;36(9),900-03.
[8] Mersky H, Bogduk N. Classification of chronic pain, descriptors of chronic pain terms, task force on taxonomy (IASP). 1994,2(suppl-3)210.
[9] Khan FA, Hamdani GA. Comparison of intrathecal fentanyl and buprenorphine in urological surgery. J Pak Med Assooc. 2006;56:(6)277-81.
[10] Borse YM, Thorat SA, Dighe JP, Patil P. A comparative study of interathecal bupivacaine and bupivacaine with buprenorphine for postoperative analgesia in orthopedic surgeries. Ind J Clin Anaesth. 2015;2(2):92-96.
[11] Arora MV, Khan MZ, Choubey MS, Rasheed MA, Sarkar A. Comparison of spinal block after intrathecal clonidine-bupivacaine, buprenorphine-bupivacaine and bupivacaine alone in lower limb surgeries. Anesth Essays Res. 2016;10:455-61.
[12] Raju G, Priyanka V, Dayanand VP. Comparison of analgesic effects of equipotent doses of interathecal morphine and buprnorphine during spinal anaesthesia with hyperbaric bupivacaine. Int Med J. 2014;1(9):520-24.
[13] Harshavardhan P, Anantavenkta TR, Chandraprakash C. Combination of hyperbaric bupivacaine with buprenorphine in lower abdominal surgery- A comparative study. Journal of Science. 2015;7:484-88.

[14] Capogna G, Celleno D, Tagariello V, Loffreda-Mancinelli C. Intrathecal buprenorphine for postoperative analgesia in the elderly patient. Anaesthesia. 1988;43(2):128-30. Doi: 10.1111/j.1365-2044.1988.tb05482.x. PMID: 3354808.
[15] Singh Y, Yadav AK, Bajpai V, Dwivedi P, Verma S, Verma RK, et al. Comparison of intrathecal fentanyl and buprenorphine as adjuvants to bupivacaine in gynecological surgery. Anaesthesia, Pain & Intensive Care. 2022;26;39-43. 10.35975/apic.v26i1.1764.
[16] Rao BD, Chandraprakash K. Comparative study of intrathecal bupivacaine 0.5% with bupivacaine 0.5% and buprenorphine low dose for postoperative analgesia in lower abdominal surgeries. Int Surg J. 2016;3(1):253-57.
[17] Nelamangala K, Madhusudhana R, Krishnamurthy D, Vasantha NSK. Comparative study of intrathecal bupivacaine with additives buphrenorphine and fentanyl for postoperative analgesia. Journal of Dental and Medical Sciences (IOSR-JDMS). 2016;15:6(VI):39-40.
[18] Sen M. Intrathecal buprenorphine for postoperative analgesia in orthopaedic surgeries. Ind Med Assoc.1992;90:05-06.
[19] Sapkalpravin S, Kulkarni KD, Rajurkar SS, Nandekarprema D. Comparative study of interathecal clonidine and interathecal buprenorphine for postoperative analgesia after lower limb orthopaedic surgery. Int J Curr Reas Rev. 2013;5(6):87-91.

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