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Original Research Article

Comparative Study of Intrathecal Fentanyl and Buprenorphine as an Adjuvant to 0.5% Hyperbaric Bupivacaine in Spinal Anaesthesia for Lower Abdominal and Lower Limb Surgery in Adults

Vinay Kumar[1], Shruti Kirti[2], Krishna Kumar[3]

[1,2]Senior Resident, Department of Anaesthesia, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar

[3]Assistant Professor and Head of Department, Department of Anaesthesia, Sri Krishna Medical College & Hospital, Muzaffarpur, Bihar

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Corresponding author: Dr. Shruti Kirti

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Abstract:

Background: Neural axial blockade is the recommended type of anesthesia for lower limb procedures. Because of its quick onset, superior blockade, lower failure rates, and cost-effectiveness, spinal block is still the preferred treatment. The current study compares the effectiveness of intrathecal bupivacaine combined with buprenorphine and fentanyl in orthopaedic procedures involving the lower limbs.

Method: Five patients were excluded because they did not meet the inclusion criteria out of 89 scheduled patients for lower abdomen and lower limb surgery. By using a computer-generated random number sequence, the remaining 84 patients were randomly split into two groups. The dosage for Group B was 50 µg of buprenorphine and 3 cc (15 mg) of strong Bupivacaine. Group F received 3cc (15mg) of Bupivacaine (heavy) and 25µg of fentanyl.

Results: When combined with bupivacaine, buprenorphine, and fentanyl, spinal anesthesia offers high-quality intraoperative and postoperative analgesia. Sensory and motor blocks are greatly prolonged by buprenorphine and bupropion. Buprenorphine group has longer analgesia and sedation durations than Fentanyl group.

Conclusion: Both groups' hemodynamic stability was equivalent and statistically insignificant.

Keywords: Spinal, Bupivacaine, Fentanyl, Buprenorphine.

Introduction

As it serves to dull autonomic, somatic, and endocrine reflexes with the potential to reduce perioperative morbidity, effective management of peri-operative pain in lower extremity orthopedic surgery is a crucial part of early postoperative recovery. [1]

Neural axial blockade is the recommended type of anesthesia for lower limb procedures. Because of its quick start, superior blocking, low failure rates, and cost-effectiveness, spinal block is still the preferred method. However, it has limitations, including a short postoperative analgesic duration and side effects such hypotension and bradycardia brought on by sympathetic blockade. Bupivacaine is more effective than ropivacaine and has a longer duration of action because of its increased lipid solubility. It works by temporarily blocking the neuronal sodium channel. Intrathecal local anesthetics have been given adjuvants, such as epinephrine [2], neostigmine [3], magnesium [4], midazolam [5], ketamine [6], and clonidine [7], in an effort to prolong analgesia and lower the likelihood of adverse effects. Intrathecal adjuvants include the opioids. [8, 9, 10] Their usage may be restricted, though, by serious side effects include urine retention, respiratory depression, hemodynamic instability, itching, and occasionally severe nausea and vomiting. [11,12,13] A centrally acting, lipid soluble drug with partial agonist activity for the opioid receptor, buprenorphine, has analgesic effects at both the spinal and supraspinal levels. [14] Buprenorphine is compatible with CSF and has negligible to no side effects, such as pruritis and nausea. Due to its high molecular weight and lipophilicity, it may be able to avoid spreading rostrally and causing respiratory depression.

Fentanyl is a powerful synthetic µ receptor and has local anesthetic effect on the primary afferent sensory C nerve fibers, inducing analgesia. It has repeatedly been shown to extend the duration of anaesthesia [15,16]. The effects of intrathecal fentanyl coupled with local anesthetics in humans have only seldom been studied to date. [9,18,19] In

those experiments, adding 10-15 mg of bupivacaine and 25 µg of fentanyl lengthened the time that local anesthetics remained in effect. There is no research comparing the advantages and disadvantages of using the medications fentanyl and buprenorphine in conjunction with bupivacaine for lower abdomen and lower limb procedures. In order to compare the effectiveness, hemodynamic stability, length of sensory and motor blockage, post-operative analgesia, and side effects of buprenorphine and fentanyl as an adjuvant to hyperbaric bupivacaine in lower abdomen and lower limb procedures, we did this study.

Material and Methods

From January 2022 to December 2022, this study was conducted in the Department of Anaesthesia, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar. Every patient provided a signed statement of informed consent.

In total, 84 patients with ASA Grades 1 and 2 and the age range of 18 to 60 years were included in the study; 42 patients in each group had 80% power to detect a difference between means of 142.28 with an alpha level of 0.05 (two-tailed).

Pregnant women and individuals with a history of bleeding disorders or who are taking anticoagulants, infection at the injection site, allergy to local anesthetics, cardiac disease, heart blocks, dysrhythmias, anemia, severe hypovolemia, shock, septicemia, and neurological defects were excluded from this study.

They were randomized by computer generated random number sequence into two groups: Group B received 50µg of buprenorphine with 3cc (15mg) of Bupivacaine (heavy).

Group F received 25µg of fentanyl with 3cc (15mg) of Bupivacaine (heavy).

Data was calculated, using the SPSS software version 22.0 and was presented as median (range) or mean (SD) as appropriate. Descriptive data was presented as mean± SD. Continuous data was analyzed by paired /unpaired 't' tests and chi-square test assess the statistical difference between groups.

Results

Table 1: Demographic variable and duration of surgery are compare between both groups

Parameters	Group F	Group B	p-value
Age (in years)	38.23±12.54	37.40±13.36	0.769(NS)
Weight (in kg)	68.05±3.91	67.61±4.55	0.608(NS)
Height (cm)	166.76±3.24	166.09±3.15	0.342(NS)
Duration of surgery (in minute)	55.85±13.59	58.40±15.22	0.416(NS)

P value >0.05.

Table 2: Onset time of motor and sensory block and duration of motor block are compare between both groups

Parameters	Group F	Group B	p-value
Onset time of sensory block (min)	5.61±0.82	5.80±0.80	0.286
Duration of motor block (min)	175.5±11.39	176.02±7.19	0.801
Onset time of motor block (min)	6.69±0.71	6.90±0.65	0.156

P value >0.05.

Table 3:

Parameters	Group F	Group B	p-value
Time for sensory regression to S2 from HSL (highest sensory level) in (min.)	203.07±13.64	221.80±9.55	<0.0001(HS)
Time to 1st analgesic requirement (whereas VAS>4) in (min.)	257.95±10.20	391.19±14.92	<0.0001(HS)
Total dose of rescue analgesia (mg)	309.52±57.63	221.42±41.53	<0.0001(HS)
Modified Ramsay sedation score	1.11±0.32	2.02±0.86	<0.0001(HS)

Time to reach S2 from the highest sensory level, Modified Ramsay Sedation Score, and Analgesia Duration are all longer with Buprenorphine than with Fentanyl, and the total dose needed for Rescue Analgesia is lower in the Buprenorphine group. (P <0.05) in table 3.

Table 4: VAS SCORE VAS score was observed significantly lower in Buprenorphine Group after 210 min of Subarachnoid Block

Time	VAS		t-value	p-value
	Group F (Mean ± SD)	Group B (Mean ± SD)		
Before spinal	4.47±3.96			
0	4.23±3.79	4.26±4.00	0.173	
1	3.30±3.01	3.42±3.28	0.144	

3	2.28±2.17	2.35±2.35	0.735	
5	1.5±1.61	1.23±1.65	0.604	
7	0.54±0.86	0.42±0.94		
10		0.04±0.38		
12				
15				
20				
25				
30				
45				
60				
90				
120	0.07±0.26			
150	0.45±0.63			
180	1.28±0.59			
210	2.28±0.67	0.54±0.70	11.55	<0.0001
240	3.52±0.80	1.30±0.51	15.01	<0.0001
270	3.78±0.60	1.78±0.41	17.63	<0.0001
300	2.88±0.94	2.21±0.41	4.196	<0.0001
330	2.40±0.76	2.73±0.44	2.436	0.017
360	2.57±0.83	3.52±0.50	6.348	<0.0001

Table 5: Side effects in our study, none of the patients had respiratory depression, hypotension and Bradycardia in both study groups

Side effects	Group F	Percentage	Group B	Percentage
Pruritis	5	11.90%	0	0
Shivering	1	2.38%	0	0
Nausea and vomiting	0	0	3	7.14%

Discussion: Due to the numerous nerve endings found in the periosteum and mineralized bone, long bone fractures during trauma can cause severe pain, especially before stabilization. [20] According to meta-analyses, regional anesthesia, more specifically central neuraxial anesthesia, lowers the risk of postoperative pneumonia in patients who need surgical stabilization and lowers the incidence of deep vein thrombosis (DVT), pulmonary embolism, postoperative confusion, and other complications. [21,22] Buprenorphine has a long duration of action and a minimal potential for addiction since it dissociates from the μ-opioid receptor slowly. [15, 16, 24] Age, sex, weight, height, and baseline hemodynamic parameters make up the demographic profile. In both groups, the average heart rate, systolic blood pressure, diastolic blood pressure, and mean arterial pressure were similar, statistically insignificant, and in line with findings from earlier studies [16,26]. Our study two groups' ASA status and surgical time were comparable (P > 0.05) and relatively similar to prior studies [16, 26], giving us a consistent basis on which to compare the outcomes. In our investigation, the mean time to attain sensory level T-10 for the fentanyl and buprenorphine groups was 5.61±0.82 and 5.80±0.80, respectively. Therefore, we may say that buprenorphine took longer than fentanyl to achieve sensory level T-10, but the difference was statistically insignificant. Our findings concur with those of studies by Kamal Sonya [29], Safiya I. Seikh [30], and Aravinder Pal Singh et al. [17]. In our study, the mean time to reach modified bromage grade 3 was 6.69±0.71 minutes for the fentanyl group and 6.90±0.65 minutes for the buprenorphine group. Therefore, we may say that buprenorphine took longer than fentanyl to get a modified Bromage score of 3, although the difference was statistically insignificant. Fauzia A. Khan et al. [31], Mahima Gupta et al. [27], and Poupak Rahimzadeh et al. [37] all came to the same conclusion. In our study, the mean sedation score after surgery for the Fentanyl group was 1.11±0.32 and 2.02±0.86 for the Buprenorphine group, which is statistically significant (p value<0.0001). It follows that intrathecal buprenorphine produces significantly higher sedation than fentanyl. By interfering with a synthetic μ receptor, fentanyl has a sedative effect. Following intrathecal buprenorphine administration, sedation may be brought on by systemic absorption of the drug, vascular redistribution to higher centers, or cephalad migration in CSF. [16,32] With a higher dose of buprenorphine, the sedation score increased. [15] In our investigation, the motor block lasted 175.5±11.39 min in the fentanyl group and 176.02±7.19 min in the buprenorphine group, both of which were statistically significant (p value <0.0001). Similar research was conducted and

similar findings were made by Jaishri Bogra et al [33], Rajni Gupta et al [26], and Ayman Eskander T et al [25]. The mean time for the initial rescue analgesia in our study was 257.95±10.20 min for the Fentanyl group and 391.19±14.92 min for the Buprenorphine group, which is statistically significant (p value <0.0001). Safiya et al. [32], Rajni Gupta et al. [26], Soumya Samal et al. [34], Harbhej Singh et al. [23], and Major Vishal Arora et al.[28] conducted comparable investigations and reached similar conclusions. To enhance the effectiveness of local anesthetics, buprenorphine has frequently been utilized in spinal anesthesia [35]. However, if the dose of buprenorphine is raised, adverse effects like hypotension, bradycardia, and sedation become more pronounced [36].

Conclusion

According to the results of our investigation, buprenorphine greatly lengthens the sensory and motor block when combined with bupivacaine. Fentanyl and buprenorphine both offered high-quality pre- and post-operative analgesia as well as hemodynamic stability. The analgesia was statistically significant and clinically superior in the buprenorphine group compared to the fentanyl group.

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