Original research article

A Comparative Study of Buprenorphine Versus Butorphanol in Supraclavicular Brachial Plexus Block for Postoperative Analgesia

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Abstract

Background: Supraclavicular block is commonly used for surgical procedures on the elbow, forearm, and hand. A variety of opioid medications are used as adjuvants to provide postoperative analgesia via brachial plexus block. We in the current study evaluated the efficacy of Buprenorphine versus Butorphanol along with local anesthetics for postoperative analgesia.

Methods: N=50 cases aged from 18 to 50 years with an ASA grade of I or II undergoing orthopedic upper limb procedures by supraclavicular brachial plexus block. Group, I (Buprenorphine 100 µg) and group II (Butorphanol 1 mg) were added to the local anesthetic mixture via injection. In both, groups the onset of sensory block, motor block, and the extent of blockage were investigated, and the occurrence of any complications was noted. All patients were monitored for analgesia hourly until the VAS pain score indicated that analgesia was required post-operatively.

Results: The onset of sensory blockade was 4.85 ± 1.1 minutes in group II and 3.51 ± 0.9 minutes. Similarly, the onset of motor block was 8.89 ± 3.2 minutes in group I and 5.85 ± 2.23 in group II. The onset of the complete block was at 16.59 ± 4.51 minutes in group I and 13.29 ± 2.11 minutes in group II. group II had the mean VAS scores higher which indicates moderate pain and rescue analgesia was required in group II. In group I the mean VAS scores was less than 4 and the requirement of rescue analgesia was not necessary. The mean duration of analgesia was also greater in group I was 19.50 ± 5.5 hours compared to group II was 16.33 ± 6.7 hours.

Conclusions: The duration of postoperative analgesia was greater in the buprenorphine group as compared to the butorphanol group. The mean VAS scores were higher in the butorphanol group at the end of 6 hours and the requirement for rescue analgesia was higher in the group. Therefore, buprenorphine appears to have higher efficacy and longer duration of action as compared to butorphanol for infusion along with local anesthetics for supraclavicular blocks.

Keywords: Buprenorphine, Butorphanol, Supraclavicular Brachial Plexus Block, Postoperative Analgesia.

Introduction

Anesthesiologists' primary priority is pain relief, which has garnered a lot of attention in this rapidly growing specialty of medicine. For this objective, a variety of methods, medicines, and routes have been tested. The premise that pain is a sensory warning communicated by individual nerve fibers that may be modulated or interrupted anywhere along the nerve's journey is fundamental to the current neural blockade. Acute postoperative pain is the result of a complicated physiological response to tissue damage or illness. It manifests as unpleasant, undesirable sensory and emotional experiences because of autonomic, psychological, and behavioral reactions. Despite breakthroughs in our understanding of pain pathology, analgesic pharmacology, and the development of efficient treatments, post-operative pain management still takes a lot of work. Brachial plexus block provides adequate anesthesia and postoperative analgesia for all the upper limb procedures. Supraclavicular brachial plexus block (SBPB) provides anesthesia for surgeries around the elbow, forearm, and hand. [1, 2] Local anesthetics alone for supraclavicular brachial plexus block give good intraoperative circumstances but result in a shorter postoperative analgesia duration Tramadol, butorphanol, buprenorphine, -adrenergic agonists, and dexamethasone are some of the adjuvants that are used to expedite the onset of the block and extend the duration of postoperative analgesia. [3] Because opioids and local anesthetics have a synergistic effect, adding them to bupivacaine extends the duration of analgesia and increases the quality of the block. [4] Buprenorphine (CN-L-cyclopropyl methyl oripavine) is a narcotic agonist and antagonist semisynthetic ring C bridge oripavine derivative of thebaine. In terms of analgesic efficacy, it is 25 to 40 times more effective than Morphine. [5-7] Buprenorphine produces morphine-like subjective effects in a dose-dependent manner. They take longer to start but last longer. Buprenorphine was discovered to be a selective mu receptor agonist in early receptor binding experiments. It binds to the mu, delta, and kappa receptors with a high affinity. Butorphanol is synthetic opioid-like morphine that has a partial antagonistic and agonistic effect on kappa receptors. Butorphanol has been extensively researched as an adjunct to local anesthetic drugs in upper limb peripheral nerve blocks. [8] Various studies have employed a dose range of 20 g/kg. [8 of supra] Some researchers concluded that dosages of up to 2 mg were associated with few adverse effects. [9] Furthermore, very little data exists to support the use of butorphanol as an adjuvant in supraclavicular brachial plexus block.

Material and methods

This cross-sectional study was conducted in the Department of Anesthesiology, Kakatiya Medical College, and MGM Hospital, Warangal, Telangana State. Institutional Ethical permission was obtained for the study. Written consent was obtained from all the participants of the study.

Inclusion criteria

1. Consecutive patients undergoing orthopedic surgeries on upper limb
2. Aged between 18 – 50 years
3. ASA grades I and II
4. Male and females

Exclusion criteria

1. Cases where supraclavicular blocks were not used
2. Patients with cardiovascular, respiratory, renal, and liver diseases
3. History of hypersensitivity to local anesthetics
4. History of Bleeding disorders
5. Suspected opioid addicts

All the patients were randomly allocated into two groups by a computer-generated random number so that each group consist of n=27 patients. Group I (Inj. Lignocaine hydrochloride (2%) 5-7 mg/kg + Inj. Bupivacaine hydrochloride (0.5%) 1-2 mg / kg + Inj. Buprenorphine 100 µg). For Group II (Inj. Lignocaine hydrochloride (2%) 5-7 mg/kg + Inj. Bupivacaine hydrochloride (0.5%) 1-2 mg / kg + Inj. Butorphanol 1 mg). Details of the analysis of the patients have been depicted in Figure 1.

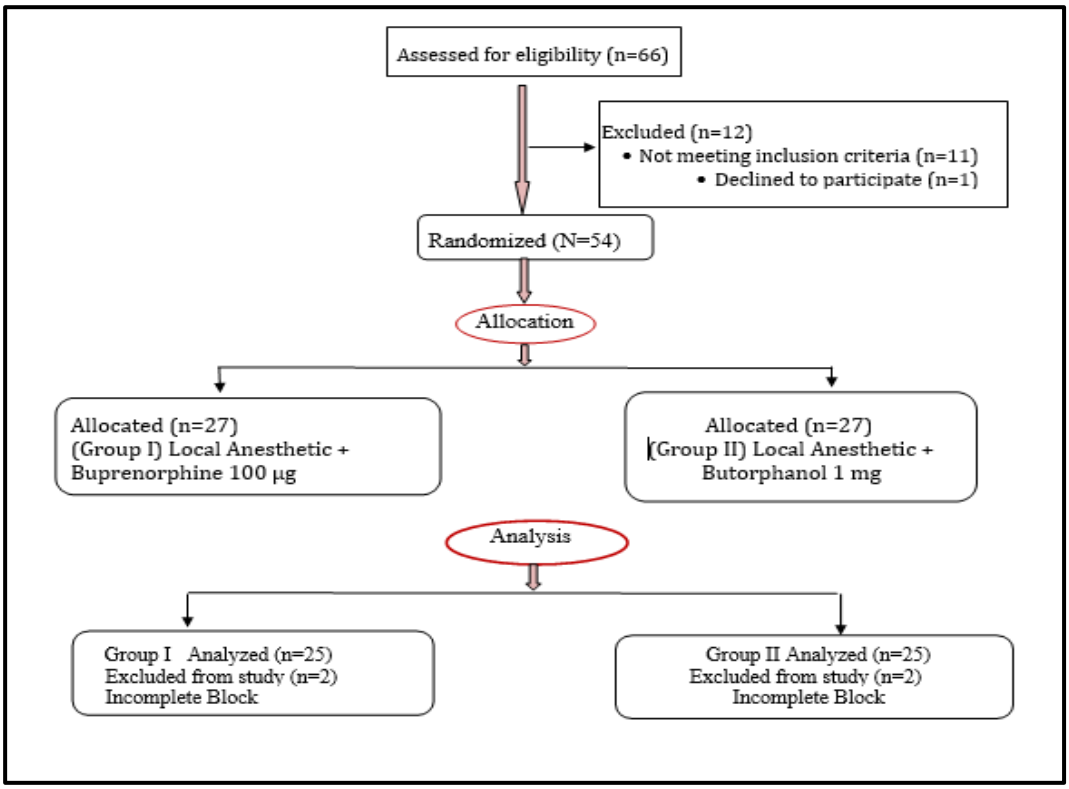

Figure 1: Algorithm of the number of patients included and analyzed in the study

Patients 'demographic data such as age, height, weight, history, and findings of the examination of airway, cardiovascular and other systems were recorded. A routine investigation like Hemoglobin, blood sugar, Blood Urea, Creatinine, Chest X-ray, and ECG was done in all patients. Patients were explained in detail about the anesthesia procedure and drugs. All the patients were kept nil by mouth for 6-8 hours pre-induction. All patients were pre-medicated with Inj. Glycopyrrolate 4 µg/kg and Inj. Ondansetron 4 mg IV, given 5 minutes before surgery. No analgesic drugs were given in premedication. All patients were observed for analgesia hourly until the patient demanded analgesia. Duration of analgesia was noted as the time taken until the patient demanded analgesia. Side effects like tachycardia, bradycardia, respiratory depression, hypotension, nausea, vomiting, pruritus, and urinary retention were also noted. Pulse rate, blood pressure, Visual Analogue Scale (VAS) the patients were shown a 10 cm long scale marked 0-10 on a blank paper and told that '0' represented 'no pain' and 10 represented the worst possible pain it was observed every hourly for 9 hrs postoperatively. All the available data was uploaded to an MS Excel spreadsheet and analyzed by SPSS version 19.0 in windows format. For continuous variables mean and Standard deviations were used and for categorical variables were represented as percentages and a p-value of <0.05 was considered significant.

Results

In Group-I, there were n=17(68%) males and n=8(32%) females the male to female ratio was approximately 2:1. The youngest patient was 19 years male and the oldest patient was a 55-year-old female. The mean age was 29.33 ± 9.21. In group II the number of cases of males was n=15(60%) and females was n=10(40%) the male to female ratio was 3:2. The youngest case was an 18-year male and the oldest case was a 51-year male. The mean age was 31.25 ± 10.12 years. The details of the demographic distribution of cases are given in table 1.

Table 1: Age-wise distribution of cases in the study

Age group in years	*Group-I (n=25) Buprenorphine*	*Group-II (n=25) Butorphanol*
18 - 20	08	07
21 - 30	06	08
31 - 40	06	06
41 – 50	03	03
> 50	02	01
Minimum Age	19	18
Maximum	55	51
Mean	29.33 ± 9.21	31.25 ± 10.12

The mean height of the cases in group I was 166.53 ± 10.33 centimeters and similarly, in group II the mean height was 164.85 ± 11.95 centimeters. The mean weight of the patients in group I was 56.33 ± 5.23 Kgs and the mean weight of patients in group II was 54.26 ± 4.12 Kgs. There were no significant differences in height and weight in both groups. The mean Pre-operative SBP in group I was 126.33 ± 6.8 mmHg and in group II it was 125.46 ± 7.5 mmHg. The mean SBP after pre-medication in group I was 125.33 ± 5.4 mmHg and in group II it was 124.64 ± 4.9 mmHg. The Post-operative SBP was 117.74 ± 10.2 mmHg in group I and in group II it was 118.22 ± 5.69 mmHg. *Fisher's exact test* for p-value was >0.5 hence not significant. The mean DBP in group I pre-operatively was 79.28 ± 3.2 mmHg and in group II it was 78.97 ± 2.2 mmHg. The mean DBP in group I after pre-medication was 78.36 ± 2.5 mmHg and 77.89 ± 1.98 mmHg and post-operatively the values were 77.68 ± 2.33 and 78.22 ± 2.4 mmHg. The mean duration of surgery in group I was 95.23 ± 17.65 minutes and in group II it was 93.25 ± 19.87 minutes. The various surgical procedures carried out in both groups of patients are depicted in Table 2.

Table 2: Distribution of Surgical Procedures

Surgical Procedure	*Group-I (n=25) Buprenorphine*	*Group-II (n=25) Butorphanol*
Open Reduction + Pinning of fractured humerus	06	09
Open Reduction + Plating of fracture radius	10	05
Open Reduction + Plating of fracture ulna	04	04
Open Reduction Internal Fixation fracture radius & ulna	03	04
Tension Band Wiring Olecranon	01	02
Open Reduction Internal Fixation and K-wiring	01	01
Total	25	25

The onset of sensory blockade was 4.85 ± 1.1 minutes in group II and 3.51 ± 0.9 minutes. Similarly, the onset of motor block was 8.89 ± 3.2 minutes in group I and 5.85 ± 2.23 in group II. The onset of the complete block was at 16.59 ± 4.51 minutes in group I and 13.29 ± 2.11

minutes in group II the p values by Fischer's exact test found all the values were significant as depicted in table 3.

Table 3: Onset of block in minutes in both groups

The onset of block in minutes	*Group-I Buprenorphine*	*Group-II Butorphanol*	*P-values*
Sensory Block	4.85 ± 1.1	3.51 ± 0.9	0.012*
Motor Block	8.89 ± 3.2	5.85 ± 2.23	0.015*
Complete block	16.59 ± 4.51	13.29 ± 2.11	0.011*

* Significant

The VAS scores at different intervals of time were noted as shown in table 4. A critical analysis of table 4 reveals that group II had the mean VAS scores higher which indicates moderate pain and rescue analgesia was required in group II. In group I the mean VAS scores was less than 4 and the requirement of rescue analgesia was not necessary. The mean duration of analgesia was also greater in group I was 19.50 ± 5.5 hours compared to group II was 16.33 ± 6.7 hours.

Table 4: VAS scores in groups at various intervals

Visual Analogue Scale (VAS) Scores	*Group-I Buprenorphine*	*Group-II Butorphanol*	*P-values*
1 hour	1.25 ± 0.25	1.65 ± 0.65	0.240
2 hours	1.54 ± 0.65	2.70 ± 0.98	0.022
4 hours	2.55 ± 0.87	3.91 ± 1.07	0.154
6 hours	3.54 ± 1.10	5.02 ± 1.23	0.010*
8 hours	4.11 ± 1.22	6.33 ± 1.56	0.023*

* Significant

A total of n=7 patients developed complications out of which n=4 occurred in group I and n=3 occurred in group 2. The most common complication was vomiting followed by pruritis in n=1 cases each from both groups (table 5). No other side effects were observed in any groups. None of the patients in both groups developed complications of supraclavicular brachial plexus block such as pneumothorax or nerve palsy.

Table 5: complications noted in both the groups

Complications	*Group-I Buprenorphine*	*Group-II Butorphanol*	*P-values*
Vomiting	3	2	0.99
Pruritis	1	1	1.0
Urinary retention	0	0	0.0
Pneumothorax	0	0	0.0
Nerve palsy	0	0	0.0

Discussion

In peripheral sensory nerve fibers, a variety of receptors mediate nociception. The understanding of these receptors has been applied to a variety of adjuncts used in conjunction with local anesthetics. These additives are thought to not only extend the duration of analgesics but also lower systemic analgesic use and side effects. Various adjuncts, such as opioids, clonidine, verapamil, neostigmine, and tramadol, have been tested to prolong perioperative analgesia. [10] Despite the fact that the role of opioids as an adjunct has been contested for a long time, they are nevertheless widely used. The goal of this study was to examine the

analgesic efficacy of Butorphanol and Buprenorphine in brachial plexus block as adjuncts to local anesthetics. In the current study butorphanol and buprenorphine adjuvants in supraclavicular plexus block and we found buprenorphine group had delayed onset of sensory, motor blockage however, it had longer postoperative analgesia than the butorphanol group. In a similar study by Wajima Z et al., [11, 12] in their series of studies found Inj. Butorphanol in local anesthetic via continuous brachial plexus bock produced prolonged pain relief in postoperative periods. E. J Viel et al., [13] have found Inj. Buprenorphine at the dosage of μg/kg in supraclavicular brachial plexus block produces significantly longer pain relief than morphine after upper limb surgery. In our study the mean duration of analgesia was also greater in group I (buprenorphine) was 19.50 ± 5.5 hours compared to group II (butorphanol) was 16.33 ± 6.7 hours. S.J.V. Kameswararao et al., [14] in their study found the addition of buprenorphine to local anesthetic produced a longer duration of analgesia (22.18±12.13) hours as compared to butorphanol of (14.13±8.14hrs). A similar duration of analgesia has been observed by Bazin et al., [15] (median 20hrs). Candido et al., [16] found that the duration of analgesia caused by buprenorphine was three times greater than that produced by local anesthetics alone after buprenorphine administration. Post-operatively comparison of duration of post operative analgesia was done by visual analog scale score. At the end of 4 hours, none of the patients in both groups experienced severe pain. However, at the end of 6 hours in Group II, the mean VAS scores of > 4.0 indicated moderate pain and the requirement of rescue analgesia was present. In a similar study by C. N. Vinod et al., [17] the mean VAS scores were higher and the requirement of rescue analgesia was found to be present Butorphanol group as compared to the buprenorphine group agreeing with the observations of the present study. The incidence of postoperative complications was similar in both groups. The common complication was vomiting. EJ Viel et al., [13] in their study observed vomiting as the common complication following brachial plexus infusion with opioids and had greater analgesic action as compared to systemic administration. Therefore, a lower dose of opioids is required for administration in neurovascular sheath must be used instead of systemic administration to prevent the side effects of nausea and vomiting.

Conclusion

The present study found that the buprenorphine 100 μgm infusion along with local anesthetic in supraclavicular bocks produced slower onset of sensory, motor, and complete blocks as compared to butorphanol 1mg infusion along with local anesthetics. However, the duration of postoperative analgesia was greater in the buprenorphine group as compared to the butorphanol group. The mean VAS scores were higher in the butorphanol group at the end of 6 hours and the requirement for rescue analgesia was higher in the group. Therefore, buprenorphine appears to have higher efficacy and longer duration of action as compared to butorphanol for infusion along with local anesthetics for supraclavicular blocks.

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