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Original Research Article

Prolongation of Postoperative Analgesia by the Addition of Buprenorphine in Brachial Plexus Block

Neena Thomas[1], Mohamed Hussain Sait[2]

[1]Assistant Professor, Department of Anaesthesiology, Government T.D Medical College, Alappuzha, Kerala, India.
[2]Assistant Professor, Department of Anaesthesiology, Government Medical College, Thrissur, India.

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Corresponding author: Dr. Neena Thomas
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Abstract

Background: Prime goal for post operative pain management is to reduce or eliminate pain and discomfort with minimum side effects and as economically as possible. Several modalities are available with merits and demerits.

Aim: We wanted to study the effect of addition of Buprenorphine to local anaesthetic solution on the duration of analgesia in supraclavicular brachial plexus block.

Materials and Methods: This was a prospective, randomized, double blind study conducted after obtaining approval from Institutional ethical committee in the Department of Anaesthesiology of T.D. Medical College, Alappuzha, Kerala, over a period of one year from May 2008 to April 2009. The study population contained 50 patients of either sex in the age group of 20 to 60 years belonging to ASA I and ASA II undergoing elective Orthopaedic surgeries on upper limb and were randomly allocated into two groups A and B of 25 each.

Group A: The patients received supraclavicular brachial plexus block with 30 ml of 0.375% Bupivacaine. Group B: The patients received Supraclavicular brachial plexus block with 30ml of 0.375% Bupivacaine mixed with Buprenorphine 5 microgram/Kg body weight.

Results: Both groups were comparable with regard to sex, age, weight, onset of sensory block, onset of motor block, ASA grade and duration of motor blockade. Addition of Buprenorphine to local anaesthetic solution significantly prolonged the duration of postoperative analgesia.

Conclusion: Buprenorphine can be safely added to local anaesthetic solution in giving brachial plexus block for upper limb surgical procedures for prolongation of postoperative analgesia.

Keywords: Buprenorphine, Prolongation of Postoperative Analgesia, Local Anaesthetic.

Introduction

Pain relief is a basic human right and failure to relieve pain is morally and ethically unacceptable. The concept of post operative pain relief and its utilization has improved dramatically over recent years. Effective relief of pain is of paramount importance to anyone undergoing surgery.

Prime goal for post operative pain management is to reduce or eliminate pain and discomfort with minimum side effects and as economically as possible. Several modalities are available with merits and demerits.

Regional blocks remain a well-accepted component of comprehensive anaesthetic care. Brachial plexus block is a suitable alternative to General anaesthesia for surgeries of the upper limb. Bupivacaine and Lignocaine are the commonly used local anaesthetic drugs in Brachial plexus block. Over past few years, studies have suggested that the addition of certain opioids to the local anaesthetic used for Brachial plexus block may provide effective, long lasting post operative analgesia.

This study was conducted to assess the post operative analgesic effect of Buprenorphine, an agonist antagonist opioid when added to the local anaesthetic solution used for Brachial plexus block.

Aim & Objectives

Aim

To study the effect of addition of Buprenorphine to local anaesthetic solution on the duration of analgesia in supraclavicular brachial plexus block.

Objectives

1. To compare the onset of analgesia in the two group of patients.
2. To study whether there was any difference in the onset of motor blockade in the two groups.
3. To compare the duration of motor blockade in the two group.
4. To study the duration of post operative analgesia among the two groups.
5. To assess whether there was any difference in side effects among the two groups.

Materials and Methods

This was a prospective, randomized, double blind study conducted in the Department of Anaesthesiology, T.D. Medical College, Alappuzha, Kerala for one year from May 2008 to April 2009 after obtaining approval from Institutional ethical committee. The study population contained 50 patients of either sex in the age group of 20 to 60 years belonging to ASA I and ASA II undergoing elective orthopaedic surgeries on upper limb were included. 50 patients were randomly allocated into two groups A and B of 25 each.

Group A: The patients received supraclavicular brachial plexus block with 30 ml of 0.375% Bupivacaine.

Group B: The patients received Supraclavicular brachial plexus block with 30ml of 0.375% Bupivacaine mixed with Buprenorphine 5 microgram/Kg body weight.

Inclusion Criteria

- Age between 20 and 60 years.
- ASA Grade I and II
- Elective orthopaedic surgeries on hand and forearm.
- Weight 50 – 65kg.

Exclusion Criteria

- Patient refusal
- Age less than 20 years and more than 60 years.
- ASA Grade III and IV
- Patients with h/o. allergy to local anaesthetics and opioids.
- Patients with coagulation abnormality

Detailed history was taken, and thorough physical examination done; relevant investigations done. The procedure in detail explained to each patient and informed written consent obtained. All subjects were required to maintain nil per oral for 8 hours prior to surgery.

As the patients arrived in the operation room, monitors were attached. Blood pressure was recorded using noninvasive blood pressure (NIBP) cuff and 3 – Lead

ECG monitor attached for continuous monitoring of the heart rate. Pulse oximeter was placed.

Patient was placed supine with head turned to the opposite side of performing the block. Under all aseptic precautions, brachial plexus block performed via the supraclavicular approach using a 22G needle with a syringe containing local anaesthetic attached to it. The classical approach to supraclavicular block was used. Drugs used were as follows.

Group A:30ml of 0.375% Bupivacaine.

Group B:30ml of 0.375% Bupivacaine mixed with 5 microgram/kg of Buprenorphine

Adequacy of the block was assessed by the Pin prick test and motor power was assessed by using a modification of the Lowett Scale. Only those patients in whom a successful block was achieved were included in the study.

3 – Point sensory score.

Sharp pain on Pin Prick – 0

Touch sensation on Pin Prick – 1

Not even touch sensation - 2

Modified Lowett Scale

Normal muscle force - 6

Slightly reduced muscle force -5.

Pronounced reduction in muscle force - 4.

Slightly impaired mobility -3

Pronounced mobility impairment -2

Almost complete paralysis -1

Complete paralysis -0.

Vital parameters like Pulse, BP, Oxygen saturation, Respiratory rate were monitored throughout surgery. No analgesics were given in the intraoperative period.

An assessment was made for onset of analgesia, onset of motor block, duration of analgesia, duration of motor block and occurrence of any side effects during the first 24 hours of post operative period. Patient was monitored every hour for first eight hours, and thereafter every two hours, during the first 24 hours of post operative period. Vital signs and side effects were looked for. Patients were asked to report when pain occurred, and time was noted. Analgesics were given when the patient complained of discomfort with pain according to Mc Gill classification pain score 2. Systemic analgesic -inj. Diclofenac 50 mg was administered for such patients

Mc Gill scoring system

No pain - 0
Slight pain -1
Discomfort due to pain -2
Unbearable due to pain -3
Excruciating pain -4

Onset of sensory block.

Time taken from the injection of local anaesthetic solution to loss of Pin Prick sensation over the forearm – sensory score of 1.

Onset of motor blockade

Time taken from injection of local anaesthetic to loss of motor power (Modified Lowett scale </= 2).

Duration of sensory block

Time of onset of analgesia and the reappearance of pain, ie; till the administration of systemic analgesics. Injection diclofenac sodium was given as systemic analgesic.

Duration of motor block

Time between onset of motor block and the return of motor power (Modified Lowett scale >3).

Side effects

Side effects like drowsiness, nausea, vomiting, pruritus, urinary retention, hypotension, bradycardia and respiratory depression were looked for.

Statistical Analysis

In the present study, the data collected were entered into a master chart and statistical tables were prepared. Data were analyzed using computer software. In order to compare the quantitative data, the statistical constants like mean and standard deviation were computed. In the case of qualitative data, the association between the variables was tested statistically with the help of chi-square test. The equality of the mean value of the two groups was tested by applying student 't' test. P value of < 0.05 was considered to be statistically significant.

Results

50 patients in the age group of 20 – 60 years undergoing elective orthopaedic surgery on upper limb belonging to ASA grade I and II were studied. The patients were randomly allocated into two groups of 25 each.

Group A: Received brachial plexus block with 0.375% Bupivacaine 30ml.

Group B: Received brachial Plexus block with 0.375% Bupivacaine 30ml mixed with 5 microgram/kg of Buprenorphine.

Table 1

SEXB * SEXA Crosstabulation

			SEXA		
			1.00	2.00	Total
SEXB	1.00	Count	11	8	19
		Std. Residual	-.3	.4	
	2.00	Count	5	1	6
		Std. Residual	.6	-.8	
Total		Count	16	9	25

Chi square test for Sex- Estimate for difference: 0.44, 95% CI for difference: (-5.21, 6.09), The statistical test shows no significant difference. Therefore, the two groups were comparable.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.281[b]	1	.258		
Continuity Correction[a]	.415	1	.520		
Likelihood Ratio	1.400	1	.237		
Fisher's Exact Test				.364	.267
Linear-by-Linear Association	1.230	1	.267		
N of Valid Cases	25				

a. Computed only for a 2x2 table

b. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 2.16.

The Chi-square test shows that the two groups were independent

ASA B * ASA A Crosstabulation

			ASA A		
			1.00	2.00	Total
ASA B	1.00	Count	16	4	20
		Std. Residual	.2	-.4	
	2.00	Count	3	2	5
		Std. Residual	-.4	.7	
Total		Count	19	6	25

Chi Square test for ASA

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.877[b]	1	.349		
Continuity Correction[a]	.123	1	.725		
Likelihood Ratio	.808	1	.369		
Fisher's Exact Test				.562	.343
Linear-by-Linear Association	.842	1	.359		
N of Valid Cases	25				

a. Computed only for a 2x2 table

b. 3 cells (75.0%) have expected count less than 5. The minimum expected count is 1.20.

The Chi-square test shows that the two groups were independent, Estimate for difference: -5.44, 95% CI for difference: (-17.29, 6.41)

Table 2

Group	**N**	**Mean**	**SD**
Group B	25	56.68	4.02
Group A	25	57.0	4.43
Two-sample T for weight comparison between Group A and Group B			
T value = -0.27 P Value = 0.790, Estimate for difference: -0.32; 95% CI for difference: (-2.73, 2.09). The statistical test shows no significant difference. Therefore, the two groups were comparable.			
Group	**N**	**Mean**	**SD**
Group B	25	19.92	8.67
Group A	25	18.68	4.94
Two-sample T for Onset of Sensory Block comparison between Group A and Group B, The statistical test shows no significant difference. Therefore, the two groups were comparable.			
T Value = 0.62, P Value = 0. 538			
Group	**N**	**Mean**	**SD**
Group B	25	10.92	2.87
Group A	25	11.60	3.23
Two-sample T for Onset of motor block comparison between Group A and Group B			
T Value = -0.79, P Value = 0.435, Estimate for difference: 1.24, 95% CI for difference: (-2.80, 5.28), The statistical test shows no significant difference. Therefore, the two groups were comparable.			
Group	**N**	**Mean**	**SD**
Group B	25	118	23.5
Group A	25	123.4	17.7
Two-sample T for Duration of Surgery comparison between Group A and Group B Estimate for difference: -0.680, 95% CI for difference: (-2.418, 1.058). The statistical test shows no significant difference. Therefore, the two groups were comparable.			
T Value = -0.93, P Value = 0.360			
Group	**N**	**Mean**	**SD**
Group B	25	7.07	1.07
Group A	25	6.56	0.828
Two-sample T for Duration of motor block comparison between Group A and Group B Estimate for difference: 0.510, 95% CI for difference: (-0.047, 1.067). The statistical test shows no significant difference. Therefore, the two groups were comparable			

T Value = 1.84 P Value = 0.072			
Group	**N**	**Mean**	**SD**
Group B	25	15.91	1.84
Group A	25	8.24	1.15
Two-sample T for Duration of Sensory block comparison between Group A and Group B			
T Value = 17.65, P Value = 0.000 Estimate for difference: 7.666, 95% CI for difference: (6.788, 8.544). The statistical test shows that there was significant difference between the groups. Therefore, the two groups were significantly different.			

Discussion

Brachial Plexus block is one of the common and important anaesthetic technique for surgical procedures in the upper extremity. Several studies have suggested that addition of opioids to local anaesthetic used for brachial plexus block may provide effective, long lasting postoperative analgesia. Buprenorphine, an agonist antagonist opioid, has a higher affinity for opioid receptors. Because of its slow dissociation from opioid receptors and longer duration of action it is particularly suitable for this.

The present study was undertaken to assess the efficacy of addition of Buprenorphine to Bupivacaine for postoperative pain relief in brachial plexus block. This is a prospective randomized double-blind study conducted among 50 patients consisting of two groups A and B of 25 each. Group A received brachial plexus block with 30 ml of 0.375% Bupivacaine and group B with 30 ml of 0.375% Bupivacaine mixed with 5 microgram/Kg of Buprenorphine.

As seen, both groups were comparable with regards to age, weight, sex comparison ASA status and duration of surgery as evidenced by statistical analysis.

Mean time taken for onset of sensory block in group B was 19.92 ± 8.67 minutes and in group A 18.68 ± 4.94 minutes. This difference between the groups was statistically not significant. (P value = 0.538).

Mean time taken for onset of motor blockade in the group B was 10.92 ± 2.87 minutes and in group A was 11.60 ± 3.23 minutes. This difference between the groups was not significant (P = 0.435). In our study, the onset of motor block was faster than sensory block in both groups. This can be explained by 'Core and mantle' concept of Winnie et al, 1977 [1] .

The above two observations show that addition of Buprenorphine to the local anaesthetic solution has not altered the time of onset of motor blockade and the time of onset of sensory blockade. Hence addition of Buprenorphine has negligible effects in the onset time for sensory and motor blockade.

Ashok Jadon et al[2] conducted a study on forty patients undergoing upper limb surgery under supraclavicular subclavian perivascular brachial plexus block. Group-I (control group) patients received 30 ml 0.3% Bupivacaine + 1 ml saline and intramuscular 1ml drug (3µgkg-1 buprenorphine + saline to make volume= 1 ml). Group-II (study group) (n=20) patients received 30 ml 0.3% bupivacaine + 1 ml study drug (3µgk.kg-1 bupivacaine + saline to make volume= 1 ml) and 1 ml of intramuscular injection of saline. Results of their study showed that the addition of Buprenorphine to Bupivacaine in brachial plexus block did not affect the onset of sensory or motor blockade; but the complete sensory effect delayed significantly.

In the present study, the mean total duration of motor block in group B was 7.07 ± 1.07 hours and in group A was 6.5

± 0.828 hours. The difference between the groups was statistically not significant (P = 0.072). This shows that addition of Buprenorphine to local anaesthetic solution did not prolong the motor blockade. Asokh Jadon et al in their study found that difference in the mean duration of motor block between the groups was not significant, 300.9 +26.1 minutes in group 1 and 329.2+ 28.4 minutes in group II; P value <0.352. Our results were comparable with their observations.

In the present study, the mean duration of satisfactory analgesia was 15.91 ± 1.84 hrs in group B and in group A was 8.24 ± 1.15 hrs. The difference in duration between the groups was significant. P value < 0.05. Addition of Buprenorphine to local anaesthetic solution had significantly prolonged (about 2 times) the duration of post operative analgesia.

Ashok Jadon et al in their study also found significant difference in the duration of postoperative analgesia between the groups. In group I, the mean duration of satisfactory analgesia was 331.2 + 33.54 minutes and in group II was 680.6+86.27 difference in duration between the groups was significant (P <0.001)

Viel et al[3] in their study involving 40 patients for supraclavicular brachial plexus block showed that Buprenorphine when added to Bupivacaine for brachial plexus block duration of analgesia was 35.05± 1.95 hours.

J.E Bazin et al[4] in their study compared the duration of analgesia produced by a mixture of Lignocaine and Bupivacaine, either alone or combined with Morphine, Buprenorphine or Sufentanil in 80 patients after brachial plexus block for orthopaedic surgery of the upper limb. They concluded that addition of an opioid to local anaesthetic mixture lengthens the duration of analgesia.

Candido K D et al[5] in their study, found that addition of Buprenorphine to the local anesthetic used for brachial plexus block , significantly prolonged the duration of postoperative analgesia. Duration of postoperative analgesia was 5.3±0.15 hours local anaesthetic was used alone as compared with 17.4±1.26 hours when Buprenorphine was added, a difference that was statistically significant. Results of our study were comparable with the above studies[6].

Patients were observed for the side effects of Buprenorphine such as nausea, vomiting Pruritus drowsiness and respiratory depression. In group B, 2 patients had nausea and 1 patient had vomiting. In group A, 2 patients had nausea. The side effects observed in both the groups were clinically not significant. A clinically significant level of other side effects were not observed.

No complications related to brachial plexus block technique were observed.

Conclusion

From the present study it can be concluded that the addition of Buprenorphine to local anaesthetics in brachial plexus block significantly prolongs the duration of postoperative analgesia. No significant side effects were observed, and vital parameters were stable. Addition of Buprenorphine has no effects in onset time for sensory and motor blockade. Therefore, Buprenorphine can be safely added to local anaesthetic solution in giving brachial plexus block for upper limb surgical procedures for prolongation of postoperative analgesia. This practice can be of particular benefit to patients undergoing ambulatory upper extremity surgery by providing analgesia after discharge from the hospital.

Authors contribution

Dr. Neena Thomas- Concept and design of the work, Data collection, Data analysis and interpretation

Dr. Mohamed Hussain Sait- Drafting the article, Critical revision of the article,

Final approval of the version to be published.

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