COMPARATIVE STUDY OF 0.5% BUPIVACAINE AND 0.5% BUPIVACAINE PLUS BUPRENORPHINE FOR BRACHIAL PLEXUS BLOCK

G. Rajendra¹, G. Hanumanth Rao², B. Deepraj Singh³, Kaka Madhuravani⁴

¹Associate Professor, Department of Anaesthesiology, Government Medical College, Nizamabad, Telangana State.

²Assistant Professor, Department of Anaesthesiology, MGM Hospital, Kakatiya Medical College, Warangal, Telangana State.

³Professor, Department of Anaesthesiology, Govt ENT Hospital, Osmania Medical College, Hyderabad.

⁴Senior Resident, Department of Anaesthesiology, Global Hospital, Hyderabad.

ABSTRACT

Opioids are well studied adjuncts, although the evidence regarding the analgesic benefit of opioid adjuncts remains equivocal. The effectiveness of 0.5% Bupivacaine and 0.5% Bupivacaine plus buprenorphine into brachial plexus sheath was evaluated. The study was a prospective, randomized, double blind and comparative study carried out; 60 ASA I and II patients undergoing elective upper limb surgeries, aged between 16-70 years were randomly allocated into two groups of 30 each. All patients received 0.5% of Bupivacaine at 2mg/kg body weight. In addition, 30 patients in group B received Buprenorphine hydrochloride (2µg/kg). Using VAS score the analgesia was evaluated every hourly for six hours, every two hours for next twelve hours and then every sixth hourly till 48 hours.

RESULT

A significant difference in the duration of analgesia was found between the groups. The duration of analgesia was longer in Bupivacaine plus Buprenorphine group than Bupivacaine group (22.18+/-12.13 hrs versus 14.13+/-8.41 hrs).

CONCLUSION

We conclude that Buprenorphine as an adjunct administered with local anesthetics into brachial plexus sheath is an efficient way to prolong the duration of analgesia for the peri-operative pain in upper limb surgery.

KEYWORDS

Analgesics, Buprenorphine, Bupivacaine; Pain, Peri-Operative, Anaesthesia, Conduction: Brachial Plexus.

HOW TO CITE THIS ARTICLE: G. Rajendra, G. Hanumanth Rao, B. Deepraj Singh, Kaka Madhuravani. "Comparative Study of 0.5% Bupivacaine and 0.5% Bupivacaine Plus Buprenorphine for Brachial Plexus Block." Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 101, December 17; Page: 16646-16654, DOI: 10.14260/jemds/2015/2485

INTRODUCTION

General anaesthesia was one of the most common methods employed to provide anaesthesia for upper limb surgeries. With the introduction of newer and safer local anaesthetics and better advantages, regional anaesthesia.¹ has taken over as the principle technique for upper limb surgeries. There are many advantages of neural blockade.² with brachial plexus block for upper limb surgeries over general anaesthesia, namely.

- Effective analgesia with good motor blockade.
- Awake patient.
- Extended post-operative analgesia.
- Early ambulation.
- Early resumption of oral feeding.
- Minimal number of drugs used so that polypharmacy is avoided.
- No airway manipulation.
- Less incidence of post-operative nausea and vomiting.

Various approaches of brachial plexus block have been used for upper limb surgeries namely.

- Interscalene approach.
- Supraclavicular approach.
- Infraclavicular approach.
- Axillary approach.

Among these approaches supraclavicular and infraclavicular techniques are more effective in producing complete anaesthesia of all the branches of the brachial plexus as the narrowest part of the plexus is encountered by these techniques.

Supraclavicular approach is easier than the infraclavicular approach as the plexus is more superficial above the clavicle.

Various local anesthetics have been used to produce brachial plexus block.

Bupivacaine 0.5% is one of the most popular drugs used because of its higher potency and prolonged duration of action. One of the drawbacks of Bupivacaine is its cardiotoxicity, especially when injected accidentally into the subclavian artery. The cardiotoxicity may be life-threatening as the dysrhythmias that are produced are resistant to all routinely used antiarrhythmics. The limitations of local anaesthetics are slower onset of action, shorter duration of action and prolonged motor and sensory blockade. Different adjuncts have been tried to fill the lacunae created by the local anaesthetics.

The novel approaches are alkalization of local anaesthetics, carbonation, addition of opiates with morphine.^{3,4,5} calcium channel blockers (Verapamil), clonidine. The existence of opioid receptors⁶ in peripheral nerve tissue has led to investigation of incorporating small doses of opioids in peripheral nerve blocks, hoping to achieve analgesia with minimal central side effects. Hence, pain relief

Financial or Other, Competing Interest: None.

Submission 19-11-2015, Peer Review 20-11-2015,

Acceptance 10-12-2015, Published 16-12-2015.

Corresponding Author:

Dr. Deepraj Singh B,

1-7-145/15 opp. Usha Mayuri Theatre,

Musheerabad,

Hyderabad,

Telangana-500020.

E-mail: drdeepraj@gmail.com

DOI:10.14260/jemds/2015/2485

using opioids using fentanyl sufentanil.⁷ admixed with local anaesthetics for peripheral nerve block has been tried.

Buprenorphine, a semi-synthetic the baine congener is thirty to thirty five times more potent than morphine. It has a longer duration of action due to high affinity to μ type opioid receptor. Therefore, a comparative study with 0.5% Bupivacaine and 0.5% Bupivacaine with Buprenorphine in brachial plexus block through supraclavicular approach for upper limb surgery is desired to improve the onset, quality and duration of analgesia.

The objective of the study is to compare the duration of sensory and motor blockade along with the duration of analgesia between 0.5% Bupivacaine and 0.5% Bupivacaine with Buprenorphine.

METHODOLOGY

Sixty patients admitted to hospital attached to Dr. PSIMS and RF, Chinoutpalli, Vijayawada, undergoing upper limb surgery lasting more than thirty minute were included in the study. The elective surgical interventions were internal fixation of bones with plates and screws, excision of bone cysts, reconstructive and other surgeries involving upper limb.

Inclusion Criteria

1. Patients with ASA1 and II physical status.
2. The age group of 16 to 70 years.
3. Both sexes.
4. Undergoing elective surgeries.

Exclusion Criteria

1. Patients with age less than 16 and greater than 60 years.
2. Patients with coagulopathy or on anti-coagulants.
3. Patients with peripheral neuropathy.
4. Patients who had received opioid in the past twelve hours.
5. Patients with history of substance abuse.
6. Local cutaneous infections.
7. Pregnant patients.
8. Patients with allergy to local anaesthetics and Buprenorphine.
9. ASA class III and IV patients.
10. Patients undergoing emergency surgical procedures.

Preoperative Preparation

The study protocol was approved by the hospital ethical committee. All the patients underwent thorough preanaesthetic evaluation on the day prior to surgery. All systems were examined including airway and the surface anatomy where the block was going to be given. The anaesthetic procedure to be carried out was explained.

They were informed about development of paresthesia. Patients were reassured to alleviate their anxieties. A written informed consent was taken. They were educated regarding the visual analogue scale. All the patients were put on overnight fasting. All of them received Tablet. Alprazolam 0.5mg and Tablet. Ranitidine 150mg night before the surgery.

Basic laboratory investigations were conducted including haemogram, urine analysis and whenever needed chest x-ray, electrocardiogram, blood sugar.

Method of Collection of Data

Supraclavicular brachial plexus block was carried out as an elective procedure on the patients undergoing upper limb surgery. Sixty patients were randomly allocated into two groups (group A, n=30 and group B, n=30) in double blind fashion. All drug solutions were prepared by an anaesthesiologist not involved in administration of anaesthesia, patient care and data collection.

Group A (n=30)

Received brachial plexus block with 0.5% Bupivacaine at the dose of 2mg/kg body weight.

Group B (n=30)

Received brachial plexus block with 0.5 % Bupivacaine plus Buprenorphine 2 μ g/kg into the solution.

All the necessary equipments and drugs needed for administration of general anaesthesia and for resuscitation were kept ready in order to manage in case of failed block or toxic reactions occurring during the procedure.

PROCEDURE

Intravenous access was secured with 18-G cannula. The following monitors were connected to the patients in the operating room.

1. Pulse oximeter.
2. Noninvasive blood pressure monitor.
3. Three lead ECG monitoring.

Under aseptic precautions brachial plexus block was performed by Supraclavicular method. Group A received 0.5% Bupivacaine at the dose of 2mg/kg body weight Group B received 0.5% Bupivacaine at the dose of 2mg/kg body weight plus Buprenorphine 2 μ g/kg. A separate 5ml injection of 1% lignocaine plain was made for an intercostobrachial nerve block in the axilla to provide anaesthesia for application of tourniquet.

The effects of anaesthetics on the following parameters were observed

1. The time of onset for sensory blockade, defined as time between injection and total abolition of pinprick response was evaluated in four nerve areas (radial, ulnar, median and musculocutaneous) at every 3 minutes until 45 minutes after the injection. The block was judged to be failed if anaesthesia was not present in 2 or more peripheral nerve distribution and such patients were excluded from the study.
2. The duration of sensory blockade, defined as the time between onset of action and return of pinprick response, was assessed every 30 minutes in at least 3 major nerve territory.
3. The duration of analgesia, defined as the time between the onset of action and the onset of pain, was the time when the patients received the first dose of analgesic. Supplemental analgesia was given in the form of intramuscular inj Diclofenac sodium 50 to 75mg, when visual analogue scale score was more than.
4. The duration of motor blockade was assessed every 30 minutes till the return of complete muscle power in at least 2 major nerve distributions.

During surgery pulse, non-invasive blood pressure and peripheral oxygen saturation through pulse oximetry were monitored. Patients were evaluated postoperatively every hourly for first six hours, second hourly for next twelve hours for the following parameters –intensity of pain, motor and sensory recovery. Patients were also monitored for the side effects of opioids including nausea, vomiting, drowsiness, pruritis and urinary retention. The intensity of pain was assessed using visual analogue scale (vas) score. This scale consists of a 100mm line on which the patients represented the degree of pain he/she was experiencing by placing a point somewhere between “no pain” (“0”) and the worst pain ever experienced (“100”). The supplemental analgesia was given in the form of inj. Diclofenac 50-75mg IM, when VAS score was more than 40mm or 4.

OBSERVATIONS AND RESULTS**Study Design**

Both groups had predominantly male patients, accounting for nearly 2/3 of the total study population in each group. There was no significant difference in age, weight and sex distribution.

Study Period	Heart Rate Beats/min				P value
	Group A (n=30)		Group B (n=30)		
	Mean	SD	Mean	SD	
Baseline	91.27	12.01	90.47	9.59	0.7766
5 th minute	101.53	14.54	101.00	14.92	0.8890
10 th minute	106.33	13.56	101.07	13.65	0.1392
15 th minute	104.70	12.50	101.10	14.56	0.3085
20 th minute	101.63	12.31	101.47	13.50	0.9603
25 th minute	100.07	10.90	99.23	13.02	0.7890
30 th minute	97.87	12.58	96.37	12.00	0.6383
45 th minute	95.33	12.20	94.53	11.62	0.7957
60 th minute	92.93	8.86	93.30	10.39	0.8836
75 th minute	91.23	8.72	90.33	9.79	0.7082
90 th minute	89.00	10.04	88.80	9.23	0.9363
2 nd hour	88.23	8.24	88.07	10.19	0.9447
3 rd hour	84.93	8.30	84.90	8.88	0.9881
4 th hour	83.20	9.29	85.33	8.41	0.3548
5 th hour	82.60	8.68	84.43	7.75	0.3918
6 th hour	82.23	8.56	84.20	6.84	0.3297
7 th hour	82.00	9.07	83.93	7.49	0.3717
8 th hour	84.47	9.36	83.87	8.06	0.7912
9 th hour	87.13	10.55	82.47	7.55	0.0536
10 th hour	89.50	10.31	81.93	7.42	0.0018**
11 th hour	91.07	9.72	80.53	6.77	0.0000**
12 th hour	91.53	10.25	82.80	7.23	0.0003**
13 th hour	89.40	10.42	82.53	8.48	0.0070**
14 th hour	88.07	9.66	84.00	8.37	0.0868
15 th hour	86.33	10.04	85.53	11.22	0.7721
16 th hour	85.60	9.98	88.00	10.73	0.3734
18 th hour	83.53	9.00	86.93	9.98	0.1710
20 th hour	82.30	8.00	85.07	10.28	0.2492
24 th hour	81.23	7.96	83.67	9.47	0.2857
28 th hour	80.70	8.09	79.47	7.18	0.5348
32 nd hour	80.47	8.80	79.27	7.11	0.5636
38 th hour	79.40	8.87	78.80	6.57	0.7670
42 nd hour	78.93	7.62	78.60	6.56	0.8566
48 th hour	78.80	7.06	78.07	7.04	0.6884
Table 1: Comparison of Heart Rate between two groups					

Table 1: Comparison of Heart Rate between two groups

**Highly significant

This chart comparing the heart rate pattern of both groups show statistical significance at 10th to 13th hour of the study period, although they are within an acceptable clinical range.

Study Period	Systolic BP in mmHg				P value
	Group A (n=30)		Group B (n=30)		
	Mean	SD	Mean	SD	
Baseline	134.07	6.54	135.60	5.64	0.3350
5 th minute	134.67	4.99	136.87	5.77	0.1197
10 th minute	135.53	4.26	138.20	5.10	0.0319
15 th minute	134.67	5.69	136.67	4.15	0.1251
20 th minute	134.40	5.39	135.07	4.26	0.5971
25 th minute	133.07	6.27	135.53	4.32	0.0814
30 th minute	132.13	5.53	134.00	4.36	0.1521
45 th minute	131.60	7.40	132.73	5.00	0.4896
60 th minute	131.20	5.79	132.80	5.60	0.2811
75 th minute	130.80	5.50	131.87	4.81	0.4272
90 th minute	129.27	5.24	131.93	5.24	0.0534
2 nd hour	128.40	5.83	130.53	4.17	0.1086
3 rd hour	129.20	6.36	130.30	4.66	0.4479
4 th hour	128.60	6.46	129.67	5.04	0.4786
5 th hour	128.13	6.30	129.27	4.25	0.4174
6 th hour	127.60	6.61	128.40	4.38	0.5826
7 th hour	129.93	6.42	128.37	4.44	0.2764
8 th hour	131.40	6.91	128.43	5.72	0.0752
9 th hour	134.13	7.88	129.10	5.61	0.0060**
10 th hour	135.73	7.94	127.93	5.32	0.0000**
11 th hour	135.53	7.33	129.60	4.85	0.0005**
12 th hour	135.00	8.25	131.30	4.59	0.0360
13 th hour	131.40	7.81	132.40	5.26	0.5631
14 th hour	129.60	6.51	133.93	6.46	0.0122*
15 th hour	130.40	7.40	135.73	6.41	0.0041**
16 th hour	128.67	8.83	135.93	7.34	0.0010**
18 th hour	127.00	6.21	134.93	7.46	0.0000**
20 th hour	126.93	6.86	131.13	4.95	0.0086**
24 th hour	125.50	6.69	130.80	6.27	0.0025**
28 th hour	125.60	5.49	127.73	5.58	0.1409
32 nd hour	128.57	6.02	127.07	4.69	0.2862
38 th hour	125.80	7.92	126.87	4.48	0.5233
42 nd hour	124.73	7.44	124.07	3.17	0.653
48 th hour	124.00	7.14	123.03	3.09	0.744
Table 2: Comparison of Systolic BP between two groups					

Table 2: Comparison of Systolic BP between two groups

In this chart, the compared systolic blood pressure changes between two groups show statistical significance between 9th to 11th and 14th, 15th, 16th, 18th, 20th and 24th hours.

Study Period	Diastolic BP in mmHg				P value
	Group A (n=30)		Group B (n=30)		
	Mean	SD	Mean	SD	
Baseline	86.07	5.13	85.87	5.63	0.8862
5 th minute	87.40	3.68	87.13	4.95	0.8136
10 th minute	86.73	5.62	86.93	4.69	0.8816
15 th minute	86.20	4.94	87.27	4.41	0.3811
20 th minute	85.40	4.40	87.00	5.14	0.2003
25 th minute	85.73	4.69	86.07	4.91	0.7890
30 th minute	85.13	5.19	85.60	4.85	0.7204
45 th minute	86.27	5.11	85.13	4.78	0.3786
60 th minute	85.00	4.86	85.00	4.72	1.0000
75 th minute	84.67	5.07	85.47	4.95	0.5390
90 th minute	83.53	4.95	84.40	5.21	0.5114
2 nd hour	83.20	4.29	84.27	5.25	0.3920
3 rd hour	81.73	9.30	82.73	4.47	0.5977
4 th hour	82.70	4.98	82.63	5.23	0.9598
5 th hour	81.73	4.09	82.07	5.00	0.7784
6 th hour	82.53	3.79	81.40	5.10	0.3322
7 th hour	82.40	3.87	80.33	5.54	0.0992
8 th hour	83.80	4.05	80.00	5.71	0.0043**
9 th hour	85.67	5.63	80.53	5.06	0.0005**
10 th hour	87.40	6.22	81.27	5.13	0.0001***
11 th hour	88.07	5.62	82.00	5.85	0.0001**
12 th hour	87.33	4.71	83.00	5.32	0.0015**
13 th hour	86.33	4.90	84.07	5.16	0.0863
14 th hour	83.60	4.31	84.47	4.92	0.4709
15 th hour	83.73	5.14	85.33	6.27	0.2840
16 th hour	83.27	5.21	84.87	7.29	0.3322
18 th hour	81.13	5.55	85.13	6.30	0.0115*
20 th hour	81.20	5.11	83.80	5.05	0.0500*
24 th hour	81.00	5.80	83.87	5.56	0.0500*
28 th hour	80.33	5.12	81.47	5.46	0.4102
32 nd hour	80.33	6.06	80.13	5.38	0.8929
38 th hour	80.07	5.21	80.07	4.65	1.0000
42 nd hour	79.60	5.47	80.07	5.00	0.7313
48 th hour	79.33	3.98	80.33	4.20	0.3479
Table3: Comparison of Diastolic BP between two groups					

Table3: Comparison of Diastolic BP between two groups

The compared diastolic blood pressure between two groups show statistical significance between 8th to 12th hrs and 18th, 20th and 24th hrs.

Study Period

Study Period	<div> <div>VAS Score</div> <div>(0=No pain 10=Pain)</div> </div>				P value
	Group A (n=30)		Group B (n=30)		
	Mean	SD	Mean	SD	
1 st hour	0.37	0.49	0.63	0.76	0.220
2 nd hour	1.30	0.95	0.87	0.86	0.086
3 rd hour	1.83	0.79	1.17	0.79	0.002**
4 th hour	2.13	0.86	2.00	0.79	0.550
5 th hour	2.50	0.90	2.33	0.80	0.330
6 th hour	2.83	1.02	2.60	0.77	0.180
7 th hour	3.27	0.91	3.03	0.81	0.335
8 th hour	3.50	0.63	3.37	0.67	0.422
9 th hour	3.97	1.07	3.40	0.62	0.036*
10 th hour	4.00	0.83	3.57	0.63	0.065
11 th hour	4.23	1.07	3.57	0.73	0.006**
12 th hour	4.47	1.38	3.77	0.90	0.037*
13 th hour	4.10	0.99	3.67	0.80	0.038*
14 th hour	3.77	0.77	3.70	0.70	0.612
15 th hour	3.60	1.00	4.07	1.36	0.141
16 th hour	4.06	1.77	4.07	1.17	0.385
17 th hour	3.53	0.97	3.97	0.96	0.050*
18 th hour	3.17	0.70	3.90	1.03	0.003**
19-24hour	3.60	1.13	3.87	0.90	0.160
25-30hour	3.53	0.86	3.60	0.72	0.742
31-36hour	3.63	0.96	3.37	0.76	0.422
37-42hour	3.23	0.86	3.07	0.64	0.602
43-48hour	2.83	0.65	2.77	0.43	0.775

Table 4: Comparison of VAS score between the two groups

Table 4: Comparison of VAS score between the two groups

The patients were assessed for postoperative pain using visual analogue scale score. The above graph compares the VAS scores between the two groups with statistical significance at 3rd, 9th, 11th to 13th, 17th and 18th hrs of the study period.

Study Parameters	Group A (n=30)		Group B (n=30)		P value
	Mean	SD	Mean	SD	
Time of onset (Minutes)	20.47	3.64	19.47	4.90	0.373
Duration of Surgery (Minutes)	79.50	26.27	84.33	37.27	0.564
Duration of Sensory blockade (Minutes)	385.67	66.67	380.50	80.15	0.787
Duration of Motor blockade (Minutes)	367.40	71.43	360.00	77.87	0.705
Duration of Analgesia (Hours)	14.13	8.41	22.18	12.13	0.004**

Table 5: Comparison of Study parameters between two groups

In the above chart the average time of onset was 20.47+/-3.64min in-group A and 19.49+/- 4.90min in-group B. The average duration of surgeries were 79.50+/-26.27min and 84.33+/-37.27min in groups A and B respectively. The observed average duration of sensory blockade was 385.67+/-66.67min in group A and 380.50+/-80.15min in group B. The average duration of motor blockade was 367.40+/-71.43 in group A and 360.0+/-77.87min in group B respectively. There was no statistical significance in terms of onset, durations of surgery, sensory blockade and motor blockade between the two groups however the average duration of analgesia were 14.13+/-8.41 hrs and 22.18+/-12.13 hrs in groups A and B respectively, showed statistical significance. The group B showed prolonged analgesia produced by addition of buprenorphine to local anaesthetics.

Fig.1: Graph Comparing the Time of Onset of Action

Fig.5: Graph Comparing the Duration of Analgesia

Fig.2: Graph Comparing Duration of Surgery

Fig.6: Comparison of Side Effects between the Two Groups

Fig.3: Graph Comparing Duration of Sensory Blockade

Fig.4: Graph Comparing the Duration of Motor Blockade

Side Effects	Group A (n=30)	Group B (n=30)
Nausea	3(10.0%)	3(10.0%)
Vomiting	2(6.7%)	1(3.3%)
Numbness	1(3.3%)	1(3.3%)
No side effects	24(80.0%)	25(83.3%)
Inference	Side effects are statistically similar between the two groups with P=0.739.	

Table 6: Comparison of side effects between the two groups

This chart compares the side effects between the two groups. The observed parameters like nausea, vomiting and numbness were comparable in both groups without any significance.

Statistical Methods

Chi-Square and Fisher Exact test has been used to find the homogeneity of sex distribution between the two groups and student 't' test has been used to find the homogeneity age and weight distribution between the two groups. Student 't' test (Two tailed) has been used to find significant difference of hemodynamics between the two groups and the study parameters namely time of onset, duration of surgery, duration of motor and sensory blockade and duration of analgesia between the two groups. Mann Whitney U test has been used to assess the significant difference of VAS score between the two groups. Chi-Square and Fisher Exact test has been used to find significant difference of incidence of side effects between the two groups. The statistical software used were SPSS.12.0.1 for windows and statistics.

DISCUSSION

Varieties of receptors mediate nociception in peripheral sensory nerve fibers. The knowledge of these receptors has been used in the form of various adjuncts administered along with local anaesthetics. These adjuncts may not only prolong the analgesic duration, but also thought to reduce the systemic analgesic consumption as well as their side effects. To prolong perioperative analgesia various adjuncts such as opioids, clonidine, verapamil, neostigmine and tramadol have been tried. Although the role of opioid as an adjunct has been debated over a long period, it is still in regular use. The objective of this study was to compare the analgesic efficacy between Bupivacaine alone and Buprenorphine as an adjunct to local anaesthetics in brachial plexus block.

The study was a prospective, randomized, double blind study carried out at Dr. PSIMS and RF, Chinoutpalli, Gannavaram. Sixty patients belonging to ASA I and II physical status patients undergoing upper limb surgeries were included in the study.

In our study we observed that there was no change in the time of onset of sensory blockade between two groups. However, Fletcher et al.⁽⁸⁾ had an early onset of block with fentanyl. The pH of the injected solution around the nerve would certainly influence the onset of action.

The other block characteristics like duration of sensory and motor blockade were similar in both groups. It was observed by the studies conducted by Bourke et al.⁽⁹⁾ Kardash et al.⁽¹⁰⁾ and Henri Racz et al.⁽¹¹⁾ that addition of morphine to local anaesthetic solution for axillary block did not change the onset time.

We observed that addition of buprenorphine to local anaesthetic solution produced much longer acting analgesia (22.18+/-12.13 hrs) than produced by addition of butorphanol (14.13+/-8.41 hrs). Murphy¹² et al. and Bazin et al. had observed a similar duration of analgesia (Median 20 hrs) on buprenorphine administration. In a similar way Candido et al.⁽¹³⁾ has observed duration of analgesia produced with buprenorphine 3 times longer than that produced by local anaesthetics alone. Wajima et al.⁽¹⁴⁾ has also found satisfactory and prolonged analgesia with butorphanol administered as continuous intrabrachial infusion.

The prolonged analgesic duration observed with buprenorphine may be attributed to its high affinity for the mu opioid receptor and high lipid solubility, which favors easy penetration through the axonal myelin and nerve membrane. The other factor that might have influenced the protracted analgesia of buprenorphine was its potency. Buprenorphine is 33 to 35 times more potent than morphine when compared with butorphanol, which is only 3.5 to 7 times more potent. The proposed different mechanisms for the opioid mediated analgesia are - It has more of a central action than direct peripheral action.

The transport of the administered drug into extradural or subarachnoid space either by diffusion or by the centripetal axonal transport results in central action. The presence of bidirectional axonal transport of opioid binding receptor has been already confirmed. This thought has been questioned by Dahl et al.⁽¹⁵⁾ He compared the effects of morphine injected extradurally with that injected periferomally. He concluded that if centripetal axonal transport exists, it was clinically not significant. Christen et al. later confirmed that morphine concentration in CSF were similar after periferomral or IM injection.

The expression of opioid receptors during the time of inflammation has been the other proposed mechanism of action. Mays et al.⁽¹⁶⁾ obtained long lasting pain relief of up to 24 hrs when 6mg of morphine was given in 30ml of saline into brachial plexus sheath for chronic pain relief. But most of the studies conducted for the post-operative pain relief during

minimal inflammation have come out with better analgesic durations. The electrophysiological study results with morphine, pethidine, fentanyl or sufentanil have suggested that opioids may exert a nonspecific action on nerves by impairing sodium and potassium conduction.

The presence of variety of receptors and the difference in the affinity of the administered drug to the receptor can be alternative explanation to the longer duration of analgesia produced by buprenorphine than butorphanol. Buprenorphine has high affinity for mu- opioid receptor, whereas butorphanol is kappa agonist with moderate affinity. Gobeaux et al. in his first study observed a significant reduction in time of onset with fentanyl 0.1mg administered into axillary sheath along with local anaesthetics.

However, there was no prolongation of analgesic duration. In his second study he found prolonged analgesia with pethidine 100 mg without any change in onset time. They concluded that varying results were due to greater lipid solubility of fentanyl and pethidine compared to morphine. The same fact allows greater distribution of the drug at the site of action as afferent nociceptive fibers are surrounded by a layer of myelin which presents a significant obstruction to water soluble agents.

We found no significant difference with respect to side effects like nausea, vomiting numbness between the two groups. At the same time there were no incidences of pruritis, respiratory depression or urinary retention.

The significant changes observed with respect to hemodynamic parameters were due to variability in the onset of pain between the two groups. The early raise of heart rate and blood pressure in group A were due to analgesic wear off. The same occurred in group B in the later period. On an average the number of supplemental Diclofenac sodium injections received were two in group A, whereas patients in group B received one supplement over 48hrs.

SUMMARY AND CONCLUSION

Opioids are known to enhance the analgesia when administered with local anaesthetics as adjuncts. We compared the analgesic effects of plain 0.5% bupivacaine and 0.5% bupivacaine plus buprenorphine solution into brachial plexus sheath in 60 patients undergoing upper extremity orthopedic surgeries. Patients were randomized into two groups of 30 each. All patients received supraclavicular brachial plexus block with 0.5% bupivacaine 2mg/kg body weight and in addition, 30 patients in group B received Buprenorphine hydrochloride (2µg/kg). Using VAS score the analgesia was evaluated every hourly for six hours, every two hours for next twelve hours and then every sixth hourly till 48 hours.

The onset of sensory block was 20.47+/-3.64min in group A and 19.49+/-4.90min in group B. There was no significant difference in time of onset of sensory blockade ($p=0.373$). (Time between injection and total abolition of pinprick response).

Duration of sensory blockade (The time between injection and complete recovery from sensory disturbance) was comparable in both groups (Group A 385.67+/-66.67 min, group B 380.50+/-80.15 min) without any statistical significance ($p=0.787$). The duration of motor blockade was also comparable in group A 367.40+/-71.43 min and group B 360.0+/-77.87 min without any statistical significance ($p=0.705$). The duration of analgesia was prolonged in group B 22.18+/-12.13 hrs, when compared with group A 14.13+/-8.41hrs. This difference was statistically significant ($p=0.004^{**}$). ($^{**}p<0.05$ is statistically significant). Side effects are statistically similar between the two groups with $P=0.739$.

CONCLUSION

We conclude that Buprenorphine as an adjunct administered with local anesthetics into brachial plexus sheath is an efficient way to prolong the duration of analgesia for the peri-operative pain in upper limb surgery.

REFERENCES

1. Atkinson RS, Rushman GB, Davies. Regional Anaesthesia in Lee's synopsis of anaesthesia. 11th ed. Butterworth Heinman publisher 1993;642-648.
2. David L, Brown B, Raymond Fink. The History of Neural Blockade and Pain Management. Michael J Cousins, Phillip O, Bridenbaugh's neural blockade in clinical anesthesia and management of pain. 3rd ed. Lippincott-Raven publisher; 1998;3-25.
3. Downing JW, Leary WP, White ES. Buprenorphine: A new potent long acting synthetic analgesic, Comparison with morphine. Br J Anaesth 1977;49:251-255.
4. Young WS, Wamsley JK, Zarbin MA, et al. Opioid receptors undergo axonal flow. Science 1980;210:76-77.
5. Fields HL, Emson PC, Leigh BK, et al.; Multiple opiate receptor sites on primary afferent fibers. Nature 1980;284:351-353.
6. Sanche ZR, Nielsen H, Heslet Liversen AD. Neuronal blockade with morphine, a hypothesis. Anaesthesia 1984;39:788-789.
7. Gissen AJ, Gugino LD, Datta S, et al. Effects of fentanyl and sufentanil on mammalian nerves. Anesthesia and Analgesia 1987;66:1272-1275.
8. Fletcher D, Kuhlman G, Samii K. Addition of fentanyl to 1.5% lidocaine does not increase the success of axillary block. Reg Anesth 1994;19:183-8.
9. Bourke DL, Furman WR. Improved postoperative analgesia with morphine added to axillary block solution. J Clin Anesth 1993;4:114-7.
10. Kardash K, Schools A. Effects of brachial plexus fentanyl on supraclavicular block. Reg Anesth 1995;20:311-5.S
11. Racz H, Gunning K, Santa D. Evaluation of effect of perineuronal morphine on the quality of postop analgesia after axillary plexus block Anesthesia Analgesia 1991;72:769-76.
12. Murphy DB, McCartney CJ, Chan VW. Novel analgesic adjuncts for brachial plexus block; a systemic review. Anesth Analg 2000;90:1122-8.
13. Candido KD, Franco CD, Khan MA, et al. Buprenorphine added to local anesthetic for brachial plexus block to provide postoperative analgesia in outpatients. Reg Anesth Pain Med 2002;27(3):336.
14. Wajima Z, Nakajima Y, Kim N. IV compared with brachial plexus infusion of butorphanol for post-operative analgesia. Br J Anesth 1995;74:392-5.
15. Eric J Veil, Dahl JB, Dagaard JJ, Kristofferson E, Johannsen HV, Dahl JA. Perineuronal morphine: a comparison with epidural morphine. Anaesthesia 1988;43:463-465.
16. Mays KS, Schnapp M, Lipmann JJ, et al. Local analgesia without anesthesia using peripheral perineural morphine injections. Anesth Analg 1987;66:417-4203.