

A COMPARATIVE STUDY TO EVALUATE THE EFFECT OF MORPHINE & BUPRENORPHINE AS AN ADJUVANT TO 0.5% ROPIVACAINE IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCKADE AND POSTOPERATIVE ANALGESIA*

Anaesthesiology

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ABSTRACT

Introduction: Peripheral neural blockade like brachial plexus block has brought a new dimension in regional anaesthesia and is now a well accepted component of comprehensive anaesthetic technique as it lacks the side effects of general anesthesia. **Aims & Objective:** To compare the onset and duration of sensory, motor blockade and duration of analgesia. **Materials and Methods -** This study was carried out in Department of Anaesthesiology, J.A. Group of Hospitals and G.R. Medical College, Gwalior (M.P.) after approval from Institutional Ethics Committee, 60 patients of ASA grade I and II scheduled for upper limb surgeries randomly divided in three groups (Buprenorphine, and Morphine) and compare sensory, motor onset, postoperative analgesia and complications. **Results & Conclusion:** Buprenorphine (0.2mg) when used as an adjuvant with 30 ml ropivacaine in supraclavicular brachial plexus block provides early onset and longer duration of motor and sensory block, more prolonged duration of total analgesia, better relief from postoperative pain with slightly high incidence of nausea and vomiting as compared to Morphine.

KEYWORDS

Buprenorphine, Morphine, Peripheral nerve block

INTRODUCTION

The word pain is a bitter experience in the lives of the mankind. Surgical pain is an acute pain and is defined as conscious perception of a noxious stimulus

Peripheral neural blockade like brachial plexus block has brought a new dimension in regional anaesthesia and is now a well accepted component of comprehensive anaesthetic technique as it lacks the side effects of general anesthesia. Among the various peripheral blockades, Supraclavicular block is the most commonly practised peripheral neural blockade and is performed at the level of distal trunk and origin of division.¹

Professor **Halsted**² of John Hopkins institute performed the first brachial plexus block in 1885 by directly exposing the nerve root in the neck and blocking than with cocaine solution.

KulanKampff³ first introduced percutaneous supraclavicular brachial plexus block using novacaine solution with adrenaline.

Ropivacaine is a long-acting amide local anaesthetic agent which produces effects similar to other local anaesthetics via reversible inhibition of sodium ion influx in nerve fibres. Ropivacaine is less lipophilic than bupivacaine and is less likely to penetrate large myelinated motor fibres, resulting in a relatively reduced motor blockade. Thus, ropivacaine has a greater degree of motor sensory differentiation. The reduced lipophilicity is also associated with decreased potential for central nervous system toxicity and cardiotoxicity. The drug displays linear and dose proportional pharmacokinetics (up to 80 mg administered intravenously). It is metabolised extensively in the liver and excreted in urine.⁴

Local anaesthetic alone for supraclavicular brachial plexus block provide adequate analgesia but for a short period due to limited duration of action of local anaesthetics, resulting in the early resolution of block with severe postoperative pain.⁵

Postoperative pain can cause psychological disturbances, distress and anxiety. Less serious autonomic disturbances like sweating and nausea are frequently associated with it. Adequate postoperative pain management can decrease the metabolic response to surgical trauma and can therefore prevent or postpone negative nitrogen balance, promote better morbidity and reduce the incidence of deep vein thrombosis and chest infection.⁶

Various perineural adjuvant including opiates like Morphine^{7,8}, Buprenorphine^{9,10} and Fentanyl^{11,12}, Dexmedetomidine¹³, Clonidine¹⁴, Magnesium Sulphate¹⁵, Dexamethasone¹⁶,

Tramadol¹⁷ etc. were added to local anaesthetics in brachial plexus block to achieve quick, dense and prolonged duration of analgesia.¹

MATERIALS AND METHODS

This study was carried out in Department of Anaesthesiology, J.A. Group of Hospitals and G.R. Medical College, Gwalior (M.P.) after approval from Institutional Ethics Committee in 60 patients of ASA grade I and II scheduled for upper limb surgeries.

Inclusion Criteria:

- 60 patients of ASA grade I and II.
- Male and non-pregnant females of age group - 18-60 yr

Exclusion Criteria:

Following patient were not included in the study:

- Age < 18 yr or > 60 yrs.
- History of allergy or sensitivity or any other reaction to local anaesthetic of amide type.
- Hypertensive patient on treatment with beta blocker, methyl dopa, MAO inhibitor, tricyclic antidepressants.
- History of significant neurological, psychiatric or neuromuscular disorder.
- Renal dysfunction
- Cardiac disease
- Patient with elevated AST, ALT values.
- Parturient and lactating women
- History of bleeding disorder

Preoperative assessment of these patients was done with complete history, general examination and systemic examination and following routine investigation - Urine (Routine and microscopic)

- Haemoglobin
- Total leukocyte count
- Differential leukocyte count
- Blood sugar random
- Blood urea
- Chest x-ray PA view
- ECG

Grouping: 60 patients were randomly divided into three groups (n=30 each) according to study drug used below:

1. Group RM (n=30)-30 ml of 0.5% ropivacaine with 5 mg Morphine (0.5 ml) diluted in 1.5 ml NS.
2. Group RB (n=30)-30 ml of 0.5% ropivacaine with 0.2 mg Buprenorphine (0.66 ml) diluted in 1.34 ml NS.

Preparation of the patient:

After patients arrival in the operating room 18G IV cannula was

placed, RL solution was started @ 10-15 drops/min and placed at the forearm contralateral to the arm to be operated and Inj. Glycopyrolate 0.2 mg half hour before surgery premedication was given I/V. Standard monitoring was done throughout the procedure including NIBP, HR, pulse oximeter.

Position:

Patients were placed in supine position with the head turned to contra lateral side and the arms extended and pulled towards the knee.

Procedure:

After proper explanation of technique and positioning, under all aseptic conditions a mark is made approximately 1.5-2.0 cm posterior to the midclavicular point. external jugular vein and subclavian artery pulsation are to be identified. local infiltration of 1ml 2% Lidocaine at subcutaneous level with 22G. a 5 cm stimuplex needle was introduced 2cm above the midclavicular point directed just lateral to subclavian artery pulsation, caudal and medially until desired muscle twitch is elicited by plexygon nerve stimulator. The current intensity set initially at 2mA and stimulating frequency set at 1Hz then gradually decrease it. The position of needle was considered to be acceptable when output current < 0.5 mA elicited a slight distal motor response in forearm and hand. After negative aspiration of blood, the study drug was injected slowly over a period of 60sec.

Interventions and observations:

After the drug injection, the following parameters were recorded:

1. Cardio Respiratory Monitoring:

Pulse rate (PR), systolic blood pressure (SBP), diastolic blood pressure (DBP), oxygen saturation (SpO₂), respiratory rate (RR), 3 lead ECG monitoring was done continuously by multiparameter monitor (MindrayBene View T5) throughout the operative procedure. Recording of parameters was noted at 0, 10, 20, and at 30 min interval up to 90 min and then every hour till 750 min.

2. Sensory Block

A. Onset of sensory block

Onset of sensory block is defined as the time interval between injection of drug and complete loss of sensation as analysed by pinprick.

B. Duration of sensory block

The time consumed between the drug injection of the drug and appearance of pain.

C. Duration of analgesia

The time interval from injection of the drug till the time patient complaints of moderate pain and VAS score of >3 is observed. Rescue analgesia was given with tramadol 50 mg iv.

3. MOTOR BLOCK:

A. Onset of motor block:

Defined as the time consumed from injection of drug to complete motor block. Motor block is evaluated by thumb abduction (radial nerve), thumb adduction (ulnar nerve), thumb opposition (median nerve), and flexion of the elbow in supination and pronation of the forearm (musculocutaneous nerve). Assessment was done using a modification of the Lovett rating scale.

Grade 6	:	Normal muscular force
Grade 5	:	Slightly reduced muscular force
Grade 4	:	Pronounced reduction of muscular force
Grade 3	:	Slightly impaired mobility
Grade 2	:	Pronounced mobility impairment
Grade 1	:	Almost complete paralysis
Grade 0	:	Complete paralysis

Assessment was done at 1 min interval from the time of injection of test drug until the block is established. Only patient with complete motor block (grade 0) were included in study and equal number of new cases were added to complete the study.

B. Duration of motor block:

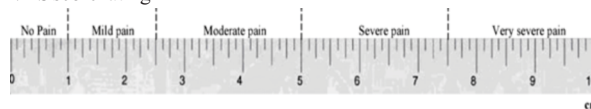
Time consumed between injection of the drug to complete return of motor power (grade 6).

4. Assessment Of Postoperative Pain :

Postoperative Pain was assessed using a visual analogue score scale which consisted of a 10 cm horizontal scale with gradations marked as

0 means no pain at all and 10 means unbearable pain.

VAS score rating



0	=	No pain
1-2.5	=	Mild pain
2.6-5.0	=	moderate pain (uncomfortable but tolerable)
5.1-7.5	=	Severe pain (very uncomfortable)
7.6-10.0	=	very severe pain (unbearable pain)

5. Sedation Score:

Sedation was assessed on the basis of **Chernik** Sedation Score.

- 0 - Completely awake
- 1 - Sleeping but responding to verbal command
- 2 - Deep sleep but arousable
- 3 - Deep sleep not arousable

6. Duration Of Surgery:

It is taken as the time from incision to skin closure.

Complications:

Careful watch was kept for complications such as nausea, vomiting, bradycardia, tachycardia, hypertension, hypotension, haematoma, headache, convulsions, and respiratory distress.

Statistical Analysis:

The observations recorded in the three groups were tabulated using EXCEL. Statistical analysis was carried out using ANOVA test, student "t" test and chi square test by SPSS V.20 software. p-value >0.05 was taken to be statistically insignificant & p-value <0.05 was taken as statistically significant whereas p-value <0.01 was taken to be statistically highly significant.

Data was described as mean±SD and frequency (Percentage) distribution and was presented through suitable statistical graphs.

OBSERVATION AND RESULTS

Table 1: Demographic profile of patients

S.no.	Parameters	Group RM		Group RB	
		Mean	±SD	Mean	±SD
1.	Age (yrs)	33.2	12.322	33.53	12.47
2.	Weight (kgs)	63	13.7	66	14
3.	Sex (M:F)	24:6		19:11	

Above table shows statistical analysis of Demographic data in terms of Mean±SD of Age in yrs, Weight in kgs and gender distribution ratio in two study groups. All the values were statistically insignificant.

Table 2: Intra-group comparison of sensory blockade (min)

Parameters	Group RM			Group RB		
	Mean	±SD	Range	Mean	±SD	Range
Onset time of sensory blockade (min)	13.433	1.59056	11-18	5.3567	1.22014	3.5-8
Duration of Sensory blockade (min)	420.02	60.515	360-540	751.667	109.67	600-960

Above table shows statistical analysis of Time of onset and duration of sensory blockade (in minutes) among two study groups.

Early onset (RB>RM) and more prolonged (RB>RM) sensory blockade was seen in group RB.

Table 3: Intra-group statistical comparison of motor blockade

Parameters	Group RM			Group RB		
	Mean	±SD	Range	Mean	±SD	Range
Onset time of motor blockade (min)	21.4	1.938	15-26	7.25	1.388	4.4-10.5
Duration of motor blockade (min)	360	67.11	260-450	631	95.66	480-870

Above table showing statistical analysis of Time of onset and duration

of motor blockade (in minutes) among two study groups.

Early onset (RB>RM) and more prolonged (RB>RM) motor blockade was seen in group RB.

Table 4 : Intra-group comparison of duration of analgesia (min)

Parameters	Group RM			Group RB		
	Mean	SD	Range	Mean	SD	Range
Duration of analgesia (min)	556	87.4	410-680	885	118.5	720-1110

Above table shows the statistical analysis of Duration of Analgesia (in hours) among two study groups.

Duration of Analgesia was more extended in group RB

Table 5 : Intra-group Changes in Mean(±SD) in Pulse rate (per min) at different time intervals during intra-operative period

S.No.	Time (min)	Group RM			Group RB		
		Mean (±SD)	t value	P value	Mean (±SD)	t value	p value
1	0	87.3±12.3			88.77±8.834		
2	10	90.3±11.36	-2.0	0.055*	86.77±8.787	0.814	0.423*
3	20	91.10±11.41	-1.7	0.086*	88.04±10.834	0.237	0.814*
4	30	91.13±14.68	-1.158	0.256*	89.73±9.270	-0.446	0.659*
5	60	88.63±16.959	-0.496	0.624*	90.77±11.178	-0.965	0.343*
6	90	91.23±11.530	-1.824	0.078*	90.43±10.871	-0.633	0.532*
7	120	87.67±12.615	-0.145	0.886*	91.57±10.405	-1.239	0.225*
8	180	88.03±11.938	-0.278	0.783*	91.73±11.212	-1.265	0.216*

Above table shows intra- group statistical analysis of Pulse rate at different time intervals during intra-operative period. All the values were statistically insignificant.

* – Not significant(p>0.05)

Table 6: Intra-group Changes in Mean(±SD) in Systolic Blood Pressure (mmHg) at different time intervals during intra-operative period

S.No	Time (min)	Group RM			Group RB		
		Mean (±SD)	t value	p value	Mean (±SD)	t value	p value
1	0	126±10.917			124.60±9.856		
2	10	124.53±11.05	0.891	0.380*	127.70±9.458	-1.920	0.065*
3	20	122.67±13.187	1.363	0.183*	122.87±9.243	0.893	0.379*
4	30	122.20±11.78	1.369	0.182*	122.27±10.243	0.789	0.436*
5	60	123.67±9.098	0.968	0.341*	122.03±11.291	0.929	0.361*
6	90	122±9.143	1.673	0.105*	121.97±12.97	1.001	0.325*
7	120	122.97±11.83	1.208	0.237*	121.80±10.340	1.115	0.247*
8	180	122.77±9.733	1.260	0.218*	120.67±9.746	1.801	0.082*

Above table shows intra-group statistical analysis of systolic blood pressure at different time intervals during intra-operative period. All the values were statistically insignificant.

* – Not significant(p>0.05)

Table 7 : Intra-group Changes in Mean(±SD) in Diastolic Blood Pressure(per min) at different time intervals during intra-operative period

S.No	Time (min)	Group RM			Group RB		
		Mean (±SD)	t value	p value	Mean (±SD)	t value	p value

1	0	81.40±9.427			80.13±7.29		
2	10	79.67±10.320	0.93	0.359*	79.36±7.8	0.521	0.607*
3	20	77.60±14.38	1.679	0.126*	76.93±8.67	1.760	0.089*
4	30	79.07±13.096	0.935	0.357*	78.46±8.70	0.993	0.329*
5	60	78.73±9.105	1.178	0.248*	79.4±7.28	0.387	0.702*
6	90	76.467±8.861	2.018	0.053*	77.066±9.09	1.568	0.128*
7	120	78.7±8.832	1.297	0.205*	78±9.54	0.997	0.327*
8	180	78.13±9.71	1.492	0.147*	78.066±8.99	1.204	0.238*

Above table shows intra-group statistical analysis of diastolic blood pressure at different time intervals during intra-operative period. All the values were statistically insignificant.

* – Not significant(p>0.0)

Table 8 : VAS scoring among two study groups

S.No.	Time	Group RM			Group RB		
		Mean (±SD)	t value	p value	Mean (±SD)	t value	p value
1	PO0	0	--	--	0	--	--
2	PO1	0	-	-	0	-	-
3	PO2	0	-	-	0	-	-
4	PO3	0.40±0.80	-	--	0	-	-
5	PO4	3.19±1.99	7.14	0.000**	0	-	-
6	PO5	3.1±2.81	5.06	0.000**	0.4±0.56	-	-
7	PO6	0.4±0.81	--	1.000*	2.63±1.58	7.288	0.000**
8	PO7	1.51±0.9	4.98	0.000**	3.96±2.32	8.20	0.000**
9	PO8	1.4±0.49	5.79	0.000**	0.167±0.53	1.66	0.1000*

Above table shows the intra- group statistical analysis of post operative VAS Score at different time intervals

* – Not significant(p>0.05)

** – Significant (p≤0.05)

*** --Highly significant(p<0.01).

Po0- 3hr after supraclavicular block

PO5- 12hr after supraclavicular block

Po1- 4hr after supraclavicular block

PO6- 16hr after supraclavicular block

Po2- 5hr after supraclavicular block

PO7- 20hr after supraclavicular block

Po3- 6hr after supraclavicular block

PO8- 24hr after supraclavicular block

PO4- 8hr after supraclavicular block

Table 9 : Intra-group comparison of time for rescue analgesia (min)

Parameters	Group RM		Group RB	
	Mean	SD	Mean	SD
Duration of Rescue analgesia (min)	496	70.6	828	108.6

Duration of Analgesia was more prolonged in group RB (RB>RM).

Table 10 : Complications in the three study groups

Complications	Group RM		Group RB	
	No.	%	No.	%
Nausea/Vomiting	0	0	9	30
Respiratory depression	0	0	0	0
Bradycardia	3	10	0	0
Hypotension	2	6.6	1	3.3
Sedation	0	0	0	0

Incidence of post operative nausea & vomiting were higher in group RB whereas the incidence of hypotension and bradycardia were higher

in group RM.

DISCUSSION

The supraclavicular block is one of the commonest techniques used for brachial plexus block performed at the level of the trunks of brachial plexus where almost the entire sensory, motor, and sympathetic innervation of the upper extremity is arranged compactly, thus providing a predictable and dense block with rapid onset.

The supraclavicular block provides anesthesia and analgesia to the upper extremity below the shoulder. It is an excellent choice for elbow and hand surgery as it is easy to perform, has a high success rate and it includes the blockade of ulnar and musculocutaneous nerve, which can be missed with the interscalene and axillary approach respectively.

The current trend of using peripheral nerve stimulator (PNS) and ultrasound guided technique (USG) have considerably increased the success rate hence, preferred over the landmark technique.

Demographic Data

In our study, patients in all three groups are comparable ($p > 0.05$) with respect to age, weight and gender distribution (Table no.1) which is in accordance with studies conducted by Jain et al⁵, Candido et al⁹, Saryazdi et al¹⁸, Sarkar et al¹⁹.

Onset And Duration Of Sensory Block

In the present study the mean ($\pm$ SD) time for onset of sensory block was found to be 13.43 ± 1.59 mins, 5.35 ± 1.22 mins in Group RM and RB respectively (Table no.2).

The onset was rapid in group RB as compared group RM. On comparing the time of onset, there was highly significant difference in between the two groups ($p < 0.01$).

Our results were at accordance with Sarkar et al¹⁹, Saharia et al²⁰, Saryazdi et al¹⁸ and Veil et al²¹.

The duration of sensory block was 420 ± 60.5 mins, 751 ± 109.67 mins and group RM, and RB respectively (Table no.3). On intergroup comparison highly significant difference ($p < 0.01$) was observed between the two groups (Table no.2).

The sensory block was more prolonged in group RB. Our results were at accordance with Sarkar et al²⁰ and Veil et al²¹.

Onset And Duration Of Motor Block

In the present study the mean ($\pm$ SD) time for onset of motor block was found to be 21.4 ± 1.93 mins, 7.25 ± 1.38 mins in Group RM and RB respectively (Table no.3).

The onset was rapid in group RB. On comparing the time of onset, there was highly significant difference in between the two groups ($p < 0.01$) (Table no.3).

Our results were at accordance with Sarkar et al¹⁹, Saryazdi et al¹⁸ and Veil et al²¹.

Duration of block was 360 ± 67.1 mins, 631 ± 95.66 mins in group RM and RB respectively (Table no.3). On intergroup comparison highly significant difference ($p < 0.01$) was observed in between the two groups (Table no.3).

Duration of motor block was more prolonged in group RB.

The result of our study were in accordance with Sarkar et al²⁸ who observed that the total duration of motor block was significantly prolonged ($p < 0.05$) with Buprenorphine (328.32 ± 47.94 min).

Duration Of Analgesia

In the present study the mean ($\pm$ SD) Duration of analgesia was 556 ± 87.4 mins, 885 ± 118.5 mins in Group RM and RB respectively (Table.4).

Duration of Analgesia was more prolonged in group RB as compared to Group RM.

On comparing the duration of analgesia, there was highly significant

difference in between the two groups ($p < 0.01$) (Table 4).

The results in our study are in accordance with study conducted by Saharia et al²⁰, Bazinet et al²² and Veil et al²¹.

HEMODYNAMICS

Basal Values:

In our study, the baseline values of mean ($\pm$ SD) pulse rate (per min) were 87.3 ± 12.3 , 88.77 ± 8.83 , in group RM and group RB respectively (Table 5).

The baseline values of mean ($\pm$ SD) systolic blood pressure (mmHg) were 126.00 ± 10.97 , 124.60 ± 9.851 in group RM and group RB respectively (Table 6).

The baseline values of mean ($\pm$ SD) diastolic blood pressure (mmHg) were 81.40 ± 9.47 , 80.13 ± 7.29 in group RM and group RB respectively (Table 7).

In our study the hemodynamic parameters like pulse rate, systolic pressure, diastolic pressure, SpO₂ and respiratory rate had no statistically significant difference.

Our observations were supported by studies done by Saryazdi et al¹⁸, Bazin et al²² and Veil et al²¹.

VAS score

Initial VAS score was zero until 5hr in group RM and 12hr in group RB as the patients did not complain any pain due to analgesic effect of local anaesthetic agent mixed with the adjuvant opioid. (Table 8). The VAS scores > 3 were observed during at 8hr (3.19 ± 1.99) and 12hr (3.1 ± 2.81) in Group RM; 16hr (2.63 ± 1.58) and 20hr (3.96 ± 2.32) in Group RB. VAS score > 3 were observed late in group RB as compared to group RM. This also correlates with our observation of more prolonged sensory block in group RB. The VAS scores decreased after administration of rescue analgesia with injection Tramadol 50 mg I/V. (Table 9)

Complications

Table-10 shows various complications observed during our study. Minimal incidence of hypotension and bradycardia was seen among the three study groups. Other common side effects related to like respiratory depression, sedation were not observed in our study.

High incidence of nausea and vomiting was observed during intra-operative and post-operative period with Buprenorphine (30%) as compared to zero incidence with Morphine. (Table 10)

Result of our study are well correlated with Saharia et al²⁰. They also observed that the incidence of nausea and vomiting was more with Buprenorphine (10%).

The observation of our study are also in accordance with Sarkar et al²⁸, Bazin et al²², Veil et al²¹, Patilet et al²³ and Jain et al⁵.

CONCLUSION

We conclude that Buprenorphine (0.2mg) when used as an adjuvant with 30 ml ropivacaine in supraclavicular brachial plexus block provides early onset and longer duration of motor and sensory block, more prolonged duration of total analgesia, better relief from postoperative pain with slightly high incidence of nausea and vomiting as compared to Morphine (5 mg).

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