Original Research Article

Indian Journal of Anesthesia and Analgesia
2018; 5 (2): 215-220
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.5218.11

A Clinical Comparison between 0.5% Bupivacaine and 0.75% Ropivacaine in Brachial Plexus Block Through Axillary Approach

I. Kiran[1], M. Bharathi[2]

[1,2] Assistant Professor, Department of Anaesthesiology, Sidhartha Medical College, Vijayawada, Andhra Pradesh 520008, India.

Abstract

Aim: To compare 0.5% Bupivacaine and 0.75% Ropivacaine in patients for brachial plexus block through axillary approach. *Materials and Methods:* A prospective randomized study patients aged between 20 to 60 years with ASA class I and II posted for elective upper limb surgeries were included in the study. The study population was randomly divided using computer generated numbers into 2 groups with 30 patients in each group. Group B (n = 30) received 0.5% Bupivacaine, Group R (n = 30) received 0.75% Ropivacaine. *Results:* There is no statistically significant difference in the demographic profile of the patients in either groups. There is significant difference in the onset of sensory block in the dermatomes C_5 to T_1. The duration of sensory block was prolonged in group B with difference is statistically and clinically significant with a P value of <0.0001. Onset of motor block is faster in group R compared to group B with a p value of <0.0001 which is highly statistically significant. The duration of motor block in group B is longer than the duration of motor block in group R. It is a significant statistical difference in these values with a p value <0.0001. There is no statistical significant in the quality of sensory block in both the groups with a P value of 0.56. There is no significant difference in quality of motor block in both the groups with p value of 0.13. There is no significant statistical difference in changes in in the hemodynamic parameters. There was no occurrence of any dysrhythmias or any changes in the pattern of ECG during this study, all the patients had normal sinus rhythm. There were no adverse effects in this study. *Conclusion:* Faster onset of sensory and motor block and less cardiotoxic effects combined with the above said characteristics of Ropivacaine makes it a better choice than Bupivacaine for brachial plexus block through axillary approach for fore arm surgeries.

Keywords: Bupivacaine; Brachial Plexus; Axillary Approach.

Introduction

Anaesthesia has evolved into a specialty subject over decades with lot of improvements in the methods employed and drugs used to provide anaesthesia with least complications. General anaesthesia is 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 has taken over as the principle technique for upper limb surgeries. There are many advantages of 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, ideal operating conditions can be met [1]. 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 Brachial block through axillary approach is technically easy compared to

Corresponding Author: M. Bharathi, Assistant Professor, Department of Anaesthesiology, Sidhartha Medical College, Vijayawada, Andhra Pradesh 520008, India.
E-mail: indupallikiran.@icloud.com

Received on 06.11.2017, **Accepted on** 16.11.2017

other approaches [1,2]. Various local anaesthetics have been used to produce brachial plexus block. Bupivacaine 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 intravascular accidentally [13].

This cardiotoxicity may be life-threatening as the dysrhythmias that are produced are resistant to all routinely used antiarrhythmics. Hence, there is a need for a drug which can have all the advantages of Bupivacaine without its cardiotoxicity. Ropivacaine is a new amino amide local anaesthetic which was introduced in western countries in the 1990s. It is a relatively new drug in India, not as used as commonly as Bupivacaine. Therefore, there is a need to study the effectiveness of Ropivacaine as a local anaesthetic for brachial plexus block through axillary approach. Hence a study was undertaken to compare the routinely used Bupivacaine with recently introduced Ropivacaine for brachial plexus block for elective upper limb surgeries.

Materials and Methods

A prospective randomized double blind clinical study entitled "A clinical comparison between 0.5% Bupivacaine and 0.75% Ropivacaine in brachial plexus block through axillary approach." was undertaken in Government General Hospital attached to Siddhartha Medical College, Vijayawada, Andhra Pradesh during the period from November 2014 to September 2016 for a period of 23 months. Sixty patients aged between 20 to 60 years with ASA class I and II posted for elective upper limb surgeries were included in the study. The study population was randomly divided using computer generated numbers into 2 groups with 30 patients in each group. Group B (n = 30) received 0.5% Bupivacaine, Group R (n = 30) received 0.75% Ropivacaine

Inclusion Criteria

Normal adult patients of either sex, aged between 20 to 65 years belonging to ASA class I and II, without any co-morbid disease, admitted for elective upper limb and wrist surgeries.

Exclusion Criteria

Patients with known hypersensitivity to study drugs, infection at the site of block, known coagulopathy or patients on anticoagulants, severe renal, hepatic, respiratory or cardiac disease, morbidly obese patients, pregnant women, neurological, psychiatric or neurovascular disorders, history of alcohol abuse, injury to any of the nerves of the upper limb.

All the patients underwent pre-anaesthetic check up. Pre-anaesthetic evaluation was done on the evening before surgery. A routine examination was conducted assessing general condition of the patient, airway assessment by mallampatti grading and rule of 1-2-3, nutritional status, weight and height of the patient, a detailed examination of the cardiovascular system, a detailed examination of the respiratory system and the surface anatomy where the block was going to be given. The following investigations were done in all the patients namely haemoglobin estimation, urine examination for albumin, sugar and microscopy, standard 12 lead ECG, X ray chest, fasting and post-prandial blood sugars and blood urea and serum creatinine. The anaesthetic procedure was explained to the patient and an informed consent was taken from the patient. All patients included in the study were given tablet alprazolam 0.5mg and ranitidine 150mg orally at 10 pm night before surgery and they were kept nil by mouth 6 hrs before surgery. On arrival of patients in the operating room, an 18 gauge intravenous cannula was inserted under local anaesthetic infiltration on the non operating hand and an infusion of lactated ringer was started. The patients were connected to multichannel monitor recording heart rate (HR), non invasive measurements of systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial blood pressure (MAP), continuous electrocardiogram (ECG) monitoring and pulse oximetry (SpO2). The baseline blood pressure and heart rate were recorded. The heart rate and rhythm were also monitored from a continuous visual display of electrocardiogram from lead II. The patients and the observing anaesthesiologist as well as physicians and nurses of the acute pain service were blinded to the study drug used. All patients were premedicated with inj. Midazolam 1 mg iv. The patient is placed in the supine position. The operating arm is abducted at shoulder joint to 90p and elbow flexed to 90p and rested on a pillow. The axillary artery is palpated and marked with a skin marker. Under aseptic precautions, skin weal raised with 2 ml of 1% lignocaine. 22G needle is inserted above the artery at the proximal most point and after fascial sheath is pierced felt as a click, 10 ml of the study drug is injected after negative aspiration. Likewise a 22G needle is inserted below the artery and the needle is directed 45p towards the humerus and after the fascial sheath is pierced,

the study drug is injected after negative aspiration. Musculocutaneous nerve may be spared in this approach so 10 ml of the study drug is injected into the body of coracobrachialis muscle. An intercostobrachial nerve block was given if tourniquet is to be placed by using 5 ml 1% lignocaine. Immediately, after block placement, patients were evaluated every 2 minutes, for the assessment of onset of sensory and motor blockade, quality of sensory and motor blockade, duration of sensory and motor blockade and haemodynamic variables. Assessment of sensory onset is tested in the C5, C6, C7, C8 and T1 dermatomes. If the block was considered to be adequate, surgeons were allowed to apply the tourniquet and start the surgery. If the block was considered to be inadequate for surgery, the patient was given general anaesthesia with endotracheal intubation. During the surgery the time of application of tourniquet, haemodynamic variables like HR, SBP, DBP, MAP, SpO2, ECG were monitored base line value (0), 1st (immediately after the administration of block), 5th and 10th minute and then every 10 minutes till the completion of the surgery, Patients were monitored for any signs of cardiovascular or central nervous system toxicity (changes in HR/BP/ rhythm/ signs of CNS stimulation) throughout the study. Any hypersensitivity reaction for the drugs and other adverse events were also monitored. To evaluate the duration of sensory and motor block, patients were asked to document the time when discomfort at the site of incision began and the time when full power returned to the shoulder. In the post-operative period, when the patient complained of pain at the operative site, inj. Diclofenac Sodium 100 mg intra muscular was given and study was concluded. Data were obtained up to 24 hrs after the block placement.

Results

There were more male patients in the study with 71.2% than the female patients with 28.8% with a p value of 0.57. The gender of the subjects was not statistically significant,

Maximum number of the subjects in the study were in the age range of 21 to 40 years. About 60% of the patients in group B and 66.6% of the patients in group R were in age group of 21-40 years.

The mean weight of the patients in group B was 68.9 ±9.1 yrs and in group R was 72.5±9.5 yrs with a p value of 0.14 which was not statistically significant. Maximum number of the subjects in the study were in the weight group of 61 to 80 kgs.

The onset of sensory block in the dermatomes C_5 to T_1 was statistically significant. The duration of sensory block was prolonged in group B with difference which was statistically and clinically significant with a P value of <0.0001. Onset of motor block is faster in group R compared to group B with a p value of <0.0001 which is highly statistically significant. The duration of motor block in group B was longer than the duration of motor block in group R. The mean onset time of motor block in group B was 416.4±21.10 minutes and group R was 380.72±15.03 minutes. Hence, the mean onset of time of motor block was statistically significant with a p value <0.0001. The quality of sensory block in both the groups was not statistically significant with P value of 0.56. The quality of motor block in both the groups was not statistically significant with p value of 0.13. The hemodynamic parameters were also not statistically significant. There were no occurrence of any dysrhythmias or any changes in the pattern of ECG during this study, all the patients

Table 1: Demographic age wise distribution of study population range

Age	Group-B		Group-R		Total	
	Count	%	Count	%	Count	%
21-30	8	26.6%	8	26.6%	16	26.6%
31-40	10	33.3%	12	40.0%	22	36.6%
41-50	8	26.7%	6	20.0%	14	23.3%
51-60	4	13.3%	4	13.3%	8	13.3%
Total	30	100.0%	30	100.0%	60	100.0%
			Weight in KGS			
51-60	8	26.7%	3	10.0%	11	18.3%
61-70	10	33.3%	12	40.0%	22	36.6%
71-80	9	30.0%	8	26.7%	17	28.3%
81-90	3	10.0%	6	20.0%	9	15.0%
91-100	0	0.0%	1	3.0%	1	1.6%
Total	30	100.0%	30	100.0%	60	100.0%

Table 2: Onset and duration of sensory block, motor block

Sensory Block		Group B			Group R			P-Value
		N	Mean	SD	N	Mean	SD	
C_5		30	12.23	1.33	29	9.00	1.10	<0.0001
C_6		30	12.67	1.30	29	9.14	1.13	<0.0001
C_7		30	12.30	1.42	29	8.93	0.88	<0.0001
C_8		30	12.17	1.32	29	9.03	0.87	<0.0001
T_1		30	12.13	1.20	29	8.72	0.92	<0.0001
Total			12.3	1.3		8.96	0.98	
Duration of	B	30	390	550	461.5	32.0		<0.0001
sensory block	R	29	390	458	426.3	17.3		
Onset of motor	B	30	--	--	20.57	2.05		<0.0001
block	R	29	--	--	14.69	1.34		
Duration of	B	30	--	--	416.40	21.10		<0.0001
motor block	R	29	--	--	380.72	15.03		

Table 3: Quality of sensory block and motor block

QSB	Group-B		Group-R		Total		P-value
	Count	%	Count	%	Count	%	
			Quality of sensory block				
Excellent	22	73.3%	20	69.0%	42	70.0%	0.56
Good	8	26.7%	9	31.0%	17	28.3%	
Poor	0	0.0%	1	3.3%	1	1.6%	
Total	30	100.0%	30	100.0%	60	100.0%	
			Quality of motor block,				
II	10	33.3%	4	13.8%	14	23.7%	0.13
III	20	66.7%	25	86.2%	45	76.3%	
Total	30	100.0%	29	100.0%	59	100.0%	

Table 4: Comparison of ECG changes and adverse effects in both groups

ECG	Group-B Count	%	Group-R Count	%	Total Count	%
NSR	30	100.0%	29	100.0%	59	100.0%
Total	30	100.0%	29	100.0%	59	100.0%
Adverse Effects						
NIL	30	100.0%	29	100.0%	59	100.0%
Total	30	100.0%	29	100.0%	59	100.0%

had normal sinus rhythm. There were no adverse effects in this study.

Discussion

In our study, the drugs selected for brachial plexus block were Bupivacaine and Ropivacaine. Bupivacaine is being regularly used for brachial plexus block for upper limb surgeries in our hospital. Ropivacaine, another local anaesthetic with structural similarity to Bupivacaine without its cardiotoxic effects is a newer drug compared to Bupivacaine. Ropivacaine has been found to be equally effective as Bupivacaine for brachial plexus block by various authors [4,5,6]. Demographic data comparing age, sex, weight shows no statistically significant differences between both the groups in the present study which was in accordance to the reports of other studies. Mean onset time of sensory blockade in group B is 12.3±1.3 minutes and in group R is 8.96±0.98 minutes. There is faster onset time in group R with average time of onset being 9.2±1.5 in C5, 9.4±2.0 in C6, 8.9±0.9 in C7, 9.0±0.9 inc8 and 8.8±0.9 in T1 as compared to mean onset time of sensory block on 12.3±1.3 in C5, 12.7±1.3 in C6, 12.3±1.4 in C7, 12.2±1.3 in C8 and 12.1±1.2 in T8 in group B with p value of <0.0001 which is highly statistically significant. Similar results were observed in other studies as in the study conducted by Kaur A *et al* [4] reported the onset of sensory block was faster in Ropivacaine group compared to Bupivacaine group with mean onset time of 12.04±2.57 minutes in group B and 8.88±1.74

minutes in group R. These results were also comparable to those obtained by Bertini *et al* [5]. In the present study mean onset time was faster in group R when compared to group B. Tripathi D *et al* [6] study which reported a faster onset in 4.22±1.52 minutes and complete block by 11.70±6.40 minutes in Ropivacaine group. Onset of 13.83±3.49 minutes and complete block by 18.46±3.55 minutes in Bupivacaine group. Sirigeri S *et al* [7] observed the onset of sensory block was faster in Ropivacaine than Bupivacaine with mean value of 16.13±3.05 in 0.5% Ropivacaine group and 17.7±2.35 minutes in 0.5% Bupivacaine group. Casati *et al* [10] reported median onset of sensory block was 30 minutes in 0.5% Levobupivaine compared to 15 minutes of onset of sensory block in 0.5% Ropivacaine. Casati A. Fanelli G *et al* [8] reported that complete sensory block was achieved by 22 ± 8 minutes in Ropivacaine group compared to 28±15 minutes in Bupivacaine group. Hetal rathod *et al* [9] reported the onset of sensory blockade as 21.13 minutes in group B compared to 13.3 minutes in group R. Dr. P. Manohar *et al* [11], reported onset of sensory blockade of 15.66±1.82 in patients receiving 0.5% Ropivacaine as compared to 16.0±1.74 in patients receiving 0.5% Bupivacaine which is statistically insignificant. Sreeharsha Sirigeri *et al.* observed that Group R provided statistically significant rapid onset of sensory and motor blockade, prolonged duration of both sensory and motor blockade, prolonged duration of analgesia than Group B for upper limb surgeries. There were no significant differences in haemodynamic changes and complications. In Surendra Raikwar *et al* [12] study fifty patients were grouped equally and one group R received 0.5% ropivacaine (100mg) 20ml and another group B received 0.5% bupivacaine (100mg) 20ml. Onset & duration of sensory and motor blockade, duration of analgesia and associated complications & side effects were recorded. It was found that there were no significant differences in duration of sensory & motor blockade, in complications or any other side effects in both the groups. But ropivacaine provided rapid onset of action and better quality of surgical anesthesia than bupivacaine when used in supraclavicular brachial plexus blockade. Chandni M Soni *et al* [13] observed that in Group R the sensory and motor onset was 6.6 minutes and 12.93 minutes while that in Group B was 7.46 and 11.57 minutes respectively n Group R the sensory duration was 548.2±24.62 minutes while that in Group B it was 589.2±27.74 minutes and the duration of motor block in Group R was 534.4±27.65 minutes while in Group B it was 596.0±24.70 minutes. Group B showed prolonged sensory and motor block duration compared to Group R. The duration of analgesia in Group R, which was shorter, (555.4±20.73 minutes) in comparison to Group B (592.6±24.03 minutes) concluded that onset of sensory block was faster in ropivacaine. Duration of sensory block was longer in Bupivacaine. Tripathi D *et al* [6] observed that the mean onset time of sensory block was 4.22±1.52 min and 13.83±3.49min ($P<0.01$), peak developed in 11.70±6.40 min and 18.46±3.55 min ($P<0.01$), in group R and group B respectively. The duration of sensory block was 9.72±2.73 hrs and 8.77 ± 0.75 hrs respectively in group R and group B. ($P >0.05$). The mean onset time of motor block was 8.92±2.92 minutes and 15.86±3.72 min ($P<0.05$), peak developed in 27.26±8.93 minutes and 23.43±3.89 min ($P<0.05$) and duration of 8.53±1.02 hrs and 8.77±0.75 hrs ($P>0.05$) in group R and group B respectively.

Conclusion

It can be concluded that 0.5% Bupivacaine has slower sensory and motor onset compared to 0.75% Ropivacaine. While the duration of Sensory and motor blockade is longer in 0.5% Bupivacaine compared to 0.75% Ropivacaine. Accidental intravascular injection of local anaesthetic is a problem in spite of meticulous technique and particularly when large volume of anaesthetic is required for efficacy. Faster onset of sensory and motor block and less cardiotoxic effects combined with the above said characteristics of Ropivacaine makes it a better choice than Bupivacaine for brachial plexus block through axillary approach for fore arm surgeries.

References

1. Cousins MJ Bridenbaugh. Neural blockade in clinical anaesthesia and pain medicine. 4th ed.: Lippincott Williams and Wilkins; 2009.
2. Edward G Morgan, Maged S Mikhail, Michael J Murray. Peripheral nerve Blocks. Chapter 17, 4th edition.. In: Clinical anaesthesiology, New Delhi: Tata McGraw-Hill; 2009.
3. McClure JH. Ropivacaine. British Journal of Anaesthesia 1996;76:300-7.
4. Kaur, A., Singh, R. B., Tripathi, R. K., & Choubey, S. Comparison between Bupivacaine and Ropivacaine in Patients Undergoing Forearm Surgeries under Axillary Brachial Plexus Block: A Prospective Randomized Study. Journal of Clinical and Diagnostic Research: JCDR, 2015;9(1):UC01–UC06. http://doi.org/10.7860/JCDR/2015/10556.5446.

5. Bertini L, Tagariello V, Mancini S, Csiachi A, Posteraro KM, Benedetto PDI, et al. 0.75% and 0.5% Ropivacaine for axillary brachial plexus block: A clinical comparison with 0.5% Bupivacaine, Regional anaesthesia and pain medicine 1999;24(6):514-8.
6. D Tripathi, K Shah, C Shah, S Shah, E Das. Supraclavicular Brachial Plexus Block for Upper Limb Orthopedic Surgery: A Randomized, Double Blinded Comparison between Ropivacaine And Bupivacaine. The Internet Journal of Anaesthesiology. 2012;30(4).
7. Sirigeri S, Patil VV. A comparative study of 0.5% Bupivacaine and 0.75% Ropivacaine in supraclavicular brachial plexus block by perivascular approach: Prospective randomized study. J. Evolution Med. Dent. Sci... 2016;5(13):568-571, DOI:10.14260/jemds/2016/130.
8. Casati A, Fanelli G, Albertin A, Deni F, Anelati D, Antonino FA, et al. Interscalene brachial plexus anaesthesia with either Ropivacaine 0.5% or Bupivacaine 0.5%. Minerva Anaesthesiol 2000; 66:39-44.
9. Rathod H.Parikh H.Upadhayaya R. Comparative study of 0.375% bupivacaine and 0.375% ropivacaine in brachial plexus block via supraclavicular approach International Journal of Biomedical Research [serial on the Internet]. 2015 February 28; [Cited 2016 November 29]; 6(2).
10. Casati A, Chelly JE, Cerchierini E, Santorsola R, Nobili F, Grispigni C, Di Benedetto P, Torri G. Clinical properties of levobupivacaine or racemic bupivacaine for sciatic nerve block. J Clin Anesth. 2002 Mar;14(2):111-4.
11. Dr. P. Manohar, Dr. Sufala Vishwas Rao. Comparison of 0.5% Ropivacaine & 0.5% Bupivacaine In Epidural Anesthesia For Patients Undergoing Lower Abdominal Surgeries In Karpaga Vinayaga Medical College And Hospital, Maduranthagam.IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) e-ISSN: 2279-0853, p-ISSN: 2279-0861. 2015 Aug;14(8 ver III): 19-23.
12. Surendra Raikwar, Sonal Awasya, Pankaj Gupta. "Comparative clinical evaluation of 0.5% ropivacaine and 0.5% bupivacaine for brachial plexus block via supraclavicular approach for upper limb surgeries". Journal of Evolution of Medical and Dental Sciences 2013 Nov 25;2(47).
13. Chandni M Soni, Hetal Parikh. Comparison of the motor and sensory block by Ropivacaine and bupivacaine in combination With lignocaine in supraclavicular block. 2013 Oct-Dec;3(4). print issn: 2249 4995, eissn: 2277 8810.